

ENGINEER DEPARTMENT, U. S. ARMY.

REPORT

UPON

UNITED STATES GEOGRAPHICAL SURVEYS

WEST OF THE ONE HUNDREDTH MERIDIAN,

IN CHARGE OF

FIRST LIEUT. GEO. M. WHEELER,

CORPS OF ENGINEERS, U. S. ARMY,

UNDER THE DIRECTION OF

BRIG. GEN. A. A. HUMPHREYS,

CHIEF OF ENGINEERS, U. S. ARMY.

PUBLISHED BY AUTHORITY OF THE HONORABLE THE SECRETARY OF WAR,

IN ACCORDANCE WITH ACTS OF CONGRESS OF JUNE 23, 1874, AND FEBRUARY 15, 1875.

IN SEVEN VOLUMES, ACCOMPANIED BY ONE TOPOGRAPHICAL AND ONE
GEOLOGICAL ATLAS.

VOL. II.—ASTRONOMY AND BAROMETRIC HYPSONOMETRY.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1877.

FORTY-THIRD CONGRESS, FIRST SESSION.

CHAPTER 455.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the following sums be, and the same are hereby, appropriated, for the objects hereinafter expressed, for the fiscal year ending June thirtieth, eighteen hundred and seventy-five, namely:

* * * * *

For engraving and printing the plates illustrating the report of the geographical and geological explorations and surveys west of the one hundredth meridian, to be published in quarto form, the printing and binding to be done at the Government Printing Office, twenty-five thousand thousand.

* * * * *

Approved June 23, 1874.

FORTY-THIRD CONGRESS, SECOND SESSION.

CHAPTER 76.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the act entitled "An act making appropriations for sundry civil expenses of the Government for the fiscal year ending June thirtieth, eighteen hundred and seventy-five, and for other purposes," approved June twenty-third, eighteen hundred and seventy-four, be, and the same is hereby, amended by adding to the clause of said act relating to the engraving and printing of the plates illustrating the report of the geographical and geological explorations and surveys west of the one hundredth meridian, the following words: and "that two thousand copies of the report shall be printed by the Congressional Printer," after substituting the word "dollars" in lieu of the concluding word of said clause.

Approved February 15, 1875.

FORTY-FOURTH CONGRESS, FIRST SESSION.

"Mr. VANCE, of Ohio, from the Committee on Printing, reported the following resolution; which was read, considered, and adopted:

"Resolved by the House of Representatives (the Senate concurring), That the following distribution shall be made of the reports of the United States geographical surveys west of the one hundredth meridian, published in accordance with acts approved June 23, 1874, and February 15, 1875, as the several volumes are issued from the Government Printing Office, to wit: Nine hundred and fifty copies of each to the House of Representatives, two hundred and fifty copies of each to the Senate, and eight hundred copies of each to the War Department for its uses."

March 29, 1876. (See Congressional Record, vol. 4, part 3, page 2037.)

Agreed to by the Senate May 4, 1876. (See Congressional Record, vol. 4, part 3, page 2969.)

NOTE.

Seven volumes, accompanied by one Topographical and one Geological Atlas, embrace reports upon Geographical Surveys of the territory of the United States West of the One hundredth Meridian of longitude from Greenwich, as follows:

Volume I.—Geographical Report.

Volume II.—Astronomy and Barometric Hypsometry.

Volume III.—Geology and Mineralogy.

Volume IV.—Palæontology.

Volume V.—Zoölogy.

Volume VI.—Botany.

Volume VII.—Archæology.

The Topographical Atlas edition, consisting of Title-Page, Legend, and Conventional Sign Sheets, Index, Progress and Basin Maps, and Sheets Nos. 49, 50, 57, 58, 59, 66, 67, 75, 76, 83, 53 (C), 61 (B), 61 (C), 61 (C sub.), 61 (D), 65 (D), 69 (B), 69 (D), 70 (A), 70 (C), 78 (B), have been issued at date of sending forward the MS. of this volume. Other sheets, of which there are seventeen in various stages of completion, will follow as rapidly as they can be prepared, engraved, and printed.

Sheets 53 (C), 61 (B), 61 (C), 61 (D), 65 (D), 69 (B), 69 (D), 70 (A), 70 (C), and 78 (B), are projected upon a scale of 1 inch to 4 miles, while the scale of 1 inch to 2 miles has been used for sheet 61 (C sub.), the latter embracing a part of the San Juan mining region of Southwestern Colorado.

The following Geological Maps, forming a part of those supplementing

Volume III, based upon the topographical sheets, have been published, *i. e.*, Title-Page, Index Sheet, Restored Outline of Lake Bonneville, Nos. 50, 59, $\frac{1}{2}$ of 58, and $\frac{1}{2}$ of 66, 66, 67, 75, 76, and 83. Other sheets are in course of completion

The Topographical Atlas referred to will comprise 95 sheets, on a scale of 1 inch to 8 miles, numbered consecutively from 1 to 95, inclusive, while the "Geological Atlas" will consist of the same number, using the topographical maps as a base. (See Progress Map of 1877.)

The quarto reports embrace the results of the special branches of the Survey that are completed at the date at which each is separately submitted, while annual reports of the operations of the work, showing its progress during the fiscal year, are regularly submitted to the Chief of Engineers, and have appeared as appendixes to his Annual Reports

ERRATA, VOL. II.

- Page 491, Altitude of Fort Garland, Colo., for 4,853.7 read 7,937.0—R. R. level.
- Page 556, Altitude of Agua Caliente, Cal., for 3,618.6 read 724.8
- Page 557, Altitude of Buffalo Peak, Colo., for 3,328.6 read 13,328.6
- Page 557, Altitude of Bullion City, Nev., for 16,386.4 read 6,386.4
- Page 558, Altitude of Fort Craig, N. Mex., for 4,619.0 read 4,447.5
- Page 559, Altitude of Engineer Pk., Colo., for 13,076.4 read 13,277.4
- Page 559, Altitude of Granite Springs, Cal., for 4,115.2 read 4,015.2
- Page 563, Altitude of Provo, Utah, for 4,544.0 read 4,567.3
- Page 563, Altitude of Rosita (sun dial), Colo., for 8,932.0 read 8,736.0
- Page 564, Altitude of San Carlos Agency, Ariz., for 2,456.0 read 2,558.7
- Page 565, Altitude of Trinidad, Colo., for 6,043.1 read 5,989.9
- Page 566, Altitude of Winnemucca, Nev., (Signal Office,) for 4,365.6 read 4,355.0



U. S. GEOGRAPHICAL SURVEYS WEST OF THE ONE HUNDREDTH MERIDIAN,
1ST LIEUT. GEO. M. WHEELER, CORPS OF ENGINEERS, U. S. ARMY, IN CHARGE.

REPORTS
UPON
THE ASTRONOMICAL DETERMINATIONS AT MAIN STATIONS
OCCUPIED IN
THE YEARS 1872, 1873, AND 1874,
AND
RESULTS OF BAROMETRIC OBSERVATIONS
OF
THE YEARS 1871, 1872, 1873, 1874, AND 1875.
IN TWO PARTS.
ILLUSTRATED BY TWENTY-TWO PLATES AND THREE WOOD-CUTS.

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The engraving and printing of the remaining plates from 7 to 22, inclusive, have been furnished by JULIUS BIEN, of New York City.

LETTER OF TRANSMITTAL.

UNITED STATES ENGINEER OFFICE,
GEOGRAPHICAL SURVEYS WEST OF THE 100TH MERIDIAN,
Washington, D. C., March 19, 1877.

GENERAL: I have the honor to submit herewith, for publication, the reports to constitute Volume II of those authorized by acts of Congress, approved June 23, 1874, and February 15, 1875.

The volume consists of the several reports upon determinations at main astronomical stations, with lists of geographical positions and altitudes of prominent points, together with results from the barometric work.

The necessity for astronomical determinations at points in the western interior, contiguous to the fields of survey, became apparent at an early stage of the work, since the principal longitudes in the region occupied were necessarily approximate for want of telegraphic communication, and other essentials of accuracy. The latitude determinations have been found to possess a much greater degree of accuracy, and are the only ones which could be relied upon, except an extremely limited number of longitudes. It is believed that the methods adopted for the observations and their computation have proven adequate for the requirements of standard field astronomical work, and the results are so grouped as to show in each case their greater or lesser probable values. The importance of these astronomical determinations with stations and meridian lines usually marked with permanent monuments in the prosecution of extended geographical surveys cannot be overestimated. In regions remote from railroad communication, more portable instruments and different methods, similar to those adopted in 1869, can be used with efficiency.

Prior to the establishment of a survey covering the entire interior of the country, it is not presumable that more elaborate means will be used for the fixing of geographical positions, so necessary in the construction of detailed topographical maps, since the cost of the establishment, in the rough mountain interior, of geodetic points of the highest order of accuracy is not justified by the uses to which they may be applied in the present development of connected surveys of this region. When topographical results are acknowledged as a want more frequent and wide-spread, a great geodetic survey of the entire territory of the United States may be begun; meanwhile, the geodesy of the mountains as it is now conducted, demanding primarily the determination of initial points at which measured and developed bases and subsequent schemes of triangulation may be laid out, such as shall meet present requirements, must be confined to such as are needed more particularly for mapping purposes, and for such geodetic points as may be required by the surveys of the public lands.

The observatory at Ogden, Utah, remains incomplete, but the importance of it, and such others as have been recommended to be established, suggests mention.

This volume will be found not without value to the future compiler, because of the geographical positions and altitudes that it contains, and serves to show the operations and results in this section up to the close of the season of 1874.

Lieut. William L. Marshall, Corps of Engineers, in charge of the barometric reductions from December 1, 1874, to August 8, 1876, submits the results of the labors of this section that had been previously carried on under the direction of Lieut. R. L. Hoxie, Corps of Engineers, after the plan of organization as laid down by the officer in charge.

It was at one time contemplated to extend the scope of the hourly observations so that the results would have been more widely distributed, but the additional force required in observations for altitude determinations and the temporary cessation of the annual occupancy of main astronomical stations, have led to their abandonment in other than exceptional cases. His report is a summary of the barometric and hypsometric observations, and results to date; other than those submitted in the regular annual reports.

The methods followed in the reduction of the barometric observations for altitudes have, with some slight modification in case of the aneroid readings, been those given in the invaluable treatise upon this subject by Lieut. Col. R. S. Williamson, Corps of Engineers, and forming Professional Paper No. 15, of the Engineer Department, United States Army.

The gradual and constant improvement in this section of the survey has been noticeable and merits approval. I take this occasion to signify appreciation of the great industry, often exhibited under the most trying circumstances, of the astronomical and meteorological observers, most of whose names appear in the several reports, while the results as shown are, in a measure, the test of their success.

All of which is respectfully submitted.

GEO. M. WHEELER,

Lieutenant of Engineers, in charge.

Brig. Gen. A. A. HUMPHREYS,

Chief of Engineers, United States Army.

U. S. GEOGRAPHICAL SURVEYS WEST OF THE ONE HUNDREDTH MERIDIAN,
1ST LIEUT. GEO. M. WHEELER, CORPS OF ENGINEERS, U. S. ARMY, IN CHARGE.

PART I.

REPORTS

UPON

THE ASTRONOMICAL DETERMINATIONS AT MAIN STATIONS IN NEVADA,
UTAH, MONTANA, WYOMING, NEBRASKA, COLORADO, AND NEW
MEXICO, OCCUPIED IN THE YEARS 1872, 1873, AND 1874,

BY

DR. F. KAMPF, JOHN H. CLARK, WM. W. MARYATT,
AND PROF. T. H. SAFFORD.

WITH LISTS OF GEOGRAPHICAL POSITIONS, &c.

ORDER OF SEQUENCE FOR AN ASTRONOMICAL REPORT AT MAIN OR PRIMARY FIELD-STATIONS.

Longitude by telegraph; latitude by zenith-telescope (Talcott's method).

1. Geographical position of station; details of physical geography.
2. Meteorological conditions, both general and special; the latter while observations were made.
3. Description of observatory; *personnel* of party.
4. Description of instruments; instrumental values.
5. Points with which connections were made; nights of observation and observers; names of computers.
6. Circumstances of telegraphic communication; name of telegraph-operator, and of the company whose wire has been employed; length of circuit, number of batteries and repeaters.
7. Tabulation of stars used.
8. Uniform tables of time-reductions at receiving and sending stations.
9. Grouping of series of exchange-signals, including means of single and serial results.
10. Personal equation.
11. Probable error by least squares.
12. Reduction of the latitude-observations properly grouped, with discussion of results.
13. Resulting astronomical co-ordinates.

ABBREVIATIONS AND SIGNS.

a, b, c = azimuth, level, and collimation corrections.

A, B, C = azimuth, level, and collimation factors.

T = observed time reduced to mean of wires and corrected for rate.

T' = observed time corrected for instrumental errors.

AR = apparent right ascension of star.

$\Delta_0 T$ = resulting error of the chronometer after the mean of the wires
is corrected for rate and level.

ΔT_0 = adopted mean error of chronometer.

$\delta T = \Delta T_0 - \Delta_0 T$.

ΔT = error of the chronometer.

v = difference between final correction of chronometer and ΔT .

U. S. GEOGRAPHICAL SURVEYS WEST OF THE ONE HUNDREDTH MERIDIAN,
1ST LIEUT. GEO. M. WHEELER, CORPS OF ENGINEERS, U. S. ARMY, IN CHARGE.

RESULTS

OF

OBSERVATIONS MADE BY DR. F. KAMPF, PROF. J. R. EASTMAN, JOHN H. CLARK, AND
O. B. WHEELER, IN THE DETERMINATION OF THE ASTRONOMICAL
CO-ORDINATES OF OBSERVATORY AT OGDEN, UTAH,

SEASONS OF 1873 AND 1874.

COMPUTATIONS BY

DR. F. KAMPF AND PROF. J. R. EASTMAN.

OGDEN, UTAH.

GEOGRAPHICAL POSITION OF STATION.

Longitude, . . . $111^{\circ} 59' 54''.64 \pm 0''.40$ west from Greenwich.
 $34^{\circ} 56' 52''.84$ west from U. S. Naval Observatory, Washington, D. C.
Latitude, . . . $41^{\circ} 13' 08''.56 \pm 0''.03$ north.
Altitude of observatory above sea (railroad level), 4374.0 feet.

Ogden is a Mormon town of nearly 2,000 inhabitants, the junction of the Union Pacific and Central Pacific Railroads. The astronomical station is situated on a low hill west of the town, near the Utah Central Railroad, about 2,000 feet from the Weber River, which flows by in a southerly direction; the *niveau* of the stream being about 100 feet below the floor of the observatory.

DESCRIPTION OF OBSERVATORY.

The foundation of this building is of granite and sandstone, and rises $3\frac{1}{2}$ feet above the ground, inclosing a cellar, which has a depth of 4 feet from the floor. The structure consists of three parts: the eastern wing, which is intended for the use of the officer in charge; the western wing, occupied as an observing transit room; and the center, which will contain a solid pyramidal pier to support an equatorial. The dimensions of the two wings are the same, being 11 feet by 15 feet on the ground and $9\frac{1}{2}$ feet in height. The central compartment is 15 feet square, and will have two floors. The eastern room is lighted by six windows, each $2\frac{5}{8}$ feet by $6\frac{1}{2}$ feet, which, in size and position, are similar to the apertures which are cut into the western wing for purposes of meridional observation. The latter openings extend to the top of the wall and thence across the roof, and are closed by vertical shutters upon the side of the building and a horizontal

pair upon the top, by which the interior is sheltered from the dust and rain. The observing room contains two piers of solid sandstone, which are planted 6 feet below the floor, and protrude 2 feet above the same. A third pier, which is of brick-work, insulated, and intended to carry a clock, has been erected in the southeastern corner of the observing room. Chronographic and telegraphic apparatus are placed on separate stands. The whole building is covered with a heavy tin roof.

CONNECTIONS—OBSERVERS—METHODS.

The longitude of Ogden observatory was determined in three different ways: first, Ogden was connected with Salt Lake City observatory in 1873, by Dr. F. Kampf and Mr. John H. Clark, observers; second, Detroit was connected with Ogden in 1873 by Mr. O. B. Wheeler, assistant in the United States Lake Survey, and Dr. F. Kampf, observers; and, third, the United States Naval Observatory at Washington, D. C., was connected with Ogden in 1874, by Prof. J. R. Eastman, of the Naval Observatory, and Mr. John H. Clark, observers. In all cases, observations were recorded at both places by means of the chronograph, and the longitude was determined by automatic signals of the chronometer, as well as by arbitrary breaks on the chronograph.

In reference to the first determination, it should be stated that each observer reduced his own observations, after leaving the field, by means of the method of least squares.

A description of the second determination will be found in the report of the Chief of Engineers for 1874, page 434 *et seq.* The observations taken at Detroit have been computed in a different way from those made at Ogden, and have afterward been recomputed by the method employed in this office. The result thereby attained is taken for the comparison of the final results.

The last determination, which was obtained in 1874 by a direct connection with Washington, is based upon the computations made by Professor Eastman and those of Dr. F. Kampf, who reduced the corresponding Ogden observations.

Tabulation of stars, &c.—Continued.

[illegible]

SEASON OF 1873.

Observations and reductions for time taken at sending station.

OGDEN, UTAH, SEPTEMBER 29, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | <i>a</i> Lyræ | 19 15 11.08 | — 0.70 | + 0.01 | + 0.82 | 19 15 11.21 | 18 32 39.22 | —42 31.93 |
| W. | 5 <i>e</i> Lyræ | 22 42.98 | — 0.40 | — 0.01 | + 0.83 | 22 43.40 | 40 11.23 | 32.11 |
| W. | <i>β</i> Lyræ | 27 57.66 | — 1.59 | — 0.01 | + 0.77 | 27 56.83 | 45 24.58 | 32.25 |
| W. | <i>o</i> Draconis..... | 31 45.03 | + 5.96 | 0.00 | + 1.25 | 31 52.24 | 49 20.02 | 32.22 |
| W. | <i>e</i> Aquilæ | 36 28.98 | — 4.47 | 0.00 | + 0.66 | 36 25.17 | 53 52.97 | 32.20 |
| W. | <i>ζ</i> Aquilæ | 42 12.10 | — 4.77 | 0.00 | + 0.67 | 42 08.00 | 59 35.78 | 32.22 |
| E. | <i>δ</i> Draconis..... | 54 54.16 | +11.43 | — 0.26 | — 1.66 | 55 03.67 | 19 12 31.49 | 32.18 |
| E. | <i>τ</i> Draconis..... | 20 00 15.31 | +18.08 | — 0.32 | — 2.21 | 20 00 30.86 | 17 58.76 | 32.10 |
| E. | <i>β</i> Cygni | 08 12.97 | — 2.58 | — 0.12 | — 0.72 | 08 09.55 | 25 37.45 | 32.10 |
| E. | <i>ι</i> Cygni | 09 01.65 | + 2.88 | — 0.17 | — 1.02 | 09 03.34 | 26 31.21 | 32.13 |
| E. | <i>κ</i> Aquilæ | 12 45.79 | — 7.55 | — 0.07 | — 0.65 | 12 37.52 | 30 05.40 | —42 32.12 |
| Mean at 19 ^h 0 ^m local sidereal time | | | | | | | | —42 32.16 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= + 1.46 + 11.00 \delta t - 1.64 a' + 2.00 c & \delta t &= -0^s.16 \\
 0 &= - 0.10 - 1.64 \delta t + 6.18 a' - 8.80 c & a' &= -0^s.94 \\
 0 &= + 13.98 + 2.00 \delta t - 8.80 a' + 34.24 c & c &= -0^s.64
 \end{aligned}$$

Adopted azimuth (to avoid large numbers) = $-9^s.00$; therefore, $a = -9^s.94$.

OGDEN, UTAH, SEPTEMBER 29, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|---|-------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | 13 H. Cephei..... | 22 17 31.60 | + 5.00 | 0.00 | — 1.08 | 22 17 35.52 | 21 35 03.27 | —42 32.25 |
| E. | 11 Cephei..... | 22 24.45 | +15.01 | 0.00 | — 1.78 | 22 37.68 | 40 05.44 | 32.24 |
| E. | <i>θ</i> Aquarii..... | 52 51.07 | — 7.71 | — 0.01 | — 0.60 | 52 42.75 | 22 10 10.51 | 32.24 |
| E. | <i>γ</i> Aquarii..... | 57 48.04 | — 6.81 | — 0.01 | — 0.59 | 57 40.63 | 15 08.30 | 32.33 |
| E. | <i>π</i> Aquarii..... | 23 01 29.30 | — 6.50 | — 0.01 | — 0.59 | 23 01 22.20 | 18 49.99 | 32.21 |
| W. | <i>ζ</i> Pegasi | 17 46.92 | — 5.20 | + 0.05 | + 0.59 | 17 42.36 | 35 10.14 | 32.22 |
| W. | <i>o</i> Andromedæ..... | 38 38.40 | + 0.10 | + 0.10 | + 0.79 | 38 39.39 | 56 07.34 | 32.05 |
| W. | <i>α</i> Pegasi | 41 04.72 | — 4.70 | + 0.07 | + 0.61 | 41 00.70 | 58 28.68 | —42 32.02 |
| Mean at 22 ^h 12 ^m local sidereal time | | | | | | | | —42 32.19 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= + 5.30 + 8.00 \delta t + 1.08 a' + 4.49 c & \delta t &= -0^s.19 \\
 0 &= + 2.13 + 1.08 \delta t + 4.46 a' - 4.36 c & a' &= -1^s.01 \\
 0 &= + 7.95 + 4.40 \delta t - 4.36 a' + 19.53 c & c &= -0^s.59
 \end{aligned}$$

Adopted azimuth = $-9^s.00$; therefore, $a = -10^s.01$.

TIME DETERMINATIONS.

13

Observations and reductions for time taken at sending station—Continued.

OGDEN, UTAH, SEPTEMBER 30, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|---------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | <i>a</i> Lyræ | 19 15 11.05 | — 0.77 | 0.00 | + 0.87 | 19 15 11.15 | 18 32 39.25 | —42 31.90 |
| E. | 5 <i>e</i> Lyræ | 22 42.77 | — 0.44 | 0.00 | + 0.83 | 22 43.21 | 40 11.27 | 31.94 |
| E. | <i>β</i> Lyræ | 27 57.63 | — 1.76 | 0.00 | + 0.82 | 27 56.69 | 45 24.56 | 32.13 |
| E. | <i>σ</i> Sagittarii | 30 08.08 | —11.40 | 0.00 | + 0.75 | 29 57.43 | 47 25.35 | 32.08 |
| E. | 50 Draconis | 32 31.75 | +24.35 | 0.00 | + 2.67 | 32 58.77 | 50 26.43 | 32.34 |
| W. | <i>ζ</i> Aquilæ | 42 13.78 | — 5.31 | — 0.14 | — 0.71 | 42 07.62 | 59 35.76 | 31.86 |
| W. | <i>d</i> Sagittarii | 52 57.24 | —10.18 | — 0.08 | — 0.72 | 52 46.26 | 19 10 14.17 | 32.09 |
| W. | <i>δ</i> Draconis | 54 52.74 | +12.73 | — 0.32 | — 1.77 | 55 03.38 | 12 31.43 | 31.95 |
| W. | <i>τ</i> Draconis | 20 00 12.91 | +20.14 | — 0.41 | — 2.35 | 20 00 30.29 | 17 58.68 | 31.61 |
| W. | <i>β</i> Cygni | 08 13.12 | — 2.88 | — 0.15 | — 0.77 | 08 09.32 | 25 37.43 | —42 31.89 |
| Mean at 19 ^h 0 ^m local sidereal time | | | | | | | | —42 31.98 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -7.44 + 10.00 \delta t - 2.21 a' - 0.47 c & \delta t &= +0^s.54 \\
 0 &= +13.48 - 2.21 \delta t + 11.71 a' + 0.34 c & a' &= -1^s.07 \\
 0 &= -25.73 - 0.47 \delta t + 0.34 a' + 43.55 c & c &= +0^s.62
 \end{aligned}$$

Adopted azimuth = $-10^s.00$; $a = -11^s.07$.

OGDEN, UTAH, SEPTEMBER 30, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|--|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | <i>γ</i> Aquilæ | 20 22 53.53 | — 5.77 | — 0.09 | — 0.67 | 20 22 47.00 | 19 40 15.02 | —42 31.98 |
| W. | <i>α</i> Aquilæ | 27 15.62 | — 5.99 | — 0.08 | — 0.67 | 27 08.88 | 44 36.98 | 31.90 |
| W. | <i>ε</i> Draconis | 30 54.61 | +15.53 | — 0.26 | — 1.91 | 31 07.97 | 48 35.94 | 32.03 |
| W. | <i>ψ</i> Cygni | 34 51.71 | + 3.44 | — 0.17 | — 1.07 | 34 53.91 | 52 21.92 | 31.99 |
| W. | <i>τ</i> Aquilæ | 40 37.07 | — 6.43 | — 0.09 | — 0.67 | 40 29.88 | 57 58.00 | 31.88 |
| E. | 31 <i>α</i> Cygni | 52 08.86 | + 1.44 | 0.00 | + 0.95 | 52 11.25 | 20 09 39.36 | 31.89 |
| E. | <i>α</i> ² Capricorni | 53 43.17 | — 9.20 | 0.00 | + 0.68 | 53 34.65 | 11 02.60 | 32.05 |
| E. | <i>α</i> Cygni | 21 19 37.64 | + 1.00 | + 0.01 | + 0.93 | 21 19 39.58 | 37 07.77 | 31.81 |
| E. | <i>γ</i> Delphini | 23 24.18 | — 4.99 | + 0.01 | + 0.68 | 23 19.88 | 40 97.84 | 32.04 |
| E. | <i>μ</i> Aquarii | 28 30.53 | — 8.65 | + 0.01 | + 0.66 | 28 22.55 | 45 50.43 | —42 32.12 |
| Mean at 20 ^h 8 ^m local sidereal time | | | | | | | | —42 31.97 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -2.40 + 10.00 \delta t + 1.77 a' - 1.66 c & \delta t &= +0^s.53 \\
 0 &= +0.87 + 1.77 \delta t + 4.49 a' + 4.69 c & a' &= -1^s.09 \\
 0 &= -8.06 - 1.66 \delta t + 4.69 a' + 21.43 c & c &= +0^s.66
 \end{aligned}$$

Adopted azimuth = $-10^s.00$; $a = -11^s.09$.

Observations and reductions for time taken at sending station—Continued.

OGDEN, UTAH, OCTOBER 1, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T. | AR. | ΔT. |
|--|--------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | <i>d</i> Sagittarii..... | 19 52 55.60 | —10.29 | —0.01 | +0.72 | 19 52 46.02 | 19 10 14.16 | —42 31.86 |
| W. | <i>δ</i> Draconis..... | 54 48.59 | +12.86 | —0.07 | +1.76 | 55 03.14 | 12 31.37 | 31.77 |
| W. | <i>τ</i> Draconis..... | 20 00 07.74 | +20.36 | —0.11 | +2.34 | 20 00 30.33 | 17 58.61 | 31.72 |
| W. | <i>β</i> Cygni..... | 08 11.33 | —2.91 | —0.04 | +0.77 | 08 09.15 | 25 37.41 | 31.74 |
| W. | <i>i</i> Cygni..... | 08 58.74 | +3.24 | —0.06 | +1.08 | 09 03.00 | 26 31.16 | 31.84 |
| E. | <i>κ</i> Aquilæ..... | 12 46.36 | —8.50 | —0.09 | —0.69 | 12 37.08 | 30 05.37 | 31.71 |
| E. | <i>γ</i> Aquilæ..... | 22 53.34 | —5.82 | —0.11 | —0.69 | 22 46.72 | 40 15.00 | 31.72 |
| E. | <i>α</i> Aquilæ..... | 27 15.57 | —6.04 | —0.11 | —0.69 | 27 08.73 | 44 36.97 | 31.76 |
| E. | <i>ε</i> Draconis..... | 30 54.30 | +15.66 | —0.30 | —1.97 | 31 07.69 | 48 35.89 | 31.80 |
| E. | <i>ψ</i> Cygni..... | 20 34 51.55 | +3.47 | —0.19 | —1.10 | 34 53.73 | 52 21.90 | —42 31.83 |
| Mean at 19 ^h 31 ^m local sidereal time..... | | | | | | | | —42 31.775 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -1.11 + 10.00 \, dt - 1.97 \, a' - 2.25 \, c & dt &= -0^s.275 \\
 0 &= +13.85 - 1.97 \, dt + 8.83 \, a' + 5.78 \, c & a' &= -1^s.19 \\
 0 &= +31.90 - 2.25 \, dt + 5.78 \, a' + 37.83 \, c & c &= -0^s.63
 \end{aligned}$$

Adopted azimuth = $-10^s.00$; = $-11^s.19$.

OGDEN, UTAH, OCTOBER 1, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T. | AR. | ΔT. |
|--|------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | <i>α</i> Cygni..... | 21 19 39.55 | +1.02 | —0.14 | —0.93 | 21 19 39.50 | 20 37 07.75 | —42 31.75 |
| E. | <i>γ</i> Delphini..... | 23 25.43 | —5.10 | —0.07 | —0.69 | 23 19.57 | 40 47.83 | 31.74 |
| E. | <i>μ</i> Aquarii..... | 28 31.94 | —8.85 | —0.07 | —0.67 | 28 22.35 | 45 50.42 | 31.93 |
| E. | <i>ν</i> Cygni..... | 35 01.04 | —0.11 | —0.16 | —0.87 | 34 59.90 | 52 28.06 | 31.84 |
| W. | <i>ζ</i> Cygni..... | 50 07.50 | —2.61 | —0.14 | +0.76 | 50 15.51 | 21 07 33.82 | 31.69 |
| W. | <i>τ</i> Cygni..... | 52 17.10 | —0.91 | —0.03 | +0.84 | 52 17.00 | 09 45.25 | 31.78 |
| W. | <i>α</i> Cephei..... | 57 56.44 | +8.62 | 0.00 | +1.41 | 58 06.47 | 15 34.59 | —42 31.88 |
| Mean at 20 ^h 56 ^m local sidereal time..... | | | | | | | | —42 31.801 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= +3.20 + 7.00 \, dt + 0.70 \, a' + 0.23 \, c & dt &= -0^s.301 \\
 0 &= +3.76 + 0.70 \, dt + 1.46 \, a' + 2.40 \, c & a' &= -1^s.342 \\
 0 &= +12.10 + 0.23 \, dt + 2.40 \, a' + 13.30 \, c & c &= -0^s.662
 \end{aligned}$$

Adopted azimuth = $-10^s.00$; $a = -11^s.342$

TIME DETERMINATIONS.

15

Observations and reductions for time taken at sending station—Continued.

OGDEN, UTAH, OCTOBER 2, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|---|--------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | <i>d</i> Sagittarii..... | 19 52 47.64 | — 1.49 | — 0.06 | — 0.10 | 19 52 45.99 | 19 10 14.14 | —42 31.85 |
| W. | <i>δ</i> Draconis..... | 55 01.91 | + 1.87 | — 0.28 | — 0.25 | 55 03.25 | 12 31.30 | 31.95 |
| W. | <i>τ</i> Draconis..... | 20 00 27.92 | + 2.95 | — 0.32 | — 0.33 | 20 00 30.22 | 17 58.52 | 31.70 |
| W. | <i>β</i> Cygni..... | 08 09.73 | — 0.42 | — 0.12 | — 0.11 | 08 09.08 | 25 37.38 | 31.70 |
| W. | <i>ι</i> Cygni..... | 09 02.80 | + 0.47 | — 0.17 | — 0.15 | 09 02.95 | 26 31.13 | 31.82 |
| E. | <i>κ</i> Aquilæ..... | 12 38.42 | — 1.23 | — 0.14 | + 0.10 | 12 37.15 | 30 05.35 | 31.80 |
| E. | <i>γ</i> Aquilæ..... | 22 47.72 | — 0.84 | — 0.19 | + 0.10 | 22 46.79 | 40 14.99 | 31.80 |
| E. | <i>α</i> Aquilæ..... | 27 09.66 | — 0.88 | — 0.18 | + 0.10 | 27 08.70 | 44 36.95 | 31.75 |
| E. | <i>ε</i> Draconis..... | 31 05.59 | + 2.27 | — 0.51 | + 0.28 | 31 07.63 | 48 35.82 | 31.81 |
| E. | <i>τ</i> Aquilæ..... | 40 30.74 | — 0.94 | — 0.08 | + 0.10 | 40 29.82 | 57 57.97 | —42 31.85 |
| Mean at 19 ^h 34 ^m local sidereal time | | | | | | | | —42 31.80 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -3.47 + 10.00 \delta t - 1.08 a - 2.85 c & \delta t &= +0.20 \\
 0 &= +14.26 - 1.08 \delta t + 9.07 a + 6.87 c & a &= -1.62 \\
 0 &= +8.19 - 2.85 \delta t + 6.87 a + 36.25 c & c &= +0.10
 \end{aligned}$$

OGDEN, UTAH, OCTOBER 2, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|---|-----------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | 61 Cygni..... | 21 43 46.34 | + 0.11 | — 0.25 | + 0.16 | 21 43 46.36 | 21 01 14.43 | —42 31.93 |
| E. | <i>ζ</i> Cygni..... | 50 06.02 | — 0.37 | — 0.23 | + 0.14 | 50 05.56 | 07 33.80 | 31.76 |
| E. | <i>τ</i> Cygni..... | 52 17.13 | — 0.13 | — 0.25 | + 0.16 | 52 16.91 | 09 45.20 | 31.71 |
| E. | <i>α</i> Cephei..... | 58 05.20 | + 1.23 | — 0.38 | + 0.27 | 58 06.32 | 15 34.55 | 31.77 |
| W. | <i>β</i> Aquarii..... | 22 07 27.90 | — 1.20 | — 0.02 | — 0.13 | 22 07 26.55 | 24 54.76 | 31.79 |
| W. | <i>β</i> Cephei..... | 09 32.67 | + 2.28 | — 0.08 | — 0.37 | 09 34.50 | 27 02.57 | 31.93 |
| W. | <i>ξ</i> Aquarii..... | 13 35.08 | — 1.25 | — 0.03 | — 0.13 | 13 33.67 | 31 01.85 | 31.82 |
| W. | <i>ε</i> Pegasi..... | 20 31.92 | — 0.87 | — 0.03 | — 0.13 | 20 30.89 | 37 59.20 | 31.69 |
| W. | 11 Cephei..... | 22 35.04 | + 2.43 | — 0.10 | — 0.38 | 22 36.99 | 40 05.30 | —42 31.69 |
| Mean at 21 ^h 20 ^m local sidereal time | | | | | | | | —42 31.79 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= +5.27 + 9.00 \delta t - 1.38 a - 3.18 c & \delta t &= -0.79 \\
 0 &= +8.47 - 1.38 \delta t + 6.31 a + 5.22 c & a &= -1.62 \\
 0 &= +2.17 - 3.18 \delta t + 5.22 a + 29.88 c & c &= +0.13
 \end{aligned}$$

Observations and reductions for time taken at sending station—Continued.

OGDEN, UTAH, OCTOBER 3, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|---|----------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | τ Draconis..... | 20 00 29.99 | + 1.21 | — 0.35 | — 0.50 | 20 00 30.35 | 19 17 58.45 | —42 31.90 |
| W. | i Cygni | 08 03.24 | + 0.19 | — 0.16 | — 0.23 | 08 03.04 | 26 31.09 | 31.95 |
| W. | κ Aquilæ | 12 38.00 | — 0.50 | — 0.07 | — 0.15 | 12 37.28 | 30 05.33 | 31.95 |
| W. | α Aquilæ | 27 09.27 | — 0.36 | — 0.08 | — 0.15 | 27 08.68 | 44 36.92 | 31.76 |
| W. | ϵ Draconis..... | 31 07.52 | + 0.93 | — 0.26 | — 0.42 | 31 07.77 | 48 35.75 | 32.02 |
| E. | τ Aquilæ | 40 30.18 | — 0.39 | — 0.13 | + 0.15 | 40 29.81 | 57 57.95 | 31.86 |
| E. | θ Aquilæ | 47 19.26 | — 0.44 | — 0.12 | + 0.14 | 47 18.84 | 20 04 47.04 | 31.80 |
| E. | α^2 Capricorni..... | 53 35.06 | — 0.55 | — 0.10 | + 0.15 | 53 34.56 | 11 02.55 | 32.01 |
| E. | κ Cephei | 55 37.63 | + 1.70 | — 0.66 | + 0.66 | 55 39.33 | 13 07.45 | 31.88 |
| E. | γ Cygni | 21 00 13.73 | — 0.03 | — 0.25 | + 0.19 | 21 00 13.64 | 17 41.73 | 31.91 |
| E. | π Capricorni..... | 02 37.90 | — 0.60 | — 0.10 | + 0.15 | 02 37.35 | 20 05.31 | 32.04 |
| E. | ϵ Delphini..... | 09 42.91 | — 0.34 | — 0.18 | + 0.15 | 09 42.54 | 27 10.61 | 31.93 |
| E. | Groom. 3241 | 13 04.03 | + 1.11 | — 0.56 | + 0.47 | 13 05.05 | 30 33.12 | —42 31.93 |
| Mean at 19 ^h 54 ^m local sidereal time | | | | | | | | —42 31.92 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -3.60 + 13.00 \delta t - 2.90 a + 4.23 c & \delta t &= +0^s.08 \\
 0 &= +12.85 - 2.90 \delta t + 18.13 a - 3.97 c & a &= -0^s.66 \\
 0 &= -12.15 + 4.23 \delta t - 3.97 a + 63.29 c & c &= +0^s.14
 \end{aligned}$$

OGDEN, UTAH, OCTOBER 4, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|---|--------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | d Sagittarii..... | 19 52 46.72 | — 0.27 | + 0.01 | — 0.11 | 19 52 46.35 | 19 10 14.10 | —42 32.25 |
| W. | δ Draconis..... | 55 03.37 | + 0.34 | + 0.05 | — 0.28 | 55 03.48 | 12 31.19 | 32.29 |
| W. | τ Draconis..... | 20 00 30.17 | + 0.54 | + 0.07 | — 0.37 | 20 00 30.41 | 17 58.36 | 32.05 |
| W. | β Cygni | 08 09.37 | — 0.03 | + 0.03 | — 0.12 | 08 09.20 | 25 37.34 | 31.86 |
| W. | i Cygni | 09 03.22 | + 0.08 | + 0.04 | — 0.17 | 09 03.17 | 26 31.05 | 32.12 |
| E. | κ Aquilæ | 12 37.62 | — 0.22 | — 0.02 | + 0.11 | 12 37.49 | 30 05.32 | 32.17 |
| E. | γ Aquilæ | 22 47.17 | — 0.15 | — 0.03 | + 0.10 | 22 47.09 | 40 14.96 | 32.13 |
| E. | α Aquilæ | 27 09.08 | — 0.16 | — 0.03 | + 0.11 | 27 09.00 | 44 36.91 | 32.09 |
| E. | ϵ Draconis..... | 31 07.22 | + 0.41 | — 0.12 | + 0.31 | 31 07.82 | 48 35.69 | 32.13 |
| E. | ψ Cygni | 34 53.72 | + 0.09 | — 0.08 | + 0.17 | 34 53.90 | 52 21.79 | —42 32.11 |
| Mean at 19 ^h 31 ^m local sidereal time | | | | | | | | —42 32.12 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= +0.85 + 10.00 \delta t - 1.97 a - 2.25 c & \delta t &= -0^s.12 \\
 0 &= +1.76 - 1.97 \delta t + 8.83 a + 5.78 c & a &= -0^s.30 \\
 0 &= -2.58 - 2.25 \delta t + 5.78 a + 37.83 c & c &= +0^s.11
 \end{aligned}$$

TIME DETERMINATIONS.

17

Observations and reductions for time taken at sending station—Continued.

OGDEN, UTAH, OCTOBER 4, 1873.

| Clamp. | Name of star. | T. | | Aa. | Bb. | Cc. | T'. | | AR. | ΔT. |
|--------|---|-----------------|-----------|-----------|-----------|-------------|-----------------|-------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | 12-year Cat. 1879 | 21 35 47.31 | + 1.51 | — 0.27 | + 0.78 | | 21 35 49.33 | 20 53 17.20 | —42 32.13 | |
| E. | 61 Cygni | 43 46.40 | + 0.03 | — 0.07 | + 0.17 | | 43 46.53 | 21 01 14.40 | 32.13 | |
| E. | ζ Cygni | 50 05.88 | — 0.10 | — 0.07 | + 0.15 | | 50 05.86 | 07 33.77 | 32.09 | |
| E. | τ Cygni | 52 17.19 | — 0.03 | — 0.07 | + 0.17 | | 52 17.26 | 09 45.16 | 32.10 | |
| E. | α Cephei | 58 06.19 | + 0.32 | — 0.12 | + 0.29 | | 58 06.63 | 15 34.48 | 32.20 | |
| W. | β Aquarii | 22 07 27.39 | — 0.31 | + 0.03 | — 0.14 | 22 07 26.97 | 24 54.73 | 32.24 | | |
| W. | β Cephei | 09 34.33 | + 0.59 | + 0.11 | — 0.39 | 09 34.64 | 27 02.48 | 32.16 | | |
| W. | ξ Aquarii | 13 34.44 | — 0.32 | + 0.03 | — 0.14 | 13 34.01 | 31 01.83 | 32.18 | | |
| W. | ε Pegasi | 20 31.48 | — 0.22 | + 0.05 | — 0.13 | 20 31.18 | 37 59.18 | 32.00 | | |
| W. | 11 Cephei | 22 36.89 | + 0.62 | + 0.21 | — 0.41 | 22 37.31 | 40 05.21 | —42 32.10 | | |
| | Mean at 21 ^h 17 ^m local sidereal time | | | | | | | | —42 32.13 | |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -1.11 + 10.00 \, dt - 5.02 \, a + 2.62 \, c & dt &= -0^s.13 \\
 0 &= +9.59 - 5.02 \, dt + 19.56 \, a - 15.89 \, c & a &= -0^s.42 \\
 0 &= -14.76 + 2.62 \, dt - 15.89 \, a + 63.52 \, c & c &= +0^s.13
 \end{aligned}$$

OGDEN, UTAH, OCTOBER 5, 1873.

| Clamp. | Name of star. | T. | | Aa. | Bb. | Cc. | T'. | | AR. | ΔT. |
|--------|---|-----------------|-----------|-----------|-----------|-------------|-----------------|-----------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | τ Draconis | 20 00 31.69 | + 0.06 | — 0.26 | — 0.43 | 20 00 31.06 | 19 17 58.28 | —42 32.78 | | |
| W. | β Cygni | 08 10.00 | — 0.01 | — 0.07 | — 0.14 | 08 09.78 | 25 37.32 | 32.46 | | |
| W. | ι Cygni | 09 03.98 | + 0.01 | — 0.09 | — 0.20 | 09 03.70 | 26 31.01 | 32.69 | | |
| W. | κ Aquilæ | 12 38.16 | — 0.03 | — 0.03 | — 0.13 | 12 37.97 | 30 05.30 | 32.67 | | |
| W. | γ Aquilæ | 22 47.71 | — 0.02 | — 0.04 | — 0.13 | 22 47.52 | 40 14.94 | 32.58 | | |
| E. | α Aquilæ | 27 09.63 | — 0.02 | — 0.12 | + 0.12 | 27 09.61 | 44 36.89 | 32.72 | | |
| E. | ε Draconis | 31 08.54 | + 0.05 | — 0.36 | + 0.37 | 31 08.60 | 48 35.62 | 32.98 | | |
| E. | ψ Cygni | 34 54.51 | + 0.01 | — 0.20 | + 0.20 | 34 54.52 | 52 21.75 | 32.77 | | |
| E. | τ Aquilæ | 40 30.52 | — 0.02 | + 0.12 | + 0.13 | 40 30.51 | 57 57.92 | 32.59 | | |
| E. | θ Aquilæ | 47 19.74 | — 0.02 | — 0.10 | + 0.12 | 47 19.74 | 20 04 47.02 | 32.72 | | |
| E. | α ² Capricorni | 53 35.29 | — 0.03 | — 0.08 | + 0.13 | 53 35.31 | 11 02.52 | 32.79 | | |
| E. | κ Cephei | 55 39.55 | + 0.09 | — 0.52 | + 0.57 | 55 39.69 | 13 07.26 | —42 32.43 | | |
| | Mean at 19 ^h 45 ^m local sidereal time | | | | | | | | —42 32.68 | |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= +1.50 + 12.00 \, dt - 2.22 \, a + 4.94 \, c & dt &= -0^s.13 \\
 0 &= +1.17 - 2.22 \, dt + 14.69 \, a - 8.43 \, c & a &= -0^s.04 \\
 0 &= -6.18 + 4.94 \, dt - .843 \, a + 53.84 \, c & c &= +0^s.13
 \end{aligned}$$

2 AST

Observations and reductions for time taken at sending station—Continued.

OGDEN, UTAH, OCTOBER 7, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | <i>a</i> Ceti | 3 38 15.61 | + 0.16 | — 0.05 | — 0.46 | 3 38 15.26 | 2 55 41.21 | —42 34.05 |
| W. | <i>ρ</i> Persei | 39 40.44 | + 0.02 | — 0.08 | — 0.57 | 39 39.81 | 57 05.76 | 34.05 |
| W. | <i>β</i> Persei | 42 32.52 | + 0.00 | — 0.08 | — 0.59 | 42 31.85 | 59 57.84 | 34.01 |
| W. | 48 Cephei | 47 01.57 | — 0.68 | — 0.18 | — 2.04 | 46 58.67 | 3 04 24.56 | 34.11 |
| W. | <i>ζ</i> Arietis | 50 13.48 | + 0.10 | — 0.05 | — 0.48 | 50 13.05 | 07 39.06 | 33.99 |
| E. | <i>a</i> Persei | 57 52.91 | — 0.05 | — 0.31 | + 0.68 | 57 53.23 | 15 19.31 | 33.92 |
| E. | <i>o</i> Tauri | 4 00 35.16 | + 0.14 | — 0.18 | + 0.46 | 4 00 35.58 | 18 01.50 | 34.08 |
| E. | <i>ξ</i> Tauri | 02 53.61 | + 0.14 | — 0.19 | + 0.46 | 02 54.02 | 20 19.80 | 34.22 |
| E. | <i>f</i> Tauri | 06 28.10 | + 0.13 | — 0.21 | + 0.46 | 06 28.48 | 23 54.51 | 33.97 |
| E. | <i>e</i> Eridani | 09 33.01 | + 0.20 | — 0.16 | + 0.46 | 09 33.51 | 26 59.36 | 34.15 |
| E. | <i>δ</i> Persei | 16 30.51 | — 0.04 | — 0.40 | + 0.66 | 16 30.73 | 33 56.63 | —42 34.10 |
| Mean at 3 ^h 14 ^m local sidereal time | | | | | | | | —42 34.06 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= + 1.69 + 11.00 \delta t + 0.45 a - 2.12 c & \delta t &= - 0^s.06 \\
 0 &= - 7.99 + 0.45 \delta t + 9.12 a + 12.81 c & a &= + 0^s.26 \\
 0 &= - 18.80 - 2.12 \delta t + 12.81 a + 34.58 c & c &= + 0^s.45
 \end{aligned}$$

OGDEN, UTAH, OCTOBER 18, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|---|--|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | <i>τ</i> Aquilæ | 20 40 32.75 | — 0.19 | + 0.01 | — 0.49 | 20 40 32.08 | 19 57 57.87 | —42 34.21 |
| W. | <i>θ</i> Aquilæ | 47 21.97 | — 0.23 | + 0.01 | — 0.49 | 47 21.26 | 20 04 46.97 | 34.29 |
| W. | <i>α</i> ² Capricorni | 53 37.64 | — 0.28 | + 0.01 | — 0.50 | 53 36.87 | 11 02.47 | 34.40 |
| W. | <i>κ</i> Cephei | 55 42.36 | + 0.87 | + 0.11 | — 2.23 | 55 41.11 | 13 06.94 | 34.17 |
| W. | <i>γ</i> Cygni | 21 00 16.49 | — 0.01 | + 0.05 | — 0.63 | 21 00 15.90 | 17 41.60 | 34.30 |
| W. | <i>π</i> Capricorni | 02 40.30 | — 0.31 | + 0.02 | — 0.51 | 02 39.50 | 20 05.23 | 34.27 |
| W. | <i>ε</i> Delphini | 09 45.44 | — 0.17 | + 0.04 | — 0.50 | 09 44.81 | 27 10.53 | 34.28 |
| W. | Gr. 3241 | 13 08.05 | + 0.57 | + 0.14 | — 1.59 | 13 07.17 | 30 32.77 | 34.40 |
| E. | <i>a</i> Cygni | 19 41.25 | + 0.03 | — 0.11 | + 0.69 | 19 41.86 | 37 07.57 | 34.29 |
| E. | <i>γ</i> Delphini | 23 21.79 | — 0.15 | — 0.08 | + 0.51 | 23 22.07 | 40 47.73 | 34.34 |
| E. | <i>μ</i> Aquarii | 28 24.37 | — 0.26 | — 0.06 | + 0.49 | 28 24.54 | 45 50.32 | 34.22 |
| E. | 12-year Cat. 1879 | 35 47.54 | + 1.23 | — 0.49 | + 2.83 | 35 51.11 | 53 16.72 | 34.39 |
| E. | 61 Cygni | 43 48.15 | + 0.02 | — 0.15 | + 0.62 | 43 48.64 | 21 01 14.32 | 34.32 |
| E. | <i>ζ</i> Cygni | 50 07.68 | — 0.08 | — 0.14 | + 0.56 | 50 08.02 | 07 33.70 | 34.32 |
| E. | <i>τ</i> Cygni | 52 18.84 | — 0.03 | — 0.15 | + 0.62 | 52 19.28 | 09 45.09 | 34.19 |
| E. | <i>a</i> Cephei | 58 07.68 | + 0.26 | — 0.28 | + 1.04 | 58 07.70 | 15 34.33 | 34.37 |
| E. | <i>β</i> Aquarii | 22 07 28.83 | — 0.25 | — 0.10 | + 0.49 | 22 07 28.97 | 24 54.69 | 34.28 |
| E. | <i>β</i> Cephei | 09 34.74 | + 0.48 | — 0.38 | + 1.42 | 09 36.26 | 27 02.28 | —42 33.98 |
| Mean at 20 ^h 42 ^m local sidereal time | | | | | | | | —42 34.28 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= + 1.19 + 18.00 \delta t - 4.39 a + 4.79 c & \delta t &= - 0^s.28 \\
 0 &= + 14.13 - 4.39 \delta t + 29.14 a - 11.23 c & a &= - 0^s.34 \\
 0 &= - 48.63 - 4.79 \delta t - 11.23 a + 94.61 c & c &= + 0^s.49
 \end{aligned}$$

Observations and reductions for time taken at sending station—Continued.

OGDEN, UTAH, OCTOBER 9, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|---|-----------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | α^2 Capricorni | 20 53 38.11 | — 0.07 | — 0.07 | — 0.47 | 20 53 37.50 | 20 11 02.46 | —42 35.04 |
| W. | κ Cephei | 55 44.18 | + 0.21 | — 0.41 | — 2.07 | 55 41.91 | 13 06.84 | 35.07 |
| W. | γ Cygni | 21 00 17.32 | 0.00 | — 0.12 | — 0.59 | 21 00 16.61 | 17 41.59 | 35.02 |
| W. | π Capricorni | 02 40.84 | — 0.08 | — 0.04 | — 0.47 | 02 40.25 | 20 05.22 | 35.03 |
| W. | ϵ Delphini | 09 46.18 | — 0.04 | — 0.06 | — 0.46 | 09 45.62 | 27 10.52 | 35.10 |
| W. | Groombr. 3241 .. | 13 09.54 | + 0.14 | — 0.64 | — 1.47 | 13 07.57 | 30 32.70 | 34.87 |
| E. | α Cygni | 19 42.10 | 0.00 | — 0.32 | + 0.64 | 19 42.42 | 37 07.55 | 34.87 |
| E. | γ Delphini | 23 22.45 | — 0.04 | — 0.21 | + 0.47 | 23 22.67 | 40 47.71 | 34.96 |
| E. | μ Aquarii | 28 25.08 | — 0.06 | — 0.14 | + 0.46 | 28 25.34 | 45 50.31 | 35.03 |
| E. | 12-year Cat. 1879. | 35 49.74 | + 0.30 | — 1.03 | + 2.63 | 35 51.64 | 53 16.59 | 35.05 |
| E. | 61 Cygni | 43 48.98 | 0.00 | — 0.29 | + 0.57 | 43 49.26 | 21 01 14.30 | 34.96 |
| E. | ζ Cygni | 50 08.48 | — 0.02 | — 0.26 | + 0.52 | 50 08.72 | 07 33.68 | —42 35.04 |
| Mean at 20 ^h 40 ^m local sidereal time | | | | | | | | —42 35.00 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -0.06 + 12.00 \delta t - 4.28 a - 0.53 c & \delta t &= 0^s.00 \\
 0 &= +4.38 - 4.28 \delta t + 25.24 a - 5.09 c & a &= -0^s.08 \\
 0 &= -35.26 - 0.53 \delta t - 5.09 a + 76.90 c & c &= +0^s.45
 \end{aligned}$$

OGDEN, UTAH, OCTOBER 10, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|---|-----------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | α^2 Capricorni | 29 53 38.98 | — 0.55 | + 0.03 | — 0.44 | 20 53 38.02 | 20 11 02.44 | —42 35.58 |
| W. | κ Cephei | 55 42.13 | + 1.70 | + 0.18 | — 1.95 | 55 42.06 | 13 06.72 | 35.34 |
| W. | γ Cygni | 21 00 17.33 | — 0.03 | + 0.05 | — 0.56 | 21 00 16.79 | 17 41.57 | 35.22 |
| W. | π Capricorni | 02 41.74 | — 0.60 | + 0.02 | — 0.45 | 02 40.71 | 20 05.20 | 35.51 |
| W. | ϵ Delphini | 09 46.60 | — 0.34 | + 0.04 | — 0.44 | 09 45.86 | 27 10.50 | 35.36 |
| W. | Groombr. 3241 .. | 13 08.24 | + 1.11 | + 0.11 | — 1.39 | 13 08.07 | 30 32.63 | 35.44 |
| E. | α Cygni | 19 42.25 | + 0.06 | — 0.08 | + 0.60 | 19 42.83 | 37 07.52 | 35.31 |
| E. | γ Delphini | 23 22.95 | — 0.30 | — 0.05 | + 0.44 | 23 23.04 | 40 47.70 | 35.34 |
| E. | μ Aquarii | 28 25.80 | — 0.52 | — 0.04 | + 0.43 | 28 25.67 | 45 50.30 | 35.37 |
| E. | 12-year Cat. 1879. | 35 47.27 | + 2.42 | — 0.31 | + 2.48 | 35 51.86 | 53 16.45 | 35.41 |
| E. | 61 Cygni | 43 49.23 | + 0.05 | — 0.10 | + 0.54 | 43 49.72 | 21 01 14.28 | 35.44 |
| E. | ζ Cygni | 50 08.71 | — 0.15 | — 0.09 | + 0.49 | 50 08.96 | 07 33.67 | —42 35.29 |
| Mean at 20 ^h 39 ^m local sidereal time | | | | | | | | —42 35.38 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -4.08 + 12.00 \delta t - 4.28 a - 0.53 c & \delta t &= +0^s.12 \\
 0 &= +19.56 - 4.28 \delta t + 25.24 a - 5.09 c & a &= -0^s.66 \\
 0 &= -36.24 - 0.53 \delta t - 5.09 a + 76.90 c & c &= +0^s.43
 \end{aligned}$$

Observations and reductions for time taken at sending station—Continued.

OGDEN, UTAH, OCTOBER 11, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|--------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | γ Delphini..... | 21 23 24.59 | — 0.23 | + 0.24 | — 0.44 | 21 23 24.16 | 20 40 47.68 | —42 36.48 |
| W. | u Aquarii..... | 28 27.67 | — 0.40 | + 0.19 | — 0.43 | 28 27.03 | 45 50.28 | 36.75 |
| W. | 12-year Cat. 1879. | 35 52.15 | + 1.86 | + 1.35 | — 2.46 | 35 52.90 | 53 16.34 | 36.56 |
| W. | 61 Cygni | 43 50.88 | + 0.04 | + 0.39 | — 0.54 | 43 50.77 | 21 01 14.26 | 36.51 |
| W. | ζ Cygni | 50 10.32 | — 0.12 | + 0.35 | — 0.49 | 50 10.06 | 07 33.65 | 36.41 |
| W. | τ Cygni | 52 21.62 | — 0.04 | + 0.39 | — 0.54 | 52 21.43 | 09 45.04 | 36.39 |
| E. | α Cephei | 58 09.00 | + 0.39 | + 0.40 | + 0.90 | 58 10.69 | 15 34.22 | 36.47 |
| E. | β Aquarii..... | 22 07 31.03 | — 0.37 | + 0.13 | + 0.43 | 22 07 31.22 | 24 54.66 | 36.56 |
| E. | β Cephei..... | 09 36.30 | + 0.72 | + 0.50 | + 1.24 | 09 38.76 | 27 02.11 | 36.65 |
| E. | ξ Aquarii..... | 13 38.21 | — 0.39 | + 0.11 | + 0.43 | 13 38.36 | 30 01.76 | 36.60 |
| E. | ε Pegasi..... | 20 35.23 | — 0.27 | + 0.14 | + 0.43 | 20 35.53 | 37 59.10 | 36.43 |
| E. | 11 Cephei..... | 22 38.82 | + 0.77 | + 0.45 | + 1.28 | 22 41.32 | 40 04.85 | —42 36.47 |
| Mean at 21 ^h 10 ^m local sidereal time..... | | | | | | | | —42 36.52 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= + 6.91 + 12.00 \delta t - 3.81 a - 0.41 c & \delta t &= - 0^s.72 \\
 0 &= + 2.81 - 3.81 \delta t + 20.37 a + 11.39 c & a &= - 0^s.51 \\
 0 &= - 22.29 - 0.41 \delta t + 11.39 a + 65.62 c & c &= + 0^s.42
 \end{aligned}$$

Observations and reductions for time taken at receiving station.

SALT LAKE CITY, UTAH, SEPTEMBER 29, 1873.

| Clamp. | Name of star. | T. | Aa. | bB. | Cc. | T'. | AR. | ΔT. |
|--|------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | ν Cygni | 12 45 32.01 | 0.00 | + 0.12 | + 0.24 | 12 45 32.37 | 20 52 28.10 | + 8 06 55.73 |
| E. | 61 Cygni (<i>pr.</i>).... | 54 18.58 | — 0.16 | + 0.14 | + 0.23 | 54 18.79 | 21 01 14.48 | 55.69 |
| E. | 61 Cygni (<i>seq.</i>).... | 54 20.01 | — 0.16 | + 0.14 | + 0.23 | 54 20.22 | 01 16.00 | 55.78 |
| E. | ζ Cygni | 13 00 38.50 | — 0.60 | + 0.15 | + 0.21 | 13 00 38.26 | 07 33.85 | 55.59 |
| E. | α Cephei | 08 36.15 | + 2.11 | + 0.30 | + 0.38 | 08 38.94 | 15 34.65 | 55.72 |
| W. | β Aquarii..... | 18 01.14 | — 2.00 | + 0.09 | — 0.18 | 17 59.05 | 24 54.79 | 55.74 |
| W. | ξ Aquarii..... | 24 08.41 | — 2.11 | + 0.09 | — 0.18 | 24 06.21 | 30 01.88 | 55.67 |
| W. | ε Pegasi..... | 31 05.03 | — 1.45 | + 0.11 | — 0.18 | 31 03.51 | 37 59.24 | 55.73 |
| W. | μ Capricorni..... | 39 31.55 | — 2.33 | + 0.07 | — 0.19 | 39 29.10 | 46 24.90 | 55.80 |
| W. | 79 Draconis..... | 44 19.06 | + 5.04 | + 0.44 | — 0.61 | 44 23.93 | 51 19.58 | 55.65 |
| W. | α Aquarii..... | 52 24.23 | — 1.84 | + 0.11 | — 0.18 | 52 22.32 | 59 18.12 | + 8 06 55.80 |
| Mean at 21 ^h 30 ^m local sidereal time..... | | | | | | | | + 8 06 55.718 |

NORMAL EQUATIONS.

$$\begin{aligned}
 11.00 \delta t + 1.28 a - 1.35 c &= - 6.83 & a &= - 2^s.743 \\
 1.28 \delta t + 6.60 a + 1.39 c &= - 18.20 & c &= + 0^s.180 \\
 - 1.35 \delta t + 1.39 a + 27.56 c &= + 1.51 & \delta t &= - 0^s.281
 \end{aligned}$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, OCTOBER 1, 1873.

| Clamp. | Name of star. | T. | | | Aa. | Bb. | Cc. | T'. | | | AR. | $\Delta T.$ | | |
|---|---------------------------|-----------------|-----------|-----------|------|-----------|-------------|-----------------|-------------|------------|-----------------|-----------------|-------------|-----------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> |
| E. | ϵ Aquilæ | 10 46 57.92 | — 1.22 | 0.00 | + | 0.15 | 10 46 56.85 | 18 53 52.88 | + | 8 06 56.03 | | | | |
| E. | ζ Aquilæ | 52 40.95 | — 1.27 | 0.00 | + | 0.14 | 52 39.82 | 59 35.75 | | 55.93 | | | | |
| E. | π Sagittarii..... | 55 21.04 | — 2.57 | + | 0.01 | + | 0.15 | 55 18.63 | 19 02 14.55 | | 55.92 | | | |
| E. | δ Draconis | 11 05 31.81 | + | 3.16 | + | 0.07 | + | 0.37 | 11 05 35.41 | 12 31.37 | | 55.96 | | |
| E. | δ Aquilæ | 12 12.92 | — 1.67 | + | 0.03 | + | 0.14 | 12 11.42 | 10 07.35 | | 55.93 | | | |
| E. | α Vulpeculæ..... | 16 31.28 | — 0.84 | + | 0.04 | + | 0.15 | 16 30.65 | 23 26.70 | | 56.07 | | | |
| W. | μ Aquilæ | 20 00.38 | — 1.51 | + | 0.06 | — | 0.14 | 19 58.79 | 27 54.78 | | 55.99 | | | |
| W. | κ Aquilæ | 23 11.57 | — 2.03 | + | 0.05 | — | 0.14 | 23 09.45 | 30 05.37 | | 55.92 | | | |
| W. | θ Cygni | 26 06.64 | + | 0.68 | + | 0.11 | — | 0.22 | 26 07.21 | 33 03.17 | | 55.96 | | |
| W. | γ Aquilæ | 33 20.49 | — 1.40 | + | 0.05 | — | 0.14 | 33 19.00 | 40 15.00 | | 56.00 | | | |
| W. | α Aquilæ | 37 42.54 | — 1.46 | + | 0.04 | — | 0.14 | 37 40.98 | 44 36.97 | | 55.99 | | | |
| W. | ϵ Draconis | 41 36.36 | + | 3.83 | + | 0.13 | — | 0.41 | 41 39.91 | 48 35.88 | + | 6 06 55.97 | | |
| Mean at 19 ^h 00 ^m local sidereal time | | | | | | | | | | | | + | 8 06 55.973 | |

NORMAL EQUATIONS.

$$\begin{aligned}
 12.00 \delta t + 2.33 a - 0.67 c &= + 5.28 & a &= -2^s.70 \\
 2.33 \delta t + 6.68 a + 2.01 c &= -15.54 & c &= +0^s.140 \\
 -0.67 \delta t + 2.01 a + 27.33 c &= -2.23 & \delta t &= +0^s.95
 \end{aligned}$$

SALT LAKE CITY, UTAH, OCTOBER 1, 1873.

| Clamp. | Name of star. | T. | | | Aa. | Bb. | Cc. | T'. | | | AR. | $\Delta T.$ | | |
|---|--------------------------|-----------------|-----------|-----------|------|-----------|-----------|-----------------|-------------|-------------|-----------------|-----------------|-------------|-----------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> |
| W. | α Cygni | 12 30 11.59 | + | 0.25 | + | 0.07 | — | 0.15 | 12 30 11.76 | 20 37 07.74 | + | 8 06 55.98 | | |
| W. | ϵ Aquarii | 33 56.62 | — 2.21 | + | 0.03 | — | 0.11 | 33 54.33 | 40 50.25 | | 55.92 | | | |
| W. | μ Aquarii | 38 56.75 | — 2.18 | + | 0.03 | — | 0.11 | 38 54.49 | 45 50.42 | | 55.93 | | | |
| W. | ν Cygni | 45 32.06 | — 0.00 | + | 0.04 | — | 0.14 | 45 31.96 | 52 28.06 | | 56.10 | | | |
| E. | α Cephei | 13 08 36.04 | + | 2.16 | + | 0.08 | + | 0.23 | 13 08 38.51 | 21 15 34.57 | | 56.06 | | |
| E. | β Cephei | 20 02.33 | + | 4.00 | + | 0.07 | + | 0.31 | 20 06.71 | 27 02.62 | | 55.91 | | |
| E. | ξ Aquarii | 24 07.93 | — 2.16 | + | 0.01 | + | 0.11 | 24 05.89 | 31 01.86 | | 55.97 | | | |
| E. | ϵ Pegasi | 31 04.43 | — 1.48 | 0.00 | + | 0.11 | | 31 03.06 | 37 59.22 | + | 8 06 56.16 | | | |
| Mean at 21 ^h 00 ^m local sidereal time | | | | | | | | | | | | + | 8 06 56.004 | |

NORMAL EQUATIONS.

$$\begin{aligned}
 8.00 \delta t + 0.58 a + 2.33 c &= -1.34 & a &= -2^s.80 \\
 0.58 \delta t + 4.74 a - 5.96 c &= -13.91 & c &= +0^s.107 \\
 2.33 \delta t - 5.96 a + 20.94 c &= +18.96 & \delta t &= +0^s.003
 \end{aligned}$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, OCTOBER 2, 1873.

| Clamp. | Name of star. | T. | | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|---|-----------------|-----------------|-----------|-----------|-----------|-------------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | δ Draconis..... | 11 05 32.44 | + 3.33 | + 0.18 | — 0.35 | 11 05 35.60 | 19 12 31.31 | + 8 06 55.71 | |
| W. | δ Aquilæ..... | 12 13.46 | — 1.77 | + 0.06 | — 0.13 | 12 11.62 | 19 07.33 | 55.71 | |
| W. | α Vulpeculæ.... | 16 31.98 | — 0.88 | + 0.08 | — 0.15 | 16 31.03 | 23 26.67 | 55.64 | |
| W. | μ Aquilæ..... | 21 00.72 | — 1.60 | + 0.08 | — 0.14 | 20 59.06 | 27 54.76 | 55.70 | |
| W. | κ Aquilæ..... | 23 11.95 | — 2.14 | + 0.06 | — 0.14 | 23 09.73 | 30 05.35 | 55.60 | |
| W. | θ Cygni..... | 26 06.72 | + 0.71 | + 0.14 | — 0.21 | 26 07.36 | 33 03.14 | 55.78 | |
| E. | γ Aquilæ..... | 33 20.44 | — 1.48 | + 0.08 | + 0.14 | 33 19.18 | 40 14.99 | 55.81 | |
| E. | α Aquilæ..... | 37 42.59 | — 1.54 | + 0.07 | + 0.14 | 37 41.26 | 44 36.94 | 55.68 | |
| E. | ε Draconis..... | 41 35.55 | + 4.05 | + 0.18 | + 0.39 | 41 40.17 | 48 35.82 | 55.65 | |
| E. | τ Aquilæ..... | 51 03.61 | — 1.60 | + 0.05 | + 0.15 | 51 02.21 | 57 57.97 | 55.76 | |
| E. | θ Aquilæ..... | 57 53.11 | — 1.91 | + 0.04 | + 0.13 | 57 51.37 | 20 04 47.04 | + 8 06 55.66 | |
| Mean at 19 ^h 30 ^m local sidereal time | | | | | | | | | + 8 06 55.70 |

NORMAL EQUATIONS.

$$\begin{aligned}
 11.00 \delta t + 1.69 a - 1.23 c &= -8.28 & a &= -2^s.854 \\
 1.69 \delta t + 6.12 a - 0.63 c &= -18.06 & c &= +0^s.134 \\
 -1.23 \delta t - 0.63 a + 26.26 c &= +5.68 & \delta t &= -0^s.31
 \end{aligned}$$

SALT LAKE CITY, UTAH, OCTOBER 2, 1873.

| Clamp. | Name of star. | T. | | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|---|-----------------------------|-----------------|-----------|-----------|-----------|-------------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | 61 Cygni (<i>pr.</i>)... | 12 54 18.50 | — 0.17 | + 0.06 | + 0.27 | 12 54 18.66 | 21 01 14.43 | + 8 06 55.77 | |
| E. | 61 Cygni (<i>seq.</i>)... | 54 19.87 | — 0.17 | + 0.06 | + 0.27 | 54 20.03 | 01 15.95 | 55.92 | |
| E. | ζ Cygni..... | 13 00 38.54 | — 0.62 | + 0.05 | + 0.24 | 13 00 28.21 | 07 33.80 | 55.59 | |
| E. | α Cephei..... | 08 36.26 | + 2.16 | + 0.08 | + 0.45 | 08 38.95 | 15 34.55 | 55.60 | |
| E. | β Aquarii..... | 18 00.97 | — 2.05 | + 0.03 | + 0.21 | 17 59.16 | 24 54.76 | 55.60 | |
| W. | ξ Aquarii..... | 24 08.51 | — 2.16 | + 0.06 | — 0.21 | 24 06.20 | 31 01.85 | 55.65 | |
| W. | ε Pegasi..... | 31 05.08 | — 1.49 | + 0.07 | — 0.21 | 31 03.45 | 37 59.21 | 55.76 | |
| W. | μ Capricorni.... | 39 31.75 | — 2.39 | + 0.05 | — 0.22 | 39 29.19 | 46 24.87 | 55.68 | |
| W. | 79 Draconis..... | 44 19.06 | + 5.17 | + 0.23 | — 0.71 | 44 23.75 | 51 19.42 | 55.67 | |
| W. | α Aquarii..... | 52 24.42 | — 1.88 | + 0.06 | — 0.21 | 52 22.39 | 59 18.10 | + 8 06 55.71 | |
| Mean at 21 ^h 30 ^m local sidereal time | | | | | | | | | + 8 06 55.695 |

NORMAL EQUATIONS.

$$\begin{aligned}
 10.00 \delta t + 1.28 a - 0.65 c &= -6.77 & a &= -2^s.805 \\
 1.28 \delta t + 6.60 a + 2.89 c &= -18.31 & c &= +0^s.210 \\
 -0.65 \delta t + 2.89 a + 25.90 c &= -2.47 & \delta t &= -0^s.303
 \end{aligned}$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, OCTOBER 3, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|---|-------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | π Sagittarii..... | 10 55 22.10 | — 2.60 | + 0.06 | — 0.18 | 10 55 19.38 | 19 02 14.51 | + 8 06 55.13 |
| W. | δ Draconis..... | 11 05 33.16 | + 3.21 | + 0.23 | — 0.44 | 05 36.16 | 12 31.25 | 55.09 |
| W. | δ Aquilæ..... | 12 14.00 | — 1.70 | + 0.08 | — 0.17 | 12 12.21 | 19 07.31 | 55.10 |
| W. | α Vulpeculæ..... | 16 32.45 | — 0.85 | + 0.09 | — 0.19 | 16 31.50 | 23 26.66 | 55.16 |
| E. | μ Aquilæ..... | 21 00.97 | — 1.53 | + 0.06 | + 0.17 | 20 59.67 | 27 54.74 | 55.07 |
| E. | κ Aquilæ..... | 23 12.04 | — 2.06 | + 0.05 | + 0.17 | 23 10.20 | 30 05.33 | 55.13 |
| E. | θ Cygni..... | 26 06.84 | + 0.69 | + 0.11 | + 0.26 | 26 07.90 | 33 03.04 | 55.14 |
| E. | γ Aquilæ..... | 33 21.03 | — 1.42 | + 0.05 | + 0.17 | 33 19.83 | 40 14.97 | 55.14 |
| E. | α Aquilæ..... | 37 43.10 | — 1.48 | + 0.05 | + 0.17 | 37 41.84 | 44 36.92 | 55.08 |
| E. | ε Draconis..... | 41 36.13 | + 3.89 | + 0.13 | + 0.50 | 41 40.65 | 48 35.75 | + 8 06 55.10 |
| Mean at 19 ^h 30 ^m local sidereal time | | | | | | | | + 8 06 55.112 |

NORMAL EQUATIONS.

$$\begin{aligned}
 10.00 \delta t + 1.41 a + 2.74 c &= -12.25 \\
 1.41 \delta t + 6.26 a - 1.06 c &= -18.57 \\
 2.74 \delta t - 1.06 a + 25.19 c &= +4.73
 \end{aligned}$$

$$\begin{aligned}
 a &= -2^s.736 \\
 c &= +0^s.170 \\
 \delta t &= -0^s.888
 \end{aligned}$$

SALT LAKE CITY, UTAH, OCTOBER 3, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|---|-------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | ε Pegasi..... | 13 31 05.29 | — 1.46 | + 0.02 | + 0.17 | 13 31 04.02 | 21 37 59.19 | + 8 06 55.17 |
| E. | μ Capricorni..... | 39 31.87 | — 2.35 | + 0.04 | + 0.18 | 39 29.74 | 46 24.86 | 55.12 |
| E. | 79 Draconis..... | 44 18.22 | + 5.08 | + 0.29 | + 0.58 | 44 24.17 | 51 19.37 | 55.20 |
| E. | α Aquarii..... | 52 24.54 | — 1.85 | + 0.08 | + 0.17 | 52 22.94 | 59 18.09 | 55.15 |
| W. | θ Aquarii..... | 14 03 17.48 | — 2.13 | + 0.06 | — 0.17 | 14 03 15.24 | 22 10 10.47 | 55.23 |
| W. | π Aquarii..... | 11 56.59 | — 1.77 | + 0.06 | — 0.17 | 11 54.71 | 18 49.96 | 55.25 |
| W. | η Aquarii..... | 21 59.11 | — 1.85 | + 0.05 | — 0.17 | 21 57.14 | 28 52.34 | 55.20 |
| W. | ζ Pegasi..... | 28 16.53 | — 1.44 | + 0.06 | — 0.17 | 28 14.98 | 35 10.12 | 55.14 |
| W. | ι Cephei..... | 34 14.83 | + 2.79 | + 0.15 | — 0.41 | 38 17.36 | 45 12.47 | + 8 06 55.11 |
| Mean at 22 ^h 00 ^m local sidereal time | | | | | | | | + 8 06 55.173 |

NORMAL EQUATIONS.

$$\begin{aligned}
 9.00 \delta t + 1.80 a + 0.01 c &= -3.41 \\
 1.80 \delta t + 7.58 a - 4.37 c &= -21.31 \\
 0.01 \delta t - 4.37 a + 24.57 c &= +16.23
 \end{aligned}$$

$$\begin{aligned}
 a &= -2^s.755 \\
 c &= +0^s.170 \\
 \delta t &= +0^s.172
 \end{aligned}$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, OCTOBER 4, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|---|-----------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | δ Draconis | 11 05 33.29 | + 3.31 | + 0.19 | — 0.54 | 11 05 36.25 | 19 12 31.19 | + 8 06 54.94 |
| W. | δ Aquilæ | 12 14.31 | — 1.75 | + 0.06 | — 0.21 | 12 12.41 | 19 07.30 | 54.89 |
| W. | α Vulpeculæ | 16 32.71 | — 0.88 | + 0.08 | — 0.23 | 16 31.68 | 23 26.64 | 54.96 |
| W. | μ Aquilæ | 21 01.58 | — 1.58 | + 0.07 | — 0.21 | 20 59.86 | 27 54.73 | 54.87 |
| W. | κ Aquilæ | 23 12.78 | — 2.12 | + 0.06 | — 0.21 | 23 10.51 | 30 05.32 | 54.81 |
| W. | θ Cygni | 26 07.64 | + 0.71 | + 0.14 | — 0.32 | 26 08.17 | 33 03.02 | 54.84 |
| W. | γ Aquilæ | 33 21.59 | — 1.47 | + 0.08 | — 0.21 | 33 19.99 | 40 14.96 | 54.97 |
| W. | α Aquilæ | 37 43.65 | — 1.53 | + 0.07 | — 0.21 | 37 41.98 | 44 36.91 | 54.93 |
| W. | ε Draconis | 41 37.07 | + 4.02 | + 0.20 | — 0.60 | 41 40.69 | 48 35.69 | 55.00 |
| E. | ν Cygni | 12 45 32.90 | 0.00 | + 0.10 | + 0.27 | 12 45 33.27 | 20 52 27.99 | 54.72 |
| E. | 61 Cygni (<i>pr.</i>) .. | 54 19.20 | — 0.17 | + 0.10 | + 0.26 | 54 19.39 | 21 01 14.40 | 55.01 |
| E. | 61 Cygni (<i>seq.</i>) .. | 54 20.72 | — 0.17 | + 0.10 | + 0.26 | 54 20.91 | 01 15.92 | 55.01 |
| E. | ζ Cygni | 13 00 39.27 | — 0.62 | + 0.10 | + 0.24 | 13 00 38.99 | 07 33.77 | 54.78 |
| E. | α Cephei | 08 37.08 | + 2.18 | + 0.18 | + 0.44 | 08 39.88 | 15 34.48 | 54.60 |
| E. | β Aquarii | 18 01.65 | — 2.07 | + 0.08 | + 0.21 | 18 59.87 | 24 54.73 | 54.86 |
| E. | ξ Aquarii | 24 08.94 | — 2.18 | + 0.10 | + 0.21 | 24 07.07 | 31 01.83 | 54.76 |
| E. | ε Pegasi | 31 05.55 | — 1.50 | + 0.13 | + 0.21 | 31 04.39 | 37 59.18 | + 8 06 54.79 |
| Mean at 20 ^h 00 ^m local sidereal time | | | | | | | | + 8 06 54.866 |

NORMAL EQUATIONS.

$$\begin{aligned}
 17.00 \delta t + 2.06 a - 3.04 c &= -8.72 & a &= -2.^{\circ}829 \\
 2.06 \delta t + 7.40 a + 5.05 c &= -20.16 & c &= +0.^{\circ}205 \\
 3.04 \delta t + 5.05 a + 37.97 c &= -6.91 & \delta t &= -0.^{\circ}137
 \end{aligned}$$

SALT LAKE CITY, UTAH, OCTOBER 5, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|---|---------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | α Vulpeculæ | 11 16 32.59 | — 0.83 | + 0.12 | + 0.16 | 11 16 32.04 | 19 23 26.61 | + 8 06 54.57 |
| E. | μ Aquilæ | 21 01.66 | — 1.50 | + 0.10 | + 0.15 | 21 00.41 | 27 54.71 | 54.30 |
| E. | κ Aquilæ | 23 12.59 | — 2.01 | + 0.08 | + 0.15 | 23 10.81 | 30 05.30 | 54.49 |
| E. | θ Cygni | 26 07.36 | + 0.67 | + 0.17 | + 0.23 | 26 08.43 | 33 03.03 | 54.60 |
| E. | γ Aquilæ | 33 21.53 | — 1.39 | + 0.09 | + 0.15 | 33 20.38 | 40 14.94 | 54.56 |
| W. | α Aquilæ | 37 43.83 | — 1.45 | + 0.10 | — 0.15 | 37 42.33 | 44 36.89 | 54.56 |
| W. | ε Draconis | 41 37.45 | + 3.81 | + 0.31 | — 0.44 | 41 41.13 | 48 35.62 | 54.49 |
| W. | τ Aquilæ | 51 04.89 | — 1.50 | + 0.11 | — 0.15 | 51 03.35 | 57 57.92 | 54.57 |
| W. | θ Aquilæ | 57 54.34 | — 1.80 | + 0.10 | — 0.15 | 57 52.49 | 04 46.97 | 54.48 |
| W. | α ² Capricorni | 12 04 10.23 | — 2.22 | + 0.09 | — 0.15 | 12 04 07.95 | 20 11 02.52 | 54.57 |
| W. | β Capricorni | 07 02.47 | — 2.30 | + 0.10 | — 0.15 | 07 00.12 | 13 54.62 | + 8 06 54.50 |
| Mean at 19 ^h 30 ^m local sidereal time | | | | | | | | + 8 06 74.517 |

NORMAL EQUATIONS.

$$\begin{aligned}
 11.00 \delta t + 3.93 a - 2.32 c &= -16.18 & a &= -2.^{\circ}63 \\
 3.93 \delta t + 5.81 a + 2.43 c &= -17.09 & c &= +0.^{\circ}149 \\
 -2.32 \delta t + 2.43 a + 20.40 c &= -2.38 & \delta t &= -0.^{\circ}482
 \end{aligned}$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, OCTOBER 5, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|---|--------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | ν Cygni | 12 45 33.40 | — 0.00 | + 0.26 | — 0.27 | 0 0 33.39 | 20 52 27.97 | + 8 06 54.58 |
| W. | γ^1 Cygni | 48 37.35 | + 0.44 | + 0.29 | — 0.30 | 37.78 | 55 31.99 | 54.21 |
| W. | 61 Cygni (<i>pr.</i>) | 54 19.97 | — 0.16 | + 0.25 | — 0.26 | 19.80 | 21 01 14.38 | 54.58 |
| W. | 61 Cygni (<i>seq.</i>) | 54 21.27 | — 0.16 | + 0.25 | — 0.26 | 21.10 | 01 15.90 | 54.80 |
| E. | ζ Cygni | 13 00 39.47 | — 0.60 | + 0.27 | + 0.24 | 39.38 | 17 33.75 | 54.37 |
| E. | α Cephei | 08 36.84 | + 2.10 | + 0.48 | + 0.44 | 39.86 | 15 34.44 | 54.58 |
| E. | β Aquarii | 18 01.77 | — 1.99 | + 0.18 | + 0.21 | 00.17 | 24 54.72 | 54.55 |
| E. | ξ Aquarii | 24 08.95 | — 2.10 | + 0.19 | + 0.21 | 07.25 | 31 01.82 | + 8 06 54.57 |
| Mean at 13 ^h 00 ^m local sidereal time | | | | | | | | + 8 06 54.531 |

NORMAL EQUATIONS.

$$\begin{aligned}
 8.00 \delta t + 0.91 a - 0.02 c &= -6.22 & \delta t &= -0.469 \\
 0.91 \delta t + 1.78 a + 0.22 c &= -5.26 & a &= -2.726 \\
 -0.02 \delta t + 0.22 a + 15.04 c &= +2.49 & c &= +0.205
 \end{aligned}$$

DETROIT, MICHIGAN, SEPTEMBER 29, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|---------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | 12 Ceti | 0 29 13.08 | + 0.01 | + 0.33 | + 0.26 | 0 29 13.68 | 0 23 36.24 | — 5 37.44 |
| W. | α Cassiopeiæ | 38 58.09 | — 0.01 | + 0.85 | + 0.45 | 38 59.38 | 33 21.99 | 37.39 |
| W. | β Ceti | 42 52.69 | + 0.02 | + 0.25 | + 0.27 | 42 53.23 | 37 15.74 | 37.49 |
| W. | ϵ Piscium | 1 02 00.79 | + 0.01 | + 0.40 | + 0.26 | 1 02 01.46 | 56 23.93 | 37.53 |
| E. | θ^1 Ceti | 23 20.49 | + 0.01 | + 0.34 | — 0.26 | 23 20.58 | 1 17 43.31 | 37.27 |
| E. | η Piscium | 30 21.37 | + 0.01 | + 0.48 | — 0.27 | 30 21.59 | 24 44.04 | 37.55 |
| E. | ϕ Piscium | 44 21.43 | + 0.01 | + 0.44 | — 0.26 | 44 21.62 | 38 44.10 | — 5 37.52 |
| Mean at 1 ^h 00 ^m local sidereal time | | | | | | | | — 5 37.46 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -0.12 + 7.00 \delta t + 3.64 a - 1.77 c & \delta t &= -0.06 \\
 0 &= +0.24 + 3.64 \delta t + 3.04 a + 0.29 c & a &= +0.02 \\
 0 &= +2.31 - 1.77 \delta t + 0.29 a + 9.45 c & c &= -0.26
 \end{aligned}$$

Observations and reductions for time taken at receiving station—Continued.

DETROIT, MICHIGAN, SEPTEMBER 30, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|---|--------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | ϵ Delphini..... | 20 32 48.36 | + 0.14 | + 0.46 | + 0.17 | 20 32 49.13 | 20 27 10.66 | — 5 38.47 |
| W. | γ^2 Delphini..... | 46 25.66 | + 0.13 | + 0.49 | + 0.17 | 46 26.45 | 40 47.84 | 38.61 |
| W. | μ Aquarii..... | 51 28.07 | + 0.22 | + 0.33 | + 0.17 | 51 28.79 | 45 50.43 | 38.36 |
| W. | 32 Vulpeculæ..... | 54 48.39 | + 0.08 | + 0.58 | + 0.19 | 54 49.24 | 49 10.72 | 38.52 |
| W. | ζ Cygni..... | 21 13 11.44 | + 0.07 | + 0.60 | + 0.19 | 21 13 12.30 | 21 07 33.83 | 38.47 |
| E. | 1 Draconis, L. C. | 24 26.65 | + 1.61 | — 2.21 | + 1.18 | 24 27.23 | 18 48.93 | 38.30 |
| E. | β Aquarii..... | 30 32.76 | + 0.21 | + 0.38 | — 0.17 | 30 33.18 | 24 54.78 | 38.40 |
| E. | ξ Aquarii..... | 36 40.03 | + 0.21 | + 0.36 | — 0.17 | 36 40.43 | 31 01.87 | 38.56 |
| E. | ϵ Pegasi..... | 43 37.29 | + 0.15 | + 0.48 | — 0.17 | 43 37.75 | 37 59.23 | 38.52 |
| E. | μ Capricorni..... | 52 02.86 | + 0.23 | + 0.32 | — 0.17 | 52 03.24 | 46 24.89 | 38.35 |
| E. | θ Pegasi..... | 22 09 28.01 | + 0.17 | + 0.45 | — 0.17 | 22 09 28.46 | 22 03 50.05 | 38.41 |
| E. | θ Aquarii..... | 15 48.60 | + 0.22 | + 0.35 | — 0.17 | 15 49.00 | 10 10.50 | 38.50 |
| E. | γ Aquarii..... | 20 46.33 | + 0.19 | + 0.39 | — 0.16 | 20 46.75 | 15 08.30 | 38.45 |
| E. | π Aquarii..... | 24 27.99 | + 0.18 | + 0.40 | — 0.17 | 24 28.40 | 18 49.98 | 38.42 |
| E. | 226 Cephei..... | 35 42.97 | — 0.60 | + 1.78 | — 0.67 | 35 43.48 | 30 05.36 | 38.12 |
| E. | ζ Pegasi..... | 40 48.34 | + 0.15 | + 0.46 | — 0.17 | 40 48.78 | 35 10.14 | 38.64 |
| E. | λ Aquarii..... | 51 40.08 | + 0.22 | + 0.34 | — 0.17 | 51 40.47 | 46 01.94 | — 5 38.53 |
| Mean at 21 ^h 55 ^m local sidereal time | | | | | | | | — 5 38.45 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -0.76 + 17.00 \delta t + 13.04 a + 1.74 c & \delta t &= -0^s.15 \\
 0 &= -17.84 + 13.04 \delta t + 45.45 a - 45.52 c & a &= +0^s.27 \\
 0 &= +26.32 + 1.74 \delta t - 45.52 a + 82.26 c & c &= -0^s.17
 \end{aligned}$$

DETROIT, MICHIGAN, OCTOBER 1, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|---|----------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | θ Aquilæ..... | 20 10 25.64 | + 0.10 | + 0.23 | — 0.27 | 20 10 25.70 | 20 04 47.06 | — 5 38.64 |
| E. | α^2 Capricorni..... | 16 41.15 | + 0.12 | + 0.20 | — 0.28 | 16 41.19 | 11 02.58 | 38.61 |
| E. | π Capricorni..... | 25 43.90 | + 0.13 | + 0.19 | — 0.29 | 25 43.93 | 20 05.34 | 38.59 |
| E. | ϵ Delphini..... | 32 49.39 | + 0.07 | + 0.35 | — 0.28 | 32 49.53 | 27 10.64 | 38.89 |
| E. | γ^2 Delphini..... | 46 26.69 | + 0.07 | + 0.40 | — 0.29 | 46 26.87 | 40 47.81 | 39.06 |
| E. | μ Aquarii..... | 51 29.05 | + 0.11 | + 0.29 | — 0.28 | 51 29.17 | 45 50.42 | 38.75 |
| E. | 32 Vulpeculæ..... | 54 49.67 | + 0.04 | + 0.51 | — 0.31 | 54 49.91 | 49 10.71 | 39.20 |
| E. | ζ Cygni..... | 21 13 12.75 | + 0.03 | + 0.61 | — 0.32 | 21 13 13.07 | 21 07 33.82 | 39.25 |
| W. | 1 Pegasi..... | 21 53.05 | + 0.06 | + 0.51 | + 0.29 | 21 53.91 | 16 14.96 | 38.95 |
| W. | β Aquarii..... | 30 32.93 | + 0.11 | + 0.35 | + 0.27 | 30 33.66 | 24 54.77 | 38.89 |
| W. | ξ Aquarii..... | 36 39.98 | + 0.11 | + 0.33 | + 0.28 | 36 40.70 | 31 01.86 | 38.84 |
| W. | ϵ Pegasi..... | 43 37.20 | + 0.08 | + 0.44 | + 0.28 | 43 38.60 | 37 59.22 | 38.78 |
| W. | μ Capricorni..... | 52 03.11 | + 0.12 | + 0.30 | + 0.28 | 52 03.81 | 46 24.83 | 38.93 |
| W. | 20 Pegasi..... | 22 00 34.75 | + 0.07 | + 0.45 | + 0.28 | 22 00 35.55 | 54 56.49 | 39.06 |
| W. | α Aquarii..... | 05 56.26 | + 0.09 | + 0.37 | + 0.27 | 05 56.99 | 59 18.10 | 38.89 |
| W. | θ Pegasi..... | 09 28.27 | + 0.09 | + 0.41 | + 0.28 | 09 29.05 | 22 03 50.05 | 39.00 |
| W. | θ Aquarii..... | 15 48.61 | + 0.11 | + 0.32 | + 0.28 | 15 49.32 | 10 10.49 | 38.83 |
| W. | γ Aquarii..... | 20 46.54 | + 0.10 | + 0.36 | + 0.27 | 20 47.27 | 15 08.29 | 38.98 |
| W. | π Aquarii..... | 24 28.16 | + 0.09 | + 0.37 | + 0.28 | 24 28.90 | 18 49.97 | 38.93 |
| W. | 226 Cephei..... | 35 41.58 | — 0.31 | + 1.68 | + 1.10 | 35 44.05 | 30 05.32 | 38.73 |
| W. | ζ Pegasi..... | 40 48.38 | + 0.08 | + 0.44 | + 0.28 | 40 49.18 | 35 10.13 | 39.05 |
| W. | λ Pegasi..... | 46 05.57 | + 0.10 | + 0.53 | + 0.30 | 46 06.50 | 40 27.31 | 39.19 |
| W. | λ Aquarii..... | 51 40.12 | + 0.11 | + 0.34 | + 0.28 | 51 40.85 | 46 01.94 | 38.91 |
| W. | α Pegasi..... | 23 04 06.76 | + 0.07 | + 0.49 | + 0.28 | 23 04 07.60 | 58 28.67 | — 5 38.93 |
| Mean at 21 ^h 55 ^m local sidereal time | | | | | | | | — 5 38.91 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= +2.73 + 24.00 \delta t + 12.42 a - 10.95 c & \delta t &= -0^s.31 \\
 0 &= +2.80 + 12.42 \delta t + 14.79 a + 3.63 c & a &= +0^s.14 \\
 0 &= +7.24 - 10.95 \delta t + 3.63 a + 40.71 c & c &= -0^s.27
 \end{aligned}$$

Observations and reductions for time taken at receiving station—Continued.

DETROIT, MICHIGAN, OCTOBER 9, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|---|-----------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | α^2 Capricorni | 20 16 20.48 | + 0.20 | — 0.03 | — 0.32 | 20 16 20.33 | 20 10 38.60 | — 5 41.73 |
| E. | ϵ Delphini | 32 52.69 | + 0.12 | + 0.03 | — 0.31 | 32 52.53 | 27 10.52 | 42.01 |
| E. | α Cygni | 42 50.30 | — 0.01 | + 0.06 | — 0.44 | 42 49.91 | 37 07.55 | 42.36 |
| E. | μ Aquarii | 51 32.38 | + 0.19 | + 0.03 | — 0.32 | 51 32.28 | 45 50.31 | 41.97 |
| E. | ν Cygni | 58 10.62 | + 0.01 | + 0.09 | — 0.41 | 58 10.31 | 52 27.89 | 42.42 |
| E. | β Cygni | 21 06 56.92 | + 0.02 | + 0.10 | — 0.39 | 21 06 56.65 | 21 01 14.30 | 42.35 |
| W. | ξ Aquarii | 36 43.44 | + 0.19 | — 0.02 | + 0.31 | 36 43.92 | 31 01.78 | 42.14 |
| W. | ϵ Pegasi | 43 40.90 | + 0.13 | — 0.03 | + 0.32 | 43 41.32 | 37 59.13 | 42.19 |
| W. | μ Capricorni | 52 06.49 | + 0.21 | — 0.02 | + 0.32 | 52 07.00 | 46 24.80 | 42.20 |
| W. | α Aquarii | 22 04 59.83 | + 0.16 | — 0.01 | + 0.31 | 22 05 00.29 | 59 18.03 | 42.26 |
| W. | θ Aquarii | 15 52.03 | + 0.19 | — 0.01 | + 0.32 | 15 52.53 | 22 10 10.42 | 42.11 |
| W. | γ Aquarii | 20 50.01 | + 0.17 | — 0.00 | + 0.31 | 20 50.49 | 15 08.24 | 42.25 |
| W. | π Aquarii | 24 31.63 | + 0.16 | + 0.01 | + 0.31 | 24 32.11 | 18 49.91 | 42.20 |
| W. | η Aquarii | 34 33.84 | + 0.16 | + 0.01 | + 0.31 | 34 34.32 | 28 52.30 | 42.02 |
| W. | δ Cephei | 35 46.14 | — 0.53 | + 0.03 | + 1.24 | 35 46.93 | 30 04.93 | 42.00 |
| W. | λ Pegasi | 46 09.11 | + 0.16 | + 0.04 | + 0.33 | 46 09.64 | 40 27.26 | 42.38 |
| W. | λ Aquarii | 51 43.60 | + 0.19 | + 0.03 | + 0.32 | 51 44.14 | 46 01.90 | 42.24 |
| W. | α Pegasi | 23 04 10.38 | + 0.12 | + 0.03 | + 0.32 | 23 04 10.87 | 58 28.64 | 42.23 |
| W. | θ Piscium | 28 15.96 | + 0.14 | + 0.05 | + 0.31 | 28 16.46 | 23 22 34.17 | 42.29 |
| W. | ι Piscium | 39 09.62 | + 0.15 | + 0.06 | + 0.31 | 39 10.14 | 33 27.85 | 42.29 |
| W. | ω Piscium | 58 31.89 | + 0.14 | + 0.07 | + 0.31 | 58 32.41 | 52 50.16 | 42.25 |
| W. | α Andromedæ | 0 07 34.16 | + 0.06 | + 0.11 | + 0.35 | 0 07 34.68 | 0 01 52.26 | — 5 42.42 |
| Mean at 21 ^h 55 ^m local sidereal time | | | | | | | | — 5 42.20 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -1.81 + 22.00 \delta t + 9.80 a - 12.34 a & \delta t &= -0^s.20 \\
 0 &= -0.87 + 9.80 \delta t + 13.05 a + 1.01 a & a &= +0^s.24 \\
 0 &= +9.83 - 12.34 \delta t + 1.01 a + 40.38 a & c &= -0^s.31
 \end{aligned}$$

DETROIT, MICHIGAN, OCTOBER 10, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|---|-----------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | α^2 Capricorni | 20 16 45.76 | + 0.24 | 0.00 | + 0.18 | 20 16 46.18 | 20 11 02.44 | — 5 43.74 |
| W. | π Capricorni | 25 48.30 | + 0.26 | + 0.02 | + 0.18 | 25 48.76 | 20 05.20 | 43.56 |
| W. | ϵ Delphini | 32 53.89 | + 0.15 | + 0.07 | + 0.18 | 32 54.29 | 27 10.50 | 43.79 |
| W. | α Cygni | 42 50.83 | — 0.01 | + 0.17 | + 0.24 | 42 51.23 | 37 07.55 | 43.68 |
| W. | μ Aquarii | 51 33.61 | + 0.22 | + 0.10 | + 0.18 | 51 34.11 | 45 50.30 | 43.81 |
| W. | β Cygni | 21 06 57.66 | + 0.02 | + 0.15 | + 0.22 | 21 06 58.05 | 21 01 14.28 | 43.77 |
| W. | ζ Cygni | 13 17.04 | + 0.07 | + 0.08 | + 0.20 | 13 17.39 | 07 33.67 | 43.72 |
| E. | β Aquarii | 30 38.26 | + 0.21 | + 0.07 | — 0.17 | 30 38.37 | 24 54.66 | 43.71 |
| E. | ξ Aquarii | 36 45.41 | + 0.22 | + 0.07 | — 0.18 | 36 45.52 | 31 01.76 | 43.76 |
| E. | ϵ Pegasi | 43 42.72 | + 0.16 | + 0.09 | — 0.17 | 43 42.80 | 37 59.11 | 43.69 |
| E. | μ Capricorni | 52 08.37 | + 0.24 | + 0.06 | — 0.18 | 52 08.49 | 46 24.79 | 43.70 |
| E. | α Aquarii | 22 05 01.63 | + 0.19 | + 0.09 | — 0.17 | 22 05 01.74 | 59 18.02 | 43.72 |
| E. | η Aquarii | 34 35.86 | + 0.19 | + 0.11 | — 0.17 | 34 35.99 | 22 23 52.30 | 43.69 |
| E. | λ Aquarii | 51 45.45 | + 0.22 | + 0.10 | — 0.18 | 51 45.59 | 46 01.89 | 43.70 |
| E. | α Pegasi | 23 04 12.33 | + 0.14 | + 0.16 | — 0.18 | 23 04 12.45 | 58 28.63 | — 5 43.82 |
| Mean at 23 ^h 25 ^m local sidereal time | | | | | | | | — 5 43.72 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -0.64 + 15.00 \delta t + 8.95 a + 0.20 c & \delta t &= -0^s.12 \\
 0 &= -0.42 + 8.95 \delta t + 6.55 a + 2.20 c & a &= +0^s.28 \\
 0 &= +2.42 + 0.20 \delta t + 2.20 a + 17.44 c & c &= -0^s.17
 \end{aligned}$$

The following tables show the corrections and rates of the chronometers used at Salt Lake City and Ogden and of the clock used at Detroit:

CHRONOMETER AT OGDEN.—NEGUS, No. 1499.

| Date. | Local sidereal time. | Correction of chronometer. | Adopted hourly rate. |
|----------------------|----------------------|----------------------------|----------------------|
| | <i>h.</i> | <i>h. m. s.</i> | <i>s.</i> |
| Sept. 29, 1873 | 20.6 | — 0 42 32.18 | — 0.008 |
| Sept. 30, 1873 | 19.6 | | — 0.008 |
| Oct. 1, 1873 | 20.1 | | 0.000 |
| Oct. 2, 1873 | 20.4 | | 0.000 |
| Oct. 3, 1873 | 19.9 | | + 0.007 |
| Oct. 4, 1873 | 20.4 | | + 0.017 |
| Oct. 5, 1873 | 19.7 | | + 0.026 |
| Oct. 7, 1873 | 3.2 | | + 0.020 |
| Oct. 8, 1873 | 20.7 | | + 0.022 |
| Oct. 9, 1873 | 20.7 | | + 0.023 |
| Oct. 10, 1873 | 20.7 | | + 0.031 |
| Oct. 11, 1873 | 21.2 | — 0 42 36.52 | ..... |

CHRONOMETER AT SALT LAKE CITY.—NEGUS, No. 1511.

| Date. | Local sidereal time. | Correction of chronometer. | Adopted hourly rate. |
|----------------------|----------------------|----------------------------|----------------------|
| | <i>h.</i> | <i>h. m. s.</i> | <i>s.</i> |
| Sept. 29, 1873 | 21.5 | + 8 06 55.72 | — 0.011 |
| Oct. 1, 1873 | 20.0 | | 0.000 |
| Oct. 2, 1873 | 20.5 | | + 0.018 |
| Oct. 3, 1873 | 20.7 | | + 0.018 |
| Oct. 4, 1873 | 20.0 | | + 0.013 |
| Oct. 5, 1873 | 20.2 | + 8 06 54.52 | + 0.014 |

CLOCK AT DETROIT.—BOND, No. 184.

| Date. | Local sidereal time. | Correction of clock. | Hourly rate. |
|----------------------|----------------------|----------------------|--------------|
| | <i>h.</i> | <i>h. m. s.</i> | <i>s.</i> |
| Sept. 29, 1873 | 0.9 | — 0 05 37.46 | + 0.001 |
| Sept. 30, 1873 | 21.9 | | + 0.020 |
| Oct. 1, 1873 | 21.9 | | + 0.022 |
| Oct. 9, 1873 | 21.9 | | + 0.025 |
| Oct. 10, 1873 | 23.4 | — 0 05 43.72 | + 0.025 |

Final results of longitude.

| Signals sent from— | Recorded at— | Mean of sig- nals sent and received. | Time-correc- tions. | Corrected time. | Difference of longitude. | Double-wave time. | Means. |
|---|-------------------|--|------------------------|--------------------|-----------------------------|----------------------|-----------|
| September 29, 1873: | | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> |
| Salt Lake City. { | Salt Lake City... | 12 31 26.13 | + 8 06 55.71 | 20 38 21.84 | 0 00 24.71 | | |
| Ogden..... { | Ogden..... | 21 20 29.31 | — 0 42 32.18 | 20 37 57.13 | | | |
| Salt Lake City. { | Salt Lake City... | 12 37 02.37 | + 8 06 55.71 | 20 43 58.08 | 24.75 | 0.04 | 24.730 |
| Ogden..... { | Ogden..... | 21 26 05.51 | — 0 42 32.18 | 20 43 33.33 | | | |
| October 1, 1873: | | | | | | | |
| Salt Lake City. { | Salt Lake City... | 12 19 58.86 | + 8 06 55.99 | 20 26 54.85 | 24.70 | | |
| Ogden..... { | Ogden..... | 21 09 01.94 | — 0 42 31.79 | 20 26 30.15 | | | |
| Salt Lake City. { | Salt Lake City... | 12 24 52.51 | + 8 06 55.99 | 20 31 48.50 | 24.76 | 0.06 | 24.730 |
| Ogden..... { | Ogden..... | 21 13 55.53 | — 0 42 31.79 | 20 31 23.74 | | | |
| October 2, 1873: | | | | | | | |
| Salt Lake City. { | Salt Lake City... | 12 36 45.70 | + 8 06 55.69 | 20 43 41.39 | 24.74 | | |
| Ogden..... { | Ogden..... | 21 25 48.45 | — 0 42 31.80 | 20 43 16.65 | | | |
| Salt Lake City. { | Salt Lake City... | 12 41 32.86 | + 8 06 55.69 | 20 48 28.55 | 24.80 | 0.06 | 24.770 |
| Ogden..... { | Ogden..... | 21 30 35.55 | — 0 42 31.80 | 20 48 03.75 | | | |
| October 3, 1873: | | | | | | | |
| Salt Lake City. { | Salt Lake City... | 13 10 42.49 | + 8 06 55.13 | 21 17 37.62 | 24.76 | | |
| Ogden..... { | Ogden..... | 21 59 44.79 | — 0 42 31.93 | 21 17 12.86 | | | |
| Salt Lake City. { | Salt Lake City... | 13 16 13.05 | + 8 06 55.13 | 21 23 08.18 | 24.79 | 0.03 | 24.775 |
| Ogden..... { | Ogden..... | 22 05 15.32 | — 0 42 31.93 | 21 22 42.39 | | | |
| October 4, 1873: | | | | | | | |
| Salt Lake City. { | Salt Lake City... | 12 30 18.28 | + 8 06 54.86 | 20 37 13.14 | 24.71 | | |
| Ogden..... { | Ogden..... | 21 19 20.56 | — 0 42 32.13 | 20 36 48.43 | | | |
| Salt Lake City. { | Salt Lake City... | 12 34 32.99 | + 8 06 54.86 | 20 41 27.85 | 24.73 | 0.02 | 24.720 |
| Ogden..... { | Ogden..... | 21 23 35.25 | — 0 42 32.13 | 20 41 03.12 | | | |
| October 5, 1873: | | | | | | | |
| Salt Lake City. { | Salt Lake City... | 12 28 33.04 | + 8 06 54.51 | 20 35 27.55 | 24.76 | 0.01 | |
| Ogden..... { | Ogden..... | 21 17 35.50 | — 0 42 32.71 | 20 35 02.79 | | | |
| Salt Lake City. { | Salt Lake City... | 12 34 03.87 | + 8 06 54.51 | 20 40 58.38 | 0 00 24.75 | | 24.755 |
| Ogden..... { | Ogden..... | 21 23 06.34 | — 0 42 32.71 | 20 40 33.63 | | | |
| Ogden west of Salt Lake City..... 0 ^h 00 ^m 24 ^s .747 ± 0 ^s .006 | | | | | | | |

Final results of longitude—Continued.

| Signals sent from— | Recorded at— | Mean of signals sent and received. | Time-corrections. | Corrected time. | Difference of longitude. | Double-wave time. | Means. |
|---------------------|--------------|------------------------------------|-------------------|-----------------|--------------------------|-------------------|-----------|
| | | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> |
| September 29, 1873: | | | | | | | |
| Detroit..... | Detroit..... | 23 53 22.00 | — 0 05 37.46 | 23 47 44.54 | 1 55 47.14 | | |
| | Ogden..... | 22 34 29.57 | — 0 42 32.17 | 21 51 57.40 | | | |
| | Detroit..... | 23 58 29.01 | — 0 05 37.46 | 23 52 51.55 | 47.50 | 0.36 | 47.320 |
| | Ogden..... | 22 39 36.22 | — 0 42 32.17 | 21 57 04.05 | | | |
| September 30, 1873: | | | | | | | |
| Detroit..... | Detroit..... | 0 10 42.00 | — 0 05 38.49 | 0 05 03.51 | 47.12 | | |
| | Ogden..... | 22 51 48.35 | — 0 42 31.96 | 22 09 16.39 | | | |
| | Detroit..... | 0 15 25.54 | — 0 05 38.49 | 0 09 47.05 | 47.45 | 0.33 | 47.285 |
| | Ogden..... | 22 56 31.56 | — 0 42 31.96 | 22 13 59.60 | | | |

Final results of longitude—Continued.

| Signals sent from— | Recorded at— | Mean of signals sent and received. | Time-corrections. | Corrected time. | Difference of longitude. | Double-wave time. | Means. |
|--------------------|--------------|------------------------------------|-------------------|-----------------|--------------------------|-------------------|-----------|
| October 1, 1873: | | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> |
| Detroit..... | Detroit..... | 23 51 32.00 | — 0 05 38.95 | 23 45 53.05 | 1 55 47.22 | 0.34 | 47.390 |
| | Ogden..... | 22 32 37.62 | — 0 42 31.79 | 21 50 05.83 | | | |
| | Detroit..... | 23 56 13.24 | — 0 05 38.95 | 23 50 34.29 | | | |
| Ogden..... | Ogden..... | 22 37 18.52 | — 0 42 31.79 | 21 54 46.73 | | | |
| October 9, 1873: | | | | | | | |
| Detroit..... | Detroit..... | 0 18 39.28 | — 0 05 42.26 | 0 12 57.02 | 47.69 | 0.31 | 47.535 |
| Ogden..... | Ogden..... | 22 59 44.37 | — 0 42 35.04 | 22 17 09.33 | | | |
| | Detroit..... | 0 30 28.84 | — 0 05 42.27 | 0 24 46.57 | | | |
| Detroit..... | Ogden..... | 23 11 34.23 | — 0 42 35.04 | 22 48 59.19 | | | |
| October 10, 1873: | | | | | | | |
| Detroit..... | Detroit..... | 23 46 02.00 | — 0 05 43.75 | 23 40 18.25 | 47.09 | 0.37 | 47.275 |
| | Ogden..... | 22 27 06.57 | — 0 42 35.41 | 21 44 31.16 | | | |
| | Detroit..... | 23 53 31.28 | — 0 05 43.75 | 23 47 47.53 | | | |
| Ogden..... | Ogden..... | 22 34 35.49 | — 0 42 35.42 | 21 52 00.07 | | | |

Ogden west of Detroit, approximate result $1^h 55^m 47^s.361$ Correction for personal equation..... $+ 0^s.110$ Ogden west of Detroit, final result $1^h 55^m 47^s.471 \pm 0^s.032$ *Observations and computations for latitude.*

OGDEN, UTAH.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|--------------|-----------------|-------------------|-----------|-----------|--------------------------|--------------------------|-------------------|----------|--------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1873. | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | <i>° ' "</i> | <i>' "</i> | <i>"</i> | <i>° ' "</i> |
| October 5... | 7721 | 2 59.0 | 29.0 | 5.3 | | 41 22 49.4 | — 9 36.7 | —3.0 | 41 13 09.7 |
| | 7731 | 2 42.0 | 29.0 | 5.3 | | 22 54.2 | — 9 42.0 | —3.0 | 09.2 |
| | 7746 | 21 15.2 | 0.0 | 34.6 | | | | | |
| | 7824 | 7 29.6 | 15.9 | 19.9 | | 16 20.9 | — 3 08.6 | —4.3 | 08.0 |
| | Gr. 3779 | 20 88.8 | 15.8 | 20.2 | | 23 23.9 | —10 10.9 | —4.4 | 08.6 |
| | 7843 | 1 22.5 | 12.3 | 23.8 | | | | | |
| | 7858 | 1 19.2 | 16.4 | 19.8 | | 22 33.8 | — 9 20.4 | —4.9 | 08.5 |
| | 7880 | 9 86.6 | 16.3 | 19.8 | | 18 04.9 | — 4 50.9 | —5.0 | 09.0 |
| | 7905 | 19 23.0 | 10.9 | 25.5 | | | | | |
| | 7932 | 8 75.0 | 22.8 | 13.5 | | | | | |
| | 7962 | 9 01.0 | 2.2 | 33.7 | | 13 22.5 | — 0 03.1 | —6.1 | 08.4 |
| | 7972 | 6 05.6 | 19.5 | 15.0 | | | | | |
| | 7984 | 11 29.0 | 9.5 | 25.9 | | 10 23.3 | + 2 42.6 | —3.3 | 07.6 |
| | 7994 | 4 55.0 | 13.7 | 21.3 | | | | | |
| | 8023 | 12 70.2 | 13.2 | 21.0 | Changed the inclination. | 17 26.5 | — 4 13.3 | —4.2 | 09.0 |

LATITUDE DETERMINATIONS.

31

Observations and computations for latitude—Continued.

OGDEN, UTAH.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|-----------------------|-----------------|-------------------|-----------|-----------|--------------------------|--------------------------|-------------------|----------|--------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1873. October 5... | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | <i>o ' "</i> | <i>' "</i> | <i>"</i> | <i>o ' "</i> |
| | 8051 | 13 62.5 | 22.0 | 12.0 | | | | | |
| | 8104 | 4 13.3 | 15.3 | 18.3 | | 41 08 12.0 | + 4 54.9 | +1 9 | 41 13 08.8 |
| | 8118 | 8 38.9 | 17.9 | 15.9 | | | | | |
| | 8128 | 19 63.0 | 23.5 | 10.0 | | 14 14.1 | — 1 09.6 | +4.2 | 08.7 |
| | 8153 | 0 88.0 | 13.3 | 20.2 | | | | | |
| | 8160 | 17 28.0 | 27.0 | 6.5 | | 04 35.7 | + 8 29.5 | +3.7 | 08.9 |
| | 8174 | 12 64.8 | 21.0 | 12.6 | | | | | |
| | 8188 | 6 48.7 | 18.9 | 14.6 | | 09 53.6 | + 3 11.4 | +3.5 | 03.5 |
| | 8211 | 5 06.3 | 20.3 | 13.2 | Changed the inclination. | | | | |
| | 8231 | 13 12.0 | 21.8 | 11.8 | | 17 14.0 | — 4 10.3 | +4.7 | 08.4 |
| | 8248 | — 0 08.0 | 22.0 | 11.6 | | | | | |
| | 8273 | 17 66.4 | 16.8 | 17.2 | | 22 16.5 | — 9 11.3 | +2.8 | 08.0 |
| | 8282 | 16 59.6 | 12.0 | 22.0 | | | | | |
| | 8324 | 1 17.0 | 24.3 | 9.9 | | 21 06.4 | — 7 59.3 | +1.2 | 08.3 |
| | 6 | 11 57.3 | 12.2 | 21.0 | | | | | |
| | 42 | 4 11.0 | 32.3 | 0.2 | | 16 54.7 | — 3 51.9 | +6.4 | 09.2 |
| | 105 | 12 91.0 | 12.7 | 19.3 | Changed the inclination. | | | | |
| | 129 | 4 50.1 | 23.3 | 8.7 | | 17 27.3 | — 4 21.3 | +2.2 | 08.2 |
| | 146 | — 0 21.0 | 13.0 | 18.9 | | | | | |
| | 164 | 19 28.9 | 23.0 | 9.0 | | 03 00.3 | +10 05.5 | +2.2 | 08.0 |
| | 201 | 12 64.0 | 15.2 | 17.0 | | | | | |
| | 224 | 5 49.0 | 13.5 | 19.0 | | 16 53.0 | — 3 42.2 | —2.0 | 08.8 |
| | 250 | 0 88.0 | 14.6 | 18.0 | | | | | |
| | 255 | 11 66.8 | 17.4 | 15.2 | | 18 44.5 | — 5 35.1 | —0.3 | 09.1 |
| | 264 | 13 02.0 | 12.8 | 20.0 | | 12 27.7 | + 0 42.0 | —1.4 | 08.3 |
| | 290 | 10 19.8 | 12.3 | 20.7 | | | | | |
| | 299 | 5 92.5 | 13.6 | 19.3 | | 15 25.5 | — 2 12.7 | —3.9 | 08.9 |
| | 341 | 16 53.2 | 15.7 | 17.2 | | | | | |
| | 379 | — 0 00.8 | 17.0 | 15.9 | | 04 34.8 | + 8 33.8 | —0.1 | 08.5 |
| | 393 | 0 10.3 | 16.9 | 16.0 | | | | | |
| | 408 | 17 20.6 | 18.0 | 14.7 | | 04 16.2 | + 8 51.2 | +1.2 | 08.6 |
| | 430 | 10 93.0 | 17.6 | 15.7 | | | | | |
| | 450 | 6 31.3 | 14.8 | 18.9 | | 10 45.2 | + 2 23.4 | —0.6 | 08.0 |
| | 454 | 3 26.5 | 16.5 | 17.3 | Air very undulating. | | | | |
| | 468 | 14 58.0 | 16.9 | 17.3 | | 19 00.4 | — 5 11.6 | —0.3 | 08.5 |
| | 487 | 13 87.6 | 19.7 | 14.9 | | | | | |
| | 516 | 4 73.0 | 13.3 | 22.0 | | 17 53.8 | — 4 44.2 | —1.1 | 08.5 |
| | 533 | 7 05.0 | 20.4 | 15.0 | | | | | |
| | 564 | 10 52.1 | 9.1 | 26.0 | | 14 59.5 | — 1 47.8 | —3.2 | 08.5 |

Observations and computations for latitude—Continued.

OGDEN, UTAH.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|-----------------------|-------------------|-----------------------------------|---------------------------|---------------------------|--------------------------|--------------------------|----------------------|--------------|---------------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1873. October 5... | 572 588 | <i>t. d.</i> 2 09.0 16 13.2 | <i>d.</i> 15.0 16.2 | <i>d.</i> 20.1 18.8 | Duplex med. | ° ' " 41 20 27.5 | ' " " — 7 16.4 | " —2.1 | ° ' " 41 13 09.0 |
| | 600 629 | 2 60.0 15 32.7 | 10.9 23.0 | 24.3 12.0 | | 06 33.7 | + 6 35.4 | —0.7 | 08.4 |
| | 647 658 666 | 21 98.7 5 28.6 8 13.6 | 17.9 14.7 17.9 | 16.9 19.7 16.3 | | 04 31.1 11 40.4 | + 8 38.9 + 1 28.5 | —1.1 —0.9 | 08.9 08.0 |
| | 686 702 712 | 4 03.2 23 55.0 — 1 00.4 | 17.8 13.0 19.0 | 16.3 20.8 14.7 | | 23 16.0 25 52.8 | —10 06.2 —12 42.9 | —1.7 —1.0 | 08.1 08.9 |
| | 745 777 | 11 93.0 3 94.3 | 19.6 7.2 | 14.0 26.8 | | 09 04.7 | + 4 08.1 | —3.9 | 08.9 |
| October 7... | 8211 8231 | 5 80.9 13 54.2 | 14.3 15.6 | 23.3 22.8 | Cloudy before. | 17 14.4 | — 4 00.3 | —4.5 | 09.6 |
| | 8248 8273 | 0 41.6 17 86.1 | 21.5 5.0 | 17.5 34.4 | | 22 16.9 | — 9 02.0 | —7.0 | 07.9 |
| | 8282 8324 | 17 55.7 2 35.4 | 20.0 7.6 | 19.2 32.0 | | 21 06.9 | — 7 52.3 | —6.5 | 08.1 |
| | 6 42 | 12 38.0 5 12.6 | 13.5 23.2 | 25.6 15.6 | Changed the inclination. | 16 55.2 | — 3 45.4 | —1.2 | 08.6 |
| | 105 129 | 12 93.2 4 51.0 | 16.0 27.0 | 22.8 11.9 | | 17 27.8 | — 4 21.7 | +2.3 | 08.4 |
| | 146 164 | — 0 65.0 18 87.0 | 13.8 28.6 | 25.0 11.0 | | 03 00.8 | +10 06.4 | +1.8 | 09.0 |
| | 201 224 | 13 39.0 6 09.2 | 14.8 27.5 | 24.0 11.4 | | 16 53.5 | — 3 46.7 | +1.9 | 08.7 |
| | 250 255 264 | 0 51.2 11 32.4 12 55.0 | 28.6 9.3 33.3 | 10.3 29.7 6.0 | | 18 45.0 12 28.2 | — 5 35.8 + 0 38.1 | —0.6 +1.9 | 08.6 08.2 |
| | 290 299 | 10 35.0 5 88.6 | 17.4 26.4 | 21.7 12.9 | | 15 26.0 | — 2 18.7 | +2.5 | 09.8 |
| | 341 379 | 16 52.2 — 0 00.6 | 23.6 16.1 | 15.7 23.2 | | 04 35.2 | + 8 33.5 | +0.2 | 08.9 |
| | 393 408 | 0 13.2 17 31.3 | 17.0 20.3 | 22.3 19.0 | | 04 16.6 | + 8 53.7 | —1.1 | 09.2 |
| | 430 450 | 10 60.5 6 13.0 | 23.9 23.0 | 16.3 17.0 | | 10 45.7 | + 2 19.1 | +3.7 | 08.5 |
| | 454 468 | 2 96.0 14 32.0 | 27.2 13.0 | 12.8 27.0 | | 19 00.8 | — 5 52.8 | +0.1 | 08.1 |

LATITUDE DETERMINATIONS.

33

Observations and computations for latitude—Continued.

OGDEN, UTAH.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude |
|-----------------------|-----------------|-------------------|-----------|-----------|-------------|--------------------------|-------------------|----------|-------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1873. October 7... | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | <i>o' "</i> | <i>' "</i> | <i>"</i> | <i>o' "</i> |
| | 487 | 14 08.3 | 18.0 | 22.0 | | 41 17 54.3 | — 4 46.9 | +2.4 | 41 13 09.8 |
| | 516 | 4 85.1 | 26.3 | 13.7 | | | | | |
| | 533 | 6 67.7 | 24.0 | 16.0 | | 15 00.0 | — 1 49.7 | —2.3 | 08.0 |
| | 564 | 10 21.0 | 11.8 | 28.2 | | | | | |
| | 572 | 2 02.4 | 35.2 | 5.0 | Duplex med. | 20 27.9 | — 7 20.6 | +0.9 | 08.2 |
| | 588 | 16 20.7 | 6.6 | 33.7 | | | | | |
| | 600 | 2 56.1 | 20.2 | 20.2 | | 06 34.2 | + 6 33.1 | +0.9 | 08.2 |
| | 629 | 15 21.5 | 22.0 | 18.8 | | | | | |
| | 647 | 22 06.0 | 21.8 | 19.0 | | 04 31.6 | + 8 35.9 | +2.1 | 09.6 |
| | 658 | 5 45.5 | 22.9 | 18.0 | | | | | |
| | 666 | 8 24.3 | 20.2 | 20.3 | | 11 40.9 | + 1 26.7 | +1.3 | 08.9 |
| | 686 | 4 25.9 | 26.0 | 14.7 | | 23 16.4 | —10 07.8 | —1.1 | 07.5 |
| | 702 | 23 82.8 | 12.9 | 28.0 | | | | | |
| | 712 | — 0 78.5 | 28.9 | 12.0 | | 25 53.2 | —12 44.6 | +0.5 | 09.1 |
| | 745 | 11 37.9 | 26.7 | 14.8 | | 09 05.2 | + 4 04.7 | —1.1 | 08.8 |
| | 750 | 9 16.4 | 27.0 | 14.5 | | 10 13.5 | + 2 55.9 | —0.9 | 08.5 |
| | 777 | 3 50.1 | 12.8 | 28.7 | | | | | |
| October 8... | 7731 | 3 13.7 | 17.0 | 18.0 | | | | | |
| | 7746 | 22 00.8 | 19.0 | 16.2 | | 22 54.7 | — 9 46.3 | +0.5 | 08.9 |
| | 7765 | 15 86.0 | 19.4 | 15.7 | | | | | |
| | 7803 | 2 26.8 | 17.0 | 17.3 | | 06 05.0 | + 7 02.3 | +1.2 | 08.5 |
| | 7824 | 6 89.1 | 9.6 | 25.8 | | 16 21.5 | — 3 13.6 | +0.9 | 08.8 |
| | Gr. 3779 | 20 49.3 | 9.0 | 26.5 | | 23 24.5 | —10 16.2 | +0.6 | 08.9 |
| | 7843 | 0 66.1 | 27.5 | 8.0 | | | | | |
| | 7880 | 9 08.8 | 23.6 | 12.2 | | | | | |
| | 7906 | 18 59.9 | 9.8 | 26.3 | | 18 05.5 | — 4 55.5 | —1.4 | 08.6 |
| | 7932 | 8 65.2 | 19.9 | 16.0 | | | | | |
| | 7962 | 9 00.0 | 9.3 | 27.4 | | 13 23.2 | — 0 10.8 | —3.9 | 08.5 |
| | 7972 | 5 49.4 | 15.9 | 21.0 | | | | | |
| | 7984 | 10 67.5 | 17.4 | 19.4 | | 10 29.0 | + 2 40.9 | —1.9 | 08.0 |
| | 7994 | 3 91.1 | 18.5 | 18.4 | | | | | |
| | 8023 | 12 14.0 | 12.3 | 25.0 | | 17 27.1 | — 4 15.6 | —3.5 | 08.0 |
| | 8051 | 13 38.7 | 18.2 | 20.1 | | | | | |
| | 8104 | 3 68.6 | 9.8 | 28.5 | | 08 12.6 | + 5 01.4 | —5.7 | 08.3 |
| | 8118 | 8 58.6 | 17.1 | 21.3 | | | | | |
| | 8128 | 10 65.3 | 19.7 | 19.3 | | 14 14.8 | — 1 04.3 | —1.1 | 09.4 |
| | 8153 | 0 66.5 | 12.0 | 27.0 | | | | | |
| | 8160 | 17 18.3 | 24.3 | 14.5 | | 04 36.4 | + 8 33.2 | —1.4 | 08.2 |
| | 8174 | 12 23.6 | 23.2 | 15.6 | | | | | |
| | 8188 | 5 89.2 | 9.7 | 29.3 | | 09 54.2 | + 3 17.1 | —3.3 | 08.0 |

3 AST

Observations and computations for latitude—Continued.

OGDEN, UTAH.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|-------------------------|-----------------|-------------------|-----------|-----------|-----------------|--------------------------|-------------------|--------|------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1873. October 8. . . | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | ° ' " |
| | 8211 | 5 25.2 | 21.0 | 18.0 | | | | | |
| | 8231 | 13 03.9 | 10.3 | 28.9 | | 41 17 14.6 | — 4 01.9 | —4.3 | 41 13 08.4 |
| | 8248 | 0 93.7 | 24.9 | 14.8 | | | | | |
| | 8273 | 18 50.2 | 10.2 | 29.0 | | 22 17.1 | — 9 05.7 | —2.4 | 09.0 |
| | 8282 | 16 08.9 | 22.0 | 17.3 | | | | | |
| | 8324 | 0 65.6 | 19.6 | 19.0 | | 02 07.1 | — 7 59.5 | +1.4 | 09.0 |
| | 6 | 12 41.0 | 15.9 | 23.0 | | | | | |
| | 42 | 5 18.3 | 20.1 | 19.8 | | 16 55.4 | — 3 44.6 | —1.9 | 08.9 |
| | 105 | 13 07.3 | 16.3 | 23.8 | | | | | |
| | 129 | 4 83.0 | 17.2 | 22.7 | | 17 28.0 | — 4 16.1 | —3.6 | 08.3 |
| | 146 | 0 32.2 | 20.2 | 19.3 | | | | | |
| | 164 | 19 80.5 | 21.3 | 18.0 | | 03 01.0 | +10 05.3 | +1.2 | 07.5 |
| | 201 | 12 85.0 | 15.1 | 24.3 | | | | | |
| | 224 | 5 60.0 | 23.4 | 16.0 | | 16 53.7 | — 3 45.2 | —0.5 | 08.0 |
| | 250 | 1 18.1 | 23.0 | 16.3 | | 18 45.2 | — 5 39.9 | +3.9 | 09.2 |
| | 255 | 12 12.0 | 23.3 | 16.0 | | | | | |
| | 264 | 13 35.8 | 17.9 | 21.8 | | 12 28.4 | + 1 33.5 | +0.9 | 07.8 |
| | 290 | 11 02.1 | 12.5 | 27.0 | | | | | |
| | 299 | 6 61.7 | 26.6 | 12.9 | | 15 26.3 | — 2 16.9 | —0.2 | 09.2 |
| | 341 | 16 98.8 | 23.2 | 16.2 | | | | | |
| | 379 | 0 49.0 | 17.5 | 22.0 | | 04 35.4 | + 8 32.6 | +0.7 | 08.7 |
| | 393 | 0 09.7 | 16.5 | 23.0 | | | | | |
| | 408 | 17 25.0 | 20.0 | 19.3 | Air undulating. | 04 16.8 | + 8 53.0 | —1.6 | 08.2 |
| | 430 | 11 21.0 | 19.0 | 20.3 | | | | | |
| | 450 | 6 69.5 | 25.7 | 13.6 | | 10 45.9 | + 2 20.3 | +3.0 | 09.2 |
| | 454 | 2 79.0 | 22.8 | 16.5 | | | | | |
| | 468 | 14 23.0 | 21.0 | 18.0 | | 19 01.0 | — 5 55.4 | +2.6 | 08.2 |
| | 487 | 14 00.0 | 16.3 | 22.8 | | | | | |
| | 516 | 4 83.5 | 21.0 | 18.0 | | 17 54.6 | — 4 44.7 | —1.0 | 08.9 |
| | 533 | 7 31.1 | 22.2 | 16.8 | | | | | |
| | 564 | 10 86.0 | 14.5 | 24.4 | | 15 00.2 | — 1 50.2 | —1.2 | 08.8 |
| | 572 | 1 97.0 | 23.1 | 15.9 | | | | | |
| | 588 | 16 14.1 | 16.1 | 22.9 | | 20 28.1 | — 7 20.2 | +0.1 | 08.0 |
| | 600 | 3 04.5 | 16.3 | 22.7 | | | | | |
| | 629 | 15 74.0 | 23.0 | 16.0 | | 06 34.4 | + 6 34.4 | +0.2 | 09.0 |
| | 647 | 22 01.2 | 21.7 | 17.3 | | 04 31.8 | + 8 39.9 | —1.8 | 09.9 |
| | 658 | 5 28.0 | 14.0 | 25.0 | | | | | |
| | 666 | 8 10.4 | 25.5 | 13.5 | | 11 41.1 | + 1 27.8 | +0.3 | 09.2 |

LATITUDE DETERMINATIONS.

35

Observations and computations for latitude—Continued.

OGDEN, UTAH.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|-----------------------|-----------------|---------------------|-----------|-----------|----------------------|--------------------------|-------------------|--------|------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1873. October 8... | | <i>t.</i> <i>d.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | ° ' " |
| | 686 | 4 49.0 | 17.0 | 22.0 | | 41 23 16.6 | —10 08.4 | +0.4 | 41 13 08.6 |
| | 702 | 24 07.2 | 22.7 | 16.3 | | | | | |
| | 712 | — 0 55.0 | 17.4 | 21.6 | | 25 53.4 | —12 45.0 | +0.6 | 09.0 |
| | 745 | 11 60.0 | 20.9 | 18.0 | | 09 05.4 | + 4 04.6 | —0.9 | 09.1 |
| | 750 | 9 39.9 | 21.0 | 17.9 | | 10 13.7 | + 1 56.2 | —0.9 | 09.0 |
| | 777 | 3 72.5 | 16.3 | 22.5 | | | | | |
| October 9... | 7994 | 4 83.8 | 21.2 | 15.3 | | | | | |
| | 8023 | 13 18.3 | 14.8 | 21.9 | | 17 27.3 | — 4 19.3 | —0.3 | 07.7 |
| | 8051 | 13 27.1 | 17.1 | 19.8 | | | | | |
| | 8104 | 3 67.6 | 16.7 | 20.3 | | 08 12.8 | + 4 58.1 | —1.7 | 09.2 |
| | 8118 | 7 93.9 | 16.8 | 20.3 | | | | | |
| | 8128 | 10 01.5 | 17.3 | 19.8 | | 14 15.0 | — 1 04.5 | —1.7 | 08.8 |
| | 8153 | 1 90.0 | 16.9 | 20.1 | | | | | |
| | 8160 | 18 28.4 | 25.5 | 11.0 | | 04 36.6 | + 8 29.0 | +3.1 | 08.7 |
| | 8174 | 12 95.2 | 19.7 | 17.0 | | | | | |
| | 8188 | 6 67.5 | 15.8 | 20.9 | | 09 54.4 | + 3 15.0 | —0.7 | 08.7 |
| | 8211 | 5 34.9 | 21.0 | 15.7 | | | | | |
| | 8231 | 13 21.0 | 12.0 | 24.7 | | 17 14.9 | — 4 04.2 | —2.0 | 08.7 |
| | 8248 | 0 64.9 | 18.6 | 18.0 | | | | | |
| | 8273 | 18 35.1 | 19.6 | 17.3 | | 22 17.3 | — 9 10.0 | +0.8 | 08.1 |
| | 8282 | 16 71.3 | 16.5 | 20.5 | | | | | |
| | 8324 | 1 32.0 | 18.7 | 18.6 | | 21 07.4 | — 7 58.2 | —1.1 | 08.1 |
| | 6 | 12 76.1 | 15.3 | 21.6 | | | | | |
| | 42 | 5 47.0 | 19.3 | 17.6 | | 16 55.6 | — 3 46.6 | —1.3 | 07.7 |
| | 105 | 13 23.2 | 16.3 | 20.4 | | | | | |
| | 120 | 4 82.0 | 24.0 | 12.8 | | 17 28.1 | — 4 21.4 | +2.0 | 08.7 |
| | 146 | 0 18.9 | 14.7 | 22.1 | | | | | |
| | 164 | 19 66.5 | 24.3 | 12.3 | | 03 01.2 | +10 05.1 | +1.3 | 07.6 |
| | 201 | 13 11.3 | 15.0 | 21.8 | | | | | |
| | 224 | 5 94.0 | 19.1 | 18.0 | | 16 54.0 | — 3 42.9 | —1.6 | 09.5 |
| | 250 | 1 14.9 | 23.3 | 14.2 | | 18 45.4 | — 5 38.9 | +2.6 | 09.1 |
| | 255 | 12 05.6 | 19.0 | 18.5 | | | | | |
| | 264 | 13 29.1 | 20.0 | 17.6 | | 12 28.7 | + 1 38.4 | +0.8 | 07.9 |
| | 290 | 10 52.1 | 15.9 | 21.7 | Very faint. | | | | |
| | 299 | 6 12.3 | 19.2 | 18.0 | | 15 26.5 | — 2 16.7 | —1.3 | 08.5 |
| | 341 | 17 33.5 | 20.1 | 17.2 | | | | | |
| | 379 | 0 70.9 | 9.8 | 27.8 | | 04 35.6 | + 8 36.6 | —4.2 | 08.0 |
| | 393 | — 0 02.0 | 17.3 | 20.1 | | | | | |
| | 408 | 17 20.3 | 15.0 | 22.3 | Very faint; hazy. | 04 17.0 | + 8 55.1 | —2.8 | 09.3 |

Observations and computations for latitude—Continued.

OGDEN, UTAH.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude |
|-----------------------|-----------------|-------------------|-----------|-----------|--------------------------|--------------------------|-------------------|----------|--------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1873. October 9... | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | <i>o ' "</i> | <i>' "</i> | <i>"</i> | <i>o ' "</i> |
| | 430 | 10 96.0 | 20.3 | 17.2 | | | | | |
| | 450 | 6 28.2 | 12.0 | 25.5 | | 41 10 46.1 | + 2 25.4 | -2.9 | 41 13 08.6 |
| | 454 | 3 60.0 | 18.8 | 18.8 | | | | | |
| | 468 | 14 97.3 | 20.2 | 17.3 | | 19 01.2 | - 5 53.4 | +0.8 | 08.6 |
| | 487 | 14 21.9 | 16.3 | 21.4 | Air undulating. | | | | |
| | 516 | 5 12.3 | 16.4 | 22.0 | | 17 54.8 | - 4 42.6 | -3.0 | 09.2 |
| | 533 | 6 64.0 | 20.3 | 17.8 | | | | | |
| | 564 | 10 22.8 | 17.2 | 21.0 | | 14 00.4 | - 1 51.5 | -0.4 | 08.5 |
| | 572 | 2 88.0 | 22.0 | 16.3 | Duplex med. | | | | |
| | 588 | 17 09.0 | 20.0 | 18.5 | | 20 28.4 | - 7 21.5 | +2.0 | 08.9 |
| | 600 | 3 06.0 | 15.1 | 23.7 | | | | | |
| | 629 | 15 83.6 | 18.6 | 20.3 | | 06 24.6 | + 6 36.9 | -2.3 | 08.7 |
| | 658 | 5 39.4 | 10.0 | 29.8 | | | | | |
| | 666 | 8 19.3 | 31.9 | 7.8 | | 11 41.3 | + 1 27.0 | +1.2 | 09.5 |
| | 686 | 3 95.9 | 29.7 | 9.8 | | 23 16.8 | -10 08.1 | -0.4 | 08.3 |
| | 702 | 23 53.0 | 8.9 | 30.3 | | | | | |
| | 712 | 1 12.7 | 33.0 | 6.1 | | 25 53.6 | -12 46.1 | +1.5 | 09.1 |
| | 745 | 11 75.0 | 22.6 | 16.4 | | 09 05.6 | + 4 06.7 | -3.0 | 09.3 |
| | 750 | 9 55.0 | 23.3 | 15.7 | | 10 13.9 | + 1 58.3 | -2.7 | 09.5 |
| | 777 | 3 81.2 | 10.8 | 28.0 | | | | | |
| October 10.. | 7721 | 2 74.0 | 23.8 | 13.2 | | | | | |
| | 7746 | 21 29.0 | 2.8 | 34.4 | | 22 50.4 | - 9 36.3 | -5.8 | 08.3 |
| | 7765 | 15 46.8 | 17.0 | 20.0 | | | | | |
| | 7803 | 1 62.7 | 9.8 | 27.7 | | 06 05.3 | + 7 10.0 | -5.8 | 09.5 |
| | 7824 | 7 11.9 | 21.9 | 15.3 | Changed the inclination. | | | | |
| | Gr. 3779 | 20 71.9 | 22.8 | 14.5 | | 16 21.8 | - 3 18.7 | +5.1 | 08.2 |
| | 7843 | 0 52.2 | 24.5 | 12.7 | | 23 24.9 | -10 21.3 | +5.5 | 09.1 |
| | 7880 | 9 46.4 | 19.6 | 17.5 | | | | | |
| | 7906 | 19 27.0 | 30.4 | 6.4 | | 18 05.9 | - 5 04.6 | +7.2 | 08.5 |
| | 7932 | 8 87.7 | 27.0 | 9.9 | | | | | |
| | 7962 | 9 58.7 | 23.3 | 13.2 | | 13 23.6 | - 0 22.1 | +7.5 | 09.0 |
| | 7972 | 6 16.4 | 25.3 | 11.4 | | | | | |
| | 7984 | 11 03.2 | 25.9 | 10.8 | | 10 29.4 | + 2 31.2 | +8.0 | 08.6 |
| | 7994 | 4 38.6 | 23.4 | 8.2 | | | | | |
| | 8023 | 12 93.2 | 20.0 | 16.7 | | 17 27.5 | - 4 25.5 | +6.5 | 08.5 |
| | 8051 | 13 48.1 | 16.1 | 20.7 | | | | | |
| | 8104 | 4 05.2 | 26.3 | 10.3 | | 08 13.0 | + 4 53.0 | +3.1 | 09.1 |
| | 8118 | 7 73.0 | 23.4 | 13.3 | Air undulating. | | | | |
| | 8128 | 10 08.0 | 26.0 | 10.9 | | 14 15.2 | - 1 13.0 | +6.9 | 09.1 |

LATITUDE DETERMINATIONS.

37

Observations and computations for latitude—Continued.

OGDEN, UTAH.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|-----------------------|-----------------|-------------------|-----------|-----------|---|--------------------------|-------------------|----------|--------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1873. October 10.. | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | <i>° ' "</i> | <i>' "</i> | <i>"</i> | <i>° ' "</i> |
| | 8153 | 1 16.5 | 21.2 | 15.9 | | | | | |
| | 8160 | 17 53.0 | 24.0 | 13.0 | | 41 04 36.8 | + 8 28.4 | +4.5 | 41 13 09.7 |
| | 8174 | 12 82.0 | 17.3 | 19.5 | | | | | |
| | 8188 | 6 65.0 | 24.4 | 13.2 | | 09 54.7 | + 3 11.7 | +2.5 | 08.9 |
| | 8211 | 5 60.0 | 22.2 | 14.4 | | | | | |
| | 8231 | 13 61.8 | 19.8 | 16.6 | | 17 15.1 | — 4 09.1 | +3.0 | 09.0 |
| | 8248 | 0 28.6 | 25.0 | 11.0 | | | | | |
| | 8273 | 18 14.2 | 20.3 | 15.8 | | 22 17.6 | — 9 14.8 | +5.1 | 07.9 |
| | 8282 | 16 38.2 | 13.9 | 22.3 | | | | | |
| | 8324 | 0 97.0 | 20.3 | 15.5 | | 21 07.6 | — 7 58.8 | —1.0 | 07.8 |
| | 6 | 12 41.9 | 16.3 | 20.9 | Closed on account of undulation of air. | | | | |
| | 42 | 4 89.2 | 32.9 | 5.0 | | 16 55.8 | — 3 53.9 | +6.4 | 08.3 |

Besides the preceding observations, some were made on the pairs 55, 63, and 68, on the 5th, 7th, 8th, 9th, and 10th of October. No. 55 seems to be wrong by 12''; No. 63 by 2''. The following are the observations made at these dates:

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|-----------------------|-----------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|----------|--------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1873. October 5... | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | <i>° ' "</i> | <i>' "</i> | <i>"</i> | <i>° ' "</i> |
| | 55 | 2 55.6 | 23.0 | 9.8 | | 41 22 44.6 | — 9 32.8 | +3.6 | 41 14 15.4 |
| | 63 | 7 23.0 | 23.3 | 9.0 | | 20 14.8 | — 7 07.6 | +3.9 | 11.1 |
| | 68 | 20 99.2 | 16.1 | 16.2 | | | | | |
| October 7... | 55 | 1 85.6 | 22.0 | 17.0 | | 22 45.1 | — 9 34.0 | +3.6 | 14.7 |
| | 63 | 6 51.5 | 22.1 | 16.8 | | 20 15.3 | — 7 09.2 | +3.7 | 09.7 |
| | 68 | 20 33.0 | 23.3 | 15.3 | | | | | |
| October 8... | 55 | 1 51.6 | 23.7 | 16.2 | | 22 45.3 | — 9 27.9 | —2.6 | 14.8 |
| | 63 | 6 16.3 | 24.3 | 15.8 | | 20 15.5 | — 7 03.5 | —2.4 | 09.6 |
| | 68 | 19 79.4 | 11.4 | 28.6 | | | | | |
| October 9... | 55 | 1 48.7 | 20.0 | 17.0 | | 22 45.5 | — 9 28.0 | —2.9 | 14.6 |
| | 63 | 6 14.1 | 21.0 | 16.0 | | 20 15.7 | — 7 03.5 | —2.4 | 09.8 |
| | 68 | 19 77.0 | 11.7 | 25.3 | | | | | |

Observations and computations for latitude—Continued.

OGDEN, UTAH.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|-----------------------|-----------------|---|-----------------------------------|-----------------------------------|----------|--------------------------------|-----------------------------|-------------------|-----------------------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1873. October 10.. | 55 63 68 | <i>t. d.</i> 1 57.3 6 24.6 20 07.6 | <i>d.</i> 21.9 21.9 23.0 | <i>d.</i> 15.9 15.8 14.7 | | ° ' " 41 22 45.8 20 15.9 | ' " — 9 34.9 — 7 09.7 | " +3.9 +4.0 | ° ' " 41 14 14.8 10.2 |

Recapitulation.

The following table shows the daily means :

| Date. | No. of observations. | Mean latitude. |
|--|--------------------------------|--|
| 1873. Oct. 5 Oct. 7 Oct. 8 Oct. 9 Oct. 10 | 36 24 36 28 16 | ° ' " 41 13 08.58 08.67 08.64 08.66 08.72 |

Giving the last date the weight $\frac{1}{2}$, the mean will be 41° 13' 08".647

The mean of all observations gives 41° 13' 08".645

Therefore the adopted latitude is 41° 13' 08".65 \pm 0".022

SEASON OF 1874.

Tabulation of stars used for determination of time at Ogden, Utah, and Washington, D. C.
1874.

| | | OGDEN. | | | | | WASHINGTON. | | | | | | OGDEN. | | | | | WASHINGTON. | | | | | | | |
|---------------|-----------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|---------------------|---------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Name of star. | | October 15. | October 16. | October 17. | October 20. | October 29. | October 31. | October 15. | October 16. | October 20. | October 29. | October 31. | Name of star. | | October 15. | October 16. | October 17. | October 20. | October 29. | October 31. | October 15. | October 16. | October 20. | October 29. | October 31. |
| a | Andromedæ | .. | x | .. | .. | .. | .. | .. | x | .. | .. | .. | ε | Ursæ Minoris, S. P. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | x |
| 22 | Andromedæ | .. | x | .. | .. | .. | .. | .. | .. | .. | .. | .. | β | Orionis | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | x |
| γ | Pegasi | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | α | Lyræ | x | x | x | x | .. | .. | .. | .. | .. | .. | .. |
| | Groombridge 29. | .. | x | .. | .. | .. | .. | .. | .. | .. | .. | .. | β | Lyræ | x | x | x | x | .. | .. | .. | .. | .. | .. | .. |
| ι | Ceti. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | σ | Sagittarii | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 12 | Ceti. | x | x | x | .. | .. | .. | .. | .. | .. | .. | .. | 50 | Draconis | x | x | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| ζ | Cassiopeiæ | .. | x | x | x | .. | .. | .. | .. | .. | .. | .. | γ | Lyræ | x | x | x | x | .. | .. | .. | .. | .. | .. | .. |
| α | Cassiopeiæ | .. | x | x | .. | .. | .. | .. | .. | .. | .. | .. | ι | Aquilæ | x | x | x | x | .. | .. | .. | .. | .. | .. | .. |
| β | Ceti. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | ζ | Lyræ | x | x | x | x | .. | .. | .. | .. | .. | .. | .. |
| 21 | Cassiopeiæ | x | x | .. | x | .. | .. | .. | x | x | .. | .. | d | Sagittarii | x | x | x | x | .. | .. | .. | .. | .. | .. | .. |
| | Bradley 82 | .. | .. | .. | x | .. | .. | .. | .. | .. | .. | .. | δ | Draconis | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| μ | Andromedæ | .. | x | x | x | .. | .. | .. | .. | .. | .. | .. | τ | Draconis | x | x | x | x | .. | .. | .. | .. | .. | .. | .. |
| ε | Piscium | .. | x | x | x | x | .. | x | x | x | .. | .. | β | Cygni | x | x | x | x | .. | .. | .. | .. | .. | .. | .. |
| β | Andromedæ | .. | x | x | x | x | .. | .. | .. | .. | .. | .. | κ | Aquilæ | x | x | x | x | .. | .. | .. | .. | .. | .. | .. |
| τ | Piscium | .. | x | x | x | x | .. | .. | .. | .. | .. | .. | γ | Aquilæ | x | x | x | x | .. | .. | .. | .. | .. | .. | .. |
| v | Piscium | .. | x | .. | x | x | .. | .. | .. | .. | .. | .. | α | Aquilæ | x | x | x | x | .. | .. | .. | .. | .. | .. | .. |
| | Polaris | .. | .. | .. | .. | .. | .. | x | x | x | x | .. | e | Draconis | x | x | x | x | .. | .. | .. | .. | .. | .. | .. |
| α | Ceti. | .. | x | .. | x | x | .. | x | x | x | x | .. | γ | Sagittæ | x | x | x | x | .. | .. | .. | .. | .. | .. | .. |
| 38 | Cassiopeiæ | .. | x | .. | x | x | .. | x | x | x | x | .. | τ | Aquilæ | .. | .. | .. | x | .. | .. | .. | .. | .. | .. | .. |
| η | Piscium | .. | .. | .. | x | x | .. | x | x | x | .. | 3 | Ursæ Majoris, L. C. | x | x | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| v | Persei | .. | .. | | | | | | | | | | | | | | | | | | | | | | |

Observations and reductions for time taken at sending station.

OGDEN, UTAH, OCTOBER 15, 1874.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|---------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | <i>a</i> Lyræ | 18 38 58.02 | — 0.02 | — 0.09 | — 0.00 | 18 38 57.95 | 18 32 41.08 | — 6 16.87 |
| W. | <i>β</i> Lyræ | 51 43.50 | + 0.04 | — 0.08 | — 0.01 | 51 43.45 | 45 26.62 | 16.83 |
| W. | 50 Draconis | 56 40.70 | — 0.57 | — 0.19 | — 0.02 | 56 39.92 | 50 22.86 | 17.06 |
| W. | <i>γ</i> Lyræ | 19 00 31.75 | + 0.05 | — 0.06 | — 0.00 | 19 00 31.74 | 54 14.89 | 16.85 |
| W. | <i>ζ</i> Aquilæ | 05 55.50 | + 0.12 | — 0.05 | — 0.01 | 05 55.56 | 59 38.50 | 17.06 |
| W. | <i>ι</i> Lyræ | 09 06.26 | + 0.03 | — 0.05 | + 0.01 | 09 06.23 | 19 02 49.35 | 16.88 |
| W. | <i>δ</i> Sagittarii | 16 34.68 | + 0.24 | — 0.02 | — 0.00 | 16 34.90 | 10 17.77 | 17.13 |
| E. | <i>τ</i> Draconis | 24 13.11 | — 0.47 | + 0.15 | + 0.02 | 24 12.81 | 17 56.14 | 16.67 |
| E. | <i>β</i> Cygni | 31 56.40 | + 0.07 | + 0.05 | + 0.01 | 31 56.53 | 25 39.74 | 16.79 |
| E. | <i>κ</i> Aquilæ | 36 25.44 | + 0.20 | + 0.05 | + 0.00 | 36 25.69 | 30 08.68 | 17.01 |
| E. | <i>γ</i> Aquilæ | 46 34.71 | + 0.14 | + 0.09 | + 0.00 | 46 34.94 | 40 17.88 | 17.06 |
| E. | <i>α</i> Aquilæ | 50 56.71 | + 0.14 | + 0.10 | + 0.01 | 50 56.96 | 44 39.92 | 17.04 |
| E. | <i>ε</i> Draconis | 54 51.90 | — 0.36 | + 0.38 | + 0.01 | 54 51.93 | 48 34.63 | 17.30 |
| E. | <i>γ</i> Sagittæ | 59 27.62 | + 0.10 | + 0.15 | + 0.01 | 59 27.88 | 53 10.87 | 17.01 |
| E. | 3 Urs. Majoris, L. C. | 20 06 35.43 | + 0.68 | — 0.14 | — 0.02 | 20 06 35.95 | 20 00 19.03 | — 6 16.92 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= +0.94 + 15.00 \delta t + 1.59 a - 2.11 c \\
 0 &= +5.06 + 1.59 \delta t + 19.40 a - 8.41 c \\
 0 &= -1.99 - 2.11 \delta t - 8.41 a + 57.30 c
 \end{aligned}
 \quad
 \begin{aligned}
 a &= +0^s.260 \\
 c &= +0^s.005 \text{ for E.}
 \end{aligned}$$

OGDEN, UTAH, OCTOBER 15, 1874.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|---------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | <i>β</i> Cephei | 21 33 19.68 | — 0.24 | + 0.18 | 0.00 | 21 33 19.62 | 21 27 02.52 | — 6 17.10 |
| E. | <i>ξ</i> Aquarii | 37 21.97 | + 0.13 | + 0.04 | 0.00 | 37 22.14 | 31 05.21 | 16.93 |
| E. | <i>ε</i> Pegasi | 44 18.96 | + 0.09 | + 0.06 | 0.00 | 44 19.11 | 38 02.26 | 16.95 |
| E. | 11 Cephei | 46 22.27 | — 0.25 | + 0.21 | 0.00 | 46 22.23 | 40 05.36 | 16.87 |
| E. | <i>μ</i> Capricorni | 52 45.08 | + 0.14 | + 0.05 | 0.00 | 52 45.27 | 46 28.34 | 16.93 |
| E. | 79 Draconis | 57 36.13 | — 0.30 | + 0.26 | 0.00 | 57 36.09 | 51 19.18 | 16.91 |
| E. | <i>α</i> Aquarii | 22 05 38.16 | + 0.11 | + 0.07 | 0.00 | 22 05 38.34 | 59 21.34 | 17.00 |
| W. | <i>ζ</i> Cephei | 12 47.87 | + 0.06 | — 0.00 | 0.00 | 12 47.93 | 22 06 30.95 | 16.98 |
| W. | <i>θ</i> Aquarii | 16 31.10 | — 0.10 | — 0.01 | 0.00 | 16 30.99 | 10 13.85 | 17.14 |
| W. | <i>γ</i> Aquarii | 21 28.87 | — 0.08 | — 0.03 | 0.00 | 21 28.76 | 15 11.58 | 17.18 |
| W. | <i>π</i> Aquarii | 25 10.40 | — 0.08 | — 0.05 | 0.00 | 25 10.27 | 18 53.21 | 17.06 |
| W. | 9 Draconis, L. C. ... | 30 38.63 | — 0.46 | + 0.18 | 0.00 | 30 38.35 | 24 21.58 | 16.77 |
| W. | 226 Cephei | 35 22.08 | + 0.27 | — 0.23 | 0.00 | 35 22.12 | 29 05.36 | 16.76 |
| W. | <i>ζ</i> Pegasi | 41 30.52 | — 0.06 | — 0.04 | 0.00 | 41 30.42 | 35 13.23 | — 6 17.14 |

NORMAL EQUATIONS.

$$\begin{aligned}
 \text{For E.: } 0 &= +0.01 + 7.00 \delta t - 1.89 a \\
 &= -1.52 + 1.89 \delta t + 9.57 a \\
 \text{For W.: } 0 &= +0.48 + 7.00 \delta t + 3.66 a \\
 &= +2.59 + 3.66 \delta t + 21.05 a
 \end{aligned}
 \quad
 \begin{aligned}
 a &= +0^s.167 \\
 a &= -0^s.122
 \end{aligned}$$

Adopted $c = 0^s.00$.

TIME DETERMINATIONS.

41

Observations and reductions for time taken at sending station—Continued.

OGDEN, UTAH, OCTOBER 15, 1874.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|---------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | <i>ι</i> Ceti | 0 19 21.14 | — 0.07 | — 0.01 | — 0.02 | 0 19 21.04 | 0 13 03.63 | — 6 17.41 |
| W. | 12 Ceti | 29 57.01 | — 0.06 | — 0.01 | — 0.02 | 29 56.92 | 23 39.64 | 17.28 |
| W. | <i>ζ</i> Cassiopeiæ | 36 18.20 | + 0.03 | — 0.02 | — 0.03 | 36 18.18 | 30 00.95 | 17.23 |
| W. | <i>α</i> Cassiopeiæ | 39 42.71 | + 0.04 | — 0.01 | — 0.03 | 39 42.71 | 33 25.56 | 17.15 |
| W. | 21 Cassiopeiæ | 43 43.63 | + 0.18 | 0.00 | — 0.07 | 43 43.74 | 37 26.57 | 17.17 |
| W. | <i>μ</i> Andromedæ | 56 06.37 | — 0.01 | 0.00 | — 0.03 | 56 06.33 | 49 48.90 | 17.43 |
| E. | <i>ε</i> Piscium | 1 02 44.65 | — 0.05 | + 0.05 | + 0.02 | 1 02 44.67 | 56 27.43 | 17.24 |
| E. | <i>β</i> Andromedæ | 09 01.19 | — 0.01 | + 0.07 | + 0.03 | 09 01.28 | 1 02 44.18 | 17.10 |
| E. | <i>τ</i> Piscium | 11 03.85 | — 0.02 | + 0.06 | + 0.02 | 11 03.91 | 04 46.76 | 17.15 |
| E. | <i>ν</i> Piscium | 18 53.06 | — 0.03 | + 0.04 | + 0.02 | 18 53.09 | 12 35.86 | 17.23 |
| E. | <i>θ</i> Ceti | 24 04.23 | — 0.07 | + 0.02 | + 0.02 | 24 04.20 | 17 46.75 | 17.45 |
| E. | 38 Cassiopeiæ | 27 14.99 | + 0.12 | + 0.05 | + 0.05 | 27 15.21 | 20 57.95 | — 6 17.26 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= + 0.08 + 12.00 \delta t - 0.60 a - 2.05 c \\
 0 &= + 0.67 - 0.60 \delta t + 8.48 a + 5.41 c & a &= - 0^s.092 \\
 0 &= - 0.25 - 2.05 \delta t + 5.41 a + 37.65 c & c &= + 0^s.019
 \end{aligned}$$

OGDEN, UTAH, OCTOBER 16, 1874.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|-----------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | <i>α</i> Lyrae | 18 38 43.03 | + 0.02 | + 0.19 | + 0.10 | 18 38 43.34 | 18 32 41.06 | — 6 02.28 |
| E. | <i>β</i> Lyrae | 51 28.63 | + 0.06 | + 0.18 | + 0.10 | 51 28.97 | 45 26.60 | 02.37 |
| E. | <i>σ</i> Sagittarii | 53 31.09 | + 0.34 | + 0.06 | + 0.09 | 53 31.58 | 47 29.16 | 02.42 |
| E. | <i>γ</i> Lyrae | 19 00 16.87 | + 0.06 | + 0.18 | + 0.10 | 19 00 17.21 | 54 14.85 | 02.36 |
| E. | <i>ζ</i> Aquilæ | 05 40.57 | + 0.16 | + 0.15 | + 0.08 | 05 40.96 | 59 38.49 | 02.47 |
| E. | <i>ι</i> Lyrae | 08 51.31 | + 0.03 | + 0.20 | + 0.10 | 08 51.64 | 19 02 49.34 | 02.30 |
| E. | <i>δ</i> Sagittarii | 16 19.79 | + 0.30 | + 0.09 | + 0.08 | 16 20.26 | 10 17.76 | 02.50 |
| W. | <i>τ</i> Draconis | 23 59.73 | — 0.60 | — 0.17 | — 0.28 | 23 58.68 | 17 56.06 | 02.62 |
| W. | <i>β</i> Cygni | 31 41.90 | + 0.09 | — 0.06 | — 0.09 | 31 41.84 | 25 39.72 | 02.12 |
| W. | <i>κ</i> Aquilæ | 36 10.95 | + 0.25 | — 0.01 | — 0.08 | 36 11.11 | 30 08.67 | 02.44 |
| W. | <i>γ</i> Aquilæ | 46 20.09 | + 0.17 | 0.00 | — 0.08 | 46 20.18 | 40 17.87 | 02.31 |
| W. | <i>α</i> Aquilæ | 50 42.15 | + 0.18 | + 0.02 | — 0.08 | 50 42.27 | 44 39.91 | 02.36 |
| W. | <i>ε</i> Draconis | 54 37.49 | — 0.46 | + 0.11 | — 0.23 | 54 36.91 | 48 34.57 | 02.34 |
| W. | <i>γ</i> Sagittæ | 59 13.12 | + 0.13 | + 0.05 | — 0.08 | 59 13.22 | 53 10.87 | 02.35 |
| W. | 3 Urs. Majoris, L. C. | 20 06 20.57 | + 0.86 | — 0.04 | + 0.22 | 20 06 21.61 | 20 00 19.11 | — 6 02.50 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= + 1.20 + 15.00 \delta t + 4.82 a - 0.74 c \\
 0 &= - 5.73 + 4.82 \delta t + 15.62 a + 18.22 c & a &= + 0^s.330 \\
 0 &= - 9.58 - 0.74 \delta t + 18.22 a + 43.01 c & c &= + 0^s.050
 \end{aligned}$$

Observations and reductions for time taken at sending station—Continued.

OGDEN, UTAH, OCTOBER 16, 1874.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|-------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. 1 | Pegasi | 21 22 20.05 | + 0.02 | + 0.06 | — 0.05 | 21 22 20.08 | 21 16 17.74 | — 6 02.34 |
| W. β | Aquarii | 31 00.63 | + 0.04 | + 0.03 | — 0.05 | 31 00.65 | 24 58.06 | 02.59 |
| W. β | Cephei | 33 05.40 | — 0.07 | + 0.05 | — 0.15 | 33 05.23 | 27 02.46 | 02.77 |
| W. ξ | Aquarii | 37 07.62 | + 0.04 | 0.00 | — 0.05 | 37 07.61 | 31 05.20 | 02.41 |
| W. ε | Pegasi | 44 04.66 | + 0.03 | — 0.02 | — 0.05 | 44 04.62 | 38 02.25 | 02.37 |
| W. 11 | Cephei | 46 08.24 | — 0.07 | — 0.08 | — 0.15 | 46 07.94 | 40 05.30 | 02.64 |
| W. μ | Capricorni | 52 30.98 | + 0.04 | — 0.03 | — 0.05 | 52 30.94 | 46 28.33 | 02.61 |
| W. 79 | Draconis | 57 22.14 | — 0.09 | — 0.14 | — 0.17 | 57 21.74 | 51 19.12 | 02.62 |
| E. α | Aquarii | 22 05 23.84 | + 0.03 | + 0.09 | + 0.05 | 22 05 24.01 | 59 21.33 | 02.68 |
| E. ζ | Cephei | 12 33.28 | — 0.03 | + 0.21 | + 0.09 | 12 33.55 | 22 06 30.92 | 02.63 |
| E. θ | Aquarii | 16 16.34 | + 0.04 | + 0.07 | + 0.05 | 16 16.50 | 10 13.84 | 02.66 |
| E. γ | Aquarii | 21 14.20 | + 0.03 | + 0.08 | + 0.05 | 21 14.36 | 15 11.57 | 02.79 |
| E. π | Aquarii | 24 55.70 | + 0.03 | + 0.08 | + 0.05 | 24 55.86 | 18 53.20 | 02.66 |
| E. 9 | Draconis, L. C. . | 30 24.57 | + 0.19 | — 0.20 | — 0.21 | 30 24.35 | 24 21.66 | 02.69 |
| E. 226 | Cephei | 26 07.43 | — 0.11 | + 0.33 | + 0.20 | 26 07.85 | 20 05.30 | — 6 02.55 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= +0.33 + 15.00 \delta t + 2.39 a - 8.87 c \\
 0 &= -0.99 + 2.39 \delta t + 31.06 a - 11.49 c \\
 0 &= -3.30 - 8.87 \delta t - 11.49 a + 76.52 c
 \end{aligned}
 \quad
 \begin{aligned}
 a &= +0^s.051 \\
 c &= +0^s.051
 \end{aligned}$$

OGDEN, UTAH, OCTOBER 16, 1874.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|-------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. α | Andromedæ | 0 07 57.79 | + 0.19 | + 0.23 | + 0.01 | 0 07 58.22 | 0 01 55.56 | — 6 02.66 |
| E. 22 | Andromedæ | 09 51.91 | — 0.07 | + 0.30 | + 0.02 | 09 52.16 | 03 49.71 | 02.45 |
| E. γ | Pegasi | 12 50.09 | + 0.35 | + 0.19 | + 0.01 | 12 50.64 | 06 47.92 | 02.72 |
| E. | Groombridge 29 .. | 15 15.09 | — 1.80 | + 0.72 | + 0.05 | 15 14.06 | 09 11.24 | 02.82 |
| E. ι | Ceti | 19 05.66 | + 0.59 | + 0.13 | + 0.01 | 19 06.39 | 13 03.63 | 02.76 |
| E. 12 | Ceti | 29 41.66 | + 0.54 | + 0.14 | + 0.01 | 29 42.35 | 23 39.64 | 02.71 |
| E. ζ | Cassiopeiæ | 36 03.58 | — 0.26 | + 0.32 | + 0.02 | 36 03.66 | 30 00.95 | 02.71 |
| W. α | Cassiopeiæ | 39 28.30 | — 0.34 | + 0.09 | — 0.02 | 39 28.03 | 33 25.56 | 02.47 |
| W. 21 | Cassiopeiæ | 43 30.70 | — 1.51 | + 0.12 | — 0.04 | 43 29.27 | 37 26.57 | 02.70 |
| W. μ | Andromedæ | 55 51.77 | + 0.06 | + 0.05 | — 0.02 | 55 51.86 | 49 48.89 | 02.97 |
| W. ε | Piscium | 1 02 29.83 | + 0.43 | + 0.03 | — 0.01 | 1 02 30.33 | 56 27.43 | 02.90 |
| W. β | Andromedæ | 08 46.85 | + 0.10 | + 0.04 | — 0.01 | 08 46.98 | 1 02 44.18 | 02.80 |
| W. τ | Piscium | 10 49.27 | + 0.18 | + 0.02 | — 0.01 | 10 49.46 | 04 46.76 | — 6 02.70 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= +1.83 + 13.00 \delta t - 2.07 a + 1.36 c \\
 0 &= -9.00 - 2.07 \delta t + 12.02 a - 1.40 c \\
 0 &= +0.50 + 1.36 \delta t - 1.40 a + 49.22 c
 \end{aligned}
 \quad
 \begin{aligned}
 a &= +0^s.746 \\
 c &= +0^s.012
 \end{aligned}$$

TIME DETERMINATIONS.

43

Observations and reductions for time taken at sending station—Continued.

OGDEN, UTAH, OCTOBER 17, 1874.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|---------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | <i>α</i> Lyræ | 18 38 45.16 | + 0.11 | + 0.11 | — 0.16 | 18 38 45.22 | 18 32 41.04 | — 6 04.18 |
| W. | <i>β</i> Lyræ | 51 30.54 | + 0.31 | + 0.10 | — 0.14 | 51 30.81 | 45 26.58 | 04.23 |
| W. | <i>σ</i> Sagittarii | 53 31.74 | + 1.88 | + 0.03 | — 0.13 | 53 33.52 | 47 29.14 | 04.38 |
| W. | <i>γ</i> Lyræ | 19 00 18.76 | + 0.33 | + 0.10 | — 0.14 | 19 00 19.05 | 54 14.84 | 04.21 |
| W. | <i>ζ</i> Aquilæ | 05 42.08 | + 0.87 | + 0.07 | — 0.13 | 05 42.89 | 59 38.47 | 04.42 |
| W. | <i>ι</i> Lyræ | 08 53.40 | + 0.20 | + 0.10 | — 0.15 | 08 53.55 | 19 02 49.32 | 04.23 |
| W. | <i>δ</i> Sagittarii | 16 20.48 | + 1.68 | + 0.04 | — 0.13 | 16 22.07 | 10 17.74 | 04.33 |
| E. | <i>τ</i> Draconis | 24 02.62 | — 3.32 | + 0.52 | + 0.42 | 24 00.24 | 17 55.97 | 04.27 |
| E. | <i>β</i> Cygni | 31 42.93 | + 0.49 | + 0.19 | + 0.14 | 31 43.75 | 25 39.70 | 04.05 |
| E. | <i>κ</i> Aquilæ | 36 11.33 | + 1.38 | + 0.12 | + 0.12 | 36 12.95 | 30 08.65 | 04.30 |
| E. | <i>γ</i> Aquilæ | 46 20.90 | + 0.95 | + 0.13 | + 0.12 | 46 22.10 | 40 17.85 | 04.25 |
| E. | <i>α</i> Aquilæ | 50 42.90 | + 0.98 | + 0.13 | + 0.12 | 50 44.13 | 44 39.89 | 04.24 |
| E. | <i>ε</i> Draconis | 54 40.70 | — 2.56 | + 0.38 | + 0.35 | 54 38.87 | 48 34.50 | 04.37 |
| E. | <i>γ</i> Sagittæ | 59 14.08 | + 0.73 | + 0.15 | + 0.13 | 59 15.09 | 53 10.85 | — 6 04.24 |

NORMAL EQUATIONS.

$$\begin{aligned}
0 &= -3.55 + 14.00 \, dt + 2.22 \, a + 3.49 \, c \\
0 &= -14.66 + 2.22 \, dt + 8.86 \, a - 11.02 \, c & a &= + 1^s.822 \\
0 &= +16.62 + 3.49 \, dt - 11.02 \, a + 35.34 \, c & c &= + 0^s.121
\end{aligned}$$

OGDEN, UTAH, OCTOBER 20, 1874.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|---------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | <i>α</i> Lyræ | 18 38 49.06 | + 0.10 | + 0.13 | + 0.28 | 18 38 49.57 | 18 32 40.97 | — 6 08.60 |
| E. | <i>β</i> Lyræ | 51 34.61 | + 0.29 | + 0.09 | + 0.26 | 51 35.25 | 45 26.51 | 08.74 |
| E. | <i>γ</i> Lyræ | 19 00 22.73 | + 0.31 | + 0.07 | + 0.25 | 19 00 23.36 | 54 14.79 | 08.57 |
| E. | <i>ζ</i> Aquilæ | 05 46.03 | + 0.83 | + 0.04 | + 0.22 | 05 47.12 | 59 38.42 | 08.70 |
| E. | <i>ι</i> Lyræ | 08 57.37 | + 0.19 | + 0.02 | + 0.26 | 08 57.84 | 19 02 49.24 | 08.60 |
| E. | <i>δ</i> Sagittarii | 16 24.47 | + 1.58 | — 0.01 | + 0.23 | 16 26.27 | 10 17.69 | 08.58 |
| E. | <i>δ</i> Draconis | 18 40.32 | — 1.97 | — 0.12 | + 0.56 | 18 38.79 | 12 30.18 | 08.61 |
| E. | <i>τ</i> Draconis | 24 07.03 | — 3.13 | — 0.15 | + 0.74 | 24 04.49 | 17 55.73 | 08.76 |
| W. | <i>β</i> Cygni | 31 48.09 | + 0.47 | — 0.14 | — 0.24 | 31 48.18 | 25 39.64 | 08.54 |
| W. | <i>κ</i> Aquilæ | 36 16.43 | + 1.21 | — 0.09 | — 0.22 | 36 17.33 | 30 08.60 | 08.73 |
| W. | <i>γ</i> Aquilæ | 46 25.94 | + 0.89 | — 0.12 | — 0.22 | 46 26.49 | 40 17.80 | 08.69 |
| W. | <i>α</i> Aquilæ | 50 47.96 | + 0.93 | — 0.13 | — 0.22 | 50 48.54 | 44 39.84 | 08.70 |
| W. | <i>ε</i> Draconis | 54 46.36 | — 2.41 | — 0.41 | — 0.62 | 54 42.92 | 48 34.29 | 08.63 |
| W. | <i>γ</i> Sagittarii | 59 19.10 | + 0.69 | — 0.17 | — 0.23 | 59 19.39 | 53 10.79 | 08.60 |
| W. | <i>τ</i> Aquilæ | 20 04 08.94 | + 0.98 | — 0.13 | — 0.22 | 20 04 09.57 | 57 00.88 | — 6 08.69 |

NORMAL EQUATIONS.

$$\begin{aligned}
0 &= +3.45 + 15.00 \, dt + 0.61 \, a + 3.88 \, c \\
0 &= -14.70 + 0.61 \, dt + 9.44 \, a - 6.22 \, c & a &= + 1^s.721 \\
0 &= +3.12 + 3.88 \, dt - 6.22 \, a + 41.94 \, c & c &= + 0^s.214
\end{aligned}$$

Observations and reductions for time taken at sending station—Continued.

OGDEN, UTAH, OCTOBER 20, 1874.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|---------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | 12 Ceti | 0 26 47.73 | + 1.24 | — 0.15 | — 0.21 | 0 26 48.61 | 8 20 39.67 | — 6 08.94 |
| W. | ζ Cassiopeiæ | 36 11.10 | — 0.60 | — 0.33 | — 0.34 | 36 09.83 | 30 00.96 | 08.87 |
| W. | α Cassiopeiæ | 39 35.96 | — 0.77 | — 0.36 | — 0.36 | 39 34.47 | 33 25.55 | 08.92 |
| W. | 21 Cassiopeiæ | 43 40.78 | — 3.47 | — 0.65 | — 0.75 | 43 35.91 | 37 26.52 | 09.39 |
| W. | Bradley 82 | 49 21.23 | — 1.46 | — 0.42 | — 0.46 | 49 18.89 | 43 09.56 | 09.33 |
| W. | μ Andromedæ | 55 58.43 | + 0.14 | — 0.25 | — 0.26 | 55 58.06 | 49 48.90 | 09.16 |
| W. | ε Piscium | 1 02 35.88 | + 0.98 | — 0.27 | — 0.20 | 1 02 36.49 | 56 27.44 | 09.05 |
| W. | β Andromedæ | 08 53.40 | + 0.22 | — 0.24 | — 0.25 | 08 53.13 | 1 02 44.18 | 08.95 |
| W. | τ Piscium | 10 55.68 | + 0.41 | — 0.23 | — 0.23 | 10 55.63 | 04 46.76 | 08.87 |
| E. | ν Piscium | 18 44.42 | + 0.48 | — 0.03 | + 0.23 | 18 45.10 | 12 35.86 | 09.24 |
| E. | θ Ceti | 23 54.75 | + 1.34 | — 0.02 | + 0.21 | 23 56.28 | 17 46.78 | 09.50 |
| E. | 32 Cassiopeiæ | 28 04.73 | — 2.36 | — 0.13 | + 0.58 | 28 06.82 | 21 57.98 | 08.84 |
| E. | η Piscium | 30 56.19 | + 0.79 | — 0.06 | + 0.21 | 30 57.13 | 24 47.70 | — 6 09.43 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= + 6.38 + 13.00 \delta t - 1.78 a - 9.00 c \\
 0 &= - 16.65 - 1.78 \delta t + 8.79 a + 6.57 c \\
 0 &= - 21.01 - 9.00 \delta t + 6.57 a + 42.75 c
 \end{aligned}
 \qquad
 \begin{aligned}
 a &= + 1^s.720 \\
 c &= + 0^s.203
 \end{aligned}$$

OGDEN, UTAH, OCTOBER 29, 1874.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | α Pegasi | 21 44 24.07 | + 0.34 | — 0.05 | + 0.15 | 21 44 24.51 | 21 38 02.08 | — 6 22.43 |
| E. | μ Capricorni | 52 50.05 | + 0.54 | — 0.03 | + 0.15 | 52 50.71 | 46 28.16 | 22.55 |
| E. | 79 Draconis | 57 42.26 | — 1.16 | — 0.23 | + 0.50 | 57 41.37 | 51 18.29 | 23.08 |
| E. | α Aquarii | 22 05 43.42 | + 0.43 | — 0.06 | + 0.14 | 22 05 43.93 | 59 21.19 | 22.74 |
| E. | ζ Cephei | 12 53.40 | — 0.33 | — 0.19 | + 0.27 | 12 53.15 | 22 06 30.54 | 22.61 |
| E. | θ Aquarii | 16 35.88 | + 0.50 | — 0.07 | + 0.15 | 16 36.46 | 10 13.70 | 22.76 |
| E. | γ Aquarii | 21 33.73 | + 0.43 | — 0.09 | + 0.14 | 21 34.21 | 15 11.43 | 22.78 |
| E. | π Aquarii | 25 15.34 | + 0.41 | — 0.09 | + 0.14 | 25 15.80 | 18 53.07 | 22.73 |
| E. | 9 Draconis, L. C. | 30 43.41 | + 2.40 | + 0.23 | — 0.61 | 30 45.48 | 24 22.80 | 22.68 |
| E. | 226 Cephei | 36 28.12 | — 1.41 | — 0.46 | + 0.58 | 36 26.83 | 30 04.44 | 22.39 |
| W. | ζ Pegasi | 41 36.25 | + 0.33 | — 0.17 | — 0.15 | 41 36.26 | 35 13.14 | 23.12 |
| W. | η Pegasi | 43 31.16 | + 0.15 | — 0.22 | — 0.17 | 43 30.92 | 37 08.17 | 22.75 |
| W. | λ Pegasi | 46 53.23 | + 0.21 | — 0.20 | — 0.15 | 46 53.09 | 40 30.16 | — 6 22.93 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= - 0.93 + 13.00 \delta t + 4.46 a + 7.92 c \\
 0 &= - 11.35 + 4.46 \delta t + 25.93 a - 28.96 c \\
 0 &= + 11.81 + 7.92 \delta t - 28.96 a + 59.16 c
 \end{aligned}
 \qquad
 \begin{aligned}
 a &= + 0^s.638 \\
 c &= + 0^s.144
 \end{aligned}$$

Observations and reductions for time taken at sending station—Continued.

OGDEN, UTAH, OCTOBER 29, 1874.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|----------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | μ Andromedæ..... | 0 56 12.21 | 0.00 | — 0.25 | — 0.22 | 0 56 11.74 | 0 49 48.92 | — 6 22.82 |
| W. | ϵ Piscium..... | 1 02 50.57 | — 0.03 | — 0.16 | — 0.17 | 1 02 50.21 | 56 27.46 | 22.75 |
| W. | β Andromedæ..... | 09 07.26 | 0.00 | — 0.24 | — 0.21 | 09 06.81 | 1 02 44.22 | 22.59 |
| W. | τ Piscium..... | 11 09.81 | — 0.01 | — 0.22 | — 0.20 | 11 09.38 | 04 46.80 | 22.58 |
| W. | ν Piscium..... | 18 59.03 | — 0.01 | — 0.19 | — 0.19 | 18 58.64 | 12 35.91 | 22.73 |
| W. | θ^1 Ceti..... | 24 10.05 | — 0.04 | — 0.10 | — 0.17 | 24 09.74 | 17 46.81 | 22.93 |
| W. | 38 Cassiopeiæ..... | 28 21.66 | + 0.06 | — 0.40 | — 0.49 | 28 20.83 | 21 58.01 | 22.82 |
| W. | η Piscium..... | 31 10.97 | — 0.02 | — 0.14 | — 0.18 | 31 10.63 | 24 47.75 | 22.88 |
| W. | ν Persei..... | 36 42.87 | + 0.01 | — 0.22 | — 0.26 | 36 42.40 | 30 19.64 | 22.76 |
| W. | ϕ Persei..... | 42 13.41 | + 0.01 | — 0.24 | — 0.27 | 42 12.91 | 35 50.22 | 22.69 |
| W. | σ Piscium..... | 45 10.89 | — 0.02 | — 0.14 | — 0.17 | 45 10.56 | 38 47.81 | 22.75 |
| E. | ϵ Cassiopeiæ..... | 51 48.13 | + 0.04 | — 0.16 | + 0.38 | 51 48.39 | 45 25.65 | 22.74 |
| E. | β Arietis..... | 54 06.94 | — 0.02 | — 0.08 | + 0.18 | 54 07.02 | 47 44.26 | 22.76 |
| E. | 50 Cassiopeiæ..... | 59 11.14 | + 0.07 | — 0.25 | + 0.55 | 59 11.51 | 52 48.70 | 22.81 |
| E. | γ Andromedæ..... | 2 02 36.47 | 0.00 | — 0.14 | + 0.23 | 2 02 36.56 | 56 13.89 | 22.67 |
| E. | α Arietis..... | 06 30.37 | — 0.01 | — 0.10 | + 0.18 | 06 30.44 | 2 00 07.81 | 22.63 |
| E. | ξ^1 Ceti..... | 12 45.46 | — 0.02 | — 0.09 | + 0.17 | 12 45.52 | 06 22.64 | — 6 22.88 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -1.68 + 17.00 \delta t + 0.10 a - 4.86 c \\
 0 &= +1.08 + 0.10 \delta t + 7.46 a - 4.42 c & a &= -0^s.045 \\
 0 &= -6.86 - 4.86 \delta t - 4.42 a + 42.97 c & c &= +0^s.172
 \end{aligned}$$

OGDEN, UTAH, OCTOBER 31, 1874.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | 226 Cephei..... | 22 36 28.93 | + 0.43 | — 0.43 | — 0.64 | 22 36 28.29 | 22 30 04.30 | — 6 23.99 |
| W. | ζ Pegasi..... | 41 38.06 | — 0.10 | — 0.11 | — 0.16 | 41 37.69 | 35 13.12 | 24.57 |
| W. | η Pegasi..... | 43 33.04 | — 0.04 | — 0.14 | — 0.18 | 43 32.68 | 37 08.14 | 24.54 |
| W. | λ Pegasi..... | 46 54.96 | — 0.06 | — 0.14 | — 0.17 | 46 54.59 | 40 30.14 | 24.45 |
| W. | ι Cephei..... | 51 38.61 | + 0.18 | — 0.29 | — 0.38 | 51 38.12 | 45 13.70 | 24.42 |
| E. | α Pegasi..... | 23 04 56.72 | — 0.70 | — 0.05 | + 0.16 | 23 04 56.13 | 58 31.71 | 24.42 |
| E. | π Cephei..... | 10 16.58 | + 3.12 | — 0.19 | + 0.60 | 10 20.11 | 23 03 55.77 | 24.34 |
| E. | σ Cephei..... | 19 52.73 | + 1.72 | — 0.19 | + 0.41 | 19 54.67 | 13 29.97 | 24.70 |
| E. | ν Pegasi..... | 25 33.13 | — 0.52 | — 0.09 | + 0.17 | 25 32.69 | 19 08.17 | 24.52 |
| E. | λ Draconis, L. C.... | 30 24.30 | — 4.07 | + 0.09 | — 0.46 | 30 19.86 | 23 55.39 | — 6 24.47 |

NORMAL EQUATIONS.

$$\begin{aligned}
 \text{For W. : } 0 &= -2.94 + 5.00 \delta t - 2.12 a \\
 0 &= +2.29 - 2.12 \delta t + 6.29 a & a &= -0^s.194 \\
 \text{For E. : } 0 &= -1.60 + 5.00 \delta t + 0.30 a \\
 0 &= +19.99 + 0.30 \delta t + 13.48 a & a &= -1^s.492
 \end{aligned}$$

Adopted $c = +0.158$ for E.

Observations and reductions for time taken at sending station—Continued.

OGDEN, UTAH, OCTOBER 31, 1874.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|-------------------|-----------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. ε | Cassiopeiæ..... | 1 51 48.86 | + 1.16 | — 0.20 | + 0.35 | 1 51 50.17 | 1 45 25.66 | — 6 24.51 |
| E. β | Arietis | 54 09.25 | — 0.54 | — 0.10 | + 0.17 | 54 08.78 | 47 44.27 | 24.51 |
| E. 50 | Cassiopeiæ..... | 59 10.91 | + 2.30 | — 0.22 | + 0.51 | 59 13.50 | 52 48.71 | 24.79 |
| E. γ | Andromedæ | 2 02 38.33 | + 0.01 | — 0.08 | + 0.21 | 2 02 38.47 | 56 13.90 | 24.57 |
| E. α | Arietis | 06 32.72 | — 0.47 | — 0.05 | + 0.17 | 06 32.37 | 2 00 07.83 | 24.54 |
| E. ξ ¹ | Ceti | 12 47.97 | — 0.78 | — 0.04 | + 0.16 | 12 47.31 | 06 22.66 | 24.65 |
| W. ι | Cassiopeiæ..... | 25 11.92 | + 1.55 | — 0.57 | — 0.40 | 25 12.50 | 18 47.90 | 24.60 |
| W. ξ ² | Ceti | 27 56.85 | — 0.78 | — 0.21 | — 0.16 | 27 55.70 | 21 30.93 | 24.72 |
| W. δ | Ceti | 39 30.93 | — 0.93 | — 0.19 | — 0.16 | 39 29.65 | 33 04.86 | 24.79 |
| W. θ | Persei | 42 05.14 | + 0.28 | — 0.38 | — 0.24 | 42 04.80 | 35 40.29 | 24.51 |
| W. μ | Ceti | 44 37.06 | — 0.75 | — 0.22 | — 0.16 | 44 35.93 | 38 11.30 | — 6 24.63 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -2.38 + 11.00 \delta t - 0.76 a + 2.81 c \\
 0 &= +9.44 - 0.76 \delta t + 6.15 a - 4.38 c \\
 0 &= -11.48 + 2.81 \delta t - 4.38 a + 32.07 c
 \end{aligned}
 \qquad
 \begin{aligned}
 a &= -1^s.413 \\
 c &= +0^s.158
 \end{aligned}$$

NOTE.—The instrument had to be removed from its pier every day to allow the carpenter to work in the observing-room.

Observations and reductions for time taken at receiving station.

NAVAL OBSERVATORY, WASHINGTON, D. C.

| Date. | Star. | Observed place. | Aa. | Bb. | Cc. | Instrumental corrections. | Corrected transit. | Adopted right ascension. | Observed clock-corrections. | v. |
|---------|---------------------------|-----------------|-----------|-----------|-----------|---------------------------|--------------------|--------------------------|-----------------------------|-------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | |
| 1874. | | | | | | | | | | |
| Oct. 15 | γ Pegasi | 0 07 38.52 | — 0.47 | — 0.44 | — 0.01 | — 0.92 | 37.60 | 47.92 | —49.68 | —0.02 |
| | β Ceti | 38 10.13 | — 0.97 | — 0.27 | — 0.01 | — 1.25 | 08.88 | 19.19 | .69 | —0.01 |
| | ε Piscium | 0 57 18.10 | — 0.58 | — 0.40 | — 0.01 | — 0.99 | 17.11 | 27.44 | .67 | +0.02 |
| | Polaris | 1 13 50.50 | +35.13 | —13.03 | — 0.42 | +21.63 | 12.13 | 22.36 | ..... | ..... |
| | θ ¹ Ceti | 18 37.61 | — 0.82 | — 0.32 | — 0.01 | — 1.15 | 36.46 | 46.77 | .69 | +0.02 |
| | η Piscium | 1 25 38.32 | — 0.46 | — 0.44 | — 0.01 | — 0.91 | 37.41 | 47.74 | .67 | +0.04 |
| | ξ ¹ Ceti | 2 07 13.26 | — 0.56 | — 0.41 | — 0.01 | — 0.98 | 12.28 | 22.54 | .74 | 0.00 |
| | γ Ceti | 2 37 40.33 | — 0.64 | — 0.38 | — 0.01 | — 1.03 | 39.30 | 49.52 | —49.78 | —0.02 |
| Oct. 16 | α Andromedæ .. | 0 02 46.33 | — 0.23 | — 0.50 | — 0.01 | — 0.74 | 45.59 | 55.58 | —50.01 | +0.01 |
| | β Ceti | 38 10.42 | — 0.97 | — 0.25 | — 0.01 | — 1.23 | 09.19 | 19.19 | .00 | +0.02 |
| | ε Piscium | 0 57 18.48 | — 0.58 | — 0.39 | — 0.01 | — 0.98 | 17.50 | 27.45 | .05 | —0.04 |
| | Polaris | 1 13 50.00 | +35.13 | —12.26 | — 0.42 | +22.45 | 12.45 | 22.39 | ..... | ..... |
| | θ ¹ Ceti | 18 37.92 | — 0.82 | — 0.31 | — 0.01 | — 1.14 | 36.78 | 46.78 | —50.00 | 0.00 |
| | η Piscium | 25 38.64 | — 0.46 | — 0.42 | — 0.01 | — 0.89 | 37.75 | 47.75 | —50.00 | 0.00 |
| | β Arietis | 1 48 34.97 | — 0.37 | — 0.45 | — 0.01 | — 0.83 | 34.14 | 44.17 | —49.97 | +0.02 |
| | ξ ¹ Ceti | 2 07 13.47 | — 0.56 | — 0.39 | — 0.01 | — 0.93 | 12.51 | 22.55 | —49.96 | +0.02 |

Observations and reductions for time taken at receiving station—Continued.

NAVAL OBSERVATORY, WASHINGTON, D. C.

| Date. | Star. | Observed place. | Aa. | Bb. | Cc. | Instrumental corrections. | Corrected transit. | Adopted right ascension. | Observed clock-corrections. | v. |
|---------|---------------------------|-----------------|-----------|-----------|-----------|---------------------------|--------------------|--------------------------|-----------------------------|-------|
| 1874. | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | |
| Oct. 20 | ϵ Piscium..... | 0 57 19.66 | — 0.56 | — 0.39 | — 0.02 | — 0.97 | 18.69 | 27.46 | —51.23 | +0.01 |
| | Polaris..... | 1 13 52.82 | +33.84 | —12.54 | — 0.85 | +20.45 | 13.27 | 22.00 | ..... | ..... |
| | θ^1 Ceti..... | 18 39.21 | — 0.79 | — 0.31 | — 0.02 | — 1.12 | 38.09 | 46.80 | .29 | —0.05 |
| | σ Piscium..... | 1 39 39.89 | — 0.54 | — 0.40 | — 0.02 | — 0.96 | 38.93 | 47.73 | .20 | +0.04 |
| | α Arietis..... | 2 00 59.77 | — 0.32 | — 0.48 | — 0.02 | — 0.82 | 58.95 | 07.73 | .22 | +0.02 |
| | ξ^1 Ceti..... | 07 14.81 | — 0.54 | — 0.40 | — 0.02 | — 0.96 | 13.85 | 22.59 | .26 | —0.02 |
| | γ Ceti..... | 37 41.84 | — 0.62 | — 0.37 | — 0.02 | — 1.01 | 49.83 | 49.58 | .25 | —0.01 |
| | α Ceti..... | 2 56 37.10 | — 0.61 | — 0.38 | — 0.02 | — 1.01 | 36.09 | 44.86 | —51.23 | +0.01 |
| Oct. 29 | ϵ Piscium..... | 0 57 21.52 | — 0.56 | — 0.42 | — 0.11 | — 1.09 | 20.43 | 27.48 | —52.95 | +0.03 |
| | Polaris..... | 1 13 58.10 | +34.16 | —13.37 | — 4.64 | +16.15 | 14.25 | 21.42 | ..... | ..... |
| | θ^1 Ceti..... | 18 41.13 | — 0.79 | — 0.33 | — 0.11 | — 1.23 | 39.90 | 46.83 | —53.07 | —0.08 |
| | η Piscium..... | 25 41.87 | — 0.45 | — 0.46 | — 0.11 | — 1.02 | 40.85 | 47.82 | —53.03 | —0.03 |
| | σ Piscium..... | 39 41.82 | — 0.54 | — 0.43 | — 0.11 | — 1.03 | 40.74 | 47.79 | —52.95 | +0.06 |
| | β Arietis..... | 1 48 38.22 | — 0.36 | — 0.49 | — 0.12 | — 0.97 | 37.25 | 44.29 | —52.96 | +0.05 |
| | α Arietis..... | 2 01 01.80 | — 0.32 | — 0.51 | — 0.12 | — 0.95 | 00.85 | 07.83 | —53.02 | 0.00 |
| | ξ^1 Ceti..... | 2 07 16.86 | — 0.55 | — 0.43 | — 0.11 | — 1.09 | 15.77 | 22.69 | —53.08 | —0.05 |
| Oct. 31 | γ^2 Ur. Min., S.P. | 3 21 49.73 | — 3.19 | + 0.46 | — 0.03 | — 2.76 | 46.97 | 53.37 | ..... | ..... |
| | η Tauri..... | 40 57.57 | — 0.30 | — 0.41 | + 0.01 | — 0.70 | 56.87 | 03.40 | —53.47 | +0.01 |
| | ζ Persei..... | 3 47 10.70 | — 0.16 | — 0.45 | + 0.01 | — 0.60 | 10.10 | 16.65 | .45 | +0.03 |
| | γ Tauri..... | 4 13 35.17 | — 0.43 | — 0.37 | + 0.01 | — 0.79 | 34.38 | 40.91 | .47 | +0.01 |
| | ϵ Tauri..... | 22 13.42 | — 0.38 | — 0.39 | + 0.01 | — 0.76 | 12.66 | 19.11 | .55 | —0.07 |
| | α Tauri..... | 29 39.24 | — 0.42 | — 0.38 | + 0.01 | — 0.79 | 38.45 | 44.94 | .51 | —0.03 |
| | 9 Camelop..... | 42 31.67 | + 1.15 | — 0.86 | + 0.02 | + 0.31 | 31.98 | 38.51 | ..... | ..... |
| | ι Aurigæ..... | 49 45.22 | — 0.13 | — 0.46 | + 0.01 | — 0.58 | 44.64 | 51.16 | .48 | 0.00 |
| | 11 Orionis..... | 58 19.80 | — 0.43 | — 0.37 | + 0.01 | — 0.79 | 19.01 | 25.55 | .46 | +0.02 |
| | ϵ Ur. Min., S.P. | 4 59 44.67 | — 6.59 | + 1.49 | — 0.07 | — 5.17 | 39.50 | 46.04 | ..... | ..... |
| | β Orionis..... | 5 09 26.47 | — 0.77 | — 0.27 | + 0.01 | — 1.03 | 25.44 | 31.97 | —53.47 | +0.01 |

The following tables show the corrections and rates of the chronometers used at Ogden and of the clock at the Naval Observatory, Washington, D. C.:

CHRONOMETER AT OGDEN.—NEGUS, No. 1511.

| Date. | Local sidereal time. | Correction of chronometer. | Adopted hourly rate. |
|------------------|----------------------|----------------------------------|-----------------------|
| 1874. Oct. 15 | <i>h.</i> 23.40 | <i>h. m. s.</i> — 0 05 17.120 | <i>s.</i> + 0.0533 |

CHRONOMETER AT OGDEN.—NEGUS, No. 1491.

| Date. | Local sidereal time. | Correction of clock. | Adopted hourly rate. |
|---------|----------------------|----------------------|----------------------|
| 1874. | <i>h.</i> | <i>h. m. s.</i> | <i>s.</i> |
| Oct. 16 | 23.23 | — 0 06 02.660 | + 0.0801 |
| Oct. 17 | 19.20 | 04.260 | + 0.0917 |
| Oct. 20 | 22.08 | 08.883 | + 0.0634 |
| Oct. 29 | 23.81 | 22.742 | + 0.0367 |
| Oct. 31 | 00.58 | — 0 06 24.530 | + 0.0367 |

CLOCK AT WASHINGTON.—KESSELS.

| Date. | Local sidereal time. | Correction of clock. | Adopted hourly rate. |
|---------|----------------------|----------------------|----------------------|
| 1874. | <i>h. m.</i> | <i>s.</i> | <i>s.</i> |
| Oct. 15 | 1 40 | — 49.717 ± 0.006 | — 0.040 |
| Oct. 16 | 1 40 | — 49.936 ± 0.006 | + 0.026 |
| Oct. 20 | 1 50 | — 51.240 ± 0.008 | + 0.004 |
| Oct. 29 | 2 00 | — 53.025 ± 0.013 | — 0.042 |
| Oct. 31 | 3 30 | — 53.480 ± 0.008 | — 0.003 |

Final results of longitude.

| Signals sent from— | Recorded at— | Mean of signals sent and received. | Time-corrections. | Corrected time. | Difference of longitude. | Double-wave time. | Means. |
|--------------------|------------------|------------------------------------|-------------------|-----------------|--------------------------|-------------------|-----------------|
| Oct. 15, 1874: | | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>s.</i> | <i>h. m. s.</i> |
| Washington { | Ogden | 23 24 10.829 | — 0 06 17.115 | 23 17 53.714 | 2 19 47.093 | | |
| Washington { | Washington | 1 38 30.526 | — 0 00 49.719 | 1 37 40.807 | | | |
| Ogden { | Ogden | 23 45 10.526 | — 0 06 17.132 | 23 38 53.394 | | | |
| Washington { | Washington | 1 59 30.700 | — 0 00 49.710 | 1 58 40.990 | 47.596 | 0.503 | 2 19 47.345 |
| Oct. 16, 1874: | | | | | | | |
| Ogden { | Ogden | 23 23 09.199 | — 0 06 02.664 | 23 17 06.535 | | | |
| Washington { | Washington | 1 37 44.204 | — 0 00 49.985 | 1 36 54.219 | 47.684 | | |
| Washington { | Ogden | 23 47 02.271 | — 0 06 02.693 | 23 40 59.575 | | | |
| Washington { | Washington | 2 01 36.707 | — 0 00 49.995 | 2 00 36.712 | 47.137 | 0.547 | 47.410 |
| Oct. 20, 1874: | | | | | | | |
| Ogden { | Ogden | 23 36 26.592 | — 0 06 08.973 | 23 20 17.619 | | | |
| Washington { | Washington | 1 50 56.541 | — 0 00 51.240 | 1 50 05.301 | 47.682 | | |
| Washington { | Ogden | 0 08 01.137 | — 0 06 09.003 | 23 59 52.134 | | | |
| Washington { | Washington | 2 20 30.526 | — 0 00 51.242 | 2 19 39.284 | 47.150 | 0.532 | 47.416 |
| Oct. 29, 1874: | | | | | | | |
| Washington { | Ogden | 0 25 18.561 | — 0 06 22.760 | 0 18 55.801 | | | |
| Washington { | Washington | 2 39 36.161 | — 0 00 53.000 | 2 38 43.161 | 47.360 | | |
| Ogden { | Ogden | 0 32 31.852 | — 0 03 22.765 | 0 26 09.087 | | | |
| Washington { | Washington | 2 46 49.938 | — 0 00 52.993 | 2 45 57.005 | 47.918 | 0.558 | 47.639 |
| Oct. 31, 1874: | | | | | | | |
| Washington { | Ogden | 1 17 19.526 | — 0 08 24.552 | 1 10 54.974 | | | |
| Washington { | Washington | 3 31 36.159 | — 0 00 53.480 | 3 30 42.679 | 47.705 | | |
| Ogden { | Ogden | 1 24 09.350 | — 0 06 24.556 | 1 17 44.794 | | | |
| Washington { | Washington | 3 38 25.464 | — 0 00 53.480 | 3 37 31.984 | 2 19 47.190 | 0.515 | 2 19 47.448 |

Ogden west of Washington..... 2^h 19^m 47^s.452
Reduction to center of dome..... + 0^s.040

Ogden west of Washington, final value 2^h 19^m 47^s.492

LATITUDE DETERMINATIONS.

49

Observations and computations for latitude.

OGDEN, UTAH.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|------------------------|-----------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|----------|--------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1874. September 28. | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | <i>° ' "</i> | <i>' "</i> | <i>"</i> | <i>° ' "</i> |
| | 6470 | 10 43.5 | 30.0 | 20.0 | | 41 03 30.3 | + 9 35.4 | +2.5 | 41 13 08.2 |
| | 6534 | 28 98.0 | 25.0 | 26.0 | | | | | |
| | 6553 | 18 99.0 | 22.0 | 30.0 | | 10 07.7 | + 2 57.8 | +4.1 | 09.6 |
| | 6659 | 13 26.0 | 38.0 | 15.0 | | | | | |
| | 6698 | 29 15.0 | 23.0 | 30.0 | | 02 33.4 | +10 36.8 | +2.2 | 12.4 |
| | 6721 | 8 69.0 | 34.0 | 19.0 | | | | | |
| | 6777 | 24 83.0 | 20.0 | 34.0 | | 09 22.1 | + 3 45.9 | +3.3 | 11.3 |
| | 6799 | 17 55.0 | 39.0 | 13.0 | | | | | |
| | 6830 | 18 17.0 | 39.0 | 14.0 | | 10 58.2 | + 2 08.4 | +3.0 | 09.6 |
| | 6851 | 22 31.0 | 20.0 | 34.0 | | | | | |
| | 6915 | 30 10.5 | 18.0 | 35.0 | | 02 07.0 | +10 59.6 | +4.1 | 10.7 |
| | 6962 | 8 84.5 | 43.0 | 11.0 | | | | | |
| | 6986 | 26 16.5 | 31.0 | 23.0 | | 05 21.3 | + 7 42.6 | +3.3 | 07.2 |
| | 7041 | 11 25.5 | 29.0 | 25.0 | | | | | |
| | 7073 | 23 87.0 | 27.0 | 27.0 | | 09 12.1 | + 3 55.4 | +3.0 | 10.5 |
| | 7112 | 16 28.5 | 33.0 | 22.0 | | | | | |
| | 7194 | 26 29.0 | 30.0 | 26.0 | | 05 48.3 | + 7 19.3 | +1.4 | 09.0 |
| | Gr. 3311 | 12 13.0 | 28.0 | 27.0 | | | | | |
| | 7290 | 9 20.0 | 25.1 | 30.0 | | 04 33.0 | + 8 33.8 | +1.9 | 08.7 |
| | 7320 | 25 76.0 | 34.0 | 22.0 | | 03 41.2 | + 9 27.4 | -0.3 | 08.3 |
| | 7336 | 27 49.0 | 30.0 | 26.0 | | | | | |
| | 7462 | 18 19.0 | 19.0 | 38.0 | | 16 58.5 | - 3 55.4 | +6.6 | 09.7 |
| | 7480 | 25 75.8 | 50.0 | 7.0 | | | | | |
| | 7521 | 15 69.0 | 34.0 | 23.0 | | 16 49.8 | - 3 43.4 | +2.2 | 08.6 |
| | 7544 | 22 89.0 | 27.0 | 30.0 | | | | | |
| | 7824 | 22 59.0 | 26.0 | 30.0 | | 16 38.5 | - 3 33.4 | +4.4 | 09.5 |
| | 7843 | 15 73.0 | 38.0 | 18.0 | | | | | |
| | 7917 | 29 77.0 | 23.0 | 33.0 | | 01 44.4 | +11 17.9 | +3.8 | 06.1 |
| | 7932 | 7 92.0 | 41.0 | 17.0 | | | | | |
| | 7972 | 15 63.3 | 23.0 | 36.0 | | 10 46.9 | + 2 16.2 | +7.7 | 10.8 |
| | 7984 | 20 02.5 | 50.0 | 9.0 | | | | | |
| | α Pegasi. | 33 56.5 | 27.0 | 31.0 | | 40 58 48.3 | +14 15.9 | +6.0 | 10.2 |
| | ο Cephei. | 5 98.0 | 42.0 | 16.0 | | | | | |
| September 29. | 6553 | 20 35.5 | 22.0 | 28.0 | | 41 10 07.7 | + 3 01.6 | -0.8 | 08.5 |
| | 6659 | 14 50.0 | 27.0 | 24.0 | | | | | |
| | 6698 | 29 61.5 | 17.0 | 34.0 | | 02 33.5 | +10 37.9 | -1.9 | 09.5 |
| | 6721 | 9 05.3 | 31.0 | 21.0 | | | | | |
| | 6777 | 23 46.5 | 27.0 | 25.0 | | 09 22.2 | + 3 47.3 | -1.0 | 08.5 |
| | 6799 | 16 13.8 | 23.0 | 28.0 | | | | | |

4 AST

Observations and computations—Continued.

OGDEN, UTAH.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|------------------------|------------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|----------|--------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1874. September 29. | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | <i>° ' "</i> | <i>' "</i> | <i>"</i> | <i>° ' "</i> |
| | 6830 | 16 75.0 | 23.0 | 28.0 | | 41 10 58.3 | + 2 09.8 | +0.5 | 41 13 08.6 |
| | 6851 | 20 93.5 | 29.0 | 22.0 | | | | | |
| | 6915 | 29 93.5 | 29.0 | 22.0 | | | | | |
| | 6962 | 8 60.3 | 22.0 | 22.0 | | 02 07.1 | +11 01.8 | 0.0 | 08.9 |
| | 6986 | 27 36.5 | 26.0 | 26.0 | | | | | |
| | 7041 | 12 40.3 | 26.0 | 24.0 | | 05 21.4 | + 7 44.1 | +1.1 | 06.6 |
| | 7073 | 22 68.0 | 23.0 | 29.0 | | | | | |
| | 7112 | 15 06.5 | 30.0 | 23.0 | | 09 12.3 | + 3 56.3 | +0.3 | 08.9 |
| | 7194 | 26 38.0 | 24.0 | 29.0 | | | | | |
| | Gr. 3311 | 12 72.5 | 29.0 | 24.0 | | 05 48.4 | + 7 19.2 | 0.0 | 07.6 |
| | 7290 | 7 04.0 | 20.0 | 33.0 | | | | | |
| | 7320 | 23 61.5 | 33.0 | 20.0 | | 04 33.2 | + 8 34.3 | 0.0 | 07.5 |
| | 7336 | 25 31.0 | ----- | ----- | | 03 41.4 | + 9 26.8 | 0.0 | 08.2 |
| | 7398 | 24 06.5 | 29.0 | 25.0 | | | | | |
| | 7402 | 15 67.0 | 20.0 | 34.0 | | 08 49.7 | + 4 20.5 | -2.8 | 07.4 |
| | 7462 | 18 46.5 | 24.0 | 30.0 | | | | | |
| | R. C. 5252 | 19 46.5 | 29.0 | 26.0 | | 13 38.5 | - 0 31.1 | -0.8 | 06.6 |
| | 7521 | 15 91.8 | 36.0 | 19.0 | | | | | |
| | 7544 | 23 02.0 | 18.0 | 37.0 | | 16 50.0 | - 0 40.7 | -0.6 | 08.7 |
| | 7602 | 20 56.0 | 31.0 | 25.0 | | | | | |
| | 7681 | 19 72.0 | 20.0 | 35.0 | | 12 46.6 | + 0 26.1 | -2.5 | 10.2 |
| | 7824 | 22 88.0 | 30.0 | 26.0 | | | | | |
| | 7843 | 16 14.0 | 24.0 | 32.0 | | 16 38.7 | - 0 29.4 | -1.1 | 08.2 |
| | 7917 | 29 48.5 | 24.0 | 32.0 | | 05 35.1 | + 7 31.8 | -1.1 | 05.8 |
| | 7932 | 13 88.0 | 25.0 | 31.0 | | 13 40.8 | - 0 32.8 | -0.5 | 07.5 |
| | 7962 | 14 92.5 | 30.0 | 26.0 | | | | | |
| | 7972 | 17 11.3 | 25.0 | 31.0 | | | | | |
| | 7984 | 21 70.5 | 27.0 | 28.0 | | 10 47.1 | + 2 22.6 | -1.9 | 07.8 |
| | 7994 | 15 80.5 | 32.0 | 23.0 | | | | | |
| | 8023 | 24 71.0 | 20.0 | 35.0 | | 17 45.7 | - 4 36.4 | -1.6 | 07.7 |
| | α Pegasi. | 33 35.0 | 47.0 | 8.0 | | | | | |
| | σ Cephei. | 5 51.0 | 2.0 | 53.0 | | 40 58 48.5 | +14 23.8 | -3.3 | 09.0 |
| September 30. | 7521 | 15 61.5 | 37.0 | 18.0 | | | | | |
| | 7544 | 22 73.0 | 15.0 | 40.0 | | 41 16 50.1 | - 3 40.8 | -1.6 | 07.7 |
| | 7602 | 19 37.0 | 23.0 | 33.0 | | | | | |
| | 7681 | 18 63.0 | 30.0 | 25.0 | | 12 46.9 | + 0 23.0 | -1.4 | 08.5 |
| | 7765 | 25 60.8 | 34.0 | 26.0 | | | | | |
| | 7803 | 12 51.0 | 22.0 | 38.0 | | 06 22.0 | + 6 46.3 | -2.2 | 06.1 |

LATITUDE DETERMINATIONS.

51

Observations and computations—Continued.

OGDEN, UTAH.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|----------------|------------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|--------|------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1874. | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | ° ' " |
| September 30. | 7824 | 21 59.5 | 17.0 | 38.0 | | | | | |
| | 7843 | 14 77.0 | 39.0 | 15.0 | | 41 16 38.9 | — 3 31.7 | +0.8 | 41 13 08.0 |
| | 7917 | 29 48.5 | 24.0 | 32.0 | | 05 35.6 | + 7 31.8 | —1.1 | 06.3 |
| | 7932 | 13 68.0 | 25.0 | 31.0 | | 13 41.5 | — 0 32.5 | —0.6 | 08.4 |
| | 7962 | 14 92.5 | 30.0 | 26.0 | | | | | |
| | 7972 | 16 29.0 | 23.0 | 33.0 | | | | | |
| | 7984 | 20 92.0 | 26.0 | 30.0 | | 10 47.3 | + 2 23.6 | —3.8 | 07.1 |
| | <i>α</i> Pegasi. | 33 36.5 | 34.0 | 22.0 | | | | | |
| | <i>ο</i> Cephei. | 5 63.5 | 20.0 | 36.0 | | 40 58 48.8 | +14 20.6 | —1.1 | 08.3 |
| | | | | | | | | | |
| October 2..... | 7290 | 7 13.5 | 20.0 | 26.0 | | | | | |
| | 7320 | 23 69.0 | 29.0 | 27.0 | | 41 04 33.6 | + 8 33.6 | +1.7 | 08.9 |
| | 7336 | 25 35.0 | ..... | ..... |  | 03 41.7 | + 9 25.1 | +1.7 | 08.5 |
| | | | | | | | | | |
| | 7398 | 23 77.0 | 26.0 | 30.0 | | | | | |
| | 7402 | 15 42.0 | 30.0 | 26.0 | | 08 50.2 | + 4 19.1 | 0.0 | 09.3 |
| | | | | | | | | | |
| | 7462 | 17 56.5 | 26.0 | 31.0 | | | | | |
| | R. C. 5252 | 18 57.0 | 32.0 | 25.0 | | 13 39.0 | — 0 31.2 | +0.6 | 08.4 |
| | | | | | | | | | |
| | 7521 | 18 71.0 | 34.0 | 23.0 | | | | | |
| | 7544 | 25 90.0 | 25.0 | 32.0 | | 16 50.5 | — 3 43.1 | +1.1 | 08.5 |
| | | | | | | | | | |
| | 7602 | 19 54.3 | 50.0 | 8.0 | | | | | |
| | 7681 | 18 85.0 | 9.0 | 49.0 | | 12 47.2 | + 0 21.5 | +0.5 | 09.2 |
| | | | | | | | | | |
| | 7765 | 26 12.8 | 27.0 | 30.0 | | | | | |
| | 7803 | 13 11.0 | 33.0 | 25.0 | | 06 22.3 | + 6 44.0 | +1.4 | 07.7 |
| | | | | | | | | | |
| | 7824 | 21 92.0 | 29.0 | 29.0 | | | | | |
| | 7843 | 15 08.0 | 31.0 | 26.0 | | 16 39.3 | — 3 32.2 | +1.4 | 08.5 |
| | | | | | | | | | |
| | 7917 | 27 83.0 | 30.0 | 27.0 | | 05 36.0 | + 7 32.5 | —1.1 | 07.4 |
| | 7932 | 12 15.8 | 33.0 | 24.0 | | 13 41.8 | — 0 33.8 | +0.5 | 08.5 |
| | 7962 | 13 24.5 | 25.0 | 32.0 | | | | | |
| | | | | | | | | | |
| | 7972 | 16 71.8 | 20.0 | 36.0 | | | | | |
| | 7984 | 21 19.5 | 39.0 | 17.0 | | 10 47.8 | + 2 18.9 | +1.9 | 08.6 |
| | | | | | | | | | |
| | 7994 | 16 17.0 | 34.0 | 23.0 | | | | | |
| | 8023 | 24 75.0 | 3.0 | 54.0 | | 17 46.1 | — 4 26.2 | —10.0 | 09.9 |
| | | | | | | | | | |
| | <i>α</i> Pegasi. | 33 48.0 | 40.0 | 16.0 | | | | | |
| | <i>ο</i> Cephei. | 5 80.0 | 16.0 | 40.0 | | 40 58 49.2 | +14 18.8 | 0.0 | 08.0 |
| October 5..... | 7073 | 22 51.2 | 29.0 | 16.0 | | | | | |
| | 7112 | 14 97.0 | 19.0 | 26.0 | | 41 09 13.0 | + 3 54.0 | +1.7 | 08.7 |
| | | | | | | | | | |
| | 7194 | 26 60.5 | 18.0 | 28.0 | | | | | |
| | Gr. 3311 | 12 87.0 | 30.0 | 16.0 | | 05 49.2 | + 7 18.6 | +1.1 | 08.9 |
| | | | | | | | | | |
| | 7290 | 6 17.0 | 20.0 | 26.0 | | | | | |
| | 7320 | 22 75.0 | 26.0 | 20.0 | | 04 34.1 | + 8 34.4 | 0.0 | 08.5 |
| | 7336 | 24 41.5 | ..... | ..... |  | 03 42.0 | + 9 26.0 | 0.0 | 08.0 |

Observations and computations—Continued.

OGDEN, UTAH.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|------------------|------------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|--------|------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1874. | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | ° ' " |
| October 5. | 7398 | 24 88.0 | 22.0 | 26.0 | | | | | |
| | 7402 | 16 55.0 | 23.0 | 25.0 | | 41 08 50.6 | + 4 18.5 | -1.7 | 41 13 07.4 |
| | 7462 | 18 22.0 | 16.0 | 32.0 | | | | | |
| | R. C. 5252 | 19 27.5 | 36.0 | 13.0 | | 13 39.5 | - 0 32.8 | +1.9 | 08.6 |
| | 7521 | 18 56.3 | 26.0 | 23.0 | | | | | |
| | 7544 | 25 80.0 | 25.0 | 23.0 | | 16 51.0 | - 3 44.5 | +1.4 | 07.9 |
| | 7602 | 20 27.2 | 30.0 | 18.0 | | | | | |
| | 7681 | 19 70.2 | 27.0 | 21.0 | | 12 47.8 | + 0 17.7 | +5.0 | 10.5 |
| | 7765 | 26 86.0 | 9.0 | 39.0 | | | | | |
| | 7803 | 13 85.5 | 45.0 | 4.0 | | 06 23.0 | + 6 43.5 | +3.0 | 09.5 |
| | 7824 | 22 38.5 | 21.0 | 28.0 | | | | | |
| | 7843 | 15 46.5 | 34.0 | 15.0 | | 16 40.0 | - 3 34.7 | +3.3 | 08.6 |
| | 7917 | 28 84.5 | ----- | ----- | | 05 36.8 | + 7 29.3 | +4.4 | 10.5 |
| | 7932 | 13 20.0 | 33.0 | 16.0 | | 13 42.5 | - 0 36.1 | +4.4 | 10.8 |
| | 7962 | 14 36.3 | 24.0 | 25.0 | | | | | |
| | 7972 | 16 90.5 | 17.0 | 32.0 | | | | | |
| | 7984 | 21 38.2 | 34.0 | 15.0 | | 10 48.5 | + 2 18.9 | +1.1 | 08.5 |
| | 7994 | 15 50.2 | 28.0 | 20.0 | | | | | |
| | 8023 | 24 48.5 | 23.0 | 26.0 | | 17 46.8 | - 0 39.1 | +1.4 | 09.1 |
| | α Pegasi. | 33 78.5 | 29.0 | 20.0 | | | | | |
| | σ Cephei. | 6 23.8 | 26.0 | 23.0 | | 40 58 49.8 | +14 14.7 | +3.3 | 07.8 |
| October 13. | 6698 | 9 25.5 | 29.0 | 21.0 | | | | | |
| | 6721 | 29 64.5 | 27.0 | 23.0 | | 41 02 34.1 | +10 32.6 | +3.3 | 10.0 |
| | 6777 | 15 23.0 | 24.0 | 28.0 | | | | | |
| | 6799 | 22 45.3 | 31.0 | 20.0 | | 09 23.0 | + 3 44.0 | +1.9 | 08.9 |
| | 6830 | 21 84.7 | 31.0 | 20.0 | | | | | |
| | 6851 | 17 74.0 | 25.0 | 27.0 | | 10 59.0 | + 2 07.6 | +2.3 | 08.9 |
| | 6915 | 8 27.2 | 28.0 | 24.0 | | | | | |
| | 6962 | 29 52.0 | 27.0 | 25.0 | | 02 03.2 | +10 59.2 | +1.5 | 08.9 |
| | 69-6 | 14 75.0 | 14.0 | 37.0 | | 05 22.6 | + 7 42.3 | +4.7 | 09.6 |
| | 7022 | 7 68.8 | 14.0 | 37.0 | | 01 43.7 | +11 21.5 | +4.7 | 09.9 |
| | 7041 | 29 65.2 | 46.0 | 6.0 | | | | | |
| | 7073 | 15 68.0 | 32.0 | 20.0 | | | | | |
| | 7112 | 23 22.7 | 22.0 | 31.0 | | 09 13.7 | + 3 54.2 | +0.8 | 08.7 |
| | 7194 | 12 23.3 | 21.0 | 31.0 | | | | | |
| | Gr. 3311 | 26 33.5 | 34.0 | 19.0 | | 05 50.0 | + 7 17.5 | +1.4 | 08.9 |
| | 7290 | 31 46.5 | 1.0 | 36.0 | | | | | |
| | 7320 | 14 93.5 | 36.0 | 18.0 | | 04 35.0 | + 8 32.9 | -0.3 | 07.6 |
| | 7336 | 13 27.0 | ----- | ----- | | 03 43.2 | + 9 24.5 | -0.3 | 07.4 |

LATITUDE DETERMINATIONS.

53

Observations and computations—Continued.

OGDEN, UTAH.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|--------------------------|------------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|----------|--------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1874. October 13..... | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | <i>o ' "</i> | <i>' "</i> | <i>"</i> | <i>o ' "</i> |
| | 7398 | 13 73.5 | 24.0 | 29.0 | | | | | |
| | 7402 | 22 04.3 | 29.0 | 25.0 | | 41 08 51.7 | + 4 17.8 | —0.3 | 41 13 09.2 |
| | 7462 | 20 75.8 | 26.0 | 28.0 | | | | | |
| | 7480 | 13 33.0 | 26.0 | 29.0 | | 17 00.9 | — 3 50.5 | —1.4 | 09.0 |
| | 7521 | 19 43.0 | 22.0 | 33.0 | | | | | |
| | 7544 | 12 15.2 | 35.0 | 19.0 | | 16 52.3 | — 3 45.8 | +1.4 | 07.9 |
| | 7602 | 18 00.2 | 28.0 | 27.0 | | | | | |
| | 7681 | 18 69.0 | 26.0 | 29.0 | | 12 49.1 | + 0 21.4 | —0.5 | 10.0 |
| | 7765 | 11 83.5 | 19.0 | 37.0 | | | | | |
| | 7803 | 24 84.0 | 36.0 | 19.0 | | 06 24.5 | + 6 43.5 | —0.5 | 07.5 |
| | 7824 | 16 12.7 | 37.0 | 18.0 | | | | | |
| | 7843 | 22 93.8 | 15.0 | 40.0 | | 16 41.5 | — 3 31.3 | —1.7 | 08.5 |
| | 7917 | 9 45.0 | 15.0 | 39.0 | | 05 38.3 | + 7 29.9 | —1.4 | 06.8 |
| | 7932 | 25 06.8 | ----- | ----- | | 13 44.0 | — 0 34.6 | —1.4 | 08.0 |
| | 7962 | 23 95.5 | 37.0 | 18.0 | | | | | |
| | 7972 | 21 00.5 | 27.0 | 28.0 | | | | | |
| | 7984 | 16 62.0 | 32.0 | 23.0 | | 10 50.1 | + 2 16.0 | +2.2 | 08.3 |
| | 7994 | 22 83.0 | 21.0 | 34.0 | | | | | |
| | 8023 | 13 73.5 | 37.0 | 18.0 | | 17 48.5 | — 4 42.2 | +1.7 | 08.0 |
| | <i>α</i> Pegasi. | 5 47.0 | 17.0 | 38.0 | | | | | |
| | <i>ο</i> Cephei | 33 08.8 | 36.0 | 19.0 | | 40 58 51.4 | +14 16.9 | —1.1 | 07.2 |
| October 14 | 6553 | 15 08.0 | 22.0 | 27.0 | | | | | |
| | 6659 | 20 85.7 | 31.0 | 20.0 | | 41 10 08.0 | + 2 58.6 | +1.7 | 08.3 |
| | 6698 | 7 48.2 | 28.0 | 23.0 | | | | | |
| | 6721 | 27 84.7 | 30.0 | 20.0 | | 02 34.1 | +10 31.9 | +4.1 | 10.1 |
| | 6777 | 15 07.5 | 21.0 | 31.0 | | | | | |
| | 6799 | 22 32.0 | 34.0 | 18.0 | | 09 23.0 | + 3 44.7 | +1.6 | 09.3 |
| | 6830 | 21 70.0 | 33.0 | 19.0 | | | | | |
| | 6851 | 17 58.3 | 22.0 | 31.0 | | 10 59.1 | + 2 07.7 | +1.4 | 08.2 |
| | 6915 | 7 71.0 | 24.0 | 28.0 | | | | | |
| | 6962 | 28 89.0 | 35.0 | 18.0 | | 02 08.3 | +10 57.1 | +3.6 | 09.0 |
| | 6986 | 15 21.2 | 19.0 | 34.0 | | 05 22.7 | + 7 44.0 | +1.1 | 07.8 |
| | 7022 | 8 16.5 | 19.0 | 34.0 | | 01 43.8 | +11 22.8 | +1.1 | 07.7 |
| | 7041 | 30 17.0 | 36.0 | 17.0 | | | | | |
| | 7073 | 15 40.2 | 16.0 | 38.0 | | | | | |
| | 7112 | 21 90.8 | 39.0 | 14.0 | | 09 13.8 | + 3 52.9 | +0.8 | 07.5 |
| | 7194 | 12 55.0 | 18.0 | 36.0 | | | | | |
| | Gr. 3311 | 26 60.3 | 36.0 | 18.0 | | 05 50.2 | + 7 16.0 | 0.0 | 06.2 |

Observations and computations—Continued.

OGDEN, UTAH.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|-------------------------|------------------|---------------------|-----------|-----------|----------|--------------------------|-------------------|--------|------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1874. October 14.... | | <i>t.</i> <i>d.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | ° ' " |
| | 7290 | 31 72.2 | 27.0 | 28.0 | | 41 04 35.1 | + 8 32.1 | +0.3 | 41 13 07.5 |
| | 7320 | 15 21.8 | 29.0 | 27.0 | | 03 43.4 | + 9 24.4 | +0.3 | 08.1 |
| | 7336 | 13 53.0 | ..... | ..... |  |  |  |  |  |
| | 7398 | 13 67.2 | 20.0 | 34.0 | | | | | |
| | 7402 | 21 95.2 | 33.0 | 20.0 | | 08 51.9 | + 4 16.9 | -0.8 | 08.0 |
| | 7462 | 20 89.0 | 24.0 | 32.0 | | | | | |
| | 7480 | 13 39.5 | 32.0 | 23.0 | | 17 01.1 | - 3 53.2 | +0.3 | 08.2 |
| | R. C. 5252 | 19 79.0 | ..... | ..... |  | 13 40.8 | - 0 34.2 | +0.3 | 06.9 |
| | 7521 | 18 91.5 | 22.0 | 33.0 | | | | | |
| | 7544 | 11 74.5 | 28.0 | 27.0 | | 16 52.5 | - 3 43.1 | -2.8 | 06.6 |
| | 7602 | 18 26.2 | 16.0 | 40.0 | | | | | |
| | 7681 | 18 50.3 | 39.0 | 17.0 | | 12 49.3 | + 0 19.9 | -0.5 | 08.7 |
| | 7765 | 11 53.5 | 30.0 | 27.0 | | | | | |
| | 7803 | 24 57.0 | 23.0 | 33.0 | | 06 24.7 | + 6 44.5 | -1.9 | 07.3 |
| | 7824 | 15 44.0 | 37.0 | 20.0 | | | | | |
| | 7843 | 22 28.0 | 17.0 | 40.0 | | 16 41.7 | - 0 32.5 | -1.6 | 07.6 |
| | 7917 | 9 20.0 | 00.0 | 00.0 | | 05 38.5 | + 7 31.5 | -0.3 | 09.7 |
| | 7932 | 24 88.0 | 20.0 | 38.0 | | 13 44.2 | - 0 35.0 | -0.3 | 08.9 |
| | 7962 | 23 75.2 | 37.0 | 20.0 | | | | | |
| | 7972 | 21 30.0 | 42.0 | 11.0 | | | | | |
| | 7984 | 16 94.0 | 14.0 | 39.0 | | 10 50.3 | + 2 15.2 | +1.7 | 07.2 |
| | 7994 | 23 35.0 | 24.0 | 34.0 | | | | | |
| | 8023 | 14 35.5 | 32.0 | 25.0 | | 17 48.8 | - 4 39.1 | -0.8 | 08.9 |
| | α Pegasi. | 4 35.2 | 12.0 | 45.0 | | | | | |
| | σ Cephei. | 31 94.7 | 42.0 | 15.0 | | 40 58 51.6 | +14 16.2 | -1.6 | 41 13 06.2 |

Mean latitude obtained in 1874..... 41° 13' 08".47

Mean latitude obtained in 1873..... 41° 13' 08".65

Adopted for final use 41° 13' 08".56

DISCUSSION OF FINAL LONGITUDES OF OGDEN OBSERVATORY.

| | <i>h.</i> | <i>m.</i> | <i>s.</i> | <i>s.</i> |
|--|-----------|-----------|-----------|-----------|
| 1873—1. Ogden west of Salt Lake City..... | 0 | 00 | 24.747 | ± 0.006 |
| Salt Lake west of Washington Naval Observatory (official information from the United States Coast Survey)..... | 2 | 19 | 22.740 | |
| Ogden west of Washington Naval Observatory..... | 2 | 19 | 47.487 | |
| Washington west of Greenwich | 5 | 08 | 12.120 | |
| Ogden west of Greenwich..... | 7 | 27 | 59.607 | |
| 1873—2. Ogden west of Detroit, Mich | 1 | 55 | 47.471 | ± 0.032 |
| Detroit west of Washington (from Report of Chief of Engineers, 1871)..... | 0 | 24 | 00.120 | |
| Ogden west of Washington | 2 | 19 | 47.591 | |
| Ogden west of Greenwich..... | 7 | 27 | 59.711 | |
| 1874—3. Ogden west of Washington | 2 | 19 | 47.492 | ± 0.034 |
| Ogden west of Greenwich..... | 7 | 27 | 59.612 | |

The probable error of these three results is determined so that the connected station is taken as correct, and the probable error in longitude in reference to Greenwich or Washington is assumed to be zero. Calling the probable errors respectively ϵ_1 , ϵ_2 , and ϵ_3 , the probable error of the adopted mean result will be

$$\epsilon_r = \pm \sqrt{\frac{\epsilon_1^2 + \epsilon_2^2 + \epsilon_3^2}{3}},$$

and therefore = ± 0.027

Ogden Observatory, east pier of the transit-room, west of the dome of the United States Naval Observatory, Washington, D. C.,

2^h 19^m 47^s.523 ± 0^s.027.

ASTRONOMICAL CO-ORDINATES OF STATION IN ASTRONOMICAL OBSERVATORY, OGDEN, UTAH.

| | <i>h.</i> | <i>m.</i> | <i>s.</i> | <i>s.</i> | <i>°</i> | <i>'</i> | <i>"</i> | <i>"</i> | |
|--------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|--|
| Longitude.. | 7 | 27 | 59.643 | ± 0.027 | or | 111 | 59 | 54.64 | ± 0.40 west from Greenwich. |
| | 2 | 19 | 47.523 | | | or | 34 | 56 | 52.84 west from U. S. Naval Observatory, Washington, D. C. |
| Latitude ... | | | | | | | | | 41 13 08.56 ± 0.03 north. |

U. S. GEOGRAPHICAL SURVEYS WEST OF THE ONE HUNDREDTH MERIDIAN,
1ST LIEUT. GEO. M. WHEELER, CORPS OF ENGINEERS, U. S. ARMY, IN CHARGE.

RESULTS

OF

OBSERVATIONS MADE BY JOHN H. CLARK AND E. P. AUSTIN IN THE
DETERMINATION OF THE ASTRONOMICAL CO-ORDINATES
OF STATION AT BEAVER, UTAH.

SEASON OF 1872.

COMPUTATIONS BY

JOHN H. CLARK, DR. F. KAMPF, AND WM. A. ROGERS.

BEAVER, UTAH.

GEOGRAPHICAL POSITION OF STATION.

Longitude, $112^{\circ} 38' 35''.90 \pm 0''.26$ west from Greenwich.
 $35^{\circ} 35' 34''.10$ west from U. S. Naval Observ-
 atory, Washington, D. C.
 Latitude, $38^{\circ} 16' 23''.28 \pm 0''.06$ north.
 Barometric altitude of observatory above sea-level, 5915.6 feet.

This station was situated in the main plaza of the town, a short distance east of the church, which is used by religious societies other than the Mormon, and between this building and the main street running from north to south. The town of Beaver is laid out on a bench or tongue of land which inclines to the south, and is bounded by North Creek and the dry bed of Beaver Creek, whose water is turned from its course for purposes of irrigation before it reaches the settlement. Directly northward, no mountains are visible; in that direction, however, the valley, if such it may be called, is much broken. On the west is a chain of mountains which has the same general direction as the Beaver Range on the east. In the south, the broken character of the general country is fully maintained.

METEOROLOGICAL CONDITIONS.

While at Beaver, a succession of storms, which, preceded by heavy winds, commenced about the middle of August, came up from the south, sometimes bringing torrents of rain, and interfering much with the astronomical operations. By the time any given storm had passed beyond Beaver, leaving weather fit for observations, it had reached Salt Lake City, interrupting the observer there, so that, out of 21 nights, there were only 10 that could be used in common for time and signal exchanges. Observations for clock-error were made on August 10, 11, 12, 13, 14, 15, 16, and September 2, 3, 4, 5, 6, 7, and it took all of that time to succeed in making three exchanges. The nights of August 18, 19, 20, 21, 23, 24, 25, 27, 30, were given to the determination of latitude; on a majority of these, there were only partial observations, in consequence of interruption from rain and clouds.

OBSERVATORY—PARTY—TELEGRAPH.

A simple wall-tent constituted the observatory. John H. Clark was principal astronomical observer, and was assisted by W. W. Marryatt. An hourly meteorological record was kept by F. R. Simonton and C. Herbert. The telegraph-line employed was the Deseret of Utah. The operator was Robert, son of Bishop Farthingham, of the Mormon Church.

INSTRUMENTS.

The observations were made with the zenith meridian instrument, Würdemann, No. 16. Its focal length was 26 inches; its aperture, $1\frac{3}{4}$ inches. It was mounted on a block of wood 7 feet in length, which was planted in the ground to a depth of 4 feet. The Negus chronometer No. 1499 was used.

CONNECTIONS—COMPUTERS

The longitude was obtained by the exchange of arbitrary signals with Brigham Young's observatory at Salt Lake City, where E. P. Austin was observer. These exchanges, which were received and sent by sound, were made on three different nights. They consisted of 42 signals in a series, 21 being transmitted each way every night. The observations for longitude were computed by John H. Clark and Dr. F. Kampf; those for latitude were reduced by Wm. A. Rogers and by Dr. Kampf.

INSTRUMENTAL VALUES.

One division of the striding-level had the value of $1''.14$. For each division of the zenith-telescope level there was a value of $1''.44$. One revolution of the zenith-micrometer was equal to $81''.00$. The telegraphic circuit was upward of 200 miles in length. There was a battery at Beaver where the line branched. There was no attempt to use a register or chronograph here, and the signals were obtained by taking the chronometer to the telegraph office.

Tabulation of stars used for determination of time at Beaver and Salt Lake City, Utah, 1872.

| Name of star. | BEAVER. | | | SALT LAKE CITY. | | | Name of star. | BEAVER. | | | SALT LAKE CITY. | | |
|-------------------------------|------------|------------|--------------|-----------------|------------|--------------|-----------------------------|------------|------------|--------------|-----------------|------------|--------------|
| | August 13. | August 15. | September 6. | August 13. | August 15. | September 6. | | August 13. | August 15. | September 6. | August 13. | August 15. | September 6. |
| α Scorpii | x | | | | | | δ Sagittarii | | | | | | x |
| ζ Ophiuchi | x | x | | | | | δ Draconis | | | | | | x |
| η Herculis | x | x | | | | | τ Draconis | | | x | | | |
| κ Ophiuchi | x | x | | | | | δ Aquilæ | | | | | | x |
| d Herculis | x | x | | | | | κ Aquilæ | | | x | | | x |
| ϵ Ursæ Minoris | | | | | x | | γ Aquilæ | x | | x | | | x |
| α Herculis | x | x | | | x | | α Aquilæ | x | | x | | | |
| 44 Ophiuchi | x | x | | | | | ϵ Draconis | x | | x | | | x |
| β Draconis | x | x | | | | | τ Aquilæ | x | | x | | | x |
| α Ophiuchi | | | | x | | | θ Aquilæ | | | | x | | |
| ω Draconis | x | x | | x | x | | α^2 Capricorni | | x | x | x | | |
| μ Herculis | | | | x | | | κ Cephei | | | | | x | |
| ψ Draconis | x | x | | | x | | π Capricorni | x | x | x | x | x | x |
| γ Draconis | x | x | | x | x | | ϵ Delphini | x | x | | | x | |
| γ^2 Sagittarii | x | x | | | | | Groombridge 3241 | | | | x | | |
| μ^1 Sagittarii | x | x | | x | x | | α Cygni | x | x | x | x | x | |
| η Serpentis | | x | | | x | | μ Aquarii | | x | | x | x | |
| 1 Aquilæ | | x | | | | | μ Capricorni | | | | | | x |
| α Lyræ | | x | | | | x | 79 Draconis | | | | | | x |
| β Lyræ | | x | | | | x | ν Cygni | | x | | | | |
| 50 Draconis | | x | | | | x | α Aquarii | | | | | | x |
| 5 Aquilæ | | | | | | x | θ Aquarii | | | | | | x |

Observations and reductions for time taken at sending station.

BEAVER, UTAH, AUGUST 13, 1872.

| Clamp. | Name of star. | T. | | | Aa. | Bb. | Cc. | T'. | | | AR. | | | $\Delta T.$ | | |
|--------|-----------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-------------|-----------|--------------|
| | | <i>h.</i> | <i>m.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h.</i> | <i>m.</i> | <i>s.</i> | <i>h.</i> | <i>m.</i> | <i>s.</i> | <i>h.</i> | <i>m.</i> | <i>s.</i> |
| W. | α Scorpii | 18 | 44 | 17.79 | + 1.54 | — 0.12 | — 0.42 | 18 | 44 | 18.79 | 16 | 22 | 35.30 | — 2 | 22 | 43.49 |
| W. | ζ Ophiuchi | 52 | 51.54 | + 1.15 | — 0.37 | — 0.39 | | 52 | 51.93 | | 30 | 08.19 | | | | 43.74 |
| W. | η Herculis | 19 | 01 | 16.70 | — 0.03 | — 0.10 | — 0.50 | 19 | 01 | 16.07 | 38 | 31.82 | | | | 44.25 |
| W. | κ Ophiuchi | 14 | 21.93 | + 0.74 | 0.00 | — 0.39 | | 14 | 22.28 | | 51 | 38.03 | | | | 44.25 |
| W. | d Herculis | 19 | 38.82 | + 0.15 | + 0.09 | — 0.46 | | 19 | 38.60 | | 56 | 54.13 | | | | 44.47 |
| W. | α Herculis | 31 | 33.94 | + 0.64 | + 0.16 | — 0.40 | | 31 | 34.34 | 17 | 08 | 50.22 | | | | 44.12 |
| W. | 44 Ophiuchi | 41 | 18.17 | + 1.47 | + 0.13 | — 0.41 | | 41 | 19.36 | | 18 | 35.15 | | | | 44.21 |
| W. | β Draconis | 50 | 19.50 | — 0.59 | + 0.03 | — 0.02 | | 50 | 18.32 | | 27 | 34.08 | | | | 44.24 |
| W. | ω Draconis | 20 | 00 | 31.35 | — 2.16 | + 1.06 | | 20 | 00 | 28.15 | 37 | 44.20 | | | | 43.95 |
| W. | ψ Draconis | 07 | 03.30 | — 2.77 | 0.00 | — 1.25 | | 06 | 59.28 | | 44 | 15.36 | | | | 43.92 |
| W. | γ Draconis | 16 | 25.08 | — 0.55 | + 0.28 | — 0.60 | | 16 | 24.21 | | 53 | 39.96 | | | | 44.25 |
| W. | γ^2 Sagittarii | 20 | 20.44 | + 1.64 | + 0.15 | — 0.44 | | 20 | 21.79 | | 57 | 37.38 | | | | 44.41 |
| W. | μ^1 Sagittarii | 28 | 52.12 | + 1.38 | + 0.16 | — 0.41 | | 28 | 53.25 | 18 | 06 | 08.60 | | — 2 | 22 | 44.65 |
| | | | | | | | | | | | | | | | | — 2 22 44.15 |

NORMAL EQUATIONS.

$$+ 13.00 \delta t - 1.73 a = + 1.20 \quad \delta t = - 0^s.15$$

$$- 1.73 \delta t + 10.55 a = - 15.83 \quad a = - 1^s.52$$

Adopted error of collimation (from previous observations), $c = + 0^s.33$.

Observations and reductions for time taken at sending station—Continued.

BEAVER, UTAH, AUGUST 13, 1872.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|--------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | γ Aquilæ | 22 02 56.78 | + 0.12 | + 0.42 | — 0.39 | 22 02 56.93 | 19 40 12.54 | —2 22 44.39 |
| W. | α Aquilæ | 07 18.87 | + 0.08 | + 0.45 | — 0.39 | 07 19.01 | 44 34.39 | 44.62 |
| W. | ε Draconis | 11 26.19 | + 0.20 | — 1.33 | — 1.11 | 11 24.95 | 48 38.76 | 45.19 |
| W. | τ Aquilæ | 20 39.90 | + 0.04 | + 0.46 | — 0.39 | 20 40.01 | 57 55.36 | 44.65 |
| W. | π Capricorni | 42 46.20 | — 0.04 | + 0.77 | — 0.40 | 42 46.53 | 20 20 02.02 | 44.51 |
| W. | ε Delphini | 49 52.66 | — 0.10 | + 0.42 | — 0.39 | 49 52.59 | 27 08.00 | 44.59 |
| W. | α Cygni | 59 51.63 | — 0.21 | — 0.15 | — 0.54 | 59 50.73 | 37 06.38 | —2 22 44.35 |
| | | | | | | | | —2 22 44.61 |

NORMAL EQUATIONS.

$$\begin{aligned}
 +7.00 \delta t - 1.19 a &= -3.24 & \delta t &= -0^s.61 \\
 -1.19 \delta t + 4.33 a &= -3.08 & a &= -0^s.88
 \end{aligned}$$

Adopted $c = +0^s.38$.

BEAVER, UTAH, AUGUST 15, 1872.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|---------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | ζ Ophiuchi | 18 52 53.36 | + 1.56 | — 0.14 | — 0.46 | 18 52 54.32 | 16 30 08.17 | —2 22 46.15 |
| W. | η Herculis | 19 01 19.34 | — 0.04 | — 0.39 | — 0.59 | 19 01 18.32 | 38 31.78 | 46.54 |
| W. | κ Ophiuchi | 13 24.15 | + 1.00 | — 0.30 | — 0.45 | 13 24.39 | 50 32.00 | 46.39 |
| W. | δ Herculis | 19 41.44 | + 0.20 | — 0.38 | — 0.54 | 19 40.72 | 56 54.09 | 46.63 |
| W. | α Herculis | 31 36.44 | + 0.86 | — 0.38 | — 0.47 | 31 33.45 | 17 08 50.18 | 46.27 |
| W. | 44 Ophiuchi | 41 19.74 | + 1.99 | — 0.15 | — 0.49 | 41 21.09 | 18 35.13 | 45.96 |
| W. | β Draconis | 50 22.29 | — 0.80 | — 0.64 | — 0.73 | 50 20.12 | 27 33.99 | 46.13 |
| W. | ω Draconis | 20 00 35.27 | — 2.91 | — 1.05 | — 1.25 | 20 00 30.05 | 37 44.07 | 45.98 |
| W. | ψ ₁ Draconis | 07 07.68 | — 3.73 | — 0.92 | — 1.48 | 07 01.55 | 44 15.25 | 46.30 |
| W. | γ Draconis | 16 28.02 | — 0.74 | — 0.38 | — 0.72 | 16 26.18 | 53 39.92 | 46.26 |
| W. | γ ² Sagittarii | 20 21.84 | + 2.21 | — 0.05 | — 0.52 | 20 23.48 | 57 37.33 | 46.12 |
| W. | μ ¹ Sagittarii | 28 53.80 | + 1.87 | — 0.14 | — 0.48 | 28 55.05 | 18 06 08.59 | 46.46 |
| W. | η Serpentis | 37 28.69 | + 1.35 | — 0.22 | — 0.45 | 37 29.37 | 14 43.03 | 46.34 |
| W. | 1 Aquilæ | 51 02.08 | + 1.52 | — 0.28 | — 0.46 | 51 02.86 | 28 16.46 | 46.40 |
| W. | α Lyræ | 55 25.46 | — 0.04 | — 0.85 | — 0.59 | 55 23.98 | 32 38.12 | 45.86 |
| W. | β Lyræ | 21 08 10.18 | + 0.21 | — 0.75 | — 0.53 | 21 05 09.11 | 45 23.11 | 46.00 |
| W. | 50 Draconis | 13 27.47 | — 4.78 | — 2.00 | — 1.79 | 13 18.90 | 18 50 32.48 | —2 22 46.42 |
| | | | | | | | | —2 22 46.26 |

NORMAL EQUATIONS.

$$\begin{aligned}
 +17.00 \delta t + 0.13 a &= -4.42 & \delta t &= -0^s.26 \\
 +0.13 \delta t + 15.98 a &= -32.78 & a &= -2^s.05
 \end{aligned}$$

 c derived from 50 Draconis, clamp E. and W., to be $= +0^s.45$.

Observations and reductions for time taken at sending station—Continued.

BEAVER, UTAH, AUGUST 15, 1872.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|--------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | α ² Capricorni..... | 22 33 44.49 | + 1.09 | — 0.05 | — 0.47 | 22 33 45.06 | 20 10 59.41 | —2 22 45.65 |
| W. | π Capricorni..... | 42 46.86 | + 1.21 | — 0.05 | — 0.48 | 42 47.54 | 20 02.02 | 45.52 |
| W. | ε Delphini..... | 49 53.96 | + 1.05 | — 0.09 | — 0.46 | 49 54.46 | 27 08.00 | 46.46 |
| W. | α Cygni..... | 59 53.66 | — 0.23 | + 0.06 | — 0.63 | 59 52.86 | 37 06.41 | 46.45 |
| W. | μ Aquarii..... | 23 08 32.38 | + 1.03 | + 0.07 | — 0.46 | 23 08 33.02 | 45 47.23 | 45.79 |
| W. | ν Cygni..... | 15 13.52 | — 0.07 | + 0.20 | — 0.59 | 15 13.06 | 20 52 26.36 | —2 22 46.70 |
| | | | | | | | | —2 22 46.09 |

NORMAL EQUATIONS.

$$\begin{aligned}
 + 6.00 \delta t - 3.00 a &= + 3.51 & \delta t &= - 0^s.09 \\
 - 3.00 \delta t + 2.89 a &= - 4.20 & a &= - 1^s.36 \\
 c \text{ adopted} &= + 0^s.45.
 \end{aligned}$$

BEAVER, UTAH, SEPTEMBER 6, 1872.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|--------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | τ Draconis..... | 21 41 06.14 | — 0.39 | — 1.13 | — 1.04 | 21 41 03.58 | 19 18 01.86 | —2 23 01.72 |
| W. | κ Aquilæ..... | 53 04.47 | + 0.15 | — 0.28 | — 0.31 | 53 04.03 | 30 02.27 | 01.76 |
| W. | γ Aquilæ..... | 22 03 14.78 | + 0.10 | — 0.27 | — 0.31 | 22 03 14.30 | 40 12.35 | 01.95 |
| W. | α Aquilæ..... | 07 36.65 | + 0.10 | — 0.26 | — 0.31 | 07 36.18 | 44 34.21 | 01.97 |
| W. | ε Draconis..... | 10 41.75 | — 0.31 | — 0.58 | — 0.88 | 10 39.98 | 47 37.75 | 02.23 |
| W. | τ Aquilæ..... | 21 57.62 | + 0.10 | — 0.38 | — 0.31 | 21 57.03 | 58 55.21 | 01.82 |
| W. | α ² Capricorni..... | 34 01.69 | + 0.16 | — 0.13 | — 0.31 | 34 01.41 | 20 10 59.32 | 02.09 |
| W. | π Capricorni..... | 43 04.21 | + 0.18 | — 0.12 | — 0.32 | 43 03.95 | 20 01.95 | 02.00 |
| W. | α Cygni..... | 22 00 08.92 | — 0.03 | — 0.28 | — 0.42 | 22 00 08.19 | 20 37 06.18 | —2 23 02.01 |
| | | | | | | | | —2 23 01.95 |

NORMAL EQUATIONS.

$$\begin{aligned}
 + 9.00 \delta t - 0.25 a &= + 0.51 & \delta t &= + 0^s.05 \\
 - 0.25 \delta t + 9.16 a &= - 1.85 & a &= - 0^s.20 \\
 c \text{ adopted} &= + 0^s.30.
 \end{aligned}$$

Observations and reductions for time taken at receiving station.

SALT LAKE CITY, AUGUST 13, 1872.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|--|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | <i>a</i> Ophiuchi | 17 29 50.46 | — 0.01 | + 0.07 | — 0.02 | 17 29 50.50 | 17 29 01.24 | —0 00 49.26 |
| E. | <i>ω</i> Draconis | 38 33.72 | + 0.04 | + 0.20 | — 0.06 | 38 33.90 | 37 44.21 | 49.69 |
| E. | <i>μ</i> Herculis | 42 17.98 | — 0.01 | + 0.05 | — 0.02 | 42 18.00 | 41 23.61 | 49.39 |
| E. | <i>γ</i> Draconis | 54 29.32 | + 0.01 | + 0.03 | — 0.03 | 54 29.33 | 53 39.97 | 49.36 |
| E. | <i>μ</i> ¹ Sagittarii | 18 06 58.16 | — 0.03 | 0.00 | — 0.02 | 18 06 58.11 | 18 06 08.61 | 49.50 |
| W. | <i>θ</i> Aquilæ | 20 05 33.50 | — 0.02 | 0.00 | + 0.02 | 20 05 33.50 | 20 05 44.24 | 49.26 |
| W. | <i>a</i> ² Capricorni | 11 48.94 | — 0.02 | — 0.01 | + 0.02 | 11 48.93 | 10 59.42 | 49.51 |
| W. | <i>π</i> Capricorni | 20 51.60 | — 0.03 | 0.00 | + 0.02 | 20 51.59 | 20 02.03 | 49.56 |
| W. | Groombr. 3241 | 31 25.24 | + 0.05 | + 0.11 | + 0.08 | 31 25.48 | 30 36.13 | 49.35 |
| W. | <i>a</i> Cygni | 38 55.90 | 0.00 | + 0.13 | + 0.03 | 38 56.06 | 38 06.42 | 49.64 |
| W. | <i>μ</i> Aquarii | 20 46 36.74 | — 0.02 | + 0.01 | + 0.02 | 20 46 36.75 | 20 45 47.24 | —0 00 49.51 |
| | | | | | | | | —0 00 49.45 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -0.02 + 11.00 \delta t + 1.47 a - 1.15 c & \delta t &= 0^s.00 \\
 0 &= +0.26 + 1.47 \delta t + 8.40 a + 0.06 c & a &= -0^s.031 \\
 0 &= +0.74 - 1.15 \delta t + 0.06 a + 30.45 c & c &= -0^s.024
 \end{aligned}$$

SALT LAKE CITY, AUGUST 15, 1872.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|--|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | <i>ε</i> Ursæ Minoris | 17 00 04.60 | — 0.07 | + 0.11 | + 0.13 | 17 00 04.77 | 16 59 12.25 | —0 00 52.52 |
| E. | <i>a</i> Herculis | 09 42.58 | + 0.01 | + 0.04 | + 0.02 | 09 42.65 | 17 08 50.18 | 52.47 |
| E. | <i>a</i> Ophiuchi | 29 53.64 | 0.00 | + 0.01 | + 0.02 | 29 53.67 | 29 01.18 | 52.49 |
| E. | <i>ω</i> Draconis | 38 36.56 | — 0.02 | + 0.05 | + 0.05 | 38 36.64 | 37 44.10 | 52.54 |
| W. | <i>ψ</i> Draconis | 45 07.80 | — 0.02 | + 0.11 | — 0.05 | 45 07.84 | 44 15.25 | 52.59 |
| W. | <i>γ</i> Draconis | 54 32.32 | 0.00 | + 0.03 | — 0.03 | 54 32.32 | 53 39.91 | 52.41 |
| W. | <i>μ</i> ¹ Sagittarii | 18 07 01.00 | + 0.01 | + 0.01 | — 0.02 | 18 07 01.00 | 18 06 08.59 | 52.41 |
| W. | <i>η</i> Serpentis | 15 35.58 | — 0.01 | 0.00 | — 0.01 | 15 35.58 | 14 43.03 | 52.55 |
| E. | <i>κ</i> Cephei | 20 14 05.97 | — 0.04 | + 0.18 | + 0.08 | 20 14 06.19 | 20 13 13.71 | 52.48 |
| E. | <i>π</i> Capricorni | 20 54.58 | + 0.01 | + 0.00 | + 0.02 | 20 54.61 | 20 02.03 | 52.58 |
| E. | <i>ε</i> Delphini | 28 00.58 | 0.00 | + 0.02 | + 0.01 | 28 00.61 | 27 08.01 | 52.60 |
| E. | <i>a</i> Cygni | 37 58.74 | 0.00 | + 0.07 | + 0.01 | 37 58.82 | 37 06.41 | 52.41 |
| E. | <i>μ</i> Aquarii | 20 46 39.72 | + 0.01 | + 0.03 | + 0.02 | 20 46 39.78 | 20 45 47.24 | —0 00 52.54 |
| | | | | | | | | —0 00 52.51 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -0.06 + 13.00 \delta t - 6.26 a + 14.34 c & \delta t &= -0^s.01 \\
 0 &= +0.14 - 6.26 \delta t + 30.66 a - 44.90 c & a &= +0^s.014 \\
 0 &= -1.01 + 14.34 \delta t - 44.90 a + 106.12 c & c &= +0^s.017
 \end{aligned}$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, SEPTEMBER 6, 1872.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|---------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | <i>α</i> Lyrae | 18 34 05.80 | 0.00 | — 0.01 | + 0.18 | 18 34 05.97 | 18 33 37.69 | — 0 01 28.28 |
| W. | <i>β</i> Lyrae | 46 50.94 | 0.00 | 0.00 | + 0.17 | 46 51.11 | 46 22.75 | 28.36 |
| W. | 50 Draconis | 51 58.70 | — 0.05 | + 0.10 | + 0.55 | 51 59.30 | 51 30.79 | 28.51 |
| W. | <i>β</i> Aquilæ | 19 01 01.44 | + 0.01 | + 0.01 | + 0.14 | 19 01 01.60 | 19 00 33.24 | 28.36 |
| W. | <i>δ</i> Sagittarii | 11 39.00 | + 0.02 | 0.00 | + 0.15 | 11 39.17 | 11 10.77 | 28.40 |
| W. | <i>δ</i> Draconis | 14 00.81 | — 0.02 | — 0.05 | + 0.36 | 14 01.10 | 13 32.85 | 28.25 |
| E. | <i>δ</i> Aquilæ | 20 33.04 | + 0.01 | 0.00 | — 0.13 | 20 32.92 | 20 04.50 | 28.42 |
| E. | <i>κ</i> Aquilæ | 31 30.96 | + 0.01 | — 0.03 | — 0.14 | 31 30.80 | 31 02.27 | 28.53 |
| E. | <i>γ</i> Aquilæ | 41 40.82 | + 0.01 | 0.00 | — 0.14 | 41 40.69 | 41 12.35 | 28.34 |
| E. | <i>ε</i> Draconis | 50 06.60 | — 0.03 | + 0.10 | — 0.36 | 50 06.31 | 49 37.75 | 28.56 |
| E. | <i>τ</i> Aquilæ | 59 23.66 | + 0.01 | + 0.01 | — 0.13 | 59 23.55 | 58 55.21 | 28.34 |
| E. | <i>π</i> Capricorni | 20 21 30.38 | + 0.02 | 0.00 | — 0.15 | 20 21 30.25 | 20 21 01.95 | 28.30 |
| W. | <i>μ</i> Capricorni | 21 47 50.02 | + 0.02 | — 0.04 | + 0.14 | 21 47 50.14 | 21 47 21.49 | 28.65 |
| W. | 79 Draconis | 52 48.06 | — 0.03 | + 0.03 | + 0.48 | 52 48.54 | 52 20.14 | 28.40 |
| W. | <i>α</i> Aquarii | 22 00 43.15 | + 0.01 | 0.00 | + 0.14 | 22 00 43.30 | 22 00 14.93 | 28.37 |
| W. | <i>θ</i> Aquarii | 11 35.53 | + 0.02 | 0.00 | + 0.14 | 11 35.69 | 11 07.17 | — 0 01 28.52 |
| | | | | | | | | — 0 01 28.41 |

NORMAL EQUATIONS.

$$\begin{aligned} 0 &= -1.22 + 16.00 \delta t + 1.04 a - 9.93 c \\ 0 &= +1.31 + 1.04 \delta t + 15.37 a + 11.74 c \\ 0 &= +7.47 - 9.93 \delta t + 11.74 a + 56.21 c \end{aligned}$$

$$\begin{aligned} \delta t &= -0^s.01 \\ a &= +0^s.022 \\ c &= -0^s.139 \end{aligned}$$

The following tables show the corrections and rates of the chronometers used at Beaver and Salt Lake City:

CHRONOMETER AT BEAVER.—NEGUS, No. 1499.

| Date. | Local side-real time. | Correction of chronometer. | Adopted hourly rate. |
|---------|-----------------------|----------------------------|----------------------|
| 1872. | <i>h.</i> | <i>h. m. s.</i> | <i>s.</i> |
| Aug. 13 | 18.50 | — 2 22 44.35 | + 0.058 |
| Aug. 15 | 18.50 | 46.19 | + 0.025 |
| Sept. 6 | 20.00 | 01.94 | + 0.010 |

CHRONOMETER AT SALT LAKE CITY.—NEGUS, No. 1511.

| Date. | Local side-real time. | Correction of chronometer. | Adopted hourly rate. |
|---------|-----------------------|----------------------------|----------------------|
| 1872. | <i>h.</i> | <i>m. s.</i> | <i>s.</i> |
| Aug. 13 | 20.00 | — 0 49.45 | + 0.067 |
| Aug. 15 | 20.00 | 52.51 | + 0.066 |
| Sept. 6 | 20.00 | 28.41 | + 0.068 |

On August 13 and 15, the mean-time chronometer Barraud, No. 22961, was used at Salt Lake City for exchanges. The following comparisons were made with Negus, No. 1511:

| | | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
|---------|------------|-----------------|-----------------|-----------------|-----------------|
| 1872. | | | | | |
| Aug. 13 | Barraud... | 11 44 02.5 | 11 49 59.5 | 10 13 05.0 | 10 16 12.5 |
| | Negus..... | 19 44 48.0 | 19 50 46.0 | 18 13 35.0 | 18 16 43.0 |
| Aug. 15 | Barraud... | 10 09 52.5 | 10 12 49.0 | 11 56 30.0 | 11 59 29.5 |
| | Negus..... | 18 18 34.0 | 18 21 31.0 | 20 05 30.0 | 18 08 30.0 |

From these comparisons, the corrections and rates for Barraud, 22961, are derived as follows:

| Date. | Time of Barraud. | Correction of Barraud. | Hourly rate. |
|---------|------------------|------------------------|--------------|
| 1872. | <i>h.</i> | <i>h. m. s.</i> | <i>s.</i> |
| Aug. 13 | 11.7836 | + 7 59 56.57 | — 10.165 |
| Aug. 15 | 11.9666 | + 8 08 07.73 | — 10.340 |

Final results of longitude.

| Signals sent from— | Recorded at— | Mean of signals sent and received. | Time-corrections. | Corrected time. | Difference of longitude. | Double-wave time. | Means. | | |
|--|-----------------|------------------------------------|-------------------|---|--------------------------|-------------------|-----------|--|--|
| August 13, 1872: | | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | | |
| Salt Lake City { | Salt Lake City. | 11 06 25.48 | + 7 59 49.69 | 19 06 15.17 | 0 02 59.57 | 59.45 | 59.510 | | |
| Beaver { | Beaver | 21 25 59.98 | — 2 22 44.38 | 19 03 15.60 | | | | | |
| Salt Lake City { | Salt Lake City. | 11 12 59.22 | + 7 59 50.81 | 19 12 50.03 | | | | | |
| Beaver { | Beaver | 21 32 34.97 | — 2 22 44.39 | 19 09 50.58 | | | | | |
| August 15, 1872: | | | | | | | | | |
| Salt Lake City { | Salt Lake City. | 11 36 35.62 | + 8 08 04.04 | 19 44 39.66 | 59.54 | 59.47 | 59.505 | | |
| Beaver { | Beaver | 22 04 26.35 | — 2 22 46.22 | 19 41 40.13 | | | | | |
| Salt Lake City { | Salt Lake City. | 11 43 21.43 | + 8 08 05.21 | 19 51 26.64 | 59.47 | | | | |
| Beaver { | Beaver | 22 11 13.39 | — 2 22 46.22 | 19 48 27.17 | | | | | |
| September 6, 1872: | | | | | | | | | |
| Salt Lake City { | Salt Lake City. | 21 16 06.46 | — 0 01 28.49 | 21 14 37.97 | 59.60 | 0 02 59.57 | 59.585 | | |
| Beaver { | Beaver | 23 34 40.32 | — 2 23 01.95 | 21 11 38.37 | | | | | |
| Salt Lake City { | Salt Lake City. | 21 22 41.09 | — 0 01 28.50 | 21 21 13.59 | | | | | |
| Beaver { | Beaver | 23 41 14.97 | — 2 23 01.95 | 21 18 13.02 | | | | | |
| Beaver west of Salt Lake City | | | | 0 ^h 02 ^m 59 ^s .533 ± 0 ^s .017 | | | | | |
| Salt Lake City west of Greenwich | | | | 7 ^h 27 ^m 34 ^s .86 | | | | | |
| Beaver west of Greenwich | | | | 7 ^h 30 ^m 34 ^s .393 ± 0 ^s .017 | | | | | |
| Beaver west of Greenwich | | | | 112° 38' 35".90 ± 0".26 | | | | | |

LATITUDE DETERMINATIONS.

67

Observations and computations for latitude.

BEAVER, UTAH.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|-----------------------|-----------------|---------------------|-----------|-----------|----------------------|----------------------------|-------------------|----------|----------------------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1872. August 20 .. | | <i>t.</i> <i>d.</i> | <i>d.</i> | <i>d.</i> | | <i>°</i> <i>'</i> <i>"</i> | <i>'</i> <i>"</i> | <i>"</i> | <i>°</i> <i>'</i> <i>"</i> |
| | 5847 | 15 28.0 | 27.0 | 19.0 | | 38 12 22.2 | + 3 58.4 | +2.8 | 38 16 23.4 |
| | 5886 | 22 47.0 | 23.0 | 18.0 | | 07 31.3 | + 8.49.0 | +3.5 | 23.8 |
| | 5929 | 10 38.0 | 24.0 | 24.0 | Must be 9 <i>t.</i> | | | | |
| | 5962 | 4 59.0 | 12.0 | 35.0 | Must be 5 <i>t.</i> | 28 25.6 | -12 06.8 | +4.2 | 23.0 |
| | 5990 | 23 57.5 | 42.0 | 7.0 | | | | | |
| | 6033 | 19 81.0 | 20.0 | 27.0 | | 14 34.7 | + 1 47.1 | +1.7 | 23.5 |
| | 6052 | 17 16.0 | 31.0 | 19.0 | | | | | |
| | 6073 | 2 74.5 | 24.0 | 25.0 | Must be 1 <i>t.</i> | 26 43.2 | -10 22.9 | +3.5 | 23.8 |
| | 6395 | 21 80.0 | 35.0 | 16.0 | Must be 20 <i>t.</i> | | | | |
| | 6438 | 14 33.0 | 24.0 | 26.0 | | 20 40.6 | - 4 21.5 | +5.9 | 25.0 |
| | 6475 | 12 39.5 | 27.0 | 25.0 | | | | | |
| | 6491 | 23 22.5 | 34.0 | 16.0 | | 19 00.4 | + 7 17.6 | +7.0 | 25.0 |
| | <i>ε</i> Drac. | 23 39.5 | 14.0 | 18.0 | | | | | |
| | <i>τ</i> Aquilæ | 9 10.8 | 20.0 | 12.0 | | 25 57.9 | - 9 37.3 | +1.4 | 22.0 |
| | 7083 | 17 61.0 | 15.0 | 18.0 | | | | | |
| | 7131 | 13 92.0 | 23.0 | 11.0 | | 18 48.9 | - 2 29.1 | +3.2 | 23.0 |
| | 7132 | 16 13.0 | ----- | ----- | | 17 20.2 | - 0 59.8 | +3.2 | 23.6 |
| | 7164 | 13 57.0 | 11.0 | 22.0 | | | | | |
| | 7171 | 19 75.5 | 27.0 | 6.0 | | 20 28.7 | - 4 09.9 | +3.5 | 22.3 |
| | 7204 | 3 44.0 | 22.0 | 11.0 | Must be 2 <i>t.</i> | | | | |
| | 7241 | 26 02.8 | 13.0 | 21.0 | | 32 16.0 | -15 53.2 | +1.0 | 23.8 |
| | 7256 | 22 55.0 | 11.0 | 23.0 | | | | | |
| | 7274 | 10 73.5 | 23.0 | 10.0 | | 08 27.4 | + 7 57.4 | +0.4 | 25.2 |
| | 7313 | 15 91.0 | 8.0 | 23.0 | | | | | |
| | 7385 | 17 45.0 | 27.0 | 5.0 | | 15 19.6 | + 1 02.2 | +2.4 | 24.2 |
| | 7505 | 10 42.0 | 15.0 | 17.0 | Must be 9 <i>t.</i> | | | | |
| | 7524 | 16 67.3 | 15.0 | 17.0 | | 21 16.9 | - 4.53.1 | -1.4 | 22.4 |
| August 21 .. | 5962 | 4 80.0 | 26.0 | 22.0 | | | | | |
| | 5990 | 22 75.3 | 27.0 | 21.0 | | 28 25.7 | -12 05.5 | +3.5 | 23.7 |
| | 6052 | 18 77.0 | 27.0 | 20.0 | | | | | |
| | 6073 | 3 35.3 | 28.0 | 20.0 | | 26 43.3 | -10 23.0 | +5.3 | 25.6 |
| | 6218 | 23 35.5 | 17.0 | 32.0 | | | | | |
| | 6235 | 8 41.5 | 38.0 | 11.0 | Rev. wrong. | 27 03.2 | -10 44.1 | +4.2 | 23.3 |
| | 6355 | 19 84.0 | 14.0 | 26.0 | | | | | |
| | 6365 | 3 17.5 | 24.0 | 16.0 | | 27 39.4 | -11 13.4 | -1.4 | 24.6 |
| | 6395 | 18 84.0 | 16.0 | 22.0 | | | | | |
| | 6438 | 12 40.0 | 26.0 | 14.0 | | 20 40.7 | - 4 20.2 | +1.4 | 21.9 |
| | 6475 | 10 07.3 | 17.0 | 22.0 | | | | | |
| | 6491 | 21 05.5 | 23.0 | 16.0 | | 38 09 00.6 | + 7 23.8 | +0.7 | 38 16 25.1 |

Observations and computations—Continued.

BEAVER, UTAH.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|-----------------------|---------------------------------|-----------------------------------|-----------------------------|-----------------------------|--------------|--------------------------|-------------------|-----------|---------------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1872. August 21 .. | τ Drac. δ Aquilæ | <i>t. d.</i> 2 77.5 27 87.5 | <i>d.</i> ----- ----- | <i>d.</i> ----- ----- | No level. | o ' " 37 59 30.9 | ' " +17 54.3 | " -2.5 | o ' " 38 16 22.7 |
| | 6674 | 15 48.5 | 25.0 | 16.0 | | 38 14 12.6 | + 2 14.8 | -2.8 | 24.6 |
| | 6676 | 11 00.0 | ----- | ----- | | 17 10.2 | - 0 46.5 | -2.8 | 20.9 |
| | 6687 | 12 15.0 | 13.0 | 29.0 | | | | | |
| | 6730 | 22 19.0 | ----- | ----- | | 23 40.7 | - 7 19.2 | +1.0 | 22.5 |
| | 6734 | 20 98.0 | 26.0 | 16.0 | Rev. wrong. | 22 52.1 | - 6 30.3 | +1.0 | 22.8 |
| | 6762 | 12 32.0 | 17.0 | 24.0 | | | | | |
| August 23 .. | 5886 | 22 36.3 | 21.0 | 27.0 | | | | | |
| | 5929 | 9 14.0 | 20.0 | 26.0 | | 07 31.6 | + 8 54.3 | -4.2 | 21.7 |
| | 5962 | 4 37.0 | 32.0 | 14.0 | | | | | |
| | 5990 | 22 16.0 | 9.0 | 37.5 | | 28 26.0 | -11 58.9 | -3.7 | 23.4 |
| | 6033 | 24 34.8 | 27.0 | 20.0 | | | | | |
| | 6052 | 21 58.0 | 16.0 | 30.5 | Cloudy. | 14 34.9 | + 1 51.9 | -2.7 | 24.1 |
| | 6674 | 16 69.5 | 31.0 | 16.0 | | | | | |
| | 6687 | 13 38.3 | 7.0 | 40.0 | | 14 12.9 | + 2 13.8 | -6.3 | 20.4 |
| | 6734 | 20 93.8 | 18.0 | 29.0 | | | | | |
| | 6762 | 11 12.3 | 35.0 | 11.0 | | 22 52.5 | - 6 36.6 | +4.6 | 20.5 |
| | 6813 | 13 73.0 | 18.0 | 29.0 | | | | | |
| | 6860 | 15 02.0 | 36.0 | 10.0 | | 15 28.5 | + 0 52.1 | +5.3 | 25.9 |
| | 6879 | 3 59.0 | 27.0 | 19.0 | | | | | |
| | 6895 | 29 83.0 | 24.0 | 23.0 | Rev. wrong. | 34 43.2 | -18 20.8 | +3.1 | 25.5 |
| | 7083 | 17 41.0 | 19.0 | 29.5 | | | | | |
| | 7131 | 13 61.5 | 40.0 | 9.0 | | 18 49.7 | - 2 33.3 | +7.2 | 23.6 |
| | 7132 | 15 77.0 | ----- | ----- | | 17 21.0 | - 1 06.3 | +7.2 | 21.9 |
| | 7204 | 5 83.5 | 27.0 | 21.0 | | | | | |
| | 7241 | 29 63.5 | 31.0 | 18.0 | | 32 16.7 | -16 01.7 | +6.6 | 21.6 |
| | 7256 | 24 04.5 | 33.5 | 14.5 | | | | | |
| | 7274 | 12 37.0 | 22.0 | 27.0 | | 08 28.2 | + 7 51.8 | +4.9 | 24.9 |
| | 7313 | 15 04.0 | 16.0 | 34.0 | | | | | |
| | 7385 | 16 51.5 | 41.0 | 7.0 | | 15 20.4 | + 0 59.6 | +5.6 | 25.6 |
| | 7444 | 12 65.5 | 25.0 | 14.0 | | | | | |
| | 7448 | 21 43.3 | 28.0 | 12.0 | | 22 07.3 | - 5 54.7 | +9.5 | 22.1 |
| | 7505 | 10 76.5 | 32.0 | 7.0 | | | | | |
| | 7524 | 18 20.5 | 17.0 | 23.0 | | 21 17.9 | - 5 00.6 | +5.2 | 22.5 |
| | 7555 | 18 41.0 | 17.0 | 22.5 | | | | | |
| | 7585 | 14 36.5 | 31.0 | 9.0 | Must be 13t. | 19 41.1 | - 3 23.9 | +5.8 | 23.0 |
| | 7733 | 19 33.0 | 20.0 | 21.0 | | | | | |
| | 7754 | 19 91.0 | 26.0 | 15.0 | | 16 45.2 | - 0 23.4 | +3.5 | 38 16 25.3 |

LATITUDE DETERMINATIONS.

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Observations and computations—Continued.

BEAVER, UTAH.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|--------------|-----------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|----------|-------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1872. | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | <i>o' "</i> | <i>' "</i> | <i>"</i> | <i>o' "</i> |
| August 23 .. | 7778 | 13 35.5 | 9.0 | 32.0 | | 38 18 23.6 | — 2 04.2 | +2.8 | 38 16 22.2 |
| | 7782 | 21 18.0 | ..... | ..... |  | 23 40.7 | — 7 20.5 | +2.8 | 23.0 |
| | 7807 | 10 28.0 | 36.0 | 5.0 | | | | | |
| August 24 .. | 6395 | 18 49.0 | 29.0 | 25.0 | | | | | |
| | 6438 | 12 09.5 | 26.0 | 28.0 | | 20 41.2 | — 4 18.4 | +0.7 | 23.5 |
| | 6475 | 11 99.0 | 34.5 | 19.0 | | | | | |
| | 6491 | 22 94.5 | 21.0 | 32.5 | | 38 09 01.2 | + 7 22.7 | +1.4 | 25.3 |
| | τ Drac. | 2 63.8 | 33.0 | 21.0 | | | | | |
| | δ Aquilæ | 27 67.0 | 19.0 | 36.0 | | 37 59 31.5 | +16 51.5 | —1.7 | 21.3 |
| | 6674 | 17 04.5 | 28.0 | 24.0 | | 38 14 13.1 | + 2 11.8 | —3.5 | 21.4 |
| | 6676 | 12 64.8 | ..... | ..... |  | 17 10.8 | — 0 45.9 | —3.5 | 21.4 |
| | 6687 | 13 78.3 | 19.0 | 33.0 | | | | | |
| | 6730 | 20 48.5 | 20.0 | 32.0 | | 23 41.3 | — 7 16.2 | —1.8 | 23.3 |
| | 6734 | 19 27.3 | ..... | ..... |  | 22 52.7 | — 6 27.3 | —1.7 | 23.7 |
| | 6762 | 9 69.0 | 29.0 | 22.0 | | | | | |
| | 6806 | 12 35.5 | 17.5 | 22.0 | | | | | |
| | 6849 | 12 54.8 | 21.0 | 18.0 | | 16 17.8 | + 0 07.8 | —0.5 | 25.1 |
| | 6879 | 2 49.0 | 10.0 | 28.0 | | | | | |
| | 6895 | 29 77.0 | 30.0 | 9.0 | | 34 43.4 | —18 22.4 | +1.0 | 22.0 |
| | 7164 | 11 51.0 | 23.0 | 16.0 | | | | | |
| | 7171 | 17 56.8 | 12.0 | 27.0 | | 20 29.7 | — 4 04.8 | —2.8 | 22.1 |
| | 7204 | 5 00.3 | 23.0 | 15.0 | | | | | |
| | 7241 | 28 62.0 | 14.0 | 25.0 | | 32 17.0 | —15 54.4 | —1.0 | 21.6 |
| | 7256 | 23 44.6 | 20.5 | 18.0 | | | | | |
| | 7274 | 11 59.5 | 13.0 | 26.5 | | 08 28.4 | + 7 58.9 | —3.9 | 23.4 |
| | 7313 | 15 02.5 | 15.0 | 24.0 | | | | | |
| | 7385 | 16 57.0 | 23.0 | 17.0 | | 15 20.7 | + 1 02.4 | —1.0 | 22.1 |
| | 7444 | 13 35.5 | 14.0 | 24.0 | | | | | |
| | 7448 | 21 82.0 | 23.0 | 16.0 | | 22 08.2 | — 5 42.1 | —1.1 | 25.0 |
| | 7505 | 11 55.0 | 22.0 | 17.0 | | | | | |
| | 7524 | 18 77.0 | 13.0 | 26.0 | | 21 18.1 | — 4 51.8 | —2.8 | 23.5 |
| | 7555 | 17 80.5 | 19.0 | 19.0 | | | | | |
| | 7585 | 12 93.0 | 18.0 | 19.5 | | 19 41.4 | — 3 17.0 | —0.5 | 23.9 |
| | 7754 | 13 98.0 | 19.0 | 19.0 | | 12 20.0 | + 4 07.5 | —4.0 | 23.5 |
| | 7778 | 23 00.0 | ..... | ..... |  | 18 23.9 | — 1 57.0 | —4.0 | 22.9 |
| | 7782 | 30 85.5 | ..... | ..... |  | 23 41.0 | — 7 14.4 | —4.0 | 22.6 |
| | 7799 | 17 15.8 | ..... | ..... |  | 14 28.1 | + 1 59.1 | —4.0 | 23.2 |
| | 7807 | 20 10.5 | 14.0 | 25.5 | | | | | |
| August 25 .. | 6475 | 9 98.5 | 31.0 | 17.0 | | | | | |
| | 6491 | 20 98.5 | 11.0 | 35.0 | | 38 09 01.3 | + 7 24.5 | —3.5 | 38 16 22.3 |

Observations and computations—Continued.

BEAVER, UTAH.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|-----------------------|---------------------------------|--|--------------------------------|--------------------------------|----------|--------------------------|----------------------|--------------|--------------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1872. August 25 .. | τ Drac. δ Aquilæ | <i>t. d.</i> 2 63.6 27 76.3 | <i>d.</i> 31.0 8.0 | <i>d.</i> 15.0 39.0 | | ° ' " 37 59 31.6 | ' " +16 55.4 | " -5.2 | ° ' ' 38 16 21.8 |
| | 6734 6762 | 20 31.0 10 72.0 | 32.0 10.0 | 16.0 36.0 | | 38 22 52.9 | - 6 27.5 | -3.5 | 21.9 |
| | 6806 6813 6849 6860 | 13 70.8 13 91.8 13 91.0 15 39.3 | 26.0 16.0 | 21.0 32.0 | | 16 18.0 15 28.9 | + 0 08.5 + 0 59.6 | -3.9 -3.9 | 22.6 24.6 |
| | 6879 6895 | 3 06.8 30 14.0 | 34.0 10.0 | 18.0 42.0 | | 34 43.6 | -18 13.9 | -5.6 | 24.1 |
| | 7083 7131 | 18 88.5 15 35.0 | 24.0 9.0 | 17.0 31.0 | | 18 50.2 | - 2 22.8 | -5.2 | 22.2 |
| | 7204 7241 | 7 60.3 31 05.5 | 24.0 7.0 | 17.0 34.5 | | 32 17.3 | -15 47.7 | -7.2 | 22.4 |
| | 7256 7274 | 24 66.8 12 82.3 | 1.0 37.0 | 41.0 4.5 | Cloudy. | 08 28.7 | + 7 58.7 | -2.8 | 24.6 |
| August 27.. | 6395 6438 | 21 35.5 14 84.0 | 34.0 32.0 | 24.0 26.0 | | 20 41.6 | - 4 23.3 | +5.6 | 23.9 |
| | 6475 6491 | 11 56.5 22 26.0 | 43.0 29.0 | 16.0 28.0 | Cloudy | 09 01.7 | + 7 12.2 | +9.8 | 23.7 |
| August 30.. | 5886 5929 | 24 16.6 11 06.0 | 26.0 32.0 | 28.0 22.0 | | 07 32.1 | + 8 49.6 | +2.8 | 24.5 |
| | 5962 5990 | 2 81.8 20 75.5 | 29.0 29.0 | 26.0 25.0 | | 28 26.5 | -12 04.8 | +2.8 | 24.5 |
| | 6033 6052 | 24 08.5 21 34.0 | 23.0 26.0 | 32.0 29.0 | | 14 35.5 | + 1 50.9 | -4.2 | 22.2 |
| | 6109 6147 | 10 45.8 32 05.5 | 29.0 28.0 | 27.0 26.0 | | 01 50.2 | +14 32.7 | +1.4 | 24.3 |
| | 6218 6235 | 23 91.0 8 00.0 | 32.0 26.0 | 24.0 29.0 | | 27 04.4 | -10 42.9 | +1.8 | 23.3 |
| | 6395 6438 | 19 02.0 12 56.8 | 29.0 29.0 | 27.0 27.0 | | 20 42.1 | - 4 20.7 | +1.4 | 22.8 |
| | 6475 6491 | 15 43.0 26 49.3 | 32.0 14.0 | 33.0 41.0 | | 38 09 02.1 | + 7 27.1 | -6.3 | 22.9 |
| | τ Drac. δ Aquilæ | 2 17.0 27 08.5 | 14.0 35.0 | 30.0 8.5 | | 37 59 32.4 | +16 46.8 | +3.7 | 22.9 |
| | 6674 6676 6687 | 16 69.0 12 27.0 13 57.5 | 26.0 21.0 | 18.0 22.0 | | 38 14 14.1 17 11.7 | + 2 05.9 - 0 52.7 | +2.9 +2.9 | 22.9 38 16 21.9 |

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BEAVER, UTAH.

Recapitulation.

| Date. | No. of observations. | Mean latitude. |
|---------|----------------------|----------------|
| 1872. | | ° ' " |
| Aug. 20 | 15 | 38 16 23.60 |
| Aug. 21 | 11 | 23.52 |
| Aug. 23 | 18 | 23.18 |
| Aug. 24 | 20 | 23.04 |
| Aug. 25 | } 11 | |
| Aug. 27 | | 23.10 |
| Aug. 30 | | 23.37 |

Adopted for the use of this office..... $38^{\circ} 16' 23''.28 \pm 0''.06$

Longitude $112^{\circ} 38' 35''.90 \pm 0''.26$ west from Greenwich.
 $35^{\circ} 35' 34''.10$ west from United States Naval Ob-
 servatory, Washington, D. C.

Latitude $38^{\circ} 16' 23''.28 + 0''.06$ north.

U. S. GEOGRAPHICAL SURVEYS WEST OF THE ONE HUNDREDTH MERIDIAN,
1ST LIEUT. GEO. M. WHEELER, CORPS OF ENGINEERS, U. S. ARMY, IN CHARGE.

RESULTS

OF

OBSERVATIONS MADE BY W. W. MARYATT AND E. P. AUSTIN IN THE
DETERMINATION OF THE ASTRONOMICAL CO-ORDINATES
OF STATION AT PIOCHE, NEVADA.

SEASON OF 1872.

COMPUTATIONS BY

W. W. MARYATT, DR. F. KAMPF, AND WM. A. ROGERS.

PIOCHE, NEVADA.

GEOGRAPHICAL POSITION OF STATION.

Longitude, $114^{\circ} 26' 18''.27 \pm 1''.12$ west from Greenwich.
 $37^{\circ} 23' 16''.47$ west from U. S. Naval Observ-
 tory at Washington, D. C.

Latitude, $37^{\circ} 55' 26''.07 \pm 0''.07$ north.

Barometric altitude of observatory above sea-level, 5942.3 feet.

The astronomical station is 120 feet to the left of the road leading from Pioche to Bullionville. Its distance from the church on the corner of Cedar and Meadow Valley streets is 3,050 feet in a line whose direction is south-west by west. About 1,250 feet from this church, on the summit of the divide, where it is crossed by Meadow Valley street, and near the Gold Hill Mine, there stands a very conspicuous telegraph-pole; the astronomical monument is situated 1,060 feet south and 1,470 feet east of this.

The city lies on the northeastern declivity of hills which form a spur of the Ely Mountains. The surrounding country slopes gradually down to the plains in the same direction.

OBSERVATORY—INSTRUMENTS—MISCELLANEOUS.

A description of the instruments used, with the values pertaining to them, will be found in the report on Beaver, which precedes this. Much general information on this station, including a description of the observatory and methods of observation, is given by Mr. Maryatt, on page 46 of the Progress Report of 1872.

This was the first of the series of stations occupied in 1872 by the late Wm. W. Maryatt, who died in 1873, at Bozeman, Montana. This gentleman took the greatest care to secure results as satisfactory as possible, as will be seen from the observations made.

CONNECTIONS—OBSERVERS—COMPUTERS.

In this, as in all other work of this year, the connected station was Salt Lake City, at which point E. P. Austin was observer. The chronograph was used in the exchange of signals; the observations for time were taken by eye and ear.

The Deseret Telegraph Line was used as a route of transmission. The length of circuit was about 300 miles. Signals were sent by the local battery at Pioche. No repeaters intervened.

Time-exchanges were made September 25, 27, 28, 30, and October 2; observations for latitude on October 4, 5, 6, 7, 10, and 11. The reduction of observations for time taken by Mr. Maryatt was accomplished by himself in the office; those of Mr. Austin were reduced by Dr. Kampf. The latitude-observations were reduced in 1873 by Wm. A. Rogers, and revised by Dr. F. Kampf, who also prepared the report.

Tabulation of stars used for determination of time at Pioche, Nevada, and Salt Lake City, Utah, 1872.

| | PIOCHE. | | | | | SALT LAKE CITY. | | | | | | PIOCHE. | | | | | SALT LAKE CITY. | | | | |
|---------------------------|---------------|---------------|---------------|---------------|------------|-----------------|---------------|---------------|---------------|------------|---------------------------|---------------|---------------|---------------|---------------|------------|-----------------|---------------|---------------|---------------|------------|
| | September 25. | September 27. | September 28. | September 30. | October 2. | September 25. | September 27. | September 28. | September 30. | October 2. | | September 25. | September 27. | September 28. | September 30. | October 2. | September 25. | September 27. | September 28. | September 30. | October 2. |
| <i>a</i> Andromedæ | x | x | x | x | x | | | | | | <i>ε</i> Delphini..... | | | | | | | | | | |
| <i>γ</i> Pegasi | x | x | x | x | x | | | | | | Groombridge 3241..... | x | x | x | x | | | | | | |
| 21 Cassiopeia | x | x | x | x | x | | | | | | <i>a</i> Cygni | x | x | x | x | | | | | | |
| <i>ε</i> Piscium | x | x | x | x | x | | | | | | <i>μ</i> Aquarii | x | x | x | x | | | | | | |
| 38 Cassiopeia | x | x | x | x | x | | | | | | 61 Cygni | x | x | x | x | | | | | | |
| <i>o</i> Piscium | x | x | x | x | x | | | | | | <i>ζ</i> Cygni | x | x | x | x | | | | | | |
| <i>β</i> Arietis | x | x | x | x | x | | | | | | <i>a</i> Cephei | x | x | x | x | | | | | | |
| 50 Cassiopeia | x | x | x | x | x | | | | | | 1 Pegasi | x | x | x | x | | | | | | |
| <i>a</i> Arietis | x | x | x | x | x | | | | | | <i>β</i> Aquarii | x | x | x | x | | | | | | |
| <i>ζ</i> Aquilæ | x | x | x | x | x | | | | | | <i>β</i> Cephei | x | x | x | x | | | | | | |
| <i>d</i> Sagittarii | x | x | x | x | x | | | | | | <i>ε</i> Aquarii | x | x | x | x | | | | | | |
| <i>δ</i> Draconis | x | x | x | x | x | | | | | | <i>ε</i> Pegasi | x | x | x | x | | | | | | |
| <i>τ</i> Draconis | x | x | x | x | x | | | | | | 11 Cephei | x | x | x | x | | | | | | |
| <i>δ</i> Aquilæ | x | x | x | x | x | | | | | | <i>μ</i> Capricorni | x | x | x | x | | | | | | |
| <i>κ</i> Aquilæ | x | x | x | x | x | | | | | | 79 Draconis | x | x | x | x | | | | | | |
| <i>γ</i> Aquilæ | x | x | x | x | x | | | | | | <i>a</i> Aquarii | x | x | x | x | | | | | | |
| <i>a</i> Aquilæ | x | x | x | x | x | | | | | | <i>π</i> Aquarii | x | x | x | x | | | | | | |
| <i>ε</i> Draconis | x | x | x | x | x | | | | | | <i>o</i> Cephei | x | x | x | x | | | | | | |
| <i>τ</i> Aquilæ | x | x | x | x | x | | | | | | Groombridge 4163..... | x | x | x | x | | | | | | |
| <i>κ</i> Cephei | x | x | x | x | x | | | | | | <i>ω</i> Piscium | x | x | x | x | | | | | | |
| <i>π</i> Capricorni..... | x | x | x | x | x | | | | | | | | | | | | | | | | |

Observations and reductions for time taken at sending station.

PIOCHE, NEVADA, SEPTEMBER 25, 1872.

| Clamp. | Name of star. | T. | | | Aa. | Bb. | Cc. | T'. | | | AR. | | | ΔT. | | |
|--------|---------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| | | <i>h.</i> | <i>m.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h.</i> | <i>m.</i> | <i>s.</i> | <i>h.</i> | <i>m.</i> | <i>s.</i> | <i>h.</i> | <i>m.</i> | <i>s.</i> |
| W. | <i>δ</i> Draconis | 21 | 42 | 56.05 | — 0.57 | + 0.15 | 0.00 | 21 | 42 | 55.63 | 19 | 12 | 31.80 | —2 | 30 | 23.83 |
| W. | <i>δ</i> Aquilæ | | 49 | 27.18 | + 0.26 | + 0.05 | 0.00 | | 49 | 27.49 | | 19 | 04.22 | | | 23.27 |
| W. | <i>κ</i> Aquilæ | 22 | 00 | 24.98 | + 0.32 | + 0.05 | 0.00 | 22 | 00 | 25.35 | | 30 | 02.01 | | | 23.34 |
| W. | <i>γ</i> Aquilæ | | 10 | 35.65 | + 0.21 | + 0.06 | 0.00 | | 10 | 35.92 | | 40 | 12.07 | | | 23.85 |
| W. | <i>ε</i> Draconis | | 19 | 01.15 | — 0.69 | + 0.16 | 0.00 | | 19 | 00.62 | | 49 | 36.65 | | | 23.97 |
| E. | <i>π</i> Capricorni | | 50 | 25.01 | + 0.39 | + 0.04 | 0.00 | | 50 | 25.44 | 20 | 20 | 01.73 | | | 23.71 |
| E. | Groombr. 3241 | 23 | 00 | 58.38 | — 0.82 | + 0.17 | 0.00 | 23 | 00 | 57.73 | | 30 | 34.17 | | | 23.56 |
| E. | <i>a</i> Cygni | | 07 | 29.64 | — 0.07 | + 0.09 | 0.00 | | 07 | 29.66 | | 37 | 05.81 | | | 23.85 |
| E. | <i>u</i> Aquarii | | 16 | 10.61 | + 0.34 | + 0.04 | 0.00 | | 16 | 10.99 | | 46 | 47.02 | | | 23.97 |
| E. | 61 Cygni | | 31 | 35.62 | 0.00 | + 0.08 | 0.00 | | 31 | 35.70 | 21 | 01 | 11.80 | | | 23.90 |
| E. | 1 Pegasi | | 46 | 35.74 | + 0.15 | + 0.07 | 0.00 | | 46 | 35.96 | | 16 | 12.11 | | | 23.85 |
| E. | <i>β</i> Cephei | | 57 | 26.45 | — 0.69 | + 0.16 | 0.00 | | 57 | 25.92 | | 27 | 02.40 | | | 23.52 |
| E. | <i>ε</i> Pegasi | 0 | 08 | 19.80 | + 0.22 | + 0.06 | 0.00 | 0 | 08 | 20.08 | 21 | 38 | 56.16 | —2 | 30 | 23.92 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= +1.39 + 13.00 \delta t - 2.17 a - 4.45 c & c &= 0^s.00 \\
 0 &= -5.75 - 2.17 \delta t + 12.64 a + 2.17 c & a &= +0^s.45 \\
 0 &= -0.62 - 4.45 \delta t + 2.17 a + 45.36 c
 \end{aligned}$$

Observations and reductions for time taken at sending station—Continued.

PIOCHE, NEVADA, SEPTEMBER 25, 1872.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|----------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | <i>α</i> Andromedæ | 2 32 12.82 | + 0.08 | — 0.42 | + 0.08 | 2 32 12.56 | 0 01 49.03 | —2 30 23.53 |
| W. | <i>γ</i> Pegasi | 37 05.23 | + 0.17 | — 0.27 | + 0.06 | 37 05.19 | 06 41.29 | 23.90 |
| W. | <i>21</i> Cassiopeiæ | 3 07 44.52 | — 0.88 | — 0.86 | + 0.22 | 3 07 43.00 | 37 19.23 | 23.77 |
| E. | <i>ε</i> Piscium | 26 44.11 | + 0.20 | — 0.25 | — 0.06 | 26 44.00 | 56 20.60 | 23.40 |
| E. | <i>38</i> Cassiopeiæ | 3 52 13.68 | — 0.60 | — 0.70 | — 0.17 | 3 52 12.21 | 1 21 48.90 | —2 30 23.31 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= +0.69 + 5.00 \delta t - 2.59 a \\
 0 &= -2.82 - 2.59 \delta t + 7.53 a & a &= +0^s.40 \\
 &\text{Adopted } c = -0^s.06 \text{ for E.}
 \end{aligned}$$

PIOCHE, NEVADA, SEPTEMBER 27, 1872.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|-------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | <i>α</i> Aquilæ | 22 00 23.93 | — 0.10 | + 0.04 | — 0.06 | 22 00 23.81 | 19 30 01.98 | —2 30 21.83 |
| E. | <i>γ</i> Aquilæ | 10 33.87 | — 0.07 | + 0.05 | — 0.06 | 10 33.79 | 40 12.04 | 21.75 |
| E. | <i>ε</i> Draconis | 18 58.26 | + 0.21 | + 0.12 | — 0.17 | 18 58.42 | 48 36.51 | 21.91 |
| E. | <i>τ</i> Aquilæ | 28 16.98 | — 0.07 | + 0.04 | — 0.06 | 28 16.89 | 57 54.93 | 21.96 |
| E. | <i>κ</i> Cephei | 43 31.77 | + 0.40 | + 0.18 | — 0.26 | 43 32.09 | 20 13 10.45 | 21.64 |
| W. | Groombr. 3241 | 23 00 56.52 | — 0.29 | — 0.17 | + 0.18 | 23 00 56.24 | 29 34.03 | 22.21 |
| W. | <i>α</i> Cygni | 07 27.84 | — 0.03 | — 0.08 | + 0.08 | 07 27.81 | 39 05.76 | 22.05 |
| W. | <i>u</i> Aquarii | 16 09.15 | + 0.12 | — 0.04 | + 0.06 | 16 09.29 | 45 47.00 | 22.29 |
| W. | <i>61</i> Cygni | 31 33.80 | 0.00 | — 0.08 | + 0.07 | 31 33.79 | 21 01 11.77 | 22.02 |
| W. | <i>ζ</i> Cygni | 37 53.28 | + 0.03 | — 0.07 | + 0.07 | 37 53.31 | 07 31.24 | 22.07 |
| W. | <i>1</i> Pegasi | 23 46 33.99 | + 0.05 | — 0.06 | + 0.06 | 23 46 34.04 | 21 10 12.09 | —2 30 21.95 |

NORMAL EQUATIONS.

$$\begin{aligned}
 \text{For E.: } 0 &= -0.10 + 5.00 \delta t - 2.73 a \\
 0 &= +1.46 - 2.73 \delta t + 11.73 a & a &= -0^s.14 \\
 \text{For W.: } 0 &= +1.92 + 6.00 \delta t - 0.75 a \\
 0 &= -0.88 - 0.75 \delta t + 4.07 a & a &= +0^s.16 \\
 &\text{Adopted } c = -0^s.06 \text{ for E.}
 \end{aligned}$$

TIME DETERMINATIONS.

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Observations and reductions for time taken at sending station—Continued.

PIOCHE, NEVADA, SEPTEMBER 27, 1872.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|--------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | ω Piscium | 2 23 08.96 | + 0.06 | + 0.02 | — 0.06 | 2 23 08.98 | 23 52 46.88 | —2 30 22.10 |
| E. | α Andromedæ | 32 11.10 | + 0.02 | + 0.02 | — 0.07 | 32 11.07 | 0 01 49.04 | 22.03 |
| E. | 21 Cassiopeiæ | 3 07 41.73 | — 0.24 | + 0.06 | — 0.22 | 3 07 41.33 | 0 37 19.25 | 22.08 |
| W. | ϵ Piscium | 26 42.91 | — 0.12 | + 0.02 | + 0.06 | 26 42.87 | 0 56 20.62 | 22.25 |
| W. | 38 Cassiopeiæ | 3 52 10.62 | + 0.36 | + 0.05 | + 0.17 | 3 52 11.20 | 1 21 48.96 | —2 30 22.24 |

NORMAL EQUATIONS.

$$\begin{aligned} \text{For E. : } 0 &= +0.37 + 3.00 \delta t - 1.47 a \\ 0 &= -0.68 - 1.47 \delta t + 5.11 a & a &= +0^{\circ}.11 \\ \text{For W. : } 0 &= +0.25 + 2.00 \delta t - 0.99 a \\ 0 &= +0.36 - 0.99 \delta t + 2.55 a & a &= -0^{\circ}.24 \end{aligned}$$

Adopted $c = -0^{\circ}.06$ for E.

PIOCHE, NEVADA, SEPTEMBER 28, 1872.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|---------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | ϵ Draconis | 22 18 58.80 | — 0.66 | — 0.12 | 0.00 | 22 18 58.02 | 19 48 36.45 | —2 30 21.57 |
| W. | τ Aquilæ | 28 16.35 | + 0.22 | — 0.04 | 0.00 | 28 16.53 | 57 54.93 | 21.61 |
| W. | ϵ Delphini | 57 29.01 | + 0.20 | — 0.04 | 0.00 | 57 29.17 | 20 29 07.65 | 21.52 |
| W. | α Cygni | 23 07 27.19 | — 0.07 | — 0.07 | 0.00 | 23 07 27.05 | 37 05.74 | 21.31 |
| W. | μ Aquarii | 16 08.34 | + 0.32 | — 0.03 | 0.00 | 16 08.63 | 45 46.99 | 21.64 |
| E. | 61 Cygni | 31 33.30 | 0.00 | — 0.06 | 0.00 | 31 33.24 | 21 01 11.75 | 21.49 |
| E. | 1 Pegasi | 46 33.40 | + 0.14 | — 0.05 | 0.00 | 46 33.49 | 16 12.08 | 21.41 |
| E. | β Cephei | 57 24.68 | — 0.66 | — 0.12 | 0.00 | 57 23.90 | 27 02.26 | 21.64 |
| E. | μ Capricorni | 0 16 42.63 | + 0.35 | — 0.03 | 0.00 | 0 16 42.95 | 46 21.38 | 21.57 |
| E. | π Aquarii | 49 08.16 | + 0.26 | — 0.04 | 0.00 | 49 08.38 | 22 18 46.73 | —2 30 21.65 |

NORMAL EQUATIONS.

$$\begin{aligned} 0 &= +1.60 + 10.00 \delta t + 0.21 a \\ 0 &= -2.94 + 0.21 \delta t + 6.98 a & a &= +0^{\circ}.40 \\ \text{Adopted } c &= 0^{\circ}.00. \end{aligned}$$

Observations and reductions for time taken at sending station—Continued.

PIOCHE, NEVADA, SEPTEMBER 28, 1872.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|--------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | Groombr. 4163 ... | 2 19 05.10 | — 1.04 | — 0.12 | 0.00 | 2 19 03.94 | 23 48 42.40 | —2 30 21.54 |
| E. | <i>a</i> Andromedæ | 32 10.66 | + 0.09 | — 0.04 | 0.00 | 32 10.71 | 0 01 49.04 | 21.67 |
| E. | <i>γ</i> Pegasi | 37 02.90 | + 0.20 | — 0.04 | 0.00 | 37 03.06 | 06 41.31 | 21.75 |
| W. | 21 Cassiopeiæ | 3 07 42.40 | — 1.09 | — 0.12 | 0.00 | 3 07 41.19 | 37 19.26 | 21.93 |
| W. | <i>e</i> Piscium | 26 42.12 | + 0.26 | — 0.03 | 0.00 | 26 42.35 | 56 20.62 | —2 30 21.73 |

NORMAL EQUATIONS.

$$0 = + 2.70 + 5.00 \delta t - 3.15 a$$

$$0 = - 5.55 - 3.15 \delta t + 9.59 a$$

$$a = + 0^s.50$$

$$\text{Adopted } c = 0^s.00.$$

PIOCHE, NEVADA, SEPTEMBER 30, 1872.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|---------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | <i>γ</i> Aquilæ | 22 10 31.45 | + 0.61 | 0.00 | 0.00 | 22 10 32.06 | 19 40 11.99 | —2 30 20.07 |
| W. | <i>ε</i> Draconis | 18 58.65 | — 1.98 | 0.00 | 0.00 | 18 56.67 | 48 36.71 | 19.96 |
| W. | <i>τ</i> Aquilæ | 28 14.33 | + 0.67 | 0.00 | 0.00 | 28 15.00 | 57 54.88 | 20.12 |
| W. | <i>π</i> Capricorni | 50 20.57 | + 1.13 | 0.00 | 0.00 | 50 21.70 | 20 20 01.66 | 20.04 |
| W. | <i>α</i> Cygni | 23 07 26.16 | — 0.22 | 0.00 | 0.00 | 23 07 25.94 | 37 05.69 | 20.25 |
| W. | <i>μ</i> Aquarii | 16 06.18 | + 0.96 | 0.00 | 0.00 | 16 07.14 | 45 46.96 | 20.18 |
| E. | 61 Cygni | 31 31.88 | 0.00 | 0.00 | 0.00 | 31 31.88 | 21 01 11.72 | 20.16 |
| E. | <i>ζ</i> Cygni | 37 51.24 | + 0.21 | 0.00 | 0.00 | 37 51.45 | 07 31.19 | 20.26 |
| E. | 1 Pegasi | 46 31.82 | + 0.44 | 0.00 | 0.00 | 46 32.26 | 16 12.05 | 20.21 |
| E. | <i>β</i> Cephei | 57 24.50 | — 1.99 | 0.00 | 0.00 | 57 22.51 | 27 02.18 | 20.33 |
| E. | <i>μ</i> Capricorni | 0 16 40.46 | + 1.05 | 0.00 | 0.00 | 0 16 41.51 | 46 21.37 | 20.14 |
| E. | <i>α</i> Aquarii | 29 34.31 | + 0.81 | 0.00 | 0.00 | 29 35.12 | 21 59 14.83 | —2 30 20.29 |

NORMAL EQUATIONS.

$$0 = - 3.28 + 12.00 \delta t + 1.29 a$$

$$0 = - 10.26 + 1.29 \delta t - 7.82 a$$

$$a = + 1^s.29$$

$$\text{Adopted } c = 0^s.00$$

Observations and reductions for time taken at sending station—Continued.

PIOCHE, NEVADA, SEPTEMBER 30, 1872.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|---------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | o Cephei | 1 43 48.61 | — 1.63 | 0.00 | 0.00 | 1 43 46.98 | 23 13 26.16 | —2 30 20.82 |
| E. | ω Piscium | 2 23 06.61 | + 0.68 | 0.00 | 0.00 | 2 23 07.29 | 52 46.89 | 20.40 |
| E. | α Andromedæ | 32 09.16 | + 0.24 | 0.00 | 0.00 | 32 09.40 | 0 01 49.05 | 20.35 |
| E. | γ Pegasi | 37 01.06 | + 0.53 | 0.00 | 0.00 | 37 01.59 | 05 41.31 | 20.28 |
| W. | ε Piscium | 3 26 40.20 | + 0.61 | 0.00 | 0.00 | 3 26 40.86 | 56 20.64 | 20.22 |
| W. | 38 Cassiopeiæ | 52 10.93 | — 1.93 | 0.00 | 0.00 | 52 09.00 | 1 21 49.04 | 19.96 |
| W. | o Piscium | 4 09 00.27 | + 0.63 | 0.00 | 0.00 | 4 09 00.90 | 38 40.78 | 20.12 |
| W. | β Arietis | 17 56.73 | + 0.41 | 0.00 | 0.00 | 17 57.14 | 47 36.93 | —2 30 20.21 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= +1.00 + 8.00 \delta t - 0.32 a \\
 0 &= -6.48 - 0.32 \delta t + 5.03 a & a &= +1^s.25 \\
 &\text{Adopted } c = 0^s.00.
 \end{aligned}$$

PIOCHE, NEVADA, OCTOBER 2, 1872.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|--------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | ε Draconis | 22 18 54.09 | + 1.26 | — 0.06 | 0.00 | 22 18 55.29 | 19 48 36.20 | —2 30 19.09 |
| W. | π Capricorni | 50 21.15 | — 0.72 | — 0.01 | 0.00 | 50 20.42 | 30 01.63 | 18.79 |
| W. | ε Delphini | 57 26.75 | — 0.38 | — 0.02 | 0.00 | 57 26.35 | 27 07.59 | 18.76 |
| W. | α Cygni | 23 07 24.80 | + 0.14 | — 0.03 | 0.00 | 23 07 24.91 | 20 37 05.64 | 19.27 |
| E. | 61 Cygni | 31 30.80 | 0.00 | — 0.03 | 0.00 | 31 30.77 | 21 01 11.68 | 19.09 |
| E. | 1 Pegasi | 46 31.26 | 0.00 | — 0.02 | 0.00 | 46 31.24 | 10 12.02 | 19.22 |
| E. | 11 Cephei | 0 10 22.39 | — 1.34 | — 0.06 | 0.00 | 0 10 23.67 | 40 04.71 | 18.96 |
| E. | α Aquarii | 29 34.81 | + 0.51 | — 0.02 | 0.00 | 29 34.28 | 59 14.81 | —2 30 19.47 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -1.00 + 8.00 \delta t + 1.05 a \\
 0 &= -5.43 + 1.05 \delta t + 6.62 a & a &= +0^s.82 \\
 &\text{Adopted } c = 0^s.00.
 \end{aligned}$$

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Observations and reductions for time taken at sending station—Continued.

PIOCHE, NEVADA, OCTOBER 2, 1872.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|--------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | Groombr. 4163 ... | 2 18 59.51 | + 2.06 | — 0.22 | 0.00 | 2 19 01.35 | 23 38 42.35 | — 2 30 19.00 |
| E. | <i>a</i> Andromedæ | 32 08.53 | — 0.18 | — 0.09 | 0.00 | 32 08.26 | 0 01 49.05 | 19.21 |
| E. | <i>γ</i> Pegasi | 37 01.19 | — 0.41 | — 0.07 | 0.00 | 37 00.71 | 06 41.32 | 19.39 |
| E. | 21 Cassiopeiæ | 3 07 36.50 | + 2.18 | — 0.23 | 0.00 | 3 07 38.45 | 37 19.29 | 19.16 |
| W. | <i>e</i> Piscium | 26 40.64 | — 0.51 | — 0.08 | 0.00 | 26 40.05 | 56 20.66 | 19.39 |
| W. | 38 Cassiopeiæ | 52 07.16 | + 1.49 | — 0.19 | 0.00 | 50 08.46 | 1 19 49.07 | 19.39 |
| W. | <i>o</i> Piscium | 4 09 00.63 | — 0.49 | — 0.07 | 0.00 | 4 09 00.07 | 38 40.80 | 19.27 |
| W. | <i>β</i> Arietis | 17 56.64 | — 0.32 | — 0.08 | 0.00 | 17 56.24 | 47 36.95 | 19.29 |
| W. | 50 Cassiopeiæ | 22 55.93 | + 1.76 | — 0.20 | 0.00 | 22 57.49 | 52 38.13 | 19.36 |
| W. | <i>α</i> Arietis | 4 30 20.09 | — 0.28 | — 0.09 | 0.00 | 4 30 19.72 | 2 00 00.33 | — 2 30 19.39 |

NORMAL EQUATIONS.

$$0 = - 3.43 + 10.00 \delta t + 5.34 a$$

$$0 = - 15.01 + 5.34 \delta t + 16.19 a$$

$$a = + 0^s.99$$

$$\text{Adopted } c = 0^s.00.$$

Observations and reductions for time taken at receiving station.

SALT LAKE CITY, UTAH, SEPTEMBER 25, 1872.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|---------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | <i>δ</i> Sagittarii | 19 12 06.46 | — 0.38 | — 0.02 | 0.00 | 19 12 06.06 | 19 10 10.48 | — 1 55.58 |
| E. | <i>δ</i> Aquilæ | 21 00.06 | — 0.26 | — 0.02 | 0.00 | 20 59.78 | 19 04.22 | 55.56 |
| E. | <i>κ</i> Aquilæ | 31 58.16 | — 0.31 | — 0.01 | 0.00 | 31 57.84 | 30 02.01 | 55.83 |
| W. | <i>γ</i> Aquilæ | 42 08.12 | — 0.22 | + 0.02 | 0.00 | 42 07.92 | 40 12.07 | 55.85 |
| W. | <i>α</i> Aquilæ | 46 29.76 | — 0.22 | + 0.02 | 0.00 | 46 29.56 | 44 33.97 | 55.59 |
| W. | <i>τ</i> Aquilæ | 59 50.84 | — 0.23 | + 0.03 | 0.00 | 59 50.64 | 57 54.96 | 55.68 |
| W. | <i>κ</i> Cephei | 20 15 05.00 | + 1.13 | + 0.23 | 0.00 | 20 15 06.36 | 20 13 10.64 | 55.72 |
| E. | 61 Cygni | 21 03 07.34 | — 0.02 | + 0.07 | 0.00 | 21 03 07.39 | 21 01 11.80 | 55.59 |
| E. | <i>ζ</i> Cygni | 09 27.30 | — 0.09 | + 0.10 | 0.00 | 09 27.31 | 07 31.27 | 56.04 |
| E. | <i>α</i> Cephei | 17 28.90 | + 0.32 | + 0.24 | 0.00 | 17 29.46 | 15 33.49 | 55.97 |
| E. | <i>β</i> Aquarii | 26 47.48 | — 0.30 | + 0.07 | 0.00 | 26 47.25 | 24 51.44 | 55.81 |
| E. | <i>ξ</i> Aquarii | 32 54.58 | — 0.32 | + 0.06 | 0.00 | 32 54.32 | 30 58.50 | 55.82 |
| E. | 11 Cephei | 21 41 59.74 | + 0.63 | + 0.18 | 0.00 | 42 00.55 | 40 05.04 | — 1 55.51 |

NORMAL EQUATIONS.

$$0 = - 0.68 + 13.00 \delta t + 0.70 a$$

$$0 = + 5.79 + 0.70 \delta t + 14.04 a \quad a = - 0^s.416$$

$$\text{Adopted } c = 0^s.00.$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, SEPTEMBER 27, 1872.

| Clamp. | Name of star. | T. | | Aa. | Bb. | Cc. | T'. | | AR. | $\Delta T.$ | |
|--------|---------------------------|-----------------|-----------|-----------|-----------|-----------|-----------------|-------------|-----------------|--------------|-----------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>m. s.</i> | <i>s.</i> |
| E. | ζ Aquilæ | 19 01 31.66 | — 0.07 | — 0.05 | 0.00 | 0.00 | 19 01 31.54 | 18 59 32.89 | | — 1 58.65 | |
| E. | δ Sagittarii | 12 09.08 | — 0.14 | — 0.02 | 0.00 | 0.00 | 12 08.92 | 10 10.47 | | 58.45 | |
| E. | δ Draconis | 14 30.18 | + 0.18 | — 0.04 | 0.00 | 0.00 | 14 30.32 | 12 31.70 | | 58.62 | |
| E. | τ Draconis | 19 59.00 | + 0.29 | — 0.03 | 0.00 | 0.00 | 19 59.26 | 18 00.45 | | 58.81 | |
| E. | κ Aquilæ | 32 00.96 | — 0.12 | — 0.05 | 0.00 | 0.00 | 32 00.79 | 30 01.98 | | 58.81 | |
| W. | γ Aquilæ | 42 10.86 | — 0.08 | — 0.04 | 0.00 | 0.00 | 42 10.74 | 40 12.04 | | 58.70 | |
| W. | α Aquilæ | 46 32.70 | — 0.08 | — 0.03 | 0.00 | 0.00 | 46 32.59 | 44 33.92 | | 58.67 | |
| W. | ϵ Draconis | 50 35.14 | + 0.22 | — 0.05 | 0.00 | 0.00 | 50 35.31 | 48 36.64 | | 58.67 | |
| W. | τ Aquilæ | 59 53.70 | — 0.09 | — 0.02 | 0.00 | 0.00 | 59 53.59 | 57 54.93 | | 58.66 | |
| W. | κ Cephei | 20 15 08.75 | + 0.43 | — 0.07 | 0.00 | 0.00 | 20 15 09.11 | 20 13 10.48 | | 58.63 | |
| E. | ϵ Pegasi | 21 39 54.96 | — 0.08 | — 0.01 | 0.00 | 0.00 | 21 39 54.87 | 21 37 56.16 | | 58.71 | |
| E. | μ Capricorni | 48 20.36 | — 0.13 | 0.00 | 0.00 | 0.00 | 48 20.23 | 46 21.39 | | — 1 58.84 | |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -1.11 + 12.00 \delta t - 2.01 a \\
 0 &= +2.90 - 2.01 \delta t + 17.61 a \quad a = -0^s.157 \\
 &\text{Adopted } c = 0^s.00.
 \end{aligned}$$

SALT LAKE CITY, UTAH, SEPTEMBER 28, 1872.

| Clamp. | Name of star. | T. | | Aa. | Bb. | Cc. | T'. | | AR. | $\Delta T.$ | |
|--------|---------------------------|-----------------|-----------|-----------|-----------|-----------|-----------------|-------------|-----------------|--------------|-----------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>m. s.</i> | <i>s.</i> |
| W. | γ Aquilæ | 19 42 11.96 | — 0.11 | — 0.04 | 0.00 | 0.00 | 19 42 11.81 | 19 40 12.02 | | — 1 59.79 | |
| W. | α Aquilæ | 46 33.70 | — 0.11 | — 0.02 | 0.00 | 0.00 | 46 33.57 | 44 33.90 | | 59.67 | |
| W. | ϵ Draconis | 50 35.96 | + 0.29 | 0.00 | 0.00 | 0.00 | 50 36.25 | 48 36.46 | | 59.79 | |
| W. | τ Aquilæ | 59 54.72 | — 0.11 | + 0.01 | 0.00 | 0.00 | 59 54.62 | 57 54.91 | | 59.71 | |
| W. | κ Cephei | 20 15 09.28 | + 0.53 | + 0.18 | 0.00 | 0.00 | 20 15 10.02 | 20 13 10.36 | | 59.66 | |
| E. | μ Capricorni | 22 01.67 | — 0.19 | — 0.03 | 0.00 | 0.00 | 22 01.45 | 20 01.69 | | 59.76 | |
| E. | ϵ Delphini | 29 07.70 | — 0.10 | — 0.04 | 0.00 | 0.00 | 29 07.56 | 27 07.65 | | 59.91 | |
| E. | Groombr. 3241 | 32 33.65 | + 0.35 | — 0.06 | 0.00 | 0.00 | 32 33.94 | 30 33.98 | | 59.96 | |
| E. | α Cygni | 39 05.44 | + 0.02 | 0.00 | 0.00 | 0.00 | 39 05.46 | 37 05.74 | | 59.72 | |
| E. | μ Aquarii | 47 46.92 | — 0.16 | — 0.01 | 0.00 | 0.00 | 47 43.75 | 45 46.99 | | 59.76 | |
| E. | 61 Cygni | 21 03 11.70 | — 0.01 | — 0.04 | 0.00 | 0.00 | 21 53 11.65 | 21 01 11.75 | | — 1 59.90 | |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -1.70 + 11.00 \delta t - 2.04 a \\
 0 &= +3.27 - 2.04 \delta t + 14.81 a \quad a = -0^s.205 \\
 &\text{Adopted } c = 0^s.00.
 \end{aligned}$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, SEPTEMBER 30, 1872.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|-------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | ζ Aquilæ..... | 19 01 35.22 | — 0.07 | — 0.07 | 0.00 | 19 01 35.08 | 18 59 32.84 | — 2 02.24 |
| W. | δ Sagittarii..... | 12 12.94 | — 0.14 | — 0.04 | 0.00 | 12 12.76 | 19 10 10.23 | 02.53 |
| W. | δ Draconis..... | 15 33.70 | + 0.18 | — 0.14 | 0.00 | 15 33.74 | 13 31.51 | 02.23 |
| W. | τ Draconis..... | 20 02.18 | + 0.29 | — 0.15 | 0.00 | 20 02.32 | 18 00.04 | 02.28 |
| W. | κ Aquilæ..... | 32 04.44 | — 0.12 | — 0.05 | 0.00 | 32 04.27 | 30 01.93 | 02.34 |
| E. | γ Aquilæ..... | 42 14.56 | — 0.08 | — 0.02 | 0.00 | 42 14.46 | 40 11.99 | 02.47 |
| E. | α Aquilæ..... | 46 36.48 | — 0.08 | — 0.02 | 0.00 | 46 36.38 | 44 33.87 | 02.51 |
| E. | ε Draconis..... | 49 38.66 | + 0.22 | — 0.05 | 0.00 | 49 38.83 | 47 36.33 | 02.50 |
| E. | τ Aquilæ..... | 50 57.50 | — 0.09 | — 0.02 | 0.00 | 50 57.39 | 48 54.89 | 02.50 |
| E. | κ Cephei..... | 20 15 12.40 | + 0.43 | — 0.10 | 0.00 | 20 15 12.73 | 20 13 10.17 | 02.56 |
| W. | α Cephei..... | 17 35.64 | + 0.12 | — 0.06 | 0.00 | 17 35.70 | 15 33.22 | 02.48 |
| W. | β Aquarii..... | 21 27 53.86 | — 0.11 | — 0.04 | 0.00 | 21 27 53.71 | 21 25 51.39 | 02.32 |
| W. | ξ Aquarii..... | 33 00.96 | — 0.12 | — 0.04 | 0.00 | 33 00.80 | 31 58.45 | 02.35 |
| W. | 11 Cephei..... | 42 07.06 | + 0.24 | — 0.15 | 0.00 | 42 07.15 | 40 04.82 | — 2 02.33 |

NORMAL EQUATIONS.

$$0 = -0.63 + 14.00 \delta t - 4.16 a$$

$$0 = +3.16 - 4.16 \delta t + 20.61 a \quad a = -0^s.157$$

$$\text{Adopted } c = 0^s.00.$$

SALT LAKE CITY, UTAH, OCTOBER 2, 1872.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|--------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | κ Aquilæ..... | 19 32 07.96 | — 0.09 | — 0.05 | 0.00 | 19 32 07.82 | 19 30 01.90 | — 2 05.92 |
| E. | γ Aquilæ..... | 42 17.98 | — 0.06 | — 0.03 | 0.00 | 42 17.89 | 40 11.96 | 05.93 |
| E. | α Aquilæ..... | 46 39.94 | — 0.06 | — 0.03 | 0.00 | 46 39.85 | 44 33.84 | 06.01 |
| E. | ε Draconis..... | 50 42.10 | + 0.16 | — 0.07 | 0.00 | 50 42.19 | 48 36.20 | 05.99 |
| W. | τ Aquilæ..... | 20 00 00.81 | — 0.06 | — 0.03 | 0.00 | 20 00 00.69 | 19 57 54.85 | 05.84 |
| W. | κ Cephei..... | 15 15.74 | + 0.31 | — 0.25 | 0.00 | 15 15.80 | 20 13 09.96 | 05.84 |
| W. | π Capricorni..... | 22 07.52 | — 0.10 | — 0.04 | 0.00 | 22 07.38 | 20 01.63 | 05.75 |
| W. | ε Delphini..... | 29 13.50 | — 0.06 | — 0.04 | 0.00 | 29 13.40 | 27 07.59 | 05.81 |
| W. | Groombr. 3241..... | 32 39.56 | + 0.19 | — 0.11 | 0.00 | 32 39.64 | 30 33.71 | 05.93 |
| E. | ξ Aquarii..... | 21 33 04.66 | — 0.09 | — 0.02 | 0.00 | 21 33 04.55 | 21 31 58.43 | 06.12 |
| E. | ε Pegasi..... | 40 02.28 | — 0.03 | — 0.02 | 0.00 | 40 02.20 | 37 56.09 | 06.11 |
| E. | 79 Draconis..... | 53 25.03 | + 0.21 | — 0.12 | 0.00 | 53 25.17 | 51 19.10 | 06.07 |
| E. | α Aquarii..... | 22 01 20.98 | — 0.03 | — 0.04 | 0.00 | 22 01 20.86 | 21 59 14.81 | — 2 06.05 |

NORMAL EQUATIONS.

$$0 = +0.46 + 13.00 \delta t - 1.90 a$$

$$0 = +2.13 - 1.90 \delta t + 19.45 a \quad a = -0^s.115$$

$$\text{Adopted } c = 0^s.00$$

The following tables show the corrections and rates of the chronometers used at Pioche and Salt Lake City:

CHRONOMETER AT PIOCHE.—NEGUS, No. 1491.

| Date. | Local sidereal time. | Correction of chronometer. | Adopted hourly rate. |
|----------|----------------------|----------------------------|----------------------|
| 1872. | <i>h.</i> | <i>h. m. s.</i> | <i>s.</i> |
| Sept. 25 | 22.0 | — 2 30 23.65 | — 0.032 |
| Sept. 27 | 22.2 | | — 0.038 |
| Sept. 28 | 22.7 | | — 0.029 |
| Sept. 30 | 22.7 | | — 0.021 |
| Oct. 2 | 23.0 | — 2 30 19.19 | |

CHRONOMETER AT SALT LAKE CITY.—NEGUS, No. 1511.

| Date. | Local sidereal time. | Correction of chronometer. | Adopted hourly rate. |
|----------|----------------------|----------------------------|----------------------|
| 1872. | <i>h.</i> | <i>h. m. s.</i> | <i>s.</i> |
| Sept. 25 | 20.4 | — 0 01 55.73 | + 0.062 |
| Sept. 27 | 20.4 | 01 53.69 | + 0.045 |
| Sept. 28 | 20.4 | 01 59.78 | + 0.050 |
| Sept. 30 | 19.8 | 02 02.40 | + 0.074 |
| Oct. 2 | 20.7 | — 0 02 05.95 | |

Final results of longitude.

| Signals sent from— | Recorded at— | Mean of signals sent and received. | Time-corrections. | Corrected time. | Difference of longitude. | Double-wave time. | Means. |
|---------------------|----------------|------------------------------------|-------------------|-----------------|--------------------------|-------------------|-----------------|
| September 25, 1872: | | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>s.</i> | <i>h. m. s.</i> |
| Salt Lake City { | Salt Lake City | 22 49 03.48 | — 0 01 55.88 | 22 47 07.60 | 0 10 10.37 | 0.09 | 0 10 10.415 |
| Salt Lake City { | Pioche | 1 07 20.86 | — 2 30 23.63 | 22 36 57.23 | | | |
| Pioche | Salt Lake City | 23 22 33.08 | — 0 01 55.91 | 23 20 37.17 | | | |
| Pioche | Pioche | 1 40 50.32 | — 2 30 23.61 | 23 10 26.71 | | | |
| September 27, 1872: | | | | | | | |
| Salt Lake City { | Salt Lake City | 23 25 09.82 | — 0 01 58.82 | 23 23 11.00 | 10.52 | 0.09 | 10.565 |
| Salt Lake City { | Pioche | 1 43 22.53 | — 2 30 22.05 | 23 13 00.48 | | | |
| Pioche | Salt Lake City | 23 43 20.75 | — 0 01 58.84 | 23 41 21.91 | | | |
| Pioche | Pioche | 2 01 33.35 | — 2 30 22.05 | 23 31 11.30 | | | |
| September 28, 1872: | | | | | | | |
| Salt Lake City { | Salt Lake City | 22 54 27.08 | — 0 01 59.90 | 22 52 27.18 | 10.33 | 0.12 | 10.390 |
| Salt Lake City { | Pioche | 1 12 38.48 | — 2 30 21.63 | 22 42 16.85 | | | |
| Pioche | Salt Lake City | 23 04 44.77 | — 0 01 59.91 | 23 02 44.86 | | | |
| Pioche | Pioche | 1 22 56.04 | — 2 30 21.63 | 22 52 34.41 | | | |
| September 30, 1872: | | | | | | | |
| Salt Lake City { | Salt Lake City | 22 44 29.41 | — 0 02 02.61 | 22 42 26.80 | 10.26 | 0.09 | 10.305 |
| Salt Lake City { | Pioche | 1 02 36.77 | — 2 30 20.23 | 22 32 16.54 | | | |
| Pioche | Salt Lake City | 23 01 15.54 | — 0 02 02.64 | 22 59 12.90 | | | |
| Pioche | Pioche | 1 19 22.77 | — 2 30 20.22 | 22 49 02.55 | | | |
| October 2, 1872: | | | | | | | |
| Salt Lake City { | Salt Lake City | 23 13 20.12 | — 0 02 06.13 | 23 11 13.99 | 10.04 | 0.15 | 0 10 10.115 |
| Salt Lake City { | Pioche | 1 31 23.14 | — 2 30 19.19 | 23 01 03.95 | | | |
| Pioche | Salt Lake City | 23 19 54.85 | — 0 02 06.14 | 23 17 48.71 | | | |
| Pioche | Pioche | 1 37 57.71 | — 2 30 19.19 | 23 07 38.52 | | | |

Pioche west of Salt Lake City $0^h 10^m 10^s.358 \pm 0^s.075$.

Observations and computations for latitude.

PIOCHE, NEVADA.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|-------------------------|-----------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|--------|------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1872. October 4. . . | | <i>t.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | ° ' " |
| | 7262 | 2.360 | 32.8 | 23.5 | | | | | |
| | 7275 | 1.418 | 24.0 | 32.0 | | 37 56 06.3 | - 0 38.1 | +0.4 | 37 55 28.6 |
| | 7727 | 9.405 | 33.7 | 23.5 | | | | | |
| | 7693 | 17.663 | 23.5 | 34.0 | | 49 50.9 | + 5 33.7 | -0.1 | 24.5 |
| | 7765 | 24.230 | 31.6 | 25.7 | | | | | |
| | 7777 | 8.451 | 24.0 | 32.8 | | 38 06 06.1 | -10 37.6 | -1.0 | 27.5 |
| | 7871 | 8.547 | 26.0 | 30.5 | | | | | |
| | 7856 | 22.063 | 29.0 | 27.7 | | 37 46 20.6 | + 9 06.0 | -1.1 | 25.5 |
| | 8059 | 21.940 | 22.0 | 35.2 | | | | | |
| | 8091 | 15.930 | 33.0 | 24.1 | | 59 31.2 | - 4 02.9 | -1.5 | 26.8 |
| | 8114 | 9.394 | 22.7 | 34.6 | | | | | |
| | 8091 | 15.930 | 33.0 | 24.1 | | 37 51 02.3 | - 4 24.1 | -1.4 | 26.8 |
| | 8195 | 20.434 | 23.3 | 23.8 | | | | | |
| | 8136 | 12.392 | 23.0 | 24.0 | | 38 00 49.4 | - 5 25.0 | +3.0 | 27.4 |
| | 8282 | 19.079 | 26.3 | 30.0 | | | | | |
| | 8227 | 14.338 | 30.1 | 26.3 | | 37 58 35.4 | - 3 11.6 | +0.0 | 23.8 |
| | 8268 | 5.086 | 26.3 | 30.5 | | | | | |
| | 8247 | 2.478 | 30.2 | 26.1 | | 57 12.5 | - 1 45.4 | -0.0 | 27.1 |
| | 60 | 16.746 | 29.5 | 27.8 | | | | | |
| | 120 | 11.579 | 26.7 | 30.8 | | 58 56.1 | - 3 28.8 | -0.8 | 26.5 |
| | 197 | 15.757 | 27.4 | 30.0 | | | | | |
| | 164 | 18.454 | 29.0 | 28.5 | | 53 36.3 | + 1 49.0 | -0.7 | 24.6 |
| | 255 | 13.663 | 31.0 | 26.0 | | | | | |
| | 223 | 10.184 | 25.0 | 31.8 | | 57 49.2 | - 2 20.6 | -0.6 | 28.0 |
| | 441 | 10.115 | 26.6 | 32.2 | | | | | |
| | 349 | 13.918 | 30.0 | 26.9 | | 52 52.3 | + 2 33.7 | -0.9 | 25.1 |
| | 508 | 18.983 | 28.0 | 31.2 | | | | | |
| | 469 | 16.419 | 27.8 | 31.0 | | 53 46.8 | + 1 43.6 | -2.2 | 23.2 |
| | 560 | 6.085 | 31.5 | 27.8 | | | | | |
| | 630 | 22.257 | 27.9 | 31.9 | | 44 28.5 | +10 53.3 | -0.1 | 21.7 |
| | 673 | 19.844 | 29.8 | 30.1 | | | | | |
| | 657 | 21.509 | 28.9 | 31.0 | | 54 17.1 | + 1 07.3 | -0.8 | 23.6 |
| | 857 | 16.927 | 28.1 | 30.3 | | | | | |
| | 707 | 18.600 | 31.1 | 28.7 | | 37 54 20.0 | + 1 07.6 | -0.3 | 27 3 |
| | 1043 | 21.089 | 28.9 | 30.8 | | | | | |
| | 1023 | 13.711 | 28.9 | 30.6 | | 38 00 25.9 | - 4 58.1 | -1.3 | 26.5 |
| October 5. . . | 6623 | 17.482 | 28.0 | 24.1 | | | | | |
| | 6602 | 13.380 | 27.0 | 24.6 | | 37 58 08.2 | - 2 45.8 | +2.2 | 24.6 |
| | 6697 | 18.140 | 23.0 | 28.9 | | | | | |
| | 6674 | 17.020 | 26.1 | 25.8 | | 56 13.7 | - 0 45.1 | -2.0 | 37 55 26.6 |

LATITUDE DETERMINATIONS.

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Observations and computations—Continued.

PIOCHE, NEVADA.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|-----------------------|-----------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|--------|------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1872. October 5... | | <i>t.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | ° ' " |
| | 6928 | 16.844 | 23.5 | 27.9 | | | | | |
| | 6912 | 8.103 | 23.8 | 28.0 | | 38 01 21.0 | — 5 53.2 | —3.0 | 37 55 24.8 |
| | 6928 | 16.844 | 23.5 | 27.9 | | | | | |
| | 6968 | 13.711 | 29.9 | 22.0 | | 37 57 30.8 | — 2 06.6 | +1.3 | 25.5 |
| | 7008 | 8.748 | 25.0 | 26.9 | | | | | |
| | 6997 | 19.305 | 25.1 | 26.0 | | 48 19.9 | + 7 06.6 | —1.0 | 25.5 |
| | 7008 | 8.748 | 25.0 | 26.9 | | | | | |
| | 7084 | 23.457 | 30.2 | 22.0 | | 45 30.2 | + 9 54.4 | +2.2 | 26.8 |
| | 7161 | 6.230 | 25.6 | 26.7 | | | | | |
| | 7194 | 22.586 | 28.1 | 24.0 | | 44 22.9 | +11 00.9 | +1.0 | 24.8 |
| | 7262 | 11.476 | 24.0 | 28.4 | | | | | |
| | 7275 | 10.453 | 33.8 | 18.7 | | 56 06.4 | — 0 41.3 | +3.8 | 28.9 |
| | 7336 | 11.900 | 26.9 | 26.0 | | | | | |
| | 7385 | 21.450 | 28.0 | 25.0 | | 48 57.5 | + 6 25.9 | +1.4 | 24.8 |
| | 7483 | 7.190 | 26.0 | 28.0 | | | | | |
| | 7410 | 12.704 | 27.0 | 26.0 | | 51 44.0 | + 3 42.8 | —0.4 | 26.4 |
| | 7545 | 6.167 | 31.8 | 23.0 | | | | | |
| | 7520 | 14.349 | 22.7 | 32.0 | | 49 57.2 | + 5 30.6 | —0.2 | 27.6 |
| | 7727 | 9.720 | 24.2 | 31.3 | | | | | |
| | 7693 | 18.010 | 31.2 | 24.0 | | 49 51.1 | + 5 35.0 | +0.0 | 26.1 |
| | 7871 | 7.619 | 21.4 | 31.2 | | | | | |
| | 7856 | 21.113 | 31.1 | 24.4 | | 37 46 20.8 | + 9 05.3 | —1.1 | 25.0 |
| | 8195 | 21.011 | 33.8 | 23.0 | | | | | |
| | 8136 | 13.046 | 19.5 | 36.8 | | 38 00 49.6 | — 5 21.8 | —2.3 | 25.5 |
| | 8268 | 6.685 | 28.0 | 29.0 | | | | | |
| | 8227 | 15.925 | 29.0 | 27.0 | | 37 49 13.1 | + 6 13.4 | +0.4 | 26.9 |
| | 8282 | 20.661 | 23.0 | 29.0 | | | | | |
| | 8227 | 15.926 | 29.0 | 27.0 | | 58 35.6 | — 3 11.3 | +0.4 | 24.7 |
| | 197 | 16.866 | 29.0 | 29.6 | | | | | |
| | 164 | 19.552 | 30.0 | 23.5 | | 53 36.5 | + 1 48.5 | +0.3 | 25.3 |
| | 255 | 16.684 | 31.5 | 26.6 | | | | | |
| | 223 | 13.171 | 26.9 | 31.0 | | 57 49.4 | — 2 22.0 | +0.3 | 27.7 |
| | 441 | 11.993 | 30.7 | 38.0 | | | | | |
| | 358 | 15.752 | 27.5 | 30.6 | | 52 10.4 | + 3 16.5 | —3.6 | 23.3 |
| | 508 | 12.569 | 31.2 | 26.9 | | | | | |
| | 469 | 15.013 | 26.0 | 32.0 | | 53 47.0 | + 1 38.7 | —0.6 | 25.1 |
| | 560 | 7.097 | 31.0 | 26.9 | | | | | |
| | 630 | 23.267 | 27.1 | 30.6 | | 44 28.7 | +10 58.5 | +0.2 | 37 55 27.4 |

Observations and computations—Continued.

PIOCHE, NEVADA.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|--------------|-----------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|--------|------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1872. | | <i>t.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | ° ' " |
| October 5... | 673 | 20.916 | 31.1 | 26.8 | | | | | |
| | 657 | 22.589 | 27.9 | 30.0 | | 37 54 17.2 | + 1 07.6 | +0.8 | 37 55 25.6 |
| | 857 | 17.903 | 24.0 | 35.0 | | | | | |
| | 825 | 20.574 | 35.0 | 23.6 | | 59 02.0 | - 3 35.3 | +0.1 | 26.8 |
| | 1062 | 13.719 | 28.0 | 30.0 | | | | | |
| | 1096 | 13.698 | 32.1 | 25.7 | | 37 55 26.5 | - 0 00.8 | +1.4 | 27.1 |
| | 1282 | 14.259 | 27.0 | 31.0 | | | | | |
| | 1262 | 6.671 | 31.3 | 27.0 | | 38 00 34.1 | - 5 06.6 | +0.1 | 27.6 |
| | 1424 | 15.667 | 32.2 | 26.0 | | | | | |
| | 1429 | 12.072 | 26.0 | 32.1 | | 37 57 53.1 | - 2 25.2 | 0.0 | 27.9 |
| October 6... | 1477 | 19.064 | 32.2 | 26.0 | | | | | |
| | 1497 | 3.360 | 29.7 | 28.9 | | 38 05 57.8 | -10 34.4 | +2.8 | 26.2 |
| | 1546 | 12.988 | 30.5 | 27.8 | | | | | |
| | 1526 | 17.720 | 27.7 | 30.6 | | 37 52 17.4 | + 3 11.3 | -0.1 | 23.6 |
| | 6623 | 15.069 | 29.7 | 16.3 | | | | | |
| | 6602 | 10.986 | 19.1 | 26.6 | | 37 58 08.3 | - 2 45.0 | +2.1 | 25.4 |
| | 6739 | 6.765 | 25.9 | 19.9 | | | | | |
| | 6712 | 16.179 | 25.0 | 21.0 | | 38 01 43.5 | - 6 20.4 | +3.5 | 26.6 |
| | 6928 | 15.983 | 23.2 | 22.9 | | | | | |
| | 6912 | 7.186 | 23.1 | 23.0 | | 38 01 21.0 | - 5 55.5 | +0.1 | 25.6 |
| | 6928 | 15.983 | 23.2 | 22.9 | | | | | |
| | 6968 | 12.751 | 25.8 | 21.0 | | 37 57 30.9 | - 2 10.6 | +1.8 | 22.1 |
| | 7161 | 5.120 | 21.0 | 26.8 | | | | | |
| | 7194 | 21.404 | 28.5 | 19.9 | | 44 23.0 | +10 58.0 | +1.0 | 22.0 |
| | 7336 | 10.257 | 24.9 | 23.9 | | | | | |
| | 7385 | 19.791 | 25.1 | 23.5 | | 48 57.6 | + 6 25.3 | +0.9 | 23.8 |
| | 7468 | 1.460 | 26.0 | 22.9 | | | | | |
| | 7410 | 9.217 | 24.7 | 24.0 | | 50 10.2 | + 5 13.5 | +1.3 | 25.0 |
| | 7560 | 6.724 | 25.0 | 23.9 | | | | | |
| | 7571 | 14.394 | 25.2 | 24.0 | | 50 14.4 | + 5 09.9 | +0.8 | 25.1 |
| | 7560 | 6.724 | 25.0 | 23.9 | | | | | |
| | 7584 | 14.394 | 25.2 | 24.0 | | 48 19.8 | + 7 03.3 | +0.9 | 24.0 |
| | 7727 | 7.315 | 25.7 | 24.0 | | | | | |
| | 7693 | 15.567 | 22.3 | 21.8 | | 49 51.2 | + 5 33.5 | +0.7 | 25.4 |
| | 7871 | 7.707 | 23.9 | 26.0 | | | | | |
| | 7856 | 21.160 | 27.5 | 22.6 | | 46 21.0 | + 9 03.6 | +1.0 | 25.6 |
| | 8059 | 20.544 | 24.1 | 27.4 | | | | | |
| | 8091 | 14.512 | 28.6 | 23.0 | | 37 59 31.1 | - 4 03.8 | +0.8 | 37 55 28.1 |

LATITUDE DETERMINATIONS.

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Observations and computations—Continued.

PIOCHE, NEVADA.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|-----------------------|-----------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|--------|------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1872. October 6... | | <i>t.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | ° ' " |
| | 8114 | 7.949 | 24.0 | 27.2 | | | | | |
| | 8097 | 6.617 | 28.6 | 23.0 | | 37 56 19.3 | — 0 53.8 | +0.8 | 37 55 26.3 |
| | 8195 | 19.733 | 25.4 | 26.2 | | | | | |
| | 8136 | 11.717 | 26.2 | 24.8 | | 38 00 49.8 | — 5 23.9 | +0.2 | 26.1 |
| | 8282 | 18.840 | 27.2 | 24.1 | | | | | |
| | 8227 | 14.143 | 23.2 | 27.0 | | 37 58 35.8 | — 3 09.8 | —0.3 | 25.7 |
| | 60 | 16.040 | 26.0 | 26.9 | | | | | |
| | 120 | 10.841 | 26.9 | 26.0 | | 58 56.5 | — 3 30.1 | 0.0 | 26.4 |
| | 255 | 13.675 | 31.9 | 22.1 | | | | | |
| | 223 | 10.116 | 25.9 | 27.0 | | 57 49.6 | — 2 23.8 | +3.1 | 28.9 |
| | 508 | 10.224 | 29.0 | 26.9 | | | | | |
| | 469 | 12.700 | 25.9 | 30.2 | | 53 47.3 | + 1 40.1 | —0.8 | 26.6 |
| | 560 | 5.258 | 29.2 | 26.7 | | | | | |
| | 630 | 21.893 | 26.9 | 27.4 | | 44 29.0 | +10 52.0 | +0.7 | 21.7 |
| | 673 | 19.033 | 28.9 | 26.6 | | | | | |
| | 657 | 20.692 | 27.2 | 27.1 | | 54 17.3 | + 1 07.0 | +0.8 | 25.1 |
| | 857 | 14.814 | 29.1 | 26.0 | | | | | |
| | 825 | 9.457 | 25.0 | 30.0 | | 59 02.2 | — 3 36.5 | —0.7 | 25.0 |
| | 962 | 5.859 | 32.3 | 23.4 | | | | | |
| | 980 | 19.899 | 23.9 | 32.0 | | 37 45 58.1 | + 9 27.4 | +0.3 | 25.8 |
| | 1043 | 18.394 | 31.0 | 25.1 | | | | | |
| | 1023 | 10.948 | 25.0 | 31.2 | | 38 00 26.2 | — 5 00.9 | —0.1 | 25.2 |
| | 1062 | 13.089 | 30.0 | 26.2 | | | | | |
| | 1096 | 13.061 | 26.0 | 30.1 | | 37 55 26.7 | — 0 01.1 | —0.1 | 25.5 |
| | 1282 | 13.843 | 30.0 | 27.9 | | | | | |
| | 1262 | 6.247 | 26.7 | 31.0 | | 38 00 34.2 | — 5 07.0 | —0.8 | 26.4 |
| | 1282 | 13.843 | 30.0 | 27.9 | | | | | |
| | 1326 | 15.665 | 27.0 | 30.9 | | 37 54 14.9 | + 1 13.6 | —0.6 | 27.9 |
| | 1424 | 10.519 | 26.0 | 31.9 | | | | | |
| | 1449 | 6.933 | 31.0 | 26.0 | | 37 57 53.2 | — 2 24.9 | —0.3 | 28.0 |
| | 1477 | 17.950 | 30.1 | 26.9 | | | | | |
| | 1497 | 2.263 | 26.0 | 30.6 | | 38 05 57.8 | —10 33.9 | —0.5 | 23.4 |
| | 1546 | 9.562 | 33.4 | 23.1 | | | | | |
| | 1526 | 14.280 | 25.0 | 31.8 | | 37 52 17.5 | + 3 10.7 | +1.3 | 29.5 |
| | 1547 | 11.842 | 33.4 | 23.1 | | | | | |
| | 1526 | 14.280 | 25.0 | 31.8 | | 53 47.2 | + 1 38.5 | +1.3 | 27.0 |
| October 7... | 6623 | 12.838 | 23.8 | 20.1 | | | | | |
| | 6602 | 8.763 | 20.2 | 23.2 | | 37 58 08.3 | — 2 44.4 | +0.3 | 37 55 24.2 |

Observations and computations—Continued.

PIOCHE, NEVADA.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|-----------------------|-----------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|--------|------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1872. October 7... | | <i>t.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | ° ' " |
| | 6697 | 16.157 | 26.4 | 17.6 | | 37 56 13.8 | — 0 45.9 | —0.4 | 37 55 27.5 |
| | 6674 | 15.020 | 16.8 | 26.9 | | | | | |
| | 6928 | 15.874 | 22.0 | 22.0 | | 38 01 21.0 | — 5 56.2 | —0.1 | 24.7 |
| | 6912 | 7.058 | 21.8 | 22.1 | | | | | |
| | 6928 | 15.874 | 22.0 | 22.0 | | 37 57 30.9 | — 2 04.6 | —1.4 | 24.9 |
| | 6968 | 12.790 | 20.4 | 24.4 | | | | | |
| | 7262 | 12.763 | 22.1 | 23.9 | | 56 06.6 | — 0 40.6 | —0.6 | 25.4 |
| | 7275 | 11.758 | 23.0 | 22.7 | | | | | |
| | 7336 | 7.937 | 24.8 | 21.2 | | 48 57.7 | + 6 27.1 | —1.0 | 23.8 |
| | 7385 | 17.516 | 20.0 | 26.4 | | | | | |
| | 7468 | 0.902 | 19.0 | 28.4 | | 50 10.4 | + 5 23.0 | —5.7 | 27.7 |
| | 7410 | 8.896 | 20.0 | 26.9 | | | | | |
| | 7468 | 0.902 | 19.0 | 28.4 | | 42 59.4 | +12 30.6 | —1.2 | 28.8 |
| | 7474 | 19.476 | 27.0 | 21.0 | | | | | |
| | 7545 | 6.662 | 20.0 | 27.9 | | 49 57.4 | + 5 33.2 | —2.2 | 28.4 |
| | 7520 | 14.907 | 24.6 | 23.0 | | | | | |
| | 7560 | 4.698 | 27.9 | 20.0 | | 48 19.9 | + 7 11.0 | —2.4 | 28.5 |
| | 7584 | 15.363 | 16.6 | 31.2 | | | | | |
| | 7727 | 8.667 | 31.8 | 17.6 | | 37 49 51.4 | + 5 35.0 | +1.2 | 27.6 |
| | 7693 | 16.957 | 19.1 | 29.9 | | | | | |
| | 7765 | 19.106 | 27.4 | 21.4 | | 38 06 06.2 | —10 37.6 | —1.0 | 27.6 |
| | 7777 | 3.329 | 20.0 | 28.8 | | | | | |
| | 8059 | 20.977 | 25.8 | 23.0 | | 37 59 31.2 | — 4 00.1 | —3.5 | 27.6 |
| | 8091 | 15.034 | 18.1 | 30.9 | | | | | |
| | 8059 | 20.977 | 25.8 | 23.0 | | 38 04 48.4 | — 9 18.3 | —3.5 | 26.6 |
| | 8097 | 7.162 | 18.1 | 30.9 | | | | | |
| | 8263 | 7.617 | 24.3 | 25.8 | | 37 49 13.5 | + 6 14.1 | —1.5 | 26.1 |
| | 8227 | 16.875 | 23.3 | 26.2 | | | | | |
| | 8282 | 21.516 | 24.0 | 26.0 | | 38 06 35.6 | —11 06.0 | —2.1 | 27.5 |
| | 8247 | 5.030 | 23.0 | 27.0 | | | | | |
| | 60 | 14.714 | 24.0 | 27.8 | | 37 58 57.0 | — 3 28.7 | —2.8 | 25.5 |
| | 120 | 9.549 | 24.0 | 27.7 | | | | | |
| | 197 | 8.648 | 20.8 | 31.2 | | 53 37.9 | + 1 51.3 | —2.9 | 26.3 |
| | 164 | 11.403 | 27.0 | 24.8 | | | | | |
| | 255 | 11.80 | 18.0 | 35.0 | | 57 49.8 | — 2 17.8 | —4.8 | 27.2 |
| | 223 | 8.39 | 27.6 | 24.3 | | | | | |
| | 560 | 3.582 | 27.1 | 27.0 | | 37 44 29.2 | +10 54.2 | +1.5 | 37 55 24.9 |
| | 630 | 19.771 | 29.5 | 25.2 | | | | | |

LATITUDE DETERMINATIONS.

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Observations and computations—Continued.

PIOCHE, NEVADA.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|----------------------|-----------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|--------|------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1872. October 7.. | | <i>t.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | ° ' " |
| | 673 | 17.417 | 27.8 | 27.0 | | | | | |
| | 657 | 19.090 | 29.4 | 25.3 | | 37 54 17.6 | + 1 07.6 | +1.7 | 37 55 26.9 |
| | 690 | 13.580 | 31.0 | 23.9 | | | | | |
| | 769 | 18.942 | 31.2 | 26.6 | | 37 51 46.6 | + 3 36.7 | +4.2 | 27.5 |
| | 858 | 18.644 | 26.0 | 29.0 | | | | | |
| | 825 | 11.050 | 30.7 | 24.3 | | 38 00 34.4 | — 5 06.9 | +1.2 | 28.7 |
| | 1043 | 16.329 | 29.0 | 26.0 | | | | | |
| | 872 | 3.241 | 27.0 | 27.9 | | 33 04 15.6 | — 8 48.9 | +0.7 | 27.4 |
| | 1043 | 16.329 | 29.0 | 26.0 | | | | | |
| | 980 | 17.837 | 28.5 | 26.3 | | 37 54 23.3 | + 1 00.9 | +2.0 | 26.2 |
| | 1043 | 16.329 | 29.0 | 26.0 | | | | | |
| | 1023 | 8.853 | 27.0 | 28.0 | | 38 00 26.4 | — 5 02.1 | +0.7 | 25.0 |
| | 1062 | 11.796 | 28.0 | 27.0 | | | | | |
| | 1096 | 11.784 | 29.0 | 25.5 | | 37 55 26.8 | — 0 00.5 | +1.6 | 27.9 |
| | 1139 | 7.640 | 32.0 | 22.0 | | | | | |
| | 1132 | 12.894 | 26.0 | 28.0 | | 37 51 52.3 | + 3 32.3 | +2.8 | 27.4 |
| | 1282 | 14.741 | 34.0 | 21.0 | | | | | |
| | 1262 | 7.030 | 25.0 | 30.0 | | 38 00 34.4 | — 5 11.5 | +2.8 | 25.7 |
| | 1424 | 12.645 | 27.0 | 28.5 | | | | | |
| | 1649 | 8.991 | 30.7 | 25.0 | | 37 57 53.3 | — 2 27.7 | +1.5 | 27.1 |
| | 1477 | 18.312 | 26.0 | 29.0 | | | | | |
| | 1497 | 2.600 | 33.2 | 21.9 | | 38 05 57.9 | —10 34.9 | +2.9 | 25.9 |
| | 1546 | 7.878 | 27.4 | 28.0 | | | | | |
| | 1526 | 12.582 | 30.7 | 25.0 | | 37 52 17.6 | + 3 10.1 | +1.8 | 29.5 |
| | 1547 | 10.155 | 27.4 | 28.0 | | | | | |
| | 1526 | 12.582 | 30.7 | 25.0 | | 53 47.3 | + 1 38.1 | +1.8 | 27.2 |
| | 1567 | 6.195 | 27.2 | 27.9 | | | | | |
| | 1620 | 13.707 | 32.6 | 23.8 | | 50 21.1 | + 5 03.6 | +2.8 | 27.5 |
| October 10.. | 6697 | 15.531 | 25.0 | 29.1 | | | | | |
| | 6674 | 14.350 | 27.0 | 27.0 | | 37 56 13.8 | — 0 47.7 | —1.4 | 24.7 |
| | 6712 | 15.446 | 28.9 | 25.0 | | | | | |
| | 6739 | 5.959 | 31.7 | 22.0 | | 38 01 43.5 | — 6 23.4 | +4.8 | 24.9 |
| | 6928 | 15.483 | 31.6 | 22.0 | | | | | |
| | 6912 | 6.607 | 23.8 | 30.0 | | 38 01 21.2 | — 5 58.7 | +1.2 | 23.7 |
| | 6928 | 15.483 | 31.6 | 22.0 | | | | | |
| | 6968 | 12.361 | 23.5 | 30.5 | | 37 57 31.2 | — 2 06.2 | +0.9 | 25.9 |
| | 7008 | 2.763 | 24.0 | 29.5 | | | | | |
| | 6997 | 13.361 | 27.0 | 26.5 | | 37 48 20.2 | + 7 08.3 | —1.7 | 37 55 26.8 |

Observations and computations—Continued.

PIOCHE, NEVADA.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|---------------------|-----------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|--------|------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1872. October 10 | | <i>t.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | ° ' " |
| | 7119 | 19.801 | 37.6 | 16.5 | | | | | |
| | 7103 | 0.772 | 21.0 | 33.0 | | 38 08 11.1 | —12 49.0 | +3.2 | 37 55 25.3 |
| | 7161 | 3.982 | 28.0 | 26.0 | | | | | |
| | 7194 | 20.375 | 27.0 | 27.0 | | 37 44 23.4 | +11 02.4 | +0.7 | 26.5 |
| | 7262 | 11.924 | 26.7 | 27.6 | | | | | |
| | 7275 | 11.007 | 26.6 | 27.5 | | 56 06.9 | — 0 37.1 | —0.6 | 29.2 |
| | 7336 | 6.251 | 29.0 | 25.0 | | | | | |
| | 7385 | 15.788 | 24.4 | 31.0 | | 48 58.1 | + 6 25.4 | —0.9 | 22.6 |
| | 7468 | 0.662 | 30.5 | 27.0 | | | | | |
| | 7410 | 8.449 | 27.0 | 29.0 | | 50 10.7 | + 5 14.7 | +0.6 | 26.0 |
| | 7468 | 0.662 | 30.5 | 27.0 | | | | | |
| | 7474 | 19.073 | 27.0 | 29.0 | | 42 59.7 | +12 23.8 | +0.6 | 24.1 |
| | 7545 | 6.930 | 34.0 | 23.0 | | | | | |
| | 7520 | 15.056 | 24.7 | 32.5 | | 49 57.8 | + 5 28.4 | +1.1 | 27.3 |
| | 7560 | 7.858 | 30.5 | 26.9 | | | | | |
| | 7571 | 15.542 | 30.0 | 27.1 | | 50 15.0 | + 5 10.5 | +2.3 | 27.8 |
| | 7560 | 7.858 | 30.5 | 26.9 | | | | | |
| | 7584 | 18.363 | 30.0 | 27.3 | | 48 20.3 | + 7 04.5 | +2.2 | 27.0 |
| | 7727 | 6.773 | 30.9 | 20.0 | | | | | |
| | 7693 | 15.031 | 27.0 | 31.7 | | 37 49 52.1 | + 5 33.7 | +2.2 | 28.0 |
| | 7765 | 17.978 | 29.7 | 28.3 | | | | | |
| | 7777 | 2.132 | 28.0 | 29.6 | | 38 06 07.1 | —10 40.3 | —0.1 | 26.7 |
| | 7871 | 5.371 | 32.0 | 26.3 | | | | | |
| | 7856 | 18.781 | 27.5 | 31.0 | | 37 46 21.6 | + 9 01.9 | +0.8 | 24.3 |
| | 8059 | 19.702 | 29.9 | 29.9 | | | | | |
| | 8091 | 13.691 | 28.6 | 31.0 | | 59 32.0 | — 4 02.9 | —0.8 | 28.3 |
| | 8114 | 7.121 | 30.9 | 29.0 | | | | | |
| | 8097 | 5.167 | 28.6 | 31.0 | | 56 20.0 | — 0 54.7 | —0.2 | 25.1 |
| | 8268 | 4.311 | 24.0 | 35.4 | | | | | |
| | 8227 | 13.542 | 32.5 | 27.0 | | 37 49 14.1 | + 6 13.0 | —2.1 | 25.0 |
| | 8282 | 18.269 | 24.0 | 25.3 | | | | | |
| | 8247 | 1.707 | 32.9 | 26.9 | | 38 06 36.2 | —11 09.3 | +1.7 | 28.6 |
| | 60 | 13.653 | 29.9 | 28.8 | | | | | |
| | 120 | 8.380 | 23.9 | 31.5 | | 37 58 57.2 | — 3 33.1 | —1.3 | 22.8 |
| | 197 | 10.325 | 29.1 | 30.0 | | | | | |
| | 164 | 12.999 | 29.0 | 29.9 | | 53 37.3 | + 1 48.1 | —0.6 | 24.8 |
| | 255 | 12.311 | 32.5 | 27.5 | | | | | |
| | 223 | 8.742 | 28.4 | 31.0 | | 37 57 50.5 | — 2 24.2 | +0.8 | 37 55 27.1 |

LATITUDE DETERMINATIONS.

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Observations and computations—Continued.

PIOCHE, NEVADA.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|-----------------------|-----------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|--------|------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1872. October 10.. | | <i>t.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | ° ' " |
| | 508 | 9.596 | 36.3 | 24.0 | | | | | |
| | 469 | 12.424 | 24.8 | 35.5 | | 37 53 48.1 | + 1 38.1 | +0.6 | 37 55 26.8 |
| | 560 | 3.796 | 29.9 | 30.8 | | | | | |
| | 630 | 19.988 | 31.6 | 29.8 | | 44 29.8 | +10 54.3 | +0.3 | 24.4 |
| | 673 | 17.621 | 28.0 | 33.8 | | | | | |
| | 657 | 19.307 | 31.8 | 29.7 | | 54 17.9 | + 1 08.1 | -1.3 | 24.7 |
| | 690 | 14.150 | 31.8 | 30.0 | | | | | |
| | 707 | 18.504 | 30.8 | 31.2 | | 52 27.1 | + 2 55.9 | +0.5 | 23.5 |
| | 857 | 15.832 | 33.3 | 30.6 | | | | | |
| | 769 | 18.484 | 29.5 | 33.2 | | 37 53 41.1 | + 1 47.2 | -0.4 | 27.9 |
| | 858 | 18.110 | 33.3 | 30.6 | | | | | |
| | 825 | 10.514 | 29.9 | 34.2 | | 38 00 35.0 | - 5 07.0 | -0.6 | 27.4 |
| | 962 | 4.381 | 29.3 | 35.0 | | | | | |
| | 872 | 3.847 | 33.8 | 30.0 | | 37 55 50.7 | - 0 21.6 | -0.7 | 28.4 |
| | 962 | 4.381 | 29.3 | 35.0 | | | | | |
| | 980 | 18.451 | 34.9 | 29.8 | | 37 45 58.9 | + 9 28.6 | -0.2 | 27.3 |
| | 1043 | 16.923 | 29.5 | 35.0 | | | | | |
| | 1023 | 9.432 | 33.9 | 30.5 | | 38 00 27.0 | - 5 02.7 | -0.7 | 23.6 |
| | 1062 | 12.059 | 34.3 | 30.0 | | | | | |
| | 1096 | 12.010 | 29.7 | 34.7 | | 37 55 27.3 | - 0 02.0 | -0.3 | 25.0 |
| | 1139 | 7.862 | 30.5 | 33.5 | | | | | |
| | 1132 | 13.192 | 34.5 | 29.5 | | 51 52.8 | + 3 35.4 | +0.7 | 28.9 |
| | 1282 | 13.532 | 29.5 | 34.5 | | | | | |
| | 1326 | 15.370 | 32.0 | 31.5 | | 37 54 15.4 | + 1 14.3 | -1.6 | 28.1 |
| | 1477 | 18.391 | 33.7 | 29.2 | | | | | |
| | 1497 | 2.740 | 26.0 | 37.0 | | 38 05 58.2 | -10 32.5 | -2.3 | 23.4 |
| | 1546 | 10.351 | 26.4 | 37.0 | | | | | |
| | 1526 | 15.006 | 35.0 | 28.0 | | 37 52 17.8 | + 3 08.1 | -1.3 | 24.6 |
| | 1547 | 12.540 | 26.4 | 37.0 | | | | | |
| | 1526 | 15.006 | 35.0 | 28.0 | | 53 47.5 | + 1 39.7 | -1.3 | 25.9 |
| | 1567 | 5.935 | 32.5 | 30.9 | | | | | |
| | 1620 | 13.499 | 31.8 | 31.8 | | 50 21.4 | + 5 05.7 | +0.6 | 27.7 |
| October 11.. | 6697 | 14.238 | 33.5 | 21.1 | | | | | |
| | 6674 | 13.049 | 21.8 | 33.0 | | 56 13.8 | - 0 48.0 | +0.4 | 26.2 |
| | 6697 | 14.238 | 33.5 | 21.1 | | | | | |
| | 6676 | 8.620 | 21.5 | 33.3 | | 37 59 11.5 | - 3 47.0 | +0.2 | 24.7 |
| | 6712 | 14.062 | 28.6 | 26.0 | | | | | |
| | 6739 | 4.681 | 29.0 | 25.5 | | 38 01 43.5 | - 6 19.1 | +2.1 | 37 55 26.5 |

Observations and computations—Continued.

PIOCHE, NEVADA.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|-----------------------|-----------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|--------|------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1872. October 11.. | | <i>t.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | ° ' " |
| | 6928 | 15.776 | 29.6 | 26.0 | | | | | |
| | 6912 | 6.941 | 26.0 | 29.0 | | 38 01 21.2 | — 5 57.0 | +0.2 | 37 55 24.4 |
| | 6923 | 15.776 | 29.6 | 26.0 | | | | | |
| | 6968 | 12.683 | 25.9 | 30.5 | | 37 57 31.2 | — 2 05.0 | —0.4 | 25.8 |
| | 7008 | 4.384 | 29.0 | 28.0 | | | | | |
| | 6997 | 14.937 | 28.0 | 28.7 | | 48 20.2 | + 7 06.5 | +0.1 | 26.8 |
| | 7008 | 4.384 | 29.0 | 28.0 | | | | | |
| | 7084 | 19.113 | 28.9 | 29.0 | | 37 45 30.6 | + 9 55.2 | +0.3 | 26.1 |
| | 7119 | 20.952 | 30.0 | 28.0 | | | | | |
| | 7103 | 2.055 | 24.8 | 32.8 | | 38 08 11.2 | —12 43.6 | —2.1 | 25.5 |
| | 7161 | 3.680 | 31.9 | 26.0 | | | | | |
| | 7194 | 20.144 | 25.3 | 33.0 | | 37 44 23.5 | +11 05.3 | —0.6 | 28.2 |
| | 7262 | 11.462 | 30.8 | 28.0 | | | | | |
| | 7275 | 10.476 | 28.0 | 30.7 | | 56 07.0 | — 0 39.8 | +0.0 | 27.2 |
| | 7468 | 0.625 | 30.5 | 30.0 | | | | | |
| | 7410 | 8.432 | 28.0 | 31.9 | | 50 10.9 | + 5 15.5 | —1.2 | 25.2 |
| | 7483 | 2.912 | 30.9 | 29.7 | | | | | |
| | 7474 | 19.030 | 29.4 | 30.7 | | 44 33.8 | +10 51.3 | —0.0 | 25.1 |
| | 7545 | 5.715 | 29.3 | 31.4 | | | | | |
| | 7520 | 13.887 | 31.7 | 28.7 | | 49 58.0 | + 5 20.2 | +0.3 | 28.5 |
| | 7560 | 8.269 | 32.3 | 27.9 | | | | | |
| | 7584 | 19.780 | 26.6 | 33.5 | | 48 20.5 | + 7 45.2 | —0.9 | 24.8 |
| | 7693 | 14.011 | 32.1 | 28.2 | | | | | |
| | 7727 | 5.758 | 30.5 | 30.1 | | 37 49 52.3 | + 5 33.5 | +1.5 | 27.3 |
| | 7765 | 18.827 | 33.7 | 27.0 | | | | | |
| | 7777 | 2.872 | 29.0 | 31.5 | | 38 06 07.2 | —10 44.7 | +1.5 | 24.0 |
| | 7871 | 3.763 | 32.2 | 28.9 | | | | | |
| | 7856 | 17.218 | 29.6 | 31.4 | | 37 46 21.8 | + 9 03.7 | +0.6 | 26.1 |
| | 8059 | 20.841 | 34.8 | 28.0 | | | | | |
| | 8091 | 14.780 | 29.4 | 32.7 | | 59 32.0 | — 4 04.9 | +1.3 | 28.4 |
| | 8114 | 8.312 | 37.0 | 25.5 | | | | | |
| | 8097 | 6.910 | 20.4 | 32.7 | | 56 20.1 | — 0 56.7 | +0.3 | 23.7 |
| | 8268 | 5.121 | 26.3 | 37.0 | | | | | |
| | 8227 | 14.354 | 33.5 | 29.1 | | 37 49 14.2 | + 6 13.1 | —2.2 | 25.1 |
| | 8282 | 19.028 | 26.0 | 36.2 | | | | | |
| | 8247 | 2.445 | 33.4 | 29.2 | | 38 06 36.3 | —11 10.0 | —2.1 | 24.2 |
| | 8322 | 15.424 | 37.5 | 25.7 | | | | | |
| | 8301 | 6.980 | 25.8 | 37.2 | | 01 04.3 | — 5 41.2 | +0.1 | 37 55 23.2 |

LATITUDE DETERMINATIONS.

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Observations and computations—Continued.

PIOCHE, NEVADA.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|-----------------------|-----------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|--------|------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1872. October 11.. | | <i>t.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | ° ' " |
| | 8330 | 17.569 | 37.6 | 25.5 | | | | | |
| | 8301 | 6.980 | 25.8 | 37.2 | | 38 02 32.2 | — 7 07.9 | +0.3 | 37 55 24.6 |
| | 7 | 14.414 | 31.7 | 31.3 | | | | | |
| | 8 | 9.712 | 28.0 | 35.2 | | 37 58 39.3 | — 3 10.0 | —2.4 | 26.9 |
| | 60 | 13.633 | 29.6 | 33.8 | | | | | |
| | 120 | 8.387 | 33.6 | 30.6 | | 58 57.7 | — 3 32.0 | —0.4 | 25.3 |
| | 197 | 8.734 | 26.4 | 38.2 | | | | | |
| | 164 | 11.397 | 37.0 | 27.5 | | 53 37.6 | + 1 47.6 | —1.0 | 24.2 |
| | 255 | 11.690 | 30.1 | 34.6 | | | | | |
| | 223 | 8.187 | 31.1 | 33.0 | | 57 50.7 | — 2 21.6 | —1.9 | 27.2 |
| | 508 | 9.100 | 30.9 | 33.9 | | | | | |
| | 469 | 11.584 | 30.7 | 33.5 | | 53 48.3 | + 1 40.4 | —2.0 | 26.7 |
| | 560 | 3.046 | 37.0 | 27.0 | | | | | |
| | 630 | 19.274 | 22.8 | 41.5 | | 44 30.0 | +10 55.6 | —3.1 | 22.5 |
| | 673 | 16.895 | 40.3 | 24.6 | | | | | |
| | 657 | 18.581 | 23.0 | 41.7 | | 54 18.0 | + 1 08.1 | —1.0 | 25.1 |
| | 857 | 14.920 | 31.9 | 33.8 | | | | | |
| | 769 | 17.595 | 31.0 | 34.0 | | 37 53 41.3 | + 1 48.1 | —1.7 | 27.7 |
| | 858 | 17.202 | 32.0 | 33.6 | | | | | |
| | 825 | 9.582 | 30.9 | 34.7 | | 38 00 33.2 | — 5 07.9 | —1.9 | 23.4 |
| | 962 | 4.141 | 33.5 | 32.5 | | | | | |
| | 872 | 3.573 | 32.0 | 33.1 | | 37 55 50.8 | — 0 22.9 | —0.4 | 27.5 |
| | 962 | 4.141 | 33.5 | 32.5 | | | | | |
| | 1023 | 9.200 | 31.0 | 34.0 | | 52 02.1 | + 3 24.4 | —0.7 | 25.8 |
| | 1062 | 11.562 | 31.6 | 34.2 | | | | | |
| | 1096 | 11.530 | 33.8 | 32.1 | | 37 55 27.5 | — 0 01.3 | —0.3 | 25.9 |
| | 1282 | 14.066 | 36.3 | 30.0 | | | | | |
| | 1262 | 6.400 | 31.2 | 35.0 | | 38 00 35.0 | — 5 09.7 | +0.9 | 26.2 |
| | 1282 | 14.066 | 36.3 | 30.0 | | | | | |
| | 1326 | 15.863 | 27.5 | 39.0 | | 37 54 15.5 | + 1 12.6 | —1.8 | 26.3 |
| | 1424 | 13.181 | 32.0 | 34.1 | | | | | |
| | 1449 | 9.581 | 34.0 | 32.2 | | 37 57 53.8 | — 2 25.5 | —1.1 | 27.2 |
| | 1477 | 18.253 | 36.7 | 29.5 | | | | | |
| | 1497 | 2.586 | 28.0 | 38.5 | | 38 05 58.3 | —10 33.1 | —1.1 | 37 55 24.1 |

The final result is determined by Wm. A. Rogers by taking the means of groups of stars, ten pairs in a group, and forming from them one individual result. In this way, the following mean values are obtained:

| | Means. | | | No. of observations. |
|---|--------|----|-------|----------------------|
| | ° | ' | " | |
| 1 | 37 | 55 | 25.58 | 38 |
| 2 | | | 26.31 | 20 |
| 3 | | | 26.52 | 36 |
| 4 | | | 25.51 | 29 |
| 5 | | | 26.41 | 29 |
| 6 | 37 | 55 | 26.11 | 41 |

And the final result..... $37^{\circ} 55' 26''.07 \pm 0''.05$.

ASTRONOMICAL CO-ORDINATES OF ASTRONOMICAL STATION AT PIOCHE, NEVADA

Longitude... $7^h 37^m 45^s.218 \pm 0^s.075$, or $114^{\circ} 26' 18''.27 \pm 1''.12$ west from Greenwich.
 $2^h 29^m 33^s.098$, or $37^{\circ} 23' 16''.47$ west from U. S. Naval Observatory at Washington, D. C.

Latitude $37^{\circ} 55' 26''.07 \pm 0''.07$ north.

U. S. GEOGRAPHICAL SURVEYS WEST OF THE ONE HUNDREDTH MERIDIAN,
1ST LIEUT. GEO. M. WHEELER, CORPS OF ENGINEERS, U. S. ARMY, IN CHARGE.

RESULTS
OF
OBSERVATIONS MADE BY W. W. MARYATT AND E. P. AUSTIN IN THE
DETERMINATION OF THE ASTRONOMICAL CO-ORDINATES
OF STATION AT GUNNISON, UTAH.
SEASON OF 1872.

COMPUTATIONS BY
W. W. MARYATT AND WM. A. ROGERS.

7 AST

GUNNISON, UTAH.

GEOGRAPHICAL POSITION OF STATION.

Longitude, $111^{\circ} 49' 15''.00 \pm 0''.42$ west from Greenwich.
 $34^{\circ} 46' 13''.20$ west from the U. S. Naval Observatory, Washington, D. C.

Latitude, $39^{\circ} 09' 25''.62 \pm 0''.05$ north.

Barometric altitude of observatory above sea-level, 5144.6 feet.

This place, named in honor of the late Captain Gunnison, United States Army, is situated in Sam Pitch Valley, Utah, a dreary waste, which is 9 or 10 miles in extent from east to west and 12 or 13 miles from north to south. The town is a Mormon settlement, $2\frac{1}{4}$ miles east of Sevier River, and near the north banks of Sam Pitch Creek, lying at the northern extremity of the valley, which is surrounded by high mountains and bluffs.

The astronomical station was established in the southwestern part of the town, and was connected with surrounding points by trigonometrical measurements, so that its position can be ascertained at any time.

For a description of the instruments used, the reader is referred to the report on Beaver. An account of the observatory, methods of work, etc., at Gunnison, is given in the Progress Report of 1872, page 46.

The weather was tolerable during the time of occupation. W. W. Maryatt was observer here, and E. P. Austin at the connected station, Salt Lake City. They exchanged signals over the Deseret Telegraph Line October 23 and 31, and November 1, 5, and 6. The length of circuit was about 100 miles. Signals were sent by the local battery at Gunnison without the assistance of any repeaters.

Observations for latitude were made November 8, 15, 16, 18, 19, 20, 22, and 25. These were reduced by Wm. A. Rogers. Computation of the time-observations at both stations was made by Mr. Maryatt. Final arrangement of the report was made by Dr. F. Kampf.

Tabulation of stars used for determination of time at astronomical station at Gunnison, Utah, and Salt Lake City, Utah, 1872.

| Name of star. | GUNNISON. | | | | | SALT LAKE CITY. | | | | | Name of star. | GUNNISON. | | | | | SALT LAKE CITY. | | | | | | | |
|-------------------------------|-------------|-------------|-------------|-------------|-------------|-----------------|-------------|-------------|-------------|-------------|---------------|-------------|---------------------------------|-------------|-------------|-------------|-----------------|-------------|-------------|---|---|---|---|---|
| | October 23. | October 25. | October 31. | November 1. | November 5. | November 6. | October 23. | October 25. | October 31. | November 1. | | November 5. | November 6. | October 23. | October 25. | October 31. | November 1. | November 5. | November 6. | | | | | |
| α Andromedæ | | | | | | | | | | X | | | ζ Cygni | | | X | X | | | | | | | |
| γ Pegasi | | | | | | | | | | X | | | α Cephei | | | X | | | | | | | | |
| ι Ceti | | | | | | | | | | | | | 1 Pegasi | | | X | | | | | | | | |
| α Cassiopeiæ | | | | | | | | | | | | | β Aquarii | | | | | | | | | | | |
| β Ceti | | | | | | | | | | | | | β Cephei | | | X | X | | | | | | | |
| ϵ Piscium | | | X | | | | | | | | | | ξ Aquarii | | | X | X | | | | | | | |
| θ^1 Ceti | | | | | | | | | | | | | ϵ Pegasi | | | X | X | | | | | | | |
| 38 Cassiopeiæ | X | X | X | X | X | X | | | | | | | 11 Cephei | X | X | X | X | X | X | X | X | X | X | X |
| η Piscium | | | | | | | | | X | X | | | μ Capricorni | | X | X | X | X | X | X | X | X | X | X |
| ν Piscium | | | | | | | | | X | X | | | 79 Draconis | X | X | | X | X | X | X | X | X | X | X |
| σ Piscium | X | | X | | X | X | | | | X | | | α Aquarii | X | | X | | | | X | X | X | X | X |
| β Arietis | X | X | | X | X | X | | | | X | X | | α Gruis | | X | | | | | | | | | |
| 50 Cassiopeiæ | X | X | X | X | X | X | | | | X | X | | θ Aquarii | X | X | X | X | X | X | X | X | X | X | X |
| α Arietis | X | X | X | X | X | X | | | | X | X | | π Aquarii | X | X | X | X | X | X | X | X | X | X | X |
| ξ^1 Ceti | X | X | X | X | X | X | | | | | | | 9 Draconis, L. C. | | | | | | X | X | | | | |
| ι Cassiopeiæ | | X | X | X | X | X | | | | | | | 226 Cephei | X | X | X | X | X | X | X | | | | |
| 5 Ursæ Min., L. C. | | | X | X | X | X | | | | | | | ζ Pegasi | | X | X | X | X | X | X | | | | |
| γ Ceti | X | X | X | X | X | X | | | | | | | ι Cephei | | X | X | X | X | X | X | | | | |
| β Ursæ Min., L. C. | | | X | | X | | | | | | | | α Piscis Australis | X | X | X | X | X | X | X | | | | |
| α Ceti | X | X | X | | | | | | | | | | α Pegasi | X | X | X | X | X | X | X | | | | |
| 48 Cephei | X | X | | | | | | | | | | | σ Cephei | X | X | X | X | X | X | X | | | | |
| Groombr. 3241 | | X | | | | | | | | | | | θ Piscium | | | X | | | | X | | X | X | X |
| α Cygni | | X | X | X | X | | | | | | | | ι Piscium | | | | | | X | X | | X | X | X |
| μ Aquarii | | X | X | X | X | | | | | | | | γ Cephei | | | | X | | | | | X | X | X |
| ν Cygni | | X | X | X | X | | | | | | | | Groombr. 4163 | | | | | X | | | | X | X | X |
| 61 Cygni | | X | X | | | | | | | | | | ω Piscium | | | | | | X | | | X | | |

Observations and reductions for time taken at sending station.

GUNNISON, UTAH, OCTOBER 23, 1872.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|-----------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | β Cephei | 23 46 50.01 | — 7.59 | + 0.18 | 0.00 | 23 46 42.60 | 21 27 00.93 | —2 19 41.67 |
| W. | ε Pegasi | 57 34.82 | + 2.55 | + 0.06 | 0.00 | 57 37.43 | 37 55.83 | 41.60 |
| W. | μ Capricorni | 0 05 58.52 | + 4.18 | + 0.04 | 0.00 | 0 06 02.74 | 46 21.10 | 41.64 |
| W. | 79 Draconis | 11 08.79 | — 9.72 | + 0.20 | 0.00 | 10 59.27 | 51 17.83 | 41.44 |
| W. | α Aquarii | 18 52.95 | + 3.26 | + 0.05 | 0.00 | 18 56.26 | 59 14.58 | 41.68 |
| W. | θ Aquarii | 29 44.68 | + 3.77 | + 0.05 | 0.00 | 29 48.50 | 22 10 06.88 | 41.62 |
| E. | π Aquarii | 38 23.64 | + 2.48 | + 0.05 | 0.00 | 38 26.17 | 18 46.49 | 39.68 |
| E. | 226 Cephei | 49 52.35 | — 9.50 | + 0.22 | 0.00 | 49 43.07 | 30 03.48 | 39.59 |
| E. | α Piscis Australis .. | 1 10 12.42 | + 4.33 | + 0.03 | 0.00 | 1 10 16.78 | 50 37.10 | 39.68 |
| E. | α Pegasi | 18 03.74 | + 1.72 | + 0.06 | 0.00 | 18 05.52 | 58 25.39 | 40.13 |
| E. | o Cephei | 33 10.61 | — 4.91 | + 0.16 | 0.00 | 33 05.86 | 23 13 25.60 | —2 19 40.26 |

NORMAL EQUATIONS.

$$\begin{aligned}
 \text{For W.: } 0 &= + 9.35 + 6.00 \delta t - 0.70 a \\
 0 &= - 40.11 - 0.70 \delta t + 7.78 a & a &= + 5^s.07 \\
 \text{For E.: } 0 &= + 1.95 + 5.00 \delta t - 1.48 a \\
 0 &= - 34.55 - 1.48 \delta t + 8.94 a & a &= + 3^s.99
 \end{aligned}$$

The error of collimation will be eliminated in the mean of the corrections for W. and E.

GUNNISON, UTAH, OCTOBER 23, 1872.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|---------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | 38 Cassiopeiæ | 3 41 34.69 | — 6 67 | + 0.19 | + 1.88 | 3 41 30.09 | 1 21 49.32 | —2 19 40.77 |
| E. | o Piscium | 58 18.69 | + 2.37 | + 0.09 | + 0.66 | 58 21.81 | 38 41.00 | 40.81 |
| E. | β Arietis | 4 07 15.51 | + 1.61 | + 0.10 | + 0.70 | 4 07 17.92 | 47 37.19 | 40.73 |
| E. | 50 Cassiopeiæ | 12 25.06 | — 7.95 | + 0.27 | + 2.10 | 12 19.48 | 52 38.63 | 40.85 |
| E. | α Arietis | 19 39.32 | + 1.40 | + 0.10 | + 0.71 | 19 41.53 | 2 00 00.59 | 40.94 |
| E. | ξ Ceti | 25 53.46 | + 2.39 | + 0.09 | + 0.66 | 25 56.60 | 06 15.78 | 40.82 |
| W. | γ Ceti | 56 21.44 | + 2.74 | + 0.21 | — 0.66 | 56 23.73 | 36 42.94 | 40.79 |
| W. | α Ceti | 5 15 16.73 | + 2.68 | + 0.22 | — 0.65 | 5 15 18.98 | 55 38.15 | 40.83 |
| W. | 48 Cephei | 24 13.89 | — 12.88 | + 1.06 | — 2.97 | 23 59.10 | 3 04 18.26 | —2 19 40.84 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= + 13.96 + 9.00 \delta t - 3.13 a + 3.71 c \\
 0 &= - 69.11 - 3.13 \delta t + 14.36 a + 3.54 c & a &= + 4^s.602 \\
 0 &= - 45.34 + 3.71 \delta t + 3.54 a + 45.41 c & c &= + 0^s.656
 \end{aligned}$$

Observations and reductions for time taken at sending station—Continued.

GUNNISON, UTAH, OCTOBER 25, 1872.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|----------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | Groombr. 3241..... | 22 50 14.42 | — 1.71 | + 0.48 | — 1.27 | 22 50 11.92 | 20 30 32.05 | —2 19 39.87 |
| W. | <i>α</i> Cygni..... | 56 44.92 | — 0.14 | + 0.25 | — 0.55 | 56 44.48 | 37 05.04 | 39.44 |
| E. | <i>ν</i> Cygni..... | 23 12 04.05 | — 0.07 | + 0.23 | + 0.51 | 23 12 04.72 | 52 25.23 | 39.49 |
| E. | 61 Cygni..... | 20 49.88 | + 0.02 | + 0.22 | + 0.50 | 20 50.62 | 21 01 11.22 | 39.40 |
| W. | <i>ζ</i> Cygni..... | 27 10.24 | + 0.18 | + 0.20 | — 0.45 | 27 10.17 | 07 30.75 | 39.42 |
| W. | 1 Pegasi..... | 35 50.91 | + 0.35 | + 0.18 | — 0.41 | 35 50.85 | 16 11.68 | 39.17 |
| W. | <i>β</i> Cephei..... | 23 46 42.42 | — 1.45 | + 0.44 | — 1.14 | 46 40.27 | 27 00.80 | —2 19 39.47 |

NORMAL EQUATIONS.

$$0 = + 6.66 + 7.00 \delta t - 2.91 a - 7.21 c$$

$$0 = - 9.11 - 2.91 \delta t + 5.57 a + 8.57 c$$

$$0 = - 20.05 - 7.21 \delta t + 8.57 a + 26.94 c$$

$$a = + 0^s.966$$

$$c = + 0^s.390$$

GUNNISON, UTAH, OCTOBER 25, 1872.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|--------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | <i>ε</i> Pegasi..... | 23 57 34.80 | + 0.33 | + 0.12 | — 0.33 | 23 57 34.92 | 21 37 55.80 | —2 19 39.12 |
| W. | <i>μ</i> Capricorni..... | 0 06 00.03 | + 0.54 | + 0.09 | — 0.34 | 0 06 00.32 | 46 21.08 | 39.24 |
| W. | 79 Draconis..... | 10 58.89 | — 1.25 | + 0.40 | — 1.14 | 10 56.90 | 51 17.71 | 39.19 |
| W. | <i>α</i> Gruis..... | 19 50.58 | + 0.96 | + 0.01 | — 0.49 | 19 51.06 | 22 00 12.29 | 38.77 |
| E. | <i>θ</i> Aquarii..... | 29 45.17 | + 0.48 | + 0.10 | + 0.33 | 29 46.08 | 10 06.85 | 39.23 |
| E. | <i>π</i> Aquarii..... | 38 24.79 | + 0.40 | + 0.11 | + 0.33 | 38 25.63 | 18 46.49 | 39.14 |
| E. | 226 Cephei..... | 0 49 42.32 | — 1.54 | + 0.45 | + 1.44 | 49 42.67 | 30 03.35 | —2 19 39.32 |

NORMAL EQUATIONS.

$$0 = - 0.75 + 7.00 \delta t - 0.12 a - 0.94 c$$

$$0 = - 7.08 - 0.12 \delta t + 13.44 a - 5.13 c$$

$$0 = - 7.79 - 0.94 \delta t - 5.13 a + 34.25 c$$

$$a = + 0^s.65$$

$$c = + 0^s.33$$

Observations and reductions for time taken at sending station—Continued.

GUNNISON, UTAH, OCTOBER 25, 1872.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|----------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | ζ Pegasi | 0 54 45.42 | + 0.38 | + 0.06 | + 0.34 | 0 54 46.20 | 22 35 06.77 | -2 19 39.43 |
| E. | ι Cephei | 1 04 49.21 | - 0.83 | + 0.14 | + 0.80 | 1 04 49.32 | 45 09.91 | 39.41 |
| E. | α Piscis Australis.. | 10 15.23 | + 0.85 | + 0.03 | + 0.38 | 10 16.49 | 50 37.08 | 39.41 |
| E. | α Pegasi | 18 04.04 | + 0.34 | + 0.06 | + 0.33 | 18 04.77 | 58 25.37 | 39.40 |
| E. | ο Cephei | 33 04.85 | - 0.96 | + 0.15 | + 0.86 | 1 33 04.90 | 23 13 25.55 | -2 19 39.35 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= + 0.75 + 5.00 \delta t - 0.30 a \\
 0 &= - 3.28 - 0.30 \delta t + 4.28 a \\
 &\text{Adopted}
 \end{aligned}
 \qquad
 \begin{aligned}
 a &= + 0^s.78 \\
 c &= + 0^s.33
 \end{aligned}$$

GUNNISON, UTAH, OCTOBER 25, 1872.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|---------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | ε Piscium | 3 15 59.14 | + 0.47 | + 0.07 | + 0.35 | 3 16 00.03 | 0 56 20.78 | -3 19 39.25 |
| E. | 38 Cassiopeiaë | 41 28.74 | - 1.29 | + 0.17 | + 1.00 | 41 28.62 | 1 21 49.33 | 39.29 |
| E. | β Arietis | 4 07 15.42 | + 0.31 | + 0.08 | + 0.37 | 4 07 16.18 | 47 37.20 | 38.98 |
| E. | 50 Cassiopeiaë | 12 17.95 | - 1.54 | + 0.23 | + 1.12 | 12 17.76 | 52 38.67 | 39.09 |
| E. | α Arietis | 19 39.04 | + 0.27 | + 0.09 | + 0.38 | 19 39.78 | 2 00 00.61 | 39.17 |
| E. | ξ ¹ Ceti | 25 54.07 | + 0.46 | + 0.07 | + 0.35 | 25 54.95 | 06 15.80 | 39.15 |
| W. | ι Cassiopeiaë | 38 19.30 | - 1.05 | + 0.19 | - 0.89 | 38 17.55 | 18 37.90 | 39.65 |
| W. | γ Ceti | 56 21.85 | + 0.53 | + 0.07 | - 0.35 | 56 22.10 | 36 42.97 | 39.13 |
| W. | α Ceti | 5 15 17.04 | + 0.52 | + 0.07 | - 0.35 | 5 15 17.28 | 55 38 18 | 39.10 |
| W. | 48 Cephei | 24 01.09 | - 2.50 | + 0.30 | - 1.58 | 23 57.31 | 3 04 18.37 | -2 19 33.94 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= + 2.67 + 10.00 \delta t - 4.28 a + 1.16 c \\
 0 &= - 16.06 - 4.28 \delta t + 15.76 a + 6.66 c \\
 0 &= - 24.19 + 1.16 \delta t + 6.66 a + 51.87 c
 \end{aligned}
 \qquad
 \begin{aligned}
 a &= + 0^s.893 \\
 c &= + 0^s.349
 \end{aligned}$$

Observations and reductions for time taken at sending station—Continued.

GUNNISON, UTAH, OCTOBER 31, 1872.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|-----------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | <i>a</i> Cygni..... | 22 56 31.24 | — 0.08 | + 0.09 | + 0.09 | 22 56 31.34 | 20 37 04.88 | —2 19 26.46 |
| W. | <i>μ</i> Aquarii..... | 23 05 12.37 | + 0.38 | + 0.04 | + 0.06 | 23 05 12.85 | 45 46.51 | 26.34 |
| W. | <i>v</i> Cygni..... | 11 51.26 | — 0.04 | + 0.08 | + 0.08 | 11 51.38 | 52 25.09 | 26.29 |
| E. | 61 Cygni..... | 20 37.24 | + 0.01 | + 0.08 | — 0.08 | 20 37.25 | 21 01 11.10 | 26.15 |
| E. | <i>ζ</i> Cygni..... | 26 56.87 | + 0.11 | + 0.07 | — 0.07 | 26 56.98 | 07 30.64 | 26.34 |
| E. | <i>β</i> Cephei..... | 23 46 27.57 | — 0.74 | + 0.16 | — 0.21 | 23 46 26.78 | 21 27 00.44 | —2 19 26.34 |

NORMAL EQUATIONS.

$$0 = + 0.58 + 6.00 \, dt - 0.74 \, a$$

$$0 = - 1.46 - 0.74 \, dt + 2.88 \, a \quad a = + 0^s.50$$

$$c \text{ found by preliminary reduction to be } = + 0^s.06.$$

GUNNISON, UTAH, OCTOBER 31, 1872.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|-----------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | 11 Cephei..... | 23 59 30.19 | — 0.57 | + 0.10 | — 0.22 | 23 59 29.50 | 21 40 03.10 | —2 19 26.40 |
| E. | <i>a</i> Aquarii..... | 0 18 40.64 | + 0.24 | + 0.03 | — 0.07 | 0 18 40.84 | 59 14.48 | 26.36 |
| W. | <i>θ</i> Aquarii..... | 29 32.78 | + 0.28 | + 0.03 | + 0.07 | 29 33.16 | 22 10 06.78 | 26.38 |
| W. | <i>π</i> Aquarii..... | 38 12.48 | + 0.24 | + 0.03 | + 0.07 | 38 12.82 | 18 46.42 | 26.40 |
| W. | 225 Cephei..... | 49 29.56 | — 0.84 | + 0.13 | + 0.29 | 49 29.14 | 30 02.95 | 26.19 |
| W. | <i>ζ</i> Pegasi..... | 54 32.65 | + 0.19 | + 0.04 | + 0.07 | 54 32.95 | 35 06.71 | 26.24 |
| W. | <i>ι</i> Cephei..... | 1 04 36.44 | — 0.38 | + 0.09 | + 0.18 | 1 04 36.33 | 45 09.69 | 26.64 |
| W. | <i>α</i> Piscis Australis.. | 10 02.84 | + 0.40 | + 0.02 | + 0.08 | 10 03.34 | 50 37.00 | 26.34 |
| W. | <i>α</i> Pegasi..... | 27 51.12 | + 0.16 | + 0.04 | + 0.08 | 27 51.40 | 23 08 25.31 | 26.09 |
| W. | <i>ο</i> Cephei..... | 32 51.83 | — 0.44 | + 0.09 | + 0.19 | 32 51.67 | 13 25.34 | 26.33 |
| W. | <i>θ</i> Piscium..... | 1 40 56.96 | + 0.21 | + 0.03 | + 0.07 | 1 40 57.27 | 23 21 30.81 | —2 19 26.46 |

NORMAL EQUATIONS.

$$0 = + 0.74 + 11.00 \, dt - 2.30 \, a \quad a = + 0^s.36$$

$$0 = - 4.89 - 2.30 \, dt + 13.58 \, a \quad c = + 0^s.06$$

Observations and reductions for time taken at sending station—Continued.

GUNNISON, UTAH, OCTOBER 31, 1872.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|----------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | 38 Cassiopeia | 3 41 15.98 | — 1.18 | + 0.62 | — 0.06 | 3 41 15.36 | 1 21 49.31 | —2 19 26.05 |
| E. | o Piscium | 58 06.72 | + 0.42 | + 0.27 | — 0.02 | 58 07.39 | 38 41.04 | 26.35 |
| E. | 50 Cassiopeia | 4 12 05.56 | — 1.41 | + 0.85 | — 0.06 | 4 12 04.94 | 52 38.71 | 26.23 |
| E. | a Arietis | 19 26.28 | + 0.25 | + 0.33 | — 0.02 | 19 26.84 | 2 00 00.66 | 26.18 |
| W. | ξ ¹ Ceti | 25 41.33 | + 0.43 | + 0.27 | + 0.02 | 25 42.05 | 06 15.85 | 26.20 |
| W. | ι Cassiopeia | 38 04.12 | — 0.96 | + 0.71 | + 0.05 | 38 03.92 | 18 37.99 | 25.93 |
| W. | 5 Urs. Minoris, L.C. | 47 08.32 | + 3.11 | — 0.57 | — 0.08 | 47 10.78 | 27 44.78 | 26.00 |
| W. | γ Ceti | 56 08.49 | + 0.49 | + 0.25 | + 0.02 | 56 09.25 | 36 43.03 | 26.22 |
| W. | β Urs. Minoris, L.C. | 5 10 25.70 | + 2.83 | — 0.48 | — 0.07 | 5 10 27.98 | 51 01.87 | 26.11 |
| W. | a Ceti | 15 03.67 | + 0.48 | — 0.26 | + 0.02 | 15 04.43 | 2 55 38.25 | —2 19 26.18 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= + 0.51 + 10.00 \delta t + 5.42 a + 10.60 c \\
 0 &= + 25.78 + 5.42 \delta t + 34.23 a + 21.64 c \\
 0 &= + 12.58 + 10.60 \delta t + 21.64 a + 62.21 c
 \end{aligned}
 \qquad
 \begin{aligned}
 a &= + 0^s.82 \\
 c &= - 0^s.02
 \end{aligned}$$

GUNNISON, UTAH, NOVEMBER 1, 1872.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|---------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | a Cygni | 22 56 28.60 | — 0.07 | + 0.21 | + 0.03 | 22 56 28.77 | 20 37 04.86 | —2 19 23.91 |
| W. | ν Cygni | 23 11 48.65 | — 0.04 | + 0.20 | + 0.02 | 23 11 48.83 | 52 25.06 | 23.77 |
| E. | 61 Cygni | 20 34.77 | + 0.01 | + 0.19 | — 0.03 | 20 34.94 | 21 01 11.07 | 23.87 |
| E. | ζ Cygni | 28 26 54.46 | + 0.11 | + 0.17 | — 0.03 | 28 26 54.71 | 07 30.62 | —2 19 24.09 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= - 1.04 + 4.00 \delta t + 0.00 a + 0.05 c \\
 0 &= - 0.03 + 0.00 \delta t + 0.07 a + 0.54 c \\
 0 &= - 0.24 + 0.05 \delta t + 0.54 a - 6.68 c
 \end{aligned}
 \qquad
 \begin{aligned}
 a &= + 0^s.58 \\
 c &= - 0^s.02
 \end{aligned}$$

Observations and reductions for time taken at sending station—Continued.

GUNNISON, UTAH, NOVEMBER 1, 1872.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|----------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | θ Aquarii | 0 29 29.96 | + 0.75 | + 0.05 | — 0.05 | 0 29 30.71 | 22 10 06.77 | —2 19 23.94 |
| E. | π Aquarii | 38 09.87 | + 0.63 | + 0.06 | — 0.05 | 38 10.51 | 18 46.41 | 24.10 |
| E. | 226 Cephei | 49 28.76 | — 2.40 | + 0.25 | — 0.21 | 49 26.40 | 30 02.85 | 23.55 |
| E. | ζ Pegasi | 54 30.25 | + 0.50 | + 0.07 | — 0.06 | 54 30.76 | 35 06.69 | 24.07 |
| E. | ι Cephei | 1 04 34.77 | — 1.08 | + 0.16 | — 0.13 | 1 04 33.72 | 45 09.64 | 24.08 |
| W. | α Piscis Australis.. | 09 59.91 | + 1.10 | + 0.03 | + 0.06 | 10 01.10 | 50 36.98 | 24.12 |
| W. | α Pegasi | 17 48.79 | + 0.44 | + 0.07 | + 0.05 | 17 49.35 | 58 25.30 | 24.05 |
| W. | ο Cephei | 32 50.24 | — 1.24 | + 0.17 | + 0.11 | 32 49.28 | 23 13 25.30 | 23.98 |
| W. | θ Piscium | 40 54.05 | + 0.55 | + 0.06 | + 0.05 | 40 54.71 | 21 30.80 | 23.91 |
| W. | γ Cephei | 1 53 36.45 | — 2.73 | + 0.27 | + 0.23 | 1 53 34.22 | 34 10.39 | —2 19 23.83 |

NORMAL EQUATIONS.

$$\begin{aligned}
0 &= -4.11 + 10.00 \delta t - 4.46 a - 0.78 c \\
0 &= +17.38 - 4.46 \delta t + 17.53 a + 3.65 c \\
0 &= +0.75 - 0.78 \delta t + 3.65 a + 54.73 c
\end{aligned}
\qquad
\begin{aligned}
a &= +1^s.01 \\
c &= -0^s.05
\end{aligned}$$

GUNNISON, UTAH, NOVEMBER 1, 1872.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|---------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | 38 Cassiopeiæ | 3 41 13.93 | — 1.45 | + 0.47 | + 0.23 | 3 41 13.18 | 1 21 49.30 | —2 19 23.88 |
| W. | β Arietis | 4 07 00.20 | + 0.35 | + 0.24 | + 0.09 | 4 07 00.88 | 47 37.24 | 23.64 |
| W. | 50 Cassiopeiæ | 12 03.61 | — 1.73 | + 0.64 | + 0.26 | 12 02.78 | 52 38.71 | 24.07 |
| E. | α Arietis | 19 23.92 | + 0.31 | + 0.25 | — 0.09 | 19 24.39 | 2 00 00.66 | 23.73 |
| E. | ξ ¹ Ceti | 25 39.11 | + 0.52 | + 0.21 | — 0.08 | 25 39.76 | 06 15.85 | 23.91 |
| E. | ι Cassiopeiæ | 38 02.41 | — 1.18 | + 0.54 | — 0.21 | 38 01.56 | 18 33.00 | 23.56 |
| E. | 5 Urs. Minoris, L. C. | 47 04.68 | + 3.80 | — 0.43 | + 0.34 | 47 08.39 | 27 44.77 | 23.62 |
| E. | γ Ceti | 4 56 06.23 | + 0.59 | + 0.19 | — 0.08 | 4 56 06.93 | 2 36 43.04 | —2 19 23.89 |

NORMAL EQUATIONS.

$$\begin{aligned}
0 &= -0.97 + 10.00 \delta t + 1.21 a - 5.71 c \\
0 &= -22.28 + 1.21 \delta t + 21.77 a - 8.33 c \\
0 &= +10.81 - 5.71 \delta t - 8.33 a + 37.01 c
\end{aligned}
\qquad
\begin{aligned}
a &= +1^s.00 \\
c &= -0^s.03
\end{aligned}$$

Observations and reductions for time taken at sending station—Continued.

GUNNISON, UTAH, NOVEMBER 5, 1872.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|-----------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | <i>a</i> Cygni..... | 22 56 21.77 | — 0.13 | — 0.03 | — 0.07 | 22 56 21.54 | 20 37 04.75 | —2 19 16.79 |
| E. | <i>μ</i> Aquarii..... | 23 05 02.83 | + 0.72 | — 0.01 | — 0.05 | 23 05 03.49 | 45 46.43 | 17.06 |
| E. | <i>ν</i> Cygni..... | 11 42.06 | — 0.07 | — 0.03 | — 0.07 | 11 41.89 | 52 24.97 | 16.92 |
| W. | 61 Cygni..... | 20 27.76 | + 0.02 | — 0.02 | + 0.06 | 20 27.82 | 21 01 10.99 | 16.83 |
| W. | <i>ζ</i> Cygni..... | 23 26 47.33 | + 0.18 | — 0.02 | + 0.06 | 23 26 47.55 | 07 30.55 | —2 19 17.00 |

NORMAL EQUATIONS.

$$0 = -0.05 + 5.00 \delta t + 0.76 a + 1.32 c$$

$$0 = -0.51 + 0.76 \delta t + 0.64 a + 0.23 c$$

$$0 = +0.31 + 1.32 \delta t + 0.23 a + 7.70 c$$

$$a = +0^s.96$$

$$c = -0^s.05$$

GUNNISON, UTAH, NOVEMBER 5, 1872.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|-----------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | <i>θ</i> Aquarii..... | 0 29 22.82 | + 0.46 | — 0.02 | + 0.13 | 0 29 23.39 | 22 10 06.71 | —2 19 16.68 |
| W. | <i>π</i> Aquarii..... | 38 02.52 | + 0.39 | — 0.02 | + 0.13 | 38 03.02 | 18 46.36 | 16.66 |
| W. | 226 Cephei..... | 49 20.23 | — 1.47 | — 0.03 | + 0.51 | 49 19.24 | 30 02.55 | 16.69 |
| W. | <i>ζ</i> Pegasi..... | 54 23.05 | + 0.30 | — 0.02 | + 0.13 | 54 23.46 | 35 06.65 | 16.81 |
| W. | <i>ι</i> Cephei..... | 1 04 26.55 | — 0.66 | — 0.05 | + 0.31 | 1 04 26.15 | 45 09.49 | 16.66 |
| E. | <i>α</i> Piscis Australis.. | 09 52.85 | + 0.67 | — 0.01 | — 0.15 | 09 53.36 | 50 36.93 | 16.43 |
| E. | <i>α</i> Pegasi..... | 17 41.90 | + 0.27 | — 0.02 | — 0.13 | 17 42.02 | 58 25.26 | 16.76 |
| E. | <i>ο</i> Cephei..... | 32 43.02 | — 0.76 | — 0.06 | — 0.34 | 32 41.86 | 23 13 25.16 | 16.70 |
| E. | Groombr. 4163.... | 2 08 00.20 | — 1.25 | — 0.07 | — 0.46 | 2 07 58.42 | 48 41.35 | 17.07 |
| E. | <i>γ</i> Pegasi..... | 25 57.67 | + 0.27 | — 0.02 | — 0.13 | 25 57.79 | 0 06 41.27 | —2 19 16.52 |

NORMAL EQUATIONS.

$$0 = +1.76 + 10.00 \delta t - 2.90 a - 0.06 c$$

$$0 = -10.34 - 2.90 \delta t + 15.09 a + 0.91 c$$

$$0 = +5.90 - 0.06 \delta t + 0.91 a + 47.95 c$$

$$a = +0^s.62$$

$$c = -0^s.13$$

Observations and reductions for time taken at sending station—Continued.

GUNNISON, UTAH, NOVEMBER 5, 1872.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|---------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | 38 Cassiopeiæ | 3 31 07.00 | — 1.29 | + 0.06 | — 0.23 | 3 41 05.54 | 1 11 49.28 | —2 19 16.26 |
| E. | o Piscium | 57 57.28 | + 0.46 | + 0.03 | — 0.08 | 57 57.69 | 33 41.05 | 16.64 |
| E. | β Arietis | 4 06 53.45 | + 0.31 | + 0.03 | — 0.09 | 4 06 53.70 | 47 37.26 | 16.44 |
| E. | 50 Cassiopeiæ | 11 56.76 | — 1.53 | + 0.08 | — 0.26 | 11 55.05 | 52 38.73 | 16.32 |
| W. | α Arietis | 19 16.87 | + 0.27 | + 0.03 | + 0.09 | 19 17.26 | 2 00 00.69 | 16.57 |
| W. | ξ ¹ Ceti | 25 31.87 | + 0.46 | + 0.03 | + 0.08 | 25 32.44 | 06 15.88 | 16.56 |
| W. | ι Cassiopeiæ | 37 56.14 | — 1.05 | + 0.07 | + 0.21 | 37 55.37 | 18 38.05 | 17.32 |
| W. | 5 Ursæ Min., L. C.. | 46 58.61 | + 3.38 | — 0.04 | — 0.34 | 47 01.61 | 27 44.77 | 16.84 |
| W. | γ Ceti | 55 59.01 | + 0.53 | + 0.02 | + 0.08 | 55 59.64 | 36 43.07 | 16.57 |
| W. | β Ursæ Min., L. C.. | 5 10 15.48 | + 3.07 | — 0.03 | — 0.31 | 5 10 18.21 | 2 51 01.82 | —2 19 16.39 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= + 0.92 + 9.00 \, dt + 1.72 \, a - 6.72 \, c \\
 0 &= -17.56 + 1.72 \, dt + 22.04 \, a - 8.85 \, c \\
 0 &= + 3.44 - 6.72 \, dt - 8.85 \, a + 48.03 \, c
 \end{aligned}
 \qquad
 \begin{aligned}
 a &= + 0^{\text{s}}.89 \\
 c &= - 0^{\text{s}}.08
 \end{aligned}$$

GUNNISON, UTAH, NOVEMBER 6, 1872.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|----------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | π Aquarii | 0 38 00.04 | + 0.21 | + 0.03 | — 0.12 | 0 38 00.16 | 22 18 46.35 | —2 19 13.81 |
| E. | 226 Cephei | 49 17.30 | — 0.79 | + 0.14 | — 0.48 | 49 16.17 | 30 02.47 | 13.70 |
| E. | ζ Pegasi | 54 20.45 | + 0.16 | + 0.04 | — 0.12 | 54 20.53 | 35 06.64 | 13.89 |
| E. | ι Cephei | 1 04 24.17 | — 0.35 | + 0.09 | — 0.29 | 1 04 23.62 | 45 09.45 | 14.17 |
| W. | α Piscis Australis.. | 09 50.28 | + 0.36 | + 0.02 | + 0.14 | 09 50.80 | 50 36.92 | 13.88 |
| W. | α Pegasi | 17 38.84 | + 0.14 | + 0.04 | + 0.12 | 17 39.14 | 58 25.25 | 13.89 |
| W. | o Cephei | 32 39.21 | — 0.40 | + 0.10 | + 0.31 | 32 39.22 | 23 13 25.11 | 14.11 |
| W. | θ Piscium | 40 44.38 | + 0.18 | + 0.04 | + 0.12 | 40 44.72 | 21 30.76 | 13.96 |
| W. | γ Cephei | 1 53 24.21 | — 0.89 | + 0.15 | + 0.53 | 1 53 24.00 | 23 34 10.07 | —2 19 13.93 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= + 2.21 + 9.00 \, dt - 4.21 \, a + 1.78 \, c \\
 0 &= -6.04 - 4.21 \, dt + 17.97 \, a - 2.89 \, c \\
 0 &= -5.15 + 1.78 \, dt - 2.89 \, a + 53.71 \, c
 \end{aligned}
 \qquad
 \begin{aligned}
 a &= + 0^{\text{s}}.33 \\
 c &= - 0^{\text{s}}.12
 \end{aligned}$$

Observations and reductions for time taken at sending station—Continued.

GUNNISON, UTAH, NOVEMBER 6, 1872.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|---------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | 38 Cassiopeiæ | 3 41 03.13 | — 0.70 | + 0.08 | + 0.34 | 3 41 02.85 | 1 21 49.27 | —2 19 13.58 |
| W. | o Piscium | 57 54.04 | + 0.25 | + 0.03 | + 0.12 | 57 54.44 | 38 41.05 | 13.39 |
| W. | β Arietis | 4 06 50.38 | + 0.17 | + 0.04 | + 0.13 | 4 06 50.72 | 47 37.26 | 13.46 |
| W. | 50 Cassiopeiæ | 11 52.47 | — 0.83 | + 0.11 | + 0.38 | 11 52.13 | 52 38.72 | 13.41 |
| E. | α Arietis | 19 14.12 | + 0.15 | + 0.04 | — 0.13 | 19 14.18 | 2 00 00.69 | 13.49 |
| E. | ξ ¹ Ceti | 25 29.27 | + 0.25 | + 0.03 | — 0.12 | 25 29.43 | 06 15.88 | 13.55 |
| E. | ι Cassiopeiæ | 37 52.29 | — 0.57 | + 0.09 | — 0.30 | 37 51.51 | 18 38.06 | 13.45 |
| E. | γ Ceti | 4 55 56.36 | + 0.29 | + 0.03 | — 0.12 | 4 55 56.56 | 2 36 43.08 | —2 19 13.48 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= +0.54 + 8.00 \delta t - 2.08 a + 2.50 c \\
 0 &= -2.76 - 2.08 \delta t + 7.58 a - 7.16 c \\
 0 &= -0.23 + 2.50 \delta t - 7.16 a + 30.30 c
 \end{aligned}
 \qquad
 \begin{aligned}
 a &= +0^s.48 \\
 c &= -0^s.12
 \end{aligned}$$

Observations and reductions for time taken at receiving station.

SALT LAKE CITY, UTAH, OCTOBER 23, 1872.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|--------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | ζ Cygni | 21 10 08.87 | + 0.05 | — 0.06 | — 0.06 | 21 10 08.80 | 21 07 30.79 | — 2 38.01 |
| E. | α Cephei | 18 10.58 | — 0.18 | + 0.18 | — 0.11 | 18 10.47 | 15 32.43 | 38.04 |
| E. | β Cephei | 29 39.17 | — 0.33 | + 0.18 | — 0.15 | 29 38.87 | 27 00.93 | 37.94 |
| E. | ξ Aquarii | 33 36.19 | + 0.17 | + 0.03 | — 0.05 | 33 36.34 | 30 58.17 | 38.17 |
| E. | ε Pegasi | 40 33.88 | + 0.12 | + 0.03 | — 0.05 | 40 33.98 | 37 55.73 | 38.25 |
| W. | μ Capricorni | 48 58.87 | + 0.19 | + 0.05 | + 0.05 | 48 59.16 | 46 21.10 | 38.06 |
| W. | 79 Draconis | 53 55.99 | — 0.42 | + 0.32 | + 0.17 | 53 56.06 | 51 17.85 | 38.21 |
| W. | α Aquarii | 22 01 52.32 | + 0.15 | + 0.07 | + 0.05 | 22 01 52.59 | 59 14.58 | 38.01 |
| W. | θ Aquarii | 12 44.66 | + 0.17 | + 0.06 | + 0.05 | 12 44.94 | 22 10 06.88 | 38.06 |
| W. | π Aquarii | 21 24.22 | + 0.15 | + 0.08 | + 0.05 | 21 24.50 | 18 46.52 | — 2 37.98 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -0.47 + 10.00 \delta t + 0.39 a \\
 0 &= -2.11 + 0.39 \delta t + 9.17 a
 \end{aligned}
 \qquad
 a = +0^s.228$$

Adopted $c = +0^s.05$ for W.

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, OCTOBER 23, 1872.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|---------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | <i>ι</i> Piscium | 23 36 02.20 | + 0.11 | + 0.25 | + 0.05 | 23 36 02.61 | 23 33 24.52 | — 2 38.09 |
| W. | Groombr. 4163 .. | 51 19.43 | — 0.36 | + 0.87 | + 0.17 | 51 20.11 | 48 41.87 | 38.24 |
| W. | <i>ω</i> Piscium | 55 24.55 | + 0.11 | + 0.22 | + 0.05 | 55 24.93 | 52 46.87 | 38.06 |
| E. | <i>α</i> Cassiopeiæ | 0 35 56.85 | + 0.09 | — 0.21 | — 0.09 | 0 35 56.64 | 0 33 18.69 | 37.95 |
| E. | <i>β</i> Ceti | 39 50.94 | + 0.17 | — 0.06 | — 0.05 | 39 50.88 | 37 12.55 | 38.33 |
| E. | <i>ε</i> Piscium | 0 58 59.12 | + 0.11 | — 0.07 | — 0.05 | 0 58 59.11 | 0 56 20.78 | — 2 38.33 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= +0.29 + 6.00 \delta t + 1.16 a \\
 0 &= -1.00 + 1.16 \delta t + 5.73 a \quad a = +0^s.19 \\
 &\text{Adopted } c = +0^s.05 \text{ for W.}
 \end{aligned}$$

SALT LAKE CITY, UTAH, OCTOBER 25, 1872.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | <i>ζ</i> Cygni | 21 10 12.12 | + 0.01 | — 0.17 | — 0.06 | 21 10 11.90 | 21 07 30.75 | — 2 41.15 |
| E. | <i>α</i> Cephei | 18 13.75 | — 0.03 | — 0.42 | — 0.11 | 18 13.19 | 15 32.34 | 40.85 |
| E. | <i>β</i> Aquarii | 27 32.44 | + 0.03 | — 0.14 | — 0.05 | 27 32.28 | 24 51.08 | 41.20 |
| E. | <i>β</i> Cephei | 3 41.33 | — 0.06 | — 0.51 | — 0.15 | 30 40.61 | 28 00.81 | 40.80 |
| E. | <i>ξ</i> Aquarii | 33 39.36 | + 0.03 | — 0.13 | — 0.05 | 33 39.21 | 30 58.14 | 41.07 |
| W. | <i>ε</i> Pegasi | 40 36.79 | + 0.02 | — 0.03 | + 0.05 | 40 36.78 | 37 55.80 | 40.98 |
| W. | 79 Draconis | 21 53 59.66 | — 0.07 | — 0.52 | + 0.17 | 21 53 59.24 | 21 51 17.72 | — 2 41.52 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -0.89 + 7.00 \delta t - 1.79 a \\
 0 &= -0.04 - 1.79 \delta t + 7.79 a \quad a = +0^s.04 \\
 &\text{Adopted } c = +0^s.05 \text{ for W.}
 \end{aligned}$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, OCTOBER 25, 1872.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | <i>o</i> Cephei | 23 16 06.09 | + 0.44 | — 0.33 | + 0.13 | 23 16 06.33 | 23 13 25.55 | — 2 40.78 |
| W. | <i>θ</i> Piscium | 24 12.06 | — 0.22 | — 0.09 | + 0.05 | 24 11.80 | 21 30.85 | 40.95 |
| W. | <i>ι</i> Piscium | 23 36 05.33 | — 0.22 | — 0.03 | + 0.05 | 36 05.13 | 33 24.51 | — 2 40.62 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -1.25 + 3.00 \delta t + 0.00 a \\
 0 &= +0.77 + 0.00 \delta t + 2.03 a \quad a = -0.38 \\
 \text{Adopted } c &= +0^{\text{s}}.05.
 \end{aligned}$$

SALT LAKE CITY, UTAH, OCTOBER 31, 1872.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|---------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | <i>β</i> Aquarii | 21 27 33.29 | + 0.15 | — 0.15 | + 0.05 | 21 27 33.34 | 21 24 50.99 | — 2 42.35 |
| W. | <i>β</i> Cephei | 29 42.97 | — 0.29 | — 0.97 | + 0.15 | 29 41.83 | 27 00.45 | 41.38 |
| W. | <i>ξ</i> Aquarii | 33 40.35 | + 0.16 | — 0.28 | + 0.05 | 33 40.28 | 30 58.05 | 42.23 |
| W. | <i>ε</i> Pegasi | 40 37.94 | + 0.11 | — 0.26 | + 0.05 | 40 37.84 | 37 55.71 | 42.13 |
| W. | 11 Cephei | 42 46.36 | — 0.31 | — 0.60 | + 0.15 | 42 45.60 | 40 03.11 | 42.49 |
| E. | <i>μ</i> Capricorni | 49 03.23 | + 0.17 | — 0.25 | — 0.05 | 49 03.10 | 46 21.00 | 42.10 |
| E. | 79 Draconis | 54 01.03 | — 0.38 | — 1.25 | — 0.17 | 53 59.23 | 51 17.30 | 41.93 |
| E. | <i>α</i> Aquarii | 22 01 56.88 | + 0.14 | — 0.32 | — 0.05 | 22 01 56.65 | 59 14.48 | 42.17 |
| E. | <i>θ</i> Aquarii | 12 49.21 | + 0.16 | — 0.28 | — 0.05 | 12 49.04 | 22 10 06.78 | 42.26 |
| E. | 9 Draconis, L. C. ... | 26 50.85 | + 0.77 | + 0.59 | + 0.21 | 26 52.42 | 24 10.51 | 41.91 |
| E. | <i>α</i> Andromedæ | 0 04 31.03 | + 0.05 | — 0.06 | — 0.06 | 0 04 31.01 | 0 01 48.98 | 42.03 |
| E. | <i>γ</i> Pegasi | 09 23.31 | + 0.09 | 0.00 | — 0.05 | 09 23.35 | 06 41.28 | — 2 42.07 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -0.73 + 12.00 \delta t + 0.60 a \\
 0 &= -5.19 + 0.60 \delta t + 25.18 a \quad a = +0^{\text{s}}.205
 \end{aligned}$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, OCTOBER 31, 1872.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|-----------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | θ^1 Ceti | 1 20 22.54 | 0.00 | + 0.02 | + 0.05 | 1 20 22.61 | 1 17 40.30 | — 2 42.31 |
| W. | 38 Cassiopeiæ | 24 31.06 | 0.00 | + 0.03 | + 0.14 | 24 31.28 | 21 49.32 | 41.96 |
| W. | β Arietis | 50 19.26 | 0.00 | + 0.15 | + 0.05 | 50 19.46 | 47 37.23 | 42.23 |
| W. | 50 Cassiopeiæ | 1 55 20.49 | 0.00 | + 0.60 | + 0.16 | 55 21.25 | 52 38.71 | — 2 42.54 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= +1.06 + 4.00 \delta t - 2.08 a \\
 0 &= -0.56 - 2.08 \delta t + 5.69 a & a &= 0^s.00 \\
 c &= +0^s.05 \text{ for W.}
 \end{aligned}$$

SALT LAKE CITY, UTAH, NOVEMBER 1, 1872.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|-------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | β Cephei | 21 29 41.64 | — 0.04 | 0.00 | + 0.15 | 21 20 41.75 | 21 18 00.39 | — 2 41.36 |
| W. | ξ Aquarii | 33 39.86 | + 0.02 | 0.00 | + 0.05 | 33 39.93 | 30 58.08 | 41.85 |
| W. | ϵ Pegasi | 40 37.52 | + 0.01 | 0.00 | + 0.05 | 40 37.58 | 37 55.70 | 41.88 |
| W. | 11 Cephei | 42 44.58 | — 0.04 | 0.00 | + 0.15 | 42 44.69 | 40 03.05 | 41.64 |
| W. | μ Capricorni | 49 02.86 | + 0.02 | 0.00 | + 0.05 | 49 02.93 | 46 20.98 | 41.95 |
| E. | 79 Draconis | 53 59.19 | — 0.05 | + 0.23 | — 0.17 | 53 59.20 | 51 17.23 | 41.97 |
| E. | α Aquarii | 22 01 56.38 | + 0.01 | + 0.03 | — 0.05 | 22 01 56.36 | 59 14.47 | 41.89 |
| E. | θ Aquarii | 12 48.67 | + 0.02 | 0.00 | — 0.05 | 12 48.64 | 22 10 06.77 | 41.87 |
| E. | π Aquarii | 21 28.39 | + 0.01 | 0.00 | — 0.05 | 21 28.35 | 18 46.41 | 41.94 |
| E. | 9 Draconis, L. C. .. | 22 26 52.12 | + 0.09 | — 0.46 | — 0.21 | 26 51.54 | 24 10.60 | — 2 41.94 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= +0.51 + 10.00 \delta t - 4.32 a \\
 0 &= -0.81 - 4.32 \delta t + 24.78 a & a &= +0^s.026
 \end{aligned}$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, NOVEMBER 1, 1872.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|---------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | θ Ceti | 1 20 22.28 | — 0.15 | + 0.02 | — 0.05 | 1 20 22.10 | 1 17 40.30 | — 02 41.80 |
| E. | 38 Cassiopeia | 24 30.42 | + 0.28 | + 0.13 | — 0.14 | 24 30.69 | 21 49.31 | 41.38 |
| W. | o Piscium | 41 22.71 | — 0.11 | — 0.07 | + 0.05 | 41 22.58 | 38 41.04 | 41.54 |
| W. | β Arietis | 50 18.73 | — 0.07 | + 0.08 | + 0.05 | 50 18.79 | 47 37.24 | 41.55 |
| W. | 50 Cassiopeia | 55 19.59 | + 0.32 | + 0.68 | + 0.16 | 55 20.75 | 52 38.73 | 42.02 |
| W. | a Arietis | 2 02 42.22 | — 0.07 | + 0.26 | + 0.05 | 2 02 42.46 | 2 00 00.67 | — 02 41.79 |

NORMAL EQUATIONS.

$$0 = -0.98 + 6.00 \delta t - 1.01 a$$

$$0 = +1.12 - 1.01 \delta t + 5.75 a$$

$$a = -0^s.21$$

SALT LAKE CITY, UTAH, NOVEMBER 5, 1872.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|-------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | o Cephei | 23 16 01.13 | + 5.09 | — 0.46 | + 0.08 | 23 16 05.84 | 23 13 25.09 | — 02 40.75 |
| W. | θ Piscium | 24 14.06 | — 2.52 | — 0.07 | + 0.03 | 24 11.50 | 21 30.82 | 40.68 |
| W. | ι Piscium | 36 07.59 | — 2.57 | — 0.10 | + 0.03 | 36 04.95 | 33 24.40 | 40.55 |
| W. | γ Cephei | 36 40.31 | +11.31 | — 0.62 | + 0.13 | 36 51.13 | 34 10.29 | 40.84 |
| E. | Groombr. 4163 .. | 51 14.14 | + 8.44 | — 0.44 | — 0.11 | 51 22.03 | 48 41.35 | 40.68 |
| E. | ω Piscium | 55 30.21 | — 2.48 | — 0.09 | — 0.03 | 55 27.61 | 52 46.80 | 40.81 |
| E. | a Andromeda | 0 04 30.97 | — 1.04 | — 0.10 | — 0.03 | 0 04 29.80 | 0 01 48.96 | 40.84 |
| E. | γ Pegasi | 09 24.11 | — 2.00 | — 0.06 | — 0.03 | 09 22.02 | 06 41.26 | 40.76 |
| E. | ι Ceti | 15 41.21 | — 3.39 | + 0.02 | — 0.03 | 15 37.81 | 12 56.96 | — 02 40.85 |

NORMAL EQUATIONS.

$$0 = -13.12 + 9.00 \delta t - 2.49 a + 1.27 c$$

$$0 = +60.68 - 2.49 \delta t + 13.78 a - 8.53 c$$

$$0 = -38.70 + 1.27 \delta t - 8.53 a + 45.30 c$$

$$a = -4^s.346$$

$$c = +0^s.029$$

8 AST

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, NOVEMBER 6, 1872.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|--------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | β Cephei | 21 29 40.35 | + 0.56 | — 0.48 | — 0.15 | 21 29 40.29 | 21 27 00.08 | 2 40.20 |
| E. | ξ Aquarii | 33 38.50 | — 0.29 | — 0.13 | — 0.05 | 33 38.03 | 30 57.97 | 40.06 |
| E. | ε Pegasi | 40 36.12 | — 0.20 | — 0.15 | — 0.05 | 40 35.72 | 37 55.63 | 40.09 |
| E. | 11 Cephei | 42 42.60 | + 0.60 | — 0.47 | — 0.15 | 42 42.58 | 40 02.73 | 39.85 |
| E. | μ Capricorni | 49 01.37 | — 0.32 | — 0.10 | — 0.05 | 49 00.90 | 46 20.91 | 39.99 |
| W. | 79 Draconis | 53 55.92 | + 0.72 | 0.00 | + 0.17 | 53 56.91 | 51 16.88 | 40.03 |
| W. | α Aquarii | 22 01 54.71 | — 0.26 | — 0.01 | + 0.05 | 22 01 54.49 | 59 14.41 | 40.08 |
| W. | θ Aquarii | 12 46.97 | — 0.29 | — 0.02 | + 0.05 | 12 46.71 | 22 10 06.70 | 40.01 |
| W. | π Aquarii | 21 26.50 | — 0.24 | + 0.08 | + 0.05 | 21 26.39 | 18 46.35 | 40.04 |
| W. | ο Cephei | 23 16 04.72 | + 0.45 | + 0.16 | + 0.13 | 23 16 05.46 | 23 13 25.12 | 40.34 |
| W. | θ Piscium | 24 11.02 | — 0.20 | + 0.04 | + 0.05 | 24 10.91 | 21 30.76 | 40.15 |
| W. | ι Piscium | 36 04.64 | — 0.21 | + 0.00 | + 0.05 | 36 04.48 | 33 24.43 | 40.05 |
| W. | γ Cephei | 23 36 48.92 | + 0.82 | — 0.07 | + 0.22 | 36 49.89 | 34 10.08 | — 2 39.81 |

NORMAL EQUATIONS.

$$0 = -3.48 + 13.00 \delta t - 2.97 a$$

$$0 = +8.12 - 2.97 \delta t + 19.48 a$$

$$a = -0^s.39$$

Adopted $c = +0^s.05$ for W.

SALT LAKE CITY, UTAH, NOVEMBER 6, 1872.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|---------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | θ Ceti | 1 20 20.64 | — 0.31 | — 0.03 | — 0.05 | 1 20 20.25 | 1 17 40.30 | — 2 39.95 |
| E. | 38 Cassiopeiæ | 24 28.78 | + 0.55 | — 0.05 | — 0.14 | 24 29.14 | 21 49.28 | 39.86 |
| E. | η Piscium | 27 21.37 | — 0.18 | 0.00 | — 0.05 | 27 21.14 | 24 40.93 | 40.21 |
| E. | ν Piscium | 37 29.50 | — 0.23 | + 0.02 | — 0.05 | 37 29.24 | 34 49.04 | 40.20 |
| E. | ο Piscium | 41 21.26 | — 0.21 | + 0.04 | — 0.05 | 41 21.04 | 38 41.05 | 39.99 |
| E. | β Arietis | 50 17.43 | — 0.15 | + 0.08 | — 0.05 | 50 17.31 | 47 37.26 | 40.05 |
| E. | 50 Cassiopeiæ | 55 18.20 | + 0.66 | + 0.29 | — 0.16 | 55 18.99 | 52 38.73 | 40.26 |
| E. | α Arietis | 2 02 40.87 | — 0.13 | + 0.11 | — 0.05 | 2 02 40.80 | 2 00 00.69 | — 2 40.11 |

NORMAL EQUATIONS.

$$0 = +0.63 + 8.00 \delta t + 0.03 a$$

$$0 = +2.51 + 0.03 \delta t + 6.30 a$$

$$a = -0^s.40$$

Adopted $c = +0^s.05$ for W.

The following tables show the corrections and rates of the chronometers used at Gunnison and Salt Lake City :

CHRONOMETER AT GUNNISON.—NEGUS, No. 1491.

| Date. | Local sidereal time. | Correction of chronometer. | Adopted hourly rate. |
|---------|----------------------|----------------------------|----------------------|
| 1872. | <i>h.</i> | <i>h. m. s.</i> | <i>s.</i> |
| Oct. 23 | 0.1 | — 2 19 40.78 | — 0.032 |
| Oct. 25 | 0.0 | 39.24 | — 0.090 |
| Oct. 31 | 0.0 | 26.25 | — 0.099 |
| Nov. 1 | 0.3 | 23.86 | — 0.071 |
| Nov. 5 | 0.5 | 16.71 | — 0.125 |
| Nov. 6 | 0.5 | — 2 19 13.70 | |

CHRONOMETER AT SALT LAKE CITY.—NEGUS, No. 1511.

| Date. | Local sidereal time. | Correction of chronometer. | Adopted hourly rate. |
|---------|----------------------|----------------------------|----------------------|
| 1872. | <i>h.</i> | <i>h. m. s.</i> | <i>s.</i> |
| Oct. 23 | 23.0 | — 0 02 38.12 | + 0.058 |
| Oct. 25 | 22.4 | 40.92 | + 0.008 |
| Oct. 31 | 23.8 | 42.10 | — 0.014 |
| Nov. 1 | 23.8 | 41.77 | — 0.011 |
| Nov. 5 | 23.5 | 40.75 | — 0.030 |
| Nov. 6 | 0.0 | — 0 02 40.05 | |

Final results of longitude.

| Signals sent from— | Recorded at— | Mean of signals sent and received. | Time-corrections. | Corrected time. | Difference of longitude. | Double-wave time. | Means. |
|--------------------|-----------------|------------------------------------|-------------------|-----------------|--------------------------|-------------------|-----------------|
| | | <i>l. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>s.</i> | <i>h. m. s.</i> |
| October 23, 1872: | | | | | | | |
| Salt Lake City. | Salt Lake City. | 0 12 18.51 | — 0 02 38.18 | 0 09 40.33 | 0 00 17.94 | | |
| Gunnison..... | Gunnison..... | 2 29 39.05 | — 2 19 40.78 | 0 09 58.27 | | | |
| Gunnison..... | Salt Lake City. | 0 21 08.62 | — 0 02 38.19 | 0 18 30.43 | 17.93 | .... | 0 00 17.935 |
| | Gunnison..... | 2 38 29.13 | — 2 19 40.77 | 0 18 48.36 | | | |
| October 31, 1872: | | | | | | | |
| Salt Lake City. | Salt Lake City. | 0 39 28.98 | — 0 02 42.09 | 0 36 46.89 | 18.01 | | |
| Gunnison..... | Gunnison..... | 2 56 31.09 | — 2 19 26.19 | 0 37 04.90 | | | |
| Gunnison..... | Salt Lake City. | 0 46 03.22 | — 0 02 42.09 | 0 43 21.13 | 17.95 | .... | 17.980 |
| | Gunnison..... | 3 03 05.26 | — 2 19 26.18 | 0 43 39.08 | | | |
| November 1, 1872: | | | | | | | |
| Salt Lake City. | Salt Lake City. | 0 37 21.66 | — 0 02 41.77 | 0 34 39.89 | 17.79 | | |
| Gunnison..... | Gunnison..... | 2 54 21.52 | — 2 19 23.84 | 0 34 57.68 | | | |
| Gunnison..... | Salt Lake City. | 0 44 09.97 | — 0 02 41.77 | 0 41 28.20 | 17.79 | .... | 17.790 |
| | Gunnison..... | 3 01 09.82 | — 2 19 23.83 | 0 41 44.99 | | | |
| November 5, 1872: | | | | | | | |
| Salt Lake City. | Salt Lake City. | 0 46 18.32 | — 0 02 40.72 | 0 43 37.60 | 17.76 | | |
| Gunnison..... | Gunnison..... | 3 03 12.04 | — 2 19 16.68 | 0 43 55.36 | | | |
| Gunnison..... | Salt Lake City. | 0 59 45.04 | — 0 02 40.71 | 0 57 04.33 | 17.78 | .... | 17.770 |
| | Gunnison..... | 3 16 38.77 | — 2 19 16.66 | 0 57 22.11 | | | |
| November 6, 1872: | | | | | | | |
| Salt Lake City. | Salt Lake City. | 0 55 31.06 | — 0 02 40.02 | 0 52 51.04 | 17.87 | | |
| Gunnison..... | Gunnison..... | 3 12 22.56 | — 2 19 13.65 | 0 53 08.91 | | | |
| Gunnison..... | Salt Lake City. | 1 02 05.48 | — 0 02 40.02 | 0 59 25.46 | 0 00 17.77 | .... | 0 00 17.820 |
| | Gunnison..... | 3 18 56.87 | — 2 19 13.64 | 0 59 43.23 | | | |

Gunnison east of Salt Lake City.....0^h 00^m 17^s.86 ± 0^s.023.

Observations and computations for latitude.

GUNNISON, UTAH.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|-------------|-----------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|--------|------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1872. | | <i>t.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | ° ' " |
| November 8. | 7281 | 10.808 | 18.0 | 16.9 | | | | | |
| | 7275 | 14.113 | 18.8 | 15.7 | | 39 07 10.8 | + 2 13.6 | +1.5 | 39 09 25.9 |
| | 7476 | 6.688 | 13.3 | 22.1 | | | | | |
| | 7450 | 19.543 | 19.9 | 15.7 | | 00 49.8 | + 8 39.5 | -1.6 | 27.7 |
| | 7637 | 24.057 | 24.0 | 28.3 | | | | | |
| | 7586 | 21.141 | 30.1 | 22.4 | | 11 21.2 | - 1 57.7 | +1.2 | 24.7 |
| | 7642 | 21.006 | 24.0 | 28.3 | | | | | |
| | 7571 | 17.340 | 30.1 | 22.4 | | 39 11 54.4 | - 2 28.1 | +1.2 | 27.5 |
| | 7848 | 6.515 | 20.3 | 31.1 | | | | | |
| | 7807 | 21.593 | 31.5 | 20.5 | | 33 59 15.9 | +10.09.3 | 0.0 | 25.2 |
| | 7961 | 10.772 | 22.0 | 29.3 | | | | | |
| | 7945 | 19.030 | 28.1 | 22.8 | | 39 03 53.9 | + 5 33.6 | -0.7 | 26.8 |
| | 8107 | 25.117 | 29.6 | 23.0 | | | | | |
| | 8079 | 8.245 | 24.9 | 27.7 | | 20 47.9 | -11 21.8 | +1.3 | 27.4 |
| | 80 | 22.490 | 30.5 | 25.5 | | | | | |
| | 101 | 22.238 | 31.4 | 24.2 | | 09 33.1 | - 0 10.2 | +4.3 | 27.2 |
| | 201 | 11.420 | 37.3 | 17.8 | | | | | |
| | 178 | 4.828 | 26.4 | 29.0 | | 13 48.6 | - 4 26.4 | +6.0 | 28.2 |
| | 201 | 11.420 | 37.3 | 17.8 | | | | | |
| | 215 | 20.731 | 24.0 | 31.0 | | 03 06.5 | + 6 16.3 | +4.3 | 27.1 |
| | 283 | 19.876 | 29.5 | 25.5 | | | | | |
| | 259 | 12.699 | 30.0 | 25.0 | | 14 13.0 | - 4 50.0 | +3.2 | 26.2 |
| | 450 | 21.589 | 24.0 | 20.8 | | | | | |
| | 370 | 17.734 | 25.1 | 29.5 | | 11 59.8 | - 2 35.8 | -0.4 | 23.6 |
| | 628 | 14.463 | 29.0 | 25.0 | | | | | |
| | 576 | 18.467 | 27.0 | 27.0 | | 06 42.0 | + 2 41.8 | +1.4 | 25.2 |
| | 628 | 14.463 | 29.0 | 25.0 | | | | | |
| | 580 | 12.911 | 27.0 | 27.0 | | 10 26.5 | - 1 02.7 | +1.4 | 25.2 |
| | 653 | 15.823 | 25.3 | 28.6 | | | | | |
| | 647 | 14.660 | 28.2 | 25.0 | | 39 10 12.1 | - 0 47.0 | 0.0 | 25.1 |
| | 695 | 5.062 | 34.2 | 18.0 | | | | | |
| | 682 | 22.360 | 24.0 | 30.4 | | 38 57 41.2 | +11 38.8 | +3.4 | 23.4 |
| November 15 | 7477 | 12.313 | 28.0 | 20.5 | | | | | |
| | 7399 | 19.533 | 19.9 | 27.9 | | 39 04 32.8 | + 4 51.8 | -0.2 | 24.4 |
| | 7637 | 25.007 | 29.0 | 20.3 | | | | | |
| | 7586 | 22.047 | 24.0 | 25.4 | | 11 54.4 | - 2 29.2 | +2.8 | 28.0 |
| | 7683 | 18.794 | 26.5 | 23.3 | | | | | |
| | 7712 | 11.476 | 26.1 | 23.9 | | 39 14 18.5 | - 4 55.7 | +1.9 | 39 09 24.7 |

LATITUDE DETERMINATIONS.

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Observations and computations—Continued.

GUNNISON, UTAH.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|----------------------|-----------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|--------|------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1872. November 15 | | <i>t.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | ° ' " |
| | 7749 | 27.163 | 28.1 | 21.6 | | | | | |
| | 7712 | 11.476 | 26.1 | 23.9 | | 39 19 55.9 | —10 33.9 | +3.1 | 39 09 25.1 |
| | 7915 | 16.256 | 26.0 | 25.9 | | | | | |
| | 7931 | 13.833 | 28.0 | 24.2 | | 10 59.7 | — 1 37.9 | +1.4 | 23.2 |
| | 8107 | 26.218 | 31.8 | 22.2 | | | | | |
| | 8079 | 9.291 | 25.3 | 29.1 | | 20 48.4 | —11 24.0 | +2.0 | 26.4 |
| | 8261 | 19.415 | 33.5 | 22.3 | | | | | |
| | 8211 | 10.398 | 26.1 | 29.0 | | 15 23.7 | — 6 04.4 | +2.9 | 22.2 |
| | 80 | 21.757 | 34.2 | 22.7 | | | | | |
| | 101 | 21.421 | 30.5 | 26.7 | | 09 34.1 | — 0 13.6 | +5.6 | 26.1 |
| | 152 | 21.251 | 37.0 | 19.6 | | | | | |
| | 158 | 13.236 | 26.5 | 30.3 | | 14 43.1 | — 5 23.9 | +4.8 | 24.0 |
| | 201 | 9.067 | 31.8 | 25.5 | | | | | |
| | 215 | 18.223 | 35.2 | 21.9 | | 03 07.5 | + 6 09.9 | +7.0 | 24.4 |
| | 283 | 19.638 | 41.4 | 16.8 | | | | | |
| | 259 | 12.422 | 24.0 | 33.7 | | 14 14.1 | — 4 51.6 | +5.2 | 27.7 |
| | 318 | 14.255 | 31.8 | 26.7 | | | | | |
| | 334 | 18.585 | 35.2 | 23.2 | | 06 24.2 | + 3 55.0 | +6.0 | 25.2 |
| | 416 | 10.638 | 35.1 | 23.8 | | | | | |
| | 427 | 20.830 | 20.2 | 38.5 | | 02 35.4 | + 6 51.9 | —2.8 | 24.5 |
| | 515 | 25.600 | 38.5 | 21.2 | | | | | |
| | 431 | 17.651 | 20.2 | 38.5 | | 14 47.0 | — 5 21.2 | —0.4 | 25.4 |
| | 653 | 14.870 | 34.8 | 25.6 | | | | | |
| | 647 | 13.644 | 27.2 | 32.6 | | 39 10 13.2 | — 0 49.5 | +1.3 | 25.0 |
| | 714 | 6.367 | 35.6 | 24.0 | | | | | |
| | 752 | 22.259 | 24.7 | 35.6 | | 38 58 44.1 | +10 42.2 | +0.3 | 26.6 |
| | 816 | 22.931 | 32.0 | 28.4 | | | | | |
| | 796 | 7.661 | 29.9 | 30.8 | | 39 19 43.0 | —10 17.1 | +1.0 | 26.9 |
| | 1007 | 24.633 | 31.0 | 30.3 | | | | | |
| | 974 | 23.158 | 30.7 | 30.7 | | 39 10 23.8 | — 0 59.6 | +0.3 | 24.5 |
| | 1043 | 9.153 | 31.8 | 29.8 | | | | | |
| | 1025 | 23.395 | 30.7 | 30.9 | | 38 59 50.8 | + 9 35.5 | +0.6 | 26.9 |
| | 1254 | 23.367 | 31.1 | 28.0 | | | | | |
| | 1265 | 7.887 | 29.0 | 30.7 | | 39 19 49.4 | —10 25.6 | +0.5 | 24.3 |
| | 1301 | 22.512 | 32.8 | 27.2 | | | | | |
| | 1265 | 7.887 | 29.0 | 30.7 | | 19 13.3 | — 9 51.0 | +1.4 | 23.7 |
| | 1504 | 17.575 | 37.8 | 26.0 | | | | | |
| | 1528 | 13.790 | 27.0 | 34.1 | | 39 11 56.7 | — 2 33.0 | +1.7 | 39 09 25.4 |

Observations and computations—Continued.

GUNNISON, UTAH.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|-------------|-----------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|--------|------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1872. | | <i>t.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | ° ' " |
| November 15 | 1546 | 24.990 | 32.0 | 29.7 | | | | | |
| | 1563 | 20.163 | 32.1 | 29.5 | | 39 12 38.6 | - 3 15.1 | +1.7 | 39 09 25.2 |
| | 1721 | 15.831 | 34.9 | 27.5 | | | | | |
| | 1737 | 17.209 | 29.0 | 32.9 | | 08 29.7 | + 0 55.7 | +1.3 | 26.7 |
| November 16 | 1747 | 13.235 | 43.0 | 18.9 | | | | | |
| | 1792 | 12.271 | 16.6 | 45.1 | | 10 06.9 | - 0 39.0 | -1.5 | 26.4 |
| | 7171 | 13.266 | 20.5 | 22.0 | | | | | |
| | 7204 | 12.811 | 19.0 | 24.7 | | 09 48.0 | - 0 18.4 | -2.5 | 27.1 |
| | 7281 | 12.273 | 17.5 | 27.2 | | | | | |
| | 7275 | 15.736 | 22.0 | 27.7 | | 07 10.3 | + 2 19.9 | -5.3 | 24.9 |
| | 7411 | 22.308 | 23.6 | 22.9 | | | | | |
| | 7368 | 5.852 | 20.7 | 25.0 | | 20 32.1 | -11 05.0 | -1.3 | 25.8 |
| | 7476 | 11.020 | 31.8 | 15.1 | | | | | |
| | 7450 | 23.778 | 19.0 | 27.5 | | 00 49.7 | + 8 35.4 | +2.8 | 27.9 |
| | 7559 | 18.219 | 26.0 | 21.0 | | | | | |
| | 7566 | 23.022 | 24.2 | 23.0 | | 39 06 08.4 | + 3 14.0 | +2.2 | 24.6 |
| | 7848 | 8.652 | 37.4 | 12.5 | | | | | |
| | 7807 | 23.694 | 17.4 | 32.7 | | 38 59 16.2 | +10 07.9 | +3.4 | 27.5 |
| | 8212 | 11.165 | 27.6 | 15.7 | | | | | |
| | 8195 | 21.559 | 23.5 | 20.0 | | 39 02 21.2 | + 7 00.0 | +5.6 | 26.8 |
| | 80 | 21.440 | 35.1 | 10.0 | | | | | |
| | 101 | 21.150 | 15.3 | 30.2 | | 09 34.3 | - 0 11.7 | +3.6 | 26.2 |
| | 180 | 18.970 | 37.5 | 09.0 | | | | | |
| | 164 | 13.172 | 18.0 | 28.5 | | 13 13.6 | - 3 54.3 | +6.3 | 25.6 |
| | 227 | 9.752 | 22.9 | 23.9 | | | | | |
| | 259 | 14.831 | 22.8 | 24.4 | | 06 00.1 | + 3 25.2 | -0.9 | 24.4 |
| | 283 | 22.071 | 29.7 | 17.7 | | | | | |
| | 259 | 14.831 | 22.8 | 24.4 | | 39 14 14.3 | - 4 52.6 | +3.6 | 25.3 |
| | 416 | 10.519 | 25.8 | 23.0 | | | | | |
| | 427 | 20.686 | 24.2 | 24.0 | | 37 02 35.9 | + 6 50.9 | +1.0 | 27.8 |
| | 515 | 25.490 | 29.7 | 20.0 | | | | | |
| | 431 | 17.511 | 24.2 | 24.0 | | 39 14 47.2 | - 5 22.4 | +3.5 | 28.3 |
| | 525 | 20.309 | 28.0 | 21.7 | | | | | |
| | 555 | 10.074 | 24.5 | 25.9 | | 16 17.8 | - 6 53.5 | +1.7 | 26.0 |
| | 628 | 19.780 | 28.6 | 22.3 | | | | | |
| | 580 | 18.217 | 24.9 | 25.6 | | 39 10 27.8 | - 1 13.2 | +1.9 | 26.5 |
| | 695 | 4.927 | 30.0 | 19.0 | | | | | |
| | 682 | 22.253 | 21.6 | 29.9 | | 38 57 42.8 | +11 40.1 | +1.0 | 39 09 23.9 |

LATITUDE DETERMINATIONS.

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Observations and computations—Continued.

GUNNISON, UTAH.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|-------------|-----------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|--------|------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1872. | | <i>t.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | ° ' " |
| November 16 | 714 | 7.780 | 24.9 | 26.0 | | | | | |
| | 752 | 23.603 | 29.6 | 21.9 | | 38 58 44.3 | +10 39.4 | +2.3 | 39 09 26.0 |
| | 829 | 20.910 | 29.9 | 21.5 | | | | | |
| | 877 | 21.817 | 22.5 | 29.3 | | 39 08 46.0 | + 0 36.7 | +0.5 | 23.2 |
| November 18 | 7637 | 24.702 | 18.2 | 13.8 | | | | | |
| | 7627 | 6.170 | 13.2 | 19.0 | | 39 21 55.8 | -12 28.9 | -0.5 | 26.4 |
| | 7642 | 21.717 | 18.5 | 14.0 | | | | | |
| | 7586 | 21.952 | 10.1 | 22.0 | | 39 09 18.7 | + 0 09.5 | -2.8 | 25.4 |
| | 7683 | 18.943 | 24.1 | 23.9 | | | | | |
| | 7712 | 11.735 | 23.9 | 24.3 | | 14 18.4 | - 4 51.3 | -0.1 | 27.0 |
| | 7749 | 27.267 | 22.3 | 26.0 | | | | | |
| | 7712 | 11.735 | 23.9 | 24.3 | | 19 55.9 | -10 27.6 | -1.7 | 26.6 |
| | 7882 | 9.877 | 29.0 | 21.6 | | | | | |
| | 7914 | 21.053 | 24.8 | 26.8 | | 01 52.1 | + 7 31.6 | +1.9 | 25.6 |
| | 7961 | 12.702 | 27.0 | 24.6 | | | | | |
| | 7945 | 20.936 | 25.0 | 26.5 | | 03 54.5 | + 5 32.7 | +0.3 | 27.5 |
| | 8107 | 25.520 | 25.0 | 27.6 | | | | | |
| | 8079 | 8.623 | 26.9 | 25.7 | | 20 48.6 | -11 22.8 | -0.5 | 25.3 |
| | 8212 | 11.242 | 29.9 | 23.4 | | | | | |
| | 8195 | 21.717 | 24.2 | 28.6 | | 02 21.3 | + 7 03.3 | +0.7 | 25.3 |
| | 80 | 21.604 | 29.7 | 25.9 | | | | | |
| | 101 | 21.363 | 29.6 | 26.0 | | 09 34.4 | - 0 09.7 | +2.6 | 27.3 |
| | 180 | 18.961 | 35.0 | 20.5 | | | | | |
| | 164 | 13.250 | 25.3 | 30.3 | | 13 13.8 | - 3 50.8 | +3.4 | 26.4 |
| | 227 | 8.553 | 29.1 | 25.9 | | | | | |
| | 259 | 13.630 | 28.0 | 27.3 | | 06 00.2 | + 3 25.2 | +1.4 | 26.8 |
| | 318 | 13.890 | 28.9 | 26.9 | | | | | |
| | 334 | 18.300 | 30.2 | 25.1 | | 06 24.6 | + 2 58.2 | +2.5 | 25.3 |
| November 19 | 7642 | 21.733 | 26.3 | 15.4 | | | | | |
| | 7586 | 21.889 | 17.4 | 23.8 | | 09 18.6 | + 0 06.3 | +1.6 | 26.5 |
| | 7683 | 19.972 | 22.0 | 20.0 | | | | | |
| | 7712 | 12.683 | 22.2 | 19.8 | | 14 18.4 | - 4 54.6 | +1.5 | 25.3 |
| | 7749 | 28.260 | 17.0 | 25.0 | | | | | |
| | 7712 | 12.683 | 22.2 | 19.8 | | 39 19 55.9 | -10 29.5 | -1.9 | 24.5 |
| | 7848 | 7.156 | 22.6 | 20.4 | | | | | |
| | 7807 | 22.303 | 19.0 | 24.0 | | 38 59 16.2 | +10 12.1 | -1.0 | 27.3 |
| | 7882 | 10.071 | 20.0 | 23.1 | | | | | |
| | 7914 | 21.248 | 24.7 | 18.9 | | 39 01 52.1 | + 7 31.7 | +1.0 | 39 09 24.8 |

Observations and computations—Continued.

GUNNISON, UTAH.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|----------------------|-----------------|-------------------|-----------|-----------|----------|--------------------------|--------------------|--------|------------|
| | | | N. | S. | | | Microm. and refer. | Level. | |
| 1872. November 19 | | <i>t.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | ° ' " |
| | 7945 | 21.297 | 19.9 | 24.0 | | 39 03 54.5 | + 5 32.7 | -0.2 | 39 09 27.0 |
| | 7961 | 13.063 | 23.7 | 20.2 | | | | | |
| | 8107 | 25.304 | 25.6 | 20.3 | | 20 48.6 | -11 24.7 | +2.1 | 26.0 |
| | 8079 | 8.361 | 23.2 | 22.5 | | | | | |
| | 8212 | 11.437 | 27.7 | 19.2 | | 39 02 21.3 | + 7 02.5 | +0.6 | 24.4 |
| | 8195 | 21.891 | 20.0 | 26.9 | | | | | |
| | 8231 | 18.247 | 24.4 | 22.2 | | 39 12 54.0 | - 3 31.5 | +1.7 | 24.2 |
| | 8256 | 13.014 | 24.7 | 22.2 | | | | | |
| | 80 | 22.539 | 30.6 | 18.2 | | 09 34.6 | - 0 10.3 | +2.0 | 26.3 |
| | 101 | 22.284 | 21.0 | 27.9 | | | | | |
| | 152 | 22.245 | 23.7 | 24.6 | | 14 43.5 | - 5 19.6 | +1.5 | 25.4 |
| | 158 | 14.337 | 26.3 | 21.0 | | | | | |
| | 180 | 20.229 | 37.7 | 25.6 | | 13 13.8 | - 3 50.4 | +1.4 | 24.8 |
| | 164 | 14.527 | 28.0 | 36.7 | | | | | |
| | 201 | 12.412 | 29.8 | 30.7 | | 03 08.0 | + 6 14.4 | +1.8 | 24.2 |
| | 215 | 21.676 | 33.1 | 27.1 | | | | | |
| | 283 | 20.247 | 28.0 | 20.2 | | 14 14.7 | - 4 52.2 | +2.2 | 24.7 |
| | 259 | 13.917 | 23.3 | 24.8 | | | | | |
| | 318 | 14.757 | 21.4 | 26.2 | | 06 24.8 | + 2 57.2 | +2.8 | 24.8 |
| | 334 | 19.142 | 30.2 | 18.0 | | | | | |
| | 450 | 23.457 | 34.8 | 14.9 | | 11 59.8 | - 2 39.5 | +5.6 | 25.9 |
| | 370 | 19.509 | 22.0 | 25.9 | | | | | |
| | 676 | 8.504 | 31.0 | 19.8 | | 00 39.8 | + 8 42.7 | +3.2 | 25.7 |
| | 656 | 21.440 | 24.5 | 26.5 | | | | | |
| | 816 | 24.697 | 30.2 | 21.1 | | 19 44.1 | -10 22.2 | +4.2 | 26.1 |
| | 796 | 9.300 | 27.0 | 24.0 | | | | | |
| | 916 | 15.225 | 35.4 | 16.0 | | 10 23.3 | - 0 59.6 | +4.9 | 28.6 |
| | 888 | 13.751 | 23.0 | 28.5 | | | | | |
| | 1007 | 24.522 | 35.4 | 15.8 | | 39 10 24.4 | - 1 01.8 | +5.2 | 27.8 |
| | 974 | 22.992 | 23.3 | 28.2 | | | | | |
| | 1043 | 9.143 | 38.0 | 13.2 | | 38 59 51.4 | + 9 30.8 | +2.4 | 24.6 |
| | 1025 | 23.267 | 16.8 | 34.6 | | | | | |
| November 20 | 7637 | 23.580 | 26.4 | 16.8 | | 39 21 55.7 | -12 36.1 | +3.7 | 23.3 |
| | 7627 | 4.870 | 22.0 | 21.0 | | | | | |
| | 7662 | 20.545 | 26.5 | 16.7 | | 11 54.4 | - 2 32.5 | +2.9 | 24.8 |
| | 7571 | 16.771 | 20.7 | 22.1 | | | | | |
| | 7642 | 20.545 | 26.5 | 16.7 | | 09 18.6 | + 0 02.3 | +3.0 | 39 09 23.9 |
| | 7586 | 20.602 | 20.8 | 22.0 | | | | | |

LATITUDE DETERMINATIONS.

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Observations and computations—Continued.

GUNNISON, UTAH.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|----------------------|-----------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|--------|------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1872. November 20 | | <i>t.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | ° ' " |
| | 7683 | 19.277 | 28.5 | 26.9 | | | | | |
| | 7712 | 11.946 | 30.5 | 24.9 | | 39 14 18.3 | — 4 56.3 | +2.5 | 39 09 24.5 |
| | 7749 | 27.582 | 27.9 | 27.6 | | | | | |
| | 7712 | 11.946 | 30.5 | 24.9 | | 39 19 55.9 | —10 31.9 | +2.1 | 26.1 |
| | 7848 | 7.417 | 30.6 | 25.7 | | | | | |
| | 7807 | 22.442 | 28.1 | 27.8 | | 38 59 16.3 | +10 07.2 | +1.8 | 25.3 |
| | 7882 | 10.289 | 28.7 | 27.6 | | | | | |
| | 7914 | 21.459 | 29.6 | 26.9 | | 39 01 52.1 | + 7 32.6 | +1.3 | 26.0 |
| | 7961 | 12.701 | 24.9 | 31.7 | | | | | |
| | 7945 | 20.908 | 29.8 | 26.8 | | 03 54.5 | + 5 31.6 | —1.3 | 24.8 |
| | 8107 | 25.865 | 26.9 | 30.2 | | | | | |
| | 8079 | 8.983 | 30.0 | 27.0 | | 20 50.7 | —11 22.2 | —0.1 | 28.4 |
| | 8231 | 19.885 | 26.5 | 30.4 | | | | | |
| | 8256 | 14.677 | 34.5 | 32.8 | | 12 54.1 | — 3 30.4 | —0.8 | 22.9 |
| | 80 | 21.561 | 30.7 | 29.3 | | | | | |
| | 101 | 21.175 | 35.3 | 24.6 | | 09 34.7 | — 0 15.6 | +4.2 | 23.3 |
| | 201 | 13.386 | 33.9 | 26.0 | | | | | |
| | 215 | 22.650 | 31.1 | 28.6 | | 03 08.0 | + 6 14.4 | +3.6 | 26.0 |
| | 227 | 9.609 | 28.7 | 30.5 | | | | | |
| | 259 | 14.656 | 35.8 | 23.3 | | 06 00.2 | + 3 24.0 | +3.8 | 28.0 |
| | 283 | 21.866 | 28.6 | 30.2 | | | | | |
| | 259 | 14.656 | 35.8 | 23.3 | | 39 14 14.8 | — 4 51.4 | +3.8 | 27.2 |
| | 330 | 5.575 | 30.5 | 27.9 | | | | | |
| | 321 | 23.965 | 30.7 | 28.1 | | 38 57 00.9 | +12 23.1 | +1.8 | 25.8 |
| | 416 | 9.261 | 30.8 | 28.0 | | | | | |
| | 431 | 16.093 | 39.0 | 19.6 | | 39 04 44.7 | + 4 36.0 | +7.8 | 28.5 |
| | 525 | 18.840 | 30.0 | 29.3 | | | | | |
| | 556 | 8.550 | 32.2 | 27.7 | | 16 18.3 | — 6 55.8 | +1.8 | 24.3 |
| | 628 | 19.462 | 29.2 | 30.6 | | | | | |
| | 580 | 17.862 | 32.2 | 27.0 | | 10 28.4 | — 1 04.7 | +1.3 | 25.0 |
| | 653 | 16.237 | 34.1 | 25.8 | | | | | |
| | 647 | 14.945 | 29.5 | 30.5 | | 39 10 13.9 | — 0 52.2 | +2.8 | 24.5 |
| | 695 | 6.982 | 37.6 | 22.7 | | | | | |
| | 682 | 24.220 | 26.9 | 33.0 | | 38 57 43.0 | +11 36.6 | +3.1 | 22.7 |
| | 714 | 6.673 | 33.0 | 27.0 | | | | | |
| | 752 | 22.555 | 30.0 | 31.0 | | 38 58 44.9 | +10 41.8 | +1.7 | 28.4 |
| | 829 | 19.199 | 39.9 | 22.2 | | | | | |
| | 877 | 20.035 | 27.2 | 35.3 | | 39 08 46.5 | + 0 33.8 | +3.4 | 39 09 23.7 |

Observations and computations—Continued.

GUNNISON, UTAH.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|-------------|-----------------|-------------------|--------------|--------------|----------|--------------------------|-------------------|--------|------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1872. | | <i>t.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | ° ' " |
| November 20 | 1007 974 | 24.893 23.430 | 24.1 42.1 | 39.0 21.7 | | 39 10 24.5 | — 0 59.1 | +2.0 | 39 09 27.4 |
| | 1043 1025 | 9.465 23.608 | 25.0 43.5 | 39.2 30.6 | | 38 59 51.6 | + 9 31.5 | —0.4 | 22.7 |
| | 1459 1449 | 10.319 20.514 | 26.1 25.0 | 24.3 25.7 | | 39 02 33.7 | + 6 52.0 | +0.4 | 26.1 |
| | 1494 1463 | 20.644 15.007 | 33.0 22.9 | 27.0 27.6 | | 39 13 11.4 | — 3 43.7 | +0.4 | 28.1 |
| | 1504 1528 | 17.500 13.673 | 29.5 24.5 | 20.5 25.6 | | 11 57.4 | — 2 34.7 | +2.8 | 25.5 |
| | 1546 1563 | 16.172 11.201 | 24.0 33.2 | 25.8 16.0 | | 12 39.2 | — 3 20.9 | +5.4 | 23.7 |
| | 1583 1601 | 10.606 5.852 | 30.0 25.0 | 19.0 24.3 | | 12 31.6 | — 3 12.1 | +4.1 | 23.6 |
| November 22 | 7637 7627 | 25.083 6.422 | 30.4 18.0 | 12.0 24.2 | | 21 55.6 | —12 34.2 | +4.3 | 25.7 |
| | 7642 7571 | 22.053 18.279 | 30.4 17.6 | 12.0 23.7 | | 11 54.2 | — 2 32.5 | +4.3 | 26.0 |
| | 7642 7586 | 22.053 22.093 | 30.4 18.0 | 12.0 23.3 | | 09 18.5 | + 0 01.8 | +4.6 | 24.9 |
| | 7683 7712 | 19.951 12.557 | 26.2 41.2 | 32.1 17.7 | | 39 14 18.2 | — 4 53.8 | +6.2 | 25.6 |
| | 7848 7807 | 7.313 22.350 | 31.0 31.7 | 28.9 28.0 | | 38 59 16.2 | +10 07.6 | +2.0 | 25.8 |
| | 7882 7914 | 9.420 20.574 | 31.6 30.8 | 27.9 28.4 | | 39 01 52.1 | + 7 30.7 | +2.1 | 24.9 |
| | 7961 7945 | 12.543 20.740 | 26.0 30.3 | 36.0 29.1 | | 03 54.5 | + 5 31.2 | —2.4 | 23.3 |
| | 8107 8079 | 25.722 8.752 | 38.0 28.0 | 24.4 34.3 | | 20 48.8 | —11 25.8 | +2.6 | 25.6 |
| | 8118 8136 | 20.855 9.250 | 33.1 30.6 | 24.8 31.7 | | 17 11.2 | — 7 47.3 | +1.1 | 25.0 |
| | 8212 8195 | 11.294 21.723 | 33.9 30.2 | 23.8 32.1 | | 02 21.5 | + 7 01.4 | +1.1 | 24.0 |
| | 80 101 | 22.358 22.094 | 30.7 37.2 | 33.2 26.9 | | 09 34.9 | — 0 10.7 | +2.8 | 27.0 |
| | 152 158 | 19.999 12.129 | 35.1 29.6 | 28.6 34.1 | | 39 14 44.0 | — 5 18.0 | +0.7 | 39 09 26.7 |

LATITUDE DETERMINATIONS.

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Observations and computations—Continued.

GUNNISON, UTAH.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|----------------------|-----------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|--------|------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1872. November 22 | | <i>t.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | ° ' " |
| | 201 | 13.801 | 34.2 | 29.2 | | 39 03 08.2 | + 6 18.4 | -1.0 | 39 09 25.6 |
| | 215 | 23.165 | 28.0 | 35.8 | | | | | |
| | 261 | 22.359 | 31.7 | 31.7 | | 20 17.0 | -10 59.3 | +5.2 | 22.9 |
| | 269 | 6.043 | 39.0 | 24.3 | | | | | |
| | 416 | 9.502 | 26.9 | 37.8 | | 39 02 36.7 | + 6 46.9 | +3.1 | 26.7 |
| | 427 | 19.571 | 42.1 | 22.4 | | | | | |
| | 515 | 24.378 | 25.0 | 40.7 | | 39 14 48.0 | - 5 21.6 | +1.4 | 27.8 |
| | 431 | 16.420 | 42.1 | 22.4 | | | | | |
| | 525 | 20.334 | 30.3 | 35.0 | | 16 18.6 | - 6 53.5 | +4.2 | 29.3 |
| | 556 | 10.101 | 41.1 | 24.3 | | | | | |
| | 628 | 16.449 | 27.8 | 37.2 | | 39 10 28.7 | - 0 59.3 | -3.6 | 25.8 |
| | 580 | 14.982 | 32.0 | 32.9 | | | | | |
| | 695 | 5.466 | 11.6 | 48.3 | | 38 57 43.3 | +11 54.1 | -13.9 | 23.5 |
| | 682 | 23.137 | 31.0 | 34.0 | | | | | |
| | 714 | 7.964 | 31.3 | 33.2 | | 38 58 45.2 | +10 41.4 | -2.0 | 24.6 |
| | 752 | 23.835 | 30.7 | 34.6 | | | | | |
| | 829 | 18.301 | 28.4 | 37.9 | | 39 08 46.8 | + 0 38.7 | -0.8 | 24.7 |
| | 877 | 19.258 | 36.7 | 29.6 | | | | | |
| | 916 | 16.508 | 34.0 | 32.0 | | 10 23.7 | - 0 56.0 | +0.4 | 28.1 |
| | 888 | 15.123 | 32.6 | 33.5 | | | | | |
| | 1007 | 24.087 | 28.9 | 37.8 | | 10 24.8 | - 1 57.6 | -1.3 | 25.9 |
| | 974 | 22.660 | 36.0 | 30.6 | | | | | |
| | 1254 | 22.730 | 34.9 | 24.7 | | 19 50.4 | -10 23.0 | -1.0 | 26.4 |
| | 1265 | 7.313 | 23.2 | 36.3 | | | | | |
| | 1292 | 15.973 | 30.0 | 29.9 | | 11 15.9 | - 1 49.4 | -0.2 | 26.3 |
| | 1321 | 13.267 | 30.2 | 29.7 | | | | | |
| | 1459 | 10.535 | 26.7 | 33.3 | | 02 38.8 | + 6 47.6 | -0.9 | 25.5 |
| | 1449 | 20.621 | 32.1 | 28.0 | | | | | |
| | 1494 | 17.821 | 29.0 | 31.3 | | 13 11.6 | - 3 41.4 | -3.7 | 26.5 |
| | 1463 | 12.343 | 26.0 | 34.3 | | | | | |
| | 1504 | 17.973 | 34.1 | 26.0 | | 11 57.5 | - 2 34.5 | +1.4 | 24.4 |
| | 1528 | 14.151 | 28.0 | 32.2 | | | | | |
| | 1546 | 17.117 | 33.8 | 26.0 | | 12 39.4 | - 3 12.5 | -2.4 | 24.5 |
| | 1563 | 12.353 | 22.8 | 37.5 | | | | | |
| | 1547 | 19.390 | 34.2 | 26.0 | | 39 14 09.1 | - 4 44.4 | -2.2 | 22.5 |
| | 1563 | 12.353 | 22.8 | 37.5 | | | | | |
| | 1583 | 9.895 | 28.7 | 31.1 | | 38 58 56.1 | +10 24.6 | +3.5 | 39 09 26.2 |
| | 1591 | 25.351 | 36.2 | 23.8 | | | | | |

Observations and computations—Continued.

GUNNISON, UTAH.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|-------------|-----------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|--------|------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1872. | | <i>t.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | ° ' " |
| November 22 | 1631 | 10.894 | 31.0 | 29.0 | | 39 09 29.7 | — 0 06.7 | 0.0 | 39 09 23.0 |
| | 1602 | 10.729 | 29.0 | 31.0 | | | | | |
| | 1721 | 15.694 | 32.5 | 27.7 | | 08 30.3 | + 0 54.3 | +0.8 | 25.4 |
| | 1737 | 17.037 | 28.9 | 31.3 | | | | | |
| November 25 | 1777 | 17.771 | 36.5 | 23.4 | | 39 11 07.4 | — 1 40.4 | +1.0 | 28.0 |
| | 1764 | 15.286 | 25.0 | 35.3 | | | | | |
| | 7637 | 22.525 | 29.2 | 16.8 | | 39 21 55.5 | —12 30.6 | —1.3 | 23.6 |
| | 7627 | 3.951 | 14.9 | 30.9 | | | | | |
| | 7642 | 19.455 | 28.5 | 17.5 | | 11 54.0 | — 2 25.3 | —1.8 | 26.9 |
| | 7571 | 15.860 | 14.3 | 30.5 | | | | | |
| | 7642 | 19.455 | 28.5 | 17.5 | | 09 18.4 | + 0 08.5 | —1.8 | 25.1 |
| | 7586 | 19.665 | 14.3 | 30.6 | | | | | |
| | 7683 | 18.854 | 25.0 | 21.4 | | 14 18.0 | — 4 49.7 | —3.4 | 24.9 |
| | 7712 | 11.684 | 16.9 | 30.3 | | | | | |
| | 7746 | 12.978 | 20.9 | 26.4 | | 39 05 24.0 | + 4 04.5 | —2.3 | 26.2 |
| | 7757 | 19.027 | 23.2 | 24.2 | | | | | |
| | 7848 | 6.716 | 19.7 | 28.7 | | 38 59 16.2 | +10 12.6 | —3.9 | 24.9 |
| | 7807 | 21.876 | 22.9 | 25.1 | | | | | |
| | 7882 | 9.777 | 18.3 | 30.5 | | 39 01 52.1 | + 7 35.4 | —1.4 | 26.1 |
| | 7914 | 21.050 | 28.9 | 20.8 | | | | | |
| | 8118 | 20.608 | 30.0 | 23.0 | | 17 11.3 | — 7 44.2 | —0.9 | 26.2 |
| | 8136 | 9.122 | 21.7 | 31.3 | | | | | |
| | 8212 | 12.831 | 22.4 | 30.6 | | 02 21.6 | + 7 06.7 | —2.0 | 26.3 |
| | 8195 | 23.399 | 27.7 | 25.3 | | | | | |
| | 8231 | 17.528 | 28.5 | 24.5 | | 12 54.4 | — 3 25.0 | —0.8 | 23.6 |
| | 8256 | 12.456 | 23.3 | 29.7 | | | | | |
| | 80 | 20.945 | 24.0 | 31.0 | | 09 35.2 | — 0 06.8 | —0.6 | 27.8 |
| | 101 | 20.776 | 30.2 | 24.9 | | | | | |
| | 228 | 14.102 | 32.0 | 23.0 | | 39 10 12.3 | — 0 49.3 | +0.8 | 23.8 |
| | 211 | 12.882 | 24.3 | 31.0 | | | | | |
| | 330 | 5.974 | 34.0 | 21.0 | | 38 57 01.0 | +12 25.5 | —0.7 | 25.8 |
| | 321 | 24.423 | 19.9 | 35.0 | | | | | |
| | 416 | 9.094 | 31.8 | 23.8 | | 39 02 37.0 | + 6 50.6 | —1.1 | 26.5 |
| | 427 | 19.255 | 22.1 | 33.2 | | | | | |
| | 515 | 24.047 | 30.0 | 26.0 | | 14 48.4 | — 5 22.1 | —2.5 | 23.8 |
| | 431 | 16.076 | 22.1 | 33.2 | | | | | |
| | 525 | 19.133 | 29.0 | 27.0 | | 39 16 18.9 | — 6 51.1 | —1.1 | 39 09 26.7 |
| | 556 | 8.964 | 25.3 | 30.6 | | | | | |

LATITUDE DETERMINATIONS.

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Observations and computations—Continued.

GUNNISON, UTAH.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|----------------------|-----------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|--------|------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1872. November 25 | | <i>t.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ° ' " | " | ° ' " |
| | 653 | 12.907 | 30.1 | 25.8 | | | | | |
| | 647 | 11.728 | 22.0 | 34.0 | | 39 10 14.6 | — 0 47.6 | —2.7 | 39 09 24.3 |
| | 695 | 6.490 | 30.8 | 25.2 | | | | | |
| | 682 | 23.822 | 24.5 | 31.4 | | 38 57 43.8 | +11 40.4 | —0.4 | 23.8 |
| | 1007 | 25.182 | 29.0 | 28.7 | | | | | |
| | 974 | 23.760 | 27.0 | 31.0 | | 39 10 25.3 | — 0 57.5 | —1.3 | 26.5 |
| | 1043 | 9.659 | 27.7 | 30.2 | | | | | |
| | 1025 | 23.892 | 28.0 | 30.0 | | 38 59 52.3 | + 9 35.2 | —1.6 | 39 09 25.9 |

The final result for latitude was obtained by Wm. A. Rogers in the same way as that of Pioche. The following are the single results of six groups:

| Means. | | | No. of observations. |
|--------|----|-------|----------------------|
| ° | ' | " | |
| 39 | 09 | 25.76 | 35 |
| | | 25.83 | 28 |
| | | 25.40 | 29 |
| | | 25.41 | 17 |
| | | 25.64 | 25 |
| 39 | 09 | 25.69 | 45 |

Mean 39° 09' 25".62.

ASTRONOMICAL CO-ORDINATES OF STATION AT GUNNISON, UTAH.

Longitude... 7^h 27^m 17^s.00 ± 0^s.028, or 111° 49' 15".00 ± 0".42 west from Greenwich.
 2^h 19^m 4^s.88, or 34° 46' 13".20 west from U. S. Naval Observatory at Washington, D. C.
 Latitude... 39° 09' 25".62 ± 0".05 north.

U. S. GEOGRAPHICAL SURVEYS WEST OF THE ONE HUNDREDTH MERIDIAN,
1ST LIEUT. GEO. M. WHEELER, CORPS OF ENGINEERS, U. S. ARMY, IN CHARGE.

RESULTS

OF

OBSERVATIONS MADE BY W. W. MARYATT AND JOHN H. CLARK IN THE
DETERMINATION OF THE ASTRONOMICAL CO-ORDINATES
OF STATION AT GREEN RIVER, WYOMING.

SEASON OF 1873.

COMPUTATIONS BY

JOHN H. CLARK AND PROF. T. H. SAFFORD.

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Green River to Salt Lake, via Ogden, is 220 miles. There was no repeater on the route, which was over the wires of the Atlantic and Pacific and Deseret Telegraph Lines.

Connection for time was made with Salt Lake City, at which point John H. Clark was observer, using the observatory of the president of the Mormon Church. Observations for longitude were made June 10, 12, 19, 20, 25, and 26, and observations for latitude on June 9, 10, 11, 12, 16, 17, 20, 21, 24, 27, 28, and 29. All observations taken at this station, by W. W. Maryatt, were reduced by Prof. T. H. Safford, who gives the following information in relation to the reduction for time:

"The weights assigned to each star in the formation and solution of the least-square equations were proportioned to the square of the cosine of the star's declination. Not having at hand the explanations on page 8 of the Report on Cheyenne and Colorado Springs when I found the values of T , it does not contain rate. The assumed rates were put into the values of ΔT_0 ."

Tabulation of stars used for determination of time at Green River, Wyoming, and Salt Lake City, Utah.

| Name of star. | GREEN RIVER. | | | | | | SALT LAKE CITY. | | | | | |
|----------------------------|--------------|----------|----------|----------|----------|----------|-----------------|----------|----------|----------|----------|----------|
| | June 10. | June 12. | June 19. | June 20. | June 25. | June 26. | June 10. | June 12. | June 19. | June 20. | June 25. | June 26. |
| 12 Can. Venat | X | | | | | | | | | | | |
| ϵ Virginis | X | | | | | | | | | | | |
| θ Virginis | X | | | | | | | | | | | |
| 20 Can. Venat | X | X | | | | | | | | | | |
| α Virginis | | | | | | | | X | | | | |
| Groombr. 2001 | X | X | | | | | | | | | | |
| ζ Virginis | | | | | | | | X | | | | |
| Groombr. 2029 | X | X | | | | | | | | | | |
| m Virginis | | | | | | | | X | | | | |
| η Ursæ Minoris | X | X | X | | | | | X | | | | |
| η Bootis | X | X | X | | | | | X | | | | |
| τ Virginis | X | X | X | | | | X | X | X | | | |
| α Draconis | X | X | X | | | | X | | X | | | |
| κ Virginis | X | X | | X | | | X | | X | | | |
| α Bootis | X | X | X | X | | | X | X | X | | X | |
| λ Virginis | | | | | | | | | X | | | |
| θ Bootis | | X | X | X | X | X | X | X | X | | X | X |
| 5 Ursæ Minoris | | X | | X | X | X | X | X | X | | X | X |
| π Bootis | | X | X | X | X | X | | | | | X | X |
| μ Virginis | | | | | | | | | X | | X | X |
| ϵ Bootis | | X | X | X | X | | | | X | | X | X |
| α^2 Libræ | | | X | X | X | X | | | X | | X | X |
| β Ursæ Minoris | | | X | X | X | | | | | | X | X |

Tabulation of stars, &c.—Continued.

| Name of star. | GREEN RIVER. | | | | | | SALT LAKE CITY. | | | | | |
|-------------------------|--------------|----------|----------|----------|----------|----------|-----------------|----------|----------|----------|----------|----------|
| | June 10. | June 12. | June 19. | June 20. | June 25. | June 26. | June 10. | June 12. | June 19. | June 20. | June 25. | June 26. |
| β Bootis | | | | | x | x | | | | | x | x |
| 48 Cephei, S. P. | | | | | | | | | | | x | x |
| β Libræ | | | x | x | x | x | | | | | x | x |
| α^2 Libræ | | | | | | | | | | | x | x |
| μ^1 Bootis | | | | | | | | | | | x | x |
| γ Ursæ Minoris | | | | x | x | x | | | | | | |
| ν Bootis | | | | | | x | | | | | | |
| α Coronæ | | | | | x | | | | | | | |
| α Serpentis | x | | | | x | | | | | | | |
| ϵ Serpentis | x | | | | | x | | | | x | | |
| ζ Ursæ Minoris | x | | | x | | | | x | | x | | |
| β^1 Scorpii | | | | x | | | | x | | x | | |
| Groombr. 2320 | x | x | | | | | | x | | | | |
| δ Ophiuchi | | | | x | | | | | | x | | |
| ϵ Ophiuchi | | x | | x | | | | | | | | |
| τ Herculis | x | x | | x | | | | x | | x | | |
| α Scorpii | | x | | | | | | | | | | |
| η Draconis | | | | x | | | | x | x | x | | x |
| Δ Draconis | | | | x | | | | x | x | | | x |
| ζ Ophiuchi | x | x | | | | | | | | x | | |
| η Herculis | x | x | x | x | | x | | x | x | x | | x |
| 49 Herculis | | x | x | x | | x | | | | | | |
| κ Ophiuchi | | x | | x | | | | | x | x | | x |
| δ Herculis | | | | x | | x | | | x | x | | x |
| ϵ Ursæ Minoris | | x | x | | | | | | | x | | x |
| α Herculis | | | x | | | x | | | x | x | | x |
| 44 Ophiuchi | | | x | | | x | | | | | | |
| β Draconis | | | x | | | x | | | | | | |
| ω Draconis | | | x | | | | | | | | | |
| μ Herculis | | | | | | x | | | | | | |
| γ Draconis | | | | | | x | | | | | | |
| γ Sagittarii | | | | | | x | | | | | | |
| α Herculis | | | x | | | x | | | | | | |
| η Serpentis | | | | | | | | | | | x | |
| 1 Aquilæ | | | x | | x | | | | | | x | |
| α Lyræ | | | | | x | | | | | | x | |
| β Lyræ | | | | | x | | | | | | x | |
| σ Sagittarii | | | | | x | | | | | | | |
| 50 Draconis | | | | | x | | | | | | x | |
| ζ Aquilæ | | | | | x | | | | | | x | |
| ι Lyræ | | | | | x | | | | | | | |
| δ Sagittarii | | | | | | | | | | | x | |
| 5 Draconis | | | | | x | | | | | | | |

Observations and reductions for time taken at sending station.

GREEN RIVER, WYOMING, JUNE 10, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | Δ T. | |
|--------|---------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-------------|-------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>s.</i> | |
| W. | 12 Can. Venat..... | 12 49 49.14 | + 0.06 | — 0.06 | + 0.11 | 12 49 49.25 | 12 50 06.39 | + | 17.14 |
| W. | ϵ Virginis | 55 34.78 | + 0.52 | — 0.05 | + 0.08 | 55 35.33 | 55 52.36 | | 17.03 |
| W. | θ Virginis | 13 03 05.70 | + 0.74 | — 0.06 | + 0.08 | 13 03 06.46 | 13 03 23.60 | | 17.14 |
| W. | 20 Can. Venat..... | 11 35.32 | + 0.01 | — 0.18 | + 0.11 | 11 35.26 | 11 52.27 | | 17.01 |
| W. | Groombr. 2001.... | 22 42.14 | — 1.82 | — 0.49 | + 0.28 | 22 40.11 | 22 57.22 | | 17.11 |
| W. | Groombr. 2029.... | 33 56.24 | — 1.65 | — 0.48 | + 0.26 | 33 54.37 | 34 11.55 | | 17.18 |
| E. | η Ursæ Minoris..... | 42 17.42 | — 0.23 | — 0.27 | — 0.13 | 42 16.79 | 42 34.04 | | 17.25 |
| E. | η Bootis | 48 22.42 | + 0.41 | — 0.17 | — 0.09 | 48 22.57 | 48 39.67 | | 17.10 |
| E. | τ Virginis..... | 54 54.58 | + 0.64 | — 0.14 | — 0.08 | 54 55.00 | 55 12.38 | | 17.38 |
| E. | α Draconis..... | 14 06 44.80 | — 0.96 | — 0.42 | — 0.19 | 14 00 43.23 | 14 01 00.04 | | 16.81 |
| E. | κ Virginis..... | 05 51.36 | + 0.80 | — 0.13 | — 0.08 | 05 51.95 | 06 08.78 | | 16.83 |
| E. | α Bootis | 09 36.60 | + 0.40 | — 0.21 | — 0.09 | 09 36.70 | 09 53.61 | + | 16.91 |

NORMAL EQUATIONS.

$$a_0 = + 0^s.92 \quad c_0 = - 0^s.06 \quad \Delta T_0 = 16^s.99 - 0^s.045 (T - 14^h.8)$$

$$\begin{aligned} 0 &= - 0.317 + 2.776 da + 1.574 dc + 2.788 d\Delta T & da &= + 0^s.095 & \text{Weight of } a &= 1.64 \\ 0 &= + 0.090 + 1.574 da + 12.000 dc + 0.831 d\Delta T & dc &= - 0^s.022 & c &= 10.99 \\ 0 &= - 0.486 + 2.788 da + 0.831 dc + 7.646 d\Delta T & d\Delta T &= + 0^s.031 & \Delta T &= 4.80 \end{aligned}$$

GREEN RIVER, WYOMING, JUNE 10, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | Δ T. | |
|--------|----------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-------------|-------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>s.</i> | |
| E. | α Serpentis | 15 37 45.52 | + 0.44 | — 0.28 | — 0.03 | 15 37 45.65 | 15 38 02.53 | + | 16.88 |
| E. | ϵ Serpentis | 44 13.86 | + 0.46 | — 0.29 | — 0.03 | 44 14.00 | 44 30.94 | | 16.94 |
| E. | ζ Ursæ Minoris..... | 48 31.72 | — 2.22 | — 1.48 | — 0.15 | 48 27.87 | 48 44.68 | | 16.81 |
| W. | Groombr. 2320..... | 16 05 47.72 | — 0.91 | — 0.92 | + 0.09 | 16 05 45.98 | 16 06 02.72 | | 16.74 |
| W. | τ Herculis | 15 41.18 | — 0.10 | — 0.35 | + 0.05 | 15 40.78 | 15 57.73 | | 16.95 |
| W. | ζ Ophichi..... | 29 54.46 | + 0.61 | — 0.05 | + 0.03 | 29 55.05 | 30 11.90 | | 16.85 |
| W. | η Herculis | 16 38 17.74 | + 0.04 | — 0.10 | + 0.04 | 16 38 17.72 | 16 38 34.73 | + | 17.01 |

NORMAL EQUATIONS.

$$a_0 = + 0^s.92 \quad c_0 = - 0^s.06 \quad \Delta T_0 = 16^s.99 - 0^s.045 (T - 14^h.8)$$

$$\begin{aligned} 0 &= + 0.293 + 1.866 da + 0.279 dc + 1.615 d\Delta T & da &= - 0^s.160 & \text{Weight of } a &= 1.21 \\ 0 &= - 0.170 + 0.279 da + 7.000 dc - 0.624 d\Delta T & dc &= + 0^s.028 & c &= 6.69 \\ 0 &= + 0.285 + 1.615 da - 0.624 dc + 4.201 d\Delta T & d\Delta T &= - 0^s.002 & \Delta T &= 2.70 \end{aligned}$$

Observations and reductions for time taken at sending station—Continued.

GREEN RIVER, WYOMING, JUNE 12, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|-----------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>s.</i> |
| W. | 20 Can. Venat.* | 13 11 32.54; | 0.00 | — 0.19 | — 0.12 | 13 11 32.23 | 13 11 52.24 | + [20.01] |
| W. | Groombr. 2001 | 22 39.84 | — 1.12 | — 0.47 | — 0.31 | 22 37.94 | 22 57.10 | 19.16 |
| W. | Groombr. 2029 | 33 53.94 | — 1.01 | — 0.48 | — 0.29 | 33 52.16 | 34 11.45 | 19.29 |
| W. | γ Ursæ Majoris | 42 15.18 | — 0.14 | — 0.30 | — 0.14 | 42 14.60 | 42 34.00 | 19.40 |
| W. | γ Bootis | 45 20.22 | + 0.25 | — 0.20 | — 0.10 | 48 20.17 | 48 39.66 | 19.49 |
| W. | τ Virginis | 54 52.84 | + 0.39 | — 0.15 | — 0.09 | 54 52.99 | 55 12.37 | 19.38 |
| E. | α Draconis | 14 00 41.62 | — 0.59 | — 0.49 | + 0.21 | 14 00 40.75 | 14 00 59.98 | 19.23 |
| E. | κ Virginis | 05 49.06 | + 0.49 | — 0.15 | + 0.09 | 05 49.49 | 06 08.78 | 19.29 |
| E. | α Bootis | 09 34.02 | + 0.24 | — 0.24 | + 0.10 | 09 34.12 | 09 53.60 | 19.48 |
| E. | θ Bootis | 20 35.70 | — 0.19 | — 0.40 | + 0.15 | 20 35.26 | 20 54.61 | 19.35 |
| E. | 5 Ursæ Minoris | 27 36.58 | — 1.49 | — 0.88 | + 0.33 | 27 34.59 | 27 54.25 | 19.66 |
| E. | π Bootis, pr | 34 27.80 | + 0.27 | — 0.24 | + 0.09 | 34 27.92 | 34 47.04 | 19.12 |
| E. | ε Bootis | 39 09.00 | + 0.17 | — 0.29 | + 0.10 | 14 39 08.98 | 14 39 28.18 | + 19.20 |

*Not good; note by Mr. Maryatt.

NORMAL EQUATIONS.

$$\begin{aligned}
 a_0 &= +0^s.72 & c_0 &= +0^s.09 & \Delta T_0 &= 19^s.32 - 0^s.071 (T - 15^h.3) \\
 0 &= +0.398 + 2.594 da + 0.808 dc + 1.902 d\Delta T & da &= -0^s.098 & \text{Weight of } a &= 2.04 \\
 0 &= +0.218 + 0.808 da + 12.000 dc + 1.851 d\Delta T & dc &= 0^s.000 & c &= 11.45 \\
 0 &= +0.688 + 1.902 da + 1.851 dc + 6.653 d\Delta T & d\Delta T &= -0^s.075 & \Delta T &= 5.12
 \end{aligned}$$

GREEN RIVER, WYOMING, JUNE 12, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|----------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>s.</i> |
| E. | Groombr. 2320 | 16 05 44.96 | — 1.00 | — 0.76 | + 0.24 | 16 05 43.44 | 16 06 02.69 | + 19.25 |
| E. | ε Ophiuchi | 11 18.32 | + 0.60 | — 0.22 | + 0.09 | 11 18.79 | 11 37.97 | 19.18 |
| E. | τ Herculis | 15 39.24 | — 0.10 | — 0.47 | + 0.13 | 15 38.80 | 15 57.72 | 18.92 |
| E. | α Scorpii | 21 19.40 | + 0.86 | — 0.13 | + 0.10 | 21 20.23 | 21 39.43 | 19.20 |
| E. | ζ Ophiuchi | 29 52.12 | + 0.66 | — 0.18 | + 0.09 | 29 52.69 | 30 11.91 | 19.22 |
| W. | γ Herculis | 38 15.92 | + 0.04 | — 0.32 | — 0.12 | 38 15.52 | 38 34.74 | 19.22 |
| W. | 49 Herculis | 46 00.48 | + 0.38 | — 0.22 | — 0.09 | 46 00.55 | 46 19.83 | 19.28 |
| W. | κ Ophiuchi | 51 21.78 | + 0.45 | — 0.21 | — 0.09 | 51 21.93 | 51 41.25 | 19.32 |
| W. | ε Ursæ Minoris | 16 58 59.61 | — 4.01 | — 1.35 | — 0.68 | 16 58 53.57 | 16 59 13.16 | + 19.59 |

NORMAL EQUATIONS.

$$\begin{aligned}
 a_0 &= +0^s.72 & c_0 &= +0^s.09 & \Delta T_0 &= 19^s.32 - 0^s.071 (T - 15^h.3) \\
 0 &= -0.286 + 3.103 da + 1.530 dc + 2.985 d\Delta T & da &= +0^s.110 & \text{Weight of } a &= 1.48 \\
 0 &= -0.158 + 1.530 da + 9.000 dc + 1.077 d\Delta T & dc &= +0^s.001 & c &= 8.19 \\
 0 &= -0.213 + 2.985 da + 1.077 dc + 5.900 d\Delta T & d\Delta T &= -0^s.020 & \Delta T &= 3.01
 \end{aligned}$$

Observations and reductions for time taken at sending station—Continued.

GREEN RIVER, WYOMING, JUNE 19, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|-------------------|-------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>s.</i> |
| E. η | Ursæ Majoris..... | 13 42 02.14 | — 0.15 | + 0.01 | + 0.11 | 13 42 02.11 | 13 42 33.87 | + 31.76 |
| E. η | Bootis | 48 07.38 | + 0.27 | + 0.16 | + 0.07 | 48 07.88 | 48 39.60 | 31.72 |
| E. τ | Virginis | 54 40.24 | + 0.43 | + 0.07 | + 0.07 | 54 40.81 | 55 12.33 | 31.52 |
| E. α | Draconis | 14 00 28.62 | + 0.64 | + 0.05 | + 0.16 | 14 00 28.19 | 14 00 59.74 | 31.55 |
| E. α | Bootis | 09 21.54 | — 0.27 | — 0.04 | — 0.07 | 09 21.84 | 09 53.55 | 31.71 |
| W. θ | Bootis | 20 23.40 | — 0.21 | — 0.08 | — 0.11 | 20 23.00 | 20 54.48 | 31.48 |
| W. π | Bootis, pr | 34 15.10 | + 0.29 | + 0.04 | — 0.07 | 34 15.36 | 34 47.00 | 31.64 |
| W. ε | Bootis | 38 56.26 | + 0.18 | + 0.08 | — 0.08 | 38 56.44 | 39 28.13 | 31.69 |
| W. α ² | Libræ | 43 20.66 | + 0.59 | + 0.05 | — 0.07 | 43 21.23 | 43 52.85 | 31.62 |
| W. β | Ursæ Minoris..... | 50 39.80 | — 1.40 | + 0.40 | — 0.26 | 50 38.54 | 51 10.24 | 31.70 |
| W. β | Libræ | 15 09 39.96 | + 0.53 | + 0.08 | — 0.07 | 15 09 40.50 | 15 10 12.12 | + 31.62 |

NORMAL EQUATIONS.

$$a_0 = +0^s.78 \quad c_0 = +0^s.05 \quad \Delta T_0 = 31^s.55 - 0^s.045 (T - 15^h.9)$$

$$0 = +0.234 + 2.729 da - 0.690 dc + 3.004 d\Delta T \quad da = -0^s.103 \quad \text{Weight of } a = 1.51$$

$$0 = -0.252 - 0.690 da + 11.000 dc - 0.718 d\Delta T \quad dc = +0^s.018 \quad c = 10.82$$

$$0 = +0.174 + 3.004 da - 0.718 dc + 7.418 d\Delta T \quad d\Delta T = +0^s.020 \quad \Delta T = 4.11$$

GREEN RIVER, WYOMING, JUNE 19, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|-------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>s.</i> |
| W. η | Herculis | 16 38 03.08 | + 0.04 | + 0.14 | — 0.12 | 16 38 03.14 | 16 38 34.74 | + 31.60 |
| W. 49 | Herculis | 45 48.06 | + 0.36 | + 0.09 | — 0.10 | 45 48.41 | 46 19.87 | 31.46 |
| W. ε | Ursæ Minoris..... | 58 45.12 | — 3.79 | + 0.43 | — 0.74 | 58 41.02 | 59 12.82 | 31.80 |
| W. α | Herculis | 17 08 21.40 | + 0.37 | + 0.06 | — 0.10 | 17 08 21.73 | 17 08 53.36 | 31.63 |
| W. 44 | Ophiuchi | 18 06.94 | + 0.78 | + 0.04 | — 0.10 | 18 07.66 | 18 39.10 | 31.44 |
| W. β | Draconis | 27 05.14 | — 0.24 | + 0.18 | — 0.16 | 27 04.92 | 27 36.36 | 31.44 |
| E. ω | Draconis | 37 14.80 | — 1.00 | + 0.21 | + 0.26 | 37 14.27 | 37 45.53 | 31.26 |
| E. o | Herculis | 18 02 05.58 | + 0.20 | — 0.12 | + 0.11 | 18 02 05.77 | 18 02 37.33 | 31.56 |
| E. 1 | Aquilæ | 27 47.64 | + 0.60 | — 0.09 | + 0.10 | 27 48.25 | 28 19.72 | + 31.47 |

NORMAL EQUATIONS.

$$a_0 = +0^s.78 \quad c_0 = +0^s.05 \quad \Delta T_0 = 31^s.55 - 0^s.045 (T - 15^h.9)$$

$$0 = -0.053 + 2.539 da - 0.482 dc + 2.311 d\Delta T \quad da = +0^s.005 \quad \text{Weight of } a = 1.56$$

$$0 = -0.349 - 0.482 da + 9.000 dc - 2.139 d\Delta T \quad dc = +0^s.045 \quad c = 8.08$$

$$0 = -0.066 + 2.311 da - 2.139 dc + 5.573 d\Delta T \quad d\Delta T = +0^s.027 \quad \Delta T = 3.15$$

Observations and reductions for time taken at sending station—Continued.

GREEN RIVER, WYOMING, JUNE 20, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT . |
|--------|---------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>s.</i> |
| E. | κ Virginis..... | 14 35 37.66 | — 0.36 | + 0.02 | + 0.04 | 14 05 37.36 | 14 06 08.73 | + 31.37 |
| E. | α Bootis..... | 09 22.20 | — 0.18 | + 0.03 | + 0.04 | 09 22.09 | 09 53.55 | 31.46 |
| E. | θ Bootis..... | 20 22.96 | + 0.14 | + 0.04 | + 0.06 | 20 23.20 | 20 54.46 | 31.26 |
| E. | 5 Ursæ Minoris.... | 27 21.08 | + 1.10 | + 0.06 | + 0.15 | 27 22.39 | 27 53.74 | 31.35 |
| E. | π Bootis..... | 34 15.78 | — 0.20 | + 0.01 | + 0.04 | 34 15.63 | 34 47.00 | 31.37 |
| W. | ϵ Bootis..... | 38 56.82 | — 0.12 | 0.00 | — 0.04 | 38 56.66 | 39 28.12 | 31.46 |
| W. | α^2 Libræ..... | 43 22.02 | — 0.40 | 0.00 | — 0.04 | 43 21.58 | 43 52.84 | 31.26 |
| W. | β Ursæ Minoris.... | 50 38.40 | + 0.95 | — 0.03 | — 0.13 | 50 39.19 | 51 10.18 | 30.99 |
| W. | β Libræ..... | 15 09 41.12 | — 0.36 | — 0.02 | — 0.04 | 15 09 40.70 | 15 10 12.12 | 31.42 |
| W. | γ Ursæ Minoris.... | 20 28.92 | + 0.77 | — 0.09 | — 0.12 | 20 29.48 | 21 01.10 | + 31.62 |

NORMAL EQUATIONS.

$$a_0 = -0^s.40 \quad c_0 = 0^s.000 \quad \Delta T_0 = 31^s.35 - 0^s.017 (T - 15^h.5)$$

$$\begin{aligned} 0 &= +0.140 + 3.196 da + 0.014 dc + 2.747 d\Delta T & da &= -0^s.058 & \text{Weight of } a &= 1.95 \\ 0 &= -0.353 + 0.014 da + 10.000 dc + 0.325 d\Delta T & dc &= +0^s.035 & c &= 9.97 \\ 0 &= +0.061 + 2.747 da - 0.353 dc + 6.053 d\Delta T & d\Delta T &= +0^s.013 & \Delta T &= 3.68 \end{aligned}$$

GREEN RIVER, WYOMING, JUNE 20, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT . |
|--------|--------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>s.</i> |
| W. | ζ Ursæ Minoris.... | 15 48 12.36 | + 0.88 | — 0.18 | — 0.04 | 15 48 13.02 | 15 48 44.14 | + 31.12 |
| W. | β Scorpii..... | 57 34.08 | — 0.28 | — 0.03 | — 0.01 | 57 33.76 | 58 05.15 | 31.40 |
| W. | δ Ophiuchi..... | 16 07 12.28 | — 0.21 | — 0.02 | — 0.01 | 16 07 12.04 | 16 07 43.34 | 31.30 |
| W. | ϵ Ophiuchi..... | 11 06.84 | — 0.22 | — 0.01 | — 0.01 | 11 06.60 | 11 38.00 | 31.40 |
| W. | τ Herculis..... | 15 26.46 | + 0.04 | — 0.01 | — 0.01 | 15 26.48 | 15 57.69 | 31.21 |
| E. | η Draconis..... | 21 47.86 | + 0.22 | + 0.03 | + 0.02 | 21 48.13 | 22 19.68 | 31.55 |
| E. | λ Draconis..... | 27 46.26 | + 0.39 | + 0.06 | + 0.03 | 27 46.74 | 28 18.14 | 31.40 |
| E. | η Herculis..... | 38 03.24 | — 0.02 | + 0.05 | + 0.01 | 38 03.28 | 38 34.74 | 31.46 |
| E. | 49 Herculis..... | 45 48.78 | — 0.14 | + 0.05 | + 0.01 | 45 48.70 | 46 19.87 | 31.17 |
| E. | κ Ophiuchi..... | 51 10.08 | — 0.16 | + 0.04 | + 0.01 | 51 09.97 | 51 41.30 | 31.33 |
| E. | δ Herculis..... | 16 56 25.80 | — 0.05 | + 0.06 | + 0.01 | 16 56 25.82 | 16 56 57.00 | + 31.18 |

NORMAL EQUATIONS.

$$a_0 = -0^s.40 \quad c_0 = 0^s.000 \quad \Delta T_0 = 31^s.35 - 0^s.017 (T - 15^h.5)$$

$$\begin{aligned} 0 &= -0.245 + 2.973 da - 1.271 dc + 2.826 d\Delta T & da &= +0^s.097 & \text{Weight of } a &= 1.60 \\ 0 &= +0.030 - 1.271 da + 11.000 dc + 0.558 d\Delta T & dc &= +0^s.009 & c &= 9.72 \\ 0 &= -0.204 + 2.826 da + 0.558 dc + 6.940 d\Delta T & d\Delta T &= -0^s.011 & \Delta T &= 3.96 \end{aligned}$$

Observations and reductions for time taken at sending station—Continued.

GREEN RIVER, WYOMING, JUNE 25, 1873.

| Clamp. | Name of star. | T. | | Aa. | Bb. | Cc. | T'. | | AR. | ΔT . | |
|--------|---------------------------|-----------------|-----------|-----------|-----------|-------------|-----------------|-----------|-----------------|--------------|-----------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> |
| W. | θ Bootis | 14 20 13.32 | + 0.06 | — 0.10 | — 0.23 | 14 20 13.05 | 14 20 54.36 | + | 41.31 | | |
| W. | 5 Ursæ Minoris.... | 27 12.84 | + 0.49 | — 0.16 | — 0.58 | 27 12.59 | 27 53.38 | | 40.79 | | |
| W. | π Bootis, pr | 34 05.76 | — 0.09 | — 0.03 | — 0.14 | 34 05.50 | 34 46.97 | | 41.47 | | |
| W. | ϵ Bootis | 38 46.66 | — 0.06 | — 0.04 | — 0.16 | 38 46.40 | 39 28.08 | | 41.68 | | |
| W. | α^2 Libræ | 43 11.50 | — 0.18 | — 0.03 | — 0.14 | 43 11.15 | 43 52.82 | | 41.67 | | |
| E. | β Ursæ Minoris.... | 51 27.56 | + 0.43 | — 0.38 | + 0.52 | 51 28.13 | 51 09.88 | | 41.75 | | |
| E. | β Bootis | 56 30.06 | — 0.00 | — 0.21 | + 0.18 | 56 30.03 | 57 11.60 | | 41.57 | | |
| E. | β Libræ | 15 09 30.98 | — 0.16 | — 0.17 | + 0.14 | 15 09 30.79 | 15 10 12.10 | | 41.31 | | |
| E. | γ Ursæ Minoris.... | 20 19.02 | + 0.35 | — 0.86 | + 0.45 | 20 18.96 | 21 00.88 | | 41.92 | | |
| E. | α Coronæ | 28 39.20 | — 0.06 | — 0.32 | + 0.16 | 28 38.98 | 29 20.47 | | 41.49 | | |
| E. | α Serpentis | 37 21.38 | — 0.12 | — 0.24 | + 0.14 | 37 21.16 | 38 02.53 | + | 41.37 | | |

NORMAL EQUATIONS.

$$a_0 = -0^s.37 \quad c_0 = +0^s.18 \quad \Delta T_0 = 41^s.43 - 0^s.025 (T - 16^h.8)$$

$$0 = -0.507 + 2.837 da - 0.197 dc + 2.425 d\Delta T \quad da = +0^s.164 \quad \text{Weight of } a = 1.93$$

$$0 = +0.495 - 0.197 da + 11.000 dc + 0.541 d\Delta T \quad dc = -0^s.042 \quad c = 10.96$$

$$0 = -0.481 + 2.425 da + 0.541 dc + 6.545 d\Delta T \quad d\Delta T = +0^s.014 \quad \Delta T = 4.46$$

GREEN RIVER, WYOMING, JUNE 25, 1873.

| Clamp. | Name of star. | T. | | Aa. | Bb. | Cc. | T'. | | AR. | ΔT . | |
|--------|---------------------------|-----------------|-----------|-----------|-----------|-------------|-----------------|-----------|-----------------|--------------|-----------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> |
| E. | 1 Aquilæ..... | 18 27 38.84 | — 0.44 | — 0.06 | + 0.19 | 18 27 38.53 | 18 28 19.80 | + | 41.27 | | |
| E. | α Lyræ | 31 58.86 | + 0.04 | — 0.10 | + 0.24 | 31 58.96 | 32 40.47 | | 41.51 | | |
| E. | β Lyræ | 44 44.16 | — 0.10 | — 0.13 | + 0.23 | 44 44.17 | 45 25.48 | | 41.31 | | |
| E. | σ Sagittarii | 46 44.70 | — 0.59 | — 0.05 | + 0.21 | 46 44.27 | 47 25.77 | | 41.50 | | |
| E. | 50 Draconis | 49 49.14 | + 1.25 | — 0.39 | + 0.74 | 49 50.74 | 50 32.01 | | 41.27 | | |
| W. | ζ Aquilæ..... | 58 55.56 | — 0.27 | — 0.13 | — 0.19 | 58 54.97 | 59 36.28 | | 41.31 | | |
| W. | ι Lyræ | 19 02 07.42 | — 0.07 | — 0.19 | — 0.23 | 19 02 06.93 | 19 02 48.27 | | 41.34 | | |
| W. | δ Draconis | 11 53.06 | + 0.65 | — 0.38 | — 0.49 | 11 52.84 | 12 34.37 | + | 41.53 | | |

NORMAL EQUATIONS.

$$a_0 = -0^s.37 \quad c_0 = +0^s.18 \quad \Delta T_0 = 41^s.43 - 0^s.025 (T - 16^h.8)$$

$$0 = +0.467 + 2.195 da + 1.203 dc + 1.970 d\Delta T \quad da = -0^s.201 \quad \text{Weight of } a = 1.36$$

$$0 = +0.198 + 1.203 da + 8.000 dc + 1.590 d\Delta T \quad dc = +0^s.009 \quad c = 7.26$$

$$0 = +0.470 + 1.970 da + 1.590 dc + 4.903 d\Delta T \quad d\Delta T = -0^s.018 \quad \Delta T = 3.10$$

TIME DETERMINATIONS.

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Observations and reductions for time taken at sending station—Continued.

GREEN RIVER, WYOMING, JUNE 26, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | Δ T. | |
|--------|---------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-------------|-------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>s.</i> | |
| W. | θ Bootis..... | 14 20 11.02 | — 0.09 | — 0.21 | — 0.28 | 14 20 10.44 | 14 20 54.34 | + | 43.90 |
| W. | 5 Ursæ Minoris.... | 27 11.52 | — 0.69 | — 0.44 | — 0.72 | 27 09.67 | 27 53.30 | | 43.63 |
| W. | π Bootis..... | 34 03.28 | + 0.12 | — 0.12 | — 0.18 | 34 03.10 | 34 46.96 | | 43.86 |
| W. | α^2 Libræ..... | 43 08.90 | + 0.25 | — 0.09 | — 0.18 | 43 08.88 | 43 52.82 | | 43.94 |
| W. | β Bootis..... | 56 28.02 | 0.00 | — 0.25 | — 0.23 | 56 27.54 | 57 11.59 | | 44.05 |
| E. | β Libræ..... | 15 09 27.88 | + 0.23 | — 0.15 | + 0.17 | 15 09 28.13 | 15 10 12.10 | | 43.97 |
| E. | γ Ursæ Minoris.... | 20 17.40 | — 0.48 | — 0.66 | + 0.56 | 20 16.82 | 21 00.83 | | 44.01 |
| E. | ν Bootis, pr..... | 25 40.28 | 0.00 | — 0.30 | + 0.23 | 25 40.21 | 26 24.04 | | 43.83 |
| E. | ϵ Serpentis..... | 15 43 47.14 | + 0.17 | — 0.16 | + 0.17 | 15 43 47.32 | 15 44.30.95 | + | 43.63 |

NORMAL EQUATIONS.

$$a_0 = +0^s.38 \quad c_0 = +0^s.22 \quad \Delta T_0 = 43^s.82 - 0^s.045 (T - 16^h.2)$$

$$0 = +0.257 + 2.451 da + 0.352 dc + 2.169 d\Delta T \quad da = -0^s.094 \quad \text{Weight of } a = 1.56$$

$$0 = +0.480 + 0.352 da + 9.000 dc - 0.485 d\Delta T \quad dc = -0^s.050 \quad c = 8.77$$

$$0 = +0.201 + 2.169 da - 0.485 dc + 5.469 d\Delta T \quad d\Delta T = -0^s.004 \quad \Delta T = 3.48$$

GREEN RIVER, WYOMING, JUNE 26, 1873.

| Clamp. | Name of star. | T. | | | Aa. | | Bb. | | Cc. | | T'. | | | AR. | | | Δ T. | |
|--------|---------------------------|-----------|-----------|-----------|-----------|------|-----------|------|-----------|------|-----------|-----------|-----------|-----------|-----------|-----------|-------------|-------|
| | | <i>h.</i> | <i>m.</i> | <i>s.</i> | <i>s.</i> | | <i>s.</i> | | <i>s.</i> | | <i>h.</i> | <i>m.</i> | <i>s.</i> | <i>h.</i> | <i>m.</i> | <i>s.</i> | <i>s.</i> | |
| E. | η Herculis | 16 | 37 | 50.74 | + | 0.02 | — | 0.16 | + | 0.11 | 16 | 37 | 50.71 | 16 | 38 | 34.72 | + | 44.01 |
| E. | 49 Herculis | | 45 | 35.82 | + | 0.19 | — | 0.10 | + | 0.09 | | 45 | 36.00 | | 46 | 19.89 | | 43.89 |
| E. | δ Herculis | | 56 | 13.22 | + | 0.07 | — | 0.11 | + | 0.10 | | 56 | 13.28 | | 56 | 56.99 | | 43.71 |
| E. | α Herculis | 17 | 08 | 09.40 | + | 0.19 | — | 0.11 | + | 0.08 | 17 | 08 | 09.56 | 17 | 08 | 53.39 | | 43.83 |
| E. | 44 Ophiuchi | | 17 | 54.94 | + | 0.41 | — | 0.06 | + | 0.09 | | 17 | 55.38 | | 18 | 39.16 | | 43.78 |
| W. | β Draconis | | 26 | 53.34 | — | 0.13 | — | 0.26 | — | 0.13 | | 26 | 52.82 | | 27 | 36.35 | | 43.53 |
| W. | μ Herculis | | 40 | 47.50 | + | 0.11 | — | 0.11 | — | 0.09 | | 40 | 47.41 | | 41 | 31.38 | | 43.97 |
| W. | γ Draconis | | 52 | 58.60 | — | 0.11 | — | 0.08 | — | 0.13 | | 52 | 58.28 | | 53 | 41.98 | | 43.70 |
| W. | γ Sagittarii | | 56 | 57.38 | + | 0.45 | — | 0.02 | — | 0.13 | | 56 | 57.68 | | 57 | 41.46 | | 43.78 |
| W. | α Herculis | 18 | 01 | 53.46 | + | 0.10 | — | 0.05 | — | 0.09 | 18 | 01 | 53.42 | 18 | 02 | 37.38 | + | 43.96 |

NORMAL EQUATIONS.

$$a_0 = +0^s.38 \quad c_0 = +0^s.22 \quad \Delta T_0 = 43^s.82 - 0^s.045 (T - 16^h.2)$$

$$0 = -0.126 + 2.327 da + 0.938 dc + 2.844 d\Delta T \quad da = +0^s.030 \quad \text{Weight of } a = 1.14$$

$$0 = +1.319 + 0.938 da + 10.000 dc + 0.596 d\Delta T \quad dc = -0^s.138 \quad c = 9.54$$

$$0 = -0.462 + 2.844 da + 0.596 dc + 7.050 d\Delta T \quad d\Delta T = +0^s.065 \quad \Delta T = 3.54$$

Observations and reductions for time taken at receiving station.

SALT LAKE CITY, UTAH, JUNE 10, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|--------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | τ Virginis..... | 5 47 27.73 | + 0.04 | + 0.06 | — 0.20 | 5 47 27.63 | 13 55 12.37 | 8 07 44.74 |
| W. | α Draconis..... | 53 15.42 | — 0.06 | + 0.15 | — 0.47 | 53 15.04 | 14 01 00.06 | 45.02 |
| W. | κ Virginis..... | 58 24.05 | + 0.05 | + 0.04 | — 0.20 | 58 23.94 | 06 08.73 | 44.79 |
| W. | α Bootis..... | 6 02 08.87 | + 0.02 | + 0.07 | — 0.21 | 6 02 08.75 | 09 53.63 | 44.88 |
| W. | θ Bootis..... | 03 10.01 | — 0.02 | + 0.11 | — 0.33 | 03 09.77 | 10 54.60 | 44.83 |
| W. | 5 Ursæ Minoris.... | 20 10.41 | — 0.15 | + 0.24 | — 0.84 | 6 20 09.66 | 14 27 54.38 | 8 07 44.72 |

NORMAL EQUATIONS.

$$\begin{aligned} 6.00 \delta t + 1.97 a &= -1.14 & a &= -0^s.06 \\ 1.97 \delta t + 8.18 a &= -0.85 & \delta t &= -0^s.17 \end{aligned}$$

NOTE.—Observations incomplete in consequence of cloud. The value of c is assumed to be $+0^s.20$ clamp east.

SALT LAKE CITY, UTAH, JUNE 12, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|--------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | α Virginis..... | 5 10 49.09 | + 0.06 | + 0.02 | + 0.18 | 5 10 49.35 | 13 18 31.41 | + 8 07 42.06 |
| E. | ζ Virginis..... | 20 32.32 | + 0.05 | + 0.02 | + 0.18 | 20 32.57 | 28 14.58 | 42.01 |
| E. | μ Virginis..... | 27 15.90 | + 0.05 | + 0.02 | + 0.18 | 27 16.15 | 34 58.14 | 41.99 |
| E. | η Ursæ Majoris.... | 34 51.53 | — 0.02 | + 0.05 | + 0.28 | 34 51.84 | 42 34.03 | 42.19 |
| E. | η Bootis..... | 40 57.38 | + 0.03 | + 0.03 | + 0.19 | 40 57.63 | 48 39.72 | 42.09 |
| W. | τ Virginis..... | 47 30.37 | + 0.04 | + 0.02 | — 0.18 | 47 30.25 | 55 12.36 | 42.11 |
| W. | α Bootis..... | 6 02 11.50 | + 0.03 | + 0.03 | — 0.19 | 6 02 11.37 | 14 09 53.62 | 42.25 |
| W. | θ Bootis..... | 13 12.65 | — 0.02 | + 0.05 | — 0.30 | 13 12.38 | 20 54.57 | 42.19 |
| W. | 5 Ursæ Minoris.... | 20 13.06 | — 0.17 | + 0.10 | — 0.76 | 20 12.23 | 27 54.26 | + 8 07 42.03 |

NORMAL EQUATIONS.

$$\begin{aligned} 9.00 \delta t - 0.56 a - 2.28 c &= +0.54 & a &= -0^s.07 \\ -0.56 \delta t + 8.46 a - 12.08 c &= -2.82 & c &= +0^s.18 \\ -2.28 \delta t - 12.08 a + 29.12 c &= +5.92 & \delta t &= +0^s.10 \end{aligned}$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, JUNE 12, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|-----------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | ζ Ursæ Minoris.... | 7 41 03.47 | + 0.03 | + 0.31 | — 0.98 | 7 41 02.83 | 15 48 44.96 | + 8 07 42.13 |
| W. | β ¹ Scorpii..... | 50 23.20 | — 0.01 | + 0.05 | — 0.20 | 50 23.04 | 58 05.14 | 42.10 |
| W. | Groombr. 2320.... | 58 21.29 | + 0.01 | + 0.21 | — 0.54 | 58 20.97 | 16 06 02.68 | 41.71 |
| W. | τ Herculis..... | 8 08 15.88 | + 0.00 | + 0.14 | — 0.29 | 8 08 15.73 | 15 57.65 | 41.92 |
| E. | η Draconis..... | 14 37.12 | + 0.01 | + 0.20 | + 0.42 | 14 37.75 | 22 19.73 | 41.98 |
| E. | Α Draconis..... | 20 35.73 | + 0.01 | + 0.27 | + 0.56 | 20 36.57 | 28 18.51 | 41.94 |
| E. | η Herculis..... | 8 30 52.43 | 0.00 | + 0.14 | + 0.26 | 8 30 52.83 | 16 38 34.71 | + 8 07 41.88 |

NORMAL EQUATIONS.

$$\begin{aligned}
 7.00 \delta t + 5.48 a - 3.88 c &= -1.05 & a &= + 0^s.01 \\
 5.48 \delta t + 13.55 a - 11.81 c &= -2.43 & c &= + 0^s.20 \\
 -3.88 \delta t - 11.81 a + 48.29 c &= + 9.33 & \delta t &= - 0^s.04
 \end{aligned}$$

SALT LAKE CITY, UTAH, JUNE 19, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|---------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | χ Virginis..... | 5 47 39.02 | + 1.73 | + 0.08 | — 0.22 | 5 47 40.61 | 13 55 12.31 | + 8 07 31.70 |
| W. | α Draconis..... | 53 31.21 | — 2.71 | + 0.18 | — 0.52 | 53 28.16 | 14 00 59.77 | 31.61 |
| W. | κ Virginis..... | 58 35.10 | + 2.18 | + 0.06 | — 0.22 | 58 37.12 | 06 08.68 | 31.56 |
| W. | α Bootis..... | 6 02 20.90 | + 1.03 | + 0.05 | — 0.23 | 6 02 21.78 | 09 53.57 | 31.79 |
| W. | λ Virginis..... | 04 42.03 | + 2.32 | + 0.03 | — 0.23 | 04 44.15 | 12 15.81 | 31.66 |
| E. | θ Bootis..... | 13 23.43 | — 0.92 | + 0.10 | + 0.36 | 13 22.97 | 20 54.44 | 31.47 |
| E. | 5 Ursæ Minoris.... | 20 27.74 | — 6.84 | + 0.27 | + 0.92 | 20 22.09 | 27 53.81 | 31.72 |
| E. | μ Virginis..... | 28 49.69 | + 2.00 | + 0.04 | + 0.22 | 28 51.95 | 36 23.58 | 31.63 |
| E. | ε Bootis..... | 31 55.27 | + 0.73 | + 0.06 | + 0.25 | 31 56.31 | 39 28.13 | 31.82 |
| E. | α ² Libræ..... | 6 36 18.62 | + 2.40 | + 0.03 | + 0.23 | 6 36 21.28 | 43 52.85 | + 8 07 31.57 |

NORMAL EQUATIONS.

$$\begin{aligned}
 10.00 \delta t - 0.70 a + 2.54 c &= - 0.94 & a &= - 2^s.79 \\
 0.70 \delta t + 10.20 a + 9.32 c &= - 26.13 & c &= + 0^s.22 \\
 2.54 \delta t + 9.32 a + 33.59 c &= - 19.46 & \delta t &= - 0^s.35
 \end{aligned}$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, JUNE 19, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | η Draconis | 8 14 49.77 | — 2.58 | + 0.15 | + 1.00 | 8 14 48.34 | 16 22 19.65 | +8 07 31.31 |
| E. | A Draconis | 21 49.92 | — 4.49 | + 0.20 | + 1.32 | 21 46.95 | 28 18.38 | 31.43 |
| E. | η Herculis | 31 02.79 | — 0.14 | + 0.10 | + 0.61 | 31 03.36 | 38 34.72 | 31.36 |
| W. | κ Ophiuchi | 44 08.62 | + 1.80 | + 0.05 | — 0.48 | 44 09.99 | 51 41.31 | 31.32 |
| W. | d Herculis | 49 25.51 | + 0.51 | + 0.06 | — 0.57 | 49 25.51 | 56 57.00 | 31.49 |
| W. | a Herculis | 9 01 20.80 | + 0.56 | + 0.06 | — 0.49 | 9 01 21.93 | 17 08 53.36 | +8 07 31.43 |

NORMAL EQUATIONS.

$$\begin{aligned}
 6.00 \delta t + 0.90 a + 2.97 c &= -5.61 & a &= -3^s.40 \\
 0.90 \delta t + 2.83 a + 6.55 c &= -7.14 & c &= -0^s.47 \\
 2.97 \delta t + 6.55 a + 17.51 c &= -15.99 & \delta t &= -0^s.64
 \end{aligned}$$

SALT LAKE CITY, UTAH, JUNE 20, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|----------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | ε Serpentis | 7 36 58.78 | + 1.65 | + 0.09 | + 0.18 | 7 37 00.70 | 15 44 30.97 | +8 07 30.27 |
| E. | 3 Ursæ Minoris | 41 21.24 | — 8.29 | + 0.43 | + 0.86 | 41 14.24 | 48 44.52 | 30.28 |
| E. | β Scorpii | 50 32.11 | + 2.57 | + 0.06 | + 0.19 | 50 34.93 | 58 05.17 | 30.24 |
| E. | δ Ophiuchi | 8 00 10.89 | + 1.96 | + 0.08 | + 0.18 | 8 00 13.11 | 16 07 43.31 | 30.20 |
| E. | τ Herculis | 08 27.52 | — 0.41 | + 0.17 | + 0.23 | 08 27.54 | 15 57.62 | 30.08 |
| E. | η Draconis | 14 50.90 | — 2.12 | + 0.20 | + 0.38 | 14 49.36 | 22 19.63 | 30.27 |
| E. | ζ Ophiuchi | 22 39.17 | + 2.20 | + 0.07 | + 0.18 | 22 41.62 | 30 11.96 | 30.34 |
| E. | η Herculis | 31 03.88 | + 0.11 | + 0.10 | + 0.23 | 31 04.32 | 38 34.72 | 30.40 |
| W. | κ Ophiuchi | 44 09.54 | + 1.48 | + 0.10 | — 0.18 | 44 10.94 | 51 41.31 | 30.37 |
| W. | d Herculis | 49 26.50 | + 0.41 | + 0.16 | — 0.21 | 49 26.86 | 56 57.00 | 30.14 |
| W. | ε Ursæ Minoris | 51 56.68 | — 13.70 | + 0.73 | — 1.31 | 51 42.45 | 59 12.76 | 30.31 |
| W. | a Herculis | 9 01 21.93 | + 1.28 | + 0.15 | — 0.18 | 9 01 23.18 | 17 08 53.37 | +8 07 30.19 |

NORMAL EQUATIONS.

$$\begin{aligned}
 12.00 \delta t + 4.61 a + 3.20 c &= -9.20 & a &= -2^s.787 \\
 4.61 \delta t + 36.30 a - 22.01 c &= -103.88 & c &= +0^s.177 \\
 3.20 \delta t - 22.01 a + 94.72 c &= +78.80 & \delta t &= +0^s.26
 \end{aligned}$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, JUNE 25, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|----------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | <i>a</i> Bootis | 6 02 33.98 | — 5.16 | — 0.05 | + 0.18 | 6 02 28.95 | 14 09 53.52 | +8 07 24.57 |
| E. | <i>θ</i> Bootis | 13 24.91 | + 4.51 | — 0.06 | + 0.28 | 13 29.64 | 20 54.32 | 24.68 |
| E. | 5 Ursæ Minoris..... | 20 54.82 | +33.28 | — 0.14 | + 0.71 | 20 28.67 | 27 53.38 | 24.71 |
| E. | <i>μ</i> Virginus..... | 29 08.58 | — 9.81 | — 0.03 | + 0.17 | 29 01.09 | 36 23.54 | 24.63 |
| E. | <i>ε</i> Bootis | 32 06.69 | — 3.53 | — 0.03 | + 0.19 | 32 03.35 | 39 28.08 | 24.73 |
| E. | <i>α</i> ² Libræ..... | 36 39.68 | —11.74 | — 0.02 | + 0.18 | 36 28.10 | 43 52.82 | 24.72 |
| W. | <i>β</i> Ursæ Minoris..... | 43 16.97 | —28.73 | + 0.30 | — 0.66 | 43 45.36 | 51 09.97 | 24.61 |
| W. | <i>β</i> Bootis | 49 46.97 | + 0.04 | + 0.14 | — 0.22 | 49 46.93 | 57 11.60 | 24.67 |
| W. | 48 Cephei, S. P | 57 42.95 | —54.48 | — 0.17 | + 0.77 | 56 49.07 | 15 04 13.71 | 24.64 |
| W. | <i>α</i> ² Libræ..... | 7 08 45.64 | —11.57 | + 0.03 | — 0.18 | 7 08 33.92 | 15 58.55 | 24.63 |
| W. | <i>μ</i> Bootis | 12 19.77 | — 0.89 | + 0.02 | — 0.21 | 12 18.69 | 19 43.53 | +8 07 24.84 |

NORMAL EQUATIONS.

$$\begin{aligned}
 11.00 \delta t + 2.25 a + 7.22 c &= -5.96 & a &= -1^s.61 \\
 2.25 \delta t + 28.75 a + 16.62 c &= -44.43 & c &= +0^s.17 \\
 7.22 \delta t + 16.62 a + 64.18 c &= -18.24 & \delta t &= -0^s.32
 \end{aligned}$$

SALT LAKE CITY, UTAH, JUNE 25, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|---------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | <i>γ</i> Serpensis..... | 10 07 31.28 | — 9.38 | + 0.05 | — 0.14 | 10 07 21.81 | 18 14 46.29 | +8 07 24.48 |
| W. | 1 Aquilæ..... | 20 05.66 | —10.36 | + 0.05 | — 0.14 | 20 55.21 | 28 19.80 | 24.59 |
| W. | <i>α</i> Lyræ | 25 16.60 | — 0.64 | + 0.09 | — 0.17 | 25 15.88 | 32 40.46 | 24.58 |
| E. | <i>β</i> Lyræ | 38 02.78 | — 2.13 | + 0.13 | + 0.16 | 38 00.94 | 45 25.50 | 24.56 |
| E. | 50 Draconis | 43 36.36 | +30.26 | + 0.32 | + 0.53 | 43 07.47 | 50 31.99 | 24.52 |
| E. | 3 Aquilæ..... | 52 17.89 | + 6.37 | + 0.06 | + 0.14 | 52 11.72 | 59 36.25 | 24.53 |
| E. | <i>δ</i> Sagittarii | 11 02 02.12 | —12.43 | + 0.03 | + 0.14 | 11 02 49.86 | 19 10 14.39 | +8 07 24.53 |

NORMAL EQUATIONS.

$$\begin{aligned}
 7.00 \delta t + 0.82 a + 3.93 c &= -3.97 & a &= -1^s.565 \\
 0.82 \delta t + 7.12 a + 8.67 c &= -12.68 & c &= +0^s.135 \\
 3.93 \delta t - 8.67 a + 22.82 c &= +14.76 & \delta t &= -0^s.46
 \end{aligned}$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, JUNE 26, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|----------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | θ Bootis | 6 13 30.23 | + 0.58 | + 0.03 | + 0.18 | 6 13 31.02 | 14 20 54.29 | +8 07 23.27 |
| E. | 5 Ursæ Minoris.... | 20 25.10 | + 4.29 | + 0.10 | + 0.45 | 20 29.94 | 27 53.31 | 23.37 |
| E. | μ Virginis | 29 01.20 | — 1.16 | + 0.00 | + 0.11 | 29 00.15 | 26 23.53 | 23.38 |
| E. | ε Bootis | 32 04.81 | — 0.46 | + 0.07 | + 0.12 | 32 04.54 | 39 28.07 | 23.53 |
| E. | α ³ Libræ | 36 30.76 | — 1.51 | + 0.05 | + 0.11 | 36 29.41 | 43 52.81 | 23.40 |
| W. | β Ursæ Minoris.... | 43 42.84 | + 3.69 | + 0.57 | — 0.41 | 43 46.69 | 51 09.90 | 23.21 |
| W. | β Bootis | 49 47.93 | + 0.01 | + 0.24 | — 0.14 | 49 48.04 | 57 11.59 | 23.55 |
| W. | 48 Cephei (s. pol.) .. | 56 57.44 | — 7.00 | — 0.40 | + 0.49 | 56 50.53 | 15 04 13.82 | 23.29 |
| W. | β Libræ | 7 02 50.04 | — 1.31 | + 0.10 | + 0.11 | 7 02 48.72 | 10 12.11 | 23.39 |
| W. | α ² Libræ | 08 36.93 | — 1.49 | + 0.07 | + 0.11 | 08 35.40 | 15 58.54 | 23.14 |
| W. | μ Bootis | 12 20.19 | — 0.12 | + 0.16 | + 0.14 | 12 20.19 | 19 43.52 | +8 07 23.43 |

NORMAL EQUATIONS.

$$\begin{aligned}
 11.00 \, \delta t + 2.64 \, a + 5.15 \, c &= + 0.05 & a &= -1^s.75 \\
 2.64 \, \delta t + 29.18 \, a + 15.43 \, c &= -48.44 & c &= +0^s.11 \\
 5.15 \, \delta t + 15.43 \, a + 64.10 \, c &= -18.08 & \delta t &= +0^s.36
 \end{aligned}$$

SALT LAKE CITY, UTAH, JUNE 26, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|-------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | η Draconis | 8 14 54.69 | + 1.42 | + 0.24 | — 0.33 | 8 14 56.02 | 16 22 19.52 | +8 07 23.50 |
| W. | λ Draconis | 20 52.58 | + 2.47 | + 0.30 | — 0.43 | 20 54.92 | 28 18.20 | 23.28 |
| W. | η Herculis | 31 11.47 | — 0.07 | + 0.15 | — 0.20 | 31 11.35 | 38 34.70 | 23.35 |
| E. | κ Ophiuchi | 44 18.84 | — 0.99 | + 0.08 | + 0.16 | 44 18.09 | 51 41.33 | 23.24 |
| E. | α Herculis | 49 33.77 | — 0.28 | + 0.08 | + 0.18 | 49 33.75 | 56 56.99 | 23.24 |
| E. | ε Ursæ Minoris.... | 50 38.22 | + 9.18 | + 0.39 | + 1.14 | 50 48.93 | 59 12.32 | 23.39 |
| E. | α ¹ Herculis | 9 01 30.62 | — 0.86 | + 0.06 | + 0.16 | 9 01 29.98 | 17 08 53.39 | +8 07 23.41 |

NORMAL EQUATIONS.

$$\begin{aligned}
 7.00 \, \delta t - 5.81 \, a + 4.44 \, c &= +13.95 & a &= -1^s.87 \\
 5.81 \, \delta t + 26.94 \, a - 29.93 \, c &= -57.10 & c &= -0^s.15 \\
 4.44 \, \delta t - 29.93 \, a + 72.42 \, c &= +68.66 & \delta t &= +0^s.34
 \end{aligned}$$

The following tables give the corrections and rates for the chronometers used at Green River and Salt Lake City :

CHRONOMETER AT GREEN RIVER.—NEGUS, No. 1499.

| Date. | Local sidereal time. | Correction of chronometer. | Adopted hourly rate. |
|---------|----------------------|----------------------------|----------------------|
| 1873. | <i>h.</i> | <i>s.</i> | <i>s.</i> |
| June 10 | 14.8 | + 17.004 ± 0.022 | — 0.045 |
| June 12 | 15.3 | 19.272 ± 0.017 | — 0.071 |
| June 19 | 15.9 | 31.573 ± 0.028 | — 0.045 |
| June 20 | 15.5 | 31.351 ± 0.027 | — 0.017 |
| June 25 | 16.8 | 41.428 ± 0.027 | — 0.025 |
| June 26 | 16.2 | + 43.851 ± 0.028 | — 0.045 |

CHRONOMETER AT SALT LAKE CITY.—NEGUS, No. 1511.

| Date. | Local sidereal time. | Correction of chronometer. | Adopted hourly rate. |
|---------|----------------------|----------------------------|----------------------|
| 1873. | <i>h.</i> | <i>h. m. s.</i> | <i>s.</i> |
| June 10 | 14.0 | + 8 07 44.83 | — 0.058 |
| June 12 | 14.75 | 42.02 | — 0.059 |
| June 19 | 15.5 | 31.51 | — 0.053 |
| June 20 | 16.0 | 30.25 | — 0.051 |
| June 25 | 16.5 | 24.61 | — 0.053 |
| June 26 | 15.5 | + 8 07 23.35 | — 0.054 |

Final results of longitude.

| Signals sent from— | Recorded at— | Mean of signals sent and received. | Time-corrections. | Corrected time. | Difference of longitude. | Double-wave time. | Means. |
|--------------------|-----------------|------------------------------------|-------------------|-----------------|--------------------------|-------------------|--------------|
| | | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> | <i>s.</i> | <i>m. s.</i> |
| June 10, 1873: | | | | | | | |
| Salt Lake City. { | Salt Lake City. | 6 53 18.46 | + 8 07 44.77 | 15 01 03.23 | | | |
| Green River ... { | Green River ... | 15 10 28.58 | + 0 00 16.99 | 10 45.57 | 9 42.34 | | |
| | Salt Lake City. | 7 00 19.82 | + 8 07 44.77 | 15 08 04.59 | | | |
| | Green River ... | 15 17 29.80 | + 0 00 16.99 | 17 46.79 | 9 42.20 | + 0.14 | 9 42.270 |
| June 12, 1873: | | | | | | | |
| Salt Lake City. { | Green River ... | 15 32 57.15 | + 0 00 19.25 | 15 33 16.40 | | | |
| | Salt Lake City. | 7 15 52.04 | + 8 07 41.98 | 23 34.02 | 9 42.38 | | |
| Green River ... { | Green River ... | 15 38 29.81 | + 0 00 19.26 | 15 38 49.05 | | | |
| | Salt Lake City. | 7 21 24.73 | + 8 07 41.98 | 29 06.71 | 9 42.34 | + 0.04 | 9 42.360 |
| June 19, 1873: | | | | | | | |
| Salt Lake City. { | Green River ... | 16 03 25.84 | + 0 00 31.57 | 16 03 57.41 | | | |
| | Salt Lake City. | 7 46 43.54 | + 8 07 31.49 | 15 54 15.03 | 9 42.38 | | |
| Green River ... { | Green River ... | 16 12 59.90 | + 0 00 31.56 | 16 13 31.46 | | | |
| | Salt Lake City. | 7 56 17.54 | + 8 07 31.48 | 16 03 49.02 | 9 42.44 | — 0.06 | 9 42.410 |

Final results of longitude—Continued.

| Signals sent from— | Recorded at— | Mean of signals sent and received. | Time-corrections. | Corrected time. | Difference of longitude. | Double-wave time. | Means. |
|--------------------|------------------|------------------------------------|-------------------|-----------------|--------------------------|-------------------|--------------|
| | | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> | <i>s.</i> | <i>m. s.</i> |
| June 20, 1873: | | | | | | | |
| Salt Lake City. { | Green River ... | 15 29 34.24 | + 0 00 31.35 | 15 30 05.59 | 9 42.54 | | |
| | Salt Lake City.. | 7 12 52.76 | + 8 07 30.29 | 20 23.05 | | | |
| Green River ... { | Green River ... | 15 35 59.94 | + 0 00 31.35 | 36 31.29 | 9 42.43 | + 0.11 | 9 42.485 |
| | Salt Lake City.. | 7 19 18.58 | + 8 07 30.28 | 26 48.86 | | | |
| June 25, 1873: | | | | | | | |
| Salt Lake City. { | Green River ... | 18 02 59.77 | + 0 00 41.40 | 18 03 41.17 | 9 42.55 | | |
| | Salt Lake City.. | 9 46 34.08 | + 8 07 24.54 | 17 53 58.62 | | | |
| Green River ... { | Green River ... | 18 08 40.00 | + 0 00 41.39 | 18 09 21.39 | 9 42.48 | + 0.07 | 9 42.515 |
| | Salt Lake City.. | 9 52 14.38 | + 8 07 24.53 | 17 59 38.91 | | | |
| June 26, 1873: | | | | | | | |
| Salt Lake City. { | Green River ... | 15 48 21.47 | + 0 00 43.87 | 15 49 05.34 | 9 42.49 | | |
| | Salt Lake City.. | 7 31 59.51 | + 8 07 23.34 | 39 22.85 | | | |
| Green River ... { | Green River ... | 15 53 49.87 | + 0 00 43.86 | 54 33.73 | 9 42.49 | 0.00 | 9 42.490 |
| | Salt Lake City.. | 7 37 27.90 | + 8 07 23.34 | 15 44 51.24 | | | |

Green River east of Salt Lake City 0^h 09^m 42^s.472 ± 0^s.029 (by sums of errors),
 not yet including the personal equation. ± 0^s.028 (by sums of squares),
 Salt Lake City west of Greenwich 7^h 27^m 34^s.86
 Green River west of Greenwich 7^h 17^m 52^s.438
 Green River west of Greenwich 109° 28' 06".57

Mean places of stars for 1873.0 used for determination of latitude of Green River, Wyoming.

| No. of pair. | No. in B. A. C. | Right ascension. | Declination. | No. of pair. | No. in B. A. C. | Right ascension. | Declination. |
|--------------|-----------------|------------------|--------------|--------------|-----------------|------------------|--------------|
| | | <i>h. m. s.</i> | <i>° ' "</i> | | | <i>h. m. s.</i> | <i>° ' "</i> |
| 1..... | 4741 | 14 11 33 | 46 40 19.74 | 13..... | 5643 | 16 42 54 | 57 00 33.82 |
| | 4747 | 12 37 | 36 05 46.76 | | 5703 | 49 50 | 25 56 12.22 |
| 2..... | 4804 | 14 24 13 | 50 24 50.62 | | 5747 | 16 56 55 | 33 45 12.56 |
| | 4820 | 28 47 | 33 05 32.84 | 14..... | *5776 | 17 01 28 | 48 58 47.42 |
| 3..... | 4863 | 14 37 31 | 37 17 55.00 | | 5842 | 17 12 38 | 33 14 17.72 |
| | 4881 | 39 49 | 45 43 25.14 | 15..... | 5853 | 13 35 | 49 49 40.56 |
| 4..... | 4917 | 14 47 35 | 47 00 01.34 | | 5871 | 17 16 46 | 46 21 58.58 |
| | 4961 | 58 02 | 35 42 15.40 | 16..... | 5895 | 20 03 | 37 03 57.44 |
| 5..... | 5033 | 15 09 35 | 42 38 43.44 | | 5937 | 17 27 33 | 52 23 46.14 |
| | 5076 | 17 55 | 40 02 09.94 | 17..... | 5962 | 31 47 | 30 51 54.52 |
| 6..... | 5131 | 15 27 48 | 31 47 19.92 | | 6082 | 17 51 54 | 37 16 06.96 |
| | 5181 | 34 52 | 50 50 18.82 | 18..... | 6109 | 56 19 | 45 30 30.74 |
| 7..... | 5248 | 15 44 34 | 55 45 58.04 | | 6203 | 18 11 42 | 42 07 01.44 |
| | 5302 | 52 20 | 27 14 49.34 | 19..... | 6218 | 13 05 | 40 53 15.48 |
| 8..... | 5321 | 15 56 21 | 30 12 27.82 | | 6311 | 18 24 56 | 59 37 34.44 |
| | 5341 | 58 51 | 53 16 09.72 | 20..... | 6322 | 27 29 | 23 31 25.08 |
| 9..... | 5434 | 16 10 52 | 23 26 24.66 | | 6470 | 18 50 04 | 50 33 04.20 |
| | 5459 | 15 08 | 60 03 48.02 | 21..... | 6491 | 54 12 | 32 31 00.00 |
| 10..... | 5473 | 16 17 09 | 31 11 17.94 | | 6520 | 18 57 51 | 46 45 20.56 |
| | 5503 | 21 47 | 52 00 17.76 | 22..... | 6556 | 19 02 46 | 35 54 08.16 |
| 11..... | 5541 | 16 28 32 | 30 45 59.86 | | 6650 | 19 17 59 | 73 07 08.16 |
| | 5549 | 30 53 | 52 30 05.20 | 23..... | 6772 | 19 40 13 | 10 18 19.31 |
| 12..... | 5596 | 16 35 18 | 49 10 39.46 | | | | |
| | 5619 | 39 11 | 34 16 26.24 | | | | |

* The declination of the star 5776 as given in the Catalogue of 981 Stars is 48° 58' 50".12; a proper motion of — 0".10 annually has been assumed here.

LATITUDE DETERMINATIONS.

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Observations and computations for latitude.

GREEN RIVER STATION, WYOMING.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|------------------|--------------|-------------------|-----------|-----------|-----------------------------------|--------------------------|-------------------|--------|--------|-------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1873. June 9. | | <i>t.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | " | ° ' " |
| | 5131 | 30.730 | 24.0 | 13.9 | Illumination poor. | 41 18 48.28 | +13 21.48 | -9.26 | ..... | 41 31 40.50 |
| | 5181 | 10.431 | ..... | 44.1 | | | | | | |
| | 5248 | 20.412 | 15.6 | 22.6 | Observed off line of collimation. | 30 21.74 | + 1 08.74 | +6.64 | +0.12 | 37.32 |
| | 5302 | 22.195 | 37.0 | 1.3 | | | | | | |
| | 5321 | 10.017 | 23.5 | 14.2 | | 44 16.34 | -12 46.72 | +8.75 | ..... | 38.37 |
| | 5341 | 29.907 | 33.2 | 4.7 | | | | | | |
| | 5473 | 15.434 | 21.2 | 16.0 | Growing cloudy. | 35 44.26 | - 0 47.33 | +1.34 | ..... | 38.27 |
| | 5503 | 21.850 | 19.6 | 19.0 | | | | | | |
| | 5541 | 15.822 | 28.6 | 9.5 | | 37 58.41 | - 6 20.47 | -1.94 | ..... | 36.00 |
| | 5549 | 25.692 | 5.5 | 33.0 | | | | | | |
| | 5747 | 27.103 | 30.0 | 9.0 | | 21 54.37 | + 9 41.81 | +1.48 | ..... | 37.66 |
| | 5776 | 12.010 | 12.3 | 26.9 | | | | | | |
| | 5937 | 23.820 | 12.3 | 27.1 | | 37.43.29 | - 6 07.48 | +1.55 | ..... | 37.36 |
| | 5962 | 14.287 | 30.5 | 9.0 | | | | | | |
| | 6082 | 25.357 | 18.0 | 22.3 | | 23 10.63 | + 8 27.26 | +4.14 | ..... | 42.03 |
| | 6109 | 12.198 | 31.4 | 9.2 | | | | | | |
| | 6203 | 18.641 | 17.0 | 23.9 | | 29 59.46 | + 1 33.79 | +4.12 | ..... | 37.37 |
| | 6218 | 21.074 | 32.9 | 8.2 | | | | | | |
| | 6311 | 21.863 | 17.4 | 24.2 | | 34 20.45 | - 2 43.64 | +1.16 | ..... | 37.97 |
| | 6322 | 17.618 | 26.8 | 15.0 | | | | | | |
| | 6520 | 10.152 | 20.2 | 21.9 | | 19 33.58 | +12 01.27 | +2.85 | ..... | 37.70 |
| | 6566 | 28.863 | 28.0 | 14.0 | | | | | | |
| | 6650 | 27.124 | 17.0 | 25.0 | | 42 33.57 | -10 58.99 | +2.78 | ..... | 37.36 |
| | 6772 | 10.030 | 31.0 | 11.0 | | | | | | |
| June 10. | 5747 | 26.799 | 24.0 | 14.5 | | 21 54.65 | + 9 43.58 | +0.16 | ..... | 38.39 |
| | 5776 | 11.660 | 15.2 | 24.0 | | | | | | |
| | 5842 | 18.986 | 28.0 | 11.0 | | 31 53.12 | - 0 18.46 | +2.32 | ..... | 36.98 |
| | 5853 | 19.465 | 16.0 | 23.0 | | | | | | |
| | 5871 | 23.748 | 24.1 | 14.8 | | 42 51.74 | -11 19.53 | +3.94 | ..... | 36.15 |
| | 5895 | 6.120 | 23.4 | 15.7 | | | | | | |
| | 5937 | 23.303 | 20.1 | 18.9 | | 37 43.58 | - 6 09.18 | +2.18 | ..... | 36.58 |
| | 5962 | 13.726 | 23.7 | 15.5 | | | | | | |
| | 6082 | 24.691 | 5.6 | 33.3 | | 23 10.93 | + 8 25.29 | +2.62 | ..... | 38.84 |
| | 6109 | 11.583 | 39.0 | 0.0 | | | | | | |
| | 6311 | 22.743 | 20.1 | 19.2 | | 34 20.74 | - 2 47.68 | +4.05 | ..... | 37.11 |
| | 6322 | 18.393 | 28.0 | 11.4 | | | | | | |
| | 6470 | 20.410 | 24.2 | 16.3 | | 41 31 51.96 | - 0 16.88 | +4.56 | | 31 39.64 |
| | 6491 | 19.972 | 26.3 | 14.5 | | | | | | |

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Observations and computations—Continued.

GREEN RIVER STATION, WYOMING.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|----------|--------------|-------------------|-----------|-----------|-----------------------------------|--------------------------|-------------------|--------|--------|-------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1873. | | <i>t.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | " | ° ' " |
| June 10. | 6520 | 9.917 | 27.0 | 13.5 | | | | | | |
| | 6556 | 28.551 | 27.8 | 13.1 | | 41 19 33.83 | +11 58.31 | +6.53 | ..... | 41 31 38.72 |
| | 6650 | 28.097 | 19.3 | 21.5 | | | | | | |
| | 6772 | 11.082 | 19.1 | 22.5 | | 42 33.84 | -10 55.94 | -1.30 | ..... | 36.60 |
| June 11. | 4804 | 34.610 | 32.8 | 1.9 | | | | | | |
| | 4820 | 13.237 | 15.9 | 19.0 | | 45 14.60 | -13 43.83 | +6.43 | ..... | 37.15 |
| | 4863 | 20.413 | 13.0 | 22.0 | | | | | | |
| | 4881 | 19.047 | 29.8 | 5.3 | | 30 42.84 | + 0 53.00 | +3.59 | ..... | 39.43 |
| | 4917 | 11.316 | 20.8 | 15.0 | | | | | | |
| | 4961 | 27.682 | 11.2 | 24.5 | | 21 09.88 | +10 30.88 | -1.74 | ..... | 39.02 |
| | 5033 | 12.631 | 23.7 | 13.0 | | | | | | |
| | 5076 | 29.988 | 17.2 | 19.8 | | 20 27.12 | +11 09.07 | +1.88 | ..... | 38.07 |
| | 5131 | 29.658 | 19.0 | 18.0 | | | | | | |
| | 5181 | 9.700 | 19.7 | 17.9 | | 18 48.76 | +12 49.34 | +0.65 | ..... | 38.75 |
| | 5248 | 20.132 | 19.6 | 18.3 | | | | | | |
| | 5302 | 22.063 | 21.1 | 17.3 | | 30 22.23 | + 1 14.44 | +1.18 | ..... | 37.85 |
| | 5321 | 10.119 | 23.0 | 15.6 | | | | | | |
| | 5341 | 29.878 | 23.0 | 15.9 | | 44 16.84 | -12 41.67 | +3.36 | ..... | 38.53 |
| | 5434 | 9.264 | 22.2 | 17.0 | | | | | | |
| | 5459 | 30.221 | 20.0 | 19.7 | | 45 03.47 | -13 27.85 | +1.27 | +0.35 | 37.24 |
| | 5473 | 14.861 | 20.0 | 19.7 | Observed off line of collimation. | | | | | |
| | 5503 | 21.321 | 20.9 | 16.0 | | 35 44.80 | - 4 09.02 | +0.51 | +0.21 | 36.50 |
| | 5541 | 16.352 | 27.0 | 13.0 | | | | | | |
| | 5549 | 26.355 | 23.0 | 17.0 | | 37 58.94 | - 6 25.60 | +4.63 | ..... | 37.97 |
| | 5596 | 28.224 | 35.8 | 4.0 | | | | | | |
| | 5619 | 9.620 | 20.6 | 19.7 | | 43 28.96 | -11 57.15 | +7.55 | ..... | 39.36 |
| | 5643 | 17.689 | 32.0 | 8.9 | | | | | | |
| | 5703 | 22.809 | 15.4 | 25.5 | | 28 18.66 | + 3 17.37 | +3.01 | ..... | 39.04 |
| | 5747 | 28.249 | 19.0 | 22.0 | | | | | | |
| | 5776 | 13.183 | 31.3 | 9.8 | | 21 54.95 | + 9 40.77 | +4.28 | ..... | 40.00 |
| | 5842 | 19.522 | 20.2 | 21.3 | | | | | | |
| | 5853 | 19.887 | 20.2 | 21.7 | | 31 53.40 | - 0 14.07 | -0.60 | ..... | 38.73 |
| | 5937 | 23.102 | 23.4 | 18.7 | | | | | | |
| | 5962 | 13.582 | 20.7 | 21.5 | | 37 43.88 | - 6 66.93 | +0.90 | ..... | 37.80 |
| | 6082 | 24.305 | 23.1 | 19.8 | | | | | | |
| | 6109 | 11.141 | 20.4 | 23.0 | | 23 11.24 | + 8 27.45 | +0.16 | ..... | 38.85 |
| | 6203 | 20.923 | 25.4 | 17.8 | | | | | | |
| | 6218 | 23.427 | 24.1 | 19.0 | | 41 30 00.08 | + 1 36.52 | +2.94 | | 41 31 39.54 |

LATITUDE DETERMINATIONS.

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Observations and computations—Continued.

GREEN RIVER STATION, WYOMING.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|----------|--------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|------------|------------|-------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1873. | | <i>t.</i> | <i>d.</i> | <i>d.</i> | | <i>o' "</i> | <i>' "</i> | <i>" "</i> | <i>" "</i> | <i>o' "</i> |
| June 11. | 6311 | 22.392 | 27.3 | 16.0 | | | | | | |
| | 6322 | 18.123 | 18.0 | 25.4 | | 41 34 21.04 | — 2 44.56 | +0.90 | ..... | 41 31 37.38 |
| | 6470 | 20.563 | 32.0 | 12.0 | | | | | | |
| | 6491 | 20.130 | 20.8 | 23.4 | | 31 52.27 | — 0 16.69 | +4.35 | ..... | 39.93 |
| | 6520 | 9.620 | 34.3 | 10.0 | | | | | | |
| | 6556 | 18.320 | 19.0 | 25.1 | | 19 34.19 | +12 00.85 | +4.21 | ..... | 39.25 |
| | 6650 | 27.065 | 36.4 | 8.0 | | | | | | |
| | 6772 | 9.931 | 17.2 | 28.0 | | 42 34.10 | —11 00.53 | +4.07 | ..... | 37.64 |
| June 12. | 5842 | 19.163 | 15.8 | 20.0 | | | | | | |
| | 5853 | 19.251 | ..... | 45.0 | | 31 53.70 | — 0 02.39 | —13.36 | ..... | 36 95 |
| | 5937 | 22.110 | 21.5 | 15.3 | | | | | | |
| | 5962 | 12.543 | 20.4 | 16.6 | | 37 44.18 | — 6 08.79 | +2.32 | ..... | 37.71 |
| | 6082 | 25.237 | 17.8 | 20.2 | | | | | | |
| | 6109 | 12.113 | 26.0 | 12.5 | | 23 11.54 | + 8 25.91 | +2.57 | ..... | 40.02 |
| | 6203 | 19.336 | 19.0 | 19.0 | | | | | | |
| | 6218 | 21.820 | 23.9 | 14.4 | | 30 00.38 | + 1 35.75 | +2.20 | ..... | 38.33 |
| | 6311 | 22.863 | 28.2 | 10.0 | | | | | | |
| | 6322 | 18.522 | 15.8 | 22.3 | | 34 21.34 | — 2 47.34 | +2.71 | ..... | 36.71 |
| | 6470 | 20.892 | 37.0 | 2.0 | (*) | | | | | |
| | 6491 | 20.412 | 14.8 | 24.0 | (*) | 31 52.57 | — 0 18.50 | +0.63 | +0.35 | 35.05 |
| | 6520 | 8.890 | 23.0 | 16.0 | | | | | | |
| | 6556 | 27.576 | 24.3 | 14.5 | | 19 34.50 | +12 00.31 | +3.89 | ..... | 38.70 |
| | 6650 | 26.961 | 37.0 | 2.0 | | | | | | |
| | 6772 | 9.918 | 3.7 | 30.0 | | 42 34.36 | —10 57.02 | +0.63 | ..... | 37.97 |
| June 16. | 5131 | 31.121 | 21.2 | 24.6 | | | | | | |
| | 5181 | 11.179 | 30.5 | 16.0 | | 18 49.90 | +12 48.72 | +2.57 | ..... | 41.19 |
| | 5248 | 20.642 | 26.8 | 20.0 | | | | | | |
| | 5302 | 22.533 | 21.9 | 25.3 | | 30 23.40 | + 1 12.90 | +0.79 | ..... | 37.09 |
| | 5321 | 10.052 | 23.0 | 24.1 | | | | | | |
| | 5341 | 29.801 | 27.2 | 20.1 | | 44 18.06 | —12 41.29 | +1.38 | ..... | 38.15 |
| | 5473 | 15.698 | 22.5 | 24.4 | | | | | | |
| | 5503 | 22.205 | 34.2 | 14.5 | | 35 46.09 | — 4 10.83 | +4.12 | ..... | 39.38 |
| | 5596 | 27.320 | 33.6 | 15.1 | | | | | | |
| | 5619 | 8.721 | 19.0 | 29.5 | (*) | 43 30.31 | —11 56.96 | +1.85 | +0.24 | 35.44 |
| | 5643 | 17.850 | 26.0 | 22.8 | | | | | | |
| | 5703 | 22.931 | 26.2 | 23.0 | | 28 19.99 | + 3 15.87 | +1.48 | ..... | 37.34 |
| | 5747 | 27.570 | 22.0 | 27.2 | | | | | | |
| | 5776 | 12.510 | 36.8 | 13.0 | | 41 21 56.35 | + 9 40.54 | +4.31 | ..... | 41 31 41.20 |

* Off line of collimation.

Observations and computations—Continued.

GREEN RIVER STATION, WYOMING.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|----------|--------------|-------------------|-----------|-----------|---------------------------|--------------------------|-------------------|--------|--------|-------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1873. | | <i>t.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | " | ° ' " |
| June 16. | 5842 | 18.708 | 22.9 | 37.0 | Through clouds; faint. | 41 31 54.84 | — 0 20.81 | +0.90 | ..... | 41 31 34.93 |
| | 5853 | 19.248 | 34.0 | 16.0 | | | | | | |
| | 5937 | 22.158 | 39.0 | 11.0 | | 37 45.32 | — 6 11.64 | +2.82 | ..... | 36.50 |
| | 5962 | 12.517 | 17.2 | 33.0 | | | | | | |
| June 17. | 4804 | 33.764 | 24.1 | 16.0 | (*) (*) Very faint. | 45 15.66 | —13 37.76 | +0.12 | ..... | 38.02 |
| | 4820 | 12.550 | 16.3 | 23.9 | | | | | | |
| | 4917 | 11.593 | 20.2 | 20.0 | | 21 11.08 | +10 28.68 | —1.67 | ..... | 38.09 |
| | 4961 | 27.902 | 16.7 | 24.1 | | | | | | |
| | 5033 | 13.567 | 24.0 | 17.7 | | 20 28.44 | +11 11.15 | —0.93 | ..... | 38.66 |
| | 5076 | 30.978 | 15.9 | 26.2 | | | | | | |
| | 5131 | 29.772 | 19.0 | 23.5 | | 18 50.12 | +12 48.72 | +0.30 | ..... | 39.14 |
| | 5181 | 9.830 | 24.1 | 18.3 | | | | | | |
| | 5248 | 20.557 | 24.1 | 19.0 | | 30 23.63 | + 1 15.48 | —1.44 | ..... | 37.67 |
| | 5302 | 22.515 | 16.0 | 27.3 | | | | | | |
| | 5321 | 9.981 | 19.0 | 24.0 | | 44 18.30 | —12 40.98 | +0.02 | ..... | 37.34 |
| | 5341 | 29.722 | 24.1 | 19.0 | | | | | | |
| | 5434 | 9.108 | 21.9 | 21.4 | | 45 04.94 | —13 28.71 | +0.67 | +0.22 | 37.12 |
| | 5459 | 30.087 | 23.0 | 20.6 | | | | | | |
| | 5473 | 14.120 | 16.5 | 27.3 | | 35 46.35 | — 4 10.49 | +1.44 | +0.14 | 37.44 |
| | 5503 | 20.668 | 30.5 | 13.5 | | | | | | |
| | 5541 | 15.673 | 22.8 | 21.3 | | 38 00.52 | — 6 23.75 | +1.82 | ..... | 38.59 |
| | 5549 | 25.628 | 25.3 | 18.9 | | | | | | |
| | 5596 | 28.153 | 22.3 | 21.9 | | 43 30.58 | —11 55.22 | +2.03 | ..... | 37.39 |
| | 5619 | 9.599 | 26.4 | 18.0 | | | | | | |
| | 5643 | 18.185 | 29.8 | 14.9 | | 28 20.25 | + 3 17.33 | +1.16 | ..... | 38.74 |
| | 5703 | 23.304 | 17.5 | 27.4 | | | | | | |
| | 5747 | 28.320 | 20.9 | 24.0 | | 21 56.62 | + 9 41.65 | +1.37 | ..... | 39.64 |
| | 5776 | 13.231 | 27.2 | 18.2 | | | | | | |
| | 5842 | 19.510 | 17.8 | 28.0 | | 31 55.12 | — 0 19.08 | +1.81 | ..... | 37.85 |
| | 5853 | 20.005 | 32.0 | 14.0 | | | | | | |
| | 5871 | 21.800 | 25.1 | 20.8 | | 42 53.78 | —11 19.14 | +0.46 | ..... | 35.70 |
| | 5895 | 4.182 | 21.9 | 24.2 | | | | | | |
| | 5937 | 22.510 | 24.3 | 22.0 | | 37 45.61 | — 6 09.64 | +2.38 | ..... | 38.35 |
| | 5962 | 12.921 | 27.6 | 19.6 | | | | | | |
| | 6082 | 24.645 | 26.0 | 21.5 | | 23 13.04 | + 8 23.36 | +2.59 | ..... | 38.99 |
| | 6109 | 11.587 | 27.0 | 20.3 | | | | | | |
| | 6203 | 19.680 | 30.2 | 18.0 | | | | | | |
| | 6218 | 22.109 | 22.9 | 24.3 | | 41 30 01.91 | + 1 33.63 | +2.50 | | 41 31 38.04 |

* Off line of collimation.

LATITUDE DETERMINATIONS.

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Observations and computations—Continued.

GREEN RIVER STATION, WYOMING.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|----------|--------------|-------------------|-----------|-----------|-------------|--------------------------|-------------------|--------|--------|-------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1873. | | <i>t.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | " | ° ' " |
| June 17. | 6311 | 22.317 | 39.0 | 9.3 | | | | | | |
| | 6322 | 17.950 | 15.9 | 32.7 | | 41 34 22.80 | — 2 48.34 | +2.99 | ..... | 41 31 37.45 |
| | 6470 | 19.932 | 41.0 | 8.9 | | | | | | |
| | 6491 | 19.423 | 19.2 | 30.7 | | 31 54.10 | — 0 19.62 | +4.77 | ..... | 39.25 |
| | 6520 | 9.170 | 34.3 | 15.3 | | | | | | |
| | 6556 | 27.870 | 19.1 | 30.8 | | 19 36.04 | +12 00.85 | +1.69 | ..... | 38.58 |
| | 6650 | 27.803 | 34.5 | 15.8 | | | | | | |
| | 6772 | 10.637 | 19.0 | 31.0 | | 42 35.70 | —11 01.76 | +1.55 | ..... | 35.49 |
| June 20. | 5842 | 20.193 | 25.9 | 22.8 | | | | | | |
| | 5853 | 20.711 | 25.8 | 23.0 | | 31 55.96 | — 0 19.96 | +1.37 | ..... | 37.37 |
| | 5871 | 23.611 | 25.5 | 23.3 | | | | | | |
| | 5895 | 5.932 | 30.8 | 18.0 | | 42 54.64 | —11 21.49 | +3.47 | ..... | 36.62 |
| | 5937 | 23.398 | 33.3 | 15.9 | | | | | | |
| | 5962 | 13.753 | 26.7 | 22.9 | | 37 46.46 | — 6 11.80 | +4.91 | ..... | 39.57 |
| | 6082 | 25.463 | 23.0 | 27.0 | | | | | | |
| | 6109 | 12.882 | 31.5 | 19.0 | | 23 13.94 | + 8 24.25 | +1.97 | ..... | 40.16 |
| | 6203 | 18.347 | 28.0 | 23.5 | | | | | | |
| | 6218 | 20.785 | 30.2 | 21.0 | | 30 02.82 | + 1 33.98 | +3.17 | ..... | 39.97 |
| | 6311 | 22.192 | 36.0 | 15.8 | | | | | | |
| | 6322 | 17.839 | 22.0 | 30.0 | | 34 23.68 | — 2 47.80 | +2.82 | ..... | 38.70 |
| | 6470 | 20.023 | 36.8 | 16.5 | | | | | | |
| | 6491 | 19.523 | 26.2 | 26.8 | | 31 55.02 | — 0 19.27 | +4.56 | ..... | 40.31 |
| | 6520 | 10.263 | 40.7 | 12.6 | | | | | | |
| | 6556 | 28.923 | 19.0 | 34.2 | | 19 36.96 | +11 59.31 | +2.80 | ..... | 39.07 |
| | 6650 | 27.227 | 34.4 | 19.1 | | | | | | |
| | 6772 | 10.063 | 27.0 | 27.0 | | 42 36.52 | —11 01.63 | +3.54 | ..... | 38.38 |
| June 21. | 5248 | 20.206 | 24.5 | 19.1 | | | | | | |
| | 5302 | 22.083 | 20.8 | 23.0 | | 30 24.51 | + 1 12.34 | +0.74 | ..... | 37.59 |
| | 5321 | 10.200 | 22.0 | 21.3 | | | | | | |
| | 5341 | 29.937 | 20.1 | 23.4 | | 44 19.22 | —12 40.82 | —0.51 | ..... | 37.89 |
| | 5434 | 9.191 | 23.3 | 20.1 | | | | | | |
| | 5459 | 30.190 | 23.0 | 20.9 | | 45 05.87 | —13 25.63 | +1.27 | ..... | 41.51 |
| | 5473 | 15.655 | 19.1 | 24.5 | | | | | | |
| | 5503 | 22.212 | 33.0 | 10.4 | Very faint. | 35 47.34 | — 4 12.76 | +3.77 | ..... | 38.35 |
| | 5541 | 16.270 | 19.0 | 24.7 | | | | | | |
| | 5549 | 26.300 | 31.3 | 12.7 | | 38 01.52 | — 6 26.64 | +2.93 | ..... | 37.81 |
| | 5596 | 27.300 | 24.2 | 20.0 | | | | | | |
| | 5619 | 8.688 | 24.2 | 20.1 | | 41 43 31.61 | —11 57.46 | +1.92 | ..... | 41 31 36.07 |

Observations and computations—Continued.

GREEN RIVER STATION, WYOMING.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|------------------|--------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|--------|--------|-------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1873. June 21 | | <i>t.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | " | ° ' " |
| | 5643 | 17.947 | 25.5 | 19.0 | | | | | | |
| | 5703 | 22.974 | 22.0 | 23.0 | | 41 28 21.28 | + 3 13.79 | +1.27 | ..... | 41 31 36.34 |
| | 5747 | 28.564 | 21.0 | 24.0 | | | | | | |
| | 5776 | 13.572 | 32.0 | 13.0 | | 21 57.71 | + 9 37.92 | +3.70 | ..... | 39.33 |
| | 5842 | 19.973 | 20.0 | 24.7 | | | | | | |
| | 5853 | 20.552 | 34.7 | 10.9 | | 31 56.24 | - 0 22.31 | +4.63 | ..... | 38.56 |
| | 5871 | 22.381 | 23.0 | 21.3 | | | | | | |
| | 5895 | 4.649 | 29.1 | 14.8 | | 42 54.92 | -11 23.53 | +3.70 | ..... | 35.09 |
| | 5937 | 24.107 | 31.6 | 12.2 | | | | | | |
| | 5962 | 14.403 | 25.5 | 18.0 | | 37 46.75 | - 6 14.07 | +6.23 | ..... | 38.91 |
| | 6470 | 20.231 | 39.0 | 14.9 | | | | | | |
| | 6491 | 19.632 | 23.9 | 29.7 | | 31 55.32 | - 0 23.09 | +4.24 | ..... | 36.47 |
| June 22. | 5033 | 8.273 | 30.7 | 25.0 | | | | | | |
| | 5076 | 25.619 | 25.0 | 31.0 | | 20 29.44 | +11 08.65 | -0.07 | ..... | 38.02 |
| | 5131 | 30.008 | 31.0 | 25.0 | | | | | | |
| | 5181 | 10.121 | 28.7 | 27.6 | | 18 51.18 | +12 46.60 | +1.64 | ..... | 39.42 |
| June 24. | 5434 | 7.684 | 26.0 | 21.7 | | | | | | |
| | 5459 | 28.739 | 27.1 | 21.0 | | 45 06.56 | -13 31.64 | +2.36 | ..... | 37.28 |
| | 5473 | 16.613 | 20.9 | 27.2 | | | | | | |
| | 5503 | 23.223 | 37.0 | 11.3 | | 35 48.06 | - 4 14.80 | +4.49 | ..... | 37.75 |
| | 5541 | 16.016 | 25.9 | 21.7 | | | | | | |
| | 5549 | 26.073 | 31.0 | 12.0 | | 38 02.26 | - 6 27.68 | +5.32 | ..... | 39.90 |
| | 5596 | 28.023 | 27.3 | 20.6 | | | | | | |
| | 5619 | 9.383 | 26.9 | 21.1 | | 43 32.37 | -11 58.54 | +2.89 | ..... | 36.72 |
| | 5643 | 17.042 | 33.5 | 14.6 | | | | | | |
| | 5703 | 22.027 | 24.2 | 24.0 | | 28 22.02 | + 3 12.17 | +4.42 | ..... | 38.61 |
| | 5747 | 28.294 | 23.6 | 24.6 | | | | | | |
| | 5776 | 13.355 | 34.5 | 14.9 | | 21 58.51 | + 9 35.87 | +4.31 | ..... | 38.69 |
| | 5871 | 24.283 | 17.3 | 31.3 | | | | | | |
| | 5895 | 6.506 | 41.1 | 7.7 | | 42 55.77 | -11 25.27 | +4.49 | ..... | 34.99 |
| | 5937 | 23.460 | 36.2 | 12.1 | | | | | | |
| | 5962 | 13.763 | 23.2 | 25.0 | | 37 47.60 | - 6 13.80 | +5.16 | ..... | 38.96 |
| | 6032 | 25.771 | 20.0 | 28.5 | | | | | | |
| | 6109 | 11.739 | 39.0 | 9.9 | | 23 15.12 | + 8 22.36 | +4.77 | ..... | 42.25 |
| | 6203 | 19.403 | 31.1 | 17.8 | | | | | | |
| | 6218 | 21.721 | 31.9 | 17.9 | | 30 04.04 | + 1 29.35 | +6.10 | ..... | 39.49 |
| | 6311 | 21.103 | 40.3 | 8.9 | | | | | | |
| | 6322 | 16.616 | 19.0 | 29.9 | | 41 34 24.84 | - 2 52.93 | +4.75 | | 41 31 36.63 |

LATITUDE DETERMINATIONS.

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Observations and computations—Continued.

GREEN RIVER STATION, WYOMING.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|----------|-----------------|----------------------|-----------|-----------|----------|-----------------------------|----------------------|--------|--------|-------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1873. | | <i>t.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | " | ° ' " |
| June 24. | 6470 | 19.867 | 35.4 | 11.0 | | 41 31 56.25 | — 0 22.43 | +5.88 | ..... | 41 31 39.70 |
| | 6491 | 19.285 | 24.0 | 23.0 | | | | | | |
| | 6520 | 10.572 | 34.4 | 12.3 | | 19 38.20 | +11 56.07 | +6.13 | ..... | 40.40 |
| | 6556 | 29.148 | 25.7 | 21.3 | | | | | | |
| | 6650 | 28.091 | 27.0 | 22.0 | | 42 37.62 | —11 04.77 | +4.86 | ..... | 37.71 |
| | 6772 | 10.847 | 33.5 | 17.5 | | | | | | |
| June 25. | 4863 | 19.837 | 20.3 | 24.1 | | 30 45.76 | + 0 44.45 | +8.01 | ..... | 38.22 |
| | 4881 | 18.684 | 41.7 | 3.3 | | | | | | |
| | 4917 | 12.035 | 36.2 | 9.5 | | 21 13.00 | +10 22.28 | +5.05 | ..... | 40.33 |
| | 4961 | 28.178 | 20.5 | 25.4 | | | | | | |
| | 5033 | 13.150 | 30.1 | 10.0 | | 20 30.56 | +11 05.14 | +2.52 | ..... | 38.22 |
| | 5076 | 30.405 | 15.8 | 31.0 | | | | | | |
| | 5131 | 30.311 | 25.3 | 21.2 | | 18 52.36 | +12 41.40 | +8.13 | ..... | 41.89 |
| | 5181 | 10.559 | 39.0 | 8.0 | | | | | | |
| | 5248 | 21.960 | 27.1 | 20.0 | | 30 25.97 | + 1 07.50 | +4.56 | ..... | 38.03 |
| | 5302 | 23.711 | 29.8 | 17.2 | | | | | | |
| | 5321 | 10.271 | 23.0 | 24.3 | | 44 20.76 | —12 47.84 | +6.00 | ..... | 38.92 |
| | 5341 | 30.190 | 37.2 | 10.0 | | | | | | |
| | 5434 | 8.559 | 21.2 | 26.4 | | 45 07.44 | —13 34.61 | +6.25 | ..... | 39.08 |
| | 5459 | 29.691 | 40.1 | 7.9 | | | | | | |
| | 5473 | 16.000 | 15.9 | 32.0 | | 35 48.99 | — 4 17.69 | +7.36 | ..... | 38.66 |
| | 5503 | 22.685 | 47.9 | 0.0 | | | | | | |
| | 5596 | 28.659 | 0.0 | 48.5 | | 43 33.36 | —11 45.86 | —0.98 | ..... | 37.52 |
| | 5619 | 10.348 | 26.9 | 21.5 | | | | | | |
| | 5643 | 18.495 | 34.9 | 13.6 | | 28 23.00 | + 3 12.40 | +0.81 | ..... | 36.21 |
| | 5703 | 23.486 | 15.1 | 32.9 | | | | | | |
| | 5747 | 29.106 | 24.7 | 24.0 | | 21 59.55 | + 9 35.29 | +4.24 | ..... | 39.08 |
| | 5776 | 14.182 | 33.3 | 15.7 | | | | | | |
| | 5842 | 18.533 | 20.0 | 29.7 | | 31 58.14 | — 0 23.23 | +4.28 | ..... | 39.19 |
| | 5853 | 19.136 | 39.0 | 10.8 | | | | | | |
| | 5871 | 22.585 | 29.6 | 20.2 | | 42 56.89 | —11 13.36 | +3.50 | ..... | 47.03 |
| | 5895 | 5.117 | 28.0 | 22.3 | | | | | | |
| | 5937 | 22.971 | 35.6 | 15.0 | | 37 48.70 | — 6 15.19 | +4.61 | ..... | 38.12 |
| | 5962 | 13.238 | 25.0 | 25.7 | | | | | | |
| | 6082 | 25.423 | 19.0 | 32.3 | | 23 16.30 | + 8 19.55 | +3.01 | ..... | 38.86 |
| | 6109 | 12.464 | 38.9 | 12.6 | | | | | | |
| | 6203 | 18.719 | 24.7 | 27.7 | | 41 30 05.24 | + 1 28.12 | +0.69 | ..... | 41 31 34.05 |
| | 6218 | 21.005 | 29.0 | 23.0 | | | | | | |

Observations and computations—Continued.

GREEN RIVER STATION, WYOMING.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|----------|-----------------|----------------------|-----------|-----------|----------|-----------------------------|----------------------|--------|--------|-------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1873. | | <i>t.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | " | ° ' " |
| June 25. | 6311 | 21.755 | 31.0 | 21.4 | | | | | | |
| | 6322 | 17.301 | 21.3 | 31.3 | | 41 34 26.00 | - 2 51.69 | -0.09 | ..... | 41 31 34.22 |
| June 27. | 4741 | 13.136 | 26.9 | 19.0 | | | | | | |
| | 4747 | 26.260 | 26.2 | 20.0 | | 23 09.23 | + 8 25.90 | +3.26 | ..... | 38.39 |
| | 4804 | 33.359 | 23.4 | 25.0 | | | | | | |
| | 4820 | 12.063 | 27.3 | 21.3 | | 45 17.18 | -13 40.92 | +1.02 | ..... | 37.28 |
| | 4863 | 20.703 | 23.9 | 25.4 | | | | | | |
| | 4881 | 19.352 | 27.3 | 22.1 | | 30 45.62 | + 0 52.08 | +0.86 | ..... | 38.56 |
| | 4917 | 11.382 | 27.0 | 23.3 | | | | | | |
| | 4961 | 27.653 | 19.8 | 31.6 | | 21 12.84 | +10 27.22 | -1.88 | ..... | 38.18 |
| | 5033 | 12.263 | 24.2 | 28.3 | | | | | | |
| | 5076 | 29.602 | 29.5 | 23.4 | | 20 30.38 | +11 08.38 | +0.46 | ..... | 39.22 |
| | 5131 | 30.058 | 22.0 | 31.4 | | | | | | |
| | 5181 | 10.158 | 30.4 | 24.0 | | 18 52.17 | +12 47.11 | -0.69 | ..... | 38.59 |
| | 5321 | 9.788 | 28.0 | 27.3 | (*) | | | | | |
| | 5341 | 29.641 | 36.2 | 19.1 | | 44 20.55 | -12 45.30 | +4.07 | ..... | 39.32 |
| | 5434 | 9.940 | 25.8 | 30.0 | | | | | | |
| | 5459 | 31.007 | 37.0 | 19.0 | | 45 07.22 | -13 32.10 | +3.20 | ..... | 38.32 |
| | 5473 | 15.461 | 26.3 | 29.8 | | | | | | |
| | 5503 | 22.063 | 38.7 | 17.8 | | 35 48.76 | - 4 14.50 | +3.93 | ..... | 38.19 |
| | 5541 | 16.523 | 28.0 | 29.0 | | | | | | |
| | 5549 | 26.609 | 35.9 | 21.1 | | 38 02.98 | - 6 28.79 | +3.20 | ..... | 37.39 |
| | 5596 | 29.107 | 24.0 | 33.0 | | | | | | |
| | 5619 | 10.424 | 40.2 | 17.0 | | 43 33.12 | -12 00.19 | +3.28 | ..... | 36.21 |
| | 5643 | 17.006 | 39.0 | 18.3 | | | | | | |
| | 5703 | 22.006 | 21.0 | 36.8 | | 28 22.76 | + 3 12.75 | +1.13 | ..... | 36.64 |
| | 5747 | 28.234 | 29.0 | 29.0 | | | | | | |
| | 5776 | 13.219 | 30.4 | 28.2 | | 21 59.29 | + 9 38.79 | +0.51 | ..... | 38.59 |
| | 5842 | 19.412 | 25.0 | 34.0 | | | | | | |
| | 5853 | 19.910 | 33.5 | 25.5 | | 31 57.88 | - 0 19.19 | -0.23 | ..... | 38.46 |
| | 5871 | 22.994 | 32.3 | 27.1 | | | | | | |
| | 5895 | 5.349 | 25.0 | 33.4 | | 42 56.61 | -11 20.18 | -0.51 | ..... | 35.92 |
| | 5937 | 23.739 | 25.2 | 34.8 | | | | | | |
| | 5962 | 14.154 | 34.7 | 25.4 | | 37 48.42 | - 6 09.49 | -0.02 | ..... | 38.91 |
| | 6082 | 24.688 | 26.3 | 34.1 | | | | | | |
| | 6109 | 11.600 | 31.0 | 29.7 | | 41 23 16.00 | + 8 24.52 | -1.50 | | 41 31 39.02 |

* The star observed seems to have been R. C.

LATITUDE DETERMINATIONS.

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Observations and computations—Continued.

GREEN RIVER STATION, WYOMING.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|-------------------|-----------------|----------------------|-----------|-----------|---------------------------------|-----------------------------|----------------------|--------|--------|-------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1873. June 27. | | <i>t.</i> | <i>d.</i> | <i>d.</i> | (*) (*) | ° ' " | ' " | " | " | ° ' " |
| | 6203 | 19.611 | 31.6 | 29.8 | | 41 30 04.94 | + 1 32.55 | -0.72 | +0.11 | 41 31 36.88 |
| | 6218 | 22.012 | 28.2 | 33.2 | | | | | | |
| | 6311 | 22.496 | 26.0 | 35.6 | | 34 25.71 | - 2 48.61 | +0.97 | ..... | 38.07 |
| | 6322 | 18.122 | 37.9 | 24.1 | | | | | | |
| | 6470 | 20.042 | 35.7 | 27.0 | | 31 57.18 | - 0 20.77 | +2.36 | ..... | 38.77 |
| | 6491 | 19.503 | 31.9 | 30.4 | | | | | | |
| | 6520 | 10.511 | 44.0 | 18.5 | | 19 39.14 | +11 55.80 | +3.33 | ..... | 38.27 |
| | 6556 | 29.080 | 25.7 | 36.8 | | | | | | |
| | 6650 | 27.544 | 32.1 | 31.0 | | 42 38.45 | -11 01.68 | +0.30 | ..... | 37.07 |
| | 6772 | 10.380 | 31.9 | 31.7 | | | | | | |
| June 29. | 4741 | 13.610 | 21.3 | 29.0 | (*) | 23 09.49 | + 8 28.10 | +0.66 | ..... | 38.25 |
| | 4747 | 26.791 | 30.3 | 20.0 | | | | | | |
| | 4804 | 32.807 | 30.9 | 21.8 | | 45 17.44 | -13 41.15 | +0.05 | ..... | 36.34 |
| | 4820 | 11.505 | 22.0 | 30.9 | | | | | | |
| | 4863 | 21.257 | 20.0 | 33.2 | | 30 45.90 | + 0 53.46 | -1.44 | ..... | 37.92 |
| | 4881 | 19.870 | 30.2 | 23.2 | | | | | | |
| | 4917 | 10.888 | 26.0 | 28.6 | | 21 13.16 | +10 27.26 | -2.96 | ..... | 37.46 |
| | 4961 | 27.160 | 22.6 | 32.8 | | | | | | |
| | 5033 | 11.957 | 25.8 | 29.8 | | 20 30.74 | +11 09.57 | +0.21 | ..... | 40.52 |
| | 5076 | 29.327 | 30.2 | 25.3 | | | | | | |
| | 5131 | 30.165 | 22.6 | 33.5 | Probably 10 d. error. (*) | 18 52.54 | +12 47.72 | -0.90 | ..... | 39.36 |
| | 5181 | 10.249 | 31.9 | 24.9 | | | | | | |
| | 5248 | 20.107 | 28.7 | 28.3 | | 30 26.16 | + 1 13.44 | -0.19 | ..... | 39.41 |
| | 5302 | 22.012 | 22.9 | 24.1 | | | | | | |
| | 5321 | 9.743 | 27.0 | 30.0 | | 44 20.97 | -12 41.21 | -0.53 | ..... | 39.23 |
| | 5341 | 29.490 | 25.4 | 31.6 | | | | | | |
| | 5434 | 7.771 | 26.1 | 30.9 | | 45 07.66 | -13 28.71 | -2.22 | ..... | 36.73 |
| | 5459 | 28.750 | 26.2 | 31.0 | | | | | | |
| | 5541 | 15.810 | 27.1 | 30.1 | | 38 03.46 | - 6 23.17 | -1.71 | ..... | 38.58 |
| | 5549 | 25.750 | 26.6 | 31.0 | | | | | | |
| | 5596 | 27.975 | 30.0 | 28.0 | | 40 33.60 | -11 55.69 | -1.81 | ..... | 36.10 |
| | 5619 | 9.409 | 24.4 | 34.2 | | | | | | |
| | 5643 | 16.476 | 26.7 | 32.3 | | 28 23.24 | + 3 16.06 | -1.30 | ..... | 38.00 |
| | 5703 | 21.562 | 29.9 | 29.9 | | | | | | |
| | 5747 | 27.246 | 23.1 | 36.6 | | 21 59.81 | + 9 40.49 | -1.81 | ..... | 38.49 |
| | 5776 | 12.187 | 32.9 | 27.2 | | | | | | |
| | 5842 | 19.062 | 26.8 | 33.5 | | 41 31 58.42 | - 0 20.81 | +0.21 | ..... | 41 31 37.82 |
| | 5853 | 19.602 | 34.0 | 26.4 | | | | | | |

* Observed off line of collimation.

Observations and computations—Continued.

GREEN RIVER STATION, WYOMING.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|-------------------|--------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|--------|--------|-------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1873. June 29. | | <i>t.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | " | ° ' " |
| | 5871 | 23.297 | 33.3 | 27.1 | (*) | 41 42 57.17 | -11 21.68 | -1.62 | +0.33 | 41 31 34.20 |
| | 5895 | 5.613 | 23.8 | 37.0 | | | | | | |
| | 5937 | 23.595 | 31.5 | 29.6 | | 37 48.98 | - 6 11.95 | -0.79 | ..... | 36.24 |
| | 5962 | 13.946 | 28.0 | 33.3 | | | | | | |
| | 6082 | 25.540 | 29.1 | 33.3 | | 23 16.58 | + 8 23.56 | -1.32 | ..... | 38.82 |
| | 6109 | 12.477 | 30.6 | 32.1 | | | | | | |
| | 6203 | 19.998 | 35.0 | 28.5 | | 30 05.54 | + 1 32.28 | -1.04 | ..... | 36.78 |
| | 6218 | 21.392 | 26.3 | 37.3 | | | | | | |
| | 6311 | 21.253 | 32.8 | 31.0 | | 34 26.29 | - 2 48.57 | -0.56 | ..... | 37.16 |
| | 6322 | 16.880 | 29.9 | 34.1 | | | | | | |

* Observed off line of collimation.

Discussion of latitude of Green River.

| No. of pair. | No. of observations. | Mean of latitudes. | Corrections to micrometer corrections. | Corrected latitude. | |
|--------------|----------------------|--------------------|--|---------------------|---|
| | | ° ' " | " | " | |
| 1 | 2 | 41 31 38.32 | -0.60 | 37.72 | Mean latitude.....41° 31' 38".12 |
| 2 | 4 | 37.20 | +0.98 | 38.18 | Sum of errors..... 12".03 |
| 3 | 4 | 38.53 | -0.06 | 38.47 | Probable error of one pair .....±0".452 |
| 4 | 5 | 38.61 | -0.76 | 37.85 | Sum of squares 18".48 |
| 5 | 6 | 38.78 | -0.80 | 37.98 | Probable error of one pair .....±0".464 |
| 6 | 7 | 39.76 | -0.92 | 38.84 | Probable error of final result from |
| 7 | 7 | 37.85 | -0.09 | 37.76 | sum of errors .....±0".084 |
| 8 | 8 | 38.48 | +0.91 | 39.39 | Probable error of final result from |
| 9 | 7 | 38.18 | +0.97 | 39.15 | sum of squares .....±0".097 |
| 10 | 8 | 38.07 | +0.30 | 38.37 | The pairs observed a greater number of |
| 11 | 7 | 38.03 | +0.46 | 38.49 | times do not seem more accurate. |
| 12 | 8 | 36.85 | +0.86 | 37.71 | A correction indicated by the observa- |
| 13 | 8 | 37.61 | -0.23 | 37.38 | tions of -0".072 for every minute in |
| 14 | 10 | 39.11 | -0.70 | 38.41 | the micrometer-corrections, or -0".0925 |
| 15 | 10 | 37.68 | +0.02 | 37.70 | for every revolution, has been applied |
| 16 | 7 | 35.44 | +0.81 | 36.25 | in the final result. |
| 17 | 12 | 37.92 | +0.45 | 38.37 | |
| 18 | 10 | 39.76 | -0.60 | 39.16 | |
| 19 | 9 | 37.83 | -0.12 | 37.71 | |
| 20 | 10 | 37.14 | +0.20 | 37.34 | |
| 21 | 8 | 38.57 | +0.02 | 38.53 | |
| 22 | 8 | 38.84 | -0.86 | 37.98 | |
| 23 | 8 | 37.28 | +0.79 | 38.07 | |

ASTRONOMICAL CO-ORDINATES OF GREEN RIVER, WYOMING.

Longitude..... 7^h 17^m 52^s.438 ±0^s.027 or 109° 28' 06".57 ± 0".40 west from Greenwich.
 2^h 09^m 40^s.312 ±0^s.027 or 32° 25' 04".77 west from U. S. Naval Observatory, Washington, D. C.

Latitude 41° 31' 38".12 ± 0".10 north.

U. S. GEOGRAPHICAL SURVEYS WEST OF THE ONE HUNDREDTH MERIDIAN,
1ST LIEUT. GEO. M. WHEELER, CORPS OF ENGINEERS, U. S. ARMY, IN CHARGE.

RESULTS
OF
OBSERVATIONS MADE BY W. W. MARYATT AND JOHN H. CLARK IN THE
DETERMINATION OF THE ASTRONOMICAL CO-ORDINATES
OF STATION AT WINNEMUCCA, NEVADA.
SEASON OF 1873.

COMPUTATIONS BY
PROF. T. H. SAFFORD AND JOHN H. CLARK.

WINNEMUCCA, NEVADA.

GEOGRAPHICAL POSITION OF STATION.

Longitude, $117^{\circ} 43' 54''.16 \pm 0''.22$ west from Greenwich.
" $40^{\circ} 40' 52''.36$ west from U. S. Naval Observatory, Washington, D. C.
Latitude, $40^{\circ} 58' 19''.97 \pm 0''.17$ north.
Barometric altitude of observatory above sea-level, 4355.0 feet.

Winnemucca, a station of the Union Pacific Railroad, is a flourishing settlement on Humboldt River, Nevada, situated in a sandy valley, which is surrounded in the distance by high hills. The astronomical monument was located in the northeastern part of the town, in an open lot, on a small elevation, which lifted it into full view of the river and the railroad. It was connected by triangulation with seventeen prominent points of the neighboring mountains, and also by direct measurement with numerous objects in the town. Its position is 527 feet due west of the railroad-track, 1,538 feet from the depot, 507 feet from the mill, and 687 feet from the school-house.

The meteorological conditions at this place were very favorable for astronomical observations. With few exceptions, the weather continued clear. During the fourteen days of time-exchanges, there were but four cloudy nights at Winnemucca and one at Salt Lake City, while on four other nights the wires failed, leaving for the exchange of signals five days, July 11, 16, 18, 24, 25, and 26. The wind was moderate, and its general direction was northeast and southwest.

For a description of the observatory, instruments, and instrumentalities, see the report on the preceding station, Green River. The length of telegraphic circuit, by way of Ogden, at which point there was a repeater, was about 450 miles.

Observations for latitude at Winnemucca were made July 15, 16, 18, 19, 21, 23, 24, 25, 26, 27, 28, 29, and 30. W. W. Maryatt was observer here, and John H. Clark at Salt Lake City. All of Mr. Maryatt's observations were reduced by Prof. T. H. Safford; those of Mr. Clark were computed by himself.

Tabulation of stars used for determination of time at Winnemucca, Nevada, and Salt Lake City, Utah.

| Name of star. | | WINNEMUCCA. | | | | | | SALT LAKE CITY. | | | | | |
|---------------|--------------------|-------------|----------|----------|----------|----------|----------|-----------------|----------|----------|----------|----------|----------|
| | | July 11. | July 16. | July 18. | July 24. | July 25. | July 26. | July 11. | July 16. | July 18. | July 24. | July 25. | July 26. |
| α^2 | Libræ..... | | | x | | | | | | | | | |
| β | Ursæ Minoris..... | | x | x | | | | | | | | | |
| β | Bootis..... | | x | | | | | | | | | | |
| β | Libræ..... | | x | x | | x | | | | | | | |
| μ | Bootis..... | | x | | | | | | | | | | |
| γ | Ursæ Minoris..... | | | x | x | x | x | | x | x | | | |
| a | Coronæ..... | | x | x | x | x | x | | x | x | | | |
| τ^B | Serpentis..... | | | | | | | | x | x | | | |
| a | Serpentis..... | | x | x | x | x | x | | x | x | | | |
| ϵ | Serpentis..... | | x | x | x | x | x | | x | x | | | |
| ζ | Ursæ Minoris..... | | x | x | x | x | x | | | | | | |
| ϵ | Coronæ..... | | | | | | | | | | x | | x |
| δ | Scorpii..... | | | | | | | | x | x | | | |
| θ^1 | Scorpii..... | | x | x | | x | x | | x | x | x | | x |
| | Groombr. 2320..... | | x | | x | x | x | | | | | | |
| δ | Ophiuchi..... | | | | | | | | x | x | x | x | x |
| j | Ophiuchi..... | | | | x | | | | | | | | |
| τ | Herculis..... | | | | x | x | x | | x | x | x | x | x |
| ω | Herculis..... | | | | x | | | | | | | | |
| a | Scorpii..... | | | | x | | x | | | | | | |
| η | Draconis..... | | | | | | | | x | x | x | x | x |
| ζ | Ophiuchi..... | | | | x | x | x | | x | x | x | x | x |
| η | Herculis..... | | | | | x | x | | | | x | x | x |
| | Groombr. 2376..... | | | | | | | | | | x | x | x |
| κ | Ophiuchi..... | x | | | | | | | | | x | x | x |
| d | Herculis..... | x | | | | | | | | | x | x | x |
| a^1 | Herculis..... | | | | | | | x | | | | x | |
| v | Serpentis..... | | | | | | | x | | | | x | |
| π | Herculis..... | | | | x | | | | | | | | |
| 44 | Ophiuchi..... | x | x | | x | | | | | | | | |
| β | Draconis..... | x | x | | x | x | | | | | | | |
| a | Ophiuchi..... | | | | | | | x | | | | | |
| ω | Draconis..... | x | x | x | x | x | | | | | x | | |
| μ | Herculis..... | | x | x | x | | | x | | | x | x | |
| θ | Herculis..... | | x | x | | x | | | | | | | |
| ψ_1 | Draconis..... | | | | | x | | | | | | | |
| γ | Draconis..... | x | | x | x | | x | x | x | x | x | x | |
| γ | Herculis..... | x | x | x | x | x | x | | | | | | |
| 72 | Ophiuchi..... | | | | | | | x | x | x | x | x | x |
| μ^1 | Sagittarii..... | | x | | x | | x | | x | x | x | x | x |
| δ | Ursæ Minoris..... | | | x | | x | | | | | | | |
| η | Serpentis..... | x | | | x | | | x | x | x | x | x | x |
| 109 | Herculis..... | | x | x | x | | x | | | | | | |
| | Brad. 2313..... | | | | | | | | | | | | |
| 1 | Aquilæ..... | x | x | x | | | x | x | x | x | x | x | x |
| a | Lyræ..... | x | x | x | | x | x | x | x | x | x | x | x |
| ζ^1 | Lyræ..... | | | | | | | | | | x | x | x |
| ζ^2 | Lyræ..... | | | | | | | | | x | x | x | x |
| β | Lyræ..... | x | x | x | | x | x | x | x | x | | | x |
| 50 | Draconis..... | x | x | x | | x | x | | x | x | | | x |
| ζ | Aquilæ..... | | | | | | | | | x | | | |
| δ | Draconis..... | x | | | | | | | | | | | |
| β | Cygni..... | x | | | | | | | | | | | |

Observations and reductions for time taken at receiving station.

SALT LAKE CITY, UTAH, JULY 11, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|---|---------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | α^1 Herculis | 9 01 45.33 | — 0.93 | + 0.04 | — 0.08 | 9 01 44.36 | 17 08 53.39 | +8 07 09.03 |
| W. | ν Serpentis | 06 35.85 | — 1.66 | + 0.02 | — 0.08 | 06 34.13 | 13 43.22 | 09.09 |
| W. | α Ophiuchi | 21 56.35 | — 0.91 | + 0.01 | — 0.08 | 21 55.37 | 29 04.39 | 09.02 |
| W. | μ Herculis | 34 22.88 | — 0.51 | — 0.03 | — 0.09 | 34 22.25 | 41 31.39 | 09.14 |
| W. | γ Draconis | 46 32.39 | + 0.61 | + 0.05 | — 0.13 | 46 32.92 | 53 42.02 | 09.10 |
| W. | γ^2 Ophiuchi | 54 13.82 | — 1.08 | + 0.07 | — 0.08 | 54 12.73 | 18 01 21.80 | 09.07 |
| E. | η Serpentis | 10 07 38.60 | — 1.40 | + 0.03 | + 0.08 | 10 07 37.31 | 14 46.41 | 09.10 |
| E. | ι Aquilæ | 21 12.27 | — 1.54 | + 0.03 | + 0.08 | 21 10.84 | 28 19.95 | 09.11 |
| E. | α Lyræ | 25 31.30 | — 0.10 | + 0.10 | + 0.10 | 25 31.40 | 32 40.54 | 09.14 |
| E. | β Lyræ | 38 16.77 | — 0.32 | + 0.13 | + 0.10 | 38 16.68 | 45 25.62 | +8 07 08.94 |
| Mean at 18 ^h local sidereal time | | | | | | | | +8 07 09.07 |

NORMAL EQUATIONS.

$$\begin{aligned}
 +10.00 \delta t + 3.87 a - 2.34 c &= -7.28 & \delta t &= +0^s.07 \\
 +3.87 \delta t + 2.60 a - 0.39 c &= -5.01 & a &= -2^s.026 \\
 -2.34 \delta t - 0.39 a + 13.19 c &= +1.65 & c &= +0^s.079
 \end{aligned}$$

SALT LAKE CITY, UTAH, JULY 16, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|---|----------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | γ Ursæ Minoris | 7 13 49.55 | + 3.06 | — 0.03 | + 0.39 | 7 13 52.97 | 15 20 59.52 | +8 07 06.55 |
| E. | α Coronæ | 22 13.96 | — 0.48 | + 0.02 | + 6.13 | 22 13.63 | 29 20.30 | 06.67 |
| E. | τ^6 Serpentis | 28 04.44 | — 0.77 | + 0.03 | + 0.12 | 28 03.82 | 35 10.46 | 06.64 |
| E. | α Serpentis | 30 56.64 | — 1.00 | + 0.02 | + 0.12 | 30 55.78 | 38 02.41 | 06.63 |
| E. | ϵ Serpentis | 37 25.17 | — 1.05 | + 0.02 | + 0.12 | 37 24.26 | 44 30.86 | 06.60 |
| W. | δ Scorpii | 45 46.62 | — 1.71 | + 0.03 | — 0.13 | 45 44.81 | 52 51.41 | 06.60 |
| W. | β^1 Scorpii | 51 00.20 | — 1.64 | + 0.03 | — 0.13 | 50 58.46 | 58 05.08 | 06.62 |
| W. | δ Ophiuchi | 8 00 37.96 | — 1.25 | + 0.04 | — 0.12 | 8 00 36.63 | 16 07 43.25 | 06.62 |
| W. | τ Herculis | 08 50.59 | + 0.27 | + 0.10 | — 0.17 | 08 50.79 | 15 57.31 | 06.52 |
| W. | η Draconis | 15 11.12 | + 1.35 | + 0.16 | — 0.25 | 15 12.38 | 22 19.03 | 06.65 |
| W. | ζ Ophiuchi | 23 06.78 | — 1.41 | + 0.06 | — 0.12 | 23 05.31 | 30 11.95 | +8 07 06.64 |
| Mean at 16 ^h local sidereal time | | | | | | | | +8 07 06.63 |

NORMAL EQUATIONS.

$$\begin{aligned}
 +11.00 \delta t + 2.59 a - 0.28 c &= -8.97 & \delta t &= -0^s.37 \\
 +2.59 \delta t + 7.34 a - 5.44 c &= -14.63 & a &= -1^s.780 \\
 -0.28 \delta t - 5.44 a + 26.11 c &= +12.85 & c &= +0^s.118
 \end{aligned}$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, JULY 16, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|---|---------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | γ Draconis | 9 46 35.05 | + 0.50 | — 0.05 | — 0.20 | 9 46 35.30 | 17 53 41.97 | +8 07 06.67 |
| W. | 72 Ophiuchi..... | 54 16.44 | — 0.89 | — 0.03 | — 0.12 | 54 15.40 | 18 01 21.80 | 06.40 |
| W. | ω ¹ Sagittarii | 59 07.70 | — 1.60 | — 0.02 | — 0.13 | 59 05.95 | 06 12.51 | 06.56 |
| W. | η Serpentis..... | 10 07 41.17 | — 1.16 | — 0.01 | — 0.12 | 10 07 39.88 | 14 46.43 | 06.55 |
| E. | 1 Aquilæ..... | 21 14.70 | — 1.28 | — 0.01 | + 0.12 | 21 13.53 | 28 19.98 | 06.45 |
| E. | α Lyræ | 25 33.74 | — 0.08 | — 0.01 | + 0.15 | 25 33.80 | 32 40.53 | 06.73 |
| E. | β Lyræ | 38 18.99 | — 0.27 | + 0.03 | + 0.14 | 38 18.89 | 45 25.64 | 06.75 |
| E. | 50 Draconis..... | 43 20.78 | + 3.75 | + 0.25 | + 0.48 | 43 25.26 | 50 31.76 | +8 07 06.50 |
| Mean at 18 ^h local sidereal time | | | | | | | | +8 07 06.58 |

NORMAL EQUATIONS.

$$\begin{aligned}
 + 8.00 \delta t + 0.61 a + 2.73 c &= - 4.10 & \delta t &= - 0^s.42 \\
 + 0.61 \delta t + 7.33 a - 9.55 c &= - 13.78 & a &= - 1^s.690 \\
 + 2.73 \delta t + 9.55 a + 25.39 c &= + 18.00 & c &= + 0^s.116
 \end{aligned}$$

SALT LAKE CITY, UTAH, JULY 18, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|-------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | γ Ursæ Minoris..... | 7 13 50.18 | + 3.18 | — 0.03 | + 0.36 | 7 13 53.69 | 15 20 59.34 | +8 07 05.65 |
| E. | α Coronæ | 22 14.81 | — 0.50 | — 0.01 | + 0.12 | 22 14.42 | 29 20.27 | 05.85 |
| E. | τ ⁶ Serpentis..... | 28 05.39 | — 0.80 | — 0.00 | + 0.11 | 28 04.70 | 35 10.44 | 05.74 |
| E. | α Serpentis..... | 30 57.57 | — 1.04 | + 0.01 | + 0.11 | 30 56.65 | 38 02.39 | 05.74 |
| E. | ε Serpentis..... | 37 26.07 | — 1.09 | + 0.01 | + 0.11 | 37 25.10 | 44 30.84 | 05.74 |
| W. | δ Scorpii..... | 45 47.62 | — 1.78 | + 0.01 | — 0.12 | 45 45.73 | 52 51.40 | 05.67 |
| W. | β ¹ Scorpii..... | 51 01.18 | — 1.70 | + 0.02 | — 0.12 | 50 59.38 | 58 05.07 | 05.69 |
| W. | δ Ophiuchi..... | 8 00 38.96 | — 1.30 | + 0.01 | — 0.11 | 8 00 37.56 | 16 07 43.24 | 05.68 |
| W. | τ Herculis | 08 51.65 | + 0.28 | + 0.03 | — 0.16 | 08 51.80 | 15 57.28 | 05.48 |
| W. | η Draconis | 15 11.87 | + 0.41 | + 0.04 | — 0.23 | 15 12.09 | 22 18.97 | 05.88 |
| W. | ζ Ophiuchi | 23 07.71 | — 1.46 | + 0.01 | — 0.11 | 23 06.15 | 30 11.94 | +8 07 05.79 |
| Mean at 16 ^h .0 local sidereal time | | | | | | | | +8 07 05.72 |

NORMAL EQUATIONS.

$$\begin{aligned}
 + 11.00 \delta t + 2.59 a - 0.28 c &= - 7.93 & \delta t &= - 0^s.28 \\
 + 2.59 \delta t + 7.35 a - 5.45 c &= - 14.91 & a &= - 1^s.850 \\
 - 0.28 \delta t - 5.45 a + 26.11 c &= + 13.02 & c &= + 0^s.109
 \end{aligned}$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, JULY 18, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|---------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | γ Draconis | 9 46 35.72 | + 0.56 | + 0.08 | — 0.22 | 9 46 36.14 | 17 53 41.95 | + 8 07 05.81 |
| W. | 72 Ophiuchi | 54 17.18 | — 0.99 | + 0.04 | — 0.14 | 54 16.09 | 18 01 21.81 | 05.72 |
| W. | μ ¹ Sagittarii | 59 08.80 | — 1.79 | + 0.02 | — 0.15 | 59 06.88 | 06 12.52 | 05.64 |
| W. | η Serpentis | 10 07 42.16 | — 1.28 | + 0.02 | — 0.14 | 10 07 40.76 | 14 46.44 | 05.68 |
| W. | Brad. 2313 | 14 55.88 | — 1.58 | + 0.01 | — 0.14 | 14 54.17 | 21 59.87 | 05.70 |
| E. | 1 Aquilæ | 21 15.52 | — 1.41 | — 0.01 | + 0.14 | 21 14.24 | 28 19.99 | 05.75 |
| E. | α Lyræ | 25 34.76 | — 0.09 | — 0.06 | + 0.18 | 25 34.79 | 32 40.53 | 05.74 |
| E. | ζ ₁ Lyræ | 33 20.26 | — 0.13 | — 0.06 | + 0.18 | 33 20.25 | 40 26.13 | 05.88 |
| E. | ζ ₂ Lyræ | 33 22.20 | — 0.13 | — 0.06 | + 0.18 | 33 22.19 | 40 27.98 | 05.79 |
| E. | β Lyræ | 38 20.00 | — 0.30 | — 0.07 | + 0.17 | 38 19.80 | 45 25.64 | 05.84 |
| E. | 50 Draconis | 43 21.56 | + 4.15 | — 0.22 | + 0.54 | 43 26.03 | 50 31.69 | 05.66 |
| E. | ζ Aquilæ | 52 31.52 | — 0.87 | — 0.06 | + 0.14 | 52 30.73 | 59 36.47 | + 8 07 05.74 |
| Mean at 18 ^h .5 local sidereal time | | | | | | | | + 8 07 05.75 |

NORMAL EQUATIONS.

$$\begin{aligned}
 + 12.00 \delta t + 2.07 a + 5.25 c &= - 6.17 & \delta t &= - 0^{\text{m}}.25 \\
 + 2.07 \delta t + 8.27 a - 9.80 c &= - 17.29 & a &= - 1^{\text{m}}.864 \\
 + 5.25 \delta t - 9.80 a + 30.69 c &= + 21.22 & c &= + 0^{\text{m}}.138
 \end{aligned}$$

SALT LAKE CITY, UTAH, JULY 24, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | ε Coronæ | 7 45 15.92 | — 0.49 | — 0.07 | — 0.11 | 7 45 15.25 | 15 52 21.51 | + 8 07 06.26 |
| W. | β ¹ Scorpii | 51 00.80 | — 1.74 | — 0.03 | — 0.11 | 50 58.92 | 58 05.02 | 06.10 |
| W. | δ Ophiuchi | 8 00 38.44 | — 1.32 | — 0.02 | — 0.10 | 8 00 37.00 | 16 07 43.19 | 06.19 |
| W. | τ Herculis | 08 50.91 | + 0.28 | — 0.03 | — 0.15 | 08 51.01 | 15 57.16 | 06.15 |
| W. | η Draconis | 15 11.37 | + 1.44 | — 0.05 | — 0.21 | 15 12.55 | 22 18.77 | 06.22 |
| E. | ζ Ophiuchi | 23 07.00 | + 1.49 | + 0.01 | + 0.10 | 23 05.62 | 30 11.89 | 06.27 |
| E. | η Herculis | 31 28.01 | — 0.08 | + 0.02 | + 0.13 | 31 28.08 | 38 34.42 | 06.34 |
| E. | Groombr. 2376 | 36 11.55 | + 0.08 | + 0.04 | + 0.14 | 36 11.81 | 43 17.88 | 06.07 |
| E. | κ Ophiuchi | 44 35.90 | — 1.00 | + 0.04 | + 0.10 | 44 35.04 | 51 41.25 | 06.21 |
| E. | δ Herculis | 49 50.80 | — 0.28 | + 0.04 | + 0.12 | 49 50.68 | 56 56.81 | + 8 07 06.13 |
| Mean at 16 ^h .5 local sidereal time | | | | | | | | + 8 07 06.19 |

NORMAL EQUATIONS.

$$\begin{aligned}
 + 10.00 \delta t + 2.44 a - 0.89 c &= - 2.75 & \delta t &= + 0^{\text{m}}.19 \\
 + 2.44 \delta t + 2.92 a + 1.39 c &= - 4.94 & a &= - 1^{\text{m}}.890 \\
 - 0.89 \delta t + 1.39 a + 17.02 c &= - 1.00 & c &= + 0^{\text{m}}.104
 \end{aligned}$$

11 AST

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, JULY 24, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|---|---------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | ω Draconis | 9 30 35.55 | + 2.40 | + 0.17 | + 0.43 | 9 30 38.55 | 17 37 44.79 | +8 07 06.24 |
| E. | μ Herculis | 34 25.34 | — 0.46 | + 0.08 | + 0.18 | 34 25.14 | 41 31.33 | 06.19 |
| E. | γ Draconis | 46 34.71 | + 0.55 | + 0.08 | + 0.25 | 46 35.59 | 53 41.87 | 06.28 |
| E. | 72 Ophiuchi | 54 16.34 | — 0.98 | + 0.02 | + 0.16 | 54 15.54 | 18 01 21.83 | 06.29 |
| W. | μ ¹ Sagittarii | 59 08.15 | — 1.76 | + 0.04 | — 0.17 | 59 06.26 | 06 12.52 | 06.26 |
| W. | η Serpentes | 10 07 41.59 | — 1.28 | + 0.05 | — 0.16 | 10 07 40.20 | 14 46.44 | 06.24 |
| W. | Brad. 2313 | 14 55.38 | — 1.57 | + 0.04 | — 0.16 | 14 53.69 | 21 59.89 | 06.20 |
| W. | 1 Aquilæ | 21 15.23 | — 1.41 | + 0.03 | — 0.16 | 21 13.69 | 28 19.99 | 06.30 |
| W. | α Lyræ | 25 34.38 | — 0.09 | + 0.06 | — 0.20 | 25 34.15 | 32 40.45 | 06.30 |
| W. | ζ ¹ Lyræ | 33 20.18 | — 0.13 | + 0.06 | — 0.20 | 33 19.91 | 40 26.11 | 06.20 |
| W. | ζ ² Lyræ | 33 21.94 | — 0.13 | + 0.06 | — 0.20 | 10 33 21.67 | 18 40 27.96 | +8 07 06.29 |
| Mean at 18 ^h local sidereal time | | | | | | | | +8 07 06.25 |

NORMAL EQUATIONS.

$$\begin{aligned}
 -11.00 \delta t + 2.60 a + 1.40 c &= -2.30 & \delta t &= +0^s.25 \\
 +2.60 \delta t + 4.81 a - 6.84 c &= -9.31 & a &= -1^s.850 \\
 -1.40 \delta t - 6.84 a + 21.61 c &= +15.66 & c &= +0^s.155
 \end{aligned}$$

SALT LAKE CITY, UTAH, JULY 25, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|-------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | δ Ophiuchi | 8 00 38.37 | — 1.30 | — 0.03 | — 0.12 | 8 00 36.92 | 16 07 43.18 | +8 07 06.26 |
| W. | τ Herculis | 08 51.00 | + 0.28 | — 0.07 | — 0.18 | 08 51.03 | 15 57.13 | 06.10 |
| W. | η Draconis | 15 11.39 | + 1.41 | — 0.13 | — 0.25 | 15 12.42 | 22 18.74 | 06.32 |
| W. | ζ Ophiuchi | 23 07.27 | — 1.46 | — 0.05 | — 0.12 | 23 05.64 | 30 11.88 | 06.24 |
| E. | η Herculis | 31 28.04 | — 0.07 | + 0.01 | + 0.15 | 31 28.13 | 38 34.40 | 06.27 |
| E. | Groombr. 2376 | 36 11.28 | + 0.07 | + 0.01 | + 0.16 | 36 11.52 | 43 17.87 | 06.35 |
| E. | κ Ophiuchi | 44 35.80 | — 0.98 | + 0.01 | + 0.12 | 44 34.95 | 51 41.24 | 06.29 |
| E. | δ Herculis | 49 50.92 | — 0.98 | + 0.01 | + 0.14 | 49 50.79 | 56 56.80 | 06.01 |
| E. | α ¹ Herculis | 9 01 47.80 | — 0.85 | 0.00 | + 0.12 | 9 01 47.07 | 17 08 53.32 | 06.25 |
| E. | ν Serpentes | 10 06 38.38 | — 1.52 | 0.00 | + 0.12 | 06 36.98 | 13 43.19 | +8 07 06.21 |
| Mean at 16 ^h .5 local sidereal time | | | | | | | | +8 07 06.23 |

NORMAL EQUATIONS.

$$\begin{aligned}
 +10.00 \delta t + 2.54 a + 1.32 c &= -2.26 & \delta t &= +0^s.23 \\
 +2.54 \delta t + 2.89 a + 2.36 c &= -4.55 & a &= -1^s.855 \\
 +1.32 \delta t + 2.36 a + 16.74 c &= -2.12 & c &= +0^s.117
 \end{aligned}$$

TIME DETERMINATIONS.

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Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, JULY 25, 1873.

| Clamp. | Name-of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|--|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | μ Herculis | 9 34 25.36 | — 0.45 | — 0.01 | + 0.18 | 9 34 25.08 | 17 41 31.32 | +8 07 06.24 |
| E. | γ Draconis | 46 34.94 | + 0.54 | — 0.01 | + 0.26 | 46 35.73 | 53 41.85 | 06.12 |
| E. | 72 Ophiuchi | 54 16.32 | — 0.95 | + 0.01 | + 0.16 | 54 15.54 | 18 01 21.83 | 06.29 |
| E. | μ^1 Sagittarii | 59 07.87 | — 1.70 | + 0.01 | + 0.17 | 59 06.35 | 06 12.51 | 06.16 |
| W. | η Serpentis | 10 07 41.73 | — 1.24 | + 0.03 | — 0.16 | 10 07 40.36 | 14 46.43 | 06.07 |
| W. | Bradl. 2313 | 14 55.34 | — 1.52 | + 0.04 | — 0.17 | 14 53.69 | 21 59.89 | 06.20 |
| W. | 1 Aquilæ | 21 15.33 | — 1.36 | + 0.05 | — 0.16 | 21 13.86 | 28 20.00 | 06.14 |
| W. | α Lyræ | 25 34.40 | — 0.09 | + 0.07 | — 0.21 | 25 34.17 | 32 40.50 | 06.33 |
| W. | ζ^1 Lyræ | 33 20.18 | — 0.12 | + 0.06 | — 0.21 | 33 19.91 | 40 26.10 | 06.19 |
| W. | ζ^2 Lyræ | 10 33 22.06 | — 0.12 | + 0.06 | — 0.21 | 10 33 21.79 | 18 40 27.96 | +8 07 06.17 |
| | Mean at 18 ^h .0 local sidereal time | | | | | | | +8 07 06.19 |

NORMAL EQUATIONS.

$$\begin{aligned}
 +10.00 \delta t + 3.92 a - 2.03 c &= -5.45 & \delta t &= +0^s.19 \\
 +3.92 \delta t + 3.12 a - 1.21 c &= -5.10 & a &= -1^s.790 \\
 -2.03 \delta t - 1.21 a + 13.94 c &= +4.07 & c &= +0^s.163
 \end{aligned}$$

SALT LAKE CITY, UTAH, JULY 26, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|--|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | ϵ Coronæ | 7 45 16.02 | — 0.46 | — 0.05 | — 0.19 | 7 45 15.32 | 15 52 21.48 | +8 07 06.16 |
| W. | β^1 Scorpii | 51 00.74 | — 1.62 | — 0.03 | — 0.18 | 51 58.91 | 58 05.00 | 06.09 |
| W. | δ Ophiuchi | 8 00 38.64 | — 1.23 | — 0.07 | — 0.17 | 8 06 37.17 | 16 07 43.17 | 06.00 |
| W. | τ Herculis | 08 51.29 | + 0.26 | — 0.17 | — 0.25 | 08 51.13 | 15 57.11 | 05.98 |
| E. | η Draconis | 15 11.09 | + 1.34 | — 0.22 | + 0.36 | 15 12.57 | 22 18.69 | 06.12 |
| E. | ζ Ophiuchi | 23 07.10 | — 1.39 | — 0.08 | + 0.18 | 23 05.81 | 30 11.87 | 06.06 |
| E. | η Herculis | 31 28.31 | — 0.07 | — 0.14 | + 0.22 | 31 28.32 | 38 34.40 | 06.08 |
| E. | Groombr. 2376 | 36 11.67 | + 0.07 | — 0.13 | + 0.23 | 36 11.84 | 43 17.86 | 06.02 |
| E. | κ Ophiuchi | 44 36.03 | — 0.93 | — 0.09 | + 0.17 | 44 35.18 | 51 41.25 | 06.07 |
| E. | δ Herculis | 8 49 51.12 | — 0.26 | — 0.12 | + 0.20 | 8 49 50.94 | 16 56 56.78 | +8 07 05.84 |
| | Mean at 15 ^h .5 local sidereal time | | | | | | | +8 07 06.04 |

NORMAL EQUATIONS.

$$\begin{aligned}
 +10.00 \delta t + 2.44 a + 3.35 c &= -3.30 & \delta t &= +0^s.04 \\
 +2.44 \delta t + 2.92 a - 1.81 c &= -5.37 & a &= -1^s.760 \\
 +3.35 \delta t - 1.81 a + 17.01 c &= +6.24 & c &= +0^s.172
 \end{aligned}$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, JULY 26, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|---|-------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | 72 Ophiuchi..... | 9 54 16.55 | — 0.84 | — 0.10 | + 0.08 | 9 54 15.69 | 18 01 21.84 | +8 07 06.15 |
| E. | μ^1 Sagittarii..... | 59 08.02 | — 1.51 | — 0.05 | + 0.08 | 59 06.54 | 06 12.51 | 05.97 |
| E. | η Serpentis..... | 10 07 41.46 | — 1.10 | — 0.04 | + 0.08 | 10 07 40.40 | 14 46.43 | 06.03 |
| E. | Brad. 2313..... | 14 55.19 | — 1.35 | — 0.02 | + 0.08 | 14 53.90 | 21 59.89 | 05.99 |
| E. | 1 Aquilæ..... | 21 15.17 | — 1.21 | — 0.02 | + 0.08 | 21 14.02 | 28 20.00 | 05.98 |
| W. | α Lyræ..... | 25 34.44 | — 0.08 | + 0.03 | — 0.10 | 25 34.29 | 32 40.50 | 06.21 |
| W. | ζ^1 Lyræ..... | 33 20.24 | — 0.11 | + 0.04 | — 0.10 | 33 20.07 | 40 26.10 | 06.03 |
| W. | ζ^2 Lyræ..... | 33 22.15 | — 0.11 | + 0.06 | — 0.10 | 33 22.00 | 40 27.95 | 05.95 |
| W. | β Lyræ..... | 38 19.89 | — 0.25 | + 0.07 | — 0.09 | 38 19.62 | 45 25.62 | 06.00 |
| W. | 50 Draconis..... | 43 21.91 | + 3.55 | + 0.24 | — 0.30 | 10 43 25.40 | 18 50 31.40 | +8 07 06.00 |
| Mean at 18 ^h .5 local sidereal time..... | | | | | | | | +8 07 06.03 |

NORMAL EQUATIONS.

$$\begin{aligned}
 +10.00 \delta + 1.50 a - 3.81 c &= -2.99 & \delta t &= +0^s.03 \\
 -1.90 \delta t + 7.96 a + 12.27 c &= -11.68 & a &= -1^s.590 \\
 -3.81 \delta t + 12.27 a + 27.02 c &= -17.55 & c &= +0^s.077
 \end{aligned}$$

Observations and reductions for time taken at sending station.

WINNEMUCCA, NEVADA, JULY 11, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>s.</i> |
| W. | κ Ophiuchi..... | 16 51 56.98 | + 0.51 | — 0.13 | + 0.03 | 16 51 57.39 | 16 51 41.31 | — 16.08 |
| W. | δ Herculis..... | 57 13.06 | + 0.14 | — 0.20 | + 0.03 | 57 13.03 | 56 56.94 | 16.09 |
| W. | 44 Ophiuchi..... | 17 18 54.48 | + 0.95 | — 0.12 | + 0.03 | 17 18 55.34 | 17 18 39.21 | 16.13 |
| W. | β Draconis..... | 27 52.74 | + 0.31 | — 0.44 | + 0.04 | 27 52.03 | 27 36.24 | 15.79 |
| W. | ω Draconis..... | 38 02.64 | — 1.24 | — 0.74 | + 0.07 | 38 00.73 | 37 45.16 | 15.57 |
| E. | γ Draconis..... | 53 58.60 | — 0.28 | — 0.45 | — 0.04 | 53 57.83 | 53 41.92 | 15.91 |
| E. | σ Herculis..... | 18 02 53.34 | — 0.23 | — 0.23 | — 0.03 | 18 02 53.31 | 18 02 37.43 | 15.88 |
| E. | η Serpentis..... | 15 01 48 | + 0.67 | — 0.09 | — 0.03 | 15 02.03 | 14 46.47 | 15.56 |
| E. | 1 Aquilæ..... | 28 35.14 | + 0.73 | — 0.11 | — 0.03 | 28 35.73 | 28 19.95 | 15.78 |
| E. | α Lyræ..... | 32 56.78 | + 0.05 | — 0.23 | — 0.03 | 32 56.57 | 32 40.55 | 16.02 |
| E. | β Lyræ..... | 45 41.80 | + 0.15 | — 0.30 | — 0.03 | 45 41.62 | 45 25.60 | 16.02 |
| E. | 50 Draconis..... | 50 51.78 | — 2.13 | — 0.85 | — 0.10 | 50 48.70 | 50 31.87 | 16.83 |
| W. | δ Draconis..... | 19 12 51.76 | — 1.11 | — 0.63 | + 0.07 | 19 12 50.09 | 19 12 34.44 | 15.65 |
| W. | β Cygni..... | 25 53.70 | + 0.25 | — 0.30 | + 0.03 | 19 25 53.68 | 19 25 38.13 | — 15.55 |

NORMAL EQUATIONS.

$$\begin{aligned}
 a_0 &= +1^s.07 & c_0 &= -0^s.15 & \Delta T_0 &= -15^s.84 \\
 0 &= +0.344 + 3.090 da + 0.926 dc + 2.704 \delta \Delta T & da &= -0^s.112 & \text{Weight of } a &= 2.17 \\
 0 &= -1.630 + 0.926 da + 14.000 dc + 0.388 \delta \Delta T & dc &= +0^s.125 & c &= 13.69 \\
 0 &= +0.611 + 2.704 da + 0.388 dc + 8.437 \delta \Delta T & \delta \Delta T &= -0^s.042 & \Delta T &= 6.06
 \end{aligned}$$

Observations and reductions for time taken at sending station—Continued.

WINNEMUCCA, NEVADA, JULY 16, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|-----------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>s.</i> |
| W. | β Ursæ Minoris.... | 14 51 21.42 | + 1.43 | + 0.02 | + 0.64 | 14 51 23.51 | 14 51 08.45 | — 15.06 |
| W. | β Bootis..... | 57 25.86 | 0.00 | + 0.01 | + 0.23 | 57 26.10 | 57 11.28 | 14.82 |
| W. | β Libræ..... | 15 10 27.12 | — 0.53 | 0.00 | + 0.17 | 15 10 26.76 | 15 10 11.97 | 14.79 |
| W. | μ Bootis..... | 19 57.84 | — 0.05 | 0.00 | + 0.22 | 19 58.01 | 19 43.19 | 14.82 |
| W. | α Coronæ..... | 29 35.04 | — 0.18 | 0.00 | + 0.19 | 29 35.05 | 29 20.29 | 14.76 |
| E. | α Serpentis..... | 38 17.86 | — 0.39 | 0.00 | — 0.17 | 38 17.30 | 38 02.42 | 14.88 |
| E. | ε Serpentis..... | 44 46.24 | — 0.40 | 0.00 | — 0.17 | 44 45.67 | 44 30.84 | 14.83 |
| E. | ζ Ursæ Minoris.... | 48 55.42 | + 2.01 | — 0.02 | — 0.83 | 48 56.58 | 48 42.09 | 14.49 |
| E. | β ¹ Scorpii..... | 58 20.72 | — 0.63 | 0.00 | — 0.18 | 58 19.91 | 58 05.08 | 14.83 |
| E. | Groombr. 2320... | 16 06 16.10 | + 0.84 | — 0.01 | — 0.53 | 16 06 16.40 | 16 06 01.59 | — 14.81 |

NORMAL EQUATIONS.

$$\begin{aligned}
 a_0 &= -0^s.69 & c_0 &= -0^s.05 & \Delta T_0 &= -14^s.86 - 0^s.02 (T - 16^h.8) \\
 0 &= -0.019 + 2.947 da + 0.453 dc + 2.536 d\Delta T & da &= +0^s.008 & \text{Weight of } a &= 1.86 \\
 0 &= +1.209 + 0.453 da + 10.000 dc - 0.179 d\Delta T & dc &= -0^s.120 & c &= 9.85 \\
 0 &= -0.159 + 2.536 da - 0.179 dc + 6.082 d\Delta T & d\Delta T &= +0^s.019 & \Delta T &= 3.87
 \end{aligned}$$

WINNEMUCCA, NEVADA, JULY 16, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|-------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>s.</i> |
| E. | 44 Ophiuchi..... | 17 18 54.96 | — 0.81 | 0.00 | — 0.13 | 17 18 54.02 | 17 18 39.21 | — 14.81 |
| E. | β Draconis..... | 28 50.96 | + 0.27 | + 0.01 | — 0.19 | 28 51.05 | 27 36.17 | 14.88 |
| E. | ω Draconis..... | 37 59.46 | + 1.05 | + 0.03 | — 0.32 | 38 00.22 | 37 45.01 | 15.21 |
| E. | μ Herculis..... | 41 46.64 | — 0.21 | + 0.02 | — 0.13 | 41 46.32 | 41 31.37 | 14.95 |
| E. | θ Herculis..... | 52 11.04 | — 0.07 | + 0.02 | — 0.15 | 52 10.84 | 51 56.03 | 14.81 |
| W. | ο Herculis..... | 18 02 52.48 | — 0.20 | + 0.05 | + 0.13 | 18 02 52.46 | 18 02 37.29 | 15.17 |
| W. | μ Sagittarii..... | 06 28.18 | — 0.77 | + 0.02 | + 0.13 | 06 27.56 | 06 12.52 | 15.04 |
| W. | η Serpentis..... | 15 01.72 | — 0.56 | + 0.02 | + 0.12 | 15 01.36 | 14 46.48 | 14.88 |
| W. | 109 Herculis..... | 18 34.18 | — 0.29 | + 0.01 | + 0.13 | 18 34.03 | 18 19.29 | 14.74 |
| W. | ι Aquilæ..... | 28 35.44 | — 0.62 | — 0.02 | + 0.12 | 28 34.92 | 28 19.98 | 14.94 |
| W. | α Lyræ..... | 32 55.24 | — 0.04 | — 0.06 | + 0.15 | 32 55.29 | 32 40.54 | 14.75 |
| W. | β Lyræ..... | 45 40.50 | — 0.13 | — 0.08 | + 0.15 | 45 40.44 | 45 25.61 | 14.83 |
| W. | 50 Draconis..... | 8 50 44.58 | + 1.81 | — 0.23 | + 0.46 | 18 50 46.62 | 18 50 31.74 | — 14.88 |

NORMAL EQUATIONS.

$$\begin{aligned}
 a_0 &= -0^s.69 & c_0 &= -0^s.05 & \Delta T_0 &= -14^s.86 - 0^s.02 (T - 16^h.8) \\
 0 &= +0.313 + 3.463 da - 1.952 dc + 3.552 d\Delta T & da &= -0^s.125 & \text{Weight of } a &= 1.96 \\
 0 &= +0.635 - 1.952 da + 13.000 dc - 3.034 d\Delta T & dc &= -0^s.068 & c &= 11.69 \\
 0 &= +0.270 + 3.552 da - 3.034 dc + 8.606 d\Delta T & d\Delta T &= -0^s.004 & \Delta T &= 4.87
 \end{aligned}$$

Observations and reductions for time taken at sending station—Continued.

WINNEMUCCA, NEVADA, JULY 18, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|-----------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>s.</i> |
| E. | α ² Libræ..... | 14 44 06.86 | + 0.36 | 0.00 | + 0.11 | 14 44 07.11 | 14 43 52.64 | — 14.47 |
| E. | β Ursæ Minoris... | 56 24.26 | — 0.88 | + 0.01 | — 0.42 | 56 22.97 | 51 08.31 | 14.66 |
| E. | β Libræ..... | 15 10 26.20 | + 0.32 | — 0.01 | — 0.11 | 15 10 26.40 | 15 10 11.95 | 14.45 |
| E. | γ Ursæ Minoris.... | 21 15.00 | — 0.71 | — 0.05 | — 0.36 | 21 13.88 | 20 59.60 | 14.28 |
| E. | α Coronæ..... | 29 34.62 | + 0.11 | — 0.03 | — 0.12 | 29 34.58 | 29 20.26 | 14.32 |
| W. | a Serpentis..... | 38 16.46 | + 0.23 | — 0.03 | + 0.11 | 38 16.77 | 38 02.40 | 14.37 |
| W. | ε Serpentis..... | 44 44.94 | + 0.25 | — 0.04 | + 0.11 | 44 45.26 | 44 30.83 | 14.43 |
| W. | ζ Ursæ Minoris.... | 48 57.50 | — 1.24 | — 0.20 | + 0.54 | 48 56.60 | 48 41.90 | 14.70 |
| W. | β ¹ Scorpii..... | 15 58 19.04 | + 0.39 | — 0.02 | + 0.12 | 15 58 19.53 | 15 58 05.07 | — 14.46 |

NORMAL EQUATIONS.

$$a_0 = +0^s.41 \quad c_0 = -0^s.13 \quad \Delta T_0 = -14^s.49 - 0^s.020 (T - 16^h.8)$$

$$\begin{aligned} 0 &= -0.139 + 3.700 da - 0.652 dc + 3.307 d \Delta T & da &= +0^s.009 & \text{Weight of } a &= 1.73 \\ 0 &= -0.187 - 0.652 da + 9.000 dc + 0.273 d \Delta T & dc &= +0^s.020 & c &= 8.63 \\ 0 &= -0.241 + 3.307 da + 0.273 dc + 5.770 d \Delta T & d \Delta T &= +0^s.035 & \Delta T &= 2.73 \end{aligned}$$

WINNEMUCCA, NEVADA, JULY 18, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|--------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>s.</i> |
| W. | ω Draconis..... | 17 37 59.52 | — 0.45 | — 0.04 | + 0.53 | 17 37 59.56 | 17 37 44.94 | — 14.62 |
| W. | μ Herculis..... | 41 45.46 | + 0.09 | — 0.02 | + 0.22 | 41 45.75 | 41 31.36 | 14.39 |
| W. | θ Herculis..... | 52 10.14 | + 0.03 | — 0.02 | + 0.24 | 52 10.39 | 51 56.01 | 14.38 |
| W. | γ Draconis..... | 53 56.46 | — 0.10 | — 0.03 | + 0.31 | 53 56.64 | 53 41.85 | 14.79 |
| W. | o Herculis..... | 18 02 51.68 | + 0.08 | — 0.04 | + 0.22 | 18 02 51.94 | 18 02 37.42 | 14.52 |
| E. | δ Ursæ Minoris.... | 13 54.12 | — 4.13 | — 0.54 | — 3.25 | 13 46.20 | 13 33.06 | 13.14 |
| E. | 109 Herculis..... | 18 33.96 | + 0.12 | — 0.05 | — 0.21 | 18 33.82 | 18 19.29 | 14.53 |
| E. | 1 Aquilæ..... | 28 34.52 | + 0.26 | — 0.04 | — 0.20 | 28 34.54 | 28 19.99 | 14.55 |
| E. | α Lyræ..... | 32 55.44 | + 0.02 | — 0.08 | — 0.25 | 32 55.13 | 32 40.54 | 14.59 |
| E. | β Lyræ..... | 45 40.36 | + 0.06 | — 0.07 | — 0.23 | 45 40.12 | 45 25.61 | 14.51 |
| E. | 50 Draconis..... | 18 50 48.02 | — 0.76 | — 0.20 | — 0.76 | 18 50 46.30 | 18 50 31.69 | — 14.61 |

NORMAL EQUATIONS.

$$a_0 = +0^s.41 \quad c_0 = -0^s.13 \quad \Delta T_0 = -14^s.49 - 0^s.020 (T - 16^h.8)$$

$$\begin{aligned} 0 &= +0.143 + 1.885 da + 0.130 dc + 1.172 d \Delta T & da &= -0^s.066 & \text{Weight of } a &= 1.65 \\ 0 &= +0.708 + 0.130 da + 11.000 dc + 0.308 d \Delta T & dc &= -0^s.063 & c &= 10.98 \\ 0 &= +0.151 + 1.172 da + 0.308 dc + 5.923 d \Delta T & d \Delta T &= -0^s.009 & \Delta T &= 5.19 \end{aligned}$$

Observations and reductions for time taken at sending station—Continued.

WINNEMUCCA, NEVADA, JULY 24, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT . |
|--------|----------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>s.</i> |
| W. | γ Ursæ Minoris..... | 15 21 14.08 | — 0.92 | — 0.23 | + 0.33 | 15 21 13.26 | 15 20 59.22 | — 14.04 |
| W. | α Coronæ | 29 33.96 | + 0.14 | — 0.09 | + 0.11 | 29 34.12 | 29 20.18 | 13.94 |
| W. | α Serpentis | 38 15.96 | + 0.30 | — 0.06 | + 0.10 | 38 16.30 | 38 02.34 | 13.96 |
| W. | ϵ Serpentis | 44 44.48 | + 0.32 | — 0.06 | + 0.10 | 44 44.84 | 44 30.77 | 14.07 |
| W. | ζ Ursæ Minoris..... | 48 57.34 | — 1.59 | — 0.30 | + 0.48 | 48 55.93 | 48 41.31 | 14.62 |
| E. | Groombr. 2320..... | 16 06 16.12 | — 0.66 | — 0.17 | — 0.27 | 16 06 15.02 | 16 06 01.22 | 13.80 |
| E. | ϵ Ophiuchi | 11 51.66 | + 0.38 | — 0.05 | — 0.10 | 11 51.89 | 11 37.89 | 14.00 |
| E. | τ Herculis | 16 11.54 | — 0.08 | — 0.10 | — 0.14 | 16 11.22 | 15 57.22 | 14.00 |
| E. | ω Herculis | 19 49.02 | + 0.25 | — 0.06 | — 0.10 | 19 49.11 | 19 34.93 | 14.18 |
| E. | α Scorpii..... | 21 53.08 | + 0.55 | — 0.03 | — 0.11 | 21 53.49 | 21 39.39 | 14.10 |
| E. | ζ Ophiuchi. | 16 30 25.60 | + 0.43 | — 0.04 | — 0.10 | 16 30 25.89 | 16 30 11.90 | — 13.99 |

NORMAL EQUATIONS.

$$a_0 = +0^s.45 \quad c_0 = 0^s.00 \quad \Delta T_0 = -13^s.99 \text{ [rate assumed} = 0\text{]}$$

$$0 = +0.042 + 3.739 da + 2.042 dc + 3.576 d\Delta T \quad da = +0^s.088 \quad \text{Weight of } a = 1.80$$

$$0 = +0.986 + 2.042 da + 11.000 dc + 1.519 d\Delta T \quad dc = -0^s.099 \quad c = 9.84$$

$$0 = +0.177 + 3.576 da + 1.519 dc + 7.224 d\Delta T \quad d\Delta T = -0^s.047 \quad \Delta T = 3.78$$

WINNEMUCCA, NEVADA, JULY 24, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT . |
|--------|-------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>s.</i> |
| E. | π Herculis | 17 10 53.48 | + 0.03 | — 0.06 | + 0.05 | 17 10 53.50 | 17 10 39.49 | — 14.01 |
| E. | 44 Ophiuchi..... | 18 52.76 | + 0.37 | — 0.02 | + 0.04 | 18 53.15 | 18 39.19 | 13.96 |
| E. | β Draconis | 27 50.32 | — 0.12 | — 0.10 | + 0.07 | 27 50.17 | 27 36.03 | 14.14 |
| E. | ω Draconis | 37 59.42 | — 0.49 | — 0.20 | + 0.11 | 37 58.84 | 37 44.73 | 14.11 |
| E. | μ^1 Herculis | 41 45.22 | + 0.10 | — 0.10 | + 0.05 | 41 45.27 | 41 31.32 | 13.95 |
| W. | γ Draconis | 53 56.02 | — 0.11 | — 0.17 | — 0.06 | 53 55.68 | 53 41.76 | 13.92 |
| W. | α Herculis | 18 02 51.50 | + 0.09 | — 0.13 | — 0.05 | 18 02 51.41 | 18 02 37.39 | 14.02 |
| W. | μ Sagittarii | 06 26.36 | + 0.36 | — 0.06 | — 0.04 | 06 26.62 | 06 12.52 | 14.10 |
| W. | η Serpentis | 15 00.40 | + 0.26 | — 0.10 | — 0.04 | 15 00.52 | 14 46.49 | 14.03 |
| W. | 109 Herculis | 18 33.30 | + 0.13 | — 0.14 | — 0.04 | 18 33.25 | 18 19.28 | — 13.97 |

NORMAL EQUATIONS.

$$a_0 = +0^s.45 \quad c_0 = 0^s.00 \quad \Delta T_0 = -13^s.99 \text{ [rate assumed} = 0\text{]}$$

$$0 = +0.318 + 2.585 da - 1.395 dc + 2.692 d\Delta T \quad da = -0^s.073 \quad \text{Weight of } a = 1.37$$

$$0 = -0.523 - 1.395 da + 10.000 dc - 0.792 d\Delta T \quad dc = +0^s.040 \quad c = 9.14$$

$$0 = +0.408 + 2.692 da - 0.792 dc + 6.646 d\Delta T \quad d\Delta T = -0^s.027 \quad \Delta T = 3.80$$

Observations and reductions for time taken at sending station—Continued.

WINNEMUCCA, NEVADA, JULY 25, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|-----------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>s.</i> |
| W. | β Libræ..... | 15 10 25.10 | + 0.42 | — 0.03 | + 0.09 | 15 10 25.58 | 15 10 11.87 | — 13.71 |
| W. | γ Ursæ Minoris.... | 22 13.68 | — 0.92 | — 0.33 | + 0.29 | 22 12.72 | 20 59.15 | 13.57 |
| W. | α Coronæ..... | 29 33.72 | + 0.15 | — 0.17 | + 0.10 | 29 33.80 | 29 20.16 | 13.64 |
| W. | α Serpentis..... | 38 15.76 | + 0.31 | — 0.14 | + 0.09 | 38 16.02 | 38 02.33 | 13.69 |
| W. | ε Serpentis..... | 44 44.26 | + 0.32 | — 0.13 | + 0.09 | 44 44.54 | 44 30.76 | 13.78 |
| W. | ζ Ursæ Minoris.... | 48 57.28 | — 1.60 | — 0.62 | + 0.43 | 48 55.49 | 48 41.21 | 14.28 |
| E. | β ¹ Scorpii..... | 58 18.42 | + 0.50 | — 0.08 | — 0.09 | 58 18.75 | 58 05.01 | 13.74 |
| E. | Groombr. 2320.... | 16 06 16.14 | — 0.66 | — 0.37 | — 0.24 | 16 06 14.87 | 16 06 01.17 | 13.70 |
| E. | τ Herculis..... | 16 11.34 | — 0.08 | — 0.22 | — 0.13 | 16 10.91 | 15 57.21 | 13.70 |
| E. | ζ Ophiuchi..... | 30 25.38 | + 0.43 | — 0.09 | — 0.09 | 30 25.63 | 30 11.88 | 13.75 |
| E. | η Herculis..... | 16 38 48.38 | + 0.02 | — 0.17 | — 0.11 | 16 38 48.12 | 16 38 34.43 | — 13.69 |

NORMAL EQUATIONS.

$$a_0 = -0^s.44 \quad c_0 = -0^s.08 \quad \Delta T_0 = -13^s.72 \text{ [rate assumed} = 0\text{]}$$

$$\begin{aligned} 0 &= -0.354 + 3.526 da + 0.098 dc + 3.205 d\Delta T & da &= +0^s.101 & \text{Weight of } a &= 2.04 \\ 0 &= +0.075 + 0.098 da + 11.000 dc - 0.615 d\Delta T & dc &= -0^s.008 & c &= 10.87 \\ 0 &= -0.328 + 3.205 da - 0.615 dc + 6.951 d\Delta T & d\Delta T &= 0^s.000 & \Delta T &= 3.99 \end{aligned}$$

WINNEMUCCA, NEVADA, JULY 25, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|--------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>s.</i> |
| E. | β Draconis..... | 17 27 50.24 | — 0.09 | — 0.16 | — 0.11 | 17 27 49.88 | 17 27 36.01 | — 13.87 |
| E. | ω Draconis..... | 37 59.32 | — 0.37 | — 0.25 | — 0.19 | 37 58.51 | 37 44.69 | 13.82 |
| E. | μ Herculis..... | 41 45.06 | + 0.08 | — 0.12 | — 0.08 | 41 44.94 | 41 31.32 | 13.62 |
| E. | θ Herculis..... | 52 09.84 | + 0.02 | — 0.16 | — 0.09 | 52 09.61 | 51 55.95 | 13.66 |
| W. | ο Herculis..... | 18 02 51.22 | + 0.07 | — 0.16 | + 0.08 | 18 02 51.21 | 18 02 37.39 | 13.82 |
| W. | δ Ursæ Minoris.... | 13 48.70 | — 3.49 | — 1.93 | + 1.17 | 13 44.45 | 13 31.23 | 13.22 |
| W. | α Lyræ..... | 32 54.26 | + 0.02 | — 0.23 | + 0.09 | 32 54.14 | 32 40.51 | 13.63 |
| W. | β Lyræ..... | 45 39.44 | + 0.05 | — 0.21 | + 0.09 | 45 39.37 | 45 25.60 | 13.77 |
| W. | 50 Draconis..... | 18 50 46.14 | — 0.64 | — 0.59 | + 0.27 | 18 50 45.18 | 18 50 31.44 | — 13.74 |

NORMAL EQUATIONS.

$$a_0 = +0^s.44 \quad c_0 = -0^s.08 \quad \Delta T_0 = -13^s.72 \text{ [rate assumed} = 0\text{]}$$

$$\begin{aligned} 0 &= +0.246 + 1.718 da + 1.236 dc + 0.066 d\Delta T & da &= -0^s.151 & \text{Weight of } a &= 1.57 \\ 0 &= +0.075 + 1.236 da + 10.000 dc - 0.215 d\Delta T & dc &= +0^s.011 & c &= 9.09 \\ 0 &= +0.007 + 0.066 da - 0.215 dc + 4.063 d\Delta T & d\Delta T &= +0^s.001 & \Delta T &= 4.06 \end{aligned}$$

Observations and reductions for time taken at sending station—Continued.

WINNEMUCCA, NEVADA, JULY 26, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|-----------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>s.</i> |
| W. | γ Ursæ Minoris..... | 15 21 13.38 | — 1.33 | — 0.39 | + 0.32 | 15 21 11.98 | 15 20 59.09 | — 12.89 |
| W. | a Coronæ..... | 29 33.24 | + 0.21 | — 0.15 | + 0.11 | 29 33.41 | 29 20.15 | 13.26 |
| W. | a Serpentis..... | 38 15.30 | + 0.44 | — 0.12 | + 0.10 | 38 15.72 | 38 02.31 | 13.41 |
| W. | ε Serpentis..... | 44 43.66 | + 0.46 | — 0.11 | + 0.10 | 44 44.11 | 44 30.75 | 13.36 |
| W. | ζ Ursæ Minoris..... | 48 57.08 | — 2.30 | — 0.55 | — 0.48 | 48 53.75 | 48 41.11 | 13.64 |
| E. | β ¹ Scorpii..... | 58 17.74 | + 0.72 | — 0.07 | — 0.10 | 58 18.29 | 58 05.00 | 13.29 |
| E. | Groombr. 2320..... | 16 06 15.98 | — 0.95 | — 0.34 | — 0.26 | 16 06 14.43 | 16 06 01.11 | 13.32 |
| E. | τ Herculis..... | 16 10.98 | — 0.11 | — 0.18 | — 0.14 | 16 10.55 | 15 57.19 | 13.36 |
| E. | a Scorpii..... | 21 51.96 | + 0.80 | — 0.05 | — 0.11 | 21 52.60 | 21 39.37 | 13.23 |
| E. | ζ Ophiuchi..... | 30 24.82 | + 0.62 | — 0.06 | — 0.10 | 30 25.28 | 30 11.88 | 13.40 |
| E. | η Herculis..... | 16 38 48.02 | + 0.03 | — 0.11 | — 0.13 | 16 38 47.81 | 16 38 34.41 | — 13.40 |

NORMAL EQUATIONS.

$$\begin{aligned}
 a_0 &= +0^s.75 & c_0 &= -0^s.10 & \Delta T_0 &= -13^s.39 \text{ [rate assumed = 0]} \\
 0 &= -0.292 + 3.790 da + 1.784 dc + 3.276 d \Delta T & da &= +0^s.028 & \text{Weight of } a &= 2.07 \\
 0 &= -0.142 + 1.784 da + 11.000 dc + 1.271 d \Delta T & dc &= +0^s.002 & c &= 10.14 \\
 0 &= -0.471 + 3.276 da + 1.271 dc + 6.781 d \Delta T & d \Delta T &= +0^s.055 & \Delta T &= 3.95
 \end{aligned}$$

WINNEMUCCA, NEVADA, JULY 26, 1873.

| Clamp. | Name of star. | T'. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|----------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>s.</i> |
| E. | ψ ¹ Draconis, pr..... | 17 44 30.06 | — 1.35 | + 0.11 | — 0.19 | 17 44 28.63 | 17 44 15.22 | — 13.41 |
| E. | θ Herculis..... | 52 09.20 | + 0.06 | + 0.06 | — 0.07 | 52 09.25 | 51 55.95 | 13.30 |
| E. | γ Draconis..... | 53 55.36 | — 0.23 | + 0.08 | — 0.09 | 53 55.12 | 53 41.73 | 13.39 |
| E. | o Herculis..... | 18 02 50.50 | + 0.19 | + 0.03 | — 0.07 | 18 02 50.65 | 18 02 37.38 | 13.27 |
| E. | μ ¹ Sagittarii..... | 06 25.10 | + 0.75 | + 0.08 | — 0.06 | 06 25.87 | 06 12.52 | 13.35 |
| W. | η Serpentis..... | 14 59.26 | + 0.55 | — 0.01 | + 0.06 | 14 59.86 | 14 46.49 | 13.37 |
| W. | 109 Herculis..... | 18 32.30 | + 0.28 | — 0.02 | + 0.06 | 18 32.62 | 18 19.27 | 13.35 |
| W. | 1 Aquilæ*..... | 28 32.58 | + 0.61 | — 0.04 | + 0.06 | 28 33.21 | 28 20.00 | [13.21] |
| W. | a Lyræ..... | 32 53.68 | + 0.04 | — 0.07 | + 0.08 | 32 53.73 | 32 40.50 | 13.23 |
| W. | β Lyræ..... | 45 38.74 | + 0.13 | — 0.06 | + 0.07 | 45 38.88 | 45 25.59 | 13.29 |
| W. | 50 Draconis..... | 18 50 46.60 | — 1.77 | — 0.17 | + 0.23 | 18 50 44.89 | 18 50 31.40 | — 13.49 |

* 1 Aquilæ noted as doubtful in original book.

NORMAL EQUATIONS.

$$\begin{aligned}
 a_0 &= +0^s.75 & c_0 &= -0^s.10 & \Delta T_0 &= -13^s.39 \text{ [rate assumed = 0]} \\
 0 &= -0.204 + 2.060 da - 0.177 dc + 1.790 d \Delta T & da &= +0^s.046 & \text{Weight of } a &= 1.52 \\
 0 &= -0.386 - 0.177 da + 10.000 dc - 0.267 d \Delta T & dc &= +0^s.041 & c &= 9.98 \\
 0 &= -0.461 + 1.790 da - 0.267 dc + 5.987 d \Delta T & d \Delta T &= +0^s.065 & \Delta T &= 4.43
 \end{aligned}$$

The following tables give the corrections and rates of the chronometers used at Winnemucca and Salt Lake City :

CHRONOMETER AT WINNEMUCCA.—NEGUS, No. 1499.

| Date. | Local sidereal time. | Correction of chronometer. | Adopted hourly rate. |
|---------|----------------------|----------------------------|----------------------|
| 1873. | <i>h.</i> | <i>s.</i> <i>s.</i> | <i>s.</i> |
| July 11 | 18.0 | — 15.882 ± 0.028 | 0.000 |
| July 16 | 16.8 | — 14.852 ± 0.023 | — 0.020 |
| July 18 | 16.8 | — 14.477 ± 0.025 | — 0.020 |
| July 24 | 17.0 | — 14.027 ± 0.025 | 0.000 |
| July 25 | 17.0 | — 13.720 ± 0.024 | 0.000 |
| July 26 | 17.0 | — 13.330 ± 0.024 | 0.000 |

CHRONOMETER AT SALT LAKE CITY.—NEGUS, No. 1511.

| Date. | Local sidereal time. | Correction of chronometer. | Adopted hourly rate. |
|---------|----------------------|-------------------------------|----------------------|
| 1873. | <i>h.</i> | <i>h.</i> <i>m.</i> <i>s.</i> | <i>s.</i> |
| July 11 | 18.0 | + 8 07 09.07 | — 0.026 |
| July 16 | 17.0 | 06.60 | — 0.019 |
| July 18 | 17.25 | 05.72 | — 0.013 |
| July 24 | 17.25 | 06.22 | 0.000 |
| July 25 | 17.25 | 06.21 | — 0.004 |
| July 26 | 17.5 | + 8 07 06.04 | — 0.007 |

Final results of longitude.

| Signals sent from— | Recorded at— | Mean of signals sent and received. | Time-corrections. | Corrected time. | Difference of longitude. | Double-wave time. | Means. |
|--------------------|-----------------|------------------------------------|-------------------------------|-------------------------------|--------------------------|-------------------|---------------------|
| July 11, 1873: | | <i>h.</i> <i>m.</i> <i>s.</i> | <i>h.</i> <i>m.</i> <i>s.</i> | <i>h.</i> <i>m.</i> <i>s.</i> | <i>m.</i> <i>s.</i> | <i>s.</i> | <i>m.</i> <i>s.</i> |
| Salt Lake City. { | Salt Lake City. | 8 36 55.75 | +8 07 09.10 | 16 44 04.85 | | | |
| Winnemucca .. { | Winnemucca .. | 16 21 00.00 | —0 00 15.88 | 16 20 44.12 | 23 20.73 | | |
| | Salt Lake City. | 8 43 55.86 | +8 07 09.10 | 16 51 04.96 | | | |
| | Winnemucca .. | 16 28 00.12 | —0 00 15.88 | 16 27 44.24 | 23 20.72 | .... | 23 20.725 |
| July 16, 1873: | | | | | | | |
| Salt Lake City. { | Salt Lake City. | 9 14 46.66 | +8 07 06.59 | 17 21 53.25 | | | |
| Winnemucca .. { | Winnemucca .. | 16 58 47.46 | —0 00 14.86 | 16 58 32.30 | 23 20.95 | | |
| | Salt Lake City. | 9 20 19.45 | +8 07 06.59 | 17 27 26.04 | | | |
| | Winnemucca .. | 17 04 20.15 | —0 00 14.86 | 17 04 05.29 | 23 20.75 | .... | 23 20.850 |
| July 18, 1873: | | | | | | | |
| Salt Lake City. { | Salt Lake City. | 9 22 17.62 | +8 07 05.72 | 17 29 23.34 | | | |
| Winnemucca .. { | Winnemucca .. | 17 06 17.14 | —0 00 14.49 | 17 06 02.65 | 23 20.69 | | |
| | Salt Lake City. | 9 28 00.60 | +8 07 05.71 | 17 35 06.31 | | | |
| | Winnemucca .. | 17 12 00.05 | —0 00 14.49 | 17 11 45.56 | 23 20.75 | .... | 23 20.720 |

Final results of longitude—Continued.

| Signals sent from— | Recorded at— | Mean of signals sent and received. | Time-corrections. | Corrected time. | Difference of longitude. | Double-wave time. | Means. |
|--------------------|-----------------|------------------------------------|-------------------|-----------------|--------------------------|-------------------|--------------|
| | | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> | <i>s.</i> | <i>m. s.</i> |
| July 24, 1873: | | | | | | | |
| Salt Lake City. { | Salt Lake City. | 9 02 39.59 | +8 07 06.22 | 17 09 45.81 | | | |
| | Winnemucca .. | 16 46 39.12 | —0 00 14.03 | 16 46 25.09 | 23 20.72 | | |
| Winnemucca .. { | Salt Lake City. | 9 08 30.68 | +8 07 06.22 | 17 15 36.90 | | | |
| | Winnemucca .. | 16 52 30.14 | —0 00 14.03 | 16 52 16.11 | 23 20.79 | .... | 23 20.755 |
| July 25, 1873: | | | | | | | |
| Salt Lake City. { | Salt Lake City. | 9 18 25.97 | +8 07 06.21 | 17 25 32.18 | | | |
| | Winnemucca .. | 17 02 25.20 | —0 00 13.72 | 17 02 11.48 | 23 20.70 | | |
| Winnemucca .. { | Salt Lake City. | 9 24 30.91 | +8 07 06.21 | 17 31 37.12 | | | |
| | Winnemucca .. | 17 08 30.01 | —0 00 13.72 | 17 08 16.29 | 23 20.83 | .... | 23 20.765 |
| July 26, 1873: | | | | | | | |
| Salt Lake City. { | Salt Lake City. | 9 36 13.04 | +8 07 06.04 | 17 43 19.08 | | | |
| | Winnemucca .. | 17 20 11.79 | —0 00 13.33 | 17 19 58.46 | 23 20.62 | | |
| Winnemucca .. { | Salt Lake City. | 9 40 01.41 | +8 07 06.04 | 17 47 07.45 | | | |
| | Winnemucca .. | 17 24 00.02 | —0 00 13.33 | 17 23 46.69 | 23 20.76 | .... | 23 20.690 |

Winnemucca west of Salt Lake City 0^h 23^m 50^s.751 ± 0^s.015

Not including personal equation, probable error of one night ± 0^s.036

Mean places of stars for 1873.0 used for determination of latitude of Winnemucca, Nevada.

| No. of pair. | No. in B. A. C. | Right ascension. | Declination. | No. of pair. | No. in B. A. C. | Right ascension. | Declination. |
|--------------|-----------------|------------------|--------------|--------------|-----------------|------------------|--------------|
| | | <i>h. m. s.</i> | <i>° ' "</i> | | | <i>h. m. s.</i> | <i>° ' "</i> |
| 1..... { | 5131 | 15 27 48 | 31 47 19.92 | 13..... { | 6771 | 19 39 42 | 37 02 54.92 |
| | 5164 | 31 26 | 50 07 14.80 | | 6779 | 41 00 | 44 49 18.34 |
| 2..... { | 5515 | 16 22 27 | 32 58 59.81 | | 6810 | 19 45 36 | 22 17 19.19 |
| | 5535 | 26 37 | 49 14 19.28 | 14..... { | 6818 | 46 00 | 59 05 58.60 |
| 3..... { | 6013 | 17 39 20 | 44 08 26.90 | | 6830 | 19 48 23 | 47 36 17.52 |
| | 6082 | 51 54 | 37 16 06.96 | 15..... { | 6851 | 51 32 | 34 44 49.86 |
| 4..... { | 6162 | 18 03 39 | 43 26 50.64 | | 6868 | 19 54 19 | 17 10 15.48 |
| | 6193 | 08 51 | 38 44 20.84 | 16..... { | 6905 | 20 00 08 | 64 27 55.40 |
| 5..... { | 6224 | 18 13 10 | 64 21 15.20 | | 6932 | 20 03 31 | 61 37 37.32 |
| | 6245 | 17 17 | 17 45 51.28 | 17..... { | 6941 | 05 28 | 20 45 28.82 |
| 6..... { | 6289 | 18 22 03 | 58 43 39.52 | | 6966 | 20 09 53 | 25 12 19.36 |
| | 6322 | 27 29 | 23 31 25.08 | 18..... { | 6976 | 10 27 | 56 10 46.56 |
| 7..... { | 6364 | 18 35 27 | 40 49 11.90 | | 7158 | 20 34 54 | 40 07 53.90 |
| | 6404 | 42 09 | 41 18 23.16 | 19..... { | 7174 | 37 21 | 41 15 46.96 |
| 8..... { | 6476 | 18 51 26 | 48 42 05.20 | | 7188 | 20 39 23 | 24 49 02.94 |
| | 6491 | 59 12 | 32 31 00.00 | 20..... { | 7215 | 42 12 | 57 07 29.40 |
| 9*..... { | 6553 | 19 02 37 | 32 18 11.08 | | 7361 | 21 06 13 | 22 33 45.16 |
| | 6579 | 08 48 | 49 37 10.80 | 21..... { | 7377 | 08 34 | 59 27 52.84 |
| 10..... { | 6642 | 19 18 40 | 16 41 31.54 | | 7417 | 21 15 45 | 58 05 12.46 |
| | 6662 | 20 01 | 65 28 12.04 | 22..... { | 7437 | 18 15 | 23 43 46.66 |
| 11..... { | 6673 | 19 23 12 | 29 11 34.00 | | 7453 | 21 20 36 | 36 07 10.34 |
| | 6687 | 24 19 | 52 03 43.60 | 23..... { | 7469 | 22 51 | 45 51 51.76 |
| 12..... { | 6693 | 19 27 03 | 34 11 03.32 | | | | |
| | 6721 | 31 03 | 47 53 20.08 | | | | |

* Mr. Maryatt observed the *following* component of B. A. C. 6579. The Catalogue of 981 Stars gives the *preceding*. The computer has, therefore, added + 7^{''}.7 to the declination according to Argelauder (Bonn Observations, vol. vii, p. 93).

Observations and computations for latitude.

WINNEMUCCA, NEVADA.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|------------------|-----------------|----------------------|-----------|-----------|----------|-----------------------------|----------------------|--------|--------|-------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1873. July 15 | | <i>t.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | " | ° ' " |
| | 6013 | 7.173 | 29.2 | 23.0 | | | | | | |
| | 6082 | 32.067 | 22.8 | 29.8 | | 40 42 19.26 | +15 59.60 | -0.19 | ..... | 40 58 18.67 |
| | 6162 | 24.895 | 38.7 | 14.0 | | | | | | |
| | 6193 | 13.529 | 15.0 | 37.8 | | 41 05 37.52 | - 7 18.14 | +0.44 | ..... | 19.82 |
| | 6224 | 30.034 | 39.7 | 13.6 | | | | | | |
| | 6245 | 21.852 | 14.0 | 39.8 | | 03 34.30 | - 5 15.41 | +0.07 | ..... | 18.96 |
| | 6289 | 27.697 | 38.3 | 15.7 | | | | | | |
| | 6322 | 13.293 | 19.1 | 35.5 | | 07 33.36 | - 9 15.26 | +1.43 | ..... | 19.53 |
| | 6364 | 15.442 | 22.9 | 32.0 | | | | | | |
| | 6404 | 24.095 | 44.3 | 11.2 | | 41 03 48.58 | - 5 33.55 | +5.56 | ..... | 20.59 |
| | 6476 | 3.117 | 29.6 | 26.6 | | | | | | |
| | 6491 | 36.962 | 28.7 | 27.3 | | 40 36 33.06 | +21 44.65 | +1.02 | ..... | 18.73 |
| | 6553 | 20.142 | 26.0 | 30.1 | | | | | | |
| | 6579 | 19.222 | 38.7 | 19.1 | | 40 57 41.23 | + 0 35.47 | +3.59 | ..... | 20.29 |
| | 6642 | 13.833 | 31.3 | 26.0 | | | | | | |
| | 6662 | 24.034 | 30.1 | 27.2 | | 41 04 51.24 | - 6 33.24 | +1.90 | ..... | 19.90 |
| | 6673 | 34.373 | 25.0 | 32.2 | | | | | | |
| | 6687 | 2.178 | 34.1 | 23.2 | | 40 37 38.46 | +20 41.05 | +0.86 | ..... | 20.37 |
| | 6698 | 16.912 | 27.5 | 30.0 | | | | | | |
| | 6721 | 22.995 | 35.7 | 21.7 | | 41 02 11.26 | - 3 54.48 | +2.66 | ..... | 19.44 |
| | 6771 | 24.074 | 26.9 | 30.7 | | | | | | |
| | 6779 | 20.698 | 46.7 | 11.1 | | 40 56 05.98 | + 2 10.91 | +7.36 | ..... | 24.25 |
| | 6810 | 30.817 | 27.1 | 30.4 | | | | | | |
| | 6818 | 4.903 | 22.0 | 35.7 | | 40 41 38.04 | +16 38.95 | -3.24 | ..... | 13.75 |
| | 6830 | 29.222 | 27.1 | 30.7 | | | | | | |
| | 6851 | 10.073 | 28.0 | 29.8 | | 41 10 32.78 | -12 18.15 | -1.25 | ..... | 13.38 |
| | 6868 | 25.878 | 30.5 | 27.3 | | | | | | |
| | 6905 | 11.437 | 32.5 | 25.6 | | 40 49 04.24 | + 9 16.69 | +2.34 | ..... | 23.27 |
| | 6932 | 34.131 | 33.7 | 24.6 | | | | | | |
| | 6941 | 13.570 | 15.0 | 43.3 | | 41 11 31.85 | -13 12.60 | -4.44 | ..... | 14.81 |
| | 6966 | 31.742 | 29.7 | 28.6 | | | | | | |
| | 6976 | 5.621 | 31.1 | 27.0 | | 40 41 31.63 | +16 46.93 | +1.20 | ..... | 19.76 |
| | 7158 | 32.364 | 26.8 | 31.5 | | | | | | |
| | 7174 | 6.691 | 36.2 | 22.3 | | 41 48.56 | +16 29.63 | +2.13 | ..... | 20.32 |
| | 7188 | 19.107 | 27.0 | 31.8 | | | | | | |
| | 7215 | 19.060 | 38.7 | 20.1 | | 40 58 14.17 | + 0 01.81 | +0.88 | ..... | 16.86 |
| | 7361 | 16.853 | 22.0 | 32.1 | | | | | | |
| | 7377 | 20.789 | 52.0 | 6.3 | | 41 00 46.65 | - 2 31.73 | +8.47 | | 40 58 23.39 |

LATITUDE DETERMINATIONS.

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Observations and computations—Continued.

WINNEMUCCA, NEVADA.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|---------|-----------------|----------------------|-----------|-----------|----------|-----------------------------|----------------------|--------|--------|-------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1873. | | <i>t.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | " | ° ' " |
| July 15 | 7417 | 15.920 | 32.9 | 26.3 | | | | | | |
| | 7437 | 21.912 | 22.9 | 36.3 | | 40 54 26.24 | + 3 50.99 | −1.57 | ..... | 40 58 15.66 |
| | 7453 | 19.778 | 26.7 | 32.7 | | | | | | |
| | 7469 | 21.656 | 41.4 | 17.7 | | 59 28.34 | − 1 12.40 | +4.10 | ..... | 20.04 |
| July 16 | 6642 | 13.500 | 23.7 | 24.0 | | | | | | |
| | 6662 | 23.661 | 24.2 | 23.3 | | 41 04 51.50 | − 6 27.84 | +0.09 | ..... | 23.75 |
| | 6673 | 34.068 | 22.0 | 25.8 | | | | | | |
| | 6687 | 2.656 | 32.9 | 15.0 | | 40 37 38.76 | +20 41.71 | +3.26 | ..... | 23.73 |
| | 6698 | 17.094 | 20.6 | 27.2 | | | | | | |
| | 6721 | 23.152 | 36.0 | 11.9 | | 41 02 11.56 | − 3 53.52 | +4.05 | ..... | 22.09 |
| | 6771 | 23.923 | 21.8 | 26.1 | | | | | | |
| | 6779 | 20.502 | 34.4 | 13.6 | | 40 56 06.29 | + 2 11.88 | +3.82 | ..... | 21.99 |
| | 6810 | 32.083 | 22.0 | 26.1 | | | | | | |
| | 6818 | 6.952 | 12.7 | 35.5 | | 41 38.34 | +16 47.31 | −6.23 | +0.19 | 19.61 |
| | 6868 | 25.982 | 25.7 | 22.9 | | | | | | |
| | 6905 | 11.480 | 14.9 | 34.0 | | 40 49 04.52 | + 9 19.04 | −3.77 | +0.04 | 19.83 |
| | 6932 | 34.685 | 25.3 | 23.5 | | | | | | |
| | 6941 | 14.207 | 12.2 | 36.7 | | 41 11 32.15 | −13 09.40 | −5.26 | ..... | 17.49 |
| | 6966 | 31.498 | 24.5 | 24.6 | | | | | | |
| | 6976 | 5.269 | 15.5 | 33.6 | | 40 41 31.94 | +16 51.08 | −4.21 | ..... | 18.81 |
| | 7158 | 34.428 | 20.1 | 29.7 | | | | | | |
| | 7174 | 8.646 | 31.1 | 19.0 | | 41 48.89 | +16 33.83 | +0.58 | ..... | 23.30 |
| | 7188 | 18.996 | 23.3 | 27.1 | | | | | | |
| | 7215 | 18.752 | 19.6 | 31.0 | | 40 58 14.49 | + 0 09.40 | −3.52 | +0.08 | 20.45 |
| July 18 | 7351 | 15.656 | 23.9 | 27.0 | | | | | | |
| | 7377 | 19.307 | 11.9 | 39.1 | | 41 00 46.96 | − 2 20.74 | −7.01 | ..... | 19.21 |
| | 7417 | 16.697 | 29.5 | 21.8 | | | | | | |
| | 7437 | 22.882 | 4.7 | 46.7 | | 40 54 26.51 | + 3 58.42 | −7.94 | ..... | 16.99 |
| | 7453 | 19.171 | 24.5 | 26.8 | | | | | | |
| | 7469 | 20.873 | 22.0 | 29.3 | | 40 59 28.66 | − 1 05.61 | −2.22 | ..... | 20.83 |
| | 6642 | 14.065 | 22.0 | 31.5 | | | | | | |
| | 6662 | 24.282 | 32.5 | 21.0 | | 41 04 52.17 | − 6 33.85 | +0.46 | ..... | 18.78 |
| | 6673 | 34.237 | 27.8 | 25.7 | | | | | | |
| | 6687 | 2.170 | 22.7 | 31.0 | | 40 37 39.35 | +20 36.12 | −1.44 | ..... | 14.03 |
| | 6698 | 18.908 | 27.8 | 26.3 | | | | | | |
| | 6721 | 24.957 | 33.8 | 20.0 | | 41 02 12.16 | − 3 53.17 | +3.54 | ..... | 22.53 |
| | 6771 | 25.978 | 26.0 | 27.3 | | | | | | |
| | 6779 | 22.425 | 34.3 | 19.1 | | 40 56 06.90 | + 2 16.96 | +3.22 | ..... | 40 58 27.08 |

Observations and computations—Continued.

WINNEMUCCA, NEVADA.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|---------|-----------------|----------------------|-----------|-----------|----------|-----------------------------|----------------------|--------|--------|-------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1873. | | <i>t.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | " | ° ' " |
| July 19 | 6162 | 24.101 | 24.2 | 21.3 | | | | | | |
| | 6193 | 12.753 | 19.0 | 26.3 | | 41 05 38.56 | — 7 17.44 | —1.02 | ..... | 40 58 20.10 |
| | 6224 | 29.139 | 39.8 | 5.2 | | | | | | |
| | 6245 | 21.039 | 6.1 | 38.6 | | 03 35.27 | — 5 12.25 | +0.49 | ..... | 23.51 |
| | 6289 | 27.963 | 42.3 | 2.1 | | | | | | |
| | 6322 | 13.537 | 3.3 | 40.9 | | 41 07 34.40 | — 9 16.10 | +0.66 | ..... | 18.96 |
| | 6673 | 34.195 | 17.8 | 27.1 | | | | | | |
| | 6687 | 2.033 | 32.9 | 11.7 | | 40 37 39.65 | +20 39.78 | +2.75 | ..... | 22.18 |
| | 6698 | 16.318 | 23.2 | 21.3 | | | | | | |
| | 6721 | 22.320 | 19.7 | 25.0 | | 41 02 12.46 | — 3 51.36 | —0.79 | ..... | 20.31 |
| | 6771 | 23.552 | 17.5 | 27.2 | | | | | | |
| | 6779 | 20.174 | 25.7 | 19.1 | | 40 56 07.21 | + 2 10.21 | —0.72 | ..... | 16.70 |
| | 6810 | 30.955 | 26.0 | 18.8 | | | | | | |
| | 6818 | 4.965 | 25.7 | 19.1 | | 40 41 39.22 | +16 41.88 | +3.20 | ..... | 24.30 |
| | 6830 | 28.322 | 26.1 | 18.4 | | | | | | |
| | 6851 | 9.273 | 15.8 | 28.3 | | 41 10 34.03 | —12 14.30 | —1.11 | ..... | 18.62 |
| | 6868 | 26.433 | 20.3 | 23.4 | | | | | | |
| | 6905 | 12.206 | 53.0 | —9. | | 40 49 05.39 | + 9 08.45 | +9.31 | ..... | 23.15 |
| | 6932 | 30.877 | 25.3 | 18.5 | | | | | | |
| | 6941 | 9.267 | 23.6 | 20.2 | | 41 11 33.05 | —13 14.49 | +2.36 | ..... | 20.92 |
| | 6966 | 31.543 | 21.5 | 22.0 | | | | | | |
| | 6976 | 5.544 | 18.7 | 24.8 | | 40 41 32.84 | +16 42.22 | —1.53 | ..... | 13.53 |
| July 21 | 6162 | 25.196 | 22.7 | 24.7 | | | | | | |
| | 6163 | 13.758 | 30.3 | 17.0 | | 41 05 39.06 | — 7 20.91 | +2.62 | ..... | 20.77 |
| | 6224 | 28.267 | 23.7 | 23.4 | | | | | | |
| | 6245 | 20.003 | 29.1 | 18.0 | | 03 35.74 | — 5 18.57 | +2.64 | ..... | 19.81 |
| | 6289 | 26.989 | 27.9 | 19.1 | | | | | | |
| | 6322 | 12.573 | 18.0 | 28.7 | | 41 07 34.90 | — 9 16.10 | —0.21 | ..... | 18.59 |
| July 23 | 6013 | 5.622 | 19.3 | 29.1 | | | | | | |
| | 6082 | 30.551 | 27.0 | 22.0 | | 40 42 21.16 | +16 00.95 | —1.11 | ..... | 21.00 |
| | 6162 | 24.463 | 26.9 | 23.7 | | | | | | |
| | 6193 | 13.100 | 19.0 | 32.2 | | 41 05 39.55 | — 7 18.02 | —2.32 | ..... | 19.21 |
| | 6224 | 28.313 | 22.9 | 29.0 | | | | | | |
| | 6245 | 20.150 | 25.1 | 26.9 | | 03 36.20 | — 5 14.67 | —1.83 | ..... | 19.70 |
| | 6289 | 26.125 | 27.0 | 25.6 | | | | | | |
| | 6322 | 11.737 | 16.7 | 36.3 | | 07 35.40 | — 9 14.64 | —4.21 | ..... | 16.55 |
| | 6364 | 14.454 | 26.5 | 26.9 | | | | | | |
| | 6404 | 23.011 | 24.5 | 29.0 | | 41 03 50.64 | — 5 29.85 | —1.13 | | 40 58 19.66 |

LATITUDE DETERMINATIONS.

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Observations and computations—Continued.

WINNEMUCCA, NEVADA.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|------------------|-----------------|----------------------|-----------|-----------|----------|-----------------------------|----------------------|--------|--------|-------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1873. July 23 | | <i>t.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | " | ° ' " |
| | 6476 | 2.684 | 27.0 | 27.1 | | | | | | |
| | 6491 | 36.585 | 19.0 | 35.3 | | 40 36 35.30 | +21 46.81 | -3.80 | ..... | 40 58 18.31 |
| | 6553 | 19.952 | 23.4 | 31.1 | | | | | | |
| | 6579 | 18.984 | 20.0 | 35.1 | | 40 57 43.55 | + 0 37.32 | -5.28 | ..... | 15.59 |
| | 6642 | 14.002 | 25.2 | 30.4 | | | | | | |
| | 6662 | 24.215 | 30.0 | 25.7 | | 41 04 53.52 | - 6 33.70 | -0.21 | ..... | 19.61 |
| | 6673 | 34.819 | 23.8 | 32.0 | | | | | | |
| | 6687 | 2.666 | 29.0 | 27.0 | | 40 37 40.80 | +20 39.43 | -1.44 | ..... | 18.79 |
| | 6698 | 16.462 | 22.1 | 33.7 | | | | | | |
| | 6721 | 22.498 | 32.2 | 23.8 | | 41 02 13.65 | - 3 52.67 | -0.74 | ..... | 20.24 |
| | 6771 | 23.969 | 24.8 | 31.3 | | | | | | |
| | 6779 | 20.546 | 30.3 | 26.0 | | 40 56 08.42 | + 2 11.95 | -0.51 | ..... | 19.86 |
| | 6810 | 31.626 | 26.7 | 29.8 | | | | | | |
| | 6818 | 5.693 | 27.0 | 29.7 | | 40 41 40.38 | +16 39.68 | -1.34 | +0.03 | 18.75 |
| | 6830 | 29.080 | 30.4 | 26.0 | | | | | | |
| | 6851 | 9.991 | 13.2 | 43.6 | | 41 10 35.26 | -12 15.84 | -4.77 | ..... | 14.65 |
| | 6868 | 27.203 | 27.1 | 29.9 | | | | | | |
| | 6905 | 12.800 | 25.5 | 31.8 | | 40 49 06.53 | + 9 15.23 | -2.11 | ..... | 19.65 |
| | 6932 | 31.239 | 32.3 | 25.1 | | | | | | |
| | 6941 | 10.669 | 45.2 | 12.2 | | 41 11 34.22 | -13 12.95 | +9.31 | ..... | 30.58 |
| | 6966 | 31.157 | 29.7 | 27.8 | | | | | | |
| | 6976 | 5.010 | 20.2 | 37.3 | | 40 41 34.06 | +16 47.92 | -3.52 | ..... | 18.46 |
| | 7158 | 32.616 | 28.0 | 31.5 | | | | | | |
| | 7174 | 6.968 | 44.3 | 15.1 | | 40 41 51.12 | +16 28.67 | +5.95 | ..... | 25.74 |
| | 7188 | 18.801 | 25.0 | 34.5 | | | | | | |
| | 7215 | 18.708 | 44.7 | 14.5 | | 40 58 16.65 | + 0 03.58 | +4.79 | ..... | 25.02 |
| | 7361 | 15.617 | 26.2 | 33.4 | | | | | | |
| | 7377 | 19.495 | 32.0 | 27.7 | | 41 00 49.12 | - 2 29.49 | -0.67 | +0.13 | 19.09 |
| | 7417 | 15.906 | 29.6 | 30.2 | | | | | | |
| | 7437 | 21.895 | 31.3 | 28.4 | | 40 54 28.44 | + 3 50.87 | +0.53 | ..... | 19.84 |
| | 7453 | 18.627 | 26.8 | 33.2 | | | | | | |
| | 7469 | 20.468 | 36.3 | 23.8 | | 40 59 30.92 | - 1 10.97 | +1.41 | ..... | 21.36 |
| July 24 | 6364 | 15.033 | 23.8 | 27.0 | | | | | | |
| | 6404 | 23.600 | 25.7 | 25.5 | | 41 03 50.90 | - 5 30.23 | -0.69 | ..... | 19.98 |
| | 6476 | 2.384 | 28.6 | 23.0 | | | | | | |
| | 6491 | 36.262 | 15.0 | 36.8 | | 40 36 35.58 | +21 45.92 | -3.75 | ..... | 17.75 |
| | 6553 | 20.250 | 27.0 | 25.4 | | | | | | |
| | 6579 | 19.253 | 21.4 | 31.5 | | 40 57 43.83 | + 0 38.43 | -1.97 | ..... | 40 58 20.29 |

Observations and computations—Continued.

WINNEMUCCA, NEVADA.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|------------------|-----------------|----------------------|-----------|-----------|----------|-----------------------------|----------------------|--------|--------|-------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1873. July 24 | | <i>t.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | " | ° ' " |
| | 6642 | 12.938 | 23.5 | 29.2 | | | | | | |
| | 6662 | 23.124 | 26.8 | 26.1 | | 41 04 53.78 | — 6 32.66 | —1.16 | ..... | 40 58 19.96 |
| | 6673 | 34.844 | 22.6 | 29.8 | | | | | | |
| | 6687 | 2.670 | 29.7 | 22.8 | | 40 37 41.09 | +20 40.24 | —0.07 | ..... | 21.26 |
| | 6698 | 16.874 | 21.9 | 30.0 | | | | | | |
| | 6721 | 22.899 | 27.2 | 24.5 | | 41 02 13.94 | — 3 52.25 | —1.25 | ..... | 20.44 |
| | 6771 | 23.744 | 24.2 | 27.0 | | | | | | |
| | 6779 | 20.323 | 32.3 | 19.1 | | 40 56 08.72 | + 2 11.88 | +2.41 | ..... | 23.01 |
| | 6810 | 30.880 | 23.9 | 27.2 | | | | | | |
| | 6818 | 4.922 | 25.9 | 25.0 | | 40 41 40.67 | +16 40.65 | —0.56 | ..... | 20.76 |
| | 6830 | 28.775 | 23.5 | 27.2 | | | | | | |
| | 6851 | 9.691 | 23.9 | 27.0 | | 41 10 35.56 | —12 15.65 | —1.57 | ..... | 18.34 |
| | 6868 | 26.517 | 20.6 | 30.0 | | | | | | |
| | 6905 | 12.111 | 25.3 | 26.0 | | 40 49 06.81 | + 9 15.35 | —2.34 | ..... | 19.82 |
| | 6932 | 30.212 | 27.2 | 24.2 | | | | | | |
| | 6941 | 9.626 | 18.1 | 33.4 | | 41 11 34.52 | —13 13.56 | —2.85 | ..... | 18.11 |
| | 6966 | 31.532 | 21.9 | 29.8 | | | | | | |
| | 6976 | 5.432 | 34.5 | 17.2 | | 40 41 34.36 | +16 46.11 | +2.18 | ..... | 22.65 |
| | 7158 | 33.183 | 25.9 | 25.4 | | | | | | |
| | 7174 | 7.466 | 41.3 | 10.6 | | 40 41 51.44 | +16 31.33 | +7.22 | ..... | 29.99 |
| | 7188 | 18.611 | 26.2 | 25.0 | | | | | | |
| | 7215 | 18.467 | 22.2 | 29.3 | | 40 58 16.96 | + 0 05.55 | —1.37 | ..... | 21.14 |
| July 25 | 6553 | 20.573 | 24.8 | 27.3 | | | | | | |
| | 6579 | 19.625 | 29.6 | 22.0 | | 40 57 44.11 | + 0 36.54 | +1.18 | ..... | 21.83 |
| | 6642 | 14.000 | 23.8 | 26.9 | | | | | | |
| | 6662 | 24.217 | 24.6 | 25.0 | | 41 04 54.05 | — 6 33.85 | —1.04 | ..... | 19.16 |
| | 6673 | 33.982 | 27.0 | 23.0 | | | | | | |
| | 6687 | 1.827 | 20.0 | 29.8 | | 40 37 41.37 | +20 39.51 | —1.34 | ..... | 19.54 |
| | 6698 | 17.173 | 26.0 | 23.3 | | | | | | |
| | 6721 | 23.197 | 22.1 | 27.0 | | 41 02 14.24 | — 3 52.21 | —0.51 | ..... | 21.52 |
| | 6771 | 23.940 | 22.3 | 26.0 | | | | | | |
| | 6779 | 20.545 | 29.3 | 19.1 | | 40 56 09.02 | + 2 10.57 | +1.50 | ..... | 21.39 |
| | 6810 | 33.107 | 24.5 | 24.2 | | | | | | |
| | 6818 | 7.171 | 22.3 | 26.5 | | 40 41 40.96 | +16 39.80 | —0.90 | ..... | 19.86 |
| | 6830 | 29.072 | 21.1 | 27.8 | | | | | | |
| | 6851 | 9.949 | 17.9 | 31.2 | | 41 10 35.86 | —12 17.15 | —4.63 | +0.16 | 14.24 |
| | 6868 | 26.105 | 25.0 | 24.0 | | | | | | |
| | 6905 | 11.749 | 23.3 | 26.6 | | 40 49 07.10 | + 9 13.42 | —0.51 | | 40 58 20.01 |

LATITUDE DETERMINATIONS.

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Observations and computations—Continued.

WINNEMUCCA, NEVADA.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|------------------|-----------------|----------------------|-----------|-----------|----------|-----------------------------|----------------------|--------|--------|-------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1873. July 25 | | <i>t.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | " | ° ' " |
| | 6932 | 31.123 | 28.5 | 21.9 | | | | | | |
| | 6941 | 10.520 | 17.3 | 33.2 | | 41 11 34.81 | -13 14.22 | -2.15 | ..... | 40 58 18.44 |
| | 6966 | 31.827 | 17.9 | 32.9 | | | | | | |
| | 6976 | 5.721 | 31.7 | 19.1 | | 40 41 34.66 | +16 46.34 | -0.56 | ..... | 20.44 |
| | 7158 | 32.860 | 22.1 | 28.9 | | | | | | |
| | 7174 | 7.150 | 23.0 | 28.0 | | 40 41 51.76 | +16 31.06 | -2.73 | ..... | 20.09 |
| | 7188 | 18.622 | 24.3 | 26.3 | | | | | | |
| | 7215 | 18.503 | 22.8 | 28.0 | | 40 58 17.27 | + 0 04.59 | -1.67 | ..... | 20.19 |
| | 7361 | 16.603 | 23.3 | 27.8 | | | | | | |
| | 7377 | 20.510 | 25.0 | 26.5 | | 41 00 49.74 | - 2 30.61 | -1.59 | +0.10 | 17.84 |
| | 7417 | 15.807 | 25.7 | 26.3 | | | | | | |
| | 7437 | 21.834 | 18.0 | 34.0 | | 40 54 29.00 | + 3 52.34 | -3.84 | ..... | 17.50 |
| | 7453 | 19.722 | 23.1 | 29.0 | | | | | | |
| | 7469 | 21.540 | 39.9 | 12.6 | | 40 59 31.56 | - 1 10.08 | +4.95 | ..... | 26.43 |
| July 26 | 6553 | 19.945 | 22.8 | 27.0 | | | | | | |
| | 6579 | 19.041 | 41.2 | 9.1 | | 40 57 44.39 | + 0 34.85 | +6.46 | ..... | 25.70 |
| | 6642 | 14.467 | 19.0 | 31.6 | | | | | | |
| | 6662 | 24.606 | 23.5 | 27.0 | | 41 04 54.31 | - 6 30.85 | -3.73 | ..... | 19.73 |
| | 6673 | 34.340 | 25.2 | 27.2 | | | | | | |
| | 6687 | 2.121 | 32.1 | 18.6 | | 40 37 41.65 | +20 41.98 | +2.20 | ..... | 25.83 |
| | 6698 | 17.226 | 24.0 | 26.0 | | | | | | |
| | 6721 | 23.136 | 16.0 | 34.7 | | 41 02 14.53 | - 3 47.82 | -4.93 | ..... | 21.78 |
| | 6771 | 23.441 | 29.7 | 20.0 | | | | | | |
| | 6779 | 20.010 | 18.2 | 31.2 | | 40 56 09.31 | + 2 12.26 | -0.76 | ..... | 20.81 |
| | 6810 | 31.358 | 19.0 | 30.1 | | | | | | |
| | 6818 | 5.397 | 26.8 | 22.5 | | 40 41 41.24 | +16 40.76 | -1.57 | ..... | 20.43 |
| | 6830 | 29.032 | 30.2 | 19.1 | | | | | | |
| | 6851 | 9.949 | 15.2 | 33.2 | | 41 10 36.16 | -12 15.61 | -1.60 | ..... | 18.95 |
| | 6868 | 26.403 | 17.5 | 32.0 | | | | | | |
| | 6905 | 12.012 | 31.0 | 18.9 | | 40 49 07.38 | + 9 14.77 | -0.56 | ..... | 21.59 |
| | 6932 | 30.942 | 23.4 | 26.7 | | | | | | |
| | 6941 | 10.122 | 25.5 | 24.6 | | 41 11 35.10 | -13 22.58 | -0.56 | ..... | 11.96 |
| | 6966 | 32.960 | 20.3 | 29.7 | | | | | | |
| | 6976 | 6.822 | 20.1 | 30.0 | | 40 41 34.96 | +16 47.57 | -4.47 | ..... | 18.06 |
| | 7158 | 34.118 | 24.0 | 25.9 | | | | | | |
| | 7174 | 8.473 | 38.6 | 11.4 | | 40 41 52.08 | +16 28.55 | +5.86 | ..... | 26.49 |
| | 7188 | 18.922 | 23.9 | 26.1 | | | | | | |
| | 7215 | 18.821 | 28.9 | 22.0 | | 40 58 17.57 | + 0 03.89 | +1.09 | ..... | 40 58 22.55 |

12 AST

Observations and computations—Continued.

WINNEMUCCA, NEVADA.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|------------------|-----------------|----------------------|-----------|-----------|----------|-----------------------------|----------------------|--------|--------|-------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1873. July 26 | | <i>t.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | " | ° ' " |
| | 7361 | 17.371 | 22.5 | 26.9 | | 41 00 50.05 | — 2 29.42 | —0.02 | ..... | 40 58 20.61 |
| | 7377 | 21.247 | 26.9 | 22.6 | | | | | | |
| | 7417 | 15.812 | 24.0 | 25.5 | | 40 54 29.28 | + 3 58.31 | —1.20 | ..... | 26.39 |
| | 7437 | 21.794 | 22.4 | 26.1 | | | | | | |
| | 7453 | 19.161 | 23.3 | 26.2 | | 40 59 31.88 | — 1 13.82 | +0.28 | ..... | 18.34 |
| | 7469 | 21.076 | 26.9 | 22.8 | | | | | | |
| July 27 | 6162 | 24.480 | 30.1 | 19.0 | | 41 05 40.51 | — 7 21.29 | —2.01 | ..... | 17.21 |
| | 6193 | 13.032 | 14.1 | 33.9 | | | | | | |
| | 6224 | 29.457 | 31.2 | 19.0 | | 41 03 37.10 | — 5 17.10 | —0.12 | ..... | 19.88 |
| | 6245 | 21.231 | 19.0 | 31.7 | | | | | | |
| | 6289 | 27.683 | 27.2 | 23.1 | | 41 07 36.36 | — 9 17.07 | —0.90 | ..... | 18.39 |
| | 6322 | 13.232 | 22.0 | 30.0 | | | | | | |
| | 6932 | 29.927 | 30.2 | 23.8 | | 41 11 35.38 | —13 15.84 | +0.65 | ..... | 20.19 |
| | 6941 | 9.282 | 25.0 | 28.6 | | | | | | |
| | 6966 | 32.237 | 25.7 | 27.2 | | 40 41 35.26 | +16 44.03 | +1.27 | ..... | 20.56 |
| | 6976 | 6.191 | 30.0 | 23.0 | | | | | | |
| July 28 | 6162 | 24.809 | 26.7 | 23.4 | | 41 05 40.74 | — 7 21.76 | —2.01 | ..... | 16.97 |
| | 6193 | 13.349 | 19.0 | 31.0 | | | | | | |
| | 6224 | 28.937 | 30.4 | 20.1 | | 41 03 37.31 | — 5 17.99 | +0.74 | ..... | 20.06 |
| | 6245 | 20.688 | 21.9 | 29.0 | | | | | | |
| | 6289 | 29.326 | 28.7 | 21.9 | | 41 07 36.59 | — 9 17.65 | +1.92 | ..... | 20.86 |
| | 6322 | 14.860 | 26.1 | 24.6 | | | | | | |
| | 6364 | 15.351 | 31.0 | 30.0 | | 41 03 51.96 | — 5 32.12 | +3.29 | ..... | 23.13 |
| | 6404 | 23.967 | 32.2 | 19.0 | | | | | | |
| | 6476 | 2.801 | 27.8 | 24.3 | | 40 36 36.64 | +21 43.34 | +0.33 | ..... | 20.31 |
| | 6491 | 36.612 | 25.0 | 27.1 | | | | | | |
| | 6553 | 19.770 | 23.0 | 29.8 | | 40 57 44.93 | + 0 35.62 | —0.12 | ..... | 20.43 |
| | 6579 | 18.846 | 30.0 | 23.6 | | | | | | |
| | 6642 | 18.702 | 23.9 | 30.2 | | 41 04 54.82 | — 6 38.05 | +6.88 | ..... | 23.65 |
| | 6662 | 24.028 | 45.0 | 9.0 | | | | | | |
| | 6673 | 34.628 | 23.9 | 30.2 | | 40 37 42.21 | +20 36.54 | +4.61 | ..... | 23.36 |
| | 6687 | 2.550 | 40.1 | 13.9 | | | | | | |
| | 6698 | 16.704 | 27.0 | 26.9 | | 41 02 15.12 | — 3 55.18 | +2.11 | ..... | 22.05 |
| | 6721 | 22.805 | 31.5 | 22.5 | | | | | | |
| | 6771 | 24.413 | 23.9 | 30.8 | | 40 56 09.90 | + 2 03.48 | +0.93 | ..... | 17.31 |
| | 6779 | 21.132 | 32.9 | 22.0 | | | | | | |
| | 6810 | 31.510 | 23.6 | 31.4 | | 40 41 41.80 | +16 36.71 | +2.15 | +0.05 | 40 58 20.71 |
| | 6818 | 5.674 | 36.1 | 19.0 | | | | | | |

LATITUDE DETERMINATIONS.

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Observations and computations—Continued.

WINNEMUCCA, NEVADA.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|---------|--------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|--------|--------|-------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1873. | | <i>t.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | " | ° ' " |
| July 28 | 6830 | 29.377 | 32.3 | 23.0 | | | | | | |
| | 6851 | 10.284 | 13.1 | 42.0 | | 41 10 36.76 | —12 15.99 | —4.54 | ..... | 40 58 16.23 |
| | 6868 | 27.022 | 22.7 | 32.8 | | | | | | |
| | 6905 | 12.693 | 36.8 | 19.1 | | 40 49 07.94 | + 9 12.38 | +1.76 | ..... | 22.08 |
| | 6932 | 30.770 | 27.1 | 28.8 | | | | | | |
| | 6941 | 10.101 | 27.5 | 28.6 | | 41 11 35.67 | —13 16.76 | —0.65 | ..... | 18.26 |
| | 6966 | 32.522 | 30.7 | 25.5 | | | | | | |
| | 6976 | 6.464 | 25.3 | 31.0 | | 40 41 35.56 | +16 44.49 | —0.12 | ..... | 19.93 |
| | 7158 | 33.314 | 33.3 | 24.1 | | | | | | |
| | 7174 | 7.683 | 32.1 | 25.1 | | 40 41 52.71 | +16 28.01 | +3.75 | ..... | 24.47 |
| | 7188 | 18.400 | 27.6 | 30.1 | | | | | | |
| | 7215 | 18.331 | 29.8 | 27.3 | | 40 58 18.18 | + 0 02.66 | —0.14 | ..... | 20.70 |
| | 7361 | 16.587 | 26.0 | 31.5 | | | | | | |
| | 7377 | 20.486 | 31.3 | 26.1 | | 41 00 50.66 | — 2 30.30 | —0.07 | ..... | 20.29 |
| | 7417 | 16.930 | 29.9 | 27.4 | | | | | | |
| | 7437 | 22.900 | 26.1 | 31.2 | | 40 54 29.85 | + 3 50.14 | —0.66 | ..... | 19.33 |
| | 7453 | 19.166 | 30.1 | 27.0 | | | | | | |
| | 7469 | 21.000 | 25.8 | 31.3 | | 40 59 32.53 | — 1 10.70 | —0.56 | ..... | 58 21.27 |
| July 29 | 5131 | 20.521 | 17.9 | 22.7 | | | | | | |
| | 5164 | 20.393 | 22.4 | 18.0 | | 40 57 24.50 | + 0 04.93 | —0.09 | ..... | 57 29.34 |
| | 5515 | 12.280 | 26.0 | 20.0 | | | | | | |
| | 5535 | 25.417 | 24.0 | 22.0 | | 41 06 43.16 | — 8 26.41 | +0.93 | +0.21 | 58 20.89 |
| | 6013 | 5.887 | 23.0 | 23.7 | | | | | | |
| | 6082 | 30.702 | 23.1 | 24.0 | | 40 42 22.47 | +15 56.56 | —0.37 | ..... | 18.66 |
| | 6162 | 24.416 | 26.1 | 21.1 | | | | | | |
| | 6193 | 12.948 | 22.0 | 26.0 | | 41 05 40.97 | — 7 22.07 | +0.23 | ..... | 19.13 |
| | 6224 | 28.417 | 23.0 | 25.8 | | | | | | |
| | 6245 | 20.137 | 21.8 | 27.3 | | 41 03 37.52 | — 5 19.18 | —1.92 | ..... | 16.42 |
| | 6289 | 27.263 | 28.0 | 22.0 | | | | | | |
| | 6322 | 12.772 | 25.0 | 25.5 | | 41 07 36.82 | — 9 18.61 | +1.27 | +0.01 | 19.49 |
| | 6364 | 15.710 | 24.7 | 26.8 | | | | | | |
| | 6404 | 24.328 | 38.7 | 13.2 | | 41 03 52.20 | — 5 32.20 | +5.40 | ..... | 25.40 |
| | 6476 | 3.543 | 28.8 | 23.9 | | | | | | |
| | 6491 | 37.301 | 24.2 | 28.2 | | 40 36 36.90 | +21 41.30 | +0.21 | +0.08 | 18.49 |
| | 6553 | 20.857 | 26.7 | 26.2 | | | | | | |
| | 6579 | 19.953 | 38.5 | 15.0 | | 40 57 45.21 | + 0 34.85 | +5.56 | ..... | 25.62 |
| | 6642 | 13.541 | 25.1 | 29.0 | | | | | | |
| | 6662 | 23.823 | 40.2 | 13.0 | | 41 04 55.08 | — 6 36.36 | +1.23 | ..... | 40 58 19.95 |

Observations and computations—Continued.

WINNEMUCCA, NEVADA.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|------------------|-----------------|----------------------|-----------|-----------|----------|-----------------------------|----------------------|--------|--------|-------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1873. July 29 | | <i>t.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | " | ° ' " |
| | 6673 | 34.570 | 27.0 | 27.1 | | | | | | |
| | 6687 | 2.500 | 29.8 | 24.6 | | 40 37 48.48 | +20 36.24 | + 1.18 | ..... | 40 58 19.30 |
| | 6698 | 16.398 | 25.3 | 28.6 | | | | | | |
| | 6721 | 22.476 | 25.0 | 29.3 | | 41 02 15.40 | - 3 54.29 | - 1.76 | ..... | 19.35 |
| | 6771 | 21.865 | 25.9 | 29.8 | | | | | | |
| | 6779 | 18.526 | 33.0 | 22.7 | | 40 56 10.19 | + 2 08.71 | + 1.48 | ..... | 20.38 |
| | 6810 | 31.066 | 26.2 | 29.7 | | | | | | |
| | 6818 | 5.196 | 29.9 | 26.2 | | 40 41 42.08 | +16 37.25 | + 0.05 | +0.02 | 19.40 |
| | 6830 | 29.396 | 32.9 | 23.2 | | | | | | |
| | 6851 | 10.220 | 26.7 | 29.8 | | 41 10 37.05 | -12 19.19 | + 1.53 | ..... | 19.39 |
| | 6868 | 25.858 | 23.2 | 33.1 | | | | | | |
| | 6905 | 11.538 | 42.0 | 15.0 | | 40 49 08.21 | + 9 12.03 | + 3.96 | ..... | 24.20 |
| | 6932 | 30.402 | 32.2 | 25.0 | | | | | | |
| | 6941 | 9.741 | 25.0 | 32.3 | | 41 11 35.96 | -13 16.45 | - 0.02 | ..... | 19.49 |
| | 6966 | 32.006 | 26.0 | 31.3 | | | | | | |
| | 6976 | 5.990 | 38.3 | 19.1 | | 40 41 35.86 | +16 42.87 | + 3.22 | +0.21 | 22.16 |
| July 30 | 6013 | 5.883 | 38.4 | 14.9 | | | | | | |
| | 6082 | 30.720 | 37.9 | 16.1 | | 40 42 22.68 | +15 57.40 | +11.64 | ..... | 31.72 |
| | 6162 | 23.935 | 25.9 | 28.0 | | | | | | |
| | 6193 | 12.501 | 29.8 | 24.0 | | 41 05 41.20 | - 7 20.76 | + 0.86 | ..... | 21.30 |
| | 6224 | 28.672 | 35.9 | 17.9 | | | | | | |
| | 6245 | 20.410 | 9.0 | 44.7 | | 41 03 37.74 | - 5 18.49 | - 4.10 | ..... | 15.15 |
| | 6289 | 27.622 | 26.0 | 27.8 | | | | | | |
| | 6322 | 13.150 | 28.0 | 25.9 | | 41 07 37.05 | - 9 17.88 | + 0.07 | ..... | 19.24 |
| | 6364 | 15.138 | 27.0 | 27.0 | | | | | | |
| | 6404 | 23.752 | 26.3 | 28.0 | | 41 03 52.46 | - 5 32.05 | - 0.39 | ..... | 20.02 |
| | 6476 | 2.927 | 26.0 | 29.1 | | | | | | |
| | 6491 | 36.732 | 22.0 | 33.3 | | 40 36 37.16 | +21 43.11 | - 3.32 | ..... | 16.95 |
| | 6553 | 20.437 | 23.8 | 32.1 | | | | | | |
| | 6579 | 19.535 | 32.9 | 23.6 | | 40 57 45.47 | + 0 34.77 | + 0.23 | ..... | 20.47 |
| | 6642 | 12.398 | 21.2 | 35.6 | | | | | | |
| | 6662 | 22.674 | 45.6 | 11.3 | | 41 04 55.34 | - 6 36.13 | + 4.61 | ..... | 23.82 |
| | 6673 | 34.509 | 27.0 | 30.0 | | | | | | |
| | 6687 | 2.470 | 52.5 | 4.0 | | 40 37 42.76 | +20 35.04 | +10.53 | ..... | 28.33 |
| | 6698 | 16.550 | 27.9 | 29.1 | | | | | | |
| | 6721 | 22.658 | 38.1 | 19.0 | | 41 02 15.70 | - 3 55.45 | + 4.14 | ..... | 24.39 |
| | 6810 | 32.185 | 24.6 | 33.3 | | | | | | |
| | 6818 | 6.333 | 44.2 | 14.0 | | 40 41 42.36 | +16 36.68 | + 4.98 | +0.06 | 40 58 24.08 |

Observations and computations—Continued.

WINNEMUCCA, NEVADA.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|---------|--------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|--------|--------|-------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1873. | | <i>t.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | " | ° ' " |
| July 30 | 6830 | 28.624 | 32.0 | 26.1 | | | | | | |
| | 6851 | 9.478 | 23.9 | 34.2 | | 41 10 37.34 | -12 18.04 | +1.02 | ..... | 40 58 20.33 |
| | 6868 | 26.973 | 26.9 | 30.8 | | | | | | |
| | 6905 | 12.663 | 33.9 | 23.7 | | 40 49 08.49 | + 9 11.64 | +1.46 | ..... | 21.59 |
| | 6932 | 30.906 | 30.3 | 27.0 | | | | | | |
| | 6941 | 10.225 | 27.7 | 29.3 | | 41 11 36.24 | -13 17.22 | -0.39 | ..... | 18.63 |
| | 6966 | 31.768 | 25.8 | 31.1 | | | | | | |
| | 6976 | 5.767 | 34.1 | 22.9 | | 40 41 36.16 | +16 42.29 | +1.37 | ..... | 40 58 19.82 |

Discussion of latitude of Winnemucca, Nevada.

| Number of pair. | Number of obs. | Mean level. | Latitude. | Corr. of microm. corr. | Resulting latitude. | Dates excluded. |
|-----------------|----------------|-------------|-------------|------------------------|---------------------|------------------|
| | | " | ° ' " | " | ° ' " | |
| 1 | 1 | - 0.1 | 40 57 32.34 | 0.00 | 40 57 32.34 | |
| 2 | 1 | + 0.9 | 58 20.89 | + 0.38 | 58 21.27 | |
| 3 | 3 | - 0.6 | 19.44 | - 0.72 | 18.72 | July 30. |
| 4 | 8 | - 0.4 | 19.31 | + 0.33 | 19.64 | |
| 5 | 7 | 0.0 | 19.78 | + 0.24 | 20.02 | July 30. |
| 6 | 7 | + 0.5 | 19.15 | + 0.42 | 19.57 | July 23. |
| 7 | 4 | + 0.3 | 20.70 | + 0.25 | 20.95 | July 15, 29. |
| 8 | 6 | - 1.5 | 18.42 | - 0.98 | 17.44 | |
| 9 | 6 | + 0.3 | 20.54 | - 0.03 | 20.51 | July 23, 26, 29. |
| 10 | 8 | - 0.2 | 20.11 | + 0.29 | 20.40 | July 28, 30. |
| 11 | 9 | + 0.7 | 20.63 | - 0.93 | 19.70 | July 28, 30. |
| 12 | 8 | + 0.4 | 20.74 | + 0.18 | 20.92 | July 16, 26, 30. |
| 13 | 9 | + 1.3 | 20.95 | - 0.10 | 20.85 | July 15. |
| 14 | 8 | - 0.3 | 19.74 | - 0.75 | 18.99 | July 16, 30. |
| 15 | 6 | - 0.5 | 18.17 | + 0.55 | 18.72 | July 23, 25, 28. |
| 16 | 9 | 0.0 | 21.34 | - 0.41 | 20.93 | July 19. |
| 17 | 8 | - 0.5 | 18.25 | + 0.59 | 18.84 | July 15, 16, 23. |
| 18 | 9 | + 0.4 | 19.65 | - 0.76 | 18.89 | July 16, 26. |
| 19 | 4 | + 0.9 | 22.04 | - 0.74 | 21.30 | July 23, 24, 26. |
| 20 | 6 | - 0.8 | 21.98 | 0.00 | 21.98 | July 23. |
| 21 | 4 | - 0.5 | 19.46 | + 0.11 | 19.57 | July 15, 16. |
| 22 | 5 | - 1.3 | 19.34 | - 0.18 | 19.16 | July 16. |
| 23 | 4 | - 0.2 | 20.45 | + 0.05 | 20.50 | July 15, 25. |

Mean of 22 pairs, excluding pair 1 40° 58' 19".97

Sum of errors 20".39

Probable error of 1 pair ± 0".81

Probable error of result ± 0".17

Omitting level corrections entirely:

Approximate mean of 22 pairs 40° 58' 20".02

Sum of errors 15".6

Probable error of 1 pair ± 0".62

Probable error of result ± 0".14

Excluded pairs at Winnemucca, Nevada.

| Pair. | Date. | Result with level-correction. | | | Result with-out level-correction. | | | Correction of micrometer-correction. | Pair. | Date. | Result with level-correction. | | | Result with-out level-correction. | | | Correction of micrometer-correction. |
|-------|---------|-------------------------------|----|-------|-----------------------------------|----|-------|--------------------------------------|-------|---------|-------------------------------|----|-------|-----------------------------------|----|-------|--------------------------------------|
| | | ° | ' | " | ° | ' | " | " | | | ° | ' | " | ° | ' | " | " |
| 3 | July 30 | 40 | 58 | 31.72 | 40 | 58 | 20.08 | — 0.72 | 15 | July 23 | 40 | 58 | 14.65 | 40 | 58 | 19.42 | + 0.55 |
| 5 | July 30 | | | 15.15 | | | 19.25 | + 0.24 | | July 25 | | | 14.24 | | | 18.87 | + 0.55 |
| 6 | July 23 | | | 16.55 | | | 20.76 | + 0.42 | | July 28 | | | 16.23 | | | 20.77 | + 0.55 |
| 7 | July 15 | | | 20.59 | | | 15.93 | + 0.25 | 16 | July 19 | | | 23.15 | | | 13.84 | — 0.41 |
| | July 29 | | | 25.40 | | | 20.00 | + 0.25 | 17 | July 15 | | | 14.81 | | | 19.25 | + 0.59 |
| 9 | July 23 | | | 15.59 | | | 10.87 | — 0.03 | | July 16 | | | 17.49 | | | 22.75 | + 0.59 |
| | July 26 | | | 25.70 | | | 19.24 | — 0.03 | | July 23 | | | 30.58 | | | 21.27 | + 0.59 |
| | July 29 | | | 25.62 | | | 20.06 | — 0.03 | 18 | July 16 | | | 18.81 | | | 23.02 | — 0.76 |
| 10 | July 28 | | | 23.65 | | | 21.77 | + 0.29 | | July 26 | | | 18.06 | | | 22.53 | — 0.76 |
| | July 30 | | | 23.82 | | | 19.21 | + 0.29 | 19 | July 23 | | | 25.74 | | | 19.79 | — 0.74 |
| 11 | July 28 | | | 23.36 | | | 18.75 | — 0.93 | | July 24 | | | 29.99 | | | 22.77 | — 0.74 |
| | July 30 | | | 28.33 | | | 17.80 | — 0.93 | | July 26 | | | 26.49 | | | 20.63 | — 0.74 |
| 12 | July 16 | | | 22.09 | | | 18.04 | + 0.18 | 20 | July 53 | | | 25.02 | | | 20.23 | 0.00 |
| | July 26 | | | 21.78 | | | 26.71 | + 0.18 | 21 | July 15 | | | 23.39 | | | 14.92 | + 0.11 |
| | July 30 | | | 24.39 | | | 20.25 | + 0.18 | | July 16 | | | 19.21 | | | 26.22 | + 0.11 |
| 13 | July 15 | | | 24.25 | | | 16.89 | — 0.10 | 22 | July 16 | | | 16.99 | | | 24.93 | — 0.18 |
| 14 | July 16 | | | 19.61 | | | 25.84 | — 0.75 | 23 | July 15 | | | 24.04 | | | 19.94 | + 0.05 |
| | July 30 | 40 | 58 | 24.08 | 40 | 58 | 19.10 | — 0.75 | | July 25 | 40 | 58 | 26.43 | 40 | 58 | 21.48 | + 0.05 |

REMARKS.

| | |
|--|----------------|
| Mean of results <i>with</i> level correction of 36 observations | 40° 58' 21".82 |
| Sum of errors | 142".8 |
| Probable error of one observation | ± 3".40 |
| Probable error of result | ± 0".57 |
| Mean of results <i>without</i> level correction of 36 observations | 40° 58' 20".02 |
| Sum of errors | 83".4 |
| Probable error of one observation | ± 1".99 |
| Probable error of result | ± 0".33 |
| Mean of results, including correction to micrometer-correction | 40° 58' 19".95 |
| Sum of errors | 84".6 |
| Probable error of one observation | ± 2".01 |
| Probable error of result | ± 0".33 |

ASTRONOMICAL CO-ORDINATES OF WINNEMUCCA, NEVADA.

Longitude... $7^{\text{h}} 50^{\text{m}} 55^{\text{s}}.611 \pm 0^{\text{s}}.015$ or $117^{\circ} 43' 54''.16 \pm 0''.22$ west from Greenwich.
 $2^{\text{h}} 42^{\text{m}} 43^{\text{s}}.491$ or $40^{\circ} 40' 52''.36$ west from U. S. Naval
 Observatory, Wash-
 ington, D. C.
 Latitude..... $40^{\circ} 58' 19''.97 \pm 0''.17$ north.

U. S. GEOGRAPHICAL SURVEYS WEST OF THE ONE HUNDREDTH MERIDIAN,
1ST LIEUT. GEO. M. WHEELER, CORPS OF ENGINEERS, U. S. ARMY, IN CHARGE.

RESULTS

OF

OBSERVATIONS MADE BY W. W. MARYATT AND JOHN H. CLARK IN THE
DETERMINATION OF THE ASTRONOMICAL CO-ORDINATES
OF STATION AT VIRGINIA CITY, NEVADA.

SEASON OF 1873.

COMPUTATIONS BY

PROF. T. H. SAFFORD AND JOHN H. CLARK.

VIRGINIA CITY, NEVADA.

GEOGRAPHICAL POSITION OF STATION.

Longitude, . $119^{\circ} 39' 06''.35 \pm 0''.36$ west from Greenwich.

Longitude, $42^{\circ} 36' 04''.55$ west from U. S. Naval Observatory, Washington,
D. C.

Latitude, . . $39^{\circ} 17' 35''.92 \pm 0''.10$ north.

Barometric altitude of observatory above sea-level, 6,339.0 feet.

The monument at this station is located on a prominent hill near the main road which connects Gold Hill and Virginia City, and in full view of both of these places. It is connected by triangulation with eight of the principal mountain peaks in the vicinity, and also to the stone monument on Mount Butler, and the flag-staff on Mount Davidson. Direct measurements have been made from it to the center of the air-shaft of the Imperial mine, which is 544.1 feet distant, and also to two prominent rocks near by. The first of these is 399.8 feet from the center of the monument in a direction north $48^{\circ} 47'$ east; the other is south 21° west, and 79 feet away. On account of the inconvenient conformation of the surrounding country, neither the north nor south meridian-mark could be established, but a due east line was found and marked.

METEOROLOGY—EXCHANGES—MISCELLANEOUS.

The weather was very good, and favorable for astronomical observations. An hourly meteorological record was kept, the results of which will be found in the report on meteorology.

Exchanges were made with Salt Lake City, John H. Clark, observer, on the nights of August 15, 18, 20, 25, 27, and 28. The observations for latitude were made by W. W. Maryatt on August 13, 16, 18, 22, 25, 27, 28, and 29. The notes of Mr. Maryatt were reduced by Prof. T. H. Safford. The methods of this reduction will be found in the reports on Green River

Except on two nights, when the old "overland" wire was used, the route was by way of Diamond Springs and Corinne, at which stations there were repeaters. By the "overland" wire the circuit was independent of the Corinne repeater.

Tabulation of stars used for determination of time.

[illegible]

Observations and reductions for time taken at sending station.

VIRGINIA CITY, NEVADA, AUGUST 15, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT . |
|--------|---------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>s.</i> |
| W. | δ Ophiuchi | 16 08 24.22 | + 0.39 | — 0.01 | + 0.20 | 16 08 24.80 | 16 07 42.96 | — 41.84 |
| W. | ϵ Ophiuchi | 12 19.04 | + 0.39 | — 0.01 | + 0.20 | 12 19.62 | 11 37.64 | 41.98 |
| W. | τ Herculis | 16 38.40 | — 0.11 | — 0.01 | + 0.29 | 16 38.57 | 15 56.71 | 41.86 |
| W. | α Scorpii | 22 20.34 | + 0.57 | 0.00 | + 0.22 | 22 21.13 | 21 39.12 | 42.01 |
| W. | η Herculis | 39 15.64 | 0.00 | + 0.00 | + 0.25 | 39 15.89 | 38 34.02 | 41.87 |
| W. | Groombr. 2377... | 43 36.94 | — 0.32 | + 0.01 | + 0.36 | 43 36.99 | 42 54.89 | 42.10 |
| E. | d Herculis | 57 38.50 | + 0.07 | + 0.01 | — 0.24 | 57 38.34 | 56 56.46 | 41.88 |
| E. | Groombr. 2415... | 17 04 21.92 | — 0.02 | + 0.02 | — 0.26 | 17 04 21.66 | 17 03 39.57 | 42.09 |
| E. | α Herculis | 09 34.98 | + 0.25 | + 0.02 | — 0.20 | 09 35.05 | 08 53.10 | 41.95 |
| E. | 44 Ophiuchi | 19 20.56 | + 0.55 | + 0.01 | — 0.22 | 19 20.90 | 18 39.00 | 41.90 |
| E. | β Draconis | 17 29 17.86 | — 0.21 | + 0.02 | — 0.32 | 17 29 17.35 | 17 28 35.50 | — 41.85 |

NORMAL EQUATIONS.

$$a_0 = +0^s.60 \quad c_0 = -0^s.14 \quad \Delta T_0 = -41^s.98 \text{ (assumed rate} = 0\text{)}$$

$$\begin{aligned} 0 &= -0.075 + 2.907 da - 0.691 dc + 3.073 d\Delta T & da &= -0^s.034 & \text{Weight of } a &= 1.66 \\ 0 &= +0.640 - 0.691 da + 11.000 dc - 0.820 d\Delta T & dc &= -0^s.057 & c &= 10.83 \\ 0 &= -0.277 + 3.073 da - 0.820 dc + 7.574 d\Delta T & d\Delta T &= +0^s.045 & d\Delta T &= 4.32 \end{aligned}$$

VIRGINIA CITY, NEVADA, AUGUST 15, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT . |
|--------|---------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>s.</i> |
| E. | θ Cygni | 19 33 46.74 | — 0.14 | — 0.03 | — 0.13 | 19 33 46.44 | 19 33 04.30 | — 42.14 |
| E. | τ Aquilæ | 58 40.22 | + 0.27 | — 0.02 | — 0.08 | 58 40.39 | 57 58.46 | 41.93 |
| E. | θ Aquilæ | 20 05 29.20 | + 0.32 | — 0.04 | — 0.08 | 20 05 29.40 | 20 04 47.51 | 41.89 |
| E. | γ Cygni | 18 24.66 | — 0.02 | — 0.14 | — 0.11 | 18 24.39 | 17 42.50 | 41.89 |
| E. | π Capricorni | 21 47.38 | + 0.44 | — 0.07 | — 0.09 | 21 47.66 | 20 05.71 | 41.95 |
| W. | ϵ Delphini | 27 52.78 | + 0.24 | — 0.12 | + 0.08 | 27 52.98 | 27 11.04 | 41.94 |
| W. | Groombr. 3241... | 31 18.44 | — 0.87 | — 0.41 | + 0.27 | 31 17.43 | 30 35.53 | 41.90 |
| W. | α Cygni | 38 50.46 | — 0.07 | — 0.12 | + 0.12 | 38 50.39 | 37 08.46 | 41.93 |
| W. | ϵ Cygni | 41 48.48 | + 0.06 | — 0.06 | + 0.10 | 41 48.58 | 41 06.69 | 41.89 |
| W. | μ Aquarii | 20 46 32.32 | + 0.37 | — 0.03 | + 0.08 | 20 46 32.74 | 20 45 50.69 | — 42.05 |

NORMAL EQUATIONS.

$$a_0 = +0^s.60 \quad c_0 = -0^s.14 \quad \Delta T_0 = -41^s.98 \text{ (assumed rate} = 0\text{)}$$

$$\begin{aligned} 0 &= +0.126 + 2.564 da + 1.059 dc + 2.915 d\Delta T & da &= -0^s.106 & \text{Weight of } a &= 1.30 \\ 0 &= -0.481 + 1.059 da + 10.000 dc + 0.534 d\Delta T & dc &= +0^s.058 & c &= 9.44 \\ 0 &= +0.071 + 2.915 da + 0.534 dc + 7.115 d\Delta T & d\Delta T &= +0^s.029 & \Delta T &= 3.75 \end{aligned}$$

Observations and reductions for time taken at sending station—Continued.

VIRGINIA CITY, NEVADA, AUGUST 18, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|---------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>s.</i> |
| W. | η Herculis | 16 38 49.48 | + 0.01 | — 0.02 | — 0.03 | 16 38 49.44 | 16 38 33.97 | — 15.47 |
| W. | d Herculis | 57 12.06 | — 0.04 | — 0.02 | — 0.03 | 57 12.05 | 56 56.40 | 15.65 |
| W. | a Herculis | 17 09 08.52 | + 0.14 | — 0.01 | — 0.03 | 17 09 08.62 | 17 08 53.06 | 15.56 |
| W. | 44 Ophiuchi | 18 54.34 | + 0.32 | — 0.01 | — 0.03 | 18 54.62 | 18 38.96 | 15.65 |
| W. | β Draconis | 27 51.08 | — 0.12 | — 0.02 | — 0.04 | 27 50.90 | 27 35.42 | 15.48 |
| W. | ω Draconis | 38 59.46 | — 0.44 | — 0.03 | — 0.07 | 38 58.92 | 37 43.53 | 15.39 |
| E. | γ Draconis | 53 56.98 | — 0.11 | — 0.01 | + 0.04 | 53 56.90 | 53 41.22 | 15.68 |
| E. | o Herculis | 18 02 52.58 | + 0.07 | — 0.01 | + 0.03 | 18 02 52.67 | 18 02 37.11 | 15.56 |
| E. | μ Sagittarii | 06 27.44 | + 0.30 | — 0.01 | + 0.03 | 06 27.76 | 06 12.37 | 15.39 |
| E. | Groombr. 2533 | 11 58.96 | — 0.02 | — 0.02 | + 0.04 | 11 58.96 | 11 43.35 | 15.61 |
| E. | η Serpentis | 18 15 01.70 | + 0.22 | — 0.01 | + 0.03 | 18 15 01.94 | 18 14 46.34 | — 15.60 |

NORMAL EQUATIONS.

$$\begin{aligned}
 a_0 &= + 0^s.34 & c_0 &= + 0^s.05 & \Delta T_0 &= - 15^s.56 \text{ (assumed rate} = 0) \\
 0 &= + 0.062 + 2.065 da + 0.773 dc + 2.459 d\Delta T & da &= - 0^s.017 & \text{Weight of } a &= 1.62 \\
 0 &= + 0.271 + 0.773 da + 11.000 dc - 0.285 d\Delta T & dc &= - 0^s.023 & c &= 10.55 \\
 0 &= + 0.035 + 2.459 da - 0.285 dc + 7.140 d\Delta T & d\Delta T &= 0^s.000 & \Delta T &= 4.68
 \end{aligned}$$

VIRGINIA CITY, NEVADA, AUGUST 18, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|-------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>s.</i> |
| E. | ε Lyrae, pr | 18 40 25.40 | 0.00 | — 0.04 | + 0.16 | 18 40 25.52 | 18 40 09.80 | — 15.72 |
| E. | ζ Aquilæ | 59 51.80 | + 0.19 | — 0.04 | + 0.13 | 59 52.08 | 59 36.42 | 15.66 |
| E. | ι Lyrae | 19 03 03.60 | + 0.03 | — 0.05 | + 0.15 | 19 03 03.73 | 19 02 48.24 | 15.49 |
| E. | δ Draconis | 12 49.32 | — 0.52 | — 0.12 | + 0.33 | 12 49.01 | 12 33.60 | 15.41 |
| E. | β Cygni | 25 53.48 | + 0.10 | — 0.07 | + 0.14 | 25 53.65 | 25 38.11 | 15.54 |
| W. | κ Aquilæ | 30 21.34 | — 0.30 | — 0.05 | — 0.13 | 30 21.46 | 30 05.87 | 15.59 |
| W. | θ Cygni | 33 20.28 | — 0.12 | — 0.11 | — 0.19 | 33 19.86 | 33 04.24 | 15.62 |
| W. | γ Aquilæ | 40 31.20 | + 0.21 | — 0.07 | — 0.13 | 40 31.21 | 40 15.56 | 15.65 |
| W. | α Aquilæ | 44 52.90 | + 0.22 | — 0.07 | — 0.13 | 44 52.92 | 44 37.50 | 15.42 |
| W. | ε Draconis | 19 48 55.18 | — 0.63 | — 0.19 | — 0.36 | 19 48 54.00 | 19 48 38.29 | — 15.71 |

NORMAL EQUATIONS.

$$\begin{aligned}
 a_0 &= + 0^s.34 & c_0 &= + 0^s.05 & \Delta T_0 &= - 15^s.56 \text{ (assumed rate} = 0) \\
 0 &= - 0.045 + 1.771 da - 0.812 dc + 1.872 d\Delta T & da &= + 0^s.083 & \text{Weight of } a &= 1.18 \\
 0 &= - 0.689 - 0.812 da + 10.000 dc - 0.129 d\Delta T & dc &= + 0^s.075 & c &= 9.51 \\
 0 &= - 0.003 + 1.872 da - 0.129 dc + 6.588 d\Delta T & d\Delta T &= - 0^s.022 & \Delta T &= 4.55
 \end{aligned}$$

Observations and reductions for time taken at sending station—Continued.

VIRGINIA CITY, NEVADA, AUGUST 20, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT . |
|--------|-------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>s.</i> |
| W. | δ Ophiuchi | 16 07 59.40 | + 0.10 | — 0.02 | — 0.17 | 16 07 59.31 | 16 07 42.88 | — 16.43 |
| W. | η Draconis | 22 34.48 | — 0.12 | — 0.02 | — 0.36 | 22 33.98 | 22 17.75 | 16.23 |
| W. | σ Herculis | 30 18.46 | — 0.01 | — 0.04 | — 0.23 | 30 18.18 | 30 01.86 | 16.32 |
| W. | η Herculis | 38 50.58 | 0.00 | — 0.02 | — 0.22 | 38 50.34 | 38 33.92 | 16.42 |
| W. | κ Ophiuchi | 51 57.52 | + 0.07 | 0.00 | — 0.17 | 51 57.42 | 51 40.93 | 16.49 |
| W. | δ Herculis | 57 13.14 | + 0.02 | + 0.01 | — 0.20 | 57 12.97 | 56 56.36 | 16.61 |
| E. | α Herculis | 17 09 09.22 | + 0.06 | + 0.03 | + 0.17 | 17 09 09.48 | 17 08 53.03 | 16.45 |
| E. | 44 Ophiuchi | 18 54.92 | + 0.14 | + 0.02 | + 0.19 | 18 55.27 | 18 38.93 | 16.34 |
| E. | β Draconis | 27 51.54 | — 0.05 | + 0.09 | + 0.28 | 27 51.86 | 27 35.35 | 16.51 |
| E. | ω Draconis | 37 59.42 | — 0.20 | + 0.14 | + 0.47 | 37 59.83 | 37 43.41 | 16.42 |
| E. | μ Herculis | 17 41 47.22 | + 0.03 | + 0.07 | + 0.19 | 17 41 47.51 | 17 41 30.99 | — 16.52 |

NORMAL EQUATIONS.

$$a_0 = +0^s.16 \quad c_0 = +0^s.12 \quad \Delta T_0 = -16^s.47 - 0^s.020 (T - 18^h.1)$$

$$0 = +0^s.038 + 2.173 da - 0.038 dc + 2.102 d\Delta T \quad da = -0^s.014 \quad \text{Weight of } a = 1.53$$

$$0 = -0^s.546 - 0.038 da + 11.000 dc - 1.061 d\Delta T \quad dc = +0^s.049 \quad c = 10.79$$

$$0 = +0^s.100 + 2.102 da - 1.061 dc + 7.080 d\Delta T \quad d\Delta T = -0^s.002 \quad \Delta T = 4.95$$

VIRGINIA CITY, NEVADA, AUGUST 20, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT . |
|--------|----------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>s.</i> |
| E. | ϵ Lyrae, pr | 18 40 25.84 | 0.00 | + 0.12 | + 0.18 | 18 40 26.14 | 18 40 09.77 | — 16.37 |
| E. | β Lyrae | 45 41.46 | + 0.02 | + 0.13 | + 0.17 | 45 41.78 | 45 25.38 | 16.40 |
| E. | 50 Draconis | 50 46.34 | — 0.44 | + 0.41 | + 0.56 | 50 46.87 | 50 29.97 | 16.90 |
| E. | ζ Aquilæ | 59 52.58 | + 0.09 | + 0.15 | + 0.15 | 59 52.97 | 59 36.39 | 16.58 |
| E. | ι Lyrae | 19 03 04.30 | + 0.01 | + 0.21 | + 0.18 | 19 03 04.70 | 19 02 48.21 | 16.49 |
| E. | δ Sagittarii | 10 30.84 | + 0.17 | + 0.08 | + 0.15 | 10 31.24 | 10 14.71 | 16.53 |
| W. | τ Draconis | 18 18.60 | — 0.37 | + 0.28 | — 0.49 | 18 18.02 | 18 01.50 | 16.52 |
| W. | β Cygni | 25 54.56 | + 0.04 | + 0.09 | — 0.16 | 25 54.53 | 25 38.09 | 16.44 |
| W. | θ Cygni | 33 20.90 | — 0.05 | + 0.11 | — 0.22 | 33 20.74 | 33 04.21 | 16.53 |
| W. | γ Aquilæ | 40 32.14 | + 0.09 | + 0.06 | — 0.14 | 40 32.15 | 40 15.54 | 16.61 |
| W. | α Aquilæ | 19 44 53.96 | + 0.10 | + 0.06 | — 0.14 | 19 44 53.98 | 19 44 37.49 | — 16.49 |

NORMAL EQUATIONS.

$$a_0 = +0^s.16 \quad c_0 = +0^s.12 \quad \Delta T_0 = -16^s.47 - 0^s.020 (T - 18^h.1)$$

$$0 = -0^s.052 + 2.154 da + 0.402 dc + 2.090 d\Delta T \quad da = +0^s.031 \quad \text{Weight of } a = 1.53$$

$$0 = -0^s.245 + 0.402 da + 11.000 dc + 0.786 d\Delta T \quad dc = +0^s.022 \quad c = 10.89$$

$$0 = -0^s.005 + 2.090 da + 0.796 dc + 7.080 d\Delta T \quad d\Delta T = -0^s.011 \quad \Delta T = 5.04$$

Observations and reductions for time taken at sending station—Continued.

VIRGINIA CITY, NEVADA, AUGUST 25, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|-------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>s.</i> |
| W. | <i>a</i> Herculis | 17 09 11.34 | + 0.10 | + 0.02 | — 0.10 | 17 09 11.36 | 17 08 52.96 | — 18.40 |
| W. | <i>π</i> Herculis | 10 57.36 | + 0.01 | + 0.02 | — 0.12 | 10 57.27 | 10 38.93 | 18.34 |
| W. | 44 Ophiuchi | 18 57.26 | + 0.23 | + 0.01 | — 0.10 | 18 57.40 | 18 38.86 | 18.54 |
| W. | <i>β</i> Draconis | 27 53.74 | — 0.09 | + 0.03 | — 0.15 | 27 53.53 | 27 35.20 | 18.33 |
| W. | <i>f</i> Draconis | 32 48.30 | — 0.30 | + 0.05 | — 0.25 | 32 47.80 | 32 29.74 | 18.06 |
| E. | <i>μ</i> Herculis | 41 48.94 | + 0.05 | + 0.02 | + 0.11 | 41 49.12 | 41 30.90 | 18.22 |
| E. | 109 Herculis | 18 18 37.16 | + 0.07 | + 0.02 | + 0.10 | 18 18 37.35 | 18 18 18.98 | 18.37 |
| E. | <i>b</i> Draconis | 22 23.40 | — 0.15 | + 0.04 | + 0.18 | 22 23.47 | 22 04.86 | 18.61 |
| E. | 1 Aquilæ | 18 28 37.88 | + 0.17 | + 0.01 | + 0.09 | 18 28 38.15 | 18 28 19.82 | — 18.33 |

NORMAL EQUATIONS.

$$\begin{aligned}
 a_0 &= +0^s.17 & c_0 &= +0^s.03 & \Delta T_0 &= -18^s.31 + 0^s.050 (T - 18^h.7) \\
 0 &= -0^s.002 + 2.049 da - 1.550 dc + 1.950 d\Delta T & da &= +0^s.061 & \text{Weight of } a &= 1.17 \\
 0 &= -0^s.477 - 1.550 da + 9.000 dc - 0.339 d\Delta T & dc &= +0^s.063 & c &= 7.50 \\
 0 &= -0^s.025 + 1.950 da - 0.339 dc + 5.814 d\Delta T & d\Delta T &= -0^s.012 & \Delta T &= 3.79
 \end{aligned}$$

VIRGINIA CITY, NEVADA, AUGUST 25, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|-------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>s.</i> |
| E. | <i>ι</i> Lyræ | 19 03 06.24 | + 0.01 | + 0.01 | + 0.05 | 19 03 06.31 | 19 02 48.13 | — 18.18 |
| E. | <i>δ</i> Draconis | 12 51.72 | — 0.14 | + 0.01 | + 0.11 | 12 51.70 | 12 33.31 | 18.39 |
| E. | <i>τ</i> Draconis | 18 19.66 | — 0.21 | — 0.02 | + 0.15 | 18 19.58 | 18 01.21 | 18.37 |
| E. | <i>β</i> Cygni | 25 56.08 | + 0.02 | — 0.02 | + 0.05 | 25 56.13 | 25 38.03 | 18.10 |
| E. | <i>κ</i> Aquilæ | 30 24.02 | + 0.08 | — 0.01 | + 0.04 | 30 24.13 | 30 05.83 | 18.30 |
| E. | <i>θ</i> Cygni | 33 22.48 | — 0.03 | — 0.02 | + 0.07 | 33 22.50 | 33 04.12 | 18.38 |
| W. | <i>γ</i> Aquilæ | 40 33.66 | + 0.05 | — 0.01 | — 0.04 | 40 33.66 | 40 15.51 | 18.15 |
| W. | <i>α</i> Aquilæ | 44 55.68 | + 0.06 | — 0.01 | — 0.04 | 44 55.69 | 44 37.46 | 18.23 |
| W. | <i>ε</i> Draconis | 48 56.66 | — 0.16 | — 0.02 | — 0.13 | 48 56.35 | 48 38.01 | 18.34 |
| W. | <i>ψ</i> Cygni | 52 41.18 | — 0.04 | — 0.01 | — 0.07 | 52 41.06 | 52 22.86 | 18.20 |
| W. | <i>τ</i> Aquilæ | 58 16.68 | + 0.06 | — 0.01 | — 0.04 | 58 16.69 | 57 58.41 | 18.28 |
| W. | <i>θ</i> Aquilæ | 20 05 05.72 | + 0.07 | 0.00 | — 0.04 | 20 05 05.75 | 20 04 47.47 | — 18.28 |

NORMAL EQUATIONS.

$$\begin{aligned}
 a_0 &= +0^s.17 & c_0 &= +0^s.03 & \Delta T_0 &= -18^s.31 + 0^s.050 (T - 18^h.7) \\
 0 &= +0^s.124 + 2.652 da - 1.675 dc + 2.338 d\Delta T & da &= -0^s.060 & \text{Weight of } a &= 1.76 \\
 0 &= -0^s.236 - 1.675 da + 12.000 dc - 0.917 d\Delta T & dc &= +0^s.013 & c &= 10.88 \\
 0 &= -0^s.033 + 2.338 da - 0.917 dc + 7.495 d\Delta T & d\Delta T &= +0^s.025 & \Delta T &= 5.40
 \end{aligned}$$

Observations and reductions for time taken at sending station—Continued.

VIRGINIA, CITY, NEVADA, AUGUST 27, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT . |
|--------|---------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>s.</i> |
| W. | η Draconis | 16 22 35.76 | — 0.22 | — 0.12 | — 0.04 | 16 22 35.38 | 16 22 17.43 | — 17.95 |
| W. | σ Herculis | 30 20.26 | — 0.02 | — 0.08 | — 0.03 | 30 20.13 | 30 01.68 | 18.45 |
| W. | η Herculis | 38 52.26 | 0.00 | — 0.08 | — 0.03 | 38 52.15 | 38 33.76 | 18.39 |
| W. | κ Ophiuchi | 51 59.24 | + 0.13 | — 0.05 | — 0.02 | 51 59.29 | 51 40.82 | 18.47 |
| W. | α Herculis* | 17 09 11.34 | + 0.12 | — 0.06 | — 0.02 | 17 09 11.38 | 17 08 52.92 | [18.46] |
| W. | π Herculis | 10 57.40 | + 0.01 | — 0.09 | — 0.03 | 10 57.29 | 10 38.88 | 18.41 |
| E. | 44 Ophiuchi | 18 57.04 | + 0.26 | — 0.04 | + 0.02 | 18 57.28 | 18 38.82 | 18.46 |
| E. | β Draconis | 27 53.78 | — 0.10 | — 0.12 | + 0.03 | 27 53.59 | 27 35.13 | 18.46 |
| E. | ω Draconis | 38 01.68 | — 0.37 | — 0.17 | + 0.06 | 38 01.20 | 37 43.00 | 18.20 |
| E. | μ Herculis | 41 49.30 | + 0.06 | — 0.09 | + 0.02 | 41 49.29 | 41 30.86 | 18.43 |
| E. | γ Draconis | 53 59.56 | — 0.09 | — 0.14 | + 0.03 | 53 59.36 | 53 40.96 | 18.40 |
| E. | γ Sagittarii | 57 59.28 | + 0.29 | — 0.04 | + 0.02 | 57 59.55 | 57 41.29 | 18.26 |
| E. | σ Herculis | 18 02 55.46 | + 0.06 | — 0.11 | + 0.02 | 18 02 55.43 | 18 02 36.96 | 18.47 |
| E. | μ Sagittarii | 06 30.44 | + 0.25 | — 0.05 | + 0.02 | 06 30.66 | 06 12.26 | 18.40 |
| E. | Groombr. 2533 | 12 01.84 | — 0.02 | — 0.15 | + 0.03 | 12 01.70 | 11 43.15 | 18.55 |
| E. | 109 Herculis | 18 37.42 | + 0.09 | — 0.13 | + 0.02 | 18 37.40 | 18 18.95 | 18.45 |
| E. | 1 Aquilæ | 28 38.18 | + 0.20 | — 0.09 | + 0.02 | 28 38.31 | 28 19.80 | 18.51 |
| W. | β Cygni | 19 25 56.78 | + 0.06 | — 0.24 | — 0.02 | 19 25 56.58 | 19 25 38.01 | 18.51 |
| W. | θ Cygni | 33 23.08 | — 0.08 | — 0.35 | — 0.03 | 33 22.62 | 33 04.07 | 18.55 |
| W. | γ Aquilæ | 40 34.12 | + 0.13 | — 0.20 | — 0.02 | 40 34.03 | 40 15.50 | 18.53 |
| W. | α Aquilæ | 44 55.98 | + 0.14 | — 0.20 | — 0.02 | 44 55.90 | 44 37.44 | 18.46 |
| W. | ϵ Draconis | 19 48 57.40 | — 0.40 | — 0.58 | — 0.06 | 19 48 56.36 | 19 48 37.93 | — 18.43 |

* Marked doubtful by Mr. Maryatt; rejected.

NORMAL EQUATIONS.

$$a_0 = + 0^s.14 \quad c_0 = + 0^s.06 \quad \Delta T_0 = - 18^s.42 - 0^s.030 (T - 17^h.9)$$

$$\begin{aligned} 0 &= - 0.419 + 4.716 da + 2.547 dc + 4.464 d\Delta T & da &= + 0^s.128 & \text{Weight of } a &= 3.01 \\ 0 &= + 0.513 + 2.547 da + 21.000 dc + 1.109 d\Delta T & dc &= - 0^s.039 & c &= 19.44 \\ 0 &= - 0.266 + 4.464 da + 1.109 dc + 13.520 d\Delta T & d\Delta T &= - 0^s.020 & \Delta T &= 9.21 \end{aligned}$$

Observations and reductions for time taken at sending station—Continued.

VIRGINIA CITY, NEVADA, AUGUST 28, 1873.

| Clamp. | Name of star. | T. | | | Aa. | Bb. | Cc. | T'. | | | AR. | ΔT. | |
|--------|--------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| | | <i>h.</i> | <i>m.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h.</i> | <i>m.</i> | <i>s.</i> | <i>h.</i> | <i>m.</i> | <i>s.</i> |
| W. | τ Herculis | 16 | 16 | 15.24 | — 0.02 | — 0.01 | — 0.12 | 16 | 16 | 15.09 | 16 | 15 | 56.20 |
| W. | η Draconis | 22 | 36 | 06 | — 0.09 | — 0.01 | — 0.17 | 22 | 35.79 | 22 | 17 | 39 | 18.40 |
| W. | η Herculis | 38 | 52 | 56 | 0.00 | + 0.02 | — 0.10 | 38 | 52.48 | 38 | 33 | 73 | 18.75 |
| W. | κ Ophiuchi | 51 | 59 | 72 | + 0.06 | + 0.03 | — 0.08 | 51 | 59.73 | 51 | 40 | 80 | 18.93 |
| W. | θ Herculis | 17 | 09 | 11.70 | + 0.05 | + 0.04 | — 0.08 | 17 | 09 | 11.71 | 17 | 08 | 52.90 |
| W. | π Herculis | 10 | 57 | 56 | + 0.01 | + 0.09 | — 0.10 | 10 | 57.56 | 10 | 38 | 85 | 18.71 |
| E. | 44 Ophiuchi | 18 | 57 | 30 | + 0.11 | + 0.02 | + 0.09 | 18 | 57.52 | 18 | 38 | 81 | 18.71 |
| E. | β Draconis | 27 | 53 | 70 | — 0.04 | + 0.08 | + 0.13 | 27 | 53.87 | 27 | 35 | 10 | 18.77 |
| E. | α Ophiuchi | 29 | 22 | 54 | + 0.05 | + 0.04 | + 0.08 | 29 | 22.71 | 29 | 03 | 95 | 18.66 |
| E. | μ Herculis | 41 | 49 | 30 | + 0.03 | + 0.06 | + 0.09 | 41 | 49.48 | 41 | 30 | 84 | 18.64 |
| E. | γ Draconis | 53 | 59 | 60 | — 0.04 | + 0.09 | + 0.13 | 53 | 59.78 | 53 | 40 | 93 | 18.85 |
| E. | ο Herculis | 18 | 02 | 55.50 | + 0.02 | + 0.08 | + 0.09 | 18 | 02 | 55.69 | 18 | 02 | 36.94 |
| E. | μ Sagittarii | 06 | 30 | 80 | + 0.11 | + 0.04 | + 0.08 | 06 | 31.03 | 06 | 12 | 25 | 18.78 |
| E. | Groombr. 2533... | 12 | 01 | 94 | — 0.01 | + 0.10 | + 0.11 | 12 | 02.14 | 11 | 43 | 13 | 19.01 |
| E. | η Serpensis | 15 | 04 | 80 | + 0.08 | + 0.06 | + 0.08 | 15 | 05.02 | 14 | 46 | 23 | 18.79 |
| E. | 109 Herculis | 18 | 37 | 52 | + 0.04 | + 0.08 | + 0.09 | 18 | 37.73 | 18 | 18 | 93 | 18.80 |
| E. | b Draconis | 22 | 23 | 50 | — 0.07 | + 0.14 | + 0.15 | 22 | 23.72 | 22 | 04 | 75 | 18.97 |
| E. | 1 Aquilæ | 28 | 38 | 50 | + 0.09 | + 0.05 | + 0.08 | 28 | 38.72 | 28 | 19 | 79 | 18.93 |
| E. | α Lyræ | 32 | 58 | 52 | 0.00 | + 0.09 | + 0.03 | 32 | 58.69 | 32 | 40 | 03 | 18.66 |
| E. | ε Lyræ | 40 | 28 | 26 | 0.00 | + 0.09 | + 0.10 | 40 | 28.45 | 40 | 09 | 61 | 18.84 |
| W. | κ Aquilæ | 19 | 30 | 24.62 | + 0.08 | + 0.02 | — 0.08 | 19 | 30 | 24.64 | 19 | 30 | 05.81 |
| W. | θ Cygni | 33 | 23 | 08 | — 0.03 | + 0.05 | — 0.12 | 33 | 22.98 | 33 | 04 | 05 | 18.93 |
| W. | γ Aquilæ | 40 | 34 | 26 | + 0.06 | + 0.03 | — 0.08 | 40 | 34.27 | 40 | 15 | 49 | 18.78 |
| W. | α Aquilæ | 44 | 56 | 24 | + 0.06 | + 0.03 | — 0.08 | 44 | 56.25 | 44 | 37 | 44 | 18.81 |
| W. | ε Draconis | 19 | 48 | 57.08 | — 0.17 | + 0.08 | — 0.23 | 19 | 48 | 56.76 | 19 | 48 | 37.88 |

NORMAL EQUATIONS.

$$a_0 = + 0^s.06 \quad c_0 = 0 \quad \Delta T_0 = - 18^s.80 - 0^s.030 (T - 18^h.0)$$

$$\begin{aligned} 0 &= - 0^s.447 + 5.032 da + 2.017 dc + 5.679 d\Delta T & da &= + 0^s.056 & \text{Weight of } a &= 3.11 \\ 0 &= - 2^s.102 + 2.017 da + 25.000 dc + 2.906 d\Delta T & dc &= + 0^s.079 & c &= 24.15 \\ 0 &= - 0^s.564 + 5.679 da + 2.906 dc + 17.136 d\Delta T & d\Delta T &= + 0^s.001 & \Delta T &= 10.71 \end{aligned}$$

13 AST

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, AUGUST 20, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|--------------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | <i>a</i> ¹ Herculis | 9 01 47.71 | — 0.68 | — 0.15 | — 0.09 | 9 01 46.79 | 17 08 53.02 | + 8 07 6.23 |
| W. | Groom. 966, S. P. . . | 15 44.77 | — 5.14 | + 0.27 | + 0.35 | 15 40.25 | 5 22 46.52 | 6.27 |
| W. | <i>a</i> Ophiuchi | 21 58.84 | — 0.71 | — 0.14 | — 0.09 | 21 57.90 | 17 29 04.07 | 6.17 |
| W. | <i>ω</i> Draconis | 30 36.00 | + 1.92 | — 0.42 | — 0.25 | 30 37.25 | 37 43.50 | 6.25 |
| W. | <i>μ</i> Herculis | 34 25.43 | — 0.37 | — 0.19 | — 0.10 | 34 24.77 | 41 31.00 | 6.23 |
| W. | 88 Herculis | 39 39.72 | + 0.30 | — 0.25 | — 0.14 | 39 39.63 | 46 45.72 | 6.09 |
| W. | 89 Herculis | 43 14.02 | — 0.41 | — 0.18 | — 0.10 | 43 13.33 | 50 19.53 | 6.20 |
| W. | <i>γ</i> Draconis | 46 34.74 | + 0.44 | — 0.27 | — 0.14 | 46 34.77 | 53 41.27 | 6.50 |
| E. | 72 Ophiuchi | 54 15.99 | — 0.78 | — 0.09 | + 0.09 | 54 15.21 | 18 01 21.59 | 6.38 |
| E. | <i>η</i> Serpentis | 57 41.03 | — 1.02 | — 0.07 | + 0.09 | 57 40.03 | 04 46.28 | 6.25 |
| E. | Brad. 2313 | 10 14 54.73 | — 1.26 | — 0.03 | + 0.09 | 10 14 53.53 | 21 59.75 | 6.22 |
| E. | <i>a</i> Lyrae | 10 25 33.72 | — 0.07 | + 0.05 | + 0.12 | 10 25 33.82 | 18 32 40.18 | + 8 07 6.26 |
| Mean at 18 ^h .0 local sidereal time | | | | | | | | + 8 07 6.26 |

NORMAL EQUATIONS.

$$\begin{aligned}
 + 12.00 \delta t + 5.26 a - 2.01 c &= - 4.80 & \delta t &= + 0^s.26 \\
 + 5.26 \delta t + 15.92 a + 18.37 c &= - 20.59 & a &= - 1^s.479 \\
 - 2.01 \delta t + 18.37 a + 36.72 c &= - 24.48 & c &= + 0^s.088
 \end{aligned}$$

SALT LAKE CITY, UTAH, AUGUST 20, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|--------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | <i>τ</i> Draconis | 11 10 51.18 | + 3.68 | — 0.15 | + 0.61 | 11 10 55.32 | 19 18 01.57 | + 8 07 6.25 |
| E. | <i>a</i> Vulpeculæ | 16 21.54 | — 0.62 | — 0.08 | + 0.20 | 16 21.04 | 23 27.35 | 6.31 |
| E. | <i>μ</i> Aquilæ | 20 49.89 | — 1.12 | — 0.10 | + 0.18 | 20 48.85 | 27 55.30 | 6.45 |
| E. | <i>κ</i> Aquilæ | 23 00.89 | — 1.50 | — 0.10 | + 0.18 | 22 59.47 | 30 05.86 | 6.39 |
| E. | <i>θ</i> Cygni | 25 57.18 | + 0.50 | — 0.31 | + 0.28 | 25 57.65 | 33 04.27 | 6.62 |
| W. | <i>γ</i> Aquilæ | 33 10.36 | — 1.04 | — 0.17 | — 0.18 | 33 08.97 | 40 15.53 | 6.56 |
| W. | <i>a</i> Aquilæ | 37 32.32 | — 1.08 | — 0.16 | — 0.18 | 37 30.90 | 44 37.46 | 6.56 |
| W. | <i>ε</i> Draconis | 11 41 30.07 | + 2.84 | — 0.47 | — 0.52 | 11 41 31.92 | 19 48 38.12 | + 8 07 6.20 |
| Mean at 19 ^h .5 local sidereal time | | | | | | | | + 8 07 6.42 |

NORMAL EQUATIONS.

$$\begin{aligned}
 + 8.00 \delta t - 0.83 a + 3.17 c &= + 5.57 & \delta t &= + 0^s.42 \\
 + 0.83 \delta t + 7.09 a - 1.99 c &= - 14.00 & a &= - 1^s.999 \\
 + 3.17 \delta t - 1.99 a + 28.14 c &= + 10.29 & c &= + 0^s.178
 \end{aligned}$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, AUGUST 27, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|-------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | μ Herculis | 9 34 27.32 | — 0.41 | + 0.05 | — 0.17 | 9 34 26.79 | 17 41 30.87 | +8 07 04.08 |
| W. | 88 Herculis | 39 41.34 | + 0.32 | + 0.08 | — 0.22 | 39 41.52 | 46 45.53 | 04.01 |
| W. | 89 Herculis | 43 16.05 | — 0.45 | + 0.08 | — 0.17 | 43 15.51 | 50 19.42 | 03.91 |
| W. | γ Draconis | 46 36.47 | + 0.49 | + 0.16 | — 0.24 | 46 36.88 | 53 41.06 | 04.18 |
| W. | 72 Ophiuchi | 54 18.44 | — 0.86 | + 0.09 | — 0.15 | 54 17.52 | 18 01 21.54 | 04.02 |
| W. | μ Sagittarii | 59 09.94 | — 1.54 | + 0.06 | — 0.16 | 59 08.30 | 06 12.26 | 03.96 |
| E. | η Serpentis | 10 07 43.06 | — 1.12 | + 0.08 | + 0.15 | 10 07 42.17 | 14 46.19 | 04.02 |
| E. | Brad. 2313 | 14 56.84 | — 1.38 | + 0.06 | + 0.15 | 14 55.67 | 21 59.67 | 04.00 |
| E. | 1 Aquilæ | 21 16.78 | — 1.23 | + 0.08 | + 0.15 | 21 15.78 | 28 19.80 | 04.02 |
| E. | α Lyrae | 25 35.59 | — 0.08 | + 0.18 | + 0.19 | 25 35.88 | 32 40.06 | 04.18 |
| E. | ζ^1 Lyrae | 33 21.22 | — 0.11 | + 0.20 | + 0.19 | 33 21.50 | 40 25.70 | 04.20 |
| E. | ζ^2 Lyrae | 33 23.08 | — 0.11 | + 0.23 | + 0.19 | 33 23.39 | 40 27.54 | 04.15 |
| E. | β Lyrae | 38 21.03 | — 0.26 | + 0.22 | + 0.19 | 38 21.18 | 45 25.28 | 04.10 |
| E. | 50 Draconis | 10 43 20.71 | + 3.61 | + 0.61 | + 0.59 | 10 43 25.52 | 18 50 29.46 | +8 07 03.94 |
| Mean at 18 ^h .3 local sidereal time | | | | | | | | +8 07 04.06 |

NORMAL EQUATIONS.

$$\begin{aligned}
 +14.00 \delta t + 1.93 a + 4.55 c &= -1.67 & \delta t &= +0^s.06 \\
 +1.93 \delta t + 8.24 a - 7.40 c &= -14.35 & a &= -1^s.620 \\
 +4.55 \delta t - 7.40 a + 34.42 c &= +17.42 & c &= +6^s.149
 \end{aligned}$$

SALT LAKE CITY, UTAH, AUGUST 27, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|---------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | θ Aquilæ | 11 57 44.17 | — 1.20 | + 0.05 | + 0.21 | 11 57 41.23 | 20 04 47.44 | +8 07 04.21 |
| E. | α Capricorni | 12 03 59.96 | — 1.49 | + 0.04 | + 0.21 | 12 03 58.72 | 11 02.96 | 04.24 |
| E. | β Capricorni | 06 52.14 | — 1.55 | + 0.04 | + 0.21 | 06 50.84 | 13 55.04 | 04.20 |
| E. | π Capricorni | 13 02.89 | — 1.64 | + 0.04 | + 0.22 | 13 01.51 | 20 05.69 | 04.18 |
| E. | ω Cygni | 16 06.60 | + 0.40 | + 0.12 | + 0.31 | 16 07.43 | 23 11.62 | 04.19 |
| E. | ϵ Delphini | 20 07.43 | — 0.92 | + 0.07 | + 0.21 | 20 06.79 | 27 11.01 | 04.22 |
| W. | α Cygni | 30 04.12 | + 0.16 | + 0.07 | — 0.29 | 30 04.06 | 37 08.38 | 04.32 |
| W. | ϵ Aquarii | 33 47.90 | — 1.42 | + 0.02 | — 0.21 | 33 46.29 | 40 50.54 | 04.25 |
| W. | μ Aquarii | 38 48.24 | — 1.40 | + 0.60 | — 0.21 | 38 46.63 | 45 50.70 | 04.07 |
| W. | ν Cygni | 12 45 24.70 | — 0.00 | + 0.00 | — 0.27 | 12 45 24.43 | 20 52 28.58 | +8 07 04.15 |
| Mean at 20 ^h .5 local sidereal time | | | | | | | | +8 07 04.20 |

NORMAL EQUATIONS.

$$\begin{aligned}
 +10.00 \delta t + 5.04 a + 1.91 c &= -6.64 & \delta t &= +0^s.20 \\
 +5.04 \delta t + 4.26 a + 2.09 c &= -6.25 & a &= -1^s.796 \\
 +1.91 \delta t + 2.09 a + 13.40 c &= -0.62 & c &= +0^s.206
 \end{aligned}$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, AUGUST 28, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|---------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | 88 Herculis | 9 39 41.30 | + 0.28 | + 0.10 | — 0.25 | 9 39 41.43 | 17 46 45.50 | +8 07 04.07 |
| W. | 89 Herculis | 43 16.02 | — 0.50 | + 0.07 | — 0.18 | 43 15.41 | 50 19.40 | 03.99 |
| W. | γ Draconis | 46 36.45 | + 0.53 | + 0.11 | — 0.27 | 46 36.82 | 53 41.03 | 04.21 |
| W. | 72 Ophiuchi | 54 18.53 | — 0.94 | + 0.06 | — 0.17 | 54 17.48 | 18 01 21.53 | 04.05 |
| W. | μ ¹ Sagittarii | 59 10.02 | — 1.69 | + 0.04 | — 0.18 | 59 08.19 | 06 12.25 | 04.06 |
| W. | η Serpentis | 10 07 43.17 | — 1.23 | + 0.05 | + 0.17 | 10 07 42.16 | 14 46.18 | 04.02 |
| W. | Brad. 2313 | 14 56.94 | — 1.51 | + 0.04 | + 0.17 | 14 55.64 | 21 59.66 | 04.02 |
| W. | 1 Aquilæ | 21 16.91 | — 1.35 | + 0.05 | + 0.17 | 21 15.78 | 28 19.79 | 04.01 |
| W. | α Lyræ | 25 35.66 | — 0.09 | + 0.09 | + 0.21 | 25 35.87 | 32 40.04 | 04.17 |
| W. | ζ ¹ Lyræ | 33 21.41 | — 0.12 | + 0.09 | + 0.21 | 33 21.59 | 40 25.67 | 04.08 |
| W. | ζ ² Lyræ | 33 23.18 | — 0.12 | + 0.09 | + 0.21 | 33 23.36 | 40 27.52 | 04.16 |
| W. | β Lyræ | 38 21.02 | — 0.28 | + 0.08 | + 0.20 | 38 21.02 | 45 25.26 | 04.24 |
| W. | 50 Draconis | 10 43 20.54 | + 3.97 | + 0.22 | + 0.65 | 10 43 25.38 | 18 50 29.38 | +8 07 04.00 |
| Mean at 18 ^h .0 local sidereal time | | | | | | | | +8 07 04.08 |

NORMAL EQUATIONS.

$$\begin{aligned}
 +13.00 \delta t + 1.68 a + 5.68 c &= -1.03 & \delta t &= +0^s.08 \\
 +1.68 \delta t + 8.18 a - 7.10 c &= -15.59 & a &= -1^s.780 \\
 +5.68 \delta t - 7.10 a + 33.14 c &= +18.55 & c &= +0^s.166
 \end{aligned}$$

SALT LAKE CITY, UTAH, AUGUST 28, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|---------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | θ Aquilæ | 11 57 44.36 | — 1.25 | + 0.04 | + 0.20 | 11 57 43.35 | 20 04 47.43 | +8 07 04.08 |
| E. | α ² Capricorni | 12 04 00.09 | — 1.55 | + 0.03 | + 0.20 | 12 03 58.77 | 11 02.95 | 04.18 |
| E. | β Capricorni | 06 52.40 | — 1.61 | + 0.03 | + 0.20 | 06 51.02 | 13 55.04 | 04.02 |
| E. | π Capricorni | 13 03.03 | — 1.70 | + 0.03 | + 0.21 | 13 01.52 | 20 05.69 | 04.07 |
| E. | ω Cygni | 16 06.66 | + 0.41 | + 0.08 | + 0.30 | 16 07.45 | 23 11.61 | 04.16 |
| E. | ε Delphini | 20 07.55 | — 0.95 | + 0.04 | + 0.20 | 20 06.84 | 27 11.00 | 04.16 |
| W. | α Cygni | 30 04.14 | + 0.17 | + 0.12 | — 0.27 | 30 04.16 | 37 08.37 | 04.21 |
| W. | ε Aquarii | 33 47.99 | — 1.48 | + 0.08 | — 0.20 | 33 46.39 | 40 50.54 | 04.15 |
| W. | μ Aquarii | 38 48.24 | — 1.46 | + 0.06 | — 0.20 | 38 46.64 | 45 50.70 | 04.06 |
| W. | ν Cygni | 12 45 24.71 | — 0.00 | + 0.10 | — 0.26 | 12 45 24.55 | 20 52 28.57 | +8 07 04.02 |
| Mean at 20 ^h .5 local sidereal time | | | | | | | | +8 07 04.11 |

NORMAL EQUATIONS.

$$\begin{aligned}
 +10.00 \delta t + 5.04 a + 1.91 c &= -7.93 & \delta t &= +0^s.11 \\
 +5.04 \delta t + 4.26 a + 2.09 c &= -7.07 & a &= -1^s.871 \\
 +1.91 \delta t + 2.09 a + 13.40 c &= -1.07 & c &= +0^s.195
 \end{aligned}$$

NOTE.—The observations taken at Salt Lake City August 15 and 18 are printed in the report on Fort Union; those of August 25 in the report on Labran.

The following tables give the corrections and rates of the chronometers used at Virginia City and Salt Lake City :

CHRONOMETER AT VIRGINIA CITY.—NEGUS, No. 1499.

| Date. | Local sidereal time. | Correction of chronometer. | Adopted hourly rate. |
|---------|----------------------|----------------------------|----------------------|
| 1873. | <i>h.</i> | <i>s.</i> <i>s.</i> | <i>s.</i> |
| Aug. 15 | 18.5 | — 41.943 ± 0.019 | 0.000 |
| Aug. 18 | 18.5 | — 15.571 ± 0.018 | 0.000 |
| Aug. 20 | 18.1 | — 16.476 ± 0.017 | — 0.020 |
| Aug. 25 | 18.7 | — 18.304 ± 0.018 | + 0.050 |
| Aug. 27 | 17.9 | — 18.440 ± 0.017 | — 0.030 |
| Aug. 28 | 18.0 | — 18.799 ± 0.016 | — 0.030 |

CHRONOMETER AT SALT LAKE CITY.—NEGUS, No. 1511.

| Date. | Local sidereal time. | Correction of chronometer. | Adopted hourly rate. |
|---------|----------------------|-------------------------------|----------------------|
| 1873. | <i>h.</i> | <i>h.</i> <i>m.</i> <i>s.</i> | <i>s.</i> |
| Aug. 15 | 18.0 | + 8 07 06.40 | — 0.011 |
| Aug. 18 | 18.75 | | + 0.003 |
| Aug. 20 | 18.75 | | + 0.002 |
| Aug. 25 | 19.5 | | — 0.008 |
| Aug. 27 | 19.4 | | — 0.003 |
| Aug. 28 | 19.5 | + 8 07 04.10 | 0.000 |

Final results of longitude.

| Signals sent from— | Recorded at— | Mean of signals sent and received. | Time-corrections. | Corrected time. | Difference of longitude. | Double-wave time. | Means. |
|--------------------|-----------------|------------------------------------|-------------------|-----------------|--------------------------|-------------------|--------------|
| | | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> | | <i>m. s.</i> |
| August 15, 1873: | | | | | | | |
| Salt Lake City { | Salt Lake City. | 10 59 16.69 | + 8 07 06.39 | 19 06 23.08 | | | |
| Virginia City { | Virginia City.. | 18 36 03.43 | — 0 00 41.94 | 18 35 21.49 | 31 01.59 | | |
| Salt Lake City { | Salt Lake City. | 11 04 43.63 | + 8 07 06.39 | 19 11 50.02 | | | |
| Virginia City { | Virginia City.. | 18 41 30.24 | — 0 00 41.94 | 18 40 48.30 | 31 01.72 | .... | 31 01.655 |
| August 18, 1873: | | | | | | | |
| Salt Lake City { | Salt Lake City. | 10 46 28.69 | + 8 07 05.90 | 18 53 34.59 | | | |
| Virginia City { | Virginia City.. | 18 22 48.73 | — 0 00 15.57 | 18 22 33.16 | 31 01.43 | | |
| Salt Lake City { | Salt Lake City. | 10 52 40.30 | + 8 07 05.90 | 18 59 46.20 | | | |
| Virginia City { | Virginia City.. | 18 29 00.27 | — 0 00 15.57 | 18 28 44.70 | 31 01.50 | .... | 31 01.465 |
| August 20, 1873: | | | | | | | |
| Salt Lake City { | Salt Lake City. | 10 39 59.09 | + 8 07 06.34 | 18 47 05.43 | | | |
| Virginia City { | Virginia City.. | 18 16 20.52 | — 0 00 16.48 | 18 16 04.04 | 31 01.39 | | |
| Salt Lake City { | Salt Lake City. | 10 50 38.60 | + 8 07 06.34 | 8 57 44.94 | | | |
| Virginia City { | Virginia City.. | 18 26 59.82 | — 0 00 16.48 | 18 26 43.34 | 31 01.60 | .... | 31 01.495 |
| August 25, 1873: | | | | | | | |
| Salt Lake City { | Salt Lake City. | 11 07 48.10 | + 8 07 04.37 | 19 14 52.47 | | | |
| Virginia City { | Virginia City.. | 18 44 09.32 | — 0 00 18.30 | 18 43 51.02 | 31 01.45 | | |
| Salt Lake City { | Salt Lake City. | 11 13 38.97 | + 8 07 04.37 | 19 20 43.34 | | | |
| Virginia City { | Virginia City.. | 18 49 59.96 | — 0 00 18.29 | 18 49 41.67 | 31 01.67 | .... | 31 01.560 |
| August 27, 1873: | | | | | | | |
| Salt Lake City { | Salt Lake City. | 11 34 20.90 | + 8 07 04.13 | 19 41 25.03 | | | |
| Virginia City { | Virginia City.. | 19 10 42.01 | — 0 00 18.48 | 19 10 23.53 | 31 01.50 | | |
| Salt Lake City { | Salt Lake City. | 11 40 08.93 | + 8 07 04.13 | 19 47 13.06 | | | |
| Virginia City { | Virginia City.. | 19 16 29.97 | — 0 00 18.48 | 19 16 11.49 | 31 01.57 | .... | 31 01.535 |
| August 28, 1873: | | | | | | | |
| Salt Lake City { | Salt Lake City. | 11 34 06.19 | + 8 07 04.10 | 19 41 10.29 | | | |
| Virginia City { | Virginia City.. | 19 10 27.46 | — 0 00 18.84 | 19 10 08.62 | 31 01.67 | | |
| Salt Lake City { | Salt Lake City. | 11 39 48.68 | + 8 07 04.10 | 19 46 52.78 | | | |
| Virginia City { | Virginia City.. | 19 16 09.95 | — 0 00 18.84 | 19 15 51.11 | 31 01.67 | .... | 31 01.670 |

Virginia City west of Salt Lake City0^h 31^m 01^s.563 ± 0^s.025 (by sums of errors).
 ± 0^s.023 (by sums of squares).

Salt Lake City west of Greenwich7^h 27^m 34^s.86.

Virginia City west of Greenwich7^h 58^m 36^s.423, or 119° 39' 06".35.

Virginia City west of Washington2^h 50^m 24^s.303, or 42° 36' 04".55.

ASTRONOMICAL STATION—VIRGINIA CITY, NEVADA—1873. 199

*Mean places of stars for 1873.0 used for determination of latitude of Virginia City,
Nevada.*

| No. of pair. | No. in B. A. C. | Right ascension. | Declination. | No. of pair. | No. in B. A. C. | Right ascension. | Declination. |
|--------------|-----------------|------------------|--------------|--------------|-----------------|------------------|--------------|
| | | <i>h. m. s.</i> | <i>° ' "</i> | | | <i>h. m. s.</i> | <i>° ' "</i> |
| 1 | 6021 | 17 41 29 | 27 47 47.24 | 20 | 6986 | 20 12 24 | 39 58 22.84 |
| | 6052 | 46 02 | 50 48 42.76 | | 7001 | 14 20 | 38 36 27.10 |
| 2 | 6087 | 17 53 39 | 30 12 04.70 | 21 | 7008 | 20 15 39 | 39 00 13.62 |
| | 6129 | 59 50 | 48 27 33.02 | | 7022 | 17 40 | 39 51 04.58 |
| 3 | 6185 | 18 07 56 | 54 14 56.46 | 22 | 7062 | 20 23 09 | 48 57 46.08 |
| | 6223 | 13 57 | 24 23 41.64 | | 7067 | 24 12 | 29 56 45.58 |
| 4 | 6238 | 18 16 04 | 28 48 40.10 | 23 | 7164 | 20 35 54 | 31 51 23.90 |
| | 6252 | 17 56 | 49 39 50.26 | | 7198 | 40 25 | 46 50 12.56 |
| 5 | 6349 | 18 31 07 | 38 47 32.54 | 24 | 7218 | 20 42 40 | 52 32 13.18 |
| | 6357 | 33 55 | 39 33 26.28 | | 7246 | 46 42 | 26 37 21.94 |
| 6 | 6355 | 18 32 38 | 38 40 00.02 | 25 | 7277 | 20 52 26 | 40 40 44.48 |
| | 6390 | 40 08 | 39 32 18.94 | | 7320 | 58 09 | 38 09 23.70 |
| 7 | 6404 | 18 42 09 | 41 18 23.16 | 26 | 7368 | 21 07 32 | 29 42 25.30 |
| | 6456 | 49 17 | 36 48 50.68 | | 7411 | 15 06 | 48 58 25.82 |
| 8 | 6466 | 18 50 04 | 36 44 19.10 | 27 | 7450 | 21 20 33 | 18 49 34.90 |
| | 6473 | 50 48 | 41 26 28.68 | | 7476 | 23 55 | 59 11 52.84 |
| 9 | 6497 | 18 55 13 | 31 58 08.16 | 28 | 7495 | 21 27 29 | 59 53 59.14 |
| | 6520 | 57 51 | 46 45 20.56 | | 7520 | 31 49 | 18 44 54.76 |
| 10 | 6547 | 19 01 35 | 28 25 48.64 | *29 | 7559 | 21 37 16 | 40 29 53.02 |
| | 6566 | 05 19 | 50 09 34.52 | | 7566 | 38 10 | 37 42 10.92 |
| 11 | 6581 | 19 09 26 | 38 55 43.64 | 30 | 7598 | 21 42 06 | 48 43 20.63 |
| | 6624 | 14 43 | 40 07 38.44 | | 7607 | 44 14 | 29 35 01.76 |
| 12 | 6656 | 19 19 56 | 43 08 30.58 | 31 | 7695 | 21 59 54 | 46 37 01.26 |
| | 6667 | 21 35 | 36 03 52.02 | | 7721 | 22 03 36 | 32 33 10.36 |
| 13 | 6681 | 19 23 29 | 57 46 18.90 | 32 | 7742 | 22 05 43 | 15 24 56.48 |
| | 6695 | 26 31 | 20 39 39.60 | | 7775 | 09 50 | 62 31 57.04 |
| 14 | 6718 | 19 30 33 | 42 08 08.36 | 33 | 8128 | 23 13 50 | 41 22 59.44 |
| | 6722 | 31 15 | 36 39 50.42 | | 8136 | 14 46 | 37 29 21.22 |
| 15 | 6741 | 19 34 25 | 49 55 39.90 | 34 | 8195 | 23 25 03 | 38 32 19.46 |
| | 6740 | 34 22 | 29 51 42.58 | | 8212 | 28 25 | 39 32 11.84 |
| 16 | 6754 | 19 36 55 | 45 13 29.92 | 35 | 8231 | 23 32 59 | 49 46 07.08 |
| | 6784 | 41 36 | 33 26 00.74 | | 8256 | 37 36 | 28 39 29.74 |
| 17 | 6817 | 19 46 16 | 40 16 40.06 | 36 | 8284 | 23 43 14 | 28 08 08.52 |
| | 6849 | 51 19 | 38 09 01.08 | | 8307 | 47 12 | 50 48 57.16 |
| 18 | 6896 | 19 58 13 | 16 45 56.90 | 37 | 8326 | 23 51 42 | 49 43 54.96 |
| | 6932 | 20 03 31 | 61 37 37.32 | | 8374 | 0 00 01 | 28 19 14.46 |
| 19 | 6959 | 20 09 00 | 51 04 56.40 | | | | |
| | 6973 | 10 30 | 27 25 33.24 | | | | |

* Instead of B. A. C. 7566 the star Rümcker 9430 was twice used by accident; its position from the catalogue of 981 stars is $AR = 21^h 38^m 21^s$, declination = $37^\circ 43' 28''.80$. It is a well-determined star. The pair B. A. C. 7559 and Rümcker 9430 is designated as 29^a.

The pair formed from 6456 B. A. C. (pair 7), and 6473 B. A. C. (pair 8), is denoted by 7^a.

Observations and computations for latitude.

VIRGINIA CITY, NEVADA.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|--------------------|--------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|--------|--------|-------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1873. August 13 | | <i>t.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | " | ° ' " |
| | 6547 | 20.668 | 27.0 | 10.7 | | | | | | |
| | 6566 | 20.986 | 15.0 | 22.7 | | 39 17 49.21 | — 0 12.26 | + 1.99 | ..... | 39 17 38.94 |
| | 6581 | 13.785 | 20.6 | 20.3 | | | | | | |
| | 6624 | 35.880 | 12.8 | 28.3 | | 31 48.88 | — 14 11.71 | — 3.52 | ..... | 33.65 |
| | 6656 | 35.670 | 29.0 | 29.8 | | | | | | |
| | 6667 | 6.633 | 22.4 | 35.3 | | 36 19.07 | — 18 39.31 | — 3.17 | ..... | 36.59 |
| | 6681 | 16.950 | 29.7 | 29.0 | | | | | | |
| | 6695 | 24.002 | 22.3 | 35.1 | | 13 06.44 | + 4 31.84 | — 2.80 | ..... | 35.48 |
| | 6718 | 23.035 | 31.2 | 27.0 | | | | | | |
| | 6722 | 12.850 | 22.0 | 36.2 | | 24 07.08 | — 6 32.61 | — 2.31 | ..... | 32.16 |
| | 6754 | 24.629 | 31.5 | 26.7 | | | | | | |
| | 6777 | 21.043 | 23.4 | 35.0 | | 19 52.84 | — 2 18.23 | — 1.57 | ..... | 33.04 |
| | 6817 | 14.350 | 32.9 | 25.6 | | | | | | |
| | 6849 | 21.542 | 31.7 | 26.8 | | 12 58.14 | + 4 37.23 | + 2.82 | ..... | 38.19 |
| | 6896 | 25.043 | 28.0 | 30.3 | | | | | | |
| | 6932 | 16.174 | 30.5 | 28.1 | | 11 53.85 | + 5 41.89 | + 0.02 | ..... | 35.76 |
| | 6959 | 17.882 | 29.0 | 29.8 | | | | | | |
| | 6973 | 21.335 | 34.5 | 24.2 | | 15 22.06 | + 2 13.12 | + 2.20 | ..... | 37.38 |
| | 6986 | 28.657 | 25.1 | 33.4 | | | | | | |
| | 7001 | 28.771 | 33.6 | 25.0 | | 17 32.34 | + 0 04.39 | + 0.07 | ..... | 36.80 |
| | 7008 | 10.235 | 34.0 | 24.7 | | | | | | |
| | 7022 | 22.977 | 24.0 | 34.7 | | 25 46.46 | — 8 11.17 | — 0.32 | ..... | 34.97 |
| | 7062 | 28.794 | 29.0 | 29.8 | | | | | | |
| | 7067 | 13.623 | 25.0 | 33.8 | | 27 23.02 | — 9 44.81 | — 2.22 | ..... | 35.99 |
| | 7164 | 19.711 | 28.4 | 30.3 | | | | | | |
| | 7198 | 24.914 | 34.3 | 24.8 | | 20 55.30 | — 3 20.56 | + 1.76 | ..... | 36.50 |
| | 7218 | 34.484 | 29.0 | 30.0 | | | | | | |
| | 7246 | 7.698 | 30.3 | 28.7 | | 34 47.92 | — 17 12.55 | + 0.14 | ..... | 35.51 |
| | 7277 | 26.445 | 27.2 | 31.8 | | | | | | |
| | 7320 | 14.670 | 30.4 | 28.7 | | 25 11.08 | — 7 33.90 | — 0.67 | ..... | 36.51 |
| | 7368 | 22.717 | 33.2 | 25.3 | | | | | | |
| | 7411 | 27.253 | 23.9 | 35.4 | | 20 32.24 | — 2 54.85 | — 0.83 | ..... | 36.56 |
| | 7450 | 36.600 | 32.0 | 27.2 | | | | | | |
| | 7476 | 10.567 | 27.9 | 31.2 | | 00 50.25 | + 16 43.54 | + 0.25 | ..... | 34.14 |
| | 7495 | 20.311 | 29.6 | 29.4 | | | | | | |
| | 7520 | 17.227 | 40.4 | 18.3 | | 19 33.34 | — 1 58.88 | + 5.16 | ..... | 39.62 |
| | 7559 | 15.847 | 31.0 | 28.0 | | | | | | |
| | 7566 | 32.661 | 27.9 | 31.2 | | 39 06 47.43 | + 10 48.14 | — 0.07 | | 39 17 35.50 |

LATITUDE DETERMINATIONS.

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Observations and computations—Continued.

VIRGINIA CITY, NEVADA.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|--------------------|-----------------|----------------------|-----------|-----------|----------|-----------------------------|----------------------|----------|----------|----------------------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1873. August 13 | | <i>t.</i> | <i>d.</i> | <i>d.</i> | | <i>o</i> <i>i</i> <i>"</i> | <i>'</i> <i>"</i> | <i>"</i> | <i>"</i> | <i>o</i> <i>i</i> <i>"</i> |
| | 7598 | 15.359 | 32.2 | 26.8 | | | | | | |
| | 7607 | 28.273 | 27.9 | 31.1 | | 39 09 17.63 | + 8 17.81 | + 0.51 | ..... | 39 17 35.95 |
| | 7695 | 34.600 | 33.2 | 26.1 | | | | | | |
| | 7721 | 7.183 | 23.9 | 36.0 | | 39 35 11.98 | — 17 36.86 | — 1.16 | ..... | 33.96 |
| | 7742 | 32.912 | 32.7 | 26.9 | | | | | | |
| | 7775 | 3.254 | 29.9 | 29.7 | | 38 58 32.70 | + 19 03.29 | + 1.39 | ..... | 37.38 |
| | 8128 | 26.451 | 35.5 | 26.4 | | | | | | |
| | 8136 | 32.943 | 17.9 | 44.0 | | 39 26 15.55 | — 8 40.70 | — 3.73 | ..... | 31.12 |
| | 8195 | 35.651 | 30.0 | 31.3 | | | | | | |
| | 8212 | 11.959 | 27.2 | 34.1 | | 02 20.78 | + 15 13.27 | — 1.90 | ..... | 32.15 |
| | 8231 | 16.941 | 30.1 | 31.0 | | | | | | |
| | 8256 | 24.289 | 30.7 | 30.3 | | 12 53.44 | + 4 43.25 | — 0.12 | ..... | 36.57 |
| | 8284 | 10.973 | 26.5 | 34.3 | | | | | | |
| | 8307 | 28.051 | 31.2 | 29.0 | | 28 37.68 | — 10 58.32 | — 1.43 | ..... | 37.93 |
| | 8326 | 14.877 | 28.7 | 32.0 | | | | | | |
| | 8374 | 39.724 | 28.7 | 32.0 | | 01 39.57 | + 15 57.80 | — 1.53 | ..... | 35.84 |
| August 16 | 6087 | 16.180 | 23.0 | 29.0 | | | | | | |
| | 6129 | 19.839 | 28.7 | 23.5 | | 19 57.19 | — 2 21.04 | — 0.19 | ..... | 35.96 |
| | 6185 | 28.744 | 27.0 | 25.1 | | | | | | |
| | 6223 | 25.842 | 25.1 | 27.0 | | 19 27.23 | — 1 51.87 | — 0.00 | ..... | 35.36 |
| | 6238 | 21.769 | 21.8 | 30.3 | | | | | | |
| | 6252 | 16.740 | 29.0 | 23.2 | | 14 23.50 | + 3 13.86 | — 0.63 | ..... | 36.73 |
| | 6349 | 20.267 | 21.1 | 31.2 | | | | | | |
| | 6357 | 9.378 | 24.2 | 28.0 | | 10 37.95 | + 6 59.74 | — 3.22 | ..... | 34.47 |
| | 6355 | 20.117 | 25.3 | 26.8 | | | | | | |
| | 6390 | 8.503 | 22.9 | 29.8 | | 06 18.14 | + 11 18.98 | — 1.94 | ..... | 35.18 |
| | 6404 | 5.503 | 29.8 | 22.9 | | | | | | |
| | 6456 | 27.049 | 25.7 | 26.8 | | 03 45.43 | + 13 51.89 | + 1.34 | ..... | 38.66 |
| | 6466 | 30.572 | 25.7 | 26.8 | | | | | | |
| | 6473 | 11.762 | 24.7 | 28.0 | | 05 32.41 | + 12 05.08 | — 1.02 | ..... | 36.47 |
| | 6497 | 15.293 | 25.3 | 27.0 | | | | | | |
| | 6520 | 21.943 | 25.5 | 26.9 | | 21 52.74 | — 4 16.34 | — 0.72 | ..... | 35.68 |
| | 6547 | 20.709 | 29.6 | 23.0 | | | | | | |
| | 6566 | 21.081 | 22.0 | 30.5 | | 17 49.86 | — 0 14.34 | — 0.44 | ..... | 35.08 |
| | 6581 | 13.331 | 29.1 | 23.2 | | | | | | |
| | 6624 | 25.479 | 28.2 | 24.4 | | 31 49.56 | — 14 13.75 | + 2.25 | ..... | 38.00 |
| | 6556 | 36.541 | 26.0 | 26.5 | | | | | | |
| | 6667 | 7.416 | 28.0 | 24.7 | | 39 36 19.76 | — 18 42.70 | + 0.65 | ..... | 39 17 37.71 |

Observations and computations—Continued.

VIRGINIA CITY, NEVADA.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|--------------------|--------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|--------|--------|-------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1873. August 16 | | <i>t.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | " | ° ' " |
| | 6681 | 17.593 | 25.1 | 26.3 | | 39 13 07.12 | + 4 29.29 | - 3.33 | ..... | 39 17 33.08 |
| | 6695 | 24.379 | 19.1 | 33.3 | | | | | | |
| | 6718 | 22.800 | 27.0 | 25.3 | | 24 07.80 | - 6 30.68 | - 2.92 | +0.06 | 34.26 |
| | 6722 | 12.665 | 19.0 | 33.3 | | | | | | |
| | 6741 | 30.378 | 26.2 | 26.1 | | 25 43.32 | - 8 03.28 | - 1.32 | +0.35 | 36.07 |
| | 6740 | 17.763 | 23.3 | 29.0 | | | | | | |
| | 6817 | 14.430 | 25.9 | 26.7 | | 12 58.90 | + 4 38.54 | - 5.93 | ..... | 31.51 |
| | 6849 | 21.656 | 13.8 | 38.7 | | | | | | |
| | 6896 | 23.870 | 27.0 | 25.3 | | 11 54.28 | + 5 43.39 | - 1.88 | ..... | 35.79 |
| | 6932 | 24.962 | 21.3 | 31.1 | | | | | | |
| | 6959 | 17.659 | 27.0 | 25.3 | | 15 22.84 | + 2 16.28 | - 4.26 | ..... | 34.86 |
| | 6973 | 21.194 | 16.1 | 36.2 | | | | | | |
| | 6986 | 28.548 | 29.1 | 23.3 | | 17 33.15 | + 0 04.36 | - 1.97 | ..... | 35.54 |
| | 7001 | 28.661 | 19.1 | 33.4 | | | | | | |
| | 7008 | 10.136 | 19.1 | 33.3 | | 25 47.26 | - 8 09.83 | - 2.25 | ..... | 35.18 |
| | 7022 | 22.843 | 28.5 | 24.0 | | | | | | |
| | 7062 | 27.304 | 25.0 | 27.7 | | 27 23.84 | - 9 46.85 | - 2.32 | ..... | 34.67 |
| | 7067 | 12.080 | 22.7 | 30.0 | | | | | | |
| | 7164 | 20.888 | 22.7 | 30.0 | | 20 56.13 | - 3 20.02 | - 0.83 | ..... | 35.28 |
| | 7198 | 26.077 | 28.2 | 24.5 | | | | | | |
| | 7218 | 33.122 | 26.1 | 26.6 | | 34 48.81 | - 17 13.05 | + 1.46 | ..... | 37.22 |
| | 7246 | 6.323 | 29.8 | 23.0 | | | | | | |
| | 7277 | 25.670 | 26.2 | 26.3 | | 25 11.94 | - 7 35.48 | - 1.60 | ..... | 34.86 |
| | 7320 | 13.854 | 23.0 | 29.8 | | | | | | |
| | 7368 | 22.113 | 26.9 | 25.9 | | 20 33.12 | - 2 55.43 | - 1.25 | ..... | 36.44 |
| | 7411 | 26.664 | 23.4 | 29.8 | | | | | | |
| | 7450 | 35.012 | 23.0 | 30.1 | | 00 51.10 | + 16 46.97 | - 2.41 | ..... | 35.66 |
| | 7476 | 8.890 | 25.0 | 28.3 | | | | | | |
| | 7495 | 21.043 | 30.1 | 23.2 | | 19 34.19 | - 1 56.88 | - 1.99 | ..... | 35.32 |
| | 7520 | 18.011 | 19.0 | 34.5 | | | | | | |
| | 7559 | 14.356 | 23.3 | 30.2 | | 03 48.34 | + 10 47.02 | + 0.19 | ..... | 35.55 |
| | 7566 | 31.141 | 30.7 | 23.0 | | | | | | |
| | 7598 | 15.726 | 27.0 | 26.6 | | 09 18.53 | + 8 18.85 | - 3.54 | ..... | 33.84 |
| | 7607 | 28.667 | 19.0 | 34.7 | | | | | | |
| | 7695 | 33.637 | 27.1 | 27.1 | | 39 35 12.90 | - 17 35.59 | - 2.15 | ..... | 35.16 |
| | 7721 | 6.303 | 22.5 | 31.8 | | | | | | |
| | 7742 | 31.139 | 22.9 | 31.4 | | 38 58 33.52 | + 19 03.17 | + 0.65 | | 39 17 37 34 |
| | 7775 | 1.484 | 32.9 | 21.6 | | | | | | |

LATITUDE DETERMINATIONS.

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Observations and computations—Continued.

VIRGINIA CITY, NEVADA.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|--------------------|-----------------|----------------------|-----------|-----------|----------|-----------------------------|----------------------|----------|----------|--------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1873. August 16 | | <i>t.</i> | <i>d.</i> | <i>d.</i> | | <i>° ' "</i> | <i>' "</i> | <i>"</i> | <i>"</i> | <i>° ' "</i> |
| | 8128 | 26.087 | 28.6 | 27.6 | | | | | | |
| | 8136 | 12.581 | 22.5 | 33.4 | | 39 26 16.26 | — 8 40.63 | — 2.28 | ..... | 39 17 33.55 |
| | 8195 | 35.067 | 26.2 | 29.4 | | | | | | |
| | 8212 | 11.355 | 34.8 | 21.0 | | 02 21.68 | + 15 14.04 | + 2.45 | ..... | 38.17 |
| | 8231 | 15.359 | 28.0 | 28.0 | | | | | | |
| | 8256 | 22.689 | 27.5 | 28.5 | | 12 54.32 | + 4 42.56 | — 0.23 | ..... | 36.65 |
| | 8284 | 10.147 | 26.0 | 30.0 | | | | | | |
| | 8307 | 27.354 | 35.3 | 20.7 | | 28 38.57 | — 11 03.29 | + 2.45 | ..... | 37.73 |
| | 8326 | 4.300 | 26.1 | 29.9 | | | | | | |
| | 8374 | 29.117 | 23.9 | 32.0 | | 01 40.44 | + 15 56.64 | — 2.76 | ..... | 34.32 |
| August 18 | 6959 | 18.097 | 28.1 | 26.8 | | | | | | |
| | 6973 | 21.523 | 20.7 | 34.2 | | 15 23.35 | + 2 12.08 | — 2.82 | ..... | 32.61 |
| | 7008 | 10.455 | 26.4 | 23.3 | | | | | | |
| | 7022 | 23.292 | 34.3 | 20.8 | | 25 47.79 | — 8 14.83 | + 2.69 | ..... | 35.65 |
| | 7062 | 26.982 | 28.0 | 27.3 | | | | | | |
| | 7067 | 11.672 | 28.0 | 27.3 | | 27 24.36 | — 9 50.16 | + 0.32 | ..... | 34.52 |
| | 7164 | 19.403 | 25.0 | 30.2 | | | | | | |
| | 7198 | 24.612 | 30.5 | 24.9 | | 20 56.68 | — 3 20.79 | + 0.09 | ..... | 35.98 |
| | 7218 | 33.772 | 27.2 | 28.1 | | | | | | |
| | 7246 | 6.820 | 39.7 | 15.8 | | 34 49.35 | — 17 18.94 | + 5.32 | ..... | 35.73 |
| | 7277 | 26.690 | 30.7 | 24.9 | | | | | | |
| | 7320 | 14.856 | 26.6 | 28.9 | | 25 12.50 | — 7 36.17 | + 0.81 | ..... | 37.14 |
| | 7368 | 22.182 | 24.0 | 31.4 | | | | | | |
| | 7411 | 26.877 | 37.8 | 17.9 | | 20 33.70 | — 3 00.98 | + 2.89 | ..... | 35.61 |
| | 7450 | 33.991 | 27.0 | 28.5 | | | | | | |
| | 7476 | 7.879 | 24.7 | 31.0 | | 00 51.66 | + 16 46.58 | — 1.81 | ..... | 36.43 |
| | 7495 | 20.634 | 30.9 | 24.6 | | | | | | |
| | 7520 | 17.600 | 19.0 | 36.3 | | 19 34.75 | — 1 56.96 | — 2.55 | ..... | 35.24 |
| | 7559 | 14.445 | 36.3 | 19.1 | | | | | | |
| | 7566 | 32.147 | 16.8 | 38.7 | | 06 10.00 | + 11 22.37 | — 1.09 | ..... | 31.28 |
| | 7598 | 16.021 | 38.5 | 16.9 | | | | | | |
| | 7607 | 28.877 | 17.7 | 37.8 | | 09 19.12 | + 8 15.58 | — 0.35 | ..... | 34.35 |
| | 7695 | 32.691 | 38.7 | 17.0 | | | | | | |
| | 7721 | 5.208 | 19.1 | 36.7 | | 35 13.51 | — 17 39.41 | + 0.95 | ..... | 35.05 |
| | 7742 | 32.337 | 26.9 | 28.9 | | | | | | |
| | 7775 | 2.780 | 36.7 | 19.1 | | 58 34.07 | + 18 59.40 | + 3.61 | ..... | 37.08 |
| August 22 | 6349 | 20.582 | 24.7 | 29.8 | | | | | | |
| | 6357 | 9.932 | 44.0 | 10.3 | | 39 10 39.00 | + 6 50.53 | + 6.62 | ..... | 39 17 36.15 |

Observations and computations—Continued.

VIRGINIA CITY, NEVADA.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|--------------------|-----------------|----------------------|-----------|-----------|----------|-----------------------------|----------------------|--------|--------|-------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1873. August 22 | | <i>t.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | " | ° ' " |
| | 6355 | 26.452 | 24.9 | 29.5 | | 59 06 19.20 | + 11 17.36 | + 0.53 | ..... | 39 17 37.09 |
| | 6390 | 8.883 | 30.7 | 23.8 | | | | | | |
| | 6456 | 27.019 | 25.5 | 28.8 | | 07 49.33 | + 9 47.70 | - 0.76 | ..... | 36.27 |
| | 6473 | 9.773 | 27.2 | 27.2 | | | | | | |
| | 6497 | 16.251 | 24.7 | 29.9 | | 21 53.92 | - 4 18.89 | + 0.76 | ..... | 35.79 |
| | 6520 | 22.967 | 31.5 | 23.0 | | | | | | |
| | 6547 | 21.639 | 25.0 | 29.0 | | 17 51.05 | - 0 14.53 | - 1.30 | ..... | 35.22 |
| | 6566 | 22.016 | 26.4 | 28.0 | | | | | | |
| | 6581 | 14.583 | 21.0 | 33.2 | | 31 50.82 | - 14 13.87 | - 0.21 | ..... | 36.74 |
| | 6624 | 36.734 | 32.9 | 21.6 | | | | | | |
| | 6656 | 37.150 | 32.1 | 22.3 | | 36 21.06 | - 18 43.31 | - 1.60 | ..... | 36.15 |
| | 6667 | 8.009 | 19.0 | 35.7 | | | | | | |
| | 6681 | 18.440 | 39.8 | 15.0 | | 13 08.37 | + 4 25.29 | + 0.46 | +0.83 | 34.95 |
| | 6695 | 25.322 | 16.0 | 38.8 | | | | | | |
| | 6718 | 23.434 | 37.2 | 17.6 | | 24 09.16 | - 6 32.92 | - 6.30 | +0.03 | 29.97 |
| | 6722 | 13.241 | 4.0 | 50.8 | | | | | | |
| | 6734 | 29.109 | 45.8 | 9.0 | | 25 44.67 | - 8 10.29 | + 0.05 | +0.37 | 34.80 |
| | 6740 | 16.390 | 9.0 | 45.6 | | | | | | |
| | 6754 | 26.490 | 51.0 | 4.0 | | 19 54.94 | - 2 18.31 | - 0.00 | ..... | 36.63 |
| | 6777 | 22.902 | 4.0 | 51.0 | | | | | | |
| | 6959 | 18.789 | 32.1 | 23.3 | | 15 24.33 | + 2 11.45 | + 1.09 | ..... | 36.87 |
| | 6973 | 22.199 | 25.8 | 29.9 | | | | | | |
| | 6986 | 29.553 | 44.2 | 11.2 | | 17 34.68 | - 0 01.00 | + 2.75 | ..... | 36.43 |
| | 7001 | 29.527 | 17.1 | 38.2 | | | | | | |
| | 7008 | 11.028 | 15.9 | 39.7 | | 25 48.82 | - 8 14.10 | + 1.60 | ..... | 36.32 |
| | 7022 | 23.846 | 43.0 | 12.3 | | | | | | |
| | 7062 | 28.699 | 29.3 | 26.3 | | 27 25.40 | - 9 46.85 | - 4.93 | ..... | 33.62 |
| | 7067 | 13.375 | 18.1 | 37.4 | | | | | | |
| | 7164 | 20.925 | 24.6 | 31.1 | | 20 57.74 | - 3 23.34 | + 1.23 | ..... | 35.63 |
| | 7198 | 26.200 | 33.8 | 22.0 | | | | | | |
| | 7218 | 33.834 | 29.4 | 26.2 | | 34 50.42 | - 17 15.44 | + 0.37 | ..... | 35.35 |
| | 7246 | 6.973 | 27.1 | 28.7 | | | | | | |
| | 7277 | 26.769 | 30.0 | 25.9 | | 25 13.60 | - 7 37.90 | + 6.02 | ..... | 41.72 |
| | 7320 | 14.890 | 38.9 | 17.0 | | | | | | |
| | 7368 | 22.650 | 27.2 | 28.6 | | 20 34.81 | - 2 57.36 | - 0.93 | ..... | 36.52 |
| | 7411 | 27.251 | 26.7 | 29.3 | | | | | | |
| | 7450 | 36.903 | 26.1 | 30.0 | | 39 00 52.74 | + 16 43.50 | + 0.51 | | 39 17 36.75 |
| | 7476 | 10.871 | 31.1 | 25.0 | | | | | | |

LATITUDE DETERMINATIONS.

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Observations and computations—Continued.

VIRGINIA CITY, NEVADA.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks | Half-sum of declination. | Corrections. | | | Latitude. |
|--------------------|--------------|-------------------|-----------|-----------|---------|--------------------------|-------------------|------------|------------|-------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1873. August 22 | | <i>t.</i> | <i>d.</i> | <i>d.</i> | | <i>o' "</i> | <i>' "</i> | <i>" "</i> | <i>" "</i> | <i>o' "</i> |
| | 7495 | 20.654 | 25.3 | 30.7 | | 39 19 35.86 | — 1 56.19 | — 1.30 | ..... | 39 17 38.37 |
| | 7520 | 17.640 | 27.9 | 28.1 | | | | | | |
| | 7598 | 13.558 | 22.0 | 34.0 | | 09 20.28 | + 8 17.85 | — 1.76 | ..... | 36.37 |
| | 7607 | 26.473 | 30.2 | 25.8 | | | | | | |
| | 7695 | 33.430 | 35.3 | 26.0 | | 39 35 14.71 | — 17 39.29 | — 0.16 | ..... | 25.26 |
| | 7721 | 5.950 | 23.0 | 33.0 | | | | | | |
| | 7742 | 31.024 | 32.0 | 24.0 | | 38 58 35.17 | + 19 02.56 | + 1.04 | ..... | 38.77 |
| | 7775 | 1.385 | 26.3 | 29.8 | | | | | | |
| August 25 | 7062 | 27.388 | 34.1 | 29.7 | | 39 27 26.14 | — 9 53.67 | + 2.55 | ..... | 35.02 |
| | 7067 | 11.987 | 35.2 | 28.6 | | | | | | |
| | 7218 | 33.293 | 34.2 | 17.6 | | 34 51.20 | — 17 12.43 | — 2.62 | ..... | 35.15 |
| | 7246 | 6.510 | 12.0 | 39.9 | | | | | | |
| | 7277 | 25.513 | 38.7 | 13.1 | | 25 14.40 | — 7 41.22 | + 2.64 | ..... | 35.82 |
| | 7320 | 13.548 | 19.0 | 33.2 | | | | | | |
| | 7368 | 22.163 | 23.2 | 29.0 | | 20 35.63 | — 2 58.82 | — 1.13 | ..... | 35.68 |
| | 7411 | 26.802 | 26.9 | 26.0 | | | | | | |
| | 7450 | 34.302 | 25.9 | 27.0 | | 00 53.54 | + 16 43.54 | + 0.95 | ..... | 38.03 |
| | 7476 | 8.269 | 29.0 | 23.8 | | | | | | |
| | 7495 | 21.214 | 31.3 | 21.2 | | 19 36.66 | — 1 58.92 | — 1.59 | ..... | 36.15 |
| | 7520 | 18.129 | 18.0 | 35.0 | | | | | | |
| | 7559 | 13.508 | 33.8 | 19.1 | | 06 12.02 | + 11 23.91 | — 0.53 | ..... | 35.40 |
| | 7566 | 31.250 | 18.0 | 35.0 | | | | | | |
| | 7598 | 15.105 | 26.1 | 26.7 | | 09 21.15 | + 8 15.57 | — 0.39 | ..... | 36.33 |
| | 7607 | 27.961 | 25.9 | 27.0 | | | | | | |
| | 7695 | 33.054 | 40.2 | 13.1 | | 39 35 15.60 | — 17 39.41 | — 0.93 | ..... | 35.26 |
| | 7721 | 5.571 | 11.1 | 42.2 | | | | | | |
| | 7742 | 29.603 | 26.8 | 26.8 | | 38 58 36.00 | + 19 00.55 | — 1.20 | +0.13 | 35.48 |
| | 7775 | 0.016 | 24.1 | 29.3 | | | | | | |
| August 27 | 6959 | 17.597 | 26.6 | 24.3 | | 39 15 25.49 | + 2 08.21 | + 3.03 | ..... | 36.73 |
| | 6973 | 20.923 | 31.0 | 20.2 | | | | | | |
| | 6986 | 28.810 | 36.3 | 14.9 | | 17 35.88 | — 0 00.77 | + 1.55 | ..... | 36.66 |
| | 7001 | 28.790 | 18.3 | 33.0 | | | | | | |
| | 7008 | 10.279 | 18.0 | 33.8 | | 25 50.04 | — 8 15.22 | + 1.39 | ..... | 36.21 |
| | 7022 | 23.126 | 36.8 | 15.0 | | | | | | |
| | 7062 | 27.991 | 18.9 | 32.6 | | 27 26.63 | — 9 52.14 | + 0.63 | ..... | 35.12 |
| | 7067 | 12.630 | 34.0 | 17.6 | | | | | | |
| | 7164 | 19.734 | 22.6 | 29.2 | | 39 20 59.03 | — 3 23.42 | + 0.83 | ..... | 39 17 36.44 |
| | 7198 | 25.011 | 31.2 | 21.0 | | | | | | |

Observations and computations—Continued.

VIRGINIA CITY, NEVADA.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|--------------------|--------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|--------|--------|-------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1873. August 27 | | <i>l.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | " | ° ' " |
| | 7218 | 33.061 | 27.8 | 24.5 | | | | | | |
| | 7246 | 6.140 | 27.9 | 24.7 | | 39 34 51.70 | — 17 17.76 | + 0.02 | ..... | 39 17 33.96 |
| | 7277 | 26.172 | 47.0 | 5.2 | | | | | | |
| | 7320 | 14.240 | 7.6 | 44.9 | | 25 14.92 | — 7 39.95 | + 1.04 | ..... | 36.01 |
| | 7368 | 21.520 | 25.3 | 27.0 | | | | | | |
| | 7411 | 26.232 | 34.0 | 18.3 | | 20 36.17 | — 3 01.64 | + 3.24 | ..... | 37.77 |
| | 7450 | 34.046 | 22.0 | 30.3 | | | | | | |
| | 7476 | 8.460 | 36.4 | 15.9 | | 00 54.66 | + 16 40.57 | + 2.82 | ..... | 37.45 |
| | 7495 | 20.501 | 25.9 | 26.7 | | | | | | |
| | 7520 | 17.338 | 28.5 | 24.1 | | 19 37.20 | — 2 01.93 | + 0.83 | ..... | 36.10 |
| | 7559 | 14.707 | 28.5 | 24.1 | | | | | | |
| | 7566 | 32.392 | 26.9 | 26.0 | | 06 12.56 | + 11 21.44 | + 1.69 | ..... | 35.69 |
| | 7598 | 13.721 | 33.7 | 19.0 | | | | | | |
| | 7607 | 26.538 | 21.0 | 32.0 | | 09 21.72 | + 8 13.33 | + 0.66 | ..... | 35.71 |
| | 7695 | 32.841 | 34.3 | 19.0 | | | | | | |
| | 7721 | 5.336 | 21.1 | 32.3 | | 39 35 16.18 | — 17 43.61 | + 3.06 | ..... | 35.63 |
| | 7742 | 31.490 | 25.9 | 28.0 | | | | | | |
| | 7775 | 1.939 | 28.2 | 25.3 | | 38 58 36.56 | + 18 59.17 | + 0.19 | ..... | 35.92 |
| August 28 | 6896 | 24.793 | 14.2 | 25.8 | | | | | | |
| | 6932 | 16.000 | 24.1 | 15.7 | | 39 11 57.24 | + 5 38.96 | — 0.74 | ..... | 35.46 |
| | 6959 | 17.654 | 26.7 | 29.8 | | | | | | |
| | 6973 | 21.137 | 21.9 | 34.3 | | 15 25.71 | + 2 14.26 | — 3.59 | ..... | 36.38 |
| | 6986 | 27.800 | 27.2 | 29.0 | | | | | | |
| | 7001 | 27.852 | 23.8 | 32.9 | | 17 36.11 | + 0 02.00 | — 0.21 | ..... | 37.90 |
| | 7062 | 27.417 | 29.9 | 27.0 | | | | | | |
| | 7067 | 12.090 | 25.3 | 31.3 | | 27 26.86 | — 9 50.83 | — 0.72 | ..... | 35.31 |
| | 7164 | 19.235 | 24.0 | 33.3 | | | | | | |
| | 7198 | 24.472 | 31.0 | 26.9 | | 20 59.28 | — 3 21.88 | — 1.20 | ..... | 36.20 |
| | 7218 | 32.384 | 34.0 | 23.9 | | | | | | |
| | 7246 | 5.479 | 25.3 | 32.7 | | 34 51.94 | — 17 17.13 | + 0.63 | ..... | 35.44 |
| | 7277 | 25.912 | 39.0 | 19.1 | | | | | | |
| | 7320 | 13.985 | 19.0 | 39.1 | | 25 15.17 | — 7 39.76 | — 0.05 | ..... | 35.46 |
| | 7368 | 21.197 | 27.1 | 31.5 | | | | | | |
| | 7411 | 25.907 | 47.0 | 12.1 | | 20 36.44 | — 3 01.56 | + 7.06 | ..... | 41.94 |
| | 7450 | 33.961 | 26.8 | 32.1 | | | | | | |
| | 7416 | 7.953 | 33.3 | 25.4 | | 00 54.31 | + 16 42.19 | + 0.66 | ..... | 37.16 |
| | 7495 | 19.574 | 36.3 | 22.4 | | | | | | |
| | 7520 | 16.422 | 23.3 | 35.4 | | 39 19 37.46 | — 2 01.51 | + 0.42 | | 39 17 36.37 |

LATITUDE DETERMINATIONS.

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Observations and computations—Continued.

VIRGINIA CITY, NEVADA.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|--------------------|--------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|--------|--------|-------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1873. August 28 | | <i>t.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | " | ° ' " |
| | 7559 | 15.535 | 40.9 | 18.0 | | | | | | |
| | 7566 | 33.213 | 21.6 | 37.2 | | 39 06 12.84 | + 11 21.71 | + 1.23 | ..... | 39 17 35.78 |
| | 7598 | 12.902 | 24.7 | 34.2 | | | | | | |
| | 7607 | 25.700 | 35.4 | 23.3 | | 09 22.00 | + 8 14.06 | + 0.86 | ..... | 36.92 |
| | 7695 | 32.289 | 38.7 | 21.0 | | | | | | |
| | 7721 | 4.697 | 27.6 | 32.1 | | 39 35 16.48 | — 17 40.26 | + 0.95 | ..... | 37.17 |
| | 7742 | 29.751 | 26.3 | 33.3 | | | | | | |
| | 7775 | 0.240 | 38.7 | 21.0 | | 38 58 36.84 | + 18 57.62 | + 2.48 | ..... | 36.94 |
| | 8128 | 26.018 | 32.0 | 30.2 | | | | | | |
| | 8135 | 12.365 | 33.0 | 29.2 | | 39 26 20.08 | — 8 46.29 | + 1.50 | ..... | 35.09 |
| | 8195 | 33.652 | 34.7 | 27.0 | | | | | | |
| | 8212 | 10.167 | 26.2 | 35.3 | | 02 25.25 | + 15 05.29 | + 1.99 | ..... | 32.53 |
| | 8231 | 15.648 | 28.9 | 32.3 | | | | | | |
| | 8256 | 22.784 | 40.7 | 20.3 | | 12 57.89 | + 4 35.07 | + 3.94 | ..... | 36.90 |
| | 8284 | 9.197 | 29.7 | 31.4 | | | | | | |
| | 8307 | 26.481 | 32.9 | 28.3 | | 28 41.98 | — 11 06.26 | + 0.67 | ..... | 36.39 |
| | 8326 | 4.860 | 33.4 | 27.8 | | | | | | |
| | 8374 | 29.563 | 31.0 | 30.3 | | 01 43.88 | + 15 52.25 | + 1.45 | ..... | 37.58 |
| August 29 | 6021 | 18.994 | 28.1 | 27.0 | | | | | | |
| | 6052 | 20.255 | 28.7 | 26.7 | | 18 24.45 | — 0 48.61 | + 0.72 | ..... | 36.56 |
| | 6087 | 16.582 | 26.0 | 29.3 | | | | | | |
| | 6129 | 20.305 | 29.7 | 25.8 | | 19 58.79 | — 2 23.51 | + 0.14 | ..... | 35.42 |
| | 6238 | 21.292 | 27.1 | 28.3 | | | | | | |
| | 6252 | 16.346 | 36.6 | 19.0 | | 14 25.34 | + 3 10.66 | + 3.80 | ..... | 39.80 |
| | 6349 | 20.656 | 26.9 | 29.0 | | | | | | |
| | 6357 | 9.937 | 43.9 | 12.0 | | 10 40.02 | + 6 53.18 | + 6.90 | ..... | 40.11 |
| | 6355 | 26.549 | 26.9 | 29.0 | | | | | | |
| | 6390 | 9.038 | 42.6 | 13.3 | | 06 20.28 | + 11 15.01 | + 6.29 | ..... | 41.58 |
| | 6456 | 26.961 | 22.6 | 33.7 | | | | | | |
| | 6473 | 11.750 | 35.1 | 21.0 | | 07 50.47 | + 9 46.35 | + 0.44 | ..... | 37.26 |
| | 6497 | 15.724 | 27.0 | 29.2 | | | | | | |
| | 6520 | 22.481 | 30.9 | 25.3 | | 21 55.12 | — 4 20.47 | + 0.79 | ..... | 35.44 |
| | 6547 | 20.277 | 26.8 | 30.4 | | | | | | |
| | 6566 | 20.740 | 37.1 | 19.2 | | 17 52.28 | — 0 17.84 | + 3.31 | ..... | 37.75 |
| | 6581 | 14.658 | 25.7 | 30.4 | | | | | | |
| | 6624 | 36.872 | 41.0 | 15.0 | | 31 52.14 | — 14 16.30 | + 4.93 | ..... | 40.77 |
| | 6656 | 36.462 | 26.3 | 29.9 | | | | | | |
| | 6667 | 7.202 | 32.2 | 24.0 | | 39 36 22.43 | — 18 47.90 | + 1.07 | ..... | 39 17 35.60 |

Observations and computations—Continued.

VIRGINIA CITY, NEVADA.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|--------------------|--------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|--------|--------|-------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1873. August 29 | | <i>t.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | " | ° ' " |
| | 6681 | 17.043 | 33.8 | 22.5 | | | | | | |
| | 6695 | 23.923 | 27.4 | 29.0 | | 39 13 09.69 | + 4 25.21 | + 2.25 | ..... | 39 17 37.15 |
| | 6718 | 23.263 | 29.8 | 26.5 | | | | | | |
| | 6722 | 12.993 | 41.8 | 14.8 | | 24 10.58 | — 6 35.89 | + 7.01 | ..... | 41.70 |
| | 6754 | 25.000 | 28.8 | 28.0 | | | | | | |
| | 6777 | 21.376 | 26.9 | 30.2 | | 19 56.41 | — 2 19.69 | — 0.58 | ..... | 36.14 |
| | 6817 | 15.122 | 32.0 | 25.2 | | | | | | |
| | 6849 | 22.221 | 23.4 | 34.1 | | 13 01.86 | + 4 33.65 | — 0.90 | ..... | 34.61 |
| | 6896 | 24.268 | 27.1 | 30.7 | | | | | | |
| | 6932 | 15.553 | 31.1 | 27.2 | | 11 57.44 | + 5 35.96 | + 0.07 | +0.01 | 33.48 |
| | 6959 | 17.393 | 30.6 | 27.8 | | | | | | |
| | 6973 | 20.756 | 31.6 | 26.8 | | 15 25.94 | + 2 09.64 | + 1.76 | ..... | 37.34 |
| | 6986 | 23.642 | 29.4 | 28.6 | | | | | | |
| | 7001 | 27.622 | 31.2 | 27.0 | | 17 36.34 | — 0 00.77 | + 1.16 | ..... | 36.73 |
| | 7008 | 10.081 | 32.8 | 25.3 | | | | | | |
| | 7022 | 22.953 | 32.8 | 25.3 | | 25 50.51 | — 8 16.18 | + 3.47 | ..... | 37.80 |
| | 7062 | 26.742 | 31.3 | 26.8 | | | | | | |
| | 7067 | 11.370 | 31.0 | 27.2 | | 27 27.10 | — 9 52.56 | + 1.92 | ..... | 36.46 |
| | 7164 | 20.137 | 29.8 | 28.9 | | | | | | |
| | 7198 | 25.418 | 34.5 | 24.0 | | 20 59.52 | — 3 23.57 | + 2.64 | ..... | 38.59 |
| | 7218 | 33.833 | 34.8 | 23.9 | | | | | | |
| | 7246 | 6.901 | 26.1 | 32.3 | | 34 52.19 | — 17 18.17 | + 1.09 | ..... | 35.11 |
| | 7277 | 25.089 | 38.0 | 10.3 | | | | | | |
| | 7320 | 13.140 | 23.7 | 34.6 | | 25 15.42 | — 7 40.60 | + 1.57 | ..... | 36.39 |
| | 7368 | 21.951 | 29.8 | 28.4 | | | | | | |
| | 7411 | 26.681 | 32.0 | 23.6 | | 20 36.70 | — 3 02.33 | + 1.57 | ..... | 35.94 |
| | 7450 | 34.649 | 29.8 | 29.0 | | | | | | |
| | 7476 | 8.690 | 31.4 | 27.3 | | 00 54.56 | + 16 40.69 | + 1.13 | ..... | 36.38 |
| | 7495 | 20.495 | 28.5 | 30.4 | | | | | | |
| | 7520 | 7.315 | 34.0 | 25.0 | | 19 37.72 | — 2 02.58 | + 1.64 | ..... | 36.78 |
| | 7559 | 13.893 | 29.4 | 29.5 | | | | | | |
| | 7566 | 31.532 | 34.0 | 25.1 | | 06 13.11 | + 11 19.94 | + 2.04 | ..... | 35.09 |
| | 7598 | 14.189 | 36.9 | 22.0 | | | | | | |
| | 7607 | 26.952 | 26.0 | 33.0 | | 09 22.28 | + 8 11.98 | + 1.83 | ..... | 36.09 |
| | 7695 | 34.101 | 35.1 | 23.8 | | | | | | |
| | 7721 | 6.523 | 29.5 | 30.5 | | 39 35 16.76 | — 17 43.07 | + 2.62 | ..... | 36.31 |
| | 7742 | 30.271 | 29.0 | 31.0 | | | | | | |
| | 7775 | 0.766 | 34.1 | 26.0 | | 38 58 37.12 | + 18 57.39 | + 1.41 | ..... | 39 17 35.92 |

Observations and computations—Continued.

VIRGINIA CITY, NEVADA.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination | Corrections. | | | Latitude. |
|--------------------|--------------|-------------------|-----------|-----------|----------|-------------------------|-------------------|--------|--------|-------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1873. August 29 | | <i>t.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | " | " | " | ° ' " |
| | 8128 | 26.898 | 33.0 | 28.2 | | | | | | |
| | 8136 | 13.165 | 33.0 | 28.3 | | 39 26 20.38 | — 8 49.38 | + 2.20 | +0.01 | 39 17 33.21 |
| | 8195 | 34.791 | 26.9 | 34.0 | | | | | | |
| | 8212 | 11.183 | 45.0 | 15.7 | | 02 25.55 | + 15 10.03 | + 5.14 | ..... | 40.72 |
| | 8231 | 15.143 | 30.8 | 29.7 | | | | | | |
| | 8256 | 22.342 | 33.3 | 27.0 | | 12 58.19 | + 4 37.50 | + 1.71 | ..... | 37.40 |
| | 8284 | 9.479 | 27.0 | 33.3 | | | | | | |
| | 8307 | 26.771 | 35.3 | 25.0 | | 39 28 42.26 | — 11 06.57 | + 0.93 | ..... | 39 17 36.62 |

Discussion of latitude of Virginia City, Nevada.

| No. of pair. | No. of observation. | Mean level. | Latitude. | Corrections of micrometer-correction. | Dates excluded. | No. of pair. | No. of observation. | Mean level. | Latitude. | Corrections of micrometer-correction. | Dates excluded. |
|----------------|---------------------|-------------|-------------|---------------------------------------|-----------------|-----------------|---------------------|-------------|-------------|---------------------------------------|-----------------|
| | | " | ° ' " | " | | | | " | ° ' " | " | |
| 1 | 1 | +0.7 | 39 17 36.56 | + 0.01 | | 20 | 6 | +0.6 | 39 17 36.68 | 0.00 | |
| 2 | 2 | 0.0 | 35.69 | + 0.03 | | 21 | 6 | +1.1 | 36.02 | + 0.11 | |
| 3 | 1 | 0.0 | 35.36 | + 0.03 | | 22 | 7 | 0.0 | 35.30 | + 0.14 | Aug. 22. |
| 4 | 2 | +1.6 | 38.26 | — 0.04 | | 23 | 7 | +0.6 | 36.37 | + 0.05 | |
| 5 | 1 | —3.2 | 34.47 | — 0.10 | Aug. 22, 29. | 24 | 7 | +0.2 | 35.53 | + 0.24 | |
| 6 | 2 | —0.7 | 36.14 | — 0.16 | Aug. 29. | 25 | 7 | +0.5 | 36.03 | + 0.11 | Aug. 22. |
| 7 | 1 | +1.3 | 38.66 | — 0.18 | | 26 | 7 | +0.5 | 36.36 | + 0.04 | Aug. 28. |
| 7 ^a | 2 | —0.2 | 36.78 | — 0.14 | | 27 | 8 | +0.3 | 36.50 | — 0.23 | |
| 8 | 1 | —1.0 | 36.47 | — 0.17 | | 28 | 7 | —0.6 | 36.33 | + 0.02 | Aug. 13. |
| 9 | 3 | +0.3 | 35.64 | + 0.06 | | 29 ^a | 2 | +0.1 | *35.52 | — 0.15 | |
| 10 | 4 | +0.9 | 36.75 | 0.00 | | 29 | 5 | +0.7 | 34.65 | — 0.16 | |
| 11 | 3 | —0.5 | 36.15 | + 0.20 | Aug. 29. | 30 | 8 | —0.3 | 35.70 | — 0.12 | |
| 12 | 4 | —0.8 | 36.51 | + 0.26 | | 31 | 8 | +0.4 | 35.48 | + 0.25 | |
| 13 | 4 | —0.9 | 35.16 | — 0.06 | | 32 | 8 | +1.2 | 36.85 | — 0.27 | |
| 14 | 2 | —2.6 | 33.21 | + 3.09 | Aug. 22, 29. | 33 | 4 | —0.6 | 33.24 | + 0.12 | |
| 15 | 2 | —0.6 | 35.44 | + 0.11 | | 34 | 3 | +0.8 | 34.28 | — 0.21 | Aug. 29. |
| 16 | 3 | —0.7 | 35.27 | + 0.03 | | 35 | 4 | +1.3 | 36.88 | — 0.06 | |
| 17 | 2 | +1.0 | 36.40 | — 0.06 | Aug. 16. | 36 | 4 | +0.7 | 37.17 | + 0.15 | |
| 18 | 4 | —0.6 | 35.20 | — 0.08 | | 37 | 3 | —0.9 | 39 17 35.25 | — 0.22 | |
| 19 | 6 | +0.3 | 39 17 36.22 | — 0.03 | Aug. 16. | | | | | | |

* Pair 29^a is composed of Rümcker 9430, which takes the place of B. A. C. 7566 from pair 29.

Excluding, as before, all observations whose level-correction exceeds 4'', we have:

Latitude from 13 pairs observed 1 or 2 times 39° 17' 36''.02 ± 0''.24

Probable error of 1 such pair ± 0''.88

Latitude from 13 pairs observed 3, 4, or 5 times 39° 17' 35''.55 ± 0''.24

Probable error of 1 such pair ± 0''.87

Latitude from 13 pairs observed 6, 7, or 8 times 39° 17' 36''.13 ± 0''.075

Probable error of 1 such pair ± 0''.27

Finally, giving these results relative weights of 1, 2, 3, we get final

latitude 39° 17' 35''.92 ± 0''.097

| Number of pair. | Date. | Latitude with level-correction. | Latitude without level-correction. | Corr. to micr.-corr. |
|-----------------|-----------|---------------------------------|------------------------------------|----------------------|
| | | ° ' " | ° ' " | " |
| 5 | August 22 | 39 17 36.15 | 39 17 29.53 | — 0.10 |
| | August 29 | 40. 11 | 33. 21 | — 0.10 |
| 6 | August 29 | 41. 58 | 35. 29 | — 0.16 |
| 11 | August 29 | 40. 77 | 35. 84 | + 0.20 |
| 14 | August 22 | 29. 97 | 36. 27 | + 0.09 |
| | August 29 | 41. 63 | 34. 62 | + 0.09 |
| 17 | August 16 | 31. 51 | 37. 44 | — 0.06 |
| 19 | August 16 | 34. 86 | 39. 12 | — 0.03 |
| 22 | August 22 | 33. 62 | 38. 55 | + 0.14 |
| 25 | August 22 | 41. 72 | 35. 70 | + 0.11 |
| 26 | August 28 | 41. 94 | 34. 88 | + 0.04 |
| 28 | August 13 | 39. 62 | 34. 49 | + 0.02 |
| 34 | August 29 | 39 17 40.72 | 39 17 35.58 | — 0.21 |

ASTRONOMICAL CO-ORDINATES OF VIRGINIA CITY, NEVADA.

Longitude...⁷^h 58^m 36^s.423 ± 0^s.024 or 119° 39' 06''.35 ± 0''.36 west from Greenwich.
 “ 2^h 50^m 24^s.303 or 42° 36' 04''.55 west from U. S. Naval Observ-
 atory, Washington, D. C.
 Latitude 39° 17' 35''.92 ± 0''.10 north.

U. S. GEOGRAPHICAL SURVEYS WEST OF THE ONE HUNDREDTH MERIDIAN.
GEO. M. WHEELER, LIEUT. OF ENGINEERS, U. S. ARMY, IN CHARGE.

RESULTS
OF
OBSERVATIONS MADE BY DR. F. KAMPF AND JOHN H. CLARK IN THE
DETERMINATION OF THE ASTRONOMICAL CO-ORDINATES
OF GEORGETOWN, COLORADO.
SEASON OF 1873.

COMPUTATIONS BY
DR. F. KAMPF AND JOHN H. CLARK.

GEORGETOWN, COLORADO.

GEOGRAPHICAL POSITION OF STATION.

Longitude, . . . $105^{\circ} 01' 27''.64 \pm 0''.05$ west from Greenwich.
Latitude, . . . $39^{\circ} 42' 36''.36 \pm 0''.06$ north.
Barometric altitude of observatory above sea-level, 8587.8 feet.

Georgetown, the site of this astronomical station, is the principal town of Clear Creek County. Its inhabitants are chiefly interested in mines and mining business. Their number in 1873 was reported to exceed two thousand.

The astronomical camp was situated on the eastern side of the valley, at the foot of Griffith's Mountain, on a knoll overlooking the town. Opposite the camp, on the western side of the valley, Republican Mountain rises precipitously to a height exceeding 2,000 feet, and is succeeded in the north by the Democrat and Upper Empire Peaks. Above the camp, Alpine Creek flowed down, passing near the astronomical tent. In a southern direction, the Georgetown valley is closed by Leavenworth Mountain, which is bounded on either side by a great gulch, opening into the town, through which a brawling stream descends.

Owing to the rocky nature of the ground, it was found impossible to set the square stone pillar, which served as a meridian and latitude mark, with its faces in the plane of the meridian, and it was placed in a diagonal position, facing a little south of east.

METEOROLOGICAL CONDITIONS.

The condition of the atmosphere was unfavorable for work of this nature. The weather was stormy during the first days of occupation, and after the 26th of June large forests in the southwest were continually burning, and, when the wind was from that direction, the observer was compelled to relinquish his task, on account of the undulations with which the air was

affected by the heat. In the daytime the temperature was very high, but at night the thermometer would sink to 40° or 35° F., and in one instance, the night of June 30th, snow fell to a depth of several inches. Owing to the inauspicious state of the weather and the sky, this was the most inconvenient station of the season, and it was with great trouble that the observations were accomplished at all.

The following table shows the general direction of the wind and the appearance of the sky:

| Date. | Direction of wind. | | | Condition of the sky. |
|---------|------------------------|-----------------------|------------------------|---|
| | 12 p. m. to 8 a. m. | 8 a. m. to 4 p. m. | 4 p. m. to 12 p. m. | |
| 1873. | | | | |
| June 20 | S. | N. | S. | Cloudy the whole day. |
| 21 | S. | S. | S. E. | Aurora borealis at 0.30 a. m.; clear. |
| 22 | S. | S. W. | S. | Cloudy at 3.30 a. m. |
| 23 | N. | N. | N. | Partly cloudy. |
| 24 | S. E. | S. W. | S. | Do. |
| 25 | S. E. | S. | S. | Clear. |
| 26 | S. W. | S. W. | S. W. | Clouding up at 5 p. m. |
| 27 | S. | N. | S. W. | Clear. |
| 28 | S. E. | S. E. | S. | Very heavy wind; partly cloudy. |
| 29 | S. E. | S. | N. W. | Heavy wind at 4 a. m.; very violent at 2.10 p. m., and bringing up clouds. |
| 30 | S. | N. | N. | Cloudy from 0 a. m.; wind very violent at 11.25 a. m.; at 7 p. m. commencing a rain-storm; continued until— |
| July 1 | S. | S. | S. | 0.30 a. m.; then snow-storm; flakes one-quarter of an inch in diameter. |
| 2 | S. | S. E. | S. E. | Cloudy; at 2.30 p. m. rain and thunder; clearing up at 9 p. m. |
| 3 | S. E. | S. | S. | Clear. |
| 4 | S. | N. W. | S. E. | In daytime partly cloudy; at night clear. |
| 5 | S. | S. E. | S. | Clear. |

OBSERVATORY—TELEGRAPHIC COMMUNICATION.

In its arrangement, the observatory was similar to the one at Colorado Springs, described in the astronomical report of 1874. The president of the Western Union Telegraph Company granted authority for the use of their lines. The main wire was deflected, by means of a loop, into the observing tent, a distance of nearly 700 yards. In sending signals, assistance was rendered by Mr. John Jay, in charge of the Western Union office at Georgetown. The distance to Denver is about 40 miles; from Denver to Salt Lake City it is 690 miles; making a total circuit-length of 730 miles. The signals were sent directly to Cheyenne, and were there

repeated to Salt Lake. The battery in use at the station was a small but effective instrument of two Grove cells belonging to the survey.

The astronomical and meteorological instruments were the same as those at Colorado Springs, with the same instrumental values for the reduction of observations.

CONNECTIONS—OBSERVERS—COMPUTERS.

The astronomical observations at Georgetown were conducted by Dr. F. Kampf, who arrived at this station on the 5th of June, but was unable to begin operations until the 20th of the same month, being retarded by a delay in the arrival of the instruments, and by their incomplete condition when they came. Further delay was then experienced by reason of difficulty in introducing the wires for telegraphic correspondence.

Exchanges for time were made with the station at Salt Lake City, Mr. John H. Clark in charge. In this exchange, signals were sent from Salt Lake City on the nights of June 23, 25, 27, and 28, and July 2 and 3, and from Georgetown on June 23 and 28, and July 2 and 3. Mr. Clark reduced his observations for time after returning to the office. Computations for the corresponding observations at Georgetown were made by Dr. Kampf, in the field. Observations for latitude were made by the latter on the nights of June 22, 26, and 27, and July 1, 2, 4, and 5, and were reduced by him in the office from the 20th to the 28th of January, 1874.

The meteorological records were kept with great care by C. D. Gedney, and privates J. Clancy and J. Meyer.

Tabulation of stars used for determination of time at Georgetown, Colorado, and Salt Lake City, Utah, 1873.

| Name of star. | | GEORGETOWN, COLORADO. | | | | | | | | | SALT LAKE CITY, UTAH. | | | | | | | |
|-----------------------|--------------------|-----------------------|----------|----------|----------|----------|----------|---------|---------|---------|-----------------------|----------|----------|----------|----------|---------|---------|---------|
| | | June 23. | June 25. | June 26. | June 27. | June 28. | June 29. | July 1. | July 2. | July 3. | June 23. | June 25. | June 26. | June 27. | June 28. | July 1. | July 2. | July 3. |
| <i>a</i> | Virginis | X | | | | | | | | | | | | | | | | |
| <i>ζ</i> | Virginis | X | | | | | | | | | | | | | | | | |
| <i>η</i> | Ursæ Majoris | X | X | X | X | | | | | | | | | | | | | |
| <i>η</i> | Bootis | X | X | X | X | | | | | X | | | | | | | | |
| <i>τ</i> | Virginis | | X | X | | | X | | | | | | | | | | | |
| <i>a</i> | Draconis | X | | | X | X | | | | X | | | | | | | | |
| <i>κ</i> | Virginis | | | X | X | X | X | | | | | | | | | | | |
| <i>a</i> | Bootis | X | X | X | X | X | X | | | X | X | X | | | | | | |
| <i>θ</i> | Bootis | X | X | X | X | | X | X | X | X | X | X | X | X | | | | |
| 5 | Ursæ Minoris | X | X | X | X | | X | X | X | X | X | X | X | X | X | | | |
| <i>μ</i> | Virginis | | | | | | | | | X | X | X | X | | X | X | X | |
| <i>ζ</i> | Bootis | | X | X | X | | X | X | X | X | | | | | | | | |
| <i>ε</i> | Bootis | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | |
| <i>α</i> ² | Libræ | | | | | | | | | X | X | X | X | X | X | X | | |
| <i>β</i> | Ursæ Minoris | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | |
| <i>β</i> | Bootis | X | X | X | X | X | X | X | X | X | X | X | X | X | | X | | |
| <i>ψ</i> | Bootis | | | | | X | | | | | | | | | | | | |
| 48 | Cephei, L. C | | | | | | | | | | X | X | X | X | X | X | | |
| 3 | Serpentis | | | | | X | | | | | | | | | | | | |
| <i>β</i> | Libræ | | | | | | | X | | X | X | X | X | X | X | X | | |
| <i>ο</i> ² | Libræ | | | | | | | | | | | X | X | X | X | X | X | X |
| <i>υ</i> ¹ | Bootis | | | | | | | | | | | X | X | X | X | X | X | X |
| <i>ζ</i> ³ | Libræ | | | | | | | | | | | X | X | X | X | X | X | X |
| <i>γ</i> ² | Ursæ Minoris | | | | | | X | X | X | X | | | | | | | | |
| <i>a</i> | Coronæ | | | | | | X | X | X | X | | | | | X | X | X | X |
| <i>τ</i> | Serpentis | | | | | | | | | | | | | | X | X | X | X |
| <i>α</i> | Serpentis | | | | | | X | | | | | | | | | X | X | X |
| <i>ε</i> | Serpentis | | | | | | | | | | | | | | | | X | X |
| <i>β</i> ¹ | Scorpii | | | | | | | | | | | | | | | | | X |
| <i>η</i> | Draconis | | | | | | | | | | | | | | | | | |
| <i>A</i> | Draconis | | | | | | | | | | | | | X | | | | |
| <i>ζ</i> | Ophiuchi | | | | | | | | | | | | | | | | | X |
| <i>η</i> | Herculis | | | | | | | | | | X | | | | | | | |
| <i>κ</i> | Ophiuchi | X | | | | | | | | X | X | X | | X | | | | X |
| <i>d</i> | Herculis | | | | | | | | | | X | X | X | X | | | | |
| <i>ε</i> | Ursæ Minoris | | | | | | | | | | X | X | X | X | | | | |
| <i>α</i> ¹ | Herculis | | | | | | | | | X | X | | X | X | X | | | X |
| 44 | Ophiuchi | | | | | | | | | X | | | | | | | | |
| | Groombr. 966 L. C. | | | | | | | | | | | | | X | | | | X |
| <i>β</i> | Draconis | X | | | | | | | | X | X | | | | | | | |
| <i>a</i> | Ophiuchi | | | | | | | | | X | X | | | | | | | |
| <i>ω</i> | Draconis | X | X | | | | | | | X | X | | X | | | | | X |
| <i>μ</i> | Herculis | X | X | | | | | | | | X | | | X | | | | |
| <i>ψ</i> ¹ | Draconis, pr | | X | | | | | | | X | X | | X | | | | | |
| <i>γ</i> | Draconis | X | X | | | | | | | X | X | | X | X | | | | |
| <i>γ</i> ² | Sagittarii | | | | | | | | | X | | | | | | | | |
| 72 | Ophiuchi | | | | | | | | | | | | | | | X | X | |
| <i>ο</i> | Herculis | | X | | | | | | | | | | | | | | | |
| <i>μ</i> ¹ | Sagittarii | X | | | | | | | | | | | | | | | | |
| <i>η</i> | Serpentis | X | | | | | | | | X | | | | | | X | X | X |
| <i>b</i> | Draconis | | X | | | | | | | | | | | | | | | |
| 1 | Aquilæ | | X | | | X | | | | | | | | | | | | |
| <i>a</i> | Lyræ | | X | | | X | | | | | | X | | X | | | X | |
| <i>β</i> | Lyræ | | | | | X | | | | | | X | | | | | | |
| <i>σ</i> | Sagittarii | | X | | | | | | | | | | | | | | | |
| 50 | Draconis | | | | | X | | | | | | X | | | | | | |

Tabulation of stars, &c.—Continued.

| Name of star. | GEORGETOWN, COLORADO. | | | | | | SALT LAKE CITY, UTAH. | | | | | | | | | | |
|-------------------|-----------------------|----------|----------|----------|----------|----------|-----------------------|---------|---------|----------|----------|----------|----------|----------|---------|---------|---------|
| | June 23. | June 25. | June 26. | June 27. | June 28. | June 29. | July 1. | July 2. | July 3. | June 23. | June 25. | June 26. | June 27. | June 28. | July 1. | July 2. | July 3. |
| ζ Aquilæ..... | | | | | × | | | | | | × | | | | | | |
| δ Sagittarii..... | | | | | × | | | | | | | | | | | × | |
| τ Draconis..... | | | | | × | | | | | | | | | | | | |
| κ Aquilæ..... | | | | | × | | | | | | | | | | | | |
| γ Aquilæ..... | | | | | × | | | | | | | | | | | | |
| α Aquilæ..... | | | | | × | | | | | | | | | | | | |
| ε Draconis..... | | | | | × | | | | | | | | | | | | |

Observations and reductions for time taken at receiving station.

GEORGETOWN, COLORADO, JUNE 23, 1873.

| Clamp. | Name of star. | T. | | | Aa. | Bb. | Cc. | T'. | | | AR. | | | ΔT. | |
|--|---------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| | | <i>h.</i> | <i>m.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h.</i> | <i>m.</i> | <i>s.</i> | <i>h.</i> | <i>m.</i> | <i>s.</i> | <i>m.</i> | <i>s.</i> |
| W. | α Virginis..... | 13 | 32 | 13.47 | + 0.23 | — 0.01 | — 0.66 | 13 | 32 | 13.03 | 13 | 18 | 31.32 | — 13 | 41.71 |
| W. | ζ Virginis..... | 41 | 56 | 72 | + 0.19 | — 0.06 | — 0.65 | 41 | 56 | 20 | 28 | 14 | 50 | | 41.70 |
| W. | η Ursæ Majoris..... | 56 | 16 | 74 | — 0.08 | — 0.12 | — 1.00 | 56 | 15 | 54 | 42 | 33 | 82 | | 41.72 |
| W. | η Bootis..... | 14 | 02 | 21.90 | + 0.11 | — 0.07 | — 0.69 | 14 | 02 | 21.25 | 48 | 39 | 62 | | 41.63 |
| W. | α Draconis..... | 14 | 43 | 41 | — 0.29 | — 0.15 | — 1.53 | 14 | 41 | 44 | 14 | 00 | 59.63 | | 41.81 |
| E. | α Bootis..... | 23 | 34 | 54 | + 0.10 | — 0.08 | + 0.69 | 23 | 35 | 25 | 09 | 53 | 54 | | 41.71 |
| E. | θ Bootis..... | 34 | 35 | 41 | — 0.10 | — 0.19 | + 1.06 | 34 | 36 | 18 | 20 | 54 | 36 | | 41.82 |
| E. | 5 Ursæ Minoris..... | 41 | 33 | 89 | — 0.73 | — 0.47 | + 2.72 | 41 | 35 | 41 | 27 | 53 | 52 | | 41.89 |
| E. | ε Bootis..... | 53 | 09 | 29 | + 0.07 | — 0.20 | + 0.73 | 53 | 09 | 89 | 39 | 28 | 10 | | 41.79 |
| E. | β Ursæ Minoris..... | 15 | 04 | 50.28 | — 0.63 | — 0.53 | + 2.44 | 15 | 04 | 51.56 | 51 | 10 | 10 | | 41.46 |
| E. | β Bootis..... | 10 | 52 | 82 | 0.00 | — 0.22 | + 0.85 | 10 | 43 | 45 | 14 | 57 | 11.63 | — 13 | 41.82 |
| Mean at 14 ^h 15 ^m local sidereal time..... | | | | | | | | | | | | | | — 13 | 41.73 |
| Exclusive of β Ursæ Minoris..... | | | | | | | | | | | | | | — 13 | 41.76 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -0.27 + 11.00 \delta t - 3.97 a + 6.14 c & \delta t &= -0^s.23 \\
 0 &= +6.62 - 3.97 \delta t + 13.58 a - 17.76 c & a &= +0^s.29 \\
 0 &= -25.79 + 6.14 \delta t - 17.76 a + 50.02 c & c &= +0^s.65
 \end{aligned}$$

Observations and reductions for time taken at receiving station—Continued.

GEORGETOWN, COLORADO, JUNE 23, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|---|---------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | κ Ophiuchi..... | 17 05 22.71 | + 0.08 | — 0.13 | + 0.65 | 17 05 23.31 | 16 51 41.32 | — 13 41.99 |
| E. | β Draconis | 41 17.61 | — 0.05 | — 0.37 | + 1.05 | 41 18.24 | 17 27 36.31 | 41.93 |
| E. | ω Draconis | 51 26.32 | — 0.23 | — 0.32 | + 1.77 | 51 27.54 | 37 45.58 | 41.96 |
| E. | μ Herculis | 55 12.66 | + 0.03 | — 0.14 | + 0.72 | 55 13.27 | 41 31.36 | 41.91 |
| W. | γ Draconis | 18 07 25.20 | — 0.08 | — 0.07 | — 1.02 | 18 07 24.03 | 53 42.07 | 41.96 |
| W. | μ ¹ Sagittarii | 19 54.79 | + 0.12 | — 0.03 | — 0.68 | 19 54.20 | 18 06 12.34 | 41.86 |
| W. | η Serpentis | 28 28.93 | + 0.09 | — 0.04 | — 0.64 | 18 28 28.34 | 14 46.27 | — 13 42.07 |
| Mean at 17 ^h 30 ^m local sidereal time | | | | | | | | — 13 41.95 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -0.73 + 7.00 \delta t - 0.18 a + 2.78 c & \delta t &= -0^s.15 \\
 0 &= +2.61 - 0.18 \delta t + 5.28 a - 5.19 c & a &= +0^s.13 \\
 0 &= -10.01 + 2.78 \delta t - 5.19 a + 17.33 c & c &= +0^s.64
 \end{aligned}$$

GEORGETOWN, COLORADO, JUNE 25, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|---|---------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | η Ursæ Majoris..... | 13 56 15.67 | + 0.25 | — 0.11 | — 1.02 | 13 56 14.79 | 13 42 33.78 | — 13 41.01 |
| W. | η Bootis | 14 02 21.60 | — 0.33 | — 0.13 | — 0.70 | 14 02 20.44 | 48 39.61 | 40.83 |
| W. | τ Virginis..... | 08 54.57 | — 0.54 | — 0.10 | — 0.66 | 08 53.27 | 55 12.34 | 40.93 |
| W. | α Bootis | 23 35.62 | — 0.32 | — 0.11 | — 0.70 | 23 34.49 | 14 09 53.52 | 40.97 |
| W. | θ Bootis | 34 36.39 | + 0.32 | — 0.14 | — 1.08 | 34 35.49 | 20 54.33 | 41.16 |
| E. | 5 Ursæ Minoris..... | 41 29.66 | + 2.22 | — 0.50 | + 2.77 | 41 34.15 | 27 53.38 | 40.77 |
| E. | ζ Bootis | 48 47.55 | — 0.39 | — 0.14 | + 0.69 | 48 47.71 | 35 06.55 | 41.16 |
| E. | ε Bootis | 53 08.76 | — 0.21 | — 0.16 | + 0.74 | 53 09.13 | 39 28.08 | 41.05 |
| E. | β Ursæ Minoris..... | 15 04 47.24 | + 1.92 | — 0.46 | + 2.49 | 15 04 51.19 | 51 09.97 | 41.22 |
| E. | β Bootis | 10 51.93 | + 0.03 | — 0.30 | + 0.87 | 10 52.53 | 14 57 11.60 | — 13 40.93 |
| Mean at 14 ^h 20 ^m local sidereal time | | | | | | | | — 13 41.00 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -6.32 + 10.00 \delta t - 3.33 a + 5.17 c & \delta t &= 0^s.00 \\
 0 &= +22.86 - 3.33 \delta t + 12.10 a - 18.44 c & a &= -0^s.88 \\
 0 &= -45.59 + 5.17 \delta t - 18.44 a + 44.44 c & c &= +0^s.66
 \end{aligned}$$

Observations and reductions for time taken at receiving station—Continued.

GEORGETOWN, COLORADO, JUNE 25, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|---|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | ω Draconis | 17 51 24.25 | + 1.16 | — 0.58 | + 1.89 | 17 51 26.72 | 17 37 45.56 | — 13 41.16 |
| E. | μ Herculis | 55 12.24 | — 0.21 | — 0.29 | + 0.77 | 55 12.51 | 41 31.38 | 41.13 |
| E. | ψ ¹ Draconis | 57 54.39 | + 1.53 | — 0.64 | + 2.27 | 57 57.55 | 44 16.30 | 41.25 |
| E. | γ Draconis | 18 07 22.02 | + 0.50 | — 0.33 | + 1.09 | 18 07 23.28 | 53 42.07 | 41.21 |
| E. | ο Herculis | 16 18.25 | — 0.19 | — 0.24 | + 0.78 | 16 18.60 | 18 02 37.38 | 41.22 |
| W. | b Draconis | 35 48.09 | + 0.54 | — 0.20 | — 1.32 | 35 47.11 | 22 05.92 | 41.19 |
| W. | 1 Aquilæ | 42 02.40 | — 0.66 | — 0.07 | — 0.70 | 42 00.97 | 28 19.81 | 41.16 |
| W. | a Lyræ | 46 22.68 | — 0.02 | — 0.12 | — 0.88 | 46 21.66 | 32 40.47 | 41.19 |
| W. | δ Sagittarii | 19 01 08.75 | — 0.89 | — 0.06 | — 0.76 | 19 01 07.04 | 18 47 25.77 | — 13 41.27 |
| | Mean at 18 ^h 12 ^m local sidereal time | | | | | | | — 13 41.20 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -3.12 + 9.00 \delta t - 2.04 a + 4.60 c & \delta t &= -0^s.20 \\
 0 &= +13.28 - 2.04 \delta t + 7.35 a - 10.68 c & a &= -0^s.87 \\
 0 &= -29.85 + 4.60 \delta t - 10.68 a + 31.43 c & c &= +0^s.68
 \end{aligned}$$

GEORGETOWN, COLORADO, JUNE 26, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|---|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | η Ursæ Majoris | 13 57 13.94 | + 0.95 | + 0.06 | — 0.89 | 13 57 14.06 | 13 42 33.75 | — 13 40.31 |
| W. | η Bootis | 14 02 21.45 | — 1.26 | + 0.02 | — 0.61 | 14 02 19.60 | 48 39.60 | 40.00 |
| W. | τ Virginis | 08 55.09 | — 2.08 | + 0.01 | — 0.57 | 08 52.45 | 55 12.33 | 40.12 |
| W. | a Draconis | 14 37.46 | + 3.44 | + 0.02 | — 1.36 | 14 39.56 | 14 00 59.51 | 40.05 |
| W. | κ Virginis | 19 52.08 | — 2.63 | + 0.01 | — 0.59 | 19 48.87 | 06 08.73 | 40.14 |
| W. | a Bootis | 23 35.61 | — 1.23 | + 0.01 | — 0.61 | 23 33.78 | 09 53.51 | 40.27 |
| E. | θ Bootis | 34 32.36 | + 1.23 | — 0.10 | + 0.94 | 34 34.43 | 20 54.31 | 40.12 |
| E. | 5 Ursæ Minoris | 41 22.64 | + 8.56 | — 0.24 | + 2.42 | 41 33.38 | 27 53.31 | 40.07 |
| E. | ζ Bootis | 48 47.58 | — 1.50 | — 0.04 | + 0.60 | 48 46.64 | 35 06.54 | 40.10 |
| E. | ε Bootis | 53 08.40 | — 0.82 | — 0.04 | + 0.65 | 53 08.19 | 39 28.07 | 40.12 |
| E. | β Ursæ Minoris | 15 04 40.74 | + 7.40 | — 0.15 | + 2.17 | 15 04 50.16 | 51 09.91 | 40.25 |
| E. | β Bootis | 10 51.03 | + 0.10 | — 0.08 | + 0.76 | 10 51.81 | 14 57 11.59 | — 13 40.22 |
| | Mean at 14 ^h 20 ^m local sidereal time | | | | | | | — 13 40.15 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -19.30 + 12.00 \delta t - 3.57 a + 5.06 c & \delta t &= +0^s.35 \\
 0 &= +58.37 - 3.57 \delta t + 13.71 a - 18.02 c & a &= -3^s.41 \\
 0 &= -92.52 + 5.06 \delta t - 18.02 a + 51.10 c & c &= +0^s.57
 \end{aligned}$$

Observations and reductions for time taken at receiving station—Continued.

GEORGETOWN, COLORADO, JUNE 27, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|----------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | <i>η</i> Ursæ Majoris..... | 13 56 14.55 | + 0.32 | — 0.11 | — 0.92 | 13 56 13.84 | 13 42 33.73 | — 13 40.11 |
| W. | <i>η</i> Bootis | 14 02 20.63 | — 0.43 | — 0.12 | — 0.63 | 14 02 19.45 | 48 39.59 | 39.86 |
| W. | <i>α</i> Draconis | 14 40.15 | + 1.17 | — 0.21 | — 1.41 | 14 39.70 | 14 00 59.48 | 40.22 |
| W. | <i>κ</i> Virginis | 19 50.35 | — 0.89 | — 0.05 | — 0.61 | 19 48.80 | 06 08.71 | 40.09 |
| W. | <i>α</i> Bootis | 23 34.70 | — 0.42 | — 0.07 | — 0.63 | 23 33.58 | 09 53.50 | 40.08 |
| E. | <i>5</i> Ursæ Minoris..... | 41 28.81 | + 2.90 | — 0.77 | + 2.50 | 41 33.44 | 27 53.24 | 40.20 |
| E. | <i>ζ</i> Bootis | 48 46.83 | — 0.51 | — 0.19 | + 0.62 | 48 46.75 | 35 06.51 | 40.24 |
| E. | <i>ε</i> Bootis | 53 08.07 | — 0.28 | — 0.24 | + 0.67 | 53 08.22 | 39 28.06 | 40.16 |
| E. | <i>β</i> Ursæ Minoris..... | 15 04 45.76 | + 2.51 | — 0.74 | + 2.25 | 15 04 49.78 | 51 09.85 | 39.93 |
| E. | <i>β</i> Bootis | 10 51.18 | + 0.03 | — 0.31 | + 0.79 | 10 51.69 | 14 57 11.58 | — 13 40.11 |
| Mean at 14 ^h 20 ^m local sidereal time..... | | | | | | | | — 13 40.10 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -8.03 + 10.00 \delta t - 3.82 a + 4.42 c & \delta t &= +0^s.10 \\
 0 &= +25.64 - 3.82 \delta t + 13.21 a - 16.82 c & a &= -1^s.16 \\
 0 &= -48.06 + 4.42 \delta t - 16.82 a + 47.41 c & c &= +0^s.59
 \end{aligned}$$

GEORGETOWN, COLORADO, JUNE 28, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|----------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | <i>α</i> Draconis | 14 14 35.73 | + 1.96 | + 0.08 | + 1.44 | 14 14 39.21 | 14 00 59.44 | — 13 39.77 |
| E. | <i>κ</i> Virginis..... | 19 49.15 | — 1.50 | + 0.02 | + 0.62 | 19 48.29 | 06 08.73 | 39.56 |
| E. | <i>α</i> Bootis | 23 33.26 | — 0.70 | 0.00 | + 0.65 | 23 33.21 | 09 53.49 | 39.72 |
| E. | <i>ε</i> Bootis | 53 07.48 | — 0.47 | — 0.02 | + 0.69 | 53 07.68 | 39 28.05 | 39.63 |
| W. | <i>β</i> Ursæ Minoris..... | 15 05 47.45 | + 4.22 | + 0.06 | — 2.30 | 15 04 49.43 | 51 09.79 | 39.64 |
| W. | <i>β</i> Bootis | 11 52.02 | + 0.06 | + 0.04 | — 0.80 | 10 51.32 | 57 11.57 | 39.75 |
| W. | <i>ψ</i> Bootis | 13 42.89 | — 0.49 | + 0.04 | — 0.68 | 12 41.76 | 59 01.87 | 39.89 |
| W. | <i>3</i> Serpentis..... | 15 22 35.62 | — 1.11 | + 0.03 | — 0.62 | 15 22 33.92 | 15 08 54.27 | — 13 39.65 |
| Mean at 14 ^h 35 ^m local sidereal time..... | | | | | | | | — 13 39.70 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -3.36 + 8.00 \delta t - 0.99 a - 1.65 c & \delta t &= +0^s.30 \\
 0 &= +9.79 - 0.99 \delta t + 6.89 a + 6.42 c & a &= -1^s.94 \\
 0 &= -3.67 - 1.65 \delta t + 6.42 a + 27.36 c & c &= +0^s.61
 \end{aligned}$$

Observations and reductions for time taken at receiving station—Continued.

GEORGETOWN, COLORADO, JUNE 28, 1875.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|---|--------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | 1 Aquilæ..... | 18 41 01.94 | — 1.51 | 0.00 | — 0.58 | 18 40 59.85 | 18 28 19.84 | — 13 40.01 |
| W. | <i>a</i> Lyræ..... | 45 21.15 | — 0.04 | 0.00 | — 0.73 | 45 20.38 | 32 40.49 | 39.89 |
| W. | <i>β</i> Lyræ..... | 59 06.56 | — 0.26 | — 0.01 | — 0.68 | 59 05.61 | 45 25.55 | 40.06 |
| W. | <i>σ</i> Sagittarii..... | 19 01 08.51 | — 2.03 | — 0.01 | — 0.63 | 19 01 05.84 | 47 25.82 | 40.02 |
| W. | 50 Draconis..... | 04 10.05 | + 4.56 | — 0.13 | — 2.23 | 04 12.25 | 50 32.01 | 40.24 |
| E. | <i>ζ</i> Aquilæ..... | 13 16.84 | — 0.90 | + 0.01 | + 0.58 | 13 16.53 | 59 36.30 | 40.23 |
| E. | <i>d</i> Sagittarii..... | 23 55.93 | — 1.81 | + 0.01 | + 0.60 | 23 54.73 | 19 10 14.46 | 40.27 |
| E. | <i>τ</i> Draconis..... | 31 37.22 | + 3.78 | + 0.06 | + 1.95 | 31 43.01 | 18 02.86 | 40.15 |
| E. | <i>κ</i> Aquilæ..... | 43 46.66 | — 1.47 | 0.00 | + 0.58 | 43 45.77 | 30 05.55 | 40.22 |
| E. | <i>γ</i> Aquilæ..... | 53 55.78 | — 1.00 | — 0.09 | + 0.58 | 53 55.27 | 40 15.25 | 40.02 |
| E. | <i>a</i> Aquilæ..... | 58 17.68 | — 1.03 | — 0.09 | + 0.57 | 58 17.13 | 44 37.14 | 39.99 |
| E. | <i>e</i> Draconis..... | 20 02 14.38 | + 2.93 | — 0.42 | + 1.66 | 20 02 18.55 | 19 48 38.69 | — 13 39.86 |
| Mean at 19 ^h 10 ^m local sidereal time | | | | | | | | — 13 40.08 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= + 1.67 + 12.00 \, dt - 0.61 \, a + 2.95 \, c & dt &= - 0^s.38 \\
 0 &= + 29.59 - 0.61 \, dt + 14.75 \, a - 0.72 \, c & a &= - 1^s.99 \\
 0 &= - 26.89 + 2.95 \, dt - 0.72 \, a + 46.45 \, c & c &= + 0^s.57
 \end{aligned}$$

GEORGETOWN, COLORADO, JUNE 29, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|----------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | <i>a</i> Draconis..... | 14 14 34.86 | + 3.24 | 0.00 | + 1.47 | 14 14 39.57 | 14 00 59.40 | — 13 40.17 |
| E. | <i>κ</i> Virginis..... | 19 50.53 | — 2.47 | — 0.03 | + 0.63 | 19 48.66 | 06 08.73 | 39.93 |
| E. | <i>a</i> Bootis..... | 23 34.03 | — 1.25 | — 0.10 | + 0.66 | 23 33.34 | 09 53.48 | 39.86 |
| E. | <i>θ</i> Bootis..... | 34 32.21 | + 1.25 | — 0.11 | + 1.02 | 34 34.37 | 20 54.24 | 40.13 |
| E. | 5 Ursæ Minoris..... | 41 22.75 | + 8.04 | — 0.17 | + 2.61 | 41 33.23 | 27 53.09 | 40.14 |
| W. | <i>ζ</i> Bootis..... | 48 48.71 | — 1.41 | + 0.03 | — 0.65 | 48 46.68 | 35 06.50 | 40.18 |
| W. | <i>e</i> Bootis..... | 53 09.54 | — 0.77 | + 0.03 | — 0.70 | 53 08.10 | 39 28.04 | 40.06 |
| W. | <i>β</i> Ursæ Minoris..... | 15 04 44.94 | + 6.95 | + 0.18 | — 2.35 | 15 04 49.72 | 51 09.72 | 40.00 |
| W. | <i>β</i> Bootis..... | 10 52 32 | + 0.09 | + 0.14 | — 0.82 | 10 51.73 | 57 11.55 | 40.18 |
| W. | <i>γ</i> Ursæ Minoris..... | 34 36.85 | + 5.67 | + 0.05 | — 2.04 | 34 40.53 | 15 21 00.47 | 40.06 |
| W. | <i>a</i> Coronæ..... | 43 02.12 | — 0.77 | + 0.02 | — 0.70 | 43 00.67 | 29 20.46 | 40.21 |
| W. | <i>a</i> Serpentis..... | 15 51 45.07 | — 1.73 | + 0.01 | — 0.63 | 15 51 42.72 | 38 02.51 | — 13 40.21 |
| Mean at 14 ^h 50 ^m local sidereal time..... | | | | | | | | — 13 40.09 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= - 14.21 + 12.00 \, dt - 5.26 \, a - 2.39 \, c & dt &= - 0^s.09 \\
 0 &= + 52.63 - 5.26 \, dt + 16.61 \, a - 0.13 \, c & a &= - 3^s.20 \\
 0 &= - 36.81 - 2.39 \, dt + 0.13 \, a + 59.56 \, c & c &= + 0^s.62
 \end{aligned}$$

Observations and reductions for time taken at receiving station—Continued.

GEORGETOWN, COLORADO, JULY 1, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|---------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | θ Bootis | 14 34 36.68 | — 0.69 | + 0.02 | — 1.20 | 14 34 34.81 | 14 20 54.20 | — 13 40.61 |
| W. | 5 Ursæ Minoris.... | 41 41.79 | — 4.82 | + 0.03 | — 3.07 | 41 33.93 | 27 52.94 | 40.99 |
| W. | ζ Bootis | 48 47.34 | + 0.84 | 0.00 | — 0.76 | 48 47.42 | 35 06.49 | 40.93 |
| W. | ε Bootis | 53 09.29 | + 0.46 | — 0.01 | — 0.82 | 53 18.92 | 39 28.02 | 40.90 |
| E. | β Ursæ Minoris.... | 15 04 52.19 | — 4.16 | — 0.22 | + 2.76 | 15 04 50.57 | 51 09.59 | 40.98 |
| E. | β Bootis | 10 51.50 | — 0.06 | — 0.09 | + 0.96 | 10 52.31 | 57 11.52 | 40.79 |
| E. | β Libræ | 23 50.97 | + 1.46 | — 0.04 | + 0.74 | 23 53.13 | 15 10 12.09 | 41.04 |
| E. | γ ² Ursæ Minoris.... | 34 42.23 | — 3.40 | — 0.10 | + 2.39 | 34 41.12 | 21 00.37 | 40.75 |
| E. | α Coronæ | 15 43 00.18 | + 0.46 | — 0.05 | + 0.82 | 15 43 01.41 | 29 20.45 | — 13 40.96 |
| Mean at 14 ^h 55 ^m local sidereal time..... | | | | | | | | — 13 40.88 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= +16.04 + 9.00 \delta t - 5.16 a + 2.49 c & dt &= -0.88 \\
 0 &= -31.76 - 5.16 \delta t + 15.16 a - 2.59 c & a &= +1.92 \\
 0 &= -30.68 + 2.49 \delta t - 2.59 a + 51.83 c & c &= +0.73
 \end{aligned}$$

GEORGETOWN, COLORADO, JULY 2, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|---------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | θ Bootis | 14 34 37.05 | — 0.88 | — 0.06 | — 1.15 | 14 34 34.96 | 14 20 54.17 | — 13 40.79 |
| W. | 5 Ursæ Minoris.... | 41 42.94 | — 6.15 | 0.00 | — 2.96 | 41 33.83 | 27 52.87 | 40.96 |
| W. | ζ Bootis | 48 47.01 | + 1.08 | + 0.03 | — 0.73 | 48 47.39 | 35 06.50 | 40.89 |
| W. | ε Bootis | 53 09.08 | + 0.59 | 0.00 | — 0.80 | 53 08.87 | 39 28.01 | 40.86 |
| E. | β Ursæ Minoris.... | 15 04 53.28 | — 5.32 | — 0.34 | + 2.66 | 15 04 50.28 | 51 09.53 | 40.75 |
| E. | β Bootis | 10 51.73 | — 0.07 | — 0.14 | + 0.93 | 10 52.45 | 57 11.51 | 40.94 |
| E. | β Libræ | 23 50.51 | + 1.86 | — 0.05 | + 0.71 | 23 53.03 | 15 10 12.08 | 40.95 |
| E. | γ ² Ursæ Minoris.... | 34 43.49 | — 4.34 | — 0.11 | + 2.31 | 34 41.35 | 21 00.32 | 41.03 |
| E. | α Coronæ | 15 43 00.08 | + 0.59 | — 0.12 | + 0.79 | 15 43 01.34 | 43 20.44 | — 13 40.90 |
| Mean at 14 ^h 55 ^m local sidereal time..... | | | | | | | | — 13 40.90 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= +9.95 + 9.00 \delta t - 5.16 a + 2.49 c & dt &= +0^s.10 \\
 0 &= -34.81 - 5.16 \delta t + 15.16 a - 2.59 c & a &= +2^s.45 \\
 0 &= -30.42 + 2.49 \delta t - 2.59 a + 51.83 c & c &= +0^s.70
 \end{aligned}$$

Observations and reductions for time taken at receiving station—Continued.

GEORGETOWN, COLORADO, JULY 3, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|---|---------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | η Bootis | 14 02 19.79 | — 0.30 | — 0.05 | + 1.13 | 14 02 20.57 | 13 48 39.53 | — 13 41.04 |
| E. | τ Virginis | 08 52.15 | + 0.65 | — 0.02 | + 0.73 | 08 53.51 | 55 12.23 | 41.28 |
| E. | α Draconis | 14 40.31 | — 1.07 | — 0.08 | + 1.72 | 14 40.88 | 14 00 59.25 | 41.63 |
| E. | α Bootis | 23 33.64 | + 0.38 | — 0.07 | + 0.77 | 23 34.72 | 09 53.44 | 41.28 |
| W. | θ Bootis | 34 37.16 | — 0.38 | + 0.09 | — 1.19 | 34 35.68 | 20 54.15 | 41.53 |
| W. | 5 Ursæ Minoris.... | 41 39.76 | — 2.67 | + 0.13 | — 3.06 | 41 34.16 | 27 52.78 | 41.38 |
| W. | ζ Bootis | 48 48.17 | + 0.47 | + 0.04 | — 0.76 | 48 47.92 | 35 06.49 | 41.43 |
| W. | ε Bootis | 53 09.91 | + 0.26 | + 0.03 | — 0.82 | 53 09.38 | 39 28.00 | 41.38 |
| W. | β Ursæ Minoris.... | 15 04 55.86 | — 2.31 | — 0.00 | — 2.75 | 15 04 50.80 | 51 09.45 | 41.35 |
| W. | β Bootis | 10 53.88 | — 0.03 | — 0.01 | — 0.96 | 10 52.88 | 57 11.50 | 41.38 |
| E. | β Libræ | 23 52.09 | + 0.81 | + 0.01 | + 0.73 | 23 53.64 | 15 10 12.08 | 41.56 |
| E. | γ ³ Ursæ Minoris.... | 34 41.13 | — 1.88 | + 0.01 | + 2.39 | 34 41.65 | 21 00.26 | 41.39 |
| E. | α Coronæ | 15 43 00.84 | + 0.26 | 0.00 | + 0.82 | 15 43 01.92 | 29 20.43 | — 13 41.49 |
| Mean at 14 ^h 30 ^m local sidereal time | | | | | | | | — 13 41.39 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= +12.18 + 13.00 \delta t - 5.48 a - 1.74 c & \delta t &= -0^s.39 \\
 0 &= -28.74 - 5.48 \delta t + 16.76 a + 12.07 c & a &= +1^s.06 \\
 0 &= -58.56 - 1.74 \delta t + 12.07 a + 61.92 c & c &= +0^s.73
 \end{aligned}$$

GEORGETOWN, COLORADO, JULY 3, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|---|---------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | κ Ophiuchi..... | 17 05 21.71 | + 0.61 | — 0.01 | + 0.74 | 17 05 23.05 | 16 51 41.34 | — 13 41.71 |
| E. | ε Ursæ Minoris.... | 12 52.84 | — 4.79 | — 0.06 | + 5.38 | 12 53.34 | 59 11.71 | 41.63 |
| E. | α ¹ Herculis | 22 33.86 | + 0.41 | — 0.04 | + 0.73 | 22 34.96 | 17 08 53.40 | 41.56 |
| E. | 44 Ophiuchi..... | 32 19.14 | + 0.93 | — 0.04 | + 0.79 | 32 20.82 | 18 39.20 | 41.62 |
| E. | β Draconis | 41 17.27 | — 0.33 | — 0.16 | + 1.18 | 41 17.96 | 27 36.27 | 41.69 |
| E. | α Ophiuchi..... | 42 44.97 | + 0.44 | — 0.09 | + 0.74 | 42 46.06 | 29 04.38 | 41.68 |
| W. | ω Draconis | 51 30.20 | — 1.28 | + 0.08 | — 1.99 | 51 27.01 | 37 45.43 | 41.58 |
| W. | ψ Draconis..... | 58 01.79 | — 1.68 | + 0.19 | — 2.36 | 57 57.94 | 44 16.14 | 41.80 |
| W. | γ Draconis | 18 07 23.09 | — 0.55 | + 0.10 | — 1.15 | 18 07 23.49 | 53 42.06 | 41.43 |
| W. | γ ² Sagittarii | 11 22.99 | + 1.04 | + 0.02 | — 0.84 | 11 23.21 | 57 41.53 | 41.69 |
| W. | μ ¹ Sagittarii | 19 53.92 | + 0.89 | + 0.03 | — 0.77 | 19 54.07 | 18 06 12.43 | — 13 41.64 |
| Mean at 17 ^h 30 ^m local sidereal time | | | | | | | | — 13 41.64 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= + 8.92 + 11.00 \delta t - 4.52 a + 3.33 c & \delta t &= -0^s.64 \\
 0 &= -16.16 - 4.52 \delta t + 34.37 a - 27.05 c & a &= +0^s.95 \\
 0 &= -33.69 + 3.36 \delta t - 27.05 a + 25.44 c & c &= +0^s.72
 \end{aligned}$$

Observations and reductions for time taken at sending station.

SALT LAKE CITY, UTAH, JUNE 23, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|-----------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | <i>a</i> Bootis | 6 02 23.11 | + 2.68 | + 0.03 | + 0.17 | 6 02 25.99 | 14 09 53.51 | +8 07 27.52 |
| E. | <i>θ</i> Bootis | 13 28.63 | - 2.32 | + 0.05 | + 0.26 | 13 26.62 | 20 54.36 | 27.74 |
| E. | 5 Ursæ Minoris | 20 42.54 | -17.25 | + 0.10 | + 0.67 | 20 26.06 | 27 53.53 | 27.47 |
| E. | <i>μ</i> Virginis | 28 50.82 | + 5.07 | + 0.02 | + 0.16 | 28 56.07 | 36 23.56 | 27.49 |
| E. | <i>ε</i> Bootis | 31 58.69 | + 1.83 | + 0.08 | + 0.18 | 32 00.78 | 39 28.09 | 27.31 |
| E. | <i>α</i> ² Libræ | 36 19.19 | + 6.05 | + 0.02 | + 0.17 | 36 25.43 | 43 52.83 | 27.40 |
| W. | <i>β</i> Ursæ Minoris | 43 57.98 | -14.85 | + 0.09 | - 0.61 | 43 42.61 | 51 10.10 | 27.49 |
| W. | <i>β</i> Bootis | 49 44.29 | - 0.02 | + 0.04 | - 0.21 | 49 44.10 | 57 11.62 | 27.52 |
| W. | 48 Cephei, S. P. | 56 17.20 | +28.16 | - 0.06 | + 0.73 | 56 46.03 | 15 04 13.51 | 27.48 |
| W. | <i>β</i> Libræ | 7 02 39.48 | + 5.42 | + 0.02 | - 0.16 | 7 02 44.76 | 10 12.13 | +8 07 27.37 |
| Mean at 14 ^h .5 local sidereal time | | | | | | | | +8 07 27.48 |

NORMAL EQUATIONS.

$$\begin{aligned}
 +10.00 \delta t - 2.10 a + 8.51 c &= + 20.92 & \delta t &= + 0^s.48 \\
 - 2.10 \delta t + 28.61 a - 16.81 c &= - 205.00 & a &= - 7^s.040 \\
 + 8.51 \delta t - 16.81 a + 62.54 c &= + 132.68 & c &= + 0^s.160
 \end{aligned}$$

SALT LAKE CITY, JUNE 23, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|--------------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | <i>η</i> Herculis | 8 31 07.58 | + 0.26 | - 0.04 | - 0.30 | 8 31 07.50 | 16 38 34.70 | +8 07 27.20 |
| W. | <i>κ</i> Ophiuchi | 44 10.71 | + 3.76 | - 0.02 | - 0.24 | 44 14.21 | 51 41.32 | 27.11 |
| W. | <i>δ</i> Herculis | 49 29.07 | + 1.05 | - 0.01 | - 0.28 | 49 29.83 | 56 57.00 | 27.17 |
| W. | <i>ε</i> Ursæ Minoris | 51 22.21 | -35.11 | - 0.05 | - 1.74 | 50 45.31 | 59 12.54 | 27.23 |
| W. | <i>α</i> ₁ Herculis | 9 01 23.01 | + 3.27 | - 0.00 | - 0.24 | 9 01 26.04 | 17 08 53.38 | 27.34 |
| E. | <i>β</i> Draconis | 20 11.16 | - 2.36 | + 0.02 | + 0.39 | 20 09.21 | 27 36.31 | 27.10 |
| E. | <i>ω</i> Draconis | 30 26.97 | - 9.30 | + 0.06 | + 0.65 | 30 18.38 | 37 45.57 | 27.19 |
| E. | <i>μ</i> Herculis | 34 02.03 | + 1.82 | + 0.02 | + 0.27 | 34 04.14 | 41 31.36 | 27.22 |
| E. | <i>ψ</i> ¹ Draconis | 36 00.59 | -12.21 | + 0.02 | + 0.77 | 35 49.17 | 44 16.31 | 27.14 |
| E. | <i>γ</i> Draconis | 9 46 16.30 | - 2.14 | + 0.00 | + 0.38 | 9 46 14.54 | 17 53 42.07 | +8 07 27.53 |
| Mean at 17 ^h .0 local sidereal time | | | | | | | | +8 07 27.23 |

NORMAL EQUATIONS.

$$\begin{aligned}
 +10.00 \delta t + 7.12 a^1 - 1.52 c &= + 0.81 & \delta t &= + 0^s.23 \\
 + 7.12 \delta t + 29.49 a^1 - 25.21 c &= - 8.74 & a^1 &= - 0^s.150 \\
 - 1.52 \delta t - 25.21 a^1 + 85.01 c &= + 23.37 & c &= + 0^s.235
 \end{aligned}$$

Adopted azimuth: $-7^s.00$; $a = -7^s.15$.

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, JUNE 27, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|----------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | θ Bootis | 6 13 31.08 | + 0.67 | 0.00 | + 0.06 | 6 13 31.81 | 14 20 54.28 | +8 07 22.47 |
| E. | μ Virginis | 29 02.35 | — 1.46 | 0.00 | + 0.04 | 29 00.93 | 36 23.53 | 22.60 |
| E. | ϵ Bootis | 32 05.90 | — 0.53 | 0.00 | + 0.04 | 32 05.41 | 39 28.06 | 22.65 |
| E. | α^2 Libræ | 36 32.02 | — 1.75 | + 0.15 | + 0.04 | 36 30.46 | 43 52.81 | 22.35 |
| E. | β Ursæ Minoris | 43 42.41 | + 4.29 | + 0.80 | + 0.13 | 43 47.63 | 51 09.85 | 22.22 |
| E. | β Bootis | 49 48.68 | + 0.00 | + 0.34 | + 0.05 | 49 49.07 | 57 11.58 | 22.51 |
| W. | 48 Cephei, S. P. | 57 00.43 | — 8.12 | — 0.55 | — 0.16 | 57 51.60 | 15 04 13.91 | 22.31 |
| W. | β Libræ | 7 02 51.09 | — 1.56 | + 0.17 | — 0.04 | 7 02 49.66 | 10 12.11 | 22.45 |
| W. | α^2 Libræ | 08 37.78 | — 1.73 | + 0.15 | — 0.04 | 08 36.16 | 15 58.52 | 22.36 |
| W. | μ^1 Bootis | 12 20.98 | — 0.14 | + 0.33 | — 0.05 | 12 21.12 | 19 43.51 | 22.39 |
| W. | ζ^3 Libræ | 16 11.51 | — 1.77 | + 0.15 | — 0.04 | 16 09.85 | 23 32.40 | 22.55 |
| | α Coronæ | 7 21 58.37 | — 0.54 | + 0.28 | — 0.04 | 7 21 58.07 | 15 29 20.47 | +8 07 22.40 |
| Mean at 15 ^h .0 local sidereal time | | | | | | | | +8 07 22.45 |

NORMAL EQUATIONS.

$$\begin{aligned}
 +12.00 \, dt + 6.23 \, a - 0.10 \, c &= -7.28 & dt &= +0^s.45 \\
 +6.23 \, dt + 24.03 \, a - 27.73 \, c &= -46.99 & a &= -2^s.029 \\
 -0.10 \, dt - 27.73 \, a + 48.71 \, c &= +58.12 & c &= +0^s.035
 \end{aligned}$$

SALT LAKE CITY, UTAH, JUNE 27, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|---------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | α^1 Herculis | 9 01 31.94 | — 0.81 | + 0.22 | — 0.10 | 9 01 31.25 | 17 08 53.40 | +8 07 22.15 |
| W. | Groom, 966, S. P. | 15 26.23 | — 6.07 | — 0.40 | + 0.38 | 15 20.14 | 5 22 42.21 | 22.07 |
| W. | α Ophiuchi | 21 42.94 | — 0.79 | + 0.22 | — 0.10 | 21 42.27 | 17 29 04.36 | 22.09 |
| W. | ω Draconis | 30 20.81 | + 2.28 | + 0.63 | — 0.28 | 30 23.44 | 37 45.53 | 22.09 |
| W. | μ Herculis | 34 09.57 | — 0.44 | + 0.29 | — 0.11 | 34 09.31 | 41 31.38 | 22.07 |
| W. | ψ Draconis | 36 50.84 | + 2.99 | + 0.75 | — 0.33 | 36 54.23 | 44 16.27 | 22.04 |
| W. | γ Draconis | 46 19.30 | + 0.59 | + 0.42 | — 0.16 | 46 20.15 | 53 42.08 | 21.93 |
| E. | η Serpentis | 10 07 25.45 | — 1.21 | 0.00 | + 0.10 | 10 07 24.34 | 18 14 46.31 | 21.97 |
| E. | 1 Aquilæ | 20 59.18 | — 1.33 | — 0.02 | + 0.10 | 20 57.93 | 28 19.83 | 21.90 |
| E. | α Lyræ | 10 25 18.03 | — 0.08 | — 0.06 | + 0.13 | 10 25 18.02 | 18 32 40.48 | +8 07 22.46 |
| Mean at 17 ^h .5 local sidereal time | | | | | | | | +8 07 22.08 |

NORMAL EQUATIONS.

$$\begin{aligned}
 +10.00 \, dt + 2.82 \, a - 3.68 \, c &= -4.47 & dt &= +0^s.08 \\
 +2.82 \, dt - 18.26 \, a + 23.35 \, c &= -29.53 & a &= -1^s.755 \\
 -3.68 \, dt + 23.35 \, a + 42.83 \, c &= -37.13 & c &= +0^s.097
 \end{aligned}$$

15 AST

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, JUNE 28, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|------------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | <i>θ</i> Bootis | 6 13 32.62 | + 0.65 | + 0.08 | + 0.19 | 6 13 33.54 | 14 20 54.26 | +8 07 20.72 |
| E. | 5 Ursæ Minoris.... | 20 27.14 | + 4.80 | + 0.17 | + 0.50 | 20 32.61 | 27 53.16 | 20.55 |
| E. | <i>ε</i> Bootis | 32 07.47 | — 0.51 | + 0.03 | + 0.13 | 32 07.12 | 39 28.05 | 20.93 |
| E. | <i>α</i> ² Libræ | 36 33.71 | — 1.68 | + 0.01 | + 0.12 | 36 32.16 | 43 52.81 | 20.65 |
| E. | <i>β</i> Ursæ Minoris.... | 43 44.39 | + 4.13 | + 0.03 | + 0.45 | 43 49.00 | 51 09.78 | 20.78 |
| W. | <i>β</i> Bootis | 49 50.86 | — 0.00 | + 0.05 | — 0.15 | 49 50.76 | 57 11.56 | 20.80 |
| W. | 48 Cephei, S. P. | 57 00.94 | — 7.83 | — 0.32 | + 0.54 | 57 53.33 | 15 04 14.00 | 20.67 |
| W. | <i>β</i> Libræ | 7 02 52.93 | — 1.50 | + 0.08 | — 0.12 | 7 02 51.39 | 10 12.11 | 20.72 |
| W. | <i>α</i> ² Libræ | 08 39.68 | — 1.63 | + 0.06 | — 0.12 | 08 37.96 | 15 58.52 | 20.56 |
| W. | <i>μ</i> ¹ Bootis | 12 22.95 | — 0.13 | + 0.18 | — 0.15 | 12 22.85 | 19 43.50 | 20.65 |
| W. | <i>ζ</i> ³ Libræ | 16 13.35 | — 1.70 | + 0.10 | — 0.12 | 16 11.63 | 15 33 32.40 | +8 07 20.77 |
| Mean at 15 ^h .0 local sidereal time | | | | | | | | +8 07 20.71 |

NORMAL EQUATIONS.

$$\begin{aligned}
 + 11.00 \delta t + 2.79 a + 10.67 c &= - 7.46 & \delta t &= - 0^s.629 \\
 + 2.79 \delta t + 29.41 a - 2.15 c &= - 58.68 & a &= - 1^s.960 \\
 + 10.67 \delta t - 2.15 a + 64.18 c &= + 8.46 & c &= + 0^s.117
 \end{aligned}$$

SALT LAKE CITY, UTAH, JUNE 28, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|--------------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | <i>η</i> Herculis | 8 31 13.80 | — 0.09 | + 0.41 | — 0.11 | 8 31 14.01 | 16 38 34.70 | +8 07 20.69 |
| W. | <i>κ</i> Ophiuchi..... | 44 21.47 | — 1.19 | + 0.29 | — 0.09 | 44 20.48 | 51 41.34 | 20.86 |
| W. | <i>δ</i> Herculis | 49 36.52 | — 0.34 | + 0.43 | — 0.11 | 49 36.50 | 56 56.99 | 20.49 |
| W. | <i>α</i> ¹ Herculis | 9 01 33.17 | — 1.03 | + 0.37 | — 0.09 | 9 01 32.42 | 17 08 53.40 | 20.98 |
| E. | <i>μ</i> Herculis | 34 10.39 | — 0.56 | + 0.55 | + 0.10 | 34 10.48 | 41 31.39 | 20.91 |
| E. | <i>γ</i> Draconis | 46 19.80 | + 0.67 | + 0.88 | + 0.14 | 46 21.49 | 53 42.08 | 20.59 |
| Mean at 17 ^h .0 local sidereal time | | | | | | | | +8 07 20.75 |

NORMAL EQUATIONS.

$$\begin{aligned}
 + 6.00 \delta t + 1.13 a - 1.79 c &= - 4.20 & \delta t &= - 0^s.25 \\
 + 1.13 \delta t + 0.66 a - 1.44 c &= - 1.83 & a &= - 2^s.240 \\
 - 1.79 \delta t - 1.44 a + 9.05 c &= + 4.44 & c &= + 0^s.087
 \end{aligned}$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, JULY 1, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|-------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | 5 Ursæ Minoris.... | 6 20 33.44 | + 4.67 | — 0.24 | — 0.42 | 6 20 37.45 | 14 27 52.94 | + 8 7 15.49 |
| E. | 5 Ursæ Minoris.... | 20 32.34 | + 4.67 | — 0.24 | + 0.42 | 20 37.19 | 27 52.94 | 15.75 |
| E. | μ Virginis..... | 29 08.91 | — 1.37 | — 0.03 | + 0.10 | 29 07.61 | 36 23.46 | 15.85 |
| E. | ε Bootis..... | 32 12.52 | — 0.49 | — 0.05 | + 0.11 | 32 12.09 | 39 28.02 | 15.93 |
| E. | α ² Libræ..... | 36 38.26 | — 1.64 | — 0.02 | + 0.10 | 36 36.70 | 43 52.79 | 16.09 |
| E. | β Ursæ Minoris.... | 43 49.35 | + 4.03 | — 0.13 | + 0.38 | 43 53.63 | 51 09.59 | 15.96 |
| W. | 48 Cephei, S. P..... | 57 05.86 | — 7.64 | + 0.14 | + 0.45 | 57 58.81 | 04 14.31 | 15.50 |
| W. | β Libræ..... | 7 02 57.73 | — 1.47 | — 0.04 | — 0.10 | 7 02 56.12 | 15 10 12.09 | 15.97 |
| W. | α ² Libræ..... | 08 44.60 | — 1.62 | — 0.04 | — 0.10 | 08 42.84 | 15 58.53 | 15.69 |
| W. | μ Bootis..... | 12 27.98 | — 0.13 | — 0.10 | — 0.13 | 12 27.62 | 19 43.47 | 15.85 |
| W. | ζ ³ Libræ..... | 16 18.27 | — 1.66 | — 0.05 | — 0.10 | 16 16.46 | 23 32.39 | 15.93 |
| W. | α Coronæ..... | 22 05.21 | — 0.52 | — 0.10 | — 0.11 | 22 04.43 | 29 20.44 | 15.96 |
| W. | τ ⁶ Serpentis..... | 27 55.76 | — 0.82 | — 0.11 | — 0.10 | 27 54.73 | 35 10.58 | 15.85 |
| W. | α Serpentis..... | 30 47.85 | — 1.07 | — 0.10 | — 0.10 | 7 30 46.58 | 15 34 02.50 | + 8 7 15.92 |
| Mean at 15 ^h .0 local sidereal time | | | | | | | | + 8 7 15.84 |

NORMAL EQUATIONS.

$$\begin{aligned}
 +14.00 \, \delta t + 2.65 \, a + 3.97 \, c &= -6.92 & \delta t &= -0^s.16 \\
 +2.65 \, \delta t + 36.41 \, a + 8.12 \, c &= -69.31 & a &= -1^s.910 \\
 +3.97 \, \delta t + 8.12 \, a + 81.82 \, c &= -7.95 & c &= +0^s.101
 \end{aligned}$$

SALT LAKE CITY, UTAH, JULY 2, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|-------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | μ Virginis..... | 6 29 10.12 | — 1.35 | — 0.07 | + 0.10 | 6 29 08.80 | 14 36 23.51 | + 8 07 14.71 |
| E. | α ² Libræ..... | 36 39.88 | — 1.62 | — 0.06 | + 0.10 | 36 38.30 | 43 52.78 | 14.48 |
| E. | β Ursæ Minoris.... | 43 50.87 | + 3.97 | — 0.31 | + 0.38 | 43 54.91 | 51 09.53 | 14.62 |
| W. | β Bootis..... | 49 57.00 | — 0.00 | — 0.10 | — 0.13 | 49 56.77 | 57 11.51 | 14.74 |
| W. | 48 Cephei, L. C..... | 56 06.54 | — 7.52 | + 0.19 | + 0.45 | 56 59.65 | 04 14.40 | 14.74 |
| W. | β Libræ..... | 7 02 58.93 | — 1.45 | — 0.05 | — 0.10 | 7 02 57.33 | 15 10 12.08 | 14.75 |
| W. | α ² Libræ..... | 08 45.68 | — 1.60 | — 0.03 | — 0.10 | 08 43.95 | 15 58.52 | 14.57 |
| W. | μ ¹ Bootis..... | 12 29.08 | — 0.13 | — 0.06 | — 0.13 | 12 28.76 | 19 43.45 | 14.69 |
| E. | ζ ³ Libræ..... | 16 19.17 | — 1.64 | — 0.03 | + 0.10 | 16 17.60 | 23 32.38 | 14.78 |
| E. | α Coronæ..... | 22 06.15 | — 0.51 | — 0.05 | + 0.11 | 22 05.70 | 29 20.43 | 14.73 |
| E. | τ ⁶ Serpentis..... | 27 56.62 | — 0.81 | — 0.06 | + 0.10 | 27 55.85 | 35 10.58 | 14.73 |
| E. | α Serpentis..... | 30 48.76 | — 1.05 | — 0.06 | + 0.10 | 30 47.75 | 38 02.49 | 14.74 |
| E. | ε Serpentis..... | 7 37 17.29 | — 1.11 | — 0.09 | + 0.10 | 7 37 16.19 | 15 44 30.94 | + 8 07 14.75 |
| Mean at 15 ^h .0 local sidereal time | | | | | | | | + 8 07 14.70 |

NORMAL EQUATIONS.

$$\begin{aligned}
 +13.00 \, \delta t + 7.88 \, a + 10.94 \, c &= -17.71 & \delta t &= -0^s.30 \\
 +7.88 \, \delta t + 24.69 \, a + 12.85 \, c &= -47.35 & a &= -1^s.880 \\
 +10.94 \, \delta t + 12.85 \, a + 47.84 \, c &= -22.78 & c &= +0^s.100
 \end{aligned}$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, JULY 2, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|---------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | μ Herculis | 9 34 17.16 | — 0.50 | — 0.14 | + 0.27 | 9 34 16.79 | 17 41 31.39 | +8 07 14.60 |
| E. | 72 Ophiuchi | 54 08.04 | — 1.05 | — 0.10 | + 0.24 | 54 07.13 | 18 01 21.79 | 14.66 |
| E. | η Herculis | 10 07 33.06 | — 1.37 | — 0.08 | + 0.24 | 10 07 31.85 | 14 46.35 | 14.50 |
| W. | α Lyræ | 25 26.18 | — 0.10 | — 0.20 | — 0.30 | 25 25.58 | 32 49.52 | 14.94 |
| W. | 50 Draconis | 43 14.17 | + 4.42 | — 0.26 | — 0.93 | 43 17.40 | 50 31.99 | 14.59 |
| W. | α Sagittarii | 11 03 02.03 | — 1.82 | — 0.03 | — 0.25 | 11 03 59.93 | 19 10 14.51 | +8 07 14.58 |
| Mean at 18 ^h .0 local sidereal time | | | | | | | | +8 07 14.66 |

NORMAL EQUATIONS.

$$\begin{aligned}
 + 6.00 \, \delta t + 0.21 \, a - 3.13 \, c &= - 3.18 & \delta t &= - 0^{\text{s}}.34 \\
 + 0.21 \, \delta t + 6.62 \, a + 9.28 \, c &= - 11.02 & a &= - 1^{\text{s}}.980 \\
 - 3.13 \, \delta t + 9.28 \, a + 21.60 \, c &= - 12.33 & c &= + 0^{\text{s}}.236
 \end{aligned}$$

SALT LAKE CITY, UTAH, JULY 3, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|----------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | μ Virginis | 6 29 11.50 | — 1.33 | — 0.07 | — 0.08 | 6 29 10.02 | 14 36 23.50 | +8 07 13.48 |
| W. | α^2 Libræ | 7 08 46.86 | — 1.57 | — 0.06 | — 0.08 | 7 08 45.15 | 15 15 58.51 | 13.36 |
| W. | μ^1 Bootis | 12 30.25 | — 1.13 | — 0.11 | — 0.10 | 12 28.91 | 19 43.45 | 13.54 |
| W. | ζ^3 Libræ | 16 20.63 | — 1.61 | — 0.05 | — 0.08 | 16 18.89 | 23 32.38 | 13.49 |
| W. | α Coronæ | 22 07.44 | — 0.50 | — 0.09 | — 0.09 | 22 06.76 | 29 20.43 | 13.67 |
| E. | τ^6 Serpentis | 27 57.79 | — 0.80 | — 0.09 | + 0.08 | 27 56.98 | 35 10.56 | 13.58 |
| E. | α Serpentis | 30 49.97 | — 1.04 | — 0.07 | + 0.08 | 30 48.94 | 38 02.49 | 13.55 |
| E. | ϵ Serpentis | 37 18.38 | — 1.09 | — 0.07 | + 0.08 | 37 17.30 | 44 30.93 | 13.63 |
| E. | ζ Ursæ Minoris | 41 24.61 | + 5.49 | — 0.39 | + 0.38 | 41 30.09 | 48 43.58 | 13.49 |
| E. | β^1 Scorpii | 50 53.33 | — 1.70 | — 0.05 | + 0.08 | 50 51.66 | 15 58 05.15 | +8 07 13.49 |
| Mean at 15 ^h .5 local sidereal time | | | | | | | | +8 07 13.53 |

NORMAL EQUATIONS.

$$\begin{aligned}
 + 10.00 \, \delta t + 2.31 \, a + 3.54 \, c &= + 1.27 & \delta t &= + 0^{\text{s}}.53 \\
 + 2.31 \, \delta t + 12.57 \, a - 14.82 \, c &= - 23.22 & a &= - 1^{\text{s}}.850 \\
 + 3.54 \, \delta t - 14.82 \, a + 34.13 \, c &= + 31.99 & c &= + 0^{\text{s}}.077
 \end{aligned}$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, JULY 3, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | ζ Ophiuchi..... | 8 22 59.89 | — 1.37 | — 0.08 | + 0.14 | 8 22 58.58 | 16 30 11.98 | +8 07 13.40 |
| E. | κ Ophiuchi..... | 44 28.83 | — 0.92 | — 0.10 | + 0.14 | 44 27.95 | 51 41.34 | 13.39 |
| E. | α ¹ Herculis..... | 51 40.71 | — 0.80 | — 0.06 | + 0.14 | 51 39.99 | 17 08 53.40 | 13.41 |
| E. | Groomb. 966, S. P. | 9 15 35.58 | — 6.04 | + 0.05 | — 0.52 | 9 15 29.07 | 5 22 42.56 | 13.49 |
| W. | Groomb. 966, S. P. | 15 34.48 | — 6.04 | + 0.05 | + 0.52 | 15 29.01 | 5 22 42.56 | 13.55 |
| W. | ω Draconis..... | 30 29.90 | + 2.26 | — 0.00 | — 0.37 | 30 31.79 | 17 37 45.42 | 13.63 |
| W. | 72 Ophiuchi..... | 54 09.30 | — 0.92 | + 0.04 | — 0.14 | 54 08.28 | 18 01 21.80 | 13.52 |
| W. | η Serpentis..... | 10 07 34.25 | — 1.20 | + 0.06 | — 0.14 | 10 07 32.97 | 18 14 46.36 | +8 07 13.39 |
| Mean at 17 ^h .0 local sidereal time | | | | | | | | +8 07 13.47 |

NORMAL EQUATIONS.

$$\begin{aligned}
 + 8.00 \delta t + 8.64 a - 1.73 c &= -11.48 & \delta t &= + 0^s.47 \\
 + 8.64 \delta t + 27.63 a + 4.18 c &= -43.53 & a &= -1^s.744 \\
 - 1.73 \delta t + 4.18 a + 42.47 c &= -2.73 & c &= + 0^s.135
 \end{aligned}$$

The observations for time taken at Salt Lake City June 25 and 26 are printed in the report on Green River.

From these determinations of time the following tables are derived. They contain the corrections and adopted hourly rates of the chronometers used at Georgetown and Salt Lake City. The adopted rate is the mean of the rates of the chronometer at the preceding and following dates:

CHRONOMETER AT GEORGETOWN.—NEGUS, No. 1491.

| Date. | Local sidereal time. | Correction of chronometer. | Adopted hourly rate. |
|---------|----------------------|----------------------------|----------------------|
| 1873. | <i>h. m.</i> | <i>h. m. s.</i> | <i>s.</i> |
| June 23 | 15 52 | — 0 13 41.855 | — 0.0155 |
| June 25 | 16 16 | 41.100 | — 0.0285 |
| June 26 | 14 20 | 40.150 | — 0.0218 |
| June 27 | 14 20 | 40.100 | — 0.0050 |
| June 28 | 16 52 | 39.890 | + 0.0006 |
| June 29 | 14 50 | 40.090 | + 0.0128 |
| July 1 | 14 55 | 40.850 | + 0.0087 |
| July 2 | 14 55 | 40.900 | + 0.0126 |
| July 3 | 16 13 | — 0 13 41.597* | + 0.0244 |

* Mean by giving the last determination the weight 3.

CHRONOMETER AT SALT LAKE CITY.—NEGUS, No. 1511.

| Date. | Local sidereal time. | Correction of chronometer. | Adopted hourly rate. |
|---------|----------------------|----------------------------|----------------------|
| 1873. | <i>h. m.</i> | <i>h. m. s.</i> | <i>s.</i> |
| June 23 | 15 45 | + 8 07 27.360 | — 0.0544 |
| June 25 | 16 30 | 24.610 | — 0.0568 |
| June 26 | 15 30 | 23.350 | — 0.0589 |
| June 27 | 16 15 | 22.260 | — 0.0602 |
| June 28 | 16 00 | 20.725 | — 0.0652 |
| July 1 | 15 00 | 15.840 | — 0.0572 |
| July 2 | 16 30 | 14.680 | — 0.0476 |
| July 3 | 16 15 | + 8 07 13.500 | — 0.0497 |

Final results of longitude.

| Signals sent from— | Recorded at— | Mean of signals sent and received. | Time-corrections. | Corrected time. | Difference of longitude. | Double-wave time. | Means. |
|---|-----------------|------------------------------------|-------------------|-----------------|--------------------------|-------------------|-----------------|
| | | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>s.</i> | <i>h. m. s.</i> |
| June 23, 1873: | | | | | | | |
| Salt Lake City. { | Georgetown ... | 15 33 33.77 | — 0 13 41.84 | 16 19 51.93 | 24 49.10 | | |
| | Salt Lake City. | 7 47 35.48 | + 8 07 27.35 | 15 55 02.83 | | | |
| Georgetown ... { | Georgetown ... | 16 50 58.10 | — 0 13 41.84 | 16 37 16.26 | 48.93 | 0.17 | 0 24 49.015 |
| | Salt Lake City. | 8 05 00.00 | + 8 07 27.33 | 16 12 27.33 | | | |
| June 25, 1873: | | | | | | | |
| Salt Lake City. { | Georgetown ... | 17 03 39.78 | — 0 13 41.08 | 16 49 58.70 | 49.10 | | |
| | Salt Lake City. | 8 17 45.00 | + 8 07 24.60 | 16 25 09.60 | | | |
| No signals sent from Georgetown ..... | ..... | ..... | ..... | ..... | (48.94) | (0.16) | 49.020 |
| June 27, 1873: | | | | | | | |
| Salt Lake City. { | Georgetown ... | 17 14 15.77 | — 0 13 40.09 | 17 00 35.68 | 49.11 | | |
| | Salt Lake City. | 8 28 24.35 | + 8 07 22.24 | 17 35 46.57 | | | |
| No signals sent from Georgetown; circuit open ..... | ..... | ..... | ..... | ..... | (48.95) | (0.16) | 49.030 |
| June 28, 1873: | | | | | | | |
| Salt Lake City. { | Georgetown ... | 16 52 57.27 | — 0 13 39.89 | 16 39 17.38 | 49.07 | | |
| | Salt Lake City. | 8 07 07.60 | + 8 07 20.71 | 16 14 28.31 | | | |
| Georgetown ... { | Georgetown ... | 16 58 30.00 | — 0 13 39.89 | 16 44 50.11 | 48.95 | 0.12 | 49.010 |
| | Salt Lake City. | 8 12 50.46 | + 8 07 20.70 | 16 20 11.16 | | | |
| July 2, 1873: | | | | | | | |
| Georgetown ... { | Georgetown ... | 16 30 29.54 | — 0 13 40.92 | 16 16 48.62 | 48.93 | | |
| | Salt Lake City. | 7 44 44.95 | + 8 07 14.71 | 15 51 59.66 | | | |
| Salt Lake City. { | Georgetown ... | 16 35 52.23 | — 0 13 40.92 | 16 22 11.31 | 49.13 | 0.17 | 49.045 |
| | Salt Lake City. | 7 50 07.47 | + 8 07 14.71 | 15 57 22.18 | | | |
| July 3, 1873: | | | | | | | |
| Salt Lake City. { | Georgetown ... | 16 43 52.26 | — 0 13 41.59 | 16 30 10.61 | 49.10 | | |
| | Salt Lake City. | 7 58 08.00 | + 8 07 13.51 | 16 05 21.51 | | | |
| Georgetown ... { | Georgetown ... | 16 43 29.54 | — 0 13 41.58 | 16 34 47.98 | 0 24 48.93 | 0.17 | 0 24 49.015 |
| | Salt Lake City. | 8 02 45.55 | + 8 07 13.50 | 16 09 59.05 | | | |

Georgetown east of Salt Lake City.....0^h 24^m 49^s.023 ± 0^s.0036.

Mean places of stars for 1873 used for determination of latitude of Georgetown, Colorado.

| No. of pair. | No. in B. A. C. | Right ascen- sion. | Declination. | No. of pair. | No. in B. A. C. | Right ascen- sion. | Declination. |
|--------------|--------------------|-----------------------|--------------|--------------|--------------------|-----------------------|--------------|
| | | <i>h. m. s.</i> | <i>° ' "</i> | | | <i>h. m. s.</i> | <i>° ' "</i> |
| 1..... | 5463 | 16 15 55 | 46 37 00.2 | 16..... | 7114 | 20 50 01 | 40 39 41.2 |
| | 5484 | 18 04 | 32 37 50.8 | | 7176 | 36 15 | 38 37 51.3 |
| 2..... | 5702 | 49 47 | 18 38 15.0 | 17..... | 7211 | 41 34 | 66 11 43.6 |
| | 5717 | 52 18 | 60 33 57.8 | | 7258 | 49 36 | 13 14 17.8 |
| 3..... | 5763 | 58 57 | 35 35 41.4 | 18..... | 7333 | 21 00 19 | 43 25 19.1 |
| | 5775 | 17 01 13 | 43 59 09.5 | | 7373 | 08 20 | 36 06 36.2 |
| 4..... | 5842 | 12 38 | 33 14 17.7 | 19..... | 7402 | 13 43 | 43 24 44.0 |
| | 5871 | 16 46 | 46 21 58.6 | | 7453 | 20 36 | 36 07 10.3 |
| 5..... | 5911 | 23 23 | 48 22 02.9 | 20..... | 7465 | 22 42 | 31 40 10.8 |
| | 5962 | 31 47 | 30 51 54.5 | | 7496 | 27 42 | 47 53 00.6 |
| 6..... | 6184 | 18 07 46 | 56 14 17.4 | 21..... | 7545 | 35 02 | 56 54 55.2 |
| | 6241 | 16 51 | 23 13 19.8 | | 7496 | 40 13 | 22 21 52.7 |
| 7..... | 6349 | 31 06 | 38 47 32.5 | 22..... | 7606 | 44 04 | 16 41 48.0 |
| | 6364 | 35 27 | 40 49 11.9 | | 7658 | 53 04 | 63 01 16.3 |
| 8..... | 6426 | 45 02 | 32 40 01.0 | 23..... | 7679 | 57 31 | 42 12 07.1 |
| | 6480 | 52 16 | 32 44 22.4 | | 7743 | 22 05 47 | 42 24 24.1 |
| 9..... | 6520 | 57 51 | 46 45 20.6 | 24..... | 7777 | 10 26 | 37 07 01.1 |
| | 6583 | 19 09 16 | 56 38 35.9 | | 7798 | 15 27 | 27 41 29.9 |
| 10..... | 6602 | 12 21 | 22 47 55.0 | 25..... | 7815 | 18 34 | 51 35 35.8 |
| | 6629 | 15 38 | 62 58 36.6 | 26..... | 7824 | 19 58 | 50 36 38.1 |
| 11..... | 6642 | 18 40 | 16 41 30.8 | | 7888 | 32 10 | 50 53 23.5 |
| | 6724 | 31 32 | 16 10 45.5 | 27..... | 7914 | 35 46 | 28 38 43.4 |
| 12..... | 6737 | 33 24 | 63 09 05.6 | | 7943 | 40 20 | 11 31 17.8 |
| | 6762 | 38 43 | 26 50 58.6 | 28..... | 7963 | 44 40 | 67 53 46.4 |
| 13..... | 6824 | 47 26 | 52 39 58.8 | | 8074 | 23 03 52 | 74 42 03.5 |
| | 6856 | 52 21 | 52 06 09.4 | 29..... | 8127 | 13 52 | 4 41 18.4 |
| 14..... | 6879 | 55 52 | 27 24 16.0 | | | | |
| | 7037 | 20 19 31 | 68 28 24.3 | | | | |
| 15..... | 7079 | 25 07 | 10 50 03.0 | | | | |

NOTE.—The places of μ Herenlis and γ Draconis are taken from the American Ephemeris.

Observations and computations for latitude.

GEORGETOWN, COLORADO.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|---------|-----------------|----------------------|----------|-----------|----------|-----------------------------|----------------------|----------|----------|--------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1873. | | <i>t. d.</i> | <i>d</i> | <i>d.</i> | | <i>° ' "</i> | <i>' "</i> | <i>"</i> | <i>"</i> | <i>° ' "</i> |
| June 22 | 5763 | 11 55.5 | 21.0 | 14.0 | | 39 47 21.3 | — 4 42.7 | — 2.6 | ..... | 39 42 38.0 |
| | 5775 | 2 45.2 | 9.0 | 25.5 | | | | | | |
| | 5842 | 14 92.7 | 9.0 | 25.6 | | 48 05.6 | — 5 25.9 | — 2.6 | ..... | 37.1 |
| | 5871 | 4 43.3 | 21.1 | 14.0 | | | | | | |
| June 26 | 5702 | 15 45.2 | 12.0 | 18.0 | | 36 05.3 | + 6 37.0 | — 5.9 | ..... | 36.4 |
| | 5717 | 3 66.9 | 7.6 | 23.0 | | | | | | |
| | 5763 | 5 29.9 | 15.0 | 15.0 | | | | | | |
| | 5775 | 14 34.3 | 6.0 | 25.0 | | 39 47 24.2 | — 4 40.9 | — 5.2 | ..... | 38.1 |

Observations and computations—Continued.

GEORGETOWN, COLORADO.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|------------------|----------------|-------------------|-----------|-----------|-----------------------|--------------------------|-------------------|--------|--------|------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1873. June 26 | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | " | ° ' " |
| | 5842 | 14 91.6 | 21.0 | 10.0 | | | | | | |
| | 5871 | 4 63.5 | 10.0 | 41.0 | | 39 48 06.6 | — 5 19.3 | —11.0 | ..... | 39 42 36.3 |
| | 5911 | 15 88.0 | 7.0 | 25.0 | | | | | | |
| | 5962 | 4 63.3 | 5.0 | 27.0 | | 36 56.6 | + 5 49.3 | —11.0 | ..... | 34.9 |
| | μ Herc. | 12 96.2 | 20.0 | 11.0 | | | | | | |
| | γ Drae. | 5 89.0 | 9.0 | 23.0 | | 38 59.2 | + 3 39.7 | — 1.4 | ..... | 37.5 |
| | 6184 | 10 57.8 | 12.0 | 20.0 | | | | | | |
| | 6241 | 8 58.3 | 7.3 | 25.0 | | 43 44.8 | — 1 02.0 | — 7.0 | ..... | 35.8 |
| | 6426 | 10 91.9 | 16.0 | 16.0 | | 42 37.1 | + 0 04.9 | — 6.4 | ..... | 35.6 |
| | 6480 | 6 74.0 | 16.0 | 16.0 | | 44 46.2 | — 2 04.8 | — 6.4 | ..... | 35.0 |
| | 6520 | 10 76.0 | 4.7 | 27.8 | | | | | | |
| | 6583 | 10 12.5 | 17.0 | 15.0 | | | | | | |
| | 6602 | 9 32.9 | 0.0 | 32.6 | | 43 09.8 | — 0 24.7 | — 8.4 | ..... | 36.7 |
| | 6629 | 2 86.3 | 18.0 | 14.5 | | | | | | |
| | 6642 | 16 93.9 | 2.5 | 30.3 | | 49 57.9 | — 7 17.2 | — 6.7 | ..... | 34.0 |
| | 6724 | 11 63.3 | 19.0 | 14.0 | | | | | | |
| | 6737 | 6 07.0 | 5.0 | 28.0 | 50 ^s late. | 39 49.5 | + 2 52.8 | — 4.9 | — 0.4 | 37.0 |
| | 6762 | 12 58.5 | 19.0 | 14.0 | | | | | | |
| | 6824 | 8 44.7 | 0.0 | 33.0 | | 44 52.1 | — 2 08.5 | — 7.7 | ..... | 35.9 |
| | 7114 | 6 47.7 | 15.0 | 18.0 | | | | | | |
| | 7167 | 14 21.8 | 10.3 | 23.0 | | 38 38.5 | + 4 00.4 | — 2.7 | ..... | 36.3 |
| | 7211 | 10 17.5 | 14.0 | 19.3 | | | | | | |
| | 7258 | 10 66.2 | 21.0 | 13.0 | | 42 53.6 | — 0 15.1 | + 0.7 | ..... | 39.2 |
| | 7333 | 13 01.5 | 17.0 | 16.0 | | | | | | |
| | 7373 | 6 97.3 | 13.0 | 20.0 | | 45 49.5 | — 3 11.3 | — 1.6 | ..... | 36.6 |
| | 7402 | 12 43.9 | 13.8 | 20.0 | | | | | | |
| | 7453 | 6 33.8 | 13.0 | 21.0 | | 45 48.8 | — 3 09.5 | — 3.9 | ..... | 35.4 |
| | 7465 | 6 17.7 | 15.0 | 19.0 | | | | | | |
| | 7496 | 13 59.1 | 16.0 | 18.0 | | 46 27.3 | — 3 50.3 | — 1.6 | ..... | 35.4 |
| June 27 | 6349 | 4 55.3 | 14.0 | 22.0 | | | | | | |
| | 6364 | 15 59.2 | 23.7 | 12.3 | | 48 18.0 | — 5 42.9 | + 0.9 | ..... | 36.0 |
| | 6426 | 11 84.2 | 17.0 | 19.0 | | 42 37.4 | + 0 00.7 | — 1.1 | ..... | 37.0 |
| | 6480 | 7 67.8 | 17.0 | 19.3 | | 44 46.5 | — 2 08.6 | — 1.1 | ..... | 36.8 |
| | 6520 | 11 81.8 | 17.0 | 19.0 | | | | | | |
| | 6583 | 9 15.0 | 13.0 | 22.0 | | | | | | |
| | 6602 | 8 05.5 | 25.0 | 10.0 | | 43 10.1 | — 0 33.7 | + 1.9 | ..... | 38.3 |
| | 6629 | 2 02.3 | 26.0 | 11.0 | | | | | | |
| | 6642 | 16 23.2 | 6.6 | 30.0 | | 39 49 58.3 | — 7 21.3 | — 2.3 | | 39 42 34.7 |

LATITUDE DETERMINATIONS.

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Observations and computations—Continued.

GEORGETOWN, COLORADO.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|----------|----------------|-------------------|-----------|-----------|-----------|--------------------------|-------------------|----------|----------|--------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1873. | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | <i>o ' "</i> | <i>' "</i> | <i>"</i> | <i>"</i> | <i>o ' "</i> |
| June 27 | 6724 | 7 83.2 | 17.3 | 19.0 | | | | | | |
| | 6737 | 13 28.5 | 17.2 | 19.2 | | 39 39 49.7 | + 2 49.3 | — 1.0 | ..... | 39 42 38.0 |
| | 6762 | 7 78.6 | 14.8 | 22.0 | | | | | | |
| | 6784 | 12 17.0 | 21.0 | 16.0 | | 44 52.4 | — 2 16.1 | — 0.6 | ..... | 35.7 |
| | 6856 | 11 10.8 | 19.6 | 17.0 | | | | | | |
| | 6879 | 6 38.7 | 12.2 | 24.0 | | 45 06.2 | — 2 26.3 | — 2.5 | ..... | 37.4 |
| | 7037 | 5 85.4 | 22.0 | 15.0 | | | | | | |
| | 7079 | 12 73.6 | 8.0 | 28.8 | Dpl. med. | 39 07.5 | + 3 33.7 | — 3.8 | ..... | 37.4 |
| | 7114 | 5 82.5 | 14.0 | 23.0 | | | | | | |
| | 7167 | 13 64.7 | 18.0 | 19.3 | | 38 38.8 | + 4 02.9 | — 2.8 | ..... | 38.9 |
| | 7211 | 8 52.2 | 18.0 | 19.3 | | | | | | |
| | 7258 | 7 96.1 | 22.0 | 16.0 | | 42 53.9 | + 0 17.4 | + 1.3 | ..... | 37.8 |
| | 7333 | 12 02.0 | 18.2 | 19.3 | | | | | | |
| | 7373 | 5 90.6 | 10.0 | 28.0 | | 45 49.8 | — 3 09.9 | — 5.2 | ..... | 34.7 |
| | 7402 | 11 43.6 | 18.0 | 20.0 | | | | | | |
| | 7453 | 5 33.8 | 16.7 | 21.0 | | 45 49.1 | — 3 09.4 | — 1.7 | ..... | 33.0 |
| July 1.. | 5842 | 4 52.1 | 27.0 | 15.1 | | | | | | |
| | 5871 | 15 17.0 | 14.3 | 28.0 | | 48 07.9 | — 5 30.8 | — 0.5 | ..... | 36.6 |
| | 5911 | 4 54.3 | 22.2 | 20.1 | | | | | | |
| | 5962 | 15 53.0 | 10.0 | 33.0 | | 36 57.9 | + 5 43.3 | — 5.7 | ..... | 35.5 |
| | μ Herc. | 13 79.1 | 19.9 | 24.0 | | | | | | |
| | γ Drac. | 6 67.2 | 14.5 | 29.0 | | 39 00.6 | + 3 41.1 | — 5.1 | ..... | 36.6 |
| | 6184 | 10 67.8 | 22.3 | 21.0 | | | | | | |
| | 6241 | 8 51.5 | 16.3 | 27.3 | | 43 46.2 | — 1 07.2 | — 2.7 | ..... | 36.3 |
| | 6349 | 3 26.9 | 19.0 | 25.5 | | | | | | |
| | 6364 | 14 28.0 | 24.2 | 20.1 | | 48 19.1 | — 5 42.0 | — 0.7 | ..... | 36.4 |
| | 6426 | 11 18.4 | 22.0 | 22.9 | | 42 38.6 | + 0 02.2 | — 4.9 | ..... | 35.9 |
| | 6480 | 6 98.0 | 22.0 | 23.0 | | 44 47.7 | — 2 08.3 | — 4.9 | ..... | 34.5 |
| | 6520 | 11 11.2 | 14.0 | 31.0 | | | | | | |
| | 6583 | 10 11.0 | 22.3 | 21.9 | | | | | | |
| | 6602 | 9 13.9 | 14.0 | 30.3 | | 43 11.3 | — 0 30.2 | — 4.4 | ..... | 36.7 |
| | 6629 | 17 52.1 | 25.8 | 18.0 | | | | | | |
| | 6642 | 3 25.0 | 15.6 | 29.1 | | 49 59.4 | — 7 23.2 | — 1.4 | ..... | 34.8 |
| | 6724 | 12 26.2 | 29.3 | 14.0 | | | | | | |
| | 6737 | 6 93.6 | 17.1 | 27.9 | | 39 50.9 | + 2 45.4 | + 0.7 | ..... | 37.0 |
| | 6762 | 7 41.3 | 19.7 | 25.0 | | | | | | |
| | 6824 | 11 83.0 | 23.2 | 22.0 | | 39 44 53.6 | — 2 17.2 | — 1.1 | ..... | 39 42 35.3 |

Observations and computations—Continued.

GEORGETOWN, COLORADO.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|----------|--------------|---------------------|-----------|-----------|----------|--------------------------|-------------------|--------|--------|------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1873. | | <i>t.</i> <i>d.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | " | ° ' " |
| July 1.. | 7037 | 5 65.7 | 23.3 | 21.7 | | | | | | |
| | 7079 | 12 25.6 | 27.0 | 18.0 | | 39 39 08.6 | + 3 25.0 | + 2.9 | ..... | 39 42 36.5 |
| | 7114 | 6 12.9 | 20.0 | 25.0 | | | | | | |
| | 7167 | 13 73.5 | 26.0 | 19.0 | | 38 40.1 | + 3 56.2 | + 0.6 | ..... | 36.9 |
| | 7211 | 9 09.2 | 23.9 | 21.8 | | | | | | |
| | 7258 | 8 47.4 | 25.1 | 20.2 | | 42 55.0 | - 0 19.2 | + 1.9 | ..... | 37.7 |
| | 7333 | 12 70.1 | 23.5 | 21.8 | | | | | | |
| | 7373 | 6 58.8 | 11.3 | 34.0 | | 45 51.0 | - 3 09.9 | - 5.8 | ..... | 35.3 |
| | 7402 | 12 17.4 | 24.0 | 21.2 | | | | | | |
| | 7453 | 6 02.1 | 15.0 | 30.3 | | 45 50.3 | - 3 11.1 | - 3.4 | ..... | 35.8 |
| July 2.. | 7465 | 5 91.7 | 19.2 | 25.8 | | | | | | |
| | 7496 | 13 31.0 | 18.0 | 27.3 | | 46 28.8 | - 3 49.6 | - 4.4 | ..... | 34.8 |
| | 5763 | 5 20.8 | 27.9 | 20.2 | | | | | | |
| | 5775 | 14 58.1 | 22.9 | 25.2 | | 47 25.9 | - 4 51.1 | + 1.5 | ..... | 36.3 |
| | 5842 | 3 22.7 | 25.0 | 23.0 | | | | | | |
| | 5871 | 13 92.2 | 22.2 | 26.0 | | 48 08.2 | - 5 32.2 | - 0.5 | ..... | 35.5 |
| | 5911 | 4 11.7 | 27.7 | 20.3 | | | | | | |
| | 5932 | 15 00.0 | 20.3 | 27.7 | | 36 58.1 | + 5 37.8 | 0.0 | ..... | 35.9 |
| | μ Herc. | 13 29.6 | 30.5 | 17.5 | | | | | | |
| | γ Drac. | 6 34.9 | 17.0 | 31.8 | | 39 00.9 | + 3 35.8 | - 0.5 | ..... | 36.2 |
| | 6184 | 10 62.7 | 29.0 | 19.5 | | | | | | |
| | 6241 | 8 31.8 | 19.9 | 28.6 | | 43 46.5 | - 1 11.7 | + 0.2 | ..... | 35.0 |
| | 6349 | 3 10.7 | 21.5 | 27.0 | | | | | | |
| | 6364 | 14 20.7 | 26.5 | 21.7 | | 48 19.5 | - 5 44.8 | - 0.2 | ..... | 34.5 |
| | 6426 | 10 59.1 | 20.0 | 28.5 | | 42 38.8 | - 0 03.4 | + 0.3 | ..... | 35.7 |
| | 6480 | 6 41.9 | 21.0 | 27.7 | | 44 47.9 | - 2 13.0 | + 0.8 | ..... | 35.7 |
| | 6520 | 10 70.2 | 29.3 | 19.6 | | | | | | |
| | 6583 | 10 03.1 | 23.0 | 25.3 | | | | | | |
| | 6602 | 8 83.7 | 25.2 | 23.0 | | 43 11.6 | - 0 37.1 | 0.0 | ..... | 34.5 |
| | 6629 | 17 16.0 | 19.0 | 29.3 | | | | | | |
| | 6642 | 2 91.2 | 27.8 | 21.0 | | 49 59.7 | - 7 22.5 | - 1.0 | ..... | 36.2 |
| | 6724 | 12 09.4 | 24.0 | 25.0 | | | | | | |
| | 6737 | 6 81.4 | 26.3 | 22.8 | | 39 51.2 | + 2 44.0 | + 0.7 | ..... | 35.9 |
| | 6762 | 6 60.8 | 18.0 | 31.3 | | | | | | |
| | 6824 | 11 06.9 | 32.0 | 17.0 | | 44 53.9 | - 2 18.6 | + 0.5 | ..... | 35.8 |
| | 7114 | 6 13.7 | 21.0 | 29.0 | | | | | | |
| | 7167 | 13 74.0 | 29.0 | 21.0 | | 38 40.4 | + 3 56.2 | 0.0 | ..... | 36.6 |
| | 7211 | 8 95.2 | 26.3 | 24.0 | | | | | | |
| | 7258 | 8 32.3 | 26.0 | 24.3 | | 39 42 55.3 | - 0 19.5 | + 1.1 | | 39 42 36.9 |

LATITUDE DETERMINATIONS.

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Observations and computations—Continued.

GEORGETOWN, COLORADO.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|------------------|-----------------|----------------------|-----------|-----------|-------------|-----------------------------|----------------------|--------|--------|------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1873. July 2. | | <i>t.</i> <i>d.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | " | ° ' " |
| | 7333 | 12 50.0 | 21.0 | 29.0 | | 39 45 51.3 | — 3 13.2 | — 1.5 | ..... | 39 42 36.6 |
| | 7373 | 6 28.1 | 26.3 | 24.0 | | | | | | |
| | 7402 | 11 94.9 | 13.8 | 37.0 | | 45 50.6 | — 3 14.0 | — 0.9 | ..... | 35.7 |
| | 7453 | 5 70.2 | 35.0 | 15.0 | | | | | | |
| | 7465 | 5 23.3 | 19.4 | 31.2 | | 46 29.1 | — 3 54.7 | — 0.2 | ..... | 34.2 |
| | 7496 | 12 78.9 | 31.0 | 19.7 | | | | | | |
| | 7545 | 4 44.9 | 25.0 | 25.3 | | 38 17.5 | + 4 18.8 | + 0.4 | ..... | 36.7 |
| | 7585 | 12 78.0 | 26.0 | 24.3 | | | | | | |
| | 7606 | 0 84.3 | 26.0 | 24.0 | | 51 25.7 | — 8 49.5 | + 0.4 | ..... | 36.6 |
| | 7658 | 17 89.2 | 25.0 | 25.6 | | | | | | |
| | 7679 | 2 53.5 | 23.0 | 27.4 | Very faint. | 39 27.2 | + 3 10.4 | — 2.2 | ..... | 35.4 |
| | 7743 | 14 36.0 | 24.3 | 26.0 | | 45 35.6 | — 2 56.9 | — 1.4 | ..... | 37.3 |
| | 7777 | 8 66.5 | 23.5 | 27.0 | | | | | | |
| | 7798 | 13 07.0 | 27.9 | 23.0 | | | | | | |
| | 7815 | 5 05.3 | 23.3 | 27.2 | | 38 26.8 | + 4 09.0 | + 0.3 | ..... | 36.1 |
| | 7824 | 0 57.1 | 23.0 | 27.3 | | 37 34.0 | + 5 02.0 | — 0.6 | ..... | 35.4 |
| | 7888 | 16 76.8 | 26.0 | 24.6 | | 45 56.5 | — 3 21.1 | + 0.9 | ..... | 36.3 |
| | 7914 | 10 29.5 | 26.3 | 24.3 | | | | | | |
| | 7943 | 9 59.7 | 24.3 | 26.0 | | | | | | |
| | 7963 | 9 39.2 | 29.0 | 21.4 | | 42 26.2 | + 0 06.4 | + 1.6 | ..... | 34.2 |
| July 4. | 5463 | 3 85.3 | 14.0 | 37.0 | | 37 27.9 | + 5 07.2 | + 0.8 | ..... | 35.9 |
| | 5484 | 13 74.2 | 32.8 | 12.0 | | | | | | |
| | 5702 | 15 63.3 | 18.5 | 33.0 | | 36 07.1 | + 6 27.7 | + 1.0 | ..... | 35.8 |
| | 5717 | 3 15.0 | 34.4 | 17.3 | | | | | | |
| | 5763 | 5 51.6 | 28.8 | 23.0 | | 47 26.3 | — 4 55.8 | + 7.8 | ..... | 38.3 |
| | 5775 | 15 04.0 | 37.3 | 14.5 | | | | | | |
| | 5842 | 3 95.8 | 23.9 | 28.2 | | 48 08.7 | — 5 39.4 | + 6.2 | ..... | 35.5 |
| | 5871 | 14 82.7 | 39.6 | 12.5 | | | | | | |
| | 5911 | 3 36.5 | 19.0 | 33.3 | | 36 58.6 | + 5 32.5 | + 4.7 | ..... | 35.8 |
| | 5962 | 14 07.0 | 41.8 | 10.6 | | | | | | |
| | ε Herc | 13 21.6 | 26.0 | 26.5 | | 39 01.4 | + 3 30.4 | + 6.1 | ..... | 37.9 |
| | γ Drac. | 6 44.2 | 37.7 | 15.0 | | | | | | |
| | 6114 | 12 05.9 | 28.7 | 24.0 | | 45 15.5 | — 2 43.6 | + 3.6 | ..... | 35.5 |
| | 6123 | 6 78.8 | 30.5 | 22.2 | | | | | | |
| | 6184 | 10 93.1 | 25.4 | 15.0 | | 43 47.1 | — 1 16.4 | + 4.8 | ..... | 35.5 |
| | 6241 | 8 47.2 | 23.8 | 16.7 | | | | | | |
| | 6349 | 3 49.8 | 22.0 | 8.4 | | 39 48 20.1 | — 5 49.2 | + 4.8 | ..... | 39 42 35.7 |
| | 6364 | 14 74.2 | 17.2 | 13.2 | | | | | | |

Observations and computations--Continued.

GEORGETOWN, COLORADO.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|-------------------|-----------------|----------------------|-----------|-----------|----------|-----------------------------|----------------------|----------|----------|--------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1873. July 4.. | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | <i>° ' "</i> | <i>' "</i> | <i>"</i> | <i>"</i> | <i>° ' "</i> |
| | 6426 | 11 46.8 | 19.3 | 29.3 | | 39 42 39.5 | - 0 07.4 | + 4.0 | ..... | 39 42 36.1 |
| | 6480 | 7 27.4 | 21.8 | 27.8 | | 44 48.6 | - 2 17.6 | + 5.1 | ..... | 36.1 |
| | 6520 | 11 70.6 | 37.0 | 12.5 | | | | | | |
| | 6583 | 10 35.9 | 24.7 | 24.7 | | | | | | |
| | 6602 | 9 04.8 | 37.7 | 11.7 | | 43 12.2 | - 0 40.7 | + 7.1 | ..... | 38.6 |
| | 6724 | 11 87.2 | 31.0 | 18.6 | | | | | | |
| | 6737 | 6 74.1 | 31.0 | 18.6 | | 39 51.7 | + 2 39.4 | + 6.8 | ..... | 37.9 |
| | 6762 | 6 78.6 | 18.0 | 31.9 | | | | | | |
| | 6824 | 11 54.3 | 47.2 | 2.3 | | 44 54.6 | - 2 27.8 | + 8.5 | ..... | 35.3 |
| | 6856 | 11 94.9 | 33.0 | 17.0 | | | | | | |
| | 6879 | 6 88.8 | 24.7 | 25.8 | | 45 08.4 | - 2 37.2 | + 4.1 | ..... | 35.3 |
| | 7037 | 6 17.0 | 25.3 | 25.0 | | | | | | |
| | 7079 | 13 03.0 | 12.0 | 38.3 | | 39 09.5 | + 3 33.1 | - 7.2 | ..... | 35.4 |
| | 7114 | 5 46.9 | 25.7 | 24.5 | | | | | | |
| | 7167 | 13 31.0 | 8.0 | 42.2 | | 38 41.1 | + 4 03.5 | - 9.1 | ..... | 35.5 |
| | 7211 | 9 00.9 | 24.0 | 26.0 | | | | | | |
| | 7258 | 8 62.9 | 12.0 | 37.9 | | 42 55.9 | - 0 11.8 | - 7.7 | ..... | 36.4 |
| | 7333 | 12 33.6 | 19.0 | 31.0 | | | | | | |
| | 7373 | 6 09.4 | 30.0 | 20.0 | | 45 51.9 | - 3 13.9 | - 0.6 | ..... | 37.4 |
| | 7402 | 11 75.2 | 25.8 | 24.0 | | | | | | |
| | 7453 | 5 55.2 | 18.0 | 31.8 | | 45 51.3 | - 3 12.6 | - 3.3 | ..... | 35.4 |
| | 7465 | 5 75.7 | 22.0 | 27.8 | | | | | | |
| | 7496 | 13 21.2 | 24.5 | 25.0 | | 46 29.7 | - 3 51.6 | - 1.7 | ..... | 36.4 |
| | 7545 | 4 34.7 | 26.5 | 23.3 | | | | | | |
| | 7585 | 12 82.5 | 19.8 | 29.4 | | 38 18.1 | + 4 22.1 | - 1.7 | ..... | 38.5 |
| | 7606 | - 0 11.8 | 31.0 | 18.5 | | | | | | |
| | 7658 | 16 82.3 | 15.0 | 33.8 | | 51 26.3 | - 8 46.5 | - 1.7 | ..... | 38.1 |
| | 7679 | 2 89.0 | 22.0 | 28.0 | | 39 27.7 | + 3 06.2 | + 3.4 | ..... | 37.3 |
| | 7743 | 14 80.0 | 21.0 | 29.0 | | 45 36.2 | - 3 03.7 | + 2.9 | ..... | 35.4 |
| | 7777 | 8 88.5 | 33.8 | 15.3 | | | | | | |
| | 7798 | 13 20.0 | 29.3 | 20.3 | | | | | | |
| | 7815 | 5 05.5 | 14.0 | 33.0 | | 38 27.4 | + 4 13.0 | - 3.6 | ..... | 36.8 |
| | 7824 | - 0 01.9 | 21.8 | 28.0 | | 37 34.5 | + 5 03.2 | - 0.9 | ..... | 36.8 |
| | 7888 | 16 10.5 | 22.0 | 27.5 | | 45 57.1 | - 3 17.6 | - 0.7 | ..... | 38.8 |
| | 7914 | 9 74.2 | 26.0 | 23.0 | | | | | | |
| | 7943 | 9 74.4 | 25.1 | 23.6 | | | | | | |
| | 7963 | 9 46.4 | 22.5 | 26.2 | | 42 26.7 | + 0 08.7 | - 0.6 | ..... | 34.8 |
| July 5.. | 7037 | 5 79.0 | 29.3 | 21.0 | | | | | | |
| | 7079 | 12 24.1 | 35.0 | 15.3 | | 39 39 09.7 | + 3 30.4 | + 7.7 | ..... | 39 42 37.8 |

Observations and computations—Continued.

GEORGETOWN, COLORADO.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|-------------------|--------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|----------|----------|--------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1873. July 5.. | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | <i>° ' "</i> | <i>' "</i> | <i>"</i> | <i>"</i> | <i>° ' "</i> |
| | 7114 | 6 62.3 | 24.3 | 26.0 | | | | | | |
| | 7167 | 14 00.2 | 39.0 | 11.6 | | 39 38 41.4 | + 3 49.2 | + 7.1 | ..... | 39 42 37.7 |
| | 7211 | 9 18.6 | 33.6 | 17.1 | | | | | | |
| | 7258 | 8 31.0 | 36.0 | 14.7 | | 42 56.2 | — 0 27.3 | +10.3 | ..... | 39.2 |
| | 7333 | 12 53.1 | 25.0 | 26.0 | | | | | | |
| | 7373 | 6 37.2 | 14.3 | 37.0 | | 45 52.3 | — 3 11.3 | — 6.5 | ..... | 34.5 |
| | 7402 | 12 12.4 | 17.5 | 34.0 | | | | | | |
| | 7453 | 5 78.9 | 34.0 | 17.7 | | 45 51.6 | — 3 16.8 | 0.0 | ..... | 34.8 |
| | 7465 | 5 19.3 | 25.0 | 26.8 | | | | | | |
| | 7496 | 12 53.3 | 17.0 | 34.9 | | 46 30.0 | — 3 48.0 | — 5.4 | ..... | 36.6 |
| | 7545 | 4 72.0 | 31.1 | 21.0 | | | | | | |
| | 7585 | 13 09.7 | 15.0 | 38.0 | | 38 18.4 | + 4 20.2 | — 3.5 | ..... | 35.1 |
| | 7606 | 0 38.3 | 26.0 | 27.0 | | | | | | |
| | 7658 | 17 46.5 | 29.7 | 23.8 | | 51 26.7 | — 8 50.6 | + 1.4 | ..... | 37.5 |
| | 7679 | 2 81.6 | 22.0 | 31.9 | | 39 28.0 | + 3 08.4 | + 2.5 | ..... | 38.9 |
| | 7743 | 14 66.5 | 22.0 | 32.2 | | 45 36.5 | — 2 59.6 | + 2.4 | ..... | 39.3 |
| | 7777 | 8 88.3 | 36.0 | 17.0 | | | | | | |
| | 7798 | 13 09.7 | 33.7 | 20.0 | | | | | | |
| | 7815 | 4 97.0 | 14.0 | 39.8 | | 38 27.7 | + 4 12.4 | — 3.3 | ..... | 36.8 |
| | 7824 | 0 08.0 | 21.7 | 32.2 | | 37 34.8 | + 5 03.3 | — 2.2 | ..... | 35.9 |
| | 7888 | 16 27.0 | 23.9 | 30.0 | | 45 57.4 | — 3 19.6 | — 1.0 | ..... | 36.8 |
| | 7914 | 9 84.5 | 28.3 | 25.7 | | | | | | |
| | 7943 | 9 71.0 | 33.0 | 20.9 | | | | | | |
| | 7963 | 9 35.5 | 18.3 | 35.7 | | 42 27.0 | + 0 11.0 | — 1.4 | ..... | 36.6 |
| | 8074 | 8 21.0 | 27.6 | 25.0 | | | | | | |
| | 8127 | 10 25.2 | 15.2 | 37.5 | | 39 41 36.6 | + 1 03.4 | — 5.4 | ..... | 39 42 34.6 |

ASTRONOMICAL CO-ORDINATES OF STATION AT GEORGETOWN, COLORADO.

Adopting the longitude of Washington and Salt Lake City, as given in the report for Colorado Springs, the astronomical co-ordinates for station at Georgetown, Colorado, will be:—

Longitude... $7^{\text{h}} 02^{\text{m}} 45^{\text{s}}.84$ or $105^{\circ} 41' 27''.60$ west from Greenwich.
 " $1^{\text{h}} 54^{\text{m}} 33^{\text{s}}.72 \pm 0^{\text{s}}.0036$ or $28^{\circ} 38' 25''.80 \pm 0''.05$ west from U. S. Naval Observatory at Washington, D. C.
 Latitude ... $39^{\circ} 42' 36''.36 \pm 0''.06$ north.

The probable error of one observation is derived from all results obtained more than three times, and is found to be $\pm 0''.61$; therefore the probable error of the final result will be $\pm 0''.06$. This must be combined with the probable error of the star-places used for the determination, in order to get the probable inaccuracy of the result.

U. S. GEOGRAPHICAL SURVEYS WEST OF THE ONE HUNDREDTH MERIDIAN,
1st LIEUT. GEO. M. WHEELER, CORPS OF ENGINEERS, U. S. ARMY, IN CHARGE.

RESULTS
OF
OBSERVATIONS MADE BY DR. F. KAMPF AND JOHN H. CLARK IN THE
DETERMINATION OF THE ASTRONOMICAL CO-ORDINATES
OF HUGHES, COLORADO.
SEASON OF 1873.

COMPUTATIONS BY
DR. F. KAMPF AND JOHN H. CLARK.

HUGHES, COLORADO.

GEOGRAPHICAL POSITION OF STATION.

Longitude, $104^{\circ} 48' 58''.80 \pm 0''.06$ west from Greenwich.
Latitude, $39^{\circ} 59' 24''.09 \pm 0''.03$ north.
Barometric altitude of observatory above sea-level, 5,021.6 feet.

The astronomical station was equidistant from the Denver Pacific and Boulder Valley Railroads, about 135 feet from the track of each. South of the monument was the railway office, with which was combined the telegraph office; north of it were two frame houses; and in a north-east direction was the water-tank. These buildings constituted the station of Hughes, whose population, exclusive of the few laborers engaged upon repairs of track, numbered but seven persons.

The neighboring country for a radius of about 15 miles is a very level plain, covered but sparsely with grass, and affording little inducement to the farmer. One-half of a mile from the station the Platte River flows down the valley, but its water is impure and useful only as a means of irrigation.

METEOROLOGICAL CONDITIONS.

As a rule the weather was favorable for this work. Although it generally became cloudy at four o'clock in the afternoon, it was clear again by eight or nine o'clock. The air was as quiet as could be desired, and the process of observation was more easy and successful than at the previous station. Sometimes a heavy wind arose at night, but, the tent being closed as far as possible, it did not disturb the instrument materially.

The following table gives the direction of the wind, the aspect of the sky, and other meteorological conditions attendant upon the occupation of this station:

| Date. | Direction of the wind. | | | Remarks. |
|---------|------------------------|-----------------------|------------------------|--|
| | 12 p. m. to 8 a. m. | 8 a. m. to 4 p. m. | 4 p. m. to 12 p. m. | |
| 1873. | | | | |
| July 12 | ----- | S. E. | N. | From 12 m. to 3 p. m., rain, thunder, and wind. |
| 13 | S. E. | S. W. | N. | Clear. |
| 14 | N. | S. W. | S. | From 4 to 7 p. m., rain and storm. |
| 15 | S. | N. | Variable. | Lightning at 8 o'clock, in the north. |
| 16 | S. W. | S. W. | S. W. | Do. |
| 17 | S. and N. E. | S. and N. E. | E. | Lightning at 8 o'clock, in the south. |
| 18 | N. E. | N. E. | S. E. | Do. |
| 19 | N. W. | Variable. | No wind. | Clear. |
| 20 | S. | Variable. | S. | Do. |
| 21 | S. | S. E. | W. | Rain at 8 p. m.; lightning in northwest, at 11 p. m. |
| 22 | S. | S. E. | W. | Very heavy rain and lightning in the afternoon. |
| 23 | S. E. | S. E. | N. and S. E. | Do. |

OBSERVATORY.—TELEGRAPHIC COMMUNICATION.

The construction and arrangement of the observatory was the same as at Colorado Springs, a description of which is given in the astronomical report of 1874. Owing to the failure of the stonemason to provide the monument at the specified time it became necessary to erect a temporary pile of bricks to answer that purpose. In the following September this was replaced by a permanent monument of the prevailing design. The northern meridian mark was fixed on a stable 280 feet from the station.

Denver and Cheyenne are connected by two wires of the Western Union Telegraph Company. The lower one of these was conducted into the tent by means of a loop. It was impossible to procure a suitable telegraph pole to lift the wire out of the way of accident, and, in spite of all precautions used, it was swept away by a passing wagon one day, much to the vexation of the astronomer and the delay of his work. In the transmission of signals able assistance was rendered by Mr. R. Bush, in charge of the Hughes telegraph office. Thanks are also due to the operators at Denver and Cheyenne for their liberality in surrendering their wires to the uses of this work as often as they could be spared.

INSTRUMENTS.—VALUES.—BATTERY.

The astronomical and meteorological instruments, with the values pertaining to them, were the same as at Colorado Springs, described in the

report on that station. The length of circuit, Hughes to Salt Lake City, via Corinne, is about 650 miles. The battery employed was the private property of the astronomer. It was composed of two Grove cells, very powerful in their action, which were re-inforced by a repeater at Cheyenne and another at Corinne.

CONNECTIONS.—OBSERVERS.—COMPUTERS.

The astronomical work at Hughes was conducted by Dr. F. Kampf. Exchanges for time were made with Mr. John H. Clark at Salt Lake City on July 12, 17, 18, and 19. Observations for latitude were made July 16, 18, 19, 20, 21, and 23. Each astronomer performed the computations to accompany his own work.

| Name of star. | | HUGHES, COLORADO. | | | | | | | | | | SALT LAKE CITY, UTAH. | | | | | |
|---------------|---------------|-------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------------|----------|----------|----------|----------|--|
| | | July 12. | July 13. | July 15. | July 16. | July 17. | July 18. | July 19. | July 20. | July 21. | July 12. | July 14. | July 16. | July 17. | July 18. | July 19. | |
| 5 | Ursæ Minoris | | | x | | | | | | | | | | | | | |
| ϵ | Bootis | | | x | | | | | | | | | | | | | |
| β | Ursæ Minoris | | | x | | | | | | | | | | | | | |
| μ^1 | Bootis | | | x | | | | | | | | x | | | | | |
| γ^2 | Ursæ Minoris | | | | | | | | | | | | x | x | x | | |
| ζ^3 | Libræ | | | | | | | | | | | | | | | | |
| α | Coronæ | | | | x | x | x | x | | | | x | x | x | x | | |
| τ^6 | Serpentis | | | | | | | | | | | x | x | x | x | | |
| α | Serpentis | | | | x | x | x | | x | | | x | | x | x | | |
| ϵ | Serpentis | | x | x | x | x | x | x | x | | | | x | x | x | | |
| ζ | Ursæ Minoris | | | x | x | x | x | x | x | | | | | | | | |
| ϵ | Coronæ | x | x | x | x | x | | x | x | | | x | | | | | |
| δ | Scorpii | | | | | | | | | | | | | | | | |
| β^1 | Scorpii | x | | | | | | | | | x | | | x | x | | |
| | Groombr. 2320 | x | x | x | x | x | | x | x | | x | x | | x | x | | |
| δ | Ophiuchi | | x | x | | x | | x | x | | | x | x | x | x | | |
| τ | Herculis | | x | | | | x | x | x | | | x | x | x | x | | |
| α | Scorpii | x | x | | x | x | x | x | x | | | x | x | x | x | | |
| η | Draconis | | | | | | | | | | | | | | | | |
| Λ | Draconis | | x | | x | | x | x | x | | | x | x | x | x | | |
| ζ | Ophiuchi | | | | x | x | x | x | x | | | x | x | x | x | | |
| η | Herculis | | x | | | | | | | | x | x | | | | | |
| κ | Ophiuchi | | x | | | | | | | | | | x | | | | |
| ϵ | Ursæ Minoris | | x | | | | | | x | | | | | | | | |
| α^1 | Herculis | | | | | | | | x | | | | | | | | |
| 44 | Ophiuchi | | | | | | | | x | | | | | | | | |
| β | Draconis | | | | | | | | x | | | | | | | | |
| α | Ophiuchi | | | | | | | | x | | | | | | | x | |
| ω | Draconis | | | | | | | | x | | | | | | | | |
| μ | Herculis | | | | | | | | x | | | | | | | | |
| ψ^1 | Draconis | | | | | | | | x | | | | | | | x | |
| γ | Draconis | | | | | | | | | | | x | | x | x | x | |
| 72 | Ophiuchi | | | | | | | | | | | x | x | x | x | x | |
| | Bradl. 2313 | | | | | | | | | | | x | x | x | x | x | |
| μ^1 | Sagittarii | | | | | | | | x | | x | x | x | x | x | x | |
| δ | Ursæ Minoris | | | | | | | | x | | | | | | | | |
| η | Serpentis | | | | | | | | | | x | x | x | x | x | | |
| 1 | Aquilæ | | | | | | | | | x | x | x | x | x | x | x | |
| α | Lyræ | | | | | | | | | x | x | x | x | x | x | | |
| ζ^1 | Lyræ | | | | | | | | | | x | x | x | x | x | x | |
| ζ^2 | Lyræ | | | | | | | | | | | | | | x | x | |
| β | Lyræ | | | | | | | | | | | | | | x | x | |
| 50 | Draconis | | | | | | | | x | | x | x | x | x | x | x | |
| ζ | Aquilæ | | | | | | | | | | x | x | | | | | |
| d | Sagittarii | | </ | | | | | | | | | | | | | | |

Observations and reductions for time taken at sending station.

HUGHES, COLORADO, JULY 12, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|-------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | ϵ Coronæ | 16 02 37.06 | — 0.61 | — 0.18 | — 1.80 | 16 02 34.47 | 15 52 21.66 | — 10 12.81 |
| W. | β^1 Scorpii | 08 22.19 | — 2.23 | — 0.07 | — 1.67 | 08 18.22 | 58 05.11 | 13.11 |
| W. | Groombr. 2320 ... | 16 16.27 | + 3.09 | — 0.26 | — 4.25 | 16 14.85 | 16 06 01.75 | 13.10 |
| W. | τ Herculis | 26 12.72 | + 0.42 | — 0.16 | — 2.29 | 26 10.69 | 15 57.38 | 13.31 |
| E. | α Scorpii | 16 31 53.54 | — 2.50 | — 0.10 | + 1.75 | 16 31 52.69 | 16 21 39.47 | — 10 13.22 |
| Mean at 16 ^h 08 ^m local sidereal time..... | | | | | | | | — 10 13.11 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= +5.64 + 5.00 \delta t + 0.75 a - 5.23 c & \delta t &= + 0^s.39 \\
 0 &= +2.48 + 0.75 \delta t + 3.55 a + 3.50 c & a &= - 2^s.45 \\
 0 &= -7.02 - 5.23 \delta t + 3.50 a + 12.99 c & c &= + 1^s.58
 \end{aligned}$$

HUGHES, COLORADO, JULY 12, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|---------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | α Aquilæ | 19 54 50.60 | — 0.38 | — 0.28 | + 1.85 | 19 54 50.79 | 19 44 37.35 | — 10 13.44 |
| E. | ϵ Draconis | 58 44.58 | + 3.81 | — 0.91 | + 5.30 | 58 52.78 | 48 38.85 | 13.93 |
| E. | τ Aquilæ | 20 08 11.80 | — 1.43 | — 0.30 | + 1.83 | 20 08 11.90 | 57 58.28 | 13.62 |
| E. | κ Cephei | 23 11.81 | + 7.17 | — 1.37 | + 8.26 | 23 25.87 | 20 13 11.98 | 13.89 |
| E. | π Capricorni | 30 19.59 | — 2.32 | — 0.12 | + 1.91 | 30 19.06 | 20 05.40 | 13.66 |
| W. | ϵ Delphini | 37 27.37 | — 1.28 | — 0.17 | — 1.85 | 37 24.07 | 27 10.77 | 13.30 |
| W. | Groombr. 3241 ... | 40 51.09 | + 4.51 | — 0.52 | — 5.92 | 40 49.16 | 30 35.73 | 13.43 |
| W. | α Cygni | 47 24.07 | + 0.31 | — 0.23 | — 2.56 | 47 21.54 | 37 08.29 | 13.25 |
| W. | μ Aquarii | 56 07.73 | — 2.01 | — 0.15 | — 1.85 | 56 03.72 | 45 50.33 | 13.39 |
| W. | 12 Y. C. 1879 | 21 03 36.51 | + 9.72 | — 1.01 | — 10.55 | 21 03 34.67 | 20 53 21.58 | — 10 13.09 |
| Mean at 20 ^h 20 ^m local sidereal time..... | | | | | | | | — 10 13.50 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= - 23.52 + 10.00 \delta t - 6.56 a - 1.97 c & \delta t &= + 1^s.50 \\
 0 &= + 64.13 - 6.56 \delta t + 23.80 a + 11.45 c & a &= - 2^s.61 \\
 0 &= - 114.03 - 1.97 \delta t + 11.45 a + 80.85 c & c &= + 1^s.82
 \end{aligned}$$

Observations and reductions for time taken at sending station—Continued.

HUGHES, COLORADO, JULY 13, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|---|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | <i>ε</i> Serpentis | 15 54 45.54 | — 0.32 | — 0.03 | — 1.64 | 15 54 43.55 | 15 44 30.88 | — 10 12.67 |
| W. | <i>ε</i> Coronæ | 16 02 36.20 | — 0.14 | — 0.02 | — 1.85 | 16 02 34.19 | 52 21.64 | 12.55 |
| W. | Groombr. 2320.... | 16 18.28 | + 0.70 | — 0.05 | — 4.36 | 16 14.57 | 16 06 01.73 | 12.84 |
| W. | <i>δ</i> Ophiuchi..... | 17 58.14 | — 0.38 | — 0.01 | — 1.64 | 17 56.11 | 07 43.27 | 12.84 |
| E. | <i>α</i> Scorpii..... | 31 51.17 | — 0.57 | — 0.15 | + 1.80 | 31 52.25 | 21 39.47 | 12.78 |
| E. | <i>A</i> Draconis | 38 25.21 | + 0.75 | — 0.34 | + 4.53 | 38 30.15 | 28 17.60 | 12.55 |
| E. | <i>η</i> Herculis | 48 45.48 | — 0.02 | — 0.18 | + 2.09 | 48 47.37 | 38 34.57 | 12.80 |
| E. | <i>κ</i> Ophiuchi..... | 17 01 53.01 | — 0.28 | — 0.15 | + 1.65 | 17 01 54.23 | 51 41.33 | 12.90 |
| E. | <i>ε</i> Ursæ Minoris.... | 17 09 09.70 | + 2.77 | — 1.04 | +12.02 | 17 09 23.45 | 16 59 10.65 | — 10 12.80 |
| | Mean at 16 ^h 22 ^m local sidereal time | | | | | | | — 10 12.75 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -26.38 + 9.00 \delta t - 4.51 a + 7.77 c & \delta t &= +1^s.25 \\
 0 &= +82.76 - 4.51 \delta t + 30.37 a - 37.14 c & a &= -0^s.56 \\
 0 &= -155.57 + 7.77 \delta t - 37.14 a + 77.20 c & c &= +1^s.62
 \end{aligned}$$

HUGHES, COLORADO, JULY 15, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|---|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | 5 Ursæ Minoris.... | 14 38 13.53 | — 3.02 | + 0.13 | — 6.97 | 14 38 03.67 | 14 27 51.81 | — 10 11.86 |
| W. | <i>ε</i> Bootis | 49 40.80 | + 0.30 | + 0.03 | — 1.88 | 49 39.25 | 39 27.86 | 11.39 |
| W. | <i>β</i> Ursæ Minoris.... | 15 01 28.64 | — 2.62 | + 0.06 | — 6.28 | 15 01 19.80 | 51 08.62 | 11.18 |
| W. | <i>μ</i> ¹ Bootis | 29 56.51 | + 0.05 | + 0.03 | — 2.10 | 29 54.54 | 15 19 43.28 | 11.26 |
| E. | <i>ε</i> Serpentis..... | 54 39.93 | + 0.70 | — 0.06 | + 1.67 | 54 42.29 | 44 30.87 | 11.42 |
| E. | <i>ζ</i> Ursæ Minoris.... | 58 49.73 | — 3.75 | — 0.23 | + 8.09 | 58 53.84 | 48 42.57 | 11.27 |
| E. | <i>ε</i> Coronæ | 16 02 31.03 | + 0.30 | — 0.06 | + 1.89 | 16 02 33.16 | 52 21.63 | 11.53 |
| E. | Groombr. 2320.... | 16 10.68 | — 1.53 | — 0.12 | + 4.45 | 16 13.48 | 16 06 01.64 | 11.84 |
| E. | <i>δ</i> Ophiuchi..... | 16 17 52.46 | + 0.83 | — 0.04 | + 1.66 | 16 17 54.91 | 16 07 43.26 | — 10 11.65 |
| | Mean at 15 ^h 18 ^m local sidereal time | | | | | | | — 10 11.49 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -2.23 + 9.00 \delta t - 7.20 a^1 + 0.33 c^1 & \delta t &= +0^s.01 \\
 0 &= +6.52 - 7.20 \delta t + 23.00 a^1 + 1.35 c^1 & a^1 &= -0^s.29 \\
 0 &= -10.44 + 0.33 \delta t + 1.35 a^1 + 69.44 c^1 & c^1 &= +0^s.16
 \end{aligned}$$

To avoid large numbers an azimuth of + 1^s.50 and an error of collimation of + 1^s.50 were adopted; therefore

$$\begin{aligned}
 a &= +1^s.21 \\
 c &= +1^s.66
 \end{aligned}$$

Observations and reductions for time taken at sending station—Continued.

HUGHES, COLORADO, JULY 16, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|---|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | <i>a</i> Coronæ | 15 39 32.10 | — 0.11 | + 0.07 | + 0.08 | 15 39 32.14 | 15 29 20.30 | — 10 11.84 |
| W. | <i>a</i> Serpentis | 48 14.36 | — 0.26 | + 0.05 | + 0.08 | 48 14.23 | 38 02.41 | 11.82 |
| W. | <i>ε</i> Serpentis | 54 42.67 | — 0.27 | + 0.06 | + 0.07 | 54 42.53 | 44 30.86 | 11.67 |
| W. | <i>ζ</i> Ursæ Minoris | 58 51.95 | + 1.41 | + 0.35 | + 0.37 | 58 54.08 | 48 42.46 | 11.62 |
| W. | <i>ε</i> Coronæ | 16 02 33.13 | — 0.12 | + 0.15 | + 0.08 | 16 02 33.24 | 52 21.61 | 11.63 |
| E. | Groombr. 2320 | 16 13.48 | + 0.58 | — 0.14 | — 0.20 | 16 13.72 | 16 06 01.59 | 12.13 |
| E. | <i>τ</i> Herculis | 26 09.10 | — 0.08 | — 0.07 | — 0.11 | 26 08.84 | 15 57.32 | 11.52 |
| E. | <i>a</i> Scorpii | 31 51.74 | — 0.47 | — 0.02 | — 0.08 | 31 51.17 | 21 39.45 | 11.72 |
| E. | <i>Δ</i> Draconis | 38 28.44 | + 0.63 | — 0.02 | — 0.21 | 38 28.84 | 28 17.48 | 11.36 |
| E. | <i>ζ</i> Ophiuchi | 16 40 23.87 | — 0.36 | 0.00 | — 0.07 | 16 40 23.44 | 16 30 11.95 | — 10 11.49 |
| | Mean at 16 ^h 00 ^m local sidereal time | | | | | | | — 10 11.68 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= +0.04 + 10.00 \delta t - 2.06 a - 0.21 c & \delta t &= -0^s.10 \\
 0 &= +7.39 - 2.06 \delta t + 15.01 a + 8.42 c & a &= -0^s.46 \\
 0 &= +7.53 - 0.21 \delta t + 8.42 a + 48.88 c & c &= -0^s.07
 \end{aligned}$$

HUGHES, COLORADO, JULY 17, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|---|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | <i>a</i> Coronæ | 15 39 31.69 | — 0.20 | — 0.03 | + 0.22 | 15 39 31.68 | 15 29 20.29 | — 10 11.39 |
| W. | <i>a</i> Serpentis | 48 14.16 | — 0.45 | — 0.02 | + 0.20 | 48 13.89 | 38 02.40 | 11.49 |
| W. | <i>ε</i> Serpentis | 54 42.54 | — 0.47 | — 0.02 | + 0.20 | 54 42.25 | 44 30.85 | 11.40 |
| W. | <i>ζ</i> Ursæ Minoris | 58 50.39 | + 2.48 | — 0.16 | + 0.97 | 58 53.68 | 48 42.38 | 11.30 |
| W. | <i>ε</i> Coronæ | 16 02 32.91 | — 0.20 | — 0.04 | + 0.22 | 16 02 32.89 | 52 21.60 | 11.29 |
| E. | Groombr. 2320 | 16 12.76 | + 1.02 | — 0.23 | — 0.52 | 16 13.03 | 16 06 01.55 | 11.48 |
| E. | <i>δ</i> Ophiuchi | 17 55.52 | — 0.55 | — 0.07 | — 0.19 | 17 54.71 | 07 43.24 | 11.47 |
| E. | <i>τ</i> Herculis | 26 08.98 | — 0.14 | — 0.14 | — 0.28 | 26 08.42 | 15 57.30 | 11.12 |
| E. | <i>a</i> Scorpii | 31 51.76 | — 0.83 | — 0.05 | — 0.22 | 31 50.66 | 21 39.44 | 11.22 |
| E. | <i>ζ</i> Ophiuchi | 16 40 24.16 | — 0.63 | — 0.04 | — 0.20 | 16 40 23.29 | 16 30 11.94 | — 10 11.35 |
| | Mean at 16 ^h 00 ^m local sidereal time | | | | | | | — 10 11.34 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -0.02 + 10.00 \delta t - 0.03 a - 2.00 c & \delta t &= -0^s.04 \\
 0 &= +13.61 - 0.03 \delta t + 13.65 a + 12.87 c & a &= -0^s.81 \\
 0 &= +18.59 - 2.00 \delta t + 12.87 a + 42.10 c & c &= -0^s.20
 \end{aligned}$$

Observations and reductions for time taken at sending station—Continued.

HUGHES, COLORADO, JULY 18, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|---|-----------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | <i>a</i> Coronæ | 15 39 31.29 | + 0.09 | + 0.03 | + 0.11 | 15 39 31.52 | 15 29 20.27 | — 10 11.25 |
| W. | <i>a</i> Serpentis | 48 13.39 | + 0.20 | + 0.02 | + 0.10 | 48 13.71 | 38 02.39 | 11.32 |
| W. | <i>ε</i> Serpentis | 54 41.77 | + 0.21 | + 0.02 | + 0.10 | 54 42.10 | 44 30.84 | 11.26 |
| W. | <i>ζ</i> Ursæ Minoris | 58 54.27 | — 1.10 | + 0.04 | + 0.50 | 58 53.71 | 48 42.29 | 11.42 |
| W. | <i>ε</i> Coronæ | 16 02 32.52 | + 0.09 | 0.00 | + 0.11 | 16 02 32.72 | 52 21.59 | 11.13 |
| E. | <i>δ</i> Ophiuchi | 17 54.58 | + 0.25 | — 0.05 | — 0.10 | 17 54.68 | 16 07 43.24 | 11.44 |
| E. | <i>τ</i> Herculis | 26 09.15 | + 0.06 | — 0.13 | — 0.15 | 26 08.93 | 15 57.28 | 11.65 |
| E. | <i>a</i> Scorpii | 31 50.50 | + 0.37 | — 0.04 | — 0.11 | 31 50.72 | 21 39.44 | 11.28 |
| E. | <i>A</i> Draconis | 38 29.75 | — 0.49 | — 0.29 | — 0.28 | 38 28.69 | 28 17.40 | 11.29 |
| E. | <i>ζ</i> Ophiuchi | 40 23.16 | + 0.28 | — 0.08 | — 0.10 | 40 23.26 | 30 11.94 | 11.32 |
| E. | <i>ε</i> Ursæ Minoris | 17 09 24.94 | — 1.81 | — 1.04 | — 0.74 | 17 09 21.35 | 16 59 10.06 | — 10 11.29 |
| Mean at 16 ^h 00 ^m local sidereal time | | | | | | | | — 10 11.33 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -0.98 + 11.00 \delta t - 5.10 a + 5.51 c & \delta t &= +0^s.31 \\
 0 &= -14.97 - 5.10 \delta t + 38.68 a - 24.41 c & a &= +0^s.36 \\
 0 &= +16.97 + 5.51 \delta t - 24.41 a + 97.55 c & c &= -0^s.10
 \end{aligned}$$

HUGHES, COLORADO, JULY 19, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|---|-----------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | <i>a</i> Coronæ | 15 39 31.86 | — 0.23 | — 0.07 | — 0.16 | 15 39 31.40 | 15 29 20.26 | — 10 11.14 |
| E. | <i>ε</i> Serpentis | 54 42.70 | — 0.55 | — 0.06 | — 0.15 | 54 41.94 | 44 30.83 | 11.11 |
| E. | <i>ζ</i> Ursæ Minoris | 58 51.79 | + 2.85 | — 0.39 | — 0.72 | 58 53.53 | 48 42.20 | 11.33 |
| W. | Groombr. 2320 | 16 16 11.44 | + 1.18 | — 0.16 | + 0.39 | 16 16 12.85 | 16 06 01.47 | 11.38 |
| W. | <i>δ</i> Ophiuchi | 17 55.26 | — 0.64 | — 0.05 | + 0.15 | 17 54.72 | 07 43.23 | 11.49 |
| W. | <i>τ</i> Herculis | 26 08.49 | — 0.16 | — 0.17 | + 0.21 | 26 08.37 | 15 57.26 | 11.11 |
| W. | <i>a</i> Scorpii | 31 51.35 | — 0.96 | — 0.07 | + 0.16 | 31 50.48 | 21 39.43 | 11.05 |
| W. | <i>A</i> Draconis | 38 27.33 | + 1.27 | — 0.50 | + 0.40 | 38 28.50 | 28 17.36 | 11.14 |
| W. | <i>ζ</i> Ophiuchi | 16 40 24.00 | — 0.72 | — 0.14 | + 0.15 | 16 40 23.29 | 16 30 11.93 | — 10 11.36 |
| Mean at 17 ^h 00 ^m local sidereal time | | | | | | | | — 10 11.23 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= +0.10 + 9.00 \delta t - 2.18 a - 2.94 c & \delta t &= -0^s.28 \\
 0 &= +11.89 - 2.18 \delta t + 15.11 a - 9.94 c & a &= -0^s.94 \\
 0 &= -3.28 - 2.94 \delta t - 9.94 a + 47.56 c & c &= -0^s.15
 \end{aligned}$$

Observations and reductions for time taken at sending station—Continued.

HUGHES, COLORADO, JULY 20, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|----------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | <i>a</i> Serpents..... | 15 47 13.14 | — 0.15 | — 0.06 | — 0.20 | 15 47 12.73 | 15 37 02.37 | — 10 10.36 |
| E. | <i>ε</i> Serpents..... | 54 41.93 | — 0.16 | — 0.06 | — 0.20 | 54 41.51 | 44 30.82 | 10.69 |
| E. | <i>ζ</i> Ursæ Minoris..... | 58 53.17 | + 0.52 | — 0.31 | — 0.98 | 58 52.70 | 48 42.09 | 10.61 |
| E. | <i>ε</i> Coronæ..... | 16 02 32.57 | — 0.07 | — 0.09 | — 0.22 | 16 02 32.19 | 52 21.57 | 10.62 |
| E. | <i>β</i> Scorpii..... | 08 16.40 | — 0.25 | — 0.04 | — 0.21 | 08 15.90 | 58 05.05 | 10.85 |
| W. | Groombr. 2320..... | 16 11.58 | + 0.34 | — 0.21 | + 0.53 | 16 12.24 | 16 06 01.41 | 10.83 |
| W. | <i>δ</i> Ophiuchi..... | 17 54.11 | — 0.18 | — 0.06 | + 0.20 | 17 54.07 | 07 43.23 | 10.84 |
| W. | <i>τ</i> Herculis..... | 26 07.63 | — 0.05 | 0.00 | + 0.29 | 26 07.87 | 15 57.24 | 10.63 |
| W. | <i>α</i> Scorpii..... | 31 50.30 | — 0.28 | — 0.01 | + 0.22 | 31 50.23 | 21 39.42 | 10.81 |
| W. | <i>A</i> Draconis..... | 38 26.76 | + 0.38 | — 0.07 | + 0.56 | 38 27.63 | 28 17.30 | 10.33 |
| W. | <i>ζ</i> Ophiuchi..... | 16 40 22.76 | — 0.21 | — 0.02 | + 0.20 | 16 40 22.73 | 16 30 11.92 | — 10 10.81 |
| Mean at 16 ^h 00 ^m local sidereal time..... | | | | | | | | — 10 10.67 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -0.77 + 11.00 \delta t - 0.71 a - 0.85 c & \delta t &= + 0^s.04 \\
 0 &= +2.72 - 0.71 \delta t + 16.24 a - 8.41 c & a &= -0^s.27 \\
 0 &= +7.47 - 0.85 \delta t - 8.41 a + 49.75 c & c &= -0^s.20
 \end{aligned}$$

HUGHES, COLORADO, JULY 20, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|----------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | <i>κ</i> Ophiuchi..... | 17 01 52.09 | — 0.22 | — 0.04 | + 0.26 | 17 01 52.09 | 16 51 41.28 | — 10 10.81 |
| W. | <i>ε</i> Ursæ Minoris..... | 09 16.87 | + 2.11 | — 0.27 | + 1.90 | 09 20.61 | 59 09.80 | 10.81 |
| W. | <i>α</i> Herculis..... | 19 04.18 | — 0.19 | — 0.05 | + 0.27 | 19 04.21 | 17 28 53.36 | 10.85 |
| W. | <i>44</i> Ophiuchi..... | 28 50.28 | — 0.41 | — 0.04 | + 0.28 | 28 50.11 | 18 39.21 | 10.90 |
| E. | <i>β</i> Draconis..... | 37 47.58 | + 0.15 | — 0.13 | — 0.42 | 37 47.18 | 27 36.07 | 11.11 |
| E. | <i>α</i> Ophiuchi..... | 39 15.76 | — 0.20 | — 0.22 | — 0.26 | 39 15.08 | 29 04.37 | 10.71 |
| E. | <i>ω</i> Draconis..... | 47 56.38 | + 0.57 | — 0.46 | — 0.71 | 47 55.78 | 37 44.96 | 10.82 |
| E. | <i>μ</i> Herculis..... | 51 42.61 | — 0.10 | — 0.19 | — 0.29 | 51 42.03 | 41 31.35 | 10.68 |
| E. | <i>ψ</i> Draconis..... | 17 54 26.95 | + 0.74 | — 0.48 | — 0.84 | 17 54 26.37 | 17 44 15.57 | — 10 10.80 |
| Mean at 17 ^h 18 ^m local sidereal time..... | | | | | | | | + 10 10.83 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -2.33 + 9.00 \delta t - 5.78 a - 0.72 c & \delta t &= -0^s.03 \\
 0 &= +19.66 - 5.78 \delta t - 31.45 a + 25.59 c & a &= -0^s.42 \\
 0 &= +31.70 - 0.72 \delta t + 25.59 a + 81.63 c & c &= -0^s.26
 \end{aligned}$$

Observations and reductions for time taken at sending station—Continued.

HUGHES, COLORADO, JULY 21, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|---|----------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | μ^1 Sagittarii | 18 16 23.42 | — 0.68 | — 0.07 | — 0.24 | 18 16 22.43 | 18 06 12.52 | — 10 09.91 |
| E. | δ Ursæ Minoris..... | 23 38.89 | + 8.83 | — 1.62 | — 3.87 | 23 42.23 | 13 32.30 | 09.93 |
| E. | 1 Aquilæ..... | 38 30.77 | — 0.54 | — 0.05 | — 0.23 | 38 29.95 | 28 19.99 | 09.96 |
| E. | α Lyræ | 42 50.80 | — 0.01 | — 0.06 | — 0.29 | 42 50.44 | 42 40.52 | 09.92 |
| W. | β Lyræ | 55 35.28 | — 0.10 | + 0.04 | + 0.27 | 55 35.49 | 45 25.63 | 09.86 |
| W. | 50 Draconis | 19 00 38.79 | + 1.63 | + 0.13 | + 0.87 | 19 00 41.42 | 50 31.58 | 09.84 |
| W. | ζ Aquilæ..... | 09 46.39 | — 0.32 | + 0.05 | + 0.23 | 09 46.35 | 59 36.47 | 09.88 |
| W. | δ Sagittarii | 20 25.16 | — 0.69 | + 0.03 | + 0.24 | 20 24.74 | 10 14.71 | 10.03 |
| W. | δ Draconis | 22 42.63 | + 0.90 | + 0.14 | + 0.61 | 22 44.28 | 12 34.39 | 09.89 |
| W. | τ Draconis | 19 28 10.49 | + 1.35 | + 0.17 | + 0.79 | 19 28 12.80 | 19 18 02.71 | — 10 10.09 |
| Mean at 18 ^h 42 ^m local sidereal time | | | | | | | | — 10 09.93 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -14.44 + 10.00 \delta t - 14.40 a + 7.00 c & \delta t &= +0^s.57 \\
 0 &= +82.44 - 14.40 \delta t + 163.16 a - 188.59 c & a &= -0^s.72 \\
 0 &= -64.91 + 7.00 \delta t - 188.59 a + 326.81 c & c &= -0^s.23
 \end{aligned}$$

Observations and reductions for time taken at sending station.

SALT LAKE CITY, UTAH, JULY 12, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | δ Scorpii..... | 7 45 44.41 | — 1.63 | + 0.02 | + 0.16 | 7 45 42.96 | 15 52 51.44 | +8 07 08.48 |
| E. | β^1 Scorpii..... | 50 58.06 | — 1.53 | + 0.05 | + 0.16 | 50 56.71 | 57 05.11 | 08.40 |
| E. | Groombr. 2320.... | 58 50.57 | + 2.11 | + 0.28 | + 0.40 | 58 53.36 | 16 05 01.76 | 08.40 |
| E. | τ Herculis | 8 08 48.26 | + 0.26 | + 0.30 | + 0.22 | 8 08 49.04 | 15 57.37 | 08.33 |
| E. | η Draconis | 15 08.64 | + 1.29 | + 0.45 | + 0.32 | 15 10.70 | 22 19.15 | 08.45 |
| E. | ζ Ophiuchi..... | 8 23 04.61 | — 1.34 | + 0.17 | + 0.15 | 8 23 04.59 | 16 30 11.96 | +8 07 08.37 |
| Mean at 16 ^h .0 local sidereal time | | | | | | | | +8 07 08.41 |

NORMAL EQUATIONS.

$$\begin{aligned}
 + 6.00 \delta t + 0.52 a &= + 1.56 & \delta t &= + 0^s.41 \\
 + 0.52 \delta t + 4.52 a &= - 7.46 & a &= - 1^s.697
 \end{aligned}$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, JULY 12, 1873.

| Clamp. | Name of star. | T. | | Aa. | Bb. | Cc. | T'. | | AR. | $\Delta T.$ | |
|--|---------------------------|-----------------|-----------|-----------|-----------|-------------|-----------------|-------------|-----------------|-----------------|-----------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>s.</i> |
| E. | 72 Ophiuchi | 9 54 14.08 | — 1.00 | + 0.14 | + 0.11 | 9 54 13.33 | 18 01 21.80 | +8 07 08.47 | | | |
| E. | μ Sagittarii | 59 05.55 | — 1.79 | + 0.06 | + 0.12 | 59 03.94 | 06 12.49 | 08.55 | | | |
| E. | η^1 Serpentis | 10 07 39.01 | — 1.30 | + 0.07 | + 0.11 | 07 37.89 | 14 46.41 | 08.52 | | | |
| W. | 1 Aquilæ | 21 13.08 | — 1.43 | + 0.05 | — 0.11 | 21 11.59 | 28 19.96 | 08.37 | | | |
| W. | α Lyræ | 25 31.82 | — 0.09 | + 0.06 | — 0.14 | 25 31.65 | 32 40.54 | 08.89 | | | |
| W. | β Lyræ | 38 17.23 | — 0.30 | + 0.09 | — 0.13 | 38 16.89 | 45 25.63 | 08.74 | | | |
| W. | 50 Draconis | 43 19.39 | + 4.19 | + 0.26 | — 0.43 | 43 23.41 | 50 31.85 | 08.44 | | | |
| W. | ζ Aquilæ | 52 28.82 | — 0.88 | + 0.07 | — 0.11 | 52 27.90 | 59 36.43 | 08.53 | | | |
| W. | δ Sagittarii | 11 03 08.01 | — 1.73 | + 0.04 | — 0.12 | 11 03 06.20 | 19 10 14.64 | 08.44 | | | |
| W. | δ Draconis | 05 24.06 | + 2.20 | + 0.14 | — 0.29 | 05 26.11 | 17 34.47 | 08.36 | | | |
| W. | τ Draconis | 11 10 50.92 | + 3.46 | + 0.15 | — 0.37 | 11 10 54.16 | 19 18 02.86 | +8 07 08.70 | | | |
| Mean at 19 ^h .0 local sidereal time | | | | | | | | | | +8 07 08.55 | |

NORMAL EQUATIONS.

$$\begin{aligned}
 +11.00 \, \delta t - 0.71 \, a - 12.48 \, c &= +5.98 & \delta t &= +0^s.54 \\
 -0.71 \, \delta t + 13.07 \, a + 17.95 \, c &= -23.07 & a &= -1^s.880 \\
 -12.48 \, \delta t + 17.95 \, a + 43.02 \, c &= -35.87 & c &= +0^s.108
 \end{aligned}$$

SALT LAKE CITY, UTAH, JULY 14, 1873.

| Clamp. | Name of star. | T. | | Aa. | Bb. | Cc. | T'. | | AR. | $\Delta T.$ | |
|--|----------------------------|-----------------|-----------|-----------|-----------|------------|-----------------|-------------|-----------------|-----------------|-----------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>s.</i> |
| W. | μ^1 Bootis | 7 12 35.66 | — 0.13 | + 0.15 | — 0.21 | 7 12 35.47 | 15 19 43.29 | +8 07 07.82 | | | |
| W. | ζ^3 Libræ | 21 26.41 | — 1.63 | + 0.07 | — 0.17 | 21 24.68 | 28 32.31 | 07.63 | | | |
| W. | α Coronæ | 22 13.13 | — 0.50 | + 0.15 | — 0.18 | 22 12.60 | 29 20.31 | 07.71 | | | |
| W. | τ^6 Serpentis | 28 03.74 | — 0.80 | + 0.16 | — 0.17 | 28 02.93 | 35 10.50 | 07.57 | | | |
| W. | α Serpentis | 30 55.88 | — 1.05 | + 0.16 | — 0.17 | 30 54.82 | 38 02.42 | 07.60 | | | |
| W. | ζ Ursæ Minoris | 41 29.67 | + 5.55 | + 0.70 | — 0.80 | 41 35.12 | 48 42.65 | 07.53 | | | |
| E. | β^1 Scorpii | 51 59.02 | — 1.72 | + 0.08 | + 1.17 | 51 58.55 | 58 05.10 | 07.55 | | | |
| E. | δ Ophiuchi | 8 00 36.73 | — 1.31 | + 0.12 | + 0.16 | 8 00 35.70 | 07 43.26 | 07.56 | | | |
| E. | τ Herculis | 08 49.04 | + 0.28 | + 0.22 | + 0.24 | 08 49.78 | 15 57.33 | 07.55 | | | |
| E. | η Draconis | 15 09.30 | + 1.42 | + 0.30 | + 0.35 | 15 11.37 | 22 19.08 | 07.71 | | | |
| E. | ζ Ophiuchi | 8 23 03.61 | — 1.48 | + 0.12 | + 0.17 | 8 23 02.42 | 15 36 11.95 | +8 07 07.53 | | | |
| Mean at 16 ^h .0 local sidereal time | | | | | | | | | | +8 07 07.61 | |

NORMAL EQUATIONS.

$$\begin{aligned}
 +11.00 \, \delta t + 0.73 \, a - 3.71 \, c &= +4.78 & \delta t &= +0^s.61 \\
 +0.73 \, \delta t + 12.69 \, a + 12.87 \, c &= -21.17 & a &= -1^s.870 \\
 -3.71 \, \delta t + 12.87 \, a + 39.73 \, c &= -19.82 & c &= +0^s.164
 \end{aligned}$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, JULY 17, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|----------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | γ ² Ursæ Minoris..... | 7 13 50.25 | + 3.11 | — 0.14 | + 0.36 | 7 13 53.58 | 15 20 59.45 | +8 07 05.87 |
| E. | α Coronæ..... | 22 14.80 | — 0.49 | — 0.05 | + 0.12 | 22 14.38 | 29 20.29 | 05.91 |
| E. | γ ⁶ Serpentis..... | 28 05.24 | — 0.78 | — 0.05 | + 0.11 | 28 04.52 | 35 10.44 | 05.92 |
| E. | α Serpentis..... | 30 57.46 | — 1.01 | — 0.05 | + 0.11 | 30 56.51 | 38 02.40 | 05.89 |
| E. | ε Serpentis..... | 37 25.89 | — 1.07 | — 0.07 | + 0.11 | 37 24.86 | 44 30.85 | 05.99 |
| W. | δ Scorpil..... | 45 47.39 | — 1.74 | — 0.02 | — 0.12 | 45 45.51 | 52 51.41 | 05.90 |
| W. | β ¹ Scorpil..... | 52 01.02 | — 1.67 | — 0.01 | — 0.12 | 52 59.22 | 58 05.08 | 05.86 |
| W. | δ Ophiuchi..... | 8 00 38.72 | — 1.27 | — 0.01 | — 0.11 | 8 00 37.33 | 16 07 43.24 | 05.91 |
| W. | τ Herculis..... | 08 51.47 | + 0.27 | — 0.00 | — 0.16 | 08 51.58 | 15 57.30 | 05.72 |
| W. | η Draconis..... | 15 11.81 | + 1.38 | — 0.00 | — 0.23 | 15 12.96 | 22 19.00 | 06.04 |
| W. | ζ Ophiuchi..... | 23 07.54 | — 1.43 | + 0.01 | — 0.11 | 23 06.01 | 30 11.94 | 05.93 |
| W. | η Herculis..... | 8 31 28.75 | — 0.07 | + 0.01 | — 0.14 | 8 31 28.55 | 16 38 34.53 | +8 07 05.98 |
| Mean at 16 ^h .0 local sidereal time | | | | | | | | +8 07 05.90 |

NORMAL EQUATIONS.

$$\begin{aligned}
 +12.00 \delta t + 2.63 a - 1.56 c &= -6.07 & \delta t &= +0^s.10 \\
 +2.63 \delta t + 7.34 a - 5.49 c &= -14.19 & a &= -1^s.810 \\
 -1.56 \delta t - 5.49 a + 27.75 c &= +13.04 & c &= +0^s.113
 \end{aligned}$$

SALT LAKE CITY, UTAH, JULY 17, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|--------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | γ Draconis..... | 9 46 35.73 | + 0.58 | + 0.05 | — 0.18 | 9 46 36.18 | 17 53 41.97 | +8 07 05.79 |
| W. | 72 Ophiuchi..... | 54 17.08 | — 1.02 | + 0.03 | — 0.11 | 54 15.98 | 18 01 21.80 | 05.82 |
| W. | μ ¹ Sagittarii..... | 59 08.54 | — 1.82 | — 0.01 | — 0.12 | 59 06.59 | 06 12.52 | 05.93 |
| W. | η Serpentis..... | 10 07 42.10 | — 1.32 | — 0.01 | — 0.11 | 10 07 40.66 | 14 46.44 | 05.78 |
| E. | 1 Aquilæ..... | 21 15.48 | — 1.46 | — 0.03 | + 0.11 | 21 14.10 | 23 19.98 | 05.88 |
| E. | α Lyræ..... | 25 34.52 | — 0.10 | — 0.06 | + 0.14 | 25 34.50 | 32 40.53 | 06.03 |
| E. | β Lyræ..... | 38 19.92 | — 0.31 | — 0.06 | + 0.13 | 38 19.68 | 45 25.64 | 05.96 |
| E. | 50 Draconis..... | 43 21.46 | + 4.28 | — 0.16 | + 0.44 | 43 26.02 | 50 31.72 | 05.70 |
| E. | ζ Aquilæ..... | 10 52 31.52 | — 0.90 | — 0.06 | + 0.11 | 10 52 30.67 | 18 59 36.46 | +8 07 05.79 |
| Mean at 18 ^h .5 local sidereal time | | | | | | | | +8 07 05.85 |

NORMAL EQUATIONS.

$$\begin{aligned}
 +9.00 \delta t + 1.03 a + 3.76 c &= -2.98 & \delta t &= +0^s.15 \\
 +1.08 \delta t + 7.55 a - 9.06 c &= -15.60 & a &= -1^s.920 \\
 +3.76 \delta t - 9.06 a + 26.15 c &= +19.55 & c &= +0^s.105
 \end{aligned}$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, JULY 19, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|----------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | β Draconis | 9 20 29.66 | + 0.52 | — 0.08 | + 0.19 | 9 20 30.29 | 17 27 36.09 | +8 07 05.80 |
| E. | μ Herculis | 34 25.78 | — 0.39 | — 0.06 | + 0.12 | 34 29.45 | 41 31.36 | 05.91 |
| E. | γ Draconis | 46 35.22 | + 0.47 | — 0.08 | + 0.19 | 46 35.80 | 53 41.94 | 06.14 |
| E. | 72 Ophiuchi | 54 16.86 | — 0.83 | — 0.04 | + 0.12 | 54 16.11 | 18 01 21.82 | 05.71 |
| E. | Bradl. 2313 | 10 14 55.42 | — 1.33 | — 0.03 | + 0.12 | 10 14 54.18 | 21 59.88 | 05.70 |
| E. | 1 Aquilæ | 21 15.50 | — 1.19 | — 0.03 | + 0.12 | 21 14.40 | 28 19.99 | 05.59 |
| E. | α Lyrae | 25 34.58 | — 0.07 | — 0.05 | + 0.15 | 25 34.61 | 32 40.53 | 05.92 |
| W. | ζ ¹ Lyrae | 33 20.72 | — 0.11 | — 0.02 | — 0.14 | 33 20.45 | 40 26.12 | 05.67 |
| W. | ζ ² Lyrae | 33 22.56 | — 0.11 | — 0.02 | — 0.14 | 33 22.29 | 40 27.97 | 05.68 |
| W. | β Lyrae | 38 20.18 | — 0.25 | + 0.01 | — 0.14 | 38 19.80 | 45 25.64 | 05.84 |
| W. | 50 Draconis | 10 43 22.88 | + 3.50 | + 0.05 | — 0.48 | 10 43 25.95 | 18 50 31.66 | +8 07 05.71 |
| Mean at 18 ^h .0 local sidereal time | | | | | | | | + 8 07 05.80 |

NORMAL EQUATIONS.

$$\begin{array}{rcl}
 11.00 \delta t - 0.12 a + 1.05 c = -1.99 & \delta t = -0^s.20 \\
 -0.12 \delta t + 6.85 a + 9.93 c = -9.61 & a = -1^s.570 \\
 +1.05 \delta t + 9.93 a + 31.42 c = -12.12 & c = +0^s.116
 \end{array}$$

The observations for time at Salt Lake City for July 16 and July 19 are printed in the report on Winnemucca.

The following tables show the corrections and rates of the chronometers used at Hughes and Salt Lake City:

CHRONOMETER AT HUGHES.—NEGUS, No. 1491.

| Date. | Local sidereal time. | Correction of chronometer. | Adopted hourly rate. |
|---------|----------------------|----------------------------|----------------------|
| 1873. | <i>h.</i> | <i>h. m. s.</i> | <i>s.</i> |
| July 12 | 18.2 | — 0 10 13.31 | — 0.0265 |
| July 13 | 16.4 | 12.75 | — 0.0245 |
| July 15 | 15.3 | 11.49 | — 0.0102 |
| July 16 | 16.0 | 11.68 | — 0.0065 |
| July 17 | 16.0 | 11.34 | — 0.0070 |
| July 18 | 16.0 | 11.33 | — 0.0020 |
| July 19 | 17.0 | 11.23 | — 0.0120 |
| July 20 | 16.6 | 10.75 | — 0.0270 |
| July 21 | 18.7 | — 0 10 09.93 | — 0.0340 |

CHRONOMETER AT SALT LAKE CITY.—NEGUS, No. 1511.

| Date. | Local sidereal time. | Correction of chronometer. | Adopted hourly rate. |
|---------|----------------------|----------------------------|----------------------|
| 1873. | <i>h.</i> | <i>h. m. s.</i> | <i>s.</i> |
| July 12 | 17.5 | + 8 07 08.48 | — 0.018 |
| July 14 | 16.0 | 07.61 | — 0.020 |
| July 16 | 17.0 | 06.60 | — 0.026 |
| July 17 | 17.3 | 05.85 | — 0.018 |
| July 18 | 17.3 | 05.72 | — 0.001 |
| July 19 | 18.0 | + 8 07 05.80 | + 0.003 |

Final results of longitude.

| Signals sent from— | Recorded at— | Mean of signals sent and received. | Time-corrections. | Corrected time. | Difference of longitude. | Double-wave time. | Means. |
|--------------------|-------------------|------------------------------------|-------------------|-----------------|--------------------------|-------------------|-----------|
| | | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> | <i>s.</i> | <i>s.</i> |
| July 12, 1873: | | | | | | | |
| Salt Lake City. { | Hughes | 17 57 26.57 | — 0 10 13.32 | 17 47 13.25 | | | |
| | Salt Lake City. { | 9 11 45.75 | + 8 07 08.48 | 17 18 54.23 | 28 19.02 | | |
| | Hughes | 18 19 49.82 | — 0 10 13.31 | 18 09 36.51 | | | |
| | Salt Lake City. { | 9 34 09.18 | + 8 07 08.48 | 17 41 17.66 | 18.85 | 0.17 | 18.935 |
| July 17, 1873: | | | | | | | |
| Salt Lake City. { | Hughes | 17 34 03.43 | — 0 10 11.33 | 17 23 52.10 | | | |
| | Salt Lake City. { | 8 48 27.25 | + 8 07 05.85 | 16 55 33.10 | 19.00 | | |
| | Hughes | 17 48 15.36 | — 0 10 11.33 | 17 38 04.03 | | | |
| | Salt Lake City. { | 9 02 39.31 | + 8 07 05.85 | 17 09 45.16 | 18.87 | 0.13 | 18.935 |
| July 18, 1873: | | | | | | | |
| Salt Lake City. { | Hughes | 17 52 51.34 | — 0 10 11.32 | 17 42 40.02 | | | |
| | Salt Lake City. { | 9 07 15.28 | + 8 07 05.72 | 17 14 21.00 | 19.02 | | |
| | Hughes | 17 59 25.40 | — 0 10 11.32 | 17 49 14.08 | | | |
| | Salt Lake City. { | 9 13 49.53 | + 8 07 05.72 | 17 20 55.25 | 18.83 | 0.19 | 18.925 |
| July 19, 1873: | | | | | | | |
| Salt Lake City. { | Hughes | 17 43 25.77 | — 0 10 11.22 | 17 33 14.55 | | | |
| | Salt Lake City. { | 8 57 49.70 | + 8 07 05.80 | 17 04 55.50 | 19.05 | | |
| | Hughes | 17 56 05.38 | — 0 10 11.22 | 17 45 54.16 | | | |
| | Salt Lake City. { | 9 10 29.50 | + 8 07 05.80 | 17 18 35.30 | 28 18.86 | 0.19 | 18.955 |

Hughes east of Salt Lake City 0^h 28^m 18^s.938 ± 0^s.004

Mean places of stars for 1873.0 used for determination of latitude of Hughes, Colorado.

| No. of pair. | No. in B. A. C. | Approximate right ascen- sion. | Declination. | No. of pair. | No. in B. A. C. | Approximate right ascen- sion. | Declination. |
|--------------|--------------------|--------------------------------------|--------------|--------------|--------------------|--------------------------------------|--------------|
| | | <i>h. m. s.</i> | <i>° ' "</i> | | | <i>h. m. s.</i> | <i>° ' "</i> |
| 1..... | 5775 | 17 01 13 | 43 59 09.5 | 22..... | 7041 | 20 21 00 | 42 11 24.5 |
| | 5788 | 03 32 | 36 06 05.7 | | 7061 | 22 54 | 38 01 27.5 |
| 2..... | 5883 | 18 48 | 23 04 50.2 | 23..... | 7091 | 27 24 | 48 47 32.6 |
| | 5902 | 21 13 | 57 07 37.4 | | 7131 | 32 22 | 31 07 47.8 |
| 3..... | 5927 | 26 07 | 31 15 15.1 | 24..... | 7182 | 38 18 | 49 53 04.8 |
| | 5975 | 33 18 | 48 39 36.5 | | 7194 | 40 25 | 20 15 26.1 |
| 4..... | 5986 | 35 10 | 31 16 15.7 | 25..... | 7213 | 42 28 | 36 01 29.7 |
| | 6052 | 46 02 | 50 48 42.9 | | 7253 | 48 45 | 43 54 26.2 |
| 5..... | 6024 | 52 49 | 29 15 45.2 | 26..... | 7313 | 57 29 | 39 00 32.8 |
| | 6129 | 59 50 | 48 27 33.0 | | 7326 | 59 07 | 41 07 38.4 |
| 6..... | 6178 | 18 07 07 | 31 22 28.9 | 27..... | Lal.* | 21 10 35 | 36 43 28.4 |
| | 6234 | 15 29 | 28 55 42.5 | | 7402 | 13 43 | 43 24 44.0 |
| 7..... | 6246 | 16 58 | 51 17 34.9 | 28..... | 7462 | 22 11 | 36 33 56.1 |
| 8..... | 6258 | 18 30 | 51 14 25.2 | 29..... | Arg.† | 32 50 | 50 29 37.5 |
| 9..... | 6349 | 31 06 | 38 47 32.5 | 30..... | 7560 | 37 35 | 50 36 38.5 |
| | 6355 | 32 38 | 38 40 00.4 | | 7607 | 44 13 | 29 35 02.2 |
| 10..... | 6404 | 42 09 | 41 18 23.2 | 31..... | 7631 | 47 43 | 55 12 00.9 |
| | 6453 | 49 23 | 22 29 07.9 | | 7706 | 22 01 06 | 24 43 32.1 |
| 11..... | 6496 | 54 36 | 57 38 48.7 | 32..... | 7753 | 07 11 | 33 58 46.5 |
| | 6516 | 57 38 | 47 51 19.2 | | 7800 | 15 47 | 45 53 51.4 |
| 12..... | 6553 | 19 02 37 | 32 18 11.1 | 33..... | 7858 | 26 50 | 39 07 37.8 |
| | 6602 | 12 20 | 22 47 54.6 | | 7917 | 35 56 | 40 53 00.5 |
| 13..... | 6640 | 17 56 | 57 24 19.7 | 34..... | 7931 | 38 22 | 38 48 01.9 |
| | 6673 | 23 12 | 29 11 33.8 | | 7962 | 44 38 | 41 16 53.0 |
| 14..... | 6723 | 31 02 | 50 57 54.0 | 35..... | 7997 | 51 13 | 20 05 17.1 |
| | 6740 | 34 24 | 29 51 42.0 | | 8033 | 58 09 | 59 45 42.9 |
| 15..... | 6763 | 38 26 | 50 13 52.4 | 36..... | 8091 | 23 08 45 | 27 22 47.4 |
| | 6805 | 44 55 | 10 05 58.3 | 37..... | 8097 | 09 33 | 27 33 20.8 |
| 16..... | 6836 | 48 35 | 69 56 39.2 | | 8107 | 10 54 | 52 31 43.0 |
| | 6851 | 51 32 | 34 44 49.8 | 38..... | 8131 | 14 21 | 23 02 43.2 |
| 17..... | 6876 | 55 31 | 45 25 36.2 | | 8158 | 18 22 | 56 50 19.1 |
| | 6890 | 57 41 | 15 40 34.0 | | 8203 | 27 06 | 21 47 53.2 |
| 18..... | 6905 | 20 00 07 | 64 27 56.5 | 39..... | Gr.4110 | 32 21 | 57 57 05.6 |
| 19..... | 6913 | 00 54 | 64 16 33.6 | 40..... | 8268 | 40 51 | 57 56 41.0 |
| | 6928 | 02 53 | 52 47 27.4 | 41..... | 8280 | 42 41 | 59 16 21.1 |
| 20..... | 6973 | 10 30 | 27 25 32.7 | | 8296 | 45 57 | 20 57 53.1 |
| | 6996 | 13 37 | 40 20 13.8 | 42..... | 8344 | 55 08 | 60 30 56.2 |
| 21..... | 7022 | 17 40 | 39 51 04.6 | | 32 | 0 08 00 | 19 30 00.9 |

* Jalande, No. 41341.

† Argelander's Durchmusterung, 50°, No. 3382.

Observations and computations for latitude.

HUGHES, COLORADO.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|-----------------------|-----------------|-------------------|-----------|-----------|-----------------------|--------------------------|-------------------|--------|------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1873. July 16..... | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | ° ' " |
| | 6602 | 3 85.2 | 15.9 | 20.0 | | 40 06 07.2 | - 6 39.5 | -2.8 | 39 59 24.9 |
| | 6640 | 16 71.5 | 14.3 | 20.3 | | | | | |
| | 6673 | 5 67.1 | 14.0 | 20.0 | | 04 43.7 | - 5 16.4 | -2.8 | 24.5 |
| | 6723 | 15 85.8 | 15.0 | 19.1 | | | | | |
| | 6740 | 7 11.4 | 14.3 | 21.3 | | 02 46.9 | - 3 19.8 | -3.3 | 23.8 |
| | 6763 | 13 54.6 | 15.7 | 20.7 | | | | | |
| | 6805 | 9 19.2 | 16.0 | 20.0 | | 01 17.9 | - 1 50.5 | -3.3 | 24.1 |
| | 6836 | 12 74.9 | 14.0 | 22.0 | | | | | |
| | 6996 | 15 91.5 | 17.0 | 19.0 | | 05 38.1 | - 6 10.4 | -4.9 | 22.8 |
| | 7002 | 3 98.8 | 10.0 | 26.0 | | | | | |
| | 7041 | 16 88.0 | 19.0 | 17.0 | | 40 06 24.8 | - 6 55.6 | -6.6 | 22.6 |
| | 7061 | 3 49.9 | 5.0 | 31.0 | | | | | |
| | 7091 | 3 85.4 | 17.5 | 18.5 | | 39 57 38.9 | + 1 48.9 | -3.6 | 24.2 |
| | 7131 | 7 36.1 | 12.0 | 24.2 | | | | | |
| | 7182 | 13 94.0 | 12.0 | 24.0 | | 40 04 13.9 | - 4 45.2 | -3.6 | 25.1 |
| | 7194 | 4 75.7 | 17.2 | 18.3 | | | | | |
| | 7402 | 13 61.7 | 3.0 | 33.7 | | 39 59 17.9 | + 0 03.7 | -3.8 | 23.8 |
| | 7462 | 13 93.1 | 27.0 | 10.0 | | | | | |
| | Arg. | 10 00.6 | 12.0 | 23.0 | | 40 02 17.5 | - 2 51.9 | -0.8 | 24.8 |
| | 7560 | 16 77.7 | 12.0 | 23.0 | | 05 47.9 | - 6 22.1 | -0.9 | 24.9 |
| | 7607 | 4 47.3 | 21.8 | 13.9 | | | | | |
| | 7631 | 9 02.3 | 21.8 | 13.9 | | 39 57 44.1 | + 1 42.9 | -3.7 | 23.3 |
| | 7706 | 12 33.7 | 7.3 | 28.7 | | | | | |
| | 7997 | 13 56.7 | 16.8 | 18.0 | | 39 55 27.3 | + 3 57.2 | -1.2 | 23.3 |
| | 8033 | 5 93.0 | 16.0 | 19.0 | | | | | |
| July 18..... | 6453 | 6 40.2 | 15.2 | 22.6 | Heavy wind; dusty. | 40 03 59.4 | - 4 39.2 | +4.1 | 24.3 |
| | 6496 | 15 39.2 | 30.2 | 8.0 | | | | | |
| | 6516 | 14 07.1 | 17.3 | 21.0 | | 04 47.1 | - 5 23.7 | +2.1 | 25.5 |
| | 6553 | 3 65.0 | 25.0 | 13.7 | | | | | |
| | 6602 | 3 19.6 | 18.9 | 20.2 | | 06 07.5 | - 6 47.1 | +2.5 | 22.9 |
| | 6640 | 16 30.4 | 24.8 | 14.3 | | | | | |
| | 6740 | 7 49.4 | 17.0 | 22.0 | | 02 47.5 | - 3 26.5 | +2.6 | 23.6 |
| | 6763 | 14 14.1 | 27.0 | 12.6 | | | | | |
| | 6805 | 7 25.5 | 16.3 | 23.0 | | 01 18.4 | - 1 55.6 | +0.5 | 23.3 |
| | 6836 | 10 97.7 | 23.8 | 15.4 | | | | | |
| | 6851 | 3 08.6 | 19.0 | 20.2 | | 40 05 13.0 | - 5 51.7 | +1.5 | 22.8 |
| | 6876 | 14 41.0 | 23.0 | 16.3 | | | | | |
| | 6890 | 7 88.2 | 24.7 | 15.0 | | 04 15.0 | - 4 50.9 | +0.1 | 24.2 |
| | 6905 | 17 24.7 | 15.0 | 24.4 | | 39 58 33.6 | + 0 49.9 | +0.1 | 23.6 |
| | 6913 | 6 27.4 | 15.0 | 24.4 | | | | | |

LATITUDE DETERMINATIONS.

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Observations and computations—Continued.

HUGHES, COLORADO.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|-----------------------|-----------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|----------|--------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1873. July 18..... | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | <i>o ' "</i> | <i>' "</i> | <i>"</i> | <i>o ' "</i> |
| | 6928 | 16 43.0 | 14.7 | 24.8 | | | | | |
| | 6973 | 2 66.5 | 26.3 | 12.7 | | 40 06 29.9 | — 7 07.5 | +1.0 | 39 59 23.4 |
| | 6996 | 15 58.3 | 22.6 | 16.7 | | | | | |
| | 7022 | 3 50.3 | 16.9 | 22.4 | | 05 38.7 | — 6 15.2 | +0.1 | 23.6 |
| | 7041 | 15 95.2 | 15.2 | 24.0 | | | | | |
| | 7061 | 2 29.0 | 29.0 | 10.0 | | 40 06 25.4 | — 7 04.3 | +2.8 | 23.9 |
| | 7091 | 3 73.7 | 22.9 | 16.3 | | | | | |
| | 7131 | 7 02.3 | 19.0 | 20.3 | | 39 57 39.5 | + 1 42.1 | +1.5 | 23.1 |
| | 7182 | 14 04.2 | 24.3 | 14.9 | | | | | |
| | 7194 | 4 63.2 | 17.8 | 21.6 | | 40 04 14.6 | — 4 52.3 | +1.4 | 23.7 |
| | 7213 | 11 74.6 | 16.6 | 22.8 | | | | | |
| | 7253 | 9 00.3 | 26.3 | 13.0 | | 39 57 56.9 | + 1 25.2 | +2.0 | 24.1 |
| | 7313 | 5 23.0 | 21.5 | 17.8 | | | | | |
| | 7326 | 14 22.0 | 17.3 | 22.0 | | 40 04 04.4 | — 4 39.2 | —0.3 | 24.9 |
| | Lal. | 3 71.5 | 22.5 | 16.9 | | 40 04 04.7 | — 4 41.9 | +0.2 | 23.0 |
| | 7402 | 12 79.2 | 17.3 | 22.2 | | | | | |
| | 7462 | 12 90.7 | 25.0 | 14.4 | | 39 59 18.5 | + 0 03.6 | +1.6 | 23.7 |
| | Arg. | 9 51.3 | 16.4 | 24.0 | | 40 02 18.1 | — 2 57.1 | +2.7 | 23.7 |
| | 7560 | 16 25.9 | 15.5 | 25.0 | | 40 05 48.6 | — 6 26.7 | +2.2 | 24.1 |
| | 7607 | 3 81.0 | 29.0 | 11.6 | | | | | |
| | 7631 | 8 00.0 | 24.0 | 16.7 | | | | | |
| | 7706 | 11 07.6 | 22.8 | 18.3 | | 39 57 44.9 | + 1 35.5 | +3.3 | 23.7 |
| | 7753 | 13 38.5 | 22.2 | 19.0 | | | | | |
| | 7800 | 7 32.5 | 19.9 | 23.0 | | 39 56 16.7 | + 3 08.2 | 0.0 | 24.9 |
| | 7858 | 8 52.3 | 21.0 | 22.0 | | | | | |
| | 7917 | 10 30.5 | 25.0 | 19.0 | | 40 00 16.7 | — 0 55.3 | +1.4 | 22.8 |
| | 7931 | 7 46.3 | 21.0 | 22.8 | | | | | |
| | 7962 | 13 35.9 | 26.3 | 18.2 | | 40 02 25.0 | — 3 03.1 | +1.9 | 23.8 |
| | 7997 | 13 37.8 | 21.2 | 23.0 | | | | | |
| | 8033 | 5 84.4 | 27.7 | 17.4 | | 39 55 27.8 | + 3 54.0 | +2.3 | 24.1 |
| | 8091 | 14 43.0 | 21.3 | 24.0 | | 39 57 12.7 | + 2 07.8 | +2.7 | 23.2 |
| | 8097 | 4 23.8 | 20.0 | 25.3 | | 40 02 29.4 | — 3 08.7 | +2.0 | 22.7 |
| | 8107 | 10 31.4 | 29.2 | 16.8 | | | | | |
| | 8131 | 13 06.4 | 22.0 | 24.0 | | | | | |
| | 8158 | 7 50.1 | 28.3 | 18.0 | | 39 56 28.7 | + 2 52.8 | +2.3 | 23.8 |
| | 8203 | 18 79.0 | 19.0 | 27.7 | | | | | |
| | Gr. 4110 | 5 39.6 | 28.5 | 18.9 | | 52 27.0 | + 6 56.0 | +0.3 | 23.3 |
| | 8268 | 4 99.7 | 29.0 | 18.4 | | 39 52 14.7 | + 7 08.4 | +0.5 | 39 59 23.6 |

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Observations and computations—Continued.

HUGHES, COLORADO.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|---------------|-----------------|---------------------|-----------|-----------|----------|--------------------------|-------------------|--------|------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1873. | | <i>t.</i> <i>d.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | ° ' " |
| July 18. | 8344 | 10 88.5 | 29.2 | 18.7 | | | | | |
| | 32 | 8 85.2 | 20.3 | 28.0 | | 40 00 26.4 | — 1 03.1 | +0.8 | 39 59 24.1 |
| July 19. | 6129 | 10 57.8 | 20.0 | 17.1 | | | | | |
| | 6178 | 18 83.2 | 12.3 | 25.1 | | 39 55 03.7 | + 4 16.4 | +2.7 | 22.8 |
| | 6355 | 12 91.9 | 20.2 | 18.5 | | | | | |
| | 6404 | 12 57.0 | 18.0 | 21.0 | | 39 59 13.9 | + 0 10.8 | —0.4 | 24.3 |
| | 6453 | 6 81.8 | 17.3 | 21.8 | | | | | |
| | 6496 | 15 81.0 | 28.0 | 11.3 | | 40 03 59.7 | — 4 39.3 | +3.4 | 23.8 |
| | 6516 | 14 21.1 | 20.0 | 18.9 | | | | | |
| | 6553 | 3 67.3 | 30.0 | 9.0 | | 04 46.6 | — 5 27.3 | +6.1 | 25.4 |
| | 6602 | 3 36.9 | 20.0 | 19.0 | | | | | |
| | 6640 | 16 42.4 | 22.2 | 16.8 | | 06 08.0 | — 6 45.5 | +1.8 | 24.3 |
| | 6673 | 5 37.2 | 17.6 | 21.0 | | | | | |
| | 6723 | 15 81.0 | 29.0 | 10.4 | | 04 44.6 | — 5 24.2 | +4.2 | 24.6 |
| | 6740 | 6 65.6 | 18.3 | 21.0 | | | | | |
| | 6763 | 13 33.6 | 29.8 | 9.8 | | 02 47.8 | — 3 27.5 | +4.7 | 25.0 |
| | 6805 | 7 29.5 | 17.0 | 22.3 | | | | | |
| | 6836 | 11 06.2 | 25.0 | 14.0 | | 01 18.7 | — 1 57.0 | +1.6 | 23.3 |
| | 6851 | 4 14.5 | 24.0 | 15.0 | | | | | |
| | 6876 | 15 44.2 | 18.0 | 21.0 | | 05 13.3 | — 5 50.9 | +1.6 | 24.0 |
| | 6890 | 7 25.9 | 26.0 | 13.5 | | | | | |
| | 6905 | 16 66.4 | 13.0 | 26.8 | | 40 04 15.3 | — 4 52.1 | —0.4 | 22.8 |
| | 6913 | 5 66.0 | 13.0 | 26.8 | | 39 58 33.8 | + 0 49.7 | —0.4 | 23.1 |
| | 6928 | 16 64.7 | 24.6 | 15.0 | | | | | |
| | 6973 | 2 91.8 | 14.8 | 25.5 | | 40 06 30.1 | — 7 06.4 | —0.3 | 23.4 |
| | 6996 | 16 27.0 | 23.3 | 16.8 | | | | | |
| | 7022 | 4 21.2 | 16.8 | 23.5 | | 05 39.1 | — 6 14.5 | —0.1 | 24.5 |
| | 7041 | 16 51.9 | 19.5 | 21.0 | | | | | |
| | 7061 | 2 92.5 | 21.3 | 19.0 | | 40 06 25.7 | — 7 02.2 | +0.2 | 23.7 |
| | 7091 | 3 63.6 | 23.2 | 17.0 | | | | | |
| | 7131 | 7 02.3 | 14.7 | 25.8 | | 39 57 39.8 | + 1 45.2 | —1.4 | 23.6 |
| | 7182 | 14 05.0 | 17.6 | 23.0 | | | | | |
| | 7194 | 4 63.2 | 26.5 | 14.0 | | 40 04 14.9 | — 4 52.8 | +2.0 | 24.1 |
| | 7313 | 5 52.5 | 16.7 | 24.4 | | | | | |
| | 7326 | 14 55.0 | 27.0 | 14.3 | | 04 04.71 | — 4 40.3 | +1.4 | 25.8 |
| | Lal. | 4 08.8 | —1.5 | 42.7 | | | | | |
| | 7402 | 13 12.2 | 41.5 | 0.2 | | 40 04 05.0 | — 4 40.6 | —0.6 | 23.8 |
| | 7462 | 13 31.0 | —1.2 | 42.5 | | 39 59 18.8 | + 0 05.8 | —0.7 | 39 59 23.9 |

LATITUDE DETERMINATIONS.

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Observations and computations—Continued.

HUGHES, COLORADO.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|------------------------|------------------|--|-----------------------------------|-----------------------------------|----------|--|------------------------------------|--------------------------|------------------------------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1873. July 19. | Arg. | <i>t. d.</i> 10 34.0 17 10.1 4 78.9 | <i>d.</i> 23.0 23.6 14.7 | <i>d.</i> 19.0 19.0 28.0 | | <i>o ' "</i> 40 02 18.4 40 05 48.9 | <i>' "</i> - 2 52.4 - 6 22.4 | <i>"</i> -2.6 -2.4 | <i>o ' "</i> 39 59 23.4 24.1 |
| | 7631 7706 | 8 82.4 12 00.7 | 21.9 19.3 | 21.0 24.0 | | 39 57 45.0 | + 1 33.9 | -1.0 | 22.9 |
| | 7753 7800 | 14 13.2 8 14.4 | 19.3 27.8 | 24.6 16.9 | | 39 56 17.0 | + 3 06.0 | +1.5 | 24.5 |
| | 7858 7917 | 3 65.1 5 32.7 | 27.8 14.0 | 17.0 31.0 | | 40 00 17.0 | - 0 52.1 | -1.7 | 22.2 |
| | 7931 7962 | 7 48.2 13 36.5 | 19.5 27.9 | 25.4 17.4 | | 40 02 25.3 | - 3 02.7 | +1.3 | 23.9 |
| | 7997 8033 | 13 78.7 6 12.1 | 25.0 15.0 | 19.8 30.0 | | 39 55 28.1 | + 3 58.1 | -2.7 | 23.5 |
| | 8091 8107 | 14 28.2 9 98.0 | 30.0 9.3 | 14.8 35.3 | | 57 13.0 | + 2 13.6 | -3.0 | 22.6 |
| | 8131 8158 | 13 32.4 7 75.0 | 19.3 28.3 | 25.0 16.2 | | 56 29.0 | + 2 53.1 | +1.8 | 23.9 |
| | 8203 Gr. 4110 | 18 77.7 5 45.7 | 23.0 27.7 | 21.4 17.6 | | 52 27.3 | + 6 53.7 | +3.2 | 24.2 |
| | 8268 | 5 04.1 | 28.6 | 18.0 | | 39 52 14.9 | + 7 06.6 | +3.4 | 24.9 |
| | 8280 8296 | 17 41.8 2 54.3 | 25.0 20.3 | 20.3 25.0 | | 40 07 04.5 | - 7 42.0 | +2.6 | 25.1 |
| | 8344 32 | 10 86.3 8 86.4 | 24.0 21.0 | 21.7 24.9 | | 00 26.7 | - 1 22.1 | -0.4 | 24.2 |
| July 20. | 6234 6246 | 1 50.2 15 60.6 | 16.4 21.0 | 22.1 18.0 | | 06 41.4 | - 7 18.0 | -0.7 | 22.7 |
| | 6453 6496 | 6 56.7 15 44.1 | 23.0 14.0 | 16.0 25.3 | | 03 59.9 | - 4 35.6 | -1.2 | 23.1 |
| | 6602 6640 | 3 45.4 16 52.3 | 17.0 27.7 | 23.3 13.0 | | 06 08.3 | - 6 45.9 | +2.3 | 24.7 |
| | 6805 6836 | 8 60.5 12 29.6 | 23.0 20.3 | 17.3 21.1 | | 01 19.0 | - 1 54.6 | +1.3 | 25.7 |
| | 6851 6876 | 3 61.4 14 84.5 | 20.3 19.0 | 21.0 22.8 | | 05 13.6 | - 5 48.8 | -1.2 | 23.6 |
| | 6890 6905 | 7 44.8 16 79.0 | 20.3 18.0 | 21.0 23.8 | | 40 04 15.5 | - 4 50.2 | -1.8 | 23.5 |
| | 6913 | 5 80.0 | 17.4 | 24.0 | | 39 58 34.1 | + 0 51.2 | -2.0 | 23.3 |
| | 6928 6973 | 16 23.0 2 56.7 | 20.2 23.3 | 21.0 17.4 | | 40 06 00.4 | - 7 05.9 | +1.4 | 29 59 25.9 |

Observations and computations—Continued.

HUGHES, COLORADO.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|----------------------|-----------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|-------|------------|
| | | | N. | S. | | | Microm. and refr. | Level | |
| 1873. July 20.... | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | ° ' " |
| | 6996 | 15 61.8 | 23.2 | 17.3 | | | | | |
| | 7022 | 3 59.4 | 14.6 | 25.6 | | 40 05 39.4 | — 6 13.5 | —1.4 | 39 59 24.5 |
| | 7041 | 16 47.2 | 22.1 | 18.2 | | | | | |
| | 7061 | 2 92.6 | 15.3 | 24.4 | | 40 06 26.1 | — 7 00.7 | —1.4 | 24.0 |
| | 7091 | 2 81.0 | 18.3 | 22.0 | | | | | |
| | 7131 | 6 15.0 | 23.0 | 16.7 | | 39 57 40.1 | + 1 43.7 | +0.7 | 24.5 |
| | 7182 | 13 45.3 | 24.0 | 15.9 | | | | | |
| | 7194 | 4 15.2 | 12.0 | 27.6 | | 40 04 15.2 | — 4 48.9 | —2.1 | 24.2 |
| | 7313 | 5 11.4 | 21.8 | 18.4 | | | | | |
| | 7326 | 14 06.0 | 13.4 | 27.0 | | 40 04 05.0 | — 4 37.9 | —2.8 | 24.3 |
| | 7402 | 12 48.0 | 24.4 | 16.0 | | | | | |
| | 7462 | 12 65.3 | 15.0 | 25.8 | | 39 59 19.2 | + 0 05.4 | —0.7 | 23.9 |
| | Arg. | 9 66.4 | 24.3 | 17.0 | | 40 02 18.7 | — 2 52.5 | —1.5 | 24.7 |
| | 7560 | 16 42.4 | 23.9 | 17.4 | | 40 05 49.2 | — 6 22.4 | —1.7 | 25.1 |
| | 7607 | 4 11.1 | 14.3 | 27.0 | | | | | |
| | 7631 | 8 79.8 | 23.5 | 18.3 | | | | | |
| | 7706 | 12 02.7 | 15.7 | 27.0 | | 39 57 45.3 | + 1 40.3 | —1.7 | 23.9 |
| | 7753 | 13 27.2 | 25.7 | 17.0 | | | | | |
| | 7800 | 7 27.6 | 19.0 | 24.0 | | 39 56 17.3 | + 3 06.2 | +1.0 | 24.5 |
| | 7858 | 9 09.5 | 26.3 | 17.0 | | | | | |
| | 7917 | 10 80.0 | 17.0 | 26.8 | | 40 00 17.3 | — 0 53.0 | —0.1 | 24.2 |
| | 7931 | 7 41.5 | 18.3 | 25.0 | | | | | |
| | 7962 | 13 26.9 | 27.5 | 16.4 | | 40 02 25.6 | — 3 01.8 | +1.2 | 25.0 |
| | 7997 | 13 37.9 | 22.0 | 22.0 | | | | | |
| | 8033 | 5 83.0 | 25.2 | 19.0 | | 39 55 28.4 | + 3 54.5 | +1.7 | 24.6 |
| | 8091 | 15 10.0 | 28.0 | 16.3 | | 39 57 13.3 | + 2 10.8 | +0.6 | 24.7 |
| | 8097 | 4 90.4 | 27.3 | 17.0 | | 40 02 30.0 | — 3 05.9 | +0.2 | 24.3 |
| | 8107 | 10 88.8 | 17.4 | 27.0 | | | | | |
| | 8131 | 12 86.6 | 21.2 | 22.9 | | | | | |
| | 8158 | 7 21.9 | 23.0 | 21.2 | | 39 56 29.3 | + 2 55.4 | 0.0 | 24.7 |
| | 8203 | 18 37.8 | 19.0 | 25.1 | | | | | |
| | Gr. 4110 | 4 97.5 | 26.0 | 18.5 | | 52 27.6 | + 6 56.3 | +0.4 | 24.3 |
| | 8268 | 4 57.4 | 27.0 | 17.4 | | 39 52 15.2 | + 7 08.8 | +1.0 | 25.0 |
| | 8280 | 16 52.5 | 23.0 | 21.7 | | | | | |
| | 8296 | 1 70.0 | 19.9 | 24.8 | | 40 07 05.3 | — 7 40.5 | —1.0 | 23.8 |
| | 8344 | 11 11.0 | 23.0 | 22.0 | | | | | |
| | 32 | 9 06.3 | 24.0 | 21.7 | | 00 26.9 | — 1 03.6 | +0.9 | 24.2 |
| July 21.... | 6805 | 8 63.5 | 16.6 | 27.8 | | | | | |
| | 6836 | 12 47.1 | 36.5 | 9.3 | | 40 01 19.3 | — 1 59.2 | +4.4 | 39 59 24.5 |

LATITUDE DETERMINATIONS.

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Observations and computations—Continued.

HUGHES, COLORADO.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|-----------------------|-----------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|----------|--------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1873. July 21..... | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | <i>o ' "</i> | <i>' "</i> | <i>"</i> | <i>o ' "</i> |
| | 6890 | 7 04.5 | 28.2 | 18.3 | | | | | |
| | 6905 | 16 47.0 | 19.5 | 26.0 | | 40 04 15.8 | — 4 52.7 | +0.9 | 39 59 24.0 |
| | 6913 | 5 48.0 | 19.0 | 27.0 | | 39 58 34.4 | + 0 48.6 | +0.5 | 23.5 |
| | 6928 | 16 09.8 | 24.8 | 21.0 | | | | | |
| | 6973 | 2 20.4 | 31.0 | 15.0 | | 40 06 30.7 | — 7 11.5 | +5.4 | 24.6 |
| | 6996 | 15 65.9 | 26.5 | 19.5 | | | | | |
| | 7022 | 3 52.4 | 22.0 | 24.0 | | 40 05 39.7 | — 6 16.9 | +1.4 | 24.2 |
| | 7091 | 3 54.4 | 19.0 | 27.8 | | | | | |
| | 7131 | 6 81.3 | 32.3 | 14.7 | | 39 57 40.4 | + 1 41.5 | +2.4 | 24.3 |
| | 7182 | 13 66.8 | 29.0 | 18.0 | | | | | |
| | 7194 | 4 24.6 | 19.3 | 27.6 | | 40 04 15.5 | — 4 52.6 | +0.7 | 23.6 |
| | 7213 | 11 48.0 | 22.0 | 24.7 | | | | | |
| | 7253 | 8 77.8 | 31.3 | 15.8 | | 39 57 57.8 | + 1 23.9 | +3.5 | 25.2 |
| | Lal. | 3 76.0 | 7.3 | 40.4 | | 40 04 05.7 | — 4 42.3 | +1.3 | 24.7 |
| | 7402 | 12 84.8 | 42.7 | 5.0 | | | | | |
| | 7462 | 12 96.4 | 7.3 | 40.4 | | 39 59 19.5 | + 0 03.6 | +1.3 | 24.4 |
| | Arg. | 9 28.2 | 24.0 | 22.2 | | 40 02 19.0 | — 2 54.3 | —0.9 | 23.8 |
| | 7560 | 16 09.9 | 28.8 | 19.5 | | 40 05 49.5 | — 6 26.1 | +1.2 | 24.6 |
| | 7607 | 3 66.9 | 21.9 | 26.9 | | | | | |
| | 7631 | 8 18.0 | 25.0 | 23.3 | | | | | |
| | 7706 | 11 33.8 | 23.3 | 25.2 | | 39 57 45.6 | + 1 38.1 | 0.0 | 23.7 |
| | 7753 | 12 48.3 | 21.7 | 26.8 | | | | | |
| | 7800 | 6 59.7 | 35.4 | 13.9 | | 39 56 17.6 | + 3 02.8 | +4.5 | 24.9 |
| | 7858 | 8 97.2 | 35.4 | 13.9 | | | | | |
| | 7917 | 10 80.4 | 21.7 | 26.8 | Cloudy. | 40 10 17.6 | — 0 56.9 | +4.5 | 25.2 |
| July 23..... | 5775 | 13 16.8 | 29.0 | 16.0 | | | | | |
| | 5788 | 6 73.5 | 20.0 | 25.0 | | 02 41.6 | — 3 19.8 | +2.2 | 24.0 |
| | 5883 | 2 87.2 | 26.0 | 20.3 | | | | | |
| | 5902 | 16 13.0 | 28.8 | 18.4 | | 40 06 18.0 | — 6 51.8 | —1.3 | 24.9 |
| | 5975 | 7 71.8 | 12.3 | 35.0 | | | | | |
| | 5986 | 10 34.7 | 37.0 | 10.2 | | 39 58 00.4 | + 1 21.7 | +1.1 | 23.2 |
| | 6052 | 12 84.2 | 37.0 | 10.2 | | | | | |
| | 6084 | 7 23.2 | 12.3 | 35.0 | | 40 02 17.5 | — 2 54.3 | +1.1 | 24.3 |
| | 6129 | 5 83.4 | 26.6 | 21.8 | | | | | |
| | 6178 | 14 15.0 | 23.0 | 26.0 | | 39 55 04.7 | + 4 18.3 | +0.5 | 23.5 |
| | 6234 | 1 66.6 | 30.3 | 18.9 | | | | | |
| | 6246 | 15 73.9 | 18.4 | 31.0 | | 40 06 42.1 | — 7 17.1 | —0.3 | 24.7 |
| | 6258 | 12 68.9 | 17.9 | 31.6 | | 05 07.2 | — 5 42.4 | —0.6 | 24.2 |
| | 6349 | 5 72.6 | 23.0 | 27.0 | | 40 03 01.2 | — 3 41.4 | +4.0 | 23.8 |
| | 6355 | 13 02.3 | 22.8 | 27.0 | | 39 59 15.1 | + 0 05.3 | +4.0 | 39 59 24.4 |
| | 6404 | 12 85.3 | 34.6 | 16.0 | | | | | |

Observations and computations—Continued.

HUGHES, COLORADO.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|----------------------|-----------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|--------|------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1873. July 23.... | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | ° ' " |
| | 6453 | 6 49.4 | 24.5 | 25.6 | | | | | |
| | 6496 | 15 56.4 | 33.8 | 16.8 | | 40 04 00.7 | — 4 41.7 | +4.4 | 39 59 23.4 |
| | 6516 | 14 10.4 | 26.3 | 24.2 | | | | | |
| | 6553 | 3 56.6 | 33.0 | 17.7 | | 04 47.7 | — 5 27.3 | +4.8 | 25.2 |
| | 6602 | 2 69.3 | 32.4 | 18.7 | | | | | |
| | 6640 | 15 68.0 | 13.8 | 38.0 | | 06 09.1 | — 6 43.4 | —2.9 | 22.8 |
| | 6673 | 5 10.9 | 29.2 | 22.0 | | | | | |
| | 6723 | 15 44.3 | 22.2 | 29.8 | | 04 45.8 | — 5 21.0 | —0.1 | 24.7 |
| | 6740 | 6 65.3 | 26.5 | 25.0 | | | | | |
| | 6763 | 13 26.5 | 28.2 | 23.9 | | 02 49.0 | — 3 25.4 | +1.6 | 25.2 |
| | 6805 | 7 08.3 | 23.8 | 28.0 | | | | | |
| | 6836 | 10 94.2 | 34.2 | 18.0 | | 01 19.7 | — 1 59.9 | +3.3 | 23.1 |
| | 6851 | 2 95.9 | 25.0 | 26.7 | | | | | |
| | 6876 | 14 22.2 | 27.5 | 24.0 | | 05 14.5 | — 5 49.8 | +0.5 | 25.2 |
| | 6890 | 6 68.0 | 25.2 | 26.5 | | | | | |
| | 6905 | 16 12.2 | 27.3 | 24.3 | | 40 04 16.3 | — 4 53.3 | +0.5 | 23.5 |
| | 6913 | 5 12.5 | 28.2 | 24.0 | | 39 58 34.9 | + 0 48.3 | +0.8 | 24.0 |
| | 6928 | 16 57.6 | 29.7 | 22.3 | | | | | |
| | 6973 | 2 80.0 | 23.0 | 29.4 | | 40 06 31.3 | — 7 07.9 | +0.3 | 23.7 |
| | 6996 | 15 42.3 | 29.5 | 22.8 | | | | | |
| | 7022 | 3 40.8 | 24.3 | 28.4 | | 05 40.3 | — 6 16.3 | +0.7 | 24.7 |
| | 7041 | 16 41.4 | 29.0 | 23.5 | | | | | |
| | 7061 | 2 75.3 | 25.9 | 27.0 | | 40 06 27.0 | — 7 04.3 | +1.2 | 23.9 |
| | 7091 | 3 26.7 | 24.6 | 28.0 | | | | | |
| | 7131 | 6 52.1 | 31.0 | 21.9 | | 39 57 41.0 | + 1 41.1 | +1.6 | 23.7 |
| | 7182 | 13 50.2 | 24.0 | 28.8 | | | | | |
| | 7194 | 4 01.2 | 35.0 | 18.0 | | 40 04 16.1 | — 4 54.8 | +3.4 | 24.7 |
| | 7213 | 11 40.6 | 29.9 | 23.2 | | | | | |
| | 7253 | 8 73.2 | 28.8 | 24.6 | | 39 57 58.4 | + 1 23.1 | +3.0 | 24.5 |
| | 7313 | 5 70.0 | 26.8 | 26.6 | | | | | |
| | 7326 | 14 83.6 | 31.4 | 22.2 | | 40 04 06.0 | — 4 43.8 | +2.6 | 24.8 |
| | Lal. | 3 52.2 | 23.7 | 30.0 | | | | | |
| | 7402 | 12 69.1 | 34.0 | 19.8 | | 40 04 06.3 | — 4 44.8 | +2.2 | 23.7 |
| | 7462 | 12 79.0 | 20.0 | 34.0 | | 39 59 20.1 | + 0 03.1 | +0.0 | 23.2 |
| | Arg. | 8 68.1 | 23.4 | 31.0 | | | | | |
| | 7560 | 15 44.5 | 23.3 | 31.0 | | 40 02 19.7 | — 2 58.6 | +4.5 | 25.6 |
| | 7607 | 2 93.0 | 38.9 | 15.0 | | 40 05 50.1 | — 6 28.7 | +4.5 | 39 59 25.9 |

Observations and computations—Continued.

HUGHES, COLORADO.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|-----------------------|-----------------|---------------------|-----------|-----------|--------------|--------------------------|-------------------|--------|------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1873. July 23..... | | <i>t.</i> <i>d.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | ° ' " |
| | 7631 | 8 43.0 | 31.5 | 22.8 | | | | | |
| | 7706 | 11 56.2 | 23.9 | 31.0 | | 39 57 46.2 | + 1 37.3 | +0.4 | 39 59 23.9 |
| | 7753 | 12 78.0 | 24.8 | 29.9 | | | | | |
| | 7800 | 6 86.8 | 36.0 | 19.0 | Cloudy | 39 56 18.2 | + 3 03.6 | +3.3 | 39 59 25.1 |

ASTRONOMICAL CO-ORDINATES OF HUGHES, COLORADO.

Longitude.. $6^{\text{h}} 59^{\text{m}} 15^{\text{s}}.92$ or $104^{\circ} 48' 58''.80 \pm 0''.06$ west from Greenwich.

Longitude.. $1^{\text{h}} 51^{\text{m}} 03^{\text{s}}.80$ or $27^{\circ} 45' 57''.00$ west from U. S. Naval Observatory, Washington, D. C.

Latitude ... $39^{\circ} 59' 24''.09 \pm 0''.03$ north.

From all pairs observed more than twice the probable error of one observation for latitude is found to be $\pm 0''.40$, and, therefore, that of the final result is $\pm 0''.033$.

U. S. GEOGRAPHICAL SURVEYS WEST OF THE ONE HUNDREDTH MERIDIAN,
1ST LIEUT. GEO. M. WHEELER, CORPS OF ENGINEERS, U. S. ARMY, IN CHARGE.

RESULTS
OF
OBSERVATIONS MADE BY DR. F. KAMPF AND JOHN H. CLARK IN THE
DETERMINATION OF THE ASTRONOMICAL CO-ORDINATES
OF LABRAN, COLORADO.
SEASON OF 1873.

COMPUTATIONS BY
DR. F. KAMPF AND JOHN H. CLARK.

LABRAN, COLORADO.

GEOGRAPHICAL POSITION OF STATION.

Longitude, . . . $105^{\circ} 06' 17''.78 \pm 0''.44$ west from Greenwich.

Latitude, . . . $38^{\circ} 23' 08''.97 \pm 0''.03$ north.

Barometric altitude of observatory above sea-level, 5217.8 feet.

The astronomical monument is 157 feet from the southwest corner of the depot at Labran. At the date of its occupation this station was the regular terminus of the railroad from Pueblo, but from here a branch diverged to some neighboring coal-mines, for the convenience of the Colorado Central Improvement Company. Since that time the track has been continued to Cañon City.

Streets were laid out through this settlement; but only four houses, besides the railway depot, had been erected. The office of the improvement company was in charge of Mr. Neilson R. Clark, civil engineer, to whom thanks are due for his assistance in making the various arrangements at this place.

In the east and southeast the country is level to the horizon. In the south, southwest, and northwest the foot-hills of the Rocky Mountains rise abruptly to an eminent height. But little farming, and that by irrigation, is done in this part of Colorado. Three inches below the surface the ground is too hard to be permeated by the water of the rains, and it escapes to the Arkansas River, which flows by in an easterly direction, at a distance of one and a half miles.

METEOROLOGICAL CONDITIONS.

The atmosphere at this station was free from undulation. At first it was constantly stormy, and neither stars nor sun were visible, but after three days of rain it cleared away and became tolerably fair. The wind was always very strong, and the observing-tent was often in danger of being blown away.

The following table gives the general direction of the wind and the appearance of the sky during the observations at this station :

| Date. | General direction of wind. | | | General appearance of the sky. |
|--------------------|----------------------------|--------------------|-----------------------------|---|
| | 0 ^h to 8 a. m. | 8 a. m. to 4 p. m. | 4 p. m. to 0 ^h . | |
| 1873. August 12 | ..... | N. W. and N. E. | E. and N. W. | Thunder and rain at 4.50 p. m.; clear at night. |
| 13 | N. W. | N. E. | S. E. and N. W. | Lightning at 8 p. m. |
| 14 | N. W. | N. E. | N. W. | Cloudy and rainy winds at 2.35 p. m.; heavy rain and storm at 4.30 p. m. |
| 15 | S. W. | S. E. | E. and N. E. | Rainy the whole day. |
| 16 | N. W. | E. | N. E. and N. W. | Heavy ram and lightning; clearing off a little at night. |
| 17 | (No.) | N. E. | N. W. | Rain-storm at 1.30 p. m. and 2.30 p. m. |
| 18 | N. W. | N. W. | S. E. and N. W. | Rain from 2.15 to 5 p. m.; then clearing off. |
| 19 | N. W. | N. W. | N. W. | Rain at 4 p. m.; clearing off at night. |
| 20 | N. W. | N. W. and N. E. | N. W. | Partly cloudy; lightning in south at 11 p. m. |
| 21 | S. W. and N. W. | N. E. | E. | Rain at 3 p. m.; clear at night. |
| 22 | (No.) | N. E. | N. W. | Rain-storm from 2.05 p. m. to 3.45 p. m.; rain at 6 and 11 p. m. |
| 23 | N. W. | N. W. and N. E. | S. E. | Rain-storm from 2.20 p. m. to 3.50 p. m.; hail-storm at 3.30 p. m.; lightning in northeast. |
| 24 | N. W. | N. W. and N. E. | S. E. | Rainy. |
| 25 | Changeable. | N. E. | E. and S. | Clear. |
| 26 | S. W. | N. W. | N. E. | Clear. |
| 27 | Changeable. | N. W. and N. E. | N. E. | Partly cloudy. |
| 28 | N. W. | ..... | ..... |  |

OBSERVATORY—INSTRUMENTS—INSTRUMENTAL VALUES.

The observatory and instruments were the same here as at Colorado Springs, and are described in the report upon the latter station, date of 1874. The telegraph-line was a loop from the office at Pueblo, used for railroad business alone. This loop was continued from the local office into the astronomical tent. Mr. D. Siemsen, in charge of the railway and telegraph office at this point, kindly assisted in the exchange of signals. The line was always in very bad condition, and exchanges had to be made by sound, except on the 25th, when the signals were recorded by the chronograph. The length of circuit from Labran to Salt Lake City is about 800 miles. The signals were transferred at Denver, Cheyenne, and Corinne by automatic repeaters.

CONNECTIONS.—OBSERVERS.—COMPUTERS.

Salt Lake City was the connected station, at which point Mr. John H. Clark was observer. Observations at Labran were made by Dr. F. Kampf. Each observer made the computations to accompany his own work.

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Tabulation of stars used for determination of time at Labran, Colorado, and Salt Lake City, Utah, 1873.

| Name of star. | | LABRAN, COLORADO. | | | | | | | | SALT LAKE CITY, UTAH. | | | |
|----------------|-------------------------|-------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|--------------------------|-----------|-----------|-----------|
| | | August 12 | August 16 | August 17 | August 18 | August 19 | August 20 | August 21 | August 25 | August 26 | August 16 | August 19 | August 25 | August 26 |
| ζ | Ophiuchi | | | × | × | | | | | | | | |
| η | Herculis | | | × | × | | | | | | | | |
| κ | Ophiuchi | | | × | × | | | | | | | | |
| ε | Ursæ Minoris | | | × | × | | | | | | | | |
| α ¹ | Herculis | | | × | × | | | | | | | | |
| 44 | Ophiuchi | | | × | × | | | | | | | | |
| β | Draconis | | | × | × | | | | | | | | |
| α | Ophiuchi | | | × | × | | | | | | | | |
| ω | Draconis | | | × | × | | | | | | | | |
| μ | Herculis | | | × | × | | | | | | | | |
| ε8 | Herculis | | | × | × | | | | | | | | |
| ε9 | Herculis | | | | | | | | | | | | |
| ψ ¹ | Draconis | | | | | | | | | | | | |
| γ | Draconis | | | | | | | | | | | | |
| γ ² | Sagittarii | | | | | | | | | | | | |
| 72 | Ophiuchi | | | | | | | | | | | | |
| μ ¹ | Sagittarii | | | | | | | | | | | | |
| δ | Ursæ Minoris | | | | | | | | | | | | |
| η | Serpentis | | | | | | | | | | | | |
| | Brad. 2313 | | | | | | | | | | | | |
| 1 | Aquilæ | | | | | | | | | | | | |
| α | Lyræ | | | | | | | | | | | | |
| ζ ¹ | Lyræ | | | | | | | | | | | | |
| ζ ² | Lyræ | | | | | | | | | | | | |
| β | Lyræ | | | | | | | | | | | | |
| 50 | Draconis | | | | | | | | | | | | |
| ζ | Aquilæ | | | | | | | | | | | | |
| d | Sagittarii | | | | | | | | | | | | |
| δ | Draconis | | | | | | | | | | | | |
| τ | Draconis | | | | | | | | | | | | |
| κ | Aquilæ | | | | | × | | | | | | | |
| θ | Cygni | | | | | | | | | | | | |
| γ | Aquilæ | | | | | | | | | | | | |
| α | Aquilæ | | | | | | | | | | | | |
| ε | Draconis | | | | | | | | | | | | |
| τ | Aquilæ | × | | | | × | | | | | | | |
| θ | Aquilæ | | | | | | | | | | | | |
| α ² | Capricorni | | | | | | | | | | | | |
| κ | Cephei | × | | | | × | | | | | | | |
| ω ¹ | Cygni | | | | | | | | | | | | |
| π | Capricorni | × | | | | | | | | | | | |
| ε | Delphini | × | | | | × | | | | | | | |
| α | Delphini | | | | | | | | | | | | |
| | Groombr. 3241 | × | | | | | | | | | | | |
| α | Cygni | × | × | | | × | | | | | | | |
| ε | Aquarii | | | | | | | | | | | | |
| μ | Aquarii | × | × | | | × | | | | | | | |
| v | Cygni | | | | | | | | | | | | |
| | 12-Year Catalogue, 1879 | × | × | | | × | | | | | | | |
| 61 | Cygni | × | × | | | × | | | | | | | |
| ζ | Cygni | × | × | | | × | | | | | | | |
| α | Cephei | | | | | | | | | | | | |
| β | Aquarii | | × | | | × | | | | | | | |
| β | Cephei | | × | | | | | | | | | | |
| ξ | Aquarii | | × | | | | | | | | | | |
| μ | Capricorni | | × | | | | | | | | | | |
| 79 | Draconis | | × | | | | | | | | | | |
| α | Aquarii | | × | | | | | | | | | | |

Observations and reductions for time taken at sending station.

LABRAN, COLORADO, AUGUST 12, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|---|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | τ Aquilæ | 20 09 31.33 | + 0.25 | — 0.22 | — 0.03 | 20 09 31.28 | 19 57 58.47 | — 11 32.81 |
| E. | κ Cephei | 24 46.14 | — 1.35 | — 0.21 | — 0.37 | 24 44.21 | 20 12 11.44 | 32.77 |
| E. | π Capricorni | 31 38.06 | + 0.42 | — 0.09 | — 0.09 | 31 38.37 | 20 05.70 | 32.67 |
| E. | ε Delphini | 38 43.48 | + 0.22 | — 0.03 | — 0.08 | 38 43.59 | 27 11.02 | 32.57 |
| E. | Groombr. 3241 | 42 09.57 | — 0.85 | — 0.05 | — 0.26 | 42 08.41 | 30 35.61 | 32.80 |
| W. | α Cygni | 48 41.40 | — 0.08 | + 0.06 | + 0.11 | 48 41.49 | 37 08.47 | 33.02 |
| W. | μ Aquarii | 57 23.11 | + 0.36 | + 0.03 | + 0.08 | 57 23.58 | 45 50.68 | 32.90 |
| W. | 12 Y. C. 1879 | 21 04 55.40 | — 1.82 | + 0.17 | + 0.47 | 21 04 54.22 | 53 21.52 | 32.70 |
| W. | 61 Cygni | 12 47.48 | 0.00 | + 0.03 | + 0.10 | 12 47.61 | 21 01 14.88 | 32.73 |
| W. | ζ Cygni | 21 19 06.57 | + 0.08 | — 0.01 | + 0.09 | 21 19 06.73 | 21 07 34.17 | — 11 32.56 |
| | Mean at 20 ^h 33 ^m local sidereal time | | | | | | | — 11 32.75 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= + 5.33 + 10.00 \delta t - 5.88 a + 0.25 c & \delta t &= - 0^s.25 \\
 0 &= - 14.47 - 5.88 \delta t + 28.34 a + 4.64 c & a &= + 0^s.47 \\
 0 &= + 3.86 + 0.25 \delta t + 4.64 a + 74.13 c & c &= - 0^s.08
 \end{aligned}$$

NOTE.—These observations were taken by eye and ear.

LABRAN, COLORADO, AUGUST 16, 1875.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|---|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | α Cygni | 20 48 44.42 | + 0.37 | + 0.17 | — 1.07 | 20 48 43.89 | 20 37 08.46 | — 11 35.43 |
| W. | μ Aquarii | 57 28.79 | — 1.78 | + 0.10 | — 0.78 | 57 26.33 | 45 50.70 | 35.63 |
| W. | 12 Y. C. 1879 | 21 04 51.63 | + 9.03 | + 0.65 | — 4.42 | 21 04 50.89 | 53 21.35 | 35.54 |
| W. | 61 Cygni | 12 51.25 | 0.00 | + 0.18 | — 0.97 | 12 50.46 | 21 01 14.89 | 35.57 |
| W. | ζ Cygni | 19 10.87 | — 0.40 | + 0.17 | — 0.88 | 19 09.76 | 07 34.18 | 35.58 |
| W. | α Cephei | 27 10.37 | + 2.01 | + 0.30 | — 1.62 | 27 11.06 | 15 35.55 | 35.51 |
| E. | β Aquarii | 36 31.04 | — 1.66 | 0.00 | + 0.77 | 36 30.15 | 24 54.90 | 35.25 |
| E. | β Cephei | 38 34.04 | + 3.60 | 0.00 | + 2.23 | 38 39.87 | 27 03.94 | 35.91 |
| E. | ξ Aquarii | 42 38.25 | — 1.71 | 0.00 | + 0.78 | 42 37.32 | 31 01.96 | 35.36 |
| E. | μ Capricorni | 58 01.50 | — 1.94 | — 0.07 | + 0.79 | 58 00.28 | 46 24.92 | 35.36 |
| E. | 79 Draconis | 22 02 49.05 | + 4.56 | — 0.28 | + 2.62 | 22 02 55.95 | 51 20.72 | 35.23 |
| E. | α Aquarii | 22 10 54.27 | — 1.47 | — 0.08 | + 0.76 | 22 10 53.48 | 21 59 18.10 | — 11 35.38 |
| | Mean at 21 ^h 18 ^m local sidereal time | | | | | | | — 11 35.48 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= - 0.92 + 12.00 \delta t - 4.88 a^1 - 2.37 c^1 & \delta t &= - 0^s.05 \\
 0 &= + 7.05 - 4.88 \delta t + 24.11 a^1 + 14.94 c^1 & a^1 &= - 0^s.34 \\
 0 &= + 0.72 - 2.37 \delta t + 14.94 a^1 + 68.00 c^1 & c^1 &= + 0^s.06
 \end{aligned}$$

Adopted azimuth = — 2^s.00
collimation = + 0^s.70
therefore $a = - 2^s.34$
and $c = + 0^s.76$

TIME DETERMINATIONS.

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Observations and reductions for time taken at sending station—Continued.

LABRAN, COLORADO, AUGUST 17, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | ζ Ophiuchi..... | 16 41 51.33 | — 2.57 | — 0.04 | — 0.95 | 16 41 47.77 | 16 30 11.64 | — 11 36.13 |
| W. | η Herculis..... | 50 11.41 | + 0.07 | — 0.10 | — 1.20 | 50 10.18 | 38 33.96 | 36.22 |
| W. | κ Ophiuchi..... | 17 03 19.86 | — 1.63 | — 0.09 | — 0.95 | 17 03 17.19 | 51 40.99 | 36.20 |
| W. | ε Ursæ Minoris.... | 10 32.19 | + 17.13 | — 0.64 | — 6.88 | 10 41.80 | 59 05.52 | 36.28 |
| W. | α ¹ Herculis..... | 20 31.76 | — 1.40 | — 0.13 | — 0.97 | 20 29.26 | 17 08 53.07 | 36.19 |
| E. | 44 Ophiuchi..... | 30 17.70 | — 3.23 | — 0.12 | + 1.01 | 30 15.36 | 18 38.97 | 36.39 |
| E. | β Draconis..... | 39 09.34 | + 1.33 | — 0.40 | + 1.52 | 39 11.79 | 27 35.41 | 36.38 |
| E. | α Ophiuchi..... | 40 41.24 | — 1.50 | — 0.24 | + 0.96 | 40 40.46 | 29 04.12 | 36.34 |
| E. | ω Draconis..... | 49 13.34 | + 4.67 | — 0.79 | + 2.56 | 49 19.78 | 37 43.67 | 36.11 |
| E. | μ Herculis..... | 17 53 07.23 | — 0.70 | — 0.33 | + 1.05 | 17 53 07.25 | 17 41 31.05 | — 11 36.20 |
| Mean at 17 ^h 06 ^m local sidereal time..... | | | | | | | | — 11 36.25 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -15.27 + 10.00 \delta t - 3.65 a - 4.13 c & \delta t &= + 0^s.75 \\
 0 &= + 73.98 - 3.65 \delta t + 30.74 a + 33.63 c & a &= - 3^s.33 \\
 0 &= + 46.92 - 4.13 \delta t + 33.63 a + 73.57 c & c &= + 0^s.93
 \end{aligned}$$

LABRAN, COLORADO, AUGUST 18, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | ζ Ophiuchi..... | 16 41 48.37 | — 0.26 | 0.00 | + 0.80 | 16 41 48.91 | 16 30 11.62 | — 11 37.29 |
| E. | η Herculis..... | 50 10.16 | + 0.01 | — 0.04 | + 1.01 | 50 11.14 | 38 33.94 | 37.20 |
| E. | κ Ophiuchi..... | 17 03 17.68 | — 0.17 | — 0.05 | + 0.80 | 17 03 18.26 | 51 40.98 | 37.28 |
| E. | ε Ursæ Minoris.... | 10 35.55 | + 1.76 | — 0.43 | + 5.79 | 10 42.67 | 59 05.33 | 37.34 |
| E. | α ¹ Herculis..... | 20 29.76 | — 0.14 | — 0.07 | + 0.81 | 20 30.36 | 17 08 53.05 | 37.31 |
| W. | 44 Ophiuchi..... | 30 17.59 | — 0.33 | 0.00 | — 0.85 | 30 16.41 | 18 38.96 | 37.45 |
| W. | β Draconis..... | 39 13.92 | + 0.14 | 0.00 | — 1.28 | 39 12.78 | 27 35.38 | 37.40 |
| W. | α Ophiuchi..... | 40 42.37 | — 0.15 | 0.00 | — 0.81 | 40 41.41 | 29 04.10 | 37.31 |
| W. | ω Draconis..... | 49 22.52 | + 0.48 | 0.00 | — 2.16 | 49 20.84 | 37 43.61 | 37.23 |
| W. | μ Herculis..... | 17 53 09.30 | — 0.07 | 0.00 | — 0.88 | 17 53 08.35 | 17 41 31.03 | — 11 37.32 |
| Mean at 17 ^h 06 ^m local sidereal time..... | | | | | | | | — 11 37.31 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= - 6.37 + 10.00 \delta t - 3.65 a + 4.13 c & \delta t &= + 0^s.19 \\
 0 &= + 37.52 - 3.65 \delta t + 30.74 a - 33.63 c & a &= - 0^s.34 \\
 0 &= - 69.84 + 4.13 \delta t - 33.63 a + 73.57 c & c &= + 0^s.78
 \end{aligned}$$

Observations and reductions for time taken at sending station—Continued.

LABRAN, COLORADO, AUGUST 19, 1873.

| Clamp. | Name of st: r. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|-------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | κ Aquilæ..... | 19 41 44.99 | + 0.13 | — 0.08 | — 0.34 | 19 41 44.70 | 19 30 05.86 | — 11 38.84 |
| W. | τ Aquilæ..... | 20 09 37.42 | + 0.09 | — 0.05 | — 0.33 | 20 09 37.13 | 57 58.45 | 38.68 |
| W. | κ Cephei..... | 24 52.01 | — 0.51 | — 0.18 | — 1.52 | 24 49.80 | 20 13 11.08 | 38.72 |
| W. | π Capricorni..... | 32 44.84 | + 0.16 | — 0.02 | — 0.35 | 32 44.63 | 20 05.71 | 38.92 |
| W. | ε Delphini..... | 38 50.12 | + 0.08 | — 0.03 | — 0.34 | 38 49.83 | 27 11.03 | 38.80 |
| W. | Groombr. 3241 .. | 42 15.70 | — 0.32 | — 0.08 | — 1.08 | 42 14.22 | 30 35.42 | 38.80 |
| E. | α Cygni..... | 48 46.77 | — 0.03 | — 0.20 | + 0.47 | 48 47.01 | 37 08.44 | 38.57 |
| E. | μ Aquarii..... | 57 29.14 | + 0.14 | — 0.09 | + 0.34 | 57 29.53 | 45 50.70 | 38.83 |
| E. | 12 Y. C. 1879 .. | 21 04 59.43 | — 0.69 | — 0.61 | + 1.92 | 21 05 00.05 | 53 21.21 | 38.84 |
| E. | 61 Cygni..... | 12 53.37 | 0.00 | — 0.20 | + 0.42 | 12 53.59 | 21 01 14.89 | 38.70 |
| E. | ζ Cygni..... | 19 12.75 | + 0.03 | — 0.20 | + 0.38 | 19 12.96 | 07 34.19 | 38.77 |
| E. | α Cephei..... | 21 27 14.10 | — 0.15 | — 0.36 | + 0.71 | 21 27 14.30 | 21 15 35.54 | — 11 38.76 |
| Mean at 20 ^h 30 ^m local sidereal time..... | | | | | | | | — 11 38.77 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= + 6.42 + 12.00 \delta t - 6.02 a + 0.86 c & \delta t &= - 0^s.47 \\
 0 &= - 5.70 - 6.02 \delta t + 29.60 a - 7.20 c & a &= + 0^s.18 \\
 0 &= - 24.73 + 0.86 \delta t - 7.20 a + 79.71 c & c &= + 0^s.33
 \end{aligned}$$

LABRAN, COLORADO, AUGUST 20, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | β Draconis..... | 17 39 14.52 | — 0.09 | + 0.09 | + 0.48 | 17 39 15.00 | 17 27 35.32 | — 11 39.68 |
| E. | α Ophiuchi..... | 40 42.98 | + 0.10 | + 0.07 | + 0.30 | 40 43.45 | 29 04.07 | 39.38 |
| E. | ω Draconis..... | 49 22.20 | — 0.31 | + 0.19 | + 0.80 | 49 22.88 | 37 43.50 | 39.38 |
| E. | μ Herculis..... | 53 09.95 | + 0.05 | + 0.08 | + 0.33 | 53 10.41 | 41 31.00 | 39.41 |
| E. | ψ ¹ Draconis..... | 55 52.96 | — 0.41 | + 0.16 | + 0.95 | 55 53.66 | 44 13.82 | 39.84 |
| W. | γ Draconis..... | 18 05 21.00 | — 0.08 | + 0.19 | — 0.46 | 18 05 20.65 | 53 41.27 | 39.38 |
| W. | 1 Aquilæ..... | 39 59.88 | + 0.16 | — 0.07 | — 0.30 | 39 59.67 | 18 28 19.87 | 39.80 |
| W. | β Lyræ..... | 57 05.18 | + 0.02 | — 0.11 | — 0.32 | 57 04.77 | 45 25.39 | 39.38 |
| W. | 50 Draconis..... | 19 02 11.55 | — 0.53 | — 0.31 | — 1.14 | 19 02 09.57 | 50 29.98 | 39.59 |
| W. | ζ Aquilæ..... | 11 16.40 | + 0.10 | — 0.09 | — 0.30 | 11 16.11 | 59 36.37 | 39.74 |
| W. | δ Sagittarii..... | 21 54.56 | + 0.20 | — 0.06 | — 0.31 | 21 54.39 | 19 10 14.70 | 39.69 |
| W. | δ Draconis..... | 19 24 14.32 | — 0.28 | — 0.23 | — 0.76 | 19 24 13.05 | 19 12 33.55 | — 11 39.50 |
| Mean at 18 ^h 30 ^m local sidereal time..... | | | | | | | | — 11 39.56 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= + 2.57 + 12.00 \delta t - 4.79 a - 2.54 c & \delta t &= - 0^s.06 \\
 0 &= - 3.86 - 4.79 \delta t + 14.50 a + 1.16 c & a &= + 0^s.22 \\
 0 &= - 15.46 - 2.54 \delta t + 1.16 a + 52.62 c & c &= + 0^s.29
 \end{aligned}$$

Observations and reductions for time taken at sending station—Continued.

LABRAN, COLORADO, AUGUST 21, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|---|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | 44 Ophiuchi..... | 17 20 19.27 | + 0.55 | — 0.04 | — 0.37 | 17 30 19.41 | 17 18 38.92 | — 11 40.49 |
| W. | β Draconis | 29 16.93 | — 0.23 | — 0.14 | — 0.56 | 39 16.00 | 27 35.29 | 40.71 |
| W. | ω Draconis | 39 25.88 | — 0.79 | — 0.21 | — 0.95 | 49 23.93 | 37 43.44 | 40.49 |
| W. | μ Herculis | 43 11.87 | + 0.12 | — 0.11 | — 0.39 | 53 11.49 | 41 30.98 | 40.51 |
| W. | ψ ¹ Draconis | 45 56.77 | — 1.03 | — 0.30 | — 1.12 | 55 54.32 | 44 13.76 | 40.56 |
| E. | γ Draconis | 18 05 21.66 | — 0.20 | — 0.31 | + 0.55 | 18 05 21.70 | 53 41.25 | 40.45 |
| E. | γ ² Sagittarii | 09 21.02 | + 0.61 | — 0.08 | + 0.40 | 09 21.95 | 57 41.38 | 40.57 |
| E. | μ Sagittarii | 17 52.17 | + 0.52 | — 0.11 | + 0.37 | 17 52.95 | 18 06 12.34 | 40.61 |
| E. | δ Ursæ Minoris.... | 25 07.18 | — 7.12 | — 2.67 | + 5.82 | 25 03.21 | 13 22.66 | 40.55 |
| E. | 1 Aquilæ..... | 18 39 59.93 | + 0.41 | — 0.16 | + 0.35 | 18 40 00.53 | 18 28 19.86 | — 11 40.67 |
| | Mean at 18 ^h 00 ^m local sidereal time | | | | | | | — 11 40.56 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= + 3.67 + 10.00 \delta t - 12.67 a + 11.85 c & \delta t &= - 0^s.06 \\
 0 &= - 26.20 - 12.67 \delta t + 167.86 a - 201.39 c & a &= + 0^s.56 \\
 0 &= + 5.92 + 11.85 \delta t - 201.39 a + 315.14 c & c &= + 0^s.34
 \end{aligned}$$

LABRAN, COLORADO, AUGUST 25, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|---|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | β Draconis | 17 39 20.07 | — 0.31 | — 0.06 | + 0.35 | 17 39 20.05 | 17 27 35.16 | — 11 44.89 |
| E. | α Ophiuchi..... | 40 48.30 | + 0.35 | — 0.08 | + 0.22 | 40 48.79 | 29 04.00 | 44.79 |
| E. | η Serpentis..... | 18 26 30.35 | + 0.51 | — 0.13 | + 0.22 | 18 26 30.95 | 18 14 46.22 | 44.73 |
| E. | 1 Aquilæ..... | 40 03.92 | + 0.57 | — 0.08 | + 0.22 | 14 04.63 | 28 19.82 | 44.81 |
| E. | α Lyrae | 44 24.52 | — 0.01 | — 0.12 | + 0.28 | 44 24.67 | 32 40.10 | 44.57 |
| W. | β Lyrae | 57 10.15 | + 0.08 | + 0.20 | — 0.24 | 57 10.19 | 45 25.31 | 44.88 |
| W. | 50 Draconis..... | 19 02 17.07 | — 1.83 | + 0.25 | — 0.84 | 19 02 14.65 | 50 22.62 | 45.03 |
| W. | ζ Aquilæ..... | 11 21.00 | + 0.34 | — 0.03 | — 0.22 | 11 21.09 | 59 36.32 | 44.77 |
| W. | δ Sagittarii | 21 59.03 | + 0.69 | 0.00 | — 0.23 | 21 59.49 | 19 10 14.67 | 44.82 |
| W. | δ Draconis | 24 19.47 | — 0.99 | + 0.05 | — 0.56 | 24 17.97 | 12 33.35 | 44.62 |
| W. | τ Draconis | 19 29 48.03 | — 1.53 | + 0.11 | — 0.74 | 19 29 45.87 | 19 18 01.30 | — 11 44.57 |
| | Mean at 18 ^h 46 ^m local sidereal time | | | | | | | — 11 44.78 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= + 6.74 + 11.00 \delta t - 2.74 a - 7.21 c & \delta t &= - 0^s.23 \\
 0 &= - 15.24 - 2.74 \delta t + 13.33 a + 19.05 c & a &= + 0^s.78 \\
 0 &= - 26.44 - 7.21 \delta t + 19.05 a + 44.96 c & c &= + 0^s.21
 \end{aligned}$$

18 AST

Observations and reductions for time taken at sending station—Continued.

LABRAN, COLORADO, AUGUST 25, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|---|----------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | π Capricorni | 20 31 50.02 | + 0.72 | + 0.05 | — 0.17 | 20 31 50.62 | 20 20 05.69 | — 11 44.93 |
| W. | ε Delphini | 38 55.62 | + 0.38 | + 0.07 | — 0.16 | 38 55.91 | 37 11.01 | 44.90 |
| W. | Groombr. 3241 | 42 21.92 | — 1.47 | + 0.17 | — 0.52 | 42 20.10 | 30 35.32 | 44.78 |
| W. | α Cygni | 48 53.54 | — 0.13 | + 0.07 | — 0.23 | 48 53.25 | 37 08.40 | 44.85 |
| E. | 12-Y. C., 1879 | 21 05 08.39 | — 3.13 | — 0.39 | + 0.93 | 21 05 05.80 | 53 20.91 | 44.89 |
| E. | 61 Cygni | 12 59.55 | 0.00 | — 0.12 | + 0.20 | 12 59.63 | 21 01 14.88 | 44.75 |
| E. | ζ Cygni | 19 18.73 | + 0.14 | — 0.09 | + 0.18 | 19 18.96 | 07 34.17 | 44.79 |
| E. | α Cephei | 27 20.78 | — 0.70 | — 0.17 | + 0.34 | 27 20.25 | 15 35.48 | 44.77 |
| E. | β Aquarii | 21 36 39.05 | + 0.57 | — 0.06 | + 0.16 | 21 36 39.72 | 21 24 54.93 | — 11 44.79 |
| Mean at 21 ^h 00 ^m local sidereal time | | | | | | | | — 11 44.83 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= + 1.34 + 9.00 \delta t - 4.45 a + 4.62 c & \delta t &= + 0^s.17 \\
 0 &= - 12.87 - 4.45 \delta t + 20.49 a - 18.62 c & a &= + 0^s.81 \\
 0 &= + 5.21 + 4.62 \delta t - 18.62 a + 56.84 c & c &= + 0^s.16
 \end{aligned}$$

LABRAN, COLORADO, AUGUST 26, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|---|---------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | 44 Ophiuchi | 17 30 25.95 | — 1.84 | — 0.05 | + 0.21 | 17 30 24.27 | 17 18 38.84 | — 11 45.43 |
| E. | β Draconis | 39 19.79 | + 0.76 | — 0.12 | + 0.31 | 39 20.74 | 27 35.13 | 45.61 |
| E. | α Ophiuchi | 40 50.14 | — 0.85 | — 0.06 | + 0.19 | 40 49.42 | 29 03.98 | 45.44 |
| E. | ω Draconis | 49 25.82 | + 2.65 | — 0.17 | + 0.52 | 49 28.82 | 34 43.15 | 45.67 |
| E. | μ Herculis | 53 16.53 | — 0.40 | — 0.09 | + 0.21 | 53 16.25 | 41 30.89 | 45.36 |
| E. | ψ ¹ Draconis | 55 55.26 | + 3.45 | — 0.27 | + 0.62 | 55 59.06 | 44 13.40 | 45.66 |
| W. | γ Draconis | 18 05 26.27 | + 0.68 | — 0.04 | — 0.30 | 18 05 26.61 | 53 41.09 | 45.52 |
| W. | γ ² Sagittarii | 09 29.30 | — 2.05 | — 0.01 | — 0.22 | 09 27.02 | 54 41.31 | 45.71 |
| W. | μ ¹ Sagittarii | 17 59.90 | — 1.74 | — 0.02 | — 0.20 | 17 57.94 | 18 06 12.28 | 45.66 |
| W. | δ Ursæ Minoris | 24 45.76 | + 23.88 | 0.00 | 3.19 | 25 06.45 | 13 20.88 | 45.57 |
| W. | 1 Aquilæ | 40 07.12 | — 1.38 | — 0.01 | — 0.19 | 40 05.54 | 23 19.81 | 45.73 |
| W. | α Lyræ | 18 44 25.86 | + 0.02 | — 0.01 | — 0.24 | 18 44 25.63 | 18 32 40.08 | — 11 45.55 |
| Mean at 18 ^h 00 ^m local sidereal time | | | | | | | | — 11 45.58 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= + 0.86 + 12.00 \delta t - 12.23 a^1 - 12.11 c^1 & \delta t &= + 0^s.02 \\
 0 &= - 15.15 - 12.23 \delta t + 168.06 a^1 + 201.86 c^1 & a^1 &= + 0^s.11 \\
 0 &= - 17.41 - 12.11 \delta t + 201.86 a^1 + 317.86 c^1 & c^1 &= - 0^s.01
 \end{aligned}$$

$$\begin{aligned}
 \text{Adopted azimuth} &= - 2^s.00 \\
 \text{error of collimation} &= + 0^s.20 \\
 \text{therefore} & \quad a = - 1^s.89 \\
 & \quad c = + 0^s.19
 \end{aligned}$$

Observations and reductions for time taken at receiving station.

SALT LAKE CITY, UTAH, AUGUST 16, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|---------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | α^1 Herculis | 9 01 47.50 | - 0.84 | + 0.03 | + 0.22 | 9 01 46.91 | 17 08 53.08 | +8 07 06.17 |
| E. | ω Draconis | 30 34.58 | + 2.37 | + 0.10 | + 0.58 | 30 37.63 | 37 43.72 | 06.09 |
| E. | μ Herculis | 34 25.04 | - 0.46 | + 0.06 | + 0.24 | 34 24.88 | 41 31.06 | 06.18 |
| W. | γ Draconis | 46 34.86 | + 0.55 | + 0.17 | - 0.34 | 46 35.24 | 53 41.38 | 06.14 |
| W. | 72 Ophiuchi | 54 16.59 | - 0.96 | + 0.09 | - 0.21 | 54 15.51 | 18 01 21.63 | 06.12 |
| W. | ν^1 Sagittarii | 59 08.14 | - 1.73 | + 0.05 | - 0.22 | 59 06.24 | 06 12.39 | 06.15 |
| W. | η Serpentis | 10 07 41.62 | - 1.26 | + 0.08 | - 0.21 | 10 07 40.23 | 14 46.32 | 06.09 |
| W. | Bradl. 2313 | 14 55.30 | - 1.55 | + 0.07 | - 0.22 | 14 53.60 | 21 50.78 | 06.18 |
| W. | 1 Aquilæ | 10 21 15.34 | - 1.38 | + 0.09 | - 0.21 | 10 21 13.84 | 18 28 19.91 | +8 07 06.07 |
| Mean at 18 ^h .0 local sidereal time | | | | | | | | +8 07 06.13 |

NORMAL EQUATIONS.

$$\begin{aligned}
 +9.00 \delta t + 2.89 a - 1.81 c &= -4.44 & \delta t &= +0^s.13 \\
 +2.89 \delta t + 5.01 a - 6.28 c &= -10.01 & a &= -1^s.820 \\
 -1.81 \delta t - 6.28 a + 17.86 c &= +14.91 & c &= +0^s.209
 \end{aligned}$$

SALT LAKE CITY, UTAH, AUGUST 16, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|-----------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | γ Aquilæ | 11 33 10.39 | - 0.79 | + 0.09 | - 0.17 | 11 33 09.52 | 19 40 15.55 | +8 07 06.03 |
| W. | α Aquilæ | 37 32.42 | - 0.82 | + 0.08 | - 0.16 | 37 31.52 | 44 37.47 | 05.95 |
| W. | ϵ Draconis | 41 30.44 | + 2.14 | + 0.20 | - 0.47 | 41 32.31 | 48 38.27 | 05.96 |
| E. | τ Aquilæ | 50 52.97 | - 0.85 | + 0.07 | + 0.16 | 50 52.35 | 57 58.45 | 06.10 |
| E. | θ Aquilæ | 57 42.26 | - 1.01 | + 0.07 | + 0.16 | 57 41.48 | 20 04 47.45 | 05.97 |
| E. | α^2 Capricorni | 12 03 58.15 | - 1.25 | + 0.07 | + 0.17 | 12 03 57.14 | 20 11 02.98 | +8 07 05.84 |
| Mean at 20 ^h .0 local sidereal time | | | | | | | | +8 07 05.97 |

NORMAL EQUATIONS.

$$\begin{aligned}
 +6.00 \delta t + 1.70 a - 1.91 c &= -3.04 & \delta t &= -0^s.03 \\
 +1.70 \delta t + 4.03 a + 5.17 c &= -5.30 & a &= -1^s.510 \\
 -1.91 \delta t + 5.17 a + 13.67 c &= -5.53 & c &= +0^s.162
 \end{aligned}$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, AUGUST 19, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|---|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | 72 Ophiuchi..... | 9 54 16.20 | — 0.83 | + 0.05 | + 0.18 | 9 54 15.60 | 18 01 21.60 | +8 07 06.00 |
| E. | μ ¹ Sagittarii..... | 59 07.70 | — 1.49 | + 0.02 | + 0.19 | 59 06.42 | 06 12.36 | 05.94 |
| E. | η Serpentis..... | 10 07 41.29 | — 1.08 | + 0.01 | + 0.18 | 10 07 40.40 | 14 46.29 | 05.89 |
| E. | Bradl. 2313..... | 14 55.01 | — 1.33 | 0.00 | + 0.19 | 14 53.87 | 21 59.76 | 05.89 |
| E. | 1 Aquilæ..... | 21 14.93 | — 1.19 | 0.00 | + 0.18 | 21 13.92 | 28 19.88 | 05.96 |
| E. | α Lyræ..... | 10 25 33.91 | — 0.08 | 0.00 | + 0.23 | 10 25 34.06 | 18 32 40.20 | +8 07 06.14 |
| | Mean at 18 ^h .0 local sidereal time..... | | | | | | | +8 07 05.97 |

NORMAL EQUATIONS.

$$\begin{aligned}
 +6.00 \delta t + 3.83 a &= -5.78 & \delta t &= -0^s.03 \\
 +3.83 \delta t + 2.96 a &= -4.50 & a &= -1^s.570 \\
 c \text{ adopted} &= +0^s.180.
 \end{aligned}$$

SALT LAKE CITY, UTAH, AUGUST 19, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|---|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | θ Cygni..... | 11 25 57.43 | + 0.43 | — 0.12 | + 0.32 | 11 25 58.06 | 19 33 04.27 | +8 07 06.21 |
| E. | γ Aquilæ..... | 33 10.12 | — 0.89 | — 0.05 | + 0.21 | 33 09.39 | 40 15.53 | 06.14 |
| E. | ε Draconis..... | 41 29.10 | + 2.43 | — 0.05 | + 0.61 | 41 26.09 | 48 38.16 | 06.07 |
| E. | τ Aquilæ..... | 50 53.16 | — 0.96 | — 0.00 | + 0.21 | 50 52.41 | 57 58.45 | 06.04 |
| W. | θ Aquilæ..... | 57 42.64 | — 1.15 | + 0.09 | — 0.21 | 57 41.37 | 20 04 47.47 | 06.10 |
| W. | α ² Capricorni..... | 12 03 58.50 | — 1.42 | + 0.05 | — 0.21 | 12 03 56.92 | 11 02.98 | 06.06 |
| W. | ω ¹ Cygni..... | 16 05.51 | + 0.38 | + 0.09 | — 0.32 | 16 05.66 | 23 11.72 | 06.06 |
| W. | ε Delphini..... | 20 06.01 | — 0.87 | + 0.03 | — 0.21 | 20 04.96 | 27 11.03 | 06.07 |
| W. | α Delphini..... | 12 26 41.36 | — 0.75 | 0.00 | — 0.22 | 12 26 40.39 | 20 33 46.66 | +8 07 06.27 |
| | Mean at 20 ^h .0 local sidereal time..... | | | | | | | +8 07 06.11 |

NORMAL EQUATIONS.

$$\begin{aligned}
 +9.00 \delta t + 1.64 a + 0.89 c &= -1.60 & \delta t &= +0^s.11 \\
 +1.64 \delta t + 4.30 a - 5.61 c &= -8.33 & a &= -1^s.710 \\
 +0.89 \delta t - 5.61 a + 19.48 c &= +13.76 & c &= +0^s.208
 \end{aligned}$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, AUGUST 25, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|---------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | ω Draconis | 9 30 37.29 | + 2.30 | — 0.07 | — 0.52 | 9 30 39.00 | 17 37 43.21 | +8 07 04.21 |
| W. | μ Herculis | 34 37.24 | — 0.44 | — 0.03 | — 0.21 | 34 36.56 | 41 30.90 | 04.34 |
| W. | 88 Herculis | 39 41.04 | + 0.36 | — 0.04 | — 0.28 | 39 41.08 | 46 45.59 | 04.51 |
| W. | 89 Herculis | 43 15.90 | — 0.50 | — 0.03 | — 0.21 | 43 15.16 | 50 19.45 | 04.29 |
| W. | γ Draconis | 46 36.58 | + 0.53 | — 0.03 | — 0.30 | 46 36.78 | 53 41.12 | 04.34 |
| W. | 72 Ophiuchi | 54 18.38 | — 0.94 | — 0.01 | — 0.19 | 54 17.24 | 18 01 25.55 | 04.31 |
| E. | μ Sagittarii | 59 09.38 | — 1.68 | 0.00 | + 0.20 | 59 07.90 | 06 12.29 | 04.39 |
| E. | η Serpentis | 10 07 42.98 | — 1.22 | 0.00 | + 0.19 | 10 07 41.95 | 14 46.22 | 04.27 |
| E. | Bradl. 2313 | 14 56.69 | — 1.51 | + 0.01 | + 0.19 | 14 55.38 | 21 59.70 | 04.32 |
| E. | 1 Aquilæ | 21 16.70 | — 1.35 | + 0.01 | + 0.19 | 21 15.55 | 28 19.82 | 04.27 |
| E. | α Lyræ | 25 35.63 | — 0.09 | + 0.03 | + 0.24 | 25 35.81 | 32 40.10 | 04.29 |
| E. | ζ ¹ Lyræ | 33 21.30 | — 0.12 | + 0.05 | + 0.24 | 33 21.47 | 40 25.74 | 04.27 |
| E. | ζ ² Lyræ | 33 23.14 | — 0.12 | + 0.07 | + 0.24 | 33 23.33 | 40 27.58 | 04.25 |
| E. | β Lyræ | 38 20.99 | — 0.28 | + 0.08 | + 0.22 | 38 21.01 | 45 25.31 | 04.30 |
| E. | 50 Draconis | 10 43 20.34 | + 3.95 | + 0.22 | + 0.74 | 10 43 25.25 | 18 50 29.61 | +8 07 04.36 |
| Mean at 18 ^h .0 local sidereal time | | | | | | | | +8 07 04.31 |

NORMAL EQUATIONS.

$$\begin{aligned}
 + 15.00 \delta t + 0.63 a + 3.92 c &= + 4.35 & \delta t &= + 0^s.31 \\
 + 0.63 \delta t + 9.93 a - 1.74 c &= - 17.74 & a &= - 1^s.774 \\
 + 3.92 \delta t - 1.74 a + 42.08 c &= + 12.17 & c &= + 0^s.187
 \end{aligned}$$

SALT LAKE CITY, UTAH, AUGUST 25, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|-----------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | Groombr. 3241 | 12 23 27.08 | + 3.40 | — 0.08 | + 0.38 | 12 23 30.78 | 20 30 35.22 | +8 07 04.44 |
| E. | α Cygni | 30 03.70 | + 0.18 | — 0.04 | + 0.17 | 30 04.01 | 37 08.40 | 04.39 |
| E. | ε Aquarii | 33 47.45 | — 1.59 | — 0.03 | + 0.12 | 33 45.95 | 40 50.55 | 04.60 |
| E. | μ Aquarii | 38 47.65 | — 1.57 | — 0.03 | + 0.12 | 38 46.17 | 45 50.75 | 04.58 |
| E. | ν Cygni | 45 24.20 | 0.00 | — 0.05 | + 0.16 | 45 24.31 | 52 28.59 | 04.28 |
| W. | 61 ¹ Cygni | 54 10.73 | — 0.12 | 0.00 | — 0.15 | 54 10.46 | 21 01 14.87 | 04.41 |
| W. | 61 ² Cygni | 54 12.29 | — 0.12 | + 0.01 | — 0.15 | 54 12.03 | 01 16.39 | 04.36 |
| W. | ζ Cygni | 13 00 30.47 | — 0.44 | + 0.03 | — 0.14 | 13 00 29.92 | 07 34.18 | 04.26 |
| W. | α Cephei | 08 29.49 | + 1.55 | + 0.09 | — 0.25 | 08 30.88 | 15 35.48 | 04.60 |
| W. | β Aquarii | 13 17 52.05 | — 1.47 | + 0.05 | — 0.12 | 13 17 50.51 | 21 24 54.93 | +8 07 04.42 |
| Mean at 21 ^h .0 local sidereal time | | | | | | | | +8 07 04.43 |

NORMAL EQUATIONS.

$$\begin{aligned}
 + 10.00 \delta t + 0.09 a + 1.19 c &= + 4.25 & \delta t &= + 0^s.43 \\
 + 0.09 \delta t + 5.27 a - 3.54 c &= - 10.98 & a &= - 2^s.010 \\
 + 1.19 \delta t - 3.54 a + 26.52 c &= + 10.77 & c &= + 0^s.118
 \end{aligned}$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, AUGUST 26, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|--------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | μ Herculis | 9 34 27.25 | — 0.41 | + 0.05 | — 0.18 | 9 34 26.71 | 17 41 30.89 | +8 07 04.18 |
| W. | 88 Herculis | 39 41.42 | + 0.33 | + 0.04 | — 0.24 | 39 41.55 | 46 45.56 | 04.01 |
| W. | 89 Herculis | 43 15.98 | — 0.46 | + 0.02 | — 0.18 | 43 15.36 | 50 19.43 | 04.07 |
| W. | γ Draconis | 46 36.61 | + 0.49 | + 0.00 | — 0.26 | 46 36.84 | 53 41.09 | 04.25 |
| W. | 72 Ophiuchi | 54 18.40 | — 0.87 | + 0.02 | — 0.16 | 54 17.39 | 18 01 21.54 | 04.15 |
| W. | μ^1 Sagittarii | 59 09.82 | — 1.56 | + 0.02 | — 0.17 | 59 08.11 | 06 12.28 | 04.17 |
| E. | η Serpentis | 10 07 43.03 | — 1.13 | + 0.04 | + 0.16 | 10 07 42.10 | 14 46.20 | 04.10 |
| E. | Bradl. 2313 | 14 56.83 | — 1.39 | + 0.03 | + 0.16 | 14 55.63 | 21 59.68 | 04.05 |
| E. | 1 Aquilæ | 21 16.73 | — 1.25 | + 0.04 | + 0.16 | 21 15.68 | 28 19.81 | 04.13 |
| E. | α Lyræ | 25 35.69 | — 0.08 | + 0.08 | + 0.20 | 25 35.89 | 32 40.08 | 04.19 |
| E. | ζ^1 Lyræ | 33 21.37 | — 0.11 | + 0.09 | + 0.20 | 33 21.55 | 40 25.72 | 04.17 |
| E. | ζ^2 Lyræ | 33 23.16 | — 0.11 | + 0.09 | + 0.20 | 33 23.34 | 40 27.57 | 04.23 |
| E. | β Lyræ | 38 21.08 | — 0.26 | + 0.12 | + 0.19 | 38 21.13 | 45 25.29 | 04.16 |
| E. | 50 Draconis | 10 43 20.67 | + 3.66 | + 0.48 | + 0.63 | 10 43 25.44 | 18 50 29.53 | +8 07 04.09 |
| Mean at 18 ^h .0 local sidereal time | | | | | | | | +8 07 04.14 |

NORMAL EQUATIONS.

$$\begin{aligned}
 + 14.00 \delta t + 1.93 a + 4.55 c &= - 0.49 & \delta t &= + 0^s.14 \\
 + 1.93 \delta t + 8.24 a - 7.38 c &= - 14.41 & a &= - 1^s.640 \\
 + 4.55 \delta t - 7.38 a + 34.43 c &= + 18.15 & c &= + 0^s.159
 \end{aligned}$$

SALT LAKE CITY, UTAH, AUGUST 26, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|-----------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | ϵ Delphini | 12 20 07.51 | — 0.88 | + 0.07 | + 0.16 | 12 20 06.86 | 20 27 11.01 | +8 07 04.15 |
| E. | Groombr. 3241 | 23 27.39 | + 2.92 | + 0.23 | + 0.51 | 23 31.05 | 30 35.19 | 04.14 |
| E. | α Cygni | 30 03.66 | + 0.15 | + 0.11 | + 0.22 | 30 04.14 | 37 08.39 | 04.25 |
| E. | ϵ Aquarii | 33 47.54 | — 1.37 | + 0.05 | + 0.16 | 33 46.38 | 40 50.55 | 04.17 |
| E. | μ Aquarii | 38 47.67 | — 1.35 | + 0.05 | + 0.16 | 38 46.53 | 45 50.70 | 04.17 |
| W. | ν Cygni | 45 24.61 | — 0.00 | + 0.13 | — 0.21 | 45 24.53 | 52 28.58 | 04.05 |
| W. | 61 ¹ Cygni | 54 10.94 | — 0.10 | + 0.10 | — 0.20 | 54 10.74 | 21 01 14.87 | 04.13 |
| W. | 61 ² Cygni | 54 12.38 | — 0.10 | + 0.10 | — 0.20 | 54 12.18 | 01 16.39 | 04.21 |
| W. | ζ Cygni | 13 00 30.55 | — 0.38 | + 0.07 | — 0.18 | 13 00 30.06 | 07 34.17 | 04.11 |
| W. | α Cephei | 08 30.13 | + 1.33 | + 0.10 | — 0.33 | 08 31.23 | 15 35.46 | 04.23 |
| W. | β Aquarii | 13 17 52.07 | — 1.26 | + 0.02 | — 0.16 | 13 17 50.67 | 21 24 54.94 | +8 07 04.27 |
| Mean at 21 ^h .0 local sidereal time | | | | | | | | +8 07 04.17 |

NORMAL EQUATIONS.

$$\begin{aligned}
 + 11.00 \delta t + 0.60 a - 0.43 c &= + 0.77 & \delta t &= + 0^s.17 \\
 + 0.60 \delta t + 5.54 a - 3.02 c &= - 9.91 & a &= - 1^s.725 \\
 - 0.43 \delta t - 3.02 a + 27.56 c &= + 9.44 & c &= + 0^s.156
 \end{aligned}$$

From the preceding time-observations the following corrections and rates are derived:

CHRONOMETER AT LABRAN.—NEGUS, No. 1491.

| Date. | Local sidereal time. | Correction of chronometer. | Adopted hourly rate. |
|---------|----------------------|----------------------------|----------------------|
| 1873. | <i>h.</i> | <i>h. m. s.</i> | <i>s.</i> |
| Aug. 12 | 20.55 | — 0 11 32.75 | — 0.025 |
| Aug. 16 | 21.30 | | — 0.032 |
| Aug. 17 | 17.10 | | — 0.043 |
| Aug. 18 | 17.10 | | — 0.049 |
| Aug. 19 | 20.50 | | — 0.044 |
| Aug. 20 | 18.50 | | — 0.039 |
| Aug. 21 | 18.00 | | — 0.043 |
| Aug. 25 | 19.90 | | — 0.040 |
| Aug. 26 | 18.00 | — 0 11 45.58 | — 0.035 |

CHRONOMETER AT SALT LAKE CITY.—NEGUS, No. 1511.

| Date. | Local sidereal time. | Correction of chronometer. | Adopted hourly rate. |
|---------|----------------------|----------------------------|----------------------|
| 1873. | <i>h.</i> | <i>h. m. s.</i> | <i>s.</i> |
| Aug. 16 | 19.0 | + 8 07 06.05 | 0.000 |
| Aug. 19 | 19.0 | | + 0.006 |
| Aug. 25 | 19.5 | | + 0.010 |
| Aug. 26 | 19.5 | + 8 07 04.16 | + 0.009 |

Final results of longitude.

| Signals sent from— | Recorded at— | Mean of signals sent and received. | Time-corrections. | Corrected time. | Difference of longitude. | Double-wave time. | Means. |
|--------------------|----------------|------------------------------------|-------------------|-----------------|--------------------------|-------------------|-----------|
| | | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> |
| August 16, 1873: | | | | | | | |
| Salt Lake City | Labran..... | 20 01 36.36 | — 0 11 35.43 | 19 50 00.93 | | | |
| | Salt Lake City | 11 15 45.09 | + 8 07 06.05 | 19 22 51.14 | 0 27 09.79 | | |
| | Labran..... | 20 06 45.05 | — 0 11 35.44 | 19 55 19.61 | | | |
| | Salt Lake City | 11 20 53.97 | + 8 07 06.05 | 19 28 00.02 | 09.59 | | 9.69 |
| August 19, 1873: | | | | | | | |
| Salt Lake City | Labran..... | 19 24 07.50 | — 0 11 38.71 | 19 12 28.79 | | | |
| | Salt Lake City | 10 38 13.11 | + 8 07 06.04 | 18 45 19.15 | 09.64 | | |
| | Labran..... | 19 28 30.05 | — 0 11 38.72 | 19 15 51.33 | | | |
| | Salt Lake City | 10 42 35.68 | + 8 07 06.04 | 18 49 41.72 | 09.61 | | 9.62 |
| August 25, 1873: | | | | | | | |
| Salt Lake City | Labran..... | 20 09 44.11 | — 0 11 44.81 | 19 57 59.30 | | | |
| | Salt Lake City | 11 23 45.25 | + 8 07 04.37 | 19 30 49.62 | 09.68 | | |
| | Labran..... | 20 16 45.57 | — 0 11 44.82 | 20 05 00.75 | | | |
| | Salt Lake City | 11 30 46.87 | + 8 07 04.37 | 19 37 51.24 | 09.51 | | 9.60 |
| August 26, 1873: | | | | | | | |
| Salt Lake City | Labran..... | 20 51 41.21 | — 0 11 45.67 | 20 39 55.54 | | | |
| | Salt Lake City | 12 05 41.52 | + 8 07 04.16 | 20 12 45.68 | 09.86 | | |
| | Labran..... | 20 47 45.11 | — 0 11 45.67 | 20 35 59.44 | | | |
| | Salt Lake City | 12 01 45.56 | + 8 07 04.16 | 20 08 49.72 | 0 27 09.72 | | 9.79 |

Labran east of Salt Lake City 0^h 27^m 09^s.675 ± 0^s.029.

Mean places of stars for 1873.0 used for determination of latitude of Labran, Colorado.

| No. of pair. | No. in B. A. C. | Approximate right ascen- sion. | Declination. | No. of pair. | No. in B. A. C. | Approximate right ascen- sion. | Declination. |
|--------------|--------------------|--------------------------------------|--------------|--------------|--------------------|--------------------------------------|--------------|
| | | <i>h. m. s.</i> | <i>° ' "</i> | | | <i>h. m. s.</i> | <i>° ' "</i> |
| 1..... | 6157 | 18 03 19 | 20 47 46.2 | 25..... | 6528 | 21 33 05 | 19 41 35.0 |
| | 6184 | 07 46 | 56 14 17.4 | | 7545 | 35 01 | 56 54 55.2 |
| 2..... | 6245 | 17 11 | 17 45 50.0 | 26..... | 7567 | 38 30 | 16 46 08.3 |
| | 6289 | 22 03 | 58 43 39.6 | 27..... | 7590 | 41 02 | 16 36 28.8 |
| 3..... | 6349 | 31 06 | 38 47 32.5 | | 7605 | 43 41 | 60 03 13.0 |
| 4..... | 6355 | 32 38 | 38 40 00.1 | 28..... | 7676 | 57 11 | 52 16 13.6 |
| | 6365 | 35 54 | 38 15 01.5 | | 7706 | 22 01 24 | 24 43 32.1 |
| 5..... | 6395 | 40 10 | 55 24 40.1 | | 7733 | 04 30 | 20 21 16.4 |
| | 6438 | 46 51 | 21 16 26.2 | 29..... | 7754 | 07 14 | 56 12 30.7 |
| 6..... | 6496 | 54 36 | 57 38 48.7 | 30..... | 7778 | 10 22 | 56 24 38.8 |
| | 6527 | 59 18 | 18 57 13.2 | | 7798 | 15 27 | 27 41 29.8 |
| 7..... | 6581 | 19 09 26 | 38 55 43.7 | 31..... | 7820 | 19 22 | 48 49 58.2 |
| | 6599 | 11 58 | 37 54 30.1 | | 7848 | 24 27 | 57 45 55.6 |
| 8..... | 6640 | 17 56 | 57 24 19.7 | 32..... | 7893 | 32 44 | 18 51 56.5 |
| | 6654 | 19 54 | 19 33 04.9 | | 7937 | 39 17 | 18 41 50.2 |
| 9..... | 6690 | 25 36 | 27 41 39.8 | 33..... | 7953 | 42 21 | 57 48 47.6 |
| | 6717 | 30 12 | 48 59 11.9 | 34..... | 7967 | 45 10 | 65 31 57.0 |
| 10..... | 6734 | 32 32 | 49 55 40.0 | | 8003 | 52 50 | 11 03 03.3 |
| | 6762 | 38 43 | 26 49 58.6 | 35..... | 8036 | 58 29 | 49 21 43.4 |
| 11..... | 6780 | 40 46 | 57 42 52.3 | | 8091 | 23 08 45 | 27 22 47.7 |
| | 6794 | 43 20 | 18 49 29.8 | | 8115 | 12 00 | 44 47 45.4 |
| 12..... | 6824 | 47 26 | 52 39 56.8 | 36..... | 8156 | 17 33 | 31 49 58.6 |
| | 6835 | 49 07 | 23 59 18.8 | 37..... | 8159 | 18 38 | 31 41 15.2 |
| 13..... | 6856 | 52 21 | 52 06 09.4 | 38..... | 8177 | 21 31 | 5 40 54.0 |
| | 6883 | 56 38 | 24 35 01.0 | | 8204 | 27 06 | 71 18 02.6 |
| 14..... | 6924 | 20 02 28 | 55 58 25.5 | 39..... | 8250 | 36 54 | 9 37 35.7 |
| | 6941 | 05 27 | 20 45 31.3 | | 8273 | 41 51 | 67 06 04.5 |
| 15..... | 6967 | 09 47 | 36 25 07.1 | 40..... | 8316 | 49 08 | 52 01 39.6 |
| 16..... | 6969 | 09 55 | 36 21 59.7 | | 8324 | 51 17 | 24 26 07.9 |
| | 6996 | 13 37 | 40 20 13.8 | 41..... | 55 | 0 11 14 | 15 37 34.3 |
| 17..... | 7008 | 15 39 | 39 00 13.6 | | 65 | 13 49 | 61 10 27.0 |
| | 7061 | 22 52 | 38 01 27.5 | 42..... | 80 | 17 48 | 61 07 37.6 |
| 18..... | 7098 | 27 27 | 62 34 03.6 | 43..... | 100 | 21 24 | 43 41 30.1 |
| | 7107 | 29 22 | 14 14 14.4 | | 120 | 24 41 | 32 52 49.3 |
| 19..... | 7152 | 33 46 | 29 53 28.5 | 44..... | 152 | 29 53 | 43 57 15.2 |
| | 7198 | 40 25 | 46 50 12.6 | | 166 | 32 33 | 30 09 55.6 |
| 20..... | 7268 | 51 32 | 46 55 54.0 | 45..... | 189 | 36 27 | 46 19 46.3 |
| 21..... | 7301 | 55 30 | 47 01 33.4 | | 223 | 42 18 | 16 15 16.3 |
| | 7368 | 21 07 32 | 29 42 25.7 | 46..... | 239 | 45 29 | 60 25 34.5 |
| 22..... | 7385 | 09 43 | 37 30 14.8 | | 250 | 48 10 | 22 56 24.0 |
| | 7398 | 12 26 | 38 51 48.6 | 47..... | 290 | 56 47 | 53 31 25.5 |
| 23..... | 7417 | 15 45 | 58 05 12.5 | | 316 | 59 53 | 12 16 28.5 |
| | 7450 | 20 32 | 18 49 35.2 | 48..... | 338 | 1 03 21 | 64 20 34.0 |
| 24..... | 7465 | 22 42 | 31 40 10.8 | | 391 | 12 07 | 57 33 46.3 |
| | 7501 | 21 28 32 | 45 17 28.5 | 49..... | 430 | 1 19 31 | 19 24 39.9 |

LATITUDE DETERMINATIONS.

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Observations and computations for latitude.

LABRAN, COLORADO.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|---------------|--------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|----------|--------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1873. | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | <i>° ' "</i> | <i>' "</i> | <i>"</i> | <i>° ' "</i> |
| August 13 ... | 6395 | 7 66.4 | 21.1 | 22.0 | | | | | |
| | 6438 | 12 46.2 | 21.2 | 22.3 | | 38 20 40.5 | + 2 29.0 | -0.6 | 38 23 08.9 |
| | 6496 | 4 31.0 | 14.7 | 29.0 | | | | | |
| | 6527 | 13 95.7 | 29.0 | 14.9 | | 18 08.1 | + 4 59.6 | 0.0 | 07.7 |
| | 6581 | 11 61.6 | 31.0 | 13.0 | | | | | |
| | 6599 | 7 55.4 | 14.0 | 30.0 | | 25 14.6 | - 2 06.2 | +0.6 | 09.0 |
| | 6640 | 15 23.0 | 26.5 | 17.5 | | | | | |
| | 6654 | 4 29.8 | 22.0 | 22.0 | | 28 49.4 | - 5 39.6 | +0.2 | 10.0 |
| | 6690 | 11 70.8 | 23.6 | 18.0 | | | | | |
| | 6717 | 6 67.2 | 17.5 | 22.5 | | 20 33.3 | + 2 34.4 | +0.2 | 07.9 |
| | 6734 | 8 49.0 | 20.3 | 19.7 | Cloudy. | | | | |
| | 6762 | 9 04.5 | 11.5 | 28.0 | | 22 56.7 | + 0 17.2 | -4.4 | 09.5 |
| August 16 ... | 8036 | 10 03.0 | 22.0 | 18.5 | | | | | |
| | 8091 | 11 51.3 | 21.7 | 19.6 | | 22 22.0 | + 0 46.1 | +1.5 | 07.6 |
| | 8115 | 2 20.2 | 15.8 | 26.0 | | | | | |
| | 8156 | 10 19.3 | 31.0 | 10.9 | | 18 58.3 | + 4 08.2 | +2.7 | 09.2 |
| | 8159 | 18 62.6 | 32.0 | 9.8 | | 14 36.6 | + 8 30.1 | +3.3 | 10.0 |
| | 8177 | 3 85.4 | 26.0 | 15.8 | | | | | |
| | 8204 | 16 21.6 | 11.0 | 30.8 | | 29 34.5 | - 6 23.9 | -2.6 | 08.0 |
| | 8250 | 10 92.9 | 26.8 | 15.2 | | | | | |
| | 8273 | 8 49.1 | 5.0 | 37.0 | | 21 56.2 | + 1 18.8 | -5.6 | 09.4 |
| | 8316 | 0 74.0 | 16.0 | 26.0 | | | | | |
| | 8324 | 18 32.6 | 30.8 | 11.4 | | 13 59.7 | + 9 06.3 | +2.6 | 08.6 |
| | 55 | 9 36.4 | 22.3 | 21.0 | | | | | |
| | 65 | 11 20.9 | 19.1 | 23.3 | | 24 06.3 | - 0 57.3 | -0.8 | 08.2 |
| | 80 | 8 45.5 | 19.0 | 23.4 | | 22 42.4 | + 0 28.2 | -0.9 | 09.7 |
| | 100 | 5 03.6 | 20.8 | 21.7 | | | | | |
| | 120 | 16 54.2 | 13.7 | 28.9 | | 17 15.1 | + 5 57.4 | -4.4 | 08.1 |
| | 152 | 10 69.7 | 27.6 | 15.0 | | 20 07.6 | + 3 01.6 | -0.7 | 08.5 |
| | 166 | 17 69.3 | 20.4 | 22.0 | | | | | |
| | 189 | 1 82.7 | 23.0 | 19.3 | | 14 56.2 | + 8 12.8 | +0.6 | 09.6 |
| | 223 | 12 33.4 | 23.3 | 19.0 | | | | | |
| | 239 | 7 19.6 | 16.8 | 25.6 | | 20 30.8 | + 2 39.6 | -1.3 | 09.1 |
| | 250 | 19 53.4 | 29.0 | 13.2 | | | | | |
| | 290 | 1 86.7 | 13.0 | 29.3 | | 13 59.9 | + 9 08.7 | -0.1 | 08.5 |
| | 316 | 13 79.8 | 26.7 | 15.8 | | | | | |
| | 338 | 4 98.6 | 12.0 | 30.3 | | 18 36.5 | + 4 33.7 | -2.0 | 08.2 |
| | 391 | 16 05.0 | 16.0 | 27.0 | | | | | |
| | 430 | 4 09.6 | 31.0 | 12.0 | | 38 29 18.0 | - 5 11.3 | +2.2 | 38 23 08.9 |

Observations and computations—Continued.

LABRAN, COLORADO.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|------------------------|--------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|--------|------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1873. August 17 ... | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | ° ' " |
| | 6157 | 2 56.5 | 22.6 | 19.1 | | | | | |
| | 6184 | 18 03.6 | 16.0 | 26.2 | | 38 31 09.7 | — 8 00.5 | —1.8 | 38 23 07.4 |
| | 6218 | 14 02.6 | 19.3 | 23.0 | | | | | |
| | 6235 | 6 53.2 | 23.3 | 19.2 | | 27 01.2 | — 3 52.8 | +0.1 | 08.5 |
| | 6245 | 17 62.7 | 25.0 | 17.5 | | | | | |
| | 6289 | 1 65.4 | 17.8 | 26.0 | | 14 52.6 | + 8 16.1 | —0.2 | 08.5 |
| | 6349 | 17 25.1 | 20.4 | 23.8 | | 31 25.7 | — 8 16.6 | —0.3 | 08.8 |
| | 6355 | 9 96.0 | 20.9 | 23.7 | | 27 39.5 | — 4 30.0 | —0.2 | 09.3 |
| | 6365 | 1 26.4 | 23.3 | 21.1 | | | | | |
| | 6395 | 8 07.2 | 23.0 | 21.9 | | | | | |
| | 6438 | 12 86.8 | 20.4 | 24.9 | | 20 41.2 | + 2 29.0 | —0.9 | 09.3 |
| | 6496 | 5 02.9 | 12.6 | 32.9 | | | | | |
| | 6527 | 14 65.2 | 33.2 | 12.0 | | 18 08.9 | + 4 58.9 | +0.3 | 08.1 |
| | 6581 | 11 44.4 | 14.4 | 31.2 | | | | | |
| | 6599 | 7 34.4 | 32.2 | 13.2 | | 25 15.5 | — 2 07.4 | +0.6 | 08.7 |
| | 6640 | 14 81.2 | 21.3 | 24.3 | | | | | |
| | 6654 | 3 85.2 | 21.6 | 24.0 | | 28 50.3 | — 5 40.4 | —1.5 | 08.4 |
| | 6690 | 11 83.7 | 21.5 | 24.0 | | | | | |
| | 6717 | 6 79.2 | 21.4 | 24.3 | | 20 34.2 | + 2 36.7 | —1.5 | 09.4 |
| | 6730 | 8 65.7 | 18.5 | 27.7 | | | | | |
| | 6762 | 9 01.6 | 27.9 | 18.4 | | 22 57.7 | + 0 11.1 | +0.1 | 08.9 |
| | 6780 | 2 79.7 | 20.0 | 26.4 | | | | | |
| | 6794 | 16 08.7 | 23.0 | 23.5 | | 16 19.0 | + 6 52.8 | —1.9 | 09.9 |
| | 6824 | 6 96.0 | 19.3 | 27.0 | | | | | |
| | 6835 | 13 52.1 | 25.8 | 20.6 | | 19 46.0 | + 3 23.8 | —0.7 | 09.1 |
| | 6856 | 7 35.6 | 16.3 | 30.0 | | | | | |
| | 6883 | 12 06.0 | 29.2 | 17.2 | | 20 44.1 | + 2 26.1 | —0.5 | 09.7 |
| | 6924 | 9 67.3 | 22.7 | 24.2 | | | | | |
| | 6941 | 11 68.6 | 23.2 | 23.7 | | 22 06.4 | + 1 02.5 | —0.6 | 08.3 |
| | 6967 | 9 58.9 | 22.4 | 24.3 | | 22 48.8 | + 0 19.8 | +1.5 | 10.1 |
| | 6969 | 12 60.8 | 22.4 | 24.3 | | 21 15.1 | + 1 53.5 | +1.5 | 10.1 |
| | 6996 | 8 95.2 | 27.0 | 19.7 | | | | | |
| | 7008 | 17 35.0 | 16.9 | 30.2 | | | | | |
| | 7061 | 2 28.9 | 27.0 | 19.7 | | 30 59.0 | — 7 47.8 | —1.7 | 09.5 |
| | 7098 | 10 36.0 | 15.5 | 31.6 | | | | | |
| | 7107 | 8 21.3 | 29.5 | 17.4 | | 24 16.6 | — 1 06.7 | —1.1 | 08.8 |
| | 7152 | 11 12.8 | 21.5 | 25.7 | | | | | |
| | 7198 | 8 80.7 | 20.1 | 26.9 | | 21 58.7 | + 2 12.1 | —3.0 | 07.8 |
| | 7268 | 6 00.9 | 21.8 | 26.3 | | 19 17.9 | + 3 54.8 | —4.4 | 08.3 |
| | 7301 | 11 49.2 | 23.5 | 24.6 | | 38 22 07.6 | + 1 04.5 | —3.5 | 38 23 08.6 |
| | 7368 | 13 57.0 | 18.3 | 29.8 | | | | | |

LATITUDE DETERMINATIONS.

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Observations and computations—Continued.

LABRAN, COLORADO.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|------------------------|-----------------|----------------------|-----------|-----------|----------|-----------------------------|----------------------|--------|------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1873. August 17 ... | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | ° ' " |
| | 7385 | 20 76.4 | 26.0 | 22.0 | | | | | |
| | 7398 | — 2 51.4 | 13.2 | 34.7 | | 38 11 09.7 | +12 03.3 | —4.8 | 38 23 08.2 |
| | 7417 | 13 57.4 | 6.6 | 41.4 | | | | | |
| | 7450 | 5 25.2 | 33.6 | 14.0 | | 27 31.5 | — 4 18.5 | —4.2 | 08.8 |
| | 7465 | 3 59.8 | 21.6 | 26.0 | | | | | |
| | 7501 | 14 67.5 | 18.0 | 29.7 | | 28 57.5 | — 5 44.1 | —4.4 | 19.0 |
| | 7528 | 14 12.0 | 26.0 | 22.0 | | | | | |
| | 7545 | 4 73.5 | 11.6 | 36.3 | | 18 22.6 | + 4 51.5 | —5.7 | 08.4 |
| | 7567 | 4 90.1 | 18.9 | 29.0 | | 26 18.0 | — 3 05.5 | —2.8 | 09.7 |
| | 7590 | 14 19.3 | 18.9 | 29.0 | | 21 28.3 | + 1 43.1 | —2.8 | 08.6 |
| | 7605 | 10 87.4 | 24.0 | 24.0 | | | | | |
| | 7676 | 16 31.7 | 13.8 | 34.3 | | | | | |
| | 7706 | 3 19.9 | 26.9 | 21.0 | | 30 00.3 | — 6 47.5 | —4.0 | 08.8 |
| | 7733 | 13 14.2 | 27.0 | 20.9 | | | | | |
| | 7754 | 1 13.9 | 17.0 | 31.0 | | 17 00.8 | + 6 12.8 | —4.3 | 09.3 |
| | 7778 | 12 88.1 | 17.0 | 31.0 | | 23 04.8 | + 0 08.1 | —4.3 | 08.6 |
| | 7798 | 16 83.6 | 23.0 | 25.2 | | | | | |
| | 7820 | 2 62.1 | 16.9 | 31.5 | | 15 51.3 | + 7 21.5 | —4.6 | 08.2 |
| | 7848 | 5 27.1 | 16.7 | 31.8 | | | | | |
| | 7893 | 13 38.3 | 21.0 | 27.7 | | 19 03.2 | + 4 12.0 | —6.0 | 09.2 |
| | 7937 | 17 48.0 | 26.6 | 22.0 | | | | | |
| | 7953 | 2 45.6 | 15.8 | 33.0 | | 15 25.8 | + 7 46.6 | —3.5 | 08.9 |
| | 7967 | 5 03.7 | 19.0 | 29.8 | | | | | |
| | 8003 | 15 75.1 | 31.0 | 18.0 | | 17 37.0 | + 5 32.8 | +0.6 | 10.4 |
| | 8036 | 8 95.0 | 16.0 | 33.0 | | | | | |
| | 8091 | 10 45.0 | 34.3 | 15.1 | | 22 22.3 | + 0 46.6 | +0.6 | 09.5 |
| | 8115 | 1 68.1 | 20.4 | 29.6 | | | | | |
| | 8156 | 9 73.9 | 29.0 | 21.0 | | 18 55.6 | + 4 10.3 | —0.3 | 08.6 |
| | 8159 | 18 17.8 | 29.3 | 20.7 | | 14 36.9 | + 8 32.4 | —0.2 | 09.1 |
| | 8177 | 3 05.9 | 25.3 | 24.7 | | | | | |
| | 8204 | 15 42.5 | 18.7 | 30.8 | | 29 34.7 | — 6 24.1 | —3.2 | 07.4 |
| | 8250 | 10 25.9 | 28.8 | 20.3 | | | | | |
| | 8273 | 7 81.6 | 13.0 | 36.0 | | 21 56.5 | + 1 15.9 | —4.0 | 08.4 |
| | 8316 | — 0 01.7 | 13.0 | 36.0 | | | | | |
| | 8324 | 17 75.9 | 28.7 | 20.2 | | 14 00.0 | + 9 12.1 | —4.0 | 08.1 |
| August 18 ... | 6245 | 18 21.6 | 17.4 | 27.4 | | | | | |
| | 6289 | 2 09.6 | 19.0 | 26.2 | | 14 52.6 | + 8 20.7 | —4.7 | 08.6 |
| | 6349 | 17 52.8 | 20.0 | 25.6 | | | | | |
| | 6355 | 10 24.9 | 19.8 | 26.0 | | 31 25.9 | — 8 13.8 | —4.1 | 08.0 |
| | 6365 | 1 63.0 | 18.3 | 27.5 | | 38 27 39.7 | — 4 27.7 | —4.2 | 38 23 07.8 |

Observations and computations—Continued.

LABRAN, COLORADO.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|------------------------|--------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|----------|--------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1873. August 18 ... | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | <i>° ' "</i> | <i>' "</i> | <i>"</i> | <i>° ' "</i> |
| | 6395 | 8 53.4 | 21.0 | 24.8 | | 38 20 41.5 | + 2 23.2 | +4.7 | 38 23 09.4 |
| | 6438 | 13 14.6 | 33.2 | 12.3 | | | | | |
| | 6496 | 5 05.0 | 22.9 | 23.0 | | 18 09.1 | + 4 55.6 | +3.7 | 08.4 |
| | 6527 | 14 56.7 | 29.4 | 16.0 | | | | | |
| | 6581 | 11 60.0 | 17.0 | 27.8 | | 25 15.7 | - 2 08.8 | +2.5 | 09.4 |
| | 6599 | 7 45.2 | 32.0 | 12.3 | | | | | |
| | 6640 | 15 92.2 | 25.6 | 18.9 | | 28 50.5 | - 5 41.1 | +0.1 | 09.5 |
| | 6654 | 4 94.0 | 19.0 | 25.2 | | | | | |
| | 6690 | 12 38.9 | 29.8 | 14.7 | | 20 34.5 | + 2 35.6 | -0.6 | 09.5 |
| | 6717 | 7 37.9 | 13.7 | 30.8 | | | | | |
| | 6734 | 8 74.1 | 19.0 | 25.5 | | 22 57.9 | + 0 11.1 | +0.4 | 09.4 |
| | 6762 | 9 09.7 | 26.0 | 18.0 | | | | | |
| | 6780 | 3 00.0 | 23.0 | 21.2 | | 16 19.1 | + 6 50.4 | -0.1 | 09.4 |
| | 6794 | 16 21.2 | 21.0 | 23.2 | | | | | |
| | 6824 | 7 67.1 | 26.7 | 17.9 | | 19 46.3 | + 3 24.6 | -1.7 | 09.2 |
| | 6835 | 14 25.8 | 14.8 | 29.8 | | | | | |
| | 6856 | 7 70.4 | 21.5 | 23.2 | | 20 43.7 | + 2 26.7 | -1.6 | 08.8 |
| | 6883 | 12 42.8 | 20.4 | 24.6 | | | | | |
| | 6924 | 8 41.0 | 19.0 | 25.9 | | 22 06.6 | + 1 00.6 | +1.4 | 08.6 |
| | 6941 | 10 36.0 | 28.5 | 16.4 | | | | | |
| | 6967 | 9 88.4 | 28.7 | 16.3 | | 22 49.1 | + 0 21.3 | -3.0 | 07.4 |
| | 6969 | 12 92.8 | 28.7 | 16.3 | | 21 15.4 | + 1 55.8 | -3.0 | 08.2 |
| | 6996 | 9 20.0 | 11.0 | 34.4 | | | | | |
| | 7008 | 18 38.8 | 19.5 | 26.0 | | 30 59.2 | - 7 50.7 | -0.4 | 08.1 |
| | 7061 | 3 23.0 | 32.0 | 11.4 | | | | | |
| | 7098 | 10 29.7 | 16.2 | 27.0 | | 24 16.9 | - 1 08.0 | -0.4 | 08.5 |
| | 7107 | 8 10.7 | 26.4 | 17.0 | | | | | |
| | 7152 | 11 34.7 | 21.0 | 22.0 | | 21 58.9 | + 1 12.0 | -1.0 | 09.9 |
| | 7198 | 9 03.0 | 20.3 | 23.0 | | | | | |
| | 7268 | 6 00.5 | 16.4 | 27.9 | | 19 18.2 | + 3 51.6 | -0.4 | 09.4 |
| | 7301 | 11 47.0 | 16.1 | 28.3 | | 22 07.9 | + 1 01.8 | -0.6 | 09.1 |
| | 7368 | 13 46.1 | 26.9 | 17.0 | | | | | |
| | 7385 | 21 34.1 | 29.0 | 15.3 | | 11 10.0 | +11 59.8 | +0.4 | 10.2 |
| | 7398 | - 1 83.5 | 16.0 | 28.4 | | | | | |
| | 7417 | 14 60.7 | 15.5 | 29.0 | | 27 31.8 | - 4 21.4 | -2.1 | 08.3 |
| | 7450 | 6 19.1 | 25.0 | 19.0 | | | | | |
| | 7465 | 3 97.0 | 18.9 | 25.3 | | | | | |
| | 7501 | 15 22.9 | 26.5 | 17.8 | | 38 28 57.7 | - 5 49.7 | +0.6 | 38 23 08.6 |

LATITUDE DETERMINATIONS.

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Observations and computations—Continued.

LABRAN, COLORADO.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|------------------------|--------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|--------|------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1873. August 18 ... | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | ° ' " |
| | 7528 | 14 61.3 | 20.8 | 23.8 | | | | | |
| | 7545 | 5 37.2 | 21.0 | 23.4 | | 38 18 22.9 | + 4 47.0 | —1.5 | 38 23 08.4 |
| | 7567 | 5 45.4 | 18.8 | 26.0 | | 26 18.3 | — 3 03.8 | —0.9 | 08.6 |
| | 7590 | 14 75.7 | 19.0 | 26.0 | | 21 28.6 | + 1 40.2 | —0.9 | 07.9 |
| | 7605 | 11 53.1 | 24.7 | 21.0 | | | | | |
| | 7676 | 17 03.8 | 15.3 | 30.9 | | | | | |
| | 7706 | 3 88.8 | 27.0 | 19.0 | | 20 00.6 | — 6 50.0 | —2.1 | 08.5 |
| | 7733 | 14 16.4 | 25.8 | 20.0 | | | | | |
| | 7754 | 2 29.7 | 18.2 | 27.8 | | 17 01.1 | + 6 08.6 | —1.1 | 08.6 |
| | 7778 | 14 02.4 | 17.9 | 28.2 | | 23 05.2 | + 0 04.3 | —1.2 | 08.3 |
| | 7798 | 17 44.1 | 28.6 | 17.8 | | | | | |
| | 7820 | 3 31.2 | 15.4 | 31.0 | | 15 51.6 | + 7 18.8 | —1.3 | 09.1 |
| | 7848 | 6 18.2 | 19.0 | 27.9 | | | | | |
| | 7893 | 14 16.5 | 23.8 | 22.9 | | 19 03.5 | + 4 08.0 | —2.2 | 09.3 |
| | 7937 | 18 06.7 | 31.4 | 14.0 | | | | | |
| | 7953 | 3 15.0 | 15.3 | 30.9 | | 15 26.1 | + 7 43.3 | +0.3 | 09.7 |
| | 7967 | 5 37.1 | 25.4 | 20.8 | | | | | |
| | 8003 | 16 23.5 | 11.0 | 35.0 | | 17 37.4 | + 5 37.4 | —5.3 | 09.5 |
| | 8036 | 9 87.5 | 12.8 | 33.7 | | | | | |
| | 8091 | 11 44.2 | 31.0 | 15.6 | | 22 22.6 | + 0 48.7 | —1.5 | 09.8 |
| | 8115 | 2 23.7 | 13.0 | 33.6 | | | | | |
| | 8156 | 10 37.0 | 29.0 | 18.0 | | 18 58.9 | + 4 12.6 | —2.6 | 08.9 |
| | 8159 | 18 79.0 | 29.0 | 18.0 | | 14 37.3 | + 8 34.1 | —2.6 | 08.8 |
| | 8177 | 4 16.4 | 26.0 | 21.6 | | | | | |
| | 8204 | 16 40.8 | 14.3 | 32.3 | | 29 33.0 | — 6 20.3 | —3.9 | 08.8 |
| | 8250 | 11 20.1 | 22.9 | 25.2 | | | | | |
| | 8273 | 8 69.4 | 15.7 | 32.0 | | 21 56.7 | + 1 17.9 | —5.1 | 09.5 |
| | 55 | 9 61.3 | 18.2 | 30.0 | | | | | |
| | 65 | 11 47.0 | 29.2 | 19.0 | | 24 06.9 | — 0 57.7 | —0.4 | 08.8 |
| | 80 | 8 71.2 | 29.9 | 18.9 | | 22 42.1 | + 0 28.0 | —0.2 | 09.9 |
| | 100 | 4 90.7 | 24.9 | 24.0 | | 17 15.7 | + 5 55.8 | —2.6 | 08.9 |
| | 120 | 16 36.1 | 19.3 | 29.8 | | | | | |
| | 152 | 10 48.3 | 24.8 | 24.0 | | 20 08.2 | + 3 02.6 | —2.6 | 08.2 |
| | 223 | 12 66.5 | 29.8 | 18.3 | | | | | |
| | 239 | 7 56.6 | 13.8 | 34.3 | | 20 32.3 | + 2 38.4 | —2.6 | 08.1 |
| | 250 | 19 75.6 | 21.7 | 26.3 | | | | | |
| | 290 | 2 06.0 | 21.9 | 26.0 | | 19 00.4 | + 9 09.7 | —2.4 | 07.7 |
| | 316 | 14 61.2 | 25.8 | 23.2 | | | | | |
| | 338 | 5 79.6 | 27.9 | 21.8 | | 38 18 37.0 | + 4 33.8 | —1.0 | 38 23 09.8 |

Observations and computations—Continued.

LABRAN, COLORADO.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|---------------|-----------------|----------------------|-----------|-----------|----------|-----------------------------|----------------------|----------|--------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1873. | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | <i>o ' "</i> | <i>' "</i> | <i>"</i> | <i>o ' "</i> |
| August 18 ... | 391 | 16 41.0 | 23.4 | 26.4 | | | | | |
| | 430 | 4 59.3 | 22.2 | 27.9 | | 38 29 18.5 | — 6 07.0 | —2.4 | 38 23 09.1 |
| August 20 ... | 7268 | 6 02.9 | 23.0 | 21.6 | | 19 18.8 | + 3 51.7 | —1.6 | 08.9 |
| | 7301 | 11 49.2 | 23.0 | 21.6 | | 22 08.5 | + 1 02.0 | —1.6 | 08.9 |
| | 7368 | 13 49.0 | 18.9 | 26.0 | | | | | |
| | 7385 | 21 33.6 | 23.3 | 21.8 | | | | | |
| | 7398 | — 1 81.0 | 21.3 | 24.0 | | 11 10.6 | +11 58.9 | —0.3 | 09.2 |
| | 7417 | 13 60.0 | 14.0 | 31.2 | | | | | |
| | 7450 | 5 13.5 | 29.0 | 16.7 | | 27 32.3 | — 4 22.9 | —1.3 | 08.1 |
| | 7465 | 3 86.3 | 23.9 | 21.9 | | | | | |
| | 7501 | 15 07.4 | 18.0 | 27.9 | | 28 58.3 | — 5 48.2 | —2.2 | 07.9 |
| | 7528 | 13 57.5 | 23.3 | 22.7 | | | | | |
| | 7545 | 4 37.9 | 23.5 | 22.6 | | 16 23.4 | + 4 45.6 | +0.4 | 09.4 |
| | 7567 | 4 74.1 | 23.3 | 22.9 | | 26 18.8 | — 3 10.5 | +1.3 | 09.6 |
| | 7590 | 14 03.9 | 22.8 | 23.2 | | 21 29.1 | + 1 38.3 | +1.1 | 08.5 |
| | 7605 | 10 87.3 | 25.2 | 21.0 | | | | | |
| | 7676 | 16 68.2 | 26.7 | 20.2 | | | | | |
| | 7706 | 3 41.2 | 18.4 | 28.0 | | 30 01.2 | — 6 52.1 | —0.9 | 08.2 |
| | 7733 | 13 41.2 | 26.2 | 20.3 | | | | | |
| | 7754 | 1 49.6 | 15.6 | 31.1 | | 17 01.7 | + 6 10.1 | —2.6 | 09.2 |
| | 7778 | 13 22.6 | 15.8 | 31.2 | | 23 05.7 | + 0 05.8 | —2.6 | 08.9 |
| | 7848 | 5 52.0 | 19.0 | 24.4 | | | | | |
| | 7893 | 13 43.0 | 22.0 | 21.9 | | 19 04.1 | + 4 05.7 | —1.5 | 08.3 |
| | 8115 | 2 12.0 | 16.0 | 27.9 | | | | | |
| | 8156 | 10 12.1 | 29.6 | 14.3 | | 18 59.5 | + 4 08.5 | +0.9 | 08.9 |
| | 8159 | 18 57.5 | 29.8 | 14.0 | | 14 37.8 | + 8 31.1 | +1.1 | 10.0 |
| | 8250 | 10 92.0 | 25.0 | 20.0 | | | | | |
| | 8273 | 8 67.0 | 24.0 | 21.0 | | 21 57.2 | + 1 09.9 | +2.2 | 09.3 |
| | 8316 | 0 19.0 | 15.0 | 29.8 | | | | | |
| | 8324 | 17 80.2 | 29.8 | 15.0 | | 14 00.8 | + 9 07.0 | 0.0 | 07.8 |
| August 26 ... | 6496 | 4 58.5 | 26.0 | 22.0 | | | | | |
| | 6527 | 14 11.4 | 23.8 | 23.9 | | 18 10.5 | + 4 56.0 | +1.1 | 07.6 |
| | 7301 | 11 90.8 | 15.4 | 18.0 | | | | | |
| | 7368 | 13 71.0 | 26.0 | 7.2 | | 22 09.8 | + 0 56.0 | +4.4 | 10.2 |
| | 7385 | 21 50.5 | 21.0 | 12.0 | | | | | |
| | 7398 | — 1 37.6 | 23.7 | 9.5 | | 11 12.2 | +11 50.7 | +6.4 | 09.3 |
| | 7465 | 3 55.1 | 21.8 | 12.0 | | | | | |
| | 7501 | 15 11.7 | 25.2 | 9.6 | | 38 29 00.0 | — 5 59.2 | +7.0 | 38 23 07.8 |

LATITUDE DETERMINATIONS.

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Observations and computations—Continued.

LABRAN, COLORADO.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|------------------------|--------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|----------|--------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1873. August 26 ... | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | <i>° ' "</i> | <i>' "</i> | <i>"</i> | <i>° ' "</i> |
| | 7528 | 14 05.2 | 23.3 | 11.5 | | | | | |
| | 7545 | 4 89.0 | 10.0 | 24.6 | | 38 18 25.1 | + 4 44.6 | -0.8 | 38 23 08.9 |
| | 7567 | 4 61.9 | 20.0 | 14.7 | | | | | |
| | 7590 | 13 89.8 | 20.0 | 14.7 | | 26 20.5 | - 3 10.1 | -1.0 | 09.4 |
| | 7605 | 10 74.0 | 13.0 | 21.8 | | 21 30.7 | + 1 38.1 | -1.0 | 07.8 |
| | 7676 | 16 68.2 | 26.7 | 20.2 | | | | | |
| | 7706 | 3 41.2 | 18.4 | 28.0 | | 30 02.9 | - 6 52.2 | -0.9 | 09.8 |
| | 7733 | 13 79.8 | 22.9 | 11.9 | | | | | |
| | 7754 | 1 98.0 | 11.2 | 23.5 | | 17 03.4 | + 6 07.1 | -0.4 | 10.1 |
| | 7778 | 13 71.2 | 11.4 | 23.3 | | 23 07.4 | + 0 02.7 | -0.3 | 09.8 |
| | 7798 | 17 47.4 | 17.9 | 17.0 | | | | | |
| | 7820 | 3 54.9 | 21.8 | 13.0 | | 15 53.9 | + 7 12.5 | +2.7 | 09.1 |
| | 7848 | 5 76.7 | 16.8 | 18.0 | | | | | |
| | 7893 | 13 65.5 | 15.9 | 19.0 | | 19 05.8 | + 4 05.0 | -1.2 | 09.6 |
| | 7937 | 17 89.2 | 16.4 | 18.9 | | | | | |
| | 7953 | 3 12.0 | 21.2 | 13.9 | | 15 28.9 | + 7 38.8 | +1.3 | 09.0 |
| | 7967 | 5 52.3 | 17.3 | 17.9 | | | | | |
| | 8003 | 16 19.0 | 15.0 | 20.3 | | 17 39.5 | + 5 31.3 | -1.6 | 09.2 |
| | 8036 | 9 69.6 | 10.5 | 25.0 | | | | | |
| | 8091 | 11 05.6 | 29.7 | 6.0 | | 22 24.9 | + 0 42.2 | +2.5 | 09.6 |
| | 8115 | 2 44.1 | 16.5 | 19.0 | | | | | |
| | 8156 | 10 43.7 | 18.3 | 17.5 | | 19 01.3 | + 4 08.4 | -0.5 | 09.2 |
| | 8159 | 18 88.9 | 18.0 | 18.0 | | 14 39.6 | + 8 30.9 | -0.7 | 09.8 |
| | 8177 | 3 88.6 | 18.7 | 17.4 | | | | | |
| | 8204 | 16 31.4 | 15.0 | 21.5 | | 29 37.0 | - 6 26.0 | -1.4 | 09.6 |
| | 8250 | 10 99.2 | 21.0 | 16.3 | | | | | |
| | 8273 | 8 69.4 | 15.0 | 23.0 | | 21 58.8 | + 1 11.8 | -0.9 | 09.7 |
| | 55 | 9 05.9 | 21.9 | 15.8 | | | | | |
| | 65 | 10 93.9 | 11.0 | 26.4 | | 24 09.0 | - 0 58.4 | -2.5 | 08.1 |
| | 80 | 8 19.3 | 12.0 | 25.4 | | 22 44.2 | + 0 26.9 | -2.0 | 09.1 |
| | 100 | 4 86.8 | 13.9 | 23.3 | | | | | |
| | 120 | 16 14.8 | 25.8 | 11.6 | | 17 17.9 | + 5 50.4 | +1.3 | 09.6 |
| | 166 | 17 73.5 | 21.4 | 16.1 | | | | | |
| | 189 | 1 90.2 | 13.0 | 24.6 | | 14 58.9 | + 8 11.8 | -1.7 | 09.0 |
| | 223 | 12 54.3 | 13.0 | 24.6 | | | | | |
| | 239 | 7 49.9 | 21.3 | 16.0 | | 20 33.3 | + 2 36.7 | -1.7 | 08.3 |
| | 250 | 19 45.7 | 18.0 | 20.3 | | | | | |
| | 290 | 1 88.0 | 22.0 | 16.6 | | 14 02.4 | + 9 05.9 | +0.9 | 09.2 |
| | 316 | 14 22.5 | 22.3 | 16.0 | | | | | |
| | 338 | 5 44.0 | 10.8 | 27.8 | | 38 18 38.9 | + 4 32.9 | -2.9 | 38 23 08.9 |

Observations and computations—Continued.

LABRAN, COLORADO.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|------------------------|--------------|-----------------------------------|---------------------------|---------------------------|----------|--------------------------|-------------------|-----------|---------------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1873. August 26 ... | 391 430 | <i>t. d.</i> 16 45.6 4 55.6 | <i>d.</i> 14.6 21.9 | <i>d.</i> 24.4 17.0 | | ° ' " 38 29 20.4 | ' " — 6 09.9 | " —1.4 | ° ' " 38 23 09.1 |

The mean of all results is: $38^{\circ} 23' 08''.97 \pm 0''.03$.

The probable error of one observation is derived from all observations taken two or more times on one pair, and is found to be $\pm 0''.35$; therefore the probable error of the mean result will be $\pm 0''.03$.

ASTRONOMICAL CO-ORDINATES OF LABRAN, COLORADO.

The astronomical co-ordinates resulting from these observations are:—

Longitude.. $7^{\text{h}} 00^{\text{m}} 25^{\text{s}}.185$ or $105^{\circ} 06' 17''.78 \pm 0''.44$ west from Greenwich.

Longitude.. $1^{\text{h}} 52^{\text{m}} 13^{\text{s}}.065$ or $28^{\circ} 03' 15''.98 \pm 0''.43$ west from U. S. Naval Observatory, Washington, D. C.

Latitude ... $38^{\circ} 23' 08''.97 \pm 0''.03$ north.

U. S. GEOGRAPHICAL SURVEYS WEST OF THE ONE HUNDREDTH MERIDIAN.
1ST LIEUT. GEO. M. WHEELER, CORPS OF ENGINEERS, U. S. ARMY, IN CHARGE.

RESULTS
OF
OBSERVATIONS MADE BY DR. F. KAMPF AND JOHN H. CLARK IN THE
DETERMINATION OF THE ASTRONOMICAL CO-ORDINATES
OF TRINIDAD, COLORADO.
SEASON OF 1873.

COMPUTATIONS BY
DR. F. KAMPF AND JOHN H. CLARK.

TRINIDAD, COLORADO.

GEOGRAPHICAL POSITION OF STATION.

Longitude, . . . $104^{\circ} 30' 01''.42 \pm 0''.30$ west from Greenwich.

Latitude, . . . $37^{\circ} 10' 46''.53 \pm 0''.02$ north.

Barometric altitude of observatory above sea-level, 5989.9 feet.

Trinidad is in a large valley which is drained by Purgatory Creek, a small stream flowing to the east, in which direction the valley is open. On the north and south are high mountains, the most prominent of which is Fisher's Peak, the west corner of whose summit is $201^{\circ} 24'$ from the true north, determined at the astronomical station. The town has its greatest extension from east to west. It is a settlement of about 1,200 inhabitants, the majority of whom are Mexicans.

The astronomical station is situated on a hill near the surveyed line of the railroad, at the northeast corner of the township in which Trinidad lies, and about two-thirds of a mile distant from the village.

METEOROLOGICAL CONDITIONS.

The following is a tabulated display of the meteorological circumstances that affected the occupation of this station:

| Date. | General direction of wind. | | | General condition of atmosphere. |
|---------|----------------------------|--------------------|---------------------|--|
| | 12 p. m. to 8 a. m. | 8 a. m. to 4 p. m. | 4 p. m. to 12 p. m. | |
| 1873. | | | | |
| Sept. 3 | ----- | N. W. | N. W. | Clear; heavy wind. |
| 4 | N. W. | N. E. and S. W. | S. W. | Exceedingly warm. |
| 5 | W. | N. E. | N. E. and S. E. | Rain in the afternoon and at 11 p. m. |
| 6 | N. E. | N. E. | Changeable. | Rainy the whole day. |
| 7 | S. E. | S. W. | S. W. | Rainy at night. |
| 8 | S. W. | S. W. | N. W. | Rain at 6.35 p. m. |
| 9 | S. W. | S. E. | N. W. | Clear; heavy wind. |
| 10 | S. W. | S. W. | S. W. and W. | 5.40 p. m. rain and lightning; violent wind. |
| 11 | S. W. | N. W. and N. | N. E. and N. W. | Rain at 4 p. m. |
| 12 | S. W. | N. | W. | Rain at 5 p. m. |
| 13 | S. W. | S. W. | S. W. | Rain at 1.50 p. m. and 5.30 p. m. |
| 14 | S. W. | S. W. | S. W. | Clear; heavy wind |
| 15 | S. W. | N. E. | N. | Cloudy at night. |
| 16 | S. W. | S. W. | S. W. | Clear. |
| 17 | S. W. | Changeable. | S. W. | Clear; heavy wind. |
| 18 | N. E. | N. E. | W. and S. W. | Partly cloudy. |
| 19 | S. W. | S. W. | S. W. | Partly cloudy. |
| 20 | S. W. | ----- | ----- | Clear. |

OBSERVATORY.—INSTRUMENTS.—INSTRUMENTAL VALUES.

These are sufficiently described in the report on Colorado Springs, date of 1874, at which station they were similar.

The wire of the Western Union Telegraph Company passes directly over the monument, and was conducted into the tent by means of a loop. When this station was first occupied there was no operator at the office in Trinidad. Letters were at once dispatched to Denver and Pueblo, asking that this vacancy might be filled, but without success, as there were no men to spare. Finally an operator was obtained from Las Animas. He arrived on the 10th of September, but finding the line out of order, he had to go to repair it. This is the reason why earlier exchange was not made with Salt Lake City. Even during the time of exchanges the line was in very bad condition and would not transmit signals when the weather was rainy.

Five exchanges were made: on the 13th, 15th, 16th, 17th and 18th of September. The signals sent and received on the first two of these dates were repeated at Cheyenne and Denver; on the last three days only at Cheyenne. The length of circuit by way of Ogden, at which point there was no repeater, was 875 miles.

CONNECTIONS.—OBSERVERS.—COMPUTERS.

John H. Clark was observer at the connected station, Salt Lake City, and Dr. F. Kampf at Trinidad. Each astronomer reduced his own notes. At Salt Lake City the weather was favorable, being cloudy but one night out of the five which were devoted to exchanges. Observations for latitude were made September 4, 5, 9, 10, 11 and 12.

Tabulation of stars used for determination of time at Trinidad, Colorado, and Salt Lake City, Utah, 1873.

| Name of star. | TRINIDAD, COLORADO. | | | | | | SALT LAKE CITY, UTAH. | | | | |
|-------------------------------|---------------------|---------------|---------------|---------------|---------------|---------------|-----------------------|---------------|---------------|---------------|---------------|
| | September 13. | September 14. | September 15. | September 16. | September 17. | September 18. | September 13. | September 15. | September 16. | September 17. | September 19. |
| β Lyrae | | | | | | | | | | x | |
| 50 Draconis | | | | | | | | | | x | x |
| ϵ Aquilæ | | | | | | | | | x | | |
| ζ Aquilæ | | | | | | | | | x | x | x |
| π Sagittarii | | | | | | | | | | x | x |
| δ Draconis | | | | | | | | x | x | x | x |
| δ Aquilæ | | | | | | | | x | x | x | x |
| α Vulpeculæ | | | | | | | | x | x | x | x |
| μ Aquilæ | | | | | | | | | x | x | x |
| κ Aquilæ | | | x | | x | | | | | x | |
| θ Cygni | | | x | | x | x | | | x | | x |
| γ Aquilæ | | | x | | x | x | | | x | | x |
| α Aquilæ | | | x | | x | x | | | x | | x |
| ϵ Draconis | | | x | | | x | | | | | |
| β Aquilæ | | | | | | | | | | | x |
| τ Aquilæ | | | x | | x | x | | | | | |
| θ Aquilæ | | x | x | | x | x | | | x | | |
| 31 ^o Cygni | | x | x | | | x | | | | | |
| α^2 Capricorni | | | | | | | x | | x | | |
| κ Cephei | | x | | | x | | | | | | |
| β Capricorni | | | | | | | x | | x | x | |
| γ Cygni | | x | | | | | | | | | |
| π Capricorni | | | | | | | x | | x | x | |
| ω^1 Cygni | | | | | | | x | | | x | |
| ϵ Delphini | | x | | | | | x | | x | x | |
| Groombr. 3241 | | x | | | | | | | | | |
| α Cygni | | | | | | | x | x | x | x | |
| γ Delphini | | | | x | x | | | | | | |
| ϵ Aquarii | | | | | | | x | | x | x | |
| ϵ Cygni | | x | | | | | | | | | |
| η Cephei | | x | | | | | | | | | |
| μ Aquarii | | | | x | x | | x | | x | x | |
| ν Cygni | | x | | x | x | | x | | x | x | |
| 12-year Catalogue, 1879 | | | | | | | | x | | | |
| ξ Cygni | | | x | | | | | | | | |
| 61 Cygni | | x | | x | x | | | x | | x | |
| ζ Cygni | x | x | x | x | x | x | | x | | | |
| τ Cygni | x | x | x | x | x | x | | | | | |
| α Cephei | | | x | x | x | | | | | | |
| 1 Pegasi | | | | | | | | x | | | |
| β Aquarii | x | | x | | | | | x | | | |
| β Cephei | | | x | x | x | x | | | | | |
| ξ Aquarii | x | | | | | | | x | | | |
| ϵ Pegasi | | | x | x | | x | | x | | | |
| 11 Cephei | | | x | x | | x | | | | | |
| μ Capricorni | | | x | | | | | | | | |
| 16 Pegasi | x | | | x | | | | | | | |
| 79 Draconis | | | x | x | | | | | | | |
| 20 Pegasi | x | | | x | | | | | | | |
| α Aquarii | | | x | x | | | | | | | |
| 20 Cephei | x | | | | | | | | | | |
| π^1 Pegasi | | | | x | | | | | | | |
| π^2 Pegasi | | | x | x | | | | | | | |

Tabulation of stars, &c.—Continued.

| Name of star. | TRINIDAD, COLORADO. | | | | | | SALT LAKE CITY, UTAH. | | | | |
|-----------------|---------------------|---------------|---------------|---------------|---------------|---------------|-----------------------|---------------|---------------|---------------|---------------|
| | September 13. | September 14. | September 15. | September 16. | September 17. | September 18. | September 13. | September 15. | September 16. | September 17. | September 19. |
| ζ Cephei | × | | × | | | | | | | | |
| 24 Cephei | × | | × | | | | | | | | |
| θ Aquarii | × | | × | | | | | | | | |
| 31 Pegasi | × | | | | | | | | | | |
| 3 Lacertæ | × | | | | | | | | | | |
| ζ Pegasi | × | | | | | | | | | | |

Observations and reductions for time taken at sending station.

TRINIDAD, COLORADO, SEPTEMBER 13, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|---|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | ζ Cygni | 21 18 05.40 | — 0.06 | + 0.19 | — 0.02 | 21 18 05.51 | 21 07 34.05 | — 10 31.46 |
| W. | τ Cygni | 20 16.67 | 0.00 | + 0.20 | — 0.02 | 20 16.85 | 09 45.51 | 31.34 |
| W. | β Aquarii | 35 26.59 | — 0.27 | + 0.15 | — 0.02 | 35 26.45 | 24 54.91 | 31.54 |
| W. | ξ Aquarii | 41 33.73 | — 0.28 | + 0.16 | — 0.02 | 41 33.59 | 31 02.00 | 31.59 |
| W. | 16 Pegasi | 57 50.63 | — 0.09 | + 0.22 | — 0.02 | 57 50.74 | 47 19.38 | 31.36 |
| E. | 20 Pegasi | 22 05 23.00 | — 0.17 | + 0.10 | + 0.02 | 22 05 27.95 | 54 56.62 | 31.33 |
| E. | 20 Cephei | 11 42.35 | + 0.35 | + 0.21 | + 0.04 | 11 42.95 | 22 01 11.36 | 31.59 |
| E. | 24 Cephei | 17 55.16 | + 0.71 | + 0.29 | + 0.06 | 17 56.22 | 07 24.82 | 31.40 |
| E. | θ Aquarii | 20 42.18 | — 0.28 | + 0.07 | + 0.02 | 20 41.99 | 10 10.56 | 31.43 |
| E. | 31 Pegasi | 25 49.97 | — 0.17 | + 0.08 | + 0.02 | 25 49.90 | 15 18.49 | 31.41 |
| E. | 3 Lacertæ | 29 07.74 | + 0.16 | + 0.14 | + 0.03 | 29 08.07 | 18 36.60 | 31.47 |
| E. | ζ Pegasi | 22 45 41.66 | — 0.18 | + 0.09 | + 0.02 | 22 45 41.59 | 22 35 10.17 | — 10 31.42 |
| | Mean at 22 ^h 00 ^m local sidereal time | | | | | | | — 10 31.44 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -0.49 + 12.00 \delta t + 0.72 a + 5.48 c & \delta t &= +0^s.06 \\
 0 &= +2.64 + 0.72 \delta t + 6.42 a - 8.09 c & a &= -0^s.39 \\
 0 &= -4.02 + 5.48 \delta t - 8.09 a + 23.26 c & c &= +0^s.02
 \end{aligned}$$

Observations and reductions for time taken at sending station—Continued.

TRINIDAD, COLORADO, SEPTEMBER 14, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|---|----------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | θ Aquilæ..... | 20 15 19.36 | + 0.13 | — 0.02 | + 0.02 | 20 15 19.49 | 20 04 47.31 | — 10 32.18 |
| W. | 31 ^o Cygni..... | 21 12.01 | — 0.05 | — 0.02 | + 0.03 | 21 11.97 | 09 39.74 | 32.23 |
| W. | κ Cephei..... | 23 42.03 | — 0.63 | — 0.04 | + 0.08 | 23 41.44 | 13 09.26 | 32.18 |
| W. | γ Cygni..... | 28 14.26 | — 0.02 | — 0.01 | + 0.03 | 28 14.26 | 17 42.12 | 32.14 |
| W. | ε Delphini..... | 37 42.97 | + 0.10 | 0.00 | + 0.02 | 37 43.09 | 27 10.86 | 32.23 |
| W. | Groombr. 3241.. | 41 06.78 | — 0.40 | + 0.04 | — 0.06 | 41 06.36 | 30 34.30 | 32.06 |
| E. | ε Cygni..... | 51 38.79 | + 0.01 | — 0.16 | — 0.02 | 51 38.62 | 41 06.48 | 32.14 |
| E. | η Cephei..... | 53 16.80 | — 0.18 | — 0.23 | — 0.04 | 53 16.35 | 42 44.25 | 32.10 |
| E. | ν Cygni..... | 21 03 00.80 | — 0.02 | — 0.15 | — 0.03 | 21 03 00.60 | 52 28.37 | 32.23 |
| E. | 61 Cygni..... | 11 47.07 | 0.00 | — 0.16 | — 0.02 | 11 46.89 | 21 01 14.71 | 32.16 |
| E. | ζ Cygni..... | 18 06.35 | + 0.03 | — 0.17 | — 0.02 | 18 06.19 | 07 34.04 | 32.15 |
| E. | τ Cygni..... | 21 20 17.92 | 0.00 | — 0.20 | — 0.03 | 21 20 17.69 | 21 09 45.49 | — 10 32.20 |
| Mean at 21 ^h 00 ^m local sidereal time | | | | | | | | — 10 32.17 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= +0.69 + 12.00 \delta t - 4.76 a - 4.28 c & \delta t &= +0^s.03 \\
 0 &= -2.42 - 4.76 \delta t + 13.41 a + 17.01 c & a &= +0^s.22 \\
 0 &= -2.47 - 4.28 \delta t + 17.01 a + 49.14 c & c &= -0^s.02
 \end{aligned}$$

TRINIDAD, COLORADO, SEPTEMBER 15, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|---|----------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | κ Aquilæ..... | 19 40 38.22 | + 0.20 | + 0.05 | — 0.01 | 19 40 38.46 | 19 30 05.61 | — 10 32.85 |
| E. | θ Cygni..... | 43 36.50 | — 0.10 | + 0.09 | — 0.01 | 43 36.48 | 33 03.60 | 32.68 |
| E. | γ Aquilæ..... | 50 47.94 | + 0.13 | + 0.04 | — 0.01 | 50 48.10 | 40 15.26 | 32.84 |
| E. | α Aquilæ..... | 55 09.90 | + 0.13 | + 0.02 | — 0.01 | 55 10.04 | 44 37.21 | 32.83 |
| E. | ε Draconis..... | 59 10.29 | — 0.46 | 0.00 | — 0.02 | 59 09.81 | 48 36.88 | 32.93 |
| W. | τ Aquilæ..... | 20 08 30.90 | + 0.15 | + 0.13 | + 0.01 | 20 08 31.19 | 57 58.22 | 32.97 |
| W. | θ Aquilæ..... | 15 20.02 | + 0.18 | + 0.09 | + 0.01 | 15 20.30 | 20 04 47.30 | 33.00 |
| W. | 31 ^o Cygni..... | 20 20 12.42 | — 0.06 | + 0.16 | + 0.02 | 20 20 12.54 | 20 09 39.72 | — 10 32.82 |
| Mean at 19 ^h 30 ^m local sidereal time | | | | | | | | — 10 32.89 |

NORMAL EQUATIONS

$$\begin{aligned}
 0 &= +0.57 + 8.00 \delta t + 0.63 a + 4.08 c & \delta t &= -0^s.09 \\
 0 &= -1.20 + 0.63 \delta t + 4.25 a - 4.30 c & a &= +0^s.29 \\
 0 &= +1.67 + 4.08 \delta t - 4.30 a + 18.13 c & c &= -0^s.01
 \end{aligned}$$

Observations and reductions for time taken at sending station—Continued.

TRINIDAD, COLORADO, SEPTEMBER 15, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|----------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | ξ Cygni..... | 21 10 53.94 | — 0.04 | — 0.07 | — 0.05 | 21 10 53.78 | 21 00 20.78 | — 10 33.00 |
| W. | ζ Cygni..... | 18 07.14 | + 0.04 | — 0.07 | — 0.04 | 18 07.07 | 07 34.03 | 33.04 |
| W. | τ Cygni..... | 20 18.55 | 0.00 | — 0.07 | — 0.04 | 20 18.44 | 09 45.47 | 32.97 |
| W. | α Cephei..... | 26 08.45 | — 0.25 | — 0.13 | — 0.07 | 26 08.00 | 15 35.07 | 32.93 |
| W. | β Aquarii..... | 35 27.94 | + 0.20 | — 0.01 | — 0.03 | 35 28.10 | 24 54.90 | 33.20 |
| W. | β Cephei..... | 37 37.00 | — 0.45 | 0.00 | — 0.10 | 37 36.45 | 27 03.29 | 33.16 |
| E. | ε Pegasi..... | 48 32.43 | + 0.14 | — 0.19 | + 0.03 | 48 32.41 | 37 59.34 | 33.07 |
| E. | 11 Cephei..... | 50 39.93 | — 0.48 | — 0.56 | + 0.10 | 50 38.99 | 40 06.00 | 32.99 |
| E. | μ Capricorni..... | 56 58.08 | + 0.23 | — 0.16 | + 0.03 | 56 58.18 | 46 24.99 | 33.19 |
| E. | 79 Draconis..... | 22 01 54.56 | — 0.57 | — 0.70 | + 0.11 | 22 01 53.40 | 51 20.17 | 33.23 |
| E. | α Aquarii..... | 09 51.30 | + 0.18 | — 0.20 | + 0.03 | 09 51.31 | 59 18.20 | 33.11 |
| E. | π ² Pegasi..... | 14 56.52 | + 0.03 | — 0.31 | + 0.04 | 14 56.28 | 22 04 23.25 | 33.03 |
| E. | ζ Cephei..... | 17 03.24 | — 0.18 | — 0.49 | + 0.06 | 17 02.63 | 06 29.46 | 33.17 |
| E. | θ Aquarii..... | 22 20 43.61 | + 0.17 | — 0.23 | + 0.03 | 22 20 43.58 | 22 10 10.56 | — 10 33.02 |
| Mean at 21 ^h 30 ^m local sidereal time..... | | | | | | | | — 10 33.08 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= +1.97 + 14.00 \delta t - 3.53 a + 3.73 c & \delta t &= -0^s.08 \\
 0 &= -3.80 - 3.53 \delta t + 12.79 a - 4.70 c & a &= +0^s.28 \\
 0 &= +0.75 + 3.73 \delta t - 4.70 a + 48.92 c & c &= +0^s.03
 \end{aligned}$$

TRINIDAD, COLORADO, SEPTEMBER 16, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|-------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | γ Delphini..... | 20 51 21.61 | + 0.10 | — 0.08 | + 0.06 | 20 51 21.69 | 20 40 48.01 | — 10 33.68 |
| E. | μ Aquarii..... | 56 24.03 | + 0.19 | — 0.04 | + 0.06 | 56 24.24 | 45 50.59 | 33.65 |
| E. | ν Cygni..... | 21 03 02.01 | — 0.02 | — 0.05 | + 0.08 | 21 03 02.02 | 52 28.34 | 33.68 |
| E. | 61 ¹ Cygni..... | 11 48.37 | — 0.01 | — 0.03 | + 0.07 | 11 48.37 | 21 01 14.68 | 33.69 |
| E. | ζ Cygni..... | 18 07.59 | + 0.03 | — 0.07 | + 0.07 | 18 07.62 | 07 34.02 | 33.60 |
| E. | τ Cygni..... | 20 19.11 | 0.00 | — 0.11 | + 0.07 | 20 19.07 | 09 45.47 | 33.60 |
| E. | α Cephei..... | 26 08.96 | — 0.23 | — 0.14 | + 0.12 | 26 08.71 | 15 35.05 | 33.66 |
| E. | β Cephei..... | 37 37.47 | — 0.40 | — 0.17 | + 0.17 | 37 37.07 | 27 03.26 | 33.81 |
| W. | ε Pegasi..... | 48 33.00 | + 0.12 | 0.00 | — 0.06 | 48 33.06 | 37 59.34 | 33.72 |
| W. | 11 Cephei..... | 50 40.17 | — 0.43 | 0.00 | — 0.17 | 50 39.57 | 40 05.98 | 33.59 |
| W. | 16 Pegasi..... | 57 53.05 | + 0.06 | + 0.01 | — 0.06 | 57 53.06 | 47 19.36 | 33.70 |
| W. | 79 Draconis..... | 22 01 54.50 | — 0.52 | + 0.06 | — 0.20 | 22 01 53.84 | 51 20.14 | 33.70 |
| W. | 20 Pegasi..... | 05 30.13 | + 0.11 | + 0.03 | — 0.06 | 05 30.21 | 54 56.61 | 33.60 |
| W. | α Aquarii..... | 09 51.84 | + 0.16 | + 0.03 | — 0.05 | 09 51.98 | 59 18.19 | 33.79 |
| W. | 27 π ¹ Pegasi..... | 14 12.13 | + 0.02 | + 0.08 | — 0.07 | 14 12.16 | 22 03 38.41 | 33.75 |
| W. | π ² Pegasi..... | 22 14 56.96 | + 0.03 | + 0.09 | — 0.07 | 22 14 57.01 | 22 04 23.25 | — 10 33.76 |
| Mean at 21 ^h 30 ^m local sidereal time..... | | | | | | | | — 10 33.68 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= +0.59 + 16.00 \delta t - 3.07 a - 0.88 c & \delta t &= +0^s.02 \\
 0 &= -3.23 - 3.07 \delta t + 11.77 a + 4.64 c & a &= +0^s.26 \\
 0 &= -4.02 - 0.88 \delta t + 4.64 a + 49.53 c & c &= +0^s.06
 \end{aligned}$$

Observations and reductions for time taken at sending station—Continued.

TRINIDAD, COLORADO, SEPTEMBER 17, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|---|----------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | κ Aquilæ..... | 19 40 39.70 | + 0.16 | + 0.05 | — 0.08 | 19 40 39.83 | 19 30 05.58 | — 10 34.25 |
| W. | θ Cygni..... | 43 37.98 | — 0.08 | + 0.09 | — 0.13 | 43 37.86 | 33 03.56 | 34.30 |
| W. | γ Aquilæ..... | 50 49.31 | + 0.11 | + 0.06 | — 0.08 | 50 49.40 | 40 15.23 | 34.17 |
| W. | α Aquilæ..... | 55 11.28 | + 0.12 | + 0.07 | — 0.08 | 55 11.39 | 44 37.18 | 34.21 |
| W. | τ Aquilæ..... | 20 08 32.28 | + 0.12 | + 0.09 | — 0.09 | 20 08 32.40 | 57 58.19 | 34.21 |
| W. | θ Aquilæ..... | 15 21.37 | + 0.14 | + 0.10 | — 0.08 | 15 21.53 | 20 04 47.27 | 34.26 |
| W. | κ Cephei..... | 23 43.75 | — 0.69 | + 0.48 | — 0.37 | 23 43.17 | 13 08.98 | 34.19 |
| E. | γ Delphini..... | 51 22.04 | + 0.09 | + 0.03 | + 0.03 | 51 22.24 | 40 48.00 | 34.24 |
| E. | μ Aquarii..... | 56 24.52 | + 0.16 | + 0.01 | + 0.08 | 56 24.77 | 45 50.58 | 34.19 |
| E. | ν Cygni..... | 21 03 02.51 | — 0.02 | + 0.01 | + 0.11 | 21 03 02.61 | 52 28.32 | 34.29 |
| E. | 61 ¹ Cygni..... | 11 48.74 | 0.00 | 0.00 | + 0.10 | 11 48.84 | 21 01 14.67 | 34.17 |
| E. | ζ Cygni..... | 18 08.10 | + 0.03 | — 0.01 | + 0.10 | 18 08.22 | 07 34.01 | 34.21 |
| E. | τ Cygni..... | 20 19.54 | 0.00 | — 0.02 | + 0.10 | 20 19.62 | 09 45.46 | 34.16 |
| E. | α Cephei..... | 26 09.26 | — 0.21 | — 0.06 | + 0.17 | 26 09.16 | 15 35.02 | 34.14 |
| E. | β Cephei..... | 21 37 37.74 | — 0.37 | — 0.10 | + 0.24 | 21 37 37.51 | 21 27 03.22 | — 10 34.29 |
| Mean at 20 ^h 30 ^m local sidereal time | | | | | | | | — 10 34.22 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= +0.65 + 15.00 \delta t - 1.82 a + 0.94 c & \delta t &= -0^s.02 \\
 0 &= -3.83 - 1.82 \delta t + 14.24 a + 5.63 c & a &= +0^s.23 \\
 0 &= -5.38 + 0.94 \delta t + 5.63 a + 49.57 c & c &= +0^s.08
 \end{aligned}$$

TRINIDAD, COLORADO, SEPTEMBER 18, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|---|----------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | θ Cygni..... | 43 38.67 | — 0.05 | — 0.15 | + 0.09 | 19 43 38.56 | 19 33.03.55 | — 10 35.01 |
| E. | γ Aquilæ..... | 50 50.18 | + 0.06 | — 0.10 | + 0.06 | 50 50.20 | 40 15.22 | 34.98 |
| E. | α Aquilæ..... | 55 12.18 | + 0.07 | — 0.11 | + 0.06 | 55 12.20 | 44 37.17 | 35.03 |
| E. | ε Draconis..... | 59 12 17 | — 0.22 | — 0.32 | + 0.18 | 59 11.81 | 48 36.70 | 35.11 |
| E. | τ Aquilæ..... | 20 08 33.13 | + 0.07 | — 0.11 | + 0.06 | 20 08 33.15 | 57 58.20 | 34.95 |
| E. | θ Aquilæ..... | 15 22.21 | + 0.08 | — 0.10 | + 0.05 | 15 22.25 | 20 04 47.25 | 35.00 |
| E. | 31 ^o Cygni..... | 20 14.74 | — 0.03 | — 0.17 | + 0.09 | 20 14.63 | 09 39.65 | 34.98 |
| W. | ζ Cygni..... | 21 18 08.91 | + 0.02 | + 0.20 | — 0.07 | 21 18 09.06 | 21 07 34.00 | 35.06 |
| W. | τ Cygni..... | 20 20.29 | 0.00 | + 0.23 | — 0.08 | 20 20.44 | 09 45.45 | 34.99 |
| W. | α Cephei..... | 26 10.04 | — 0.12 | + 0.21 | — 0.13 | 26 10.00 | 15 34.99 | 35.01 |
| W. | β Cephei..... | 37 38.39 | — 0.21 | + 0.25 | — 0.18 | 37 38.25 | 27 03.18 | 35.07 |
| W. | ξ Aquarii..... | 41 37.05 | + 0.09 | + 0.06 | — 0.06 | 41 37.14 | 31 01.97 | 35.17 |
| W. | ε Pegasi..... | 48 34.29 | + 0.07 | + 0.08 | — 0.06 | 48 34.38 | 37 59.32 | 35.06 |
| W. | 11 Cephei..... | 21 50 41.04 | — 0.22 | + 0.23 | — 0.18 | 21 50 40.87 | 21 40 05.89 | — 10 34.98 |
| Mean at 20 ^h 45 ^m local sidereal time | | | | | | | | — 10 35.03 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= +0.95 + 14.00 \delta t - 2.90 a - 2.56 c & \delta t &= -0^s.03 \\
 0 &= -1.95 - 2.90 \delta t + 10.65 a + 6.86 c & a &= +0^s.14 \\
 0 &= -3.73 - 2.56 \delta t + 6.86 a + 44.35 c & c &= +0^s.06
 \end{aligned}$$

Observations and reductions for time taken at receiving station.

SALT LAKE CITY, UTAH, SEPTEMBER 13, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|-----------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | α^2 Capricorni | 12 04 03.08 | - 1.48 | + 0.05 | - 0.18 | 12 04 01.47 | 20 11 02.81 | +8 07 01.34 |
| W. | β Capricorni | 06 55.22 | - 1.53 | + 0.05 | - 0.19 | 06 53.55 | 13 54.91 | 01.36 |
| W. | π Capricorni | 13 06.02 | - 1.62 | + 0.04 | - 0.19 | 13 04.25 | 20 05.57 | 01.32 |
| W. | ω Cygni | 16 09.80 | + 0.39 | + 0.11 | - 0.27 | 16 10.03 | 23 11.36 | 01.33 |
| W. | ϵ Delphini | 20 10.66 | - 0.91 | + 0.06 | - 0.18 | 20 09.63 | 27 10.87 | 01.24 |
| E. | α Cygni | 30 06.19 | + 0.16 | + 0.16 | + 0.25 | 30 06.76 | 37 08.12 | 01.36 |
| E. | ϵ Aquarii | 33 50.29 | - 1.41 | + 0.07 | + 0.18 | 33 49.13 | 40 50.45 | 01.32 |
| E. | μ Aquarii | 38 50.50 | - 1.39 | + 0.06 | + 0.18 | 38 49.35 | 45 50.61 | 01.26 |
| E. | ν Cygni | 45 26.78 | 0.00 | + 0.09 | + 0.23 | 45 27.10 | 52 28.38 | 01.28 |
| E. | 61 ¹ Cygni | 54 13.20 | - 0.11 | + 0.06 | + 0.23 | 54 13.38 | 21 01 14.72 | 01.34 |
| E. | 61 ² Cygni | 12 54 14.73 | - 0.11 | + 0.06 | + 0.23 | 12 54 14.91 | 21 01 16.24 | +8 07 01.33 |
| Mean at 20 ^h .5 local sidereal time | | | | | | | | +8 07 01.32 |

NORMAL EQUATIONS.

$$\begin{aligned}
 + 11.00 \delta t + 4.49 a + 1.63 c &= -4.24 & \delta t &= + 0^s.32 \\
 + 4.49 \delta t + 3.81 a - 1.27 c &= -5.63 & a &= -1^s.780 \\
 + 1.63 \delta t - 1.27 a + 15.62 c &= +5.56 & c &= + 0^s.178
 \end{aligned}$$

SALT LAKE CITY, UTAH, SEPTEMBER 15, 1873.

| Clamp. | Name of star | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|--------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | δ Draconis | 11 05 28.73 | + 2.24 | + 0.12 | + 0.39 | 11 05 31.48 | 19 12 32.29 | +8 07 00.81 |
| E. | δ Aquilæ | 12 07.82 | - 1.18 | + 0.04 | + 0.15 | 12 06.83 | 19 07.60 | 00.77 |
| E. | α Vulpeculæ | 11 16 26.52 | - 0.59 | + 0.05 | + 0.16 | 11 16 26.14 | 19 23 26.99 | +8 07 00.85 |
| Mean at 19 ^h .3 local sidereal time | | | | | | | | +8 07 00.81 |

NORMAL EQUATIONS.

$$\begin{aligned}
 + 3.00 \delta t - 0.24 a &= -0.10 & \delta t &= - 0^s.19 \\
 - 0.24 \delta t + 1.85 a &= -3.50 & a &= -1^s.916 \\
 \text{Adopted } c &= + 0^s.15
 \end{aligned}$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, SEPTEMBER 15, 1973.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|----------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | <i>a</i> Cygni..... | 12 30 07.29 | + 0.14 | + 0.06 | + 0.07 | 12 30 07.42 | 20 37 08.09 | +8 07 00.67 |
| W. | 12-Y. C. 1879..... | 46 12.70 | + 5.81 | + 0.22 | - 0.29 | 46 18.44 | 53 19.25 | 00.81 |
| W. | 61 ¹ Cygni..... | 54 14.12 | - 0.10 | + 0.08 | - 0.06 | 54 14.04 | 21 01 14.70 | 00.66 |
| W. | 61 ² Cygni..... | 54 15.53 | - 0.10 | + 0.08 | - 0.06 | 54 15.45 | 01 16.22 | 00.77 |
| W. | ζ Cygni..... | 13 00 33.80 | - 0.35 | + 0.10 | - 0.06 | 13 00 33.49 | 07 34.03 | 00.54 |
| E. | 1 Pegasi..... | 09 14.61 | - 0.62 | + 0.03 | + 0.05 | 09 14.07 | 16 15.13 | 01.06 |
| E. | β Aquarii..... | 17 55.14 | - 1.15 | + 0.02 | + 0.05 | 17 54.06 | 24 54.90 | 00.84 |
| E. | ξ Aquarii..... | 24 02.37 | - 1.22 | + 0.04 | + 0.05 | 24 01.24 | 31 01.99 | 00.75 |
| E. | ε Pegasi..... | 13 30 59.14 | - 0.84 | + 0.08 | + 0.05 | 13 30 58.43 | 21 37 59.34 | +8 07 00.91 |
| Mean at 21 ^h .0 local sidereal time | | | | | | | | +8 07 00.78 |

NORMAL EQUATIONS.

$$\begin{aligned}
 +9.00 \delta t - 1.01 a - 6.75 c &= -0.76 & \delta t &= -0^s.22 \\
 -0.01 \delta t + 15.15 a + 23.41 c &= -22.51 & a &= -1^s.575 \\
 6.75 \delta t + 23.41 a + 43.93 c &= -32.36 & c &= +0^s.050
 \end{aligned}$$

SALT LAKE CITY, UTAH, SEPTEMBER 16, 1973.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|-------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | ε Aquilæ..... | 10 46 53.04 | - 0.71 | + 0.04 | + 0.16 | 10 46 52.53 | 18 53 53.14 | +8 07 00.61 |
| E. | ζ Aquilæ..... | 52 36.06 | - 0.74 | + 0.04 | + 0.16 | 52 35.52 | 59 36.01 | 00.49 |
| E. | δ Draconis..... | 11 05 29.36 | + 1.84 | + 0.09 | + 0.41 | 11 05 31.70 | 19 12 32.24 | 00.54 |
| E. | δ Aquilæ..... | 12 07.91 | - 0.97 | + 0.03 | + 0.16 | 12 07.13 | 19 07.59 | 00.46 |
| E. | <i>a</i> Vulpeculæ..... | 16 26.59 | - 0.49 | + 0.04 | + 0.17 | 16 26.31 | 23 26.97 | 00.66 |
| W. | μ Aquilæ..... | 20 55.39 | - 0.88 | + 0.03 | - 0.16 | 20 54.38 | 27 55.01 | 00.63 |
| W. | θ Cygni..... | 26 02.92 | + 0.39 | + 0.05 | - 0.24 | 26 03.12 | 33 03.61 | 00.49 |
| W. | γ Aquilæ..... | 33 15.72 | - 0.82 | + 0.03 | - 0.16 | 33 14.77 | 40 15.24 | 00.47 |
| W. | <i>a</i> Aquilæ..... | 11 37 37.55 | - 0.85 | + 0.03 | - 0.16 | 11 37 36.57 | 19 44 37.19 | +8 07 00.62 |
| Mean at 19 ^h .0 local sidereal time | | | | | | | | +8 07 00.55 |

NORMAL EQUATIONS.

$$\begin{aligned}
 +9.00 \delta t + 2.05 a + 2.19 c &= +2.07 & \delta t &= +0^s.55 \\
 +2.05 \delta t + 3.20 a - 2.40 c &= -4.26 & a &= -1^s.570 \\
 +2.19 \delta t - 2.40 a + 16.64 c &= +7.59 & c &= +0^s.156
 \end{aligned}$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, SEPTEMBER 16, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|---|---------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | <i>θ</i> Aquilæ | 11 57 47.91 | — 1.14 | + 0.08 | — 0.13 | 11 57 46.72 | 20 04 47.21 | +8 07 00.49 |
| W. | <i>α</i> Capricorni | 12 04 03.75 | — 1.41 | + 0.07 | — 0.13 | 12 04 02.28 | 11 02.78 | 00.50 |
| W. | <i>β</i> Capricorni | 06 55.76 | — 1.46 | + 0.08 | — 0.14 | 06 54.24 | 13 54.88 | 00.64 |
| W. | <i>π</i> Capricorni | 13 06.66 | — 1.55 | + 0.08 | — 0.14 | 13 05.05 | 20 05.54 | 00.49 |
| W. | <i>ε</i> Delphini | 20 11.24 | — 0.87 | + 0.14 | — 0.13 | 20 10.38 | 27 10.83 | 00.45 |
| E. | <i>α</i> Cygni | 30 06.62 | + 0.15 | + 0.38 | + 0.18 | 30 07.33 | 37 08.07 | 00.74 |
| E. | <i>ε</i> Aquarii | 33 51.09 | — 1.34 | + 0.12 | + 0.13 | 33 50.00 | 40 50.42 | 00.42 |
| E. | <i>μ</i> Aquarii | 38 51.08 | — 1.33 | + 0.19 | + 0.13 | 38 50.07 | 45 50.59 | 00.52 |
| E. | <i>ν</i> Cygni | 12 45 27.40 | 0.00 | + 0.42 | + 0.17 | 12 45 27.99 | 20 52 28.34 | +8 07 00.35 |
| Mean at 20 ^h .5 local sidereal time..... | | | | | | | | +8 07 00.51 |

NORMAL EQUATIONS.

$$\begin{aligned}
 +9.00 \delta t + 5.26 a - 0.39 c &= -4.41 & \delta t &= +0^s.51 \\
 +5.26 \delta t + 4.21 a - 2.42 c &= -4.83 & a &= -1^s.700 \\
 -0.39 \delta t - 2.42 a + 11.17 c &= +5.38 & c &= +0^s.131
 \end{aligned}$$

SALT LAKE CITY, UTAH, SEPTEMBER 17, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|---|---------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | <i>β</i> Lyrae | 10 38 24.74 | — 0.28 | + 0.15 | + 0.09 | 10 38 24.70 | 18 45 24.86 | +8 07 00.16 |
| E. | 50 Draconis | 43 23.06 | + 3.97 | + 0.29 | + 0.30 | 43 27.62 | 50 27.67 | 00.05 |
| E. | <i>ζ</i> Aquilæ | 52 36.66 | — 0.84 | + 0.05 | + 0.08 | 52 35.95 | 59 35.99 | 00.04 |
| E. | <i>π</i> Sagittarii | 55 16.28 | — 1.69 | + 0.01 | + 0.08 | 55 14.68 | 19 02 14.77 | 00.09 |
| E. | <i>δ</i> Draconis | 11 05 29.73 | + 2.08 | + 0.10 | + 0.20 | 11 05 32.11 | 12 32.18 | 00.07 |
| W. | <i>δ</i> Aquilæ | 12 08.65 | — 1.10 | + 0.08 | — 0.08 | 12 07.55 | 19 07.57 | 00.02 |
| W. | <i>α</i> Vulpeculæ | 16 27.36 | — 0.55 | + 0.11 | — 0.08 | 16 26.84 | 23 26.94 | 00.10 |
| W. | <i>μ</i> Aquilæ | 20 55.85 | — 1.00 | + 0.09 | — 0.08 | 20 54.86 | 27 54.99 | 00.13 |
| W. | <i>κ</i> Aquilæ | 23 06.89 | — 1.34 | + 0.07 | — 0.08 | 23 05.54 | 30 05.58 | 00.04 |
| W. | <i>θ</i> Cygni | 11 26 02.92 | + 0.45 | + 0.17 | — 0.12 | 11 26 03.42 | 19 33 03.58 | +8 07 00.06 |
| Mean at 19 ^h .0 local sidereal time..... | | | | | | | | +8 07 00.09 |

NORMAL EQUATIONS.

$$\begin{aligned}
 +10.00 \delta t + 0.17 a + 4.18 c &= +0.90 & \delta t &= +0^s.09 \\
 +0.17 \delta t + 8.90 a - 12.05 c &= -16.73 & a &= -1^s.780 \\
 +4.18 \delta t - 12.05 a + 32.62 c &= +24.29 & c &= +0^s.076
 \end{aligned}$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, SEPTEMBER 17, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|-----------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | β Capricorni | 12 06 56.43 | — 1.57 | + 0.08 | — 0.21 | 12 06 54.73 | 20 13 54.87 | +8 07 00.14 |
| W. | π Capricorni | 13 07 26 | — 1.67 | + 0.08 | — 0.21 | 13 05.46 | 20 05.53 | 00.07 |
| W. | ω Cygni | 16 10.70 | + 0.40 | + 0.21 | — 0.30 | 16 11.01 | 23 11.22 | 00.21 |
| W. | ε Delphini | 20 11.63 | — 0.93 | + 0.11 | — 0.20 | 20 10.61 | 27 10.82 | 00.21 |
| E. | α Cygni | 30 07.34 | + 0.16 | + 0.28 | + 0.28 | 30 08.06 | 37 08.05 | 06 59.99 |
| E. | ε Aquarii | 33 51.55 | — 1.45 | + 0.11 | + 0.20 | 33 50.41 | 40 50.41 | 07 00.00 |
| E. | μ Aquarii | 38 51.78 | — 1.43 | + 0.09 | + 0.20 | 38 50.64 | 45 50.58 | 06 59.94 |
| E. | ν Cygni | 45 27.80 | 0.00 | + 0.13 | + 0.26 | 45 28.19 | 52 28.32 | 07 00.13 |
| E. | 61 ¹ Cygni | 54 14.17 | — 0.10 | + 0.11 | + 0.25 | 54 14.43 | 21 01 14.67 | 00.24 |
| E. | 61 ² Cygni | 54 15.71 | — 0.10 | + 0.11 | + 0.25 | 54 15.97 | 01 16.19 | 00.22 |
| E. | ζ Cygni | 13 00 33.94 | — 0.40 | + 0.10 | + 0.23 | 13 00 33.87 | 21 07 34.01 | +8 07 00.14 |
| Mean at 20 ^h .5 local sidereal time | | | | | | | | +8 07 00.12 |

NORMAL EQUATIONS.

$$\begin{aligned}
 +11.00 \delta t + 3.88 a + 3.81 c &= -5.50 & \delta t &= +0^s.12 \\
 +3.88 \delta t + 3.17 a - 0.18 c &= -5.60 & a &= -1^s.830 \\
 +3.18 \delta t - 0.18 a + 15.88 c &= +3.58 & c &= +0^s.196
 \end{aligned}$$

SALT LAKE CITY, UTAH, SEPTEMBER 19, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|--------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | 50 Draconis | 10 43 23.78 | + 3.81 | + 0.10 | + 0.93 | 10 43 28.62 | 18 50 27.49 | +8 06 58.87 |
| E. | ζ Aquilæ | 52 37.92 | — 0.80 | + 0.03 | + 0.24 | 52 38.19 | 59 35.96 | 58.57 |
| E. | π Sagittarii | 55 17.70 | — 1.62 | + 0.03 | + 0.25 | 55 16.36 | 19 02 14.75 | 58.39 |
| E. | δ Draconis | 11 05 30.34 | + 2.00 | + 0.18 | + 0.62 | 11 05 33.14 | 12 32.07 | 58.93 |
| E. | δ Aquilæ | 12 09.84 | — 1.06 | + 0.08 | + 0.24 | 12 09.10 | 19 07.54 | 58.44 |
| E. | α Vulpeculæ | 16 28.41 | — 0.53 | + 0.12 | + 0.26 | 16 28.26 | 23 26.92 | 58.66 |
| W. | μ Aquilæ | 20 57.41 | — 0.96 | + 0.10 | — 0.24 | 20 56.31 | 27 54.97 | 58.66 |
| W. | θ Cygni | 26 04.27 | + 0.43 | + 0.20 | — 0.37 | 26 04.53 | 33 03.53 | 59.00 |
| W. | γ Aquilæ | 33 17.50 | — 0.89 | + 0.11 | — 0.24 | 33 16.48 | 40 15.20 | 58.72 |
| W. | α Aquilæ | 37 39.47 | — 0.92 | + 0.11 | — 0.24 | 37 38.42 | 44 37.15 | 58.73 |
| W. | β Aquilæ | 11 42 08.78 | — 0.92 | + 0.11 | — 0.24 | 11 42 07.73 | 19 49 06.45 | +8 06 58.72 |
| Mean at 19 ^h .5 local sidereal time | | | | | | | | +8 06 58.70 |

NORMAL EQUATIONS.

$$\begin{aligned}
 +11.00 \delta t + 0.86 a + 5.15 c &= -14.56 & \delta t &= -1^s.30 \\
 +0.86 \delta t + 9.86 a - 11.17 c &= -20.67 & a &= -1^s.710 \\
 +5.15 \delta t - 11.17 a + 33.24 c &= +20.28 & c &= +0^s.237
 \end{aligned}$$

The following tables show the corrections and rates of the chronometers used at Trinidad and Salt Lake City :

CHRONOMETER AT TRINIDAD.—NEGUS, No. 1491.

| Date. | Local sidereal time. | Correction of chronometer. | Adopted hourly rate. |
|----------|----------------------|----------------------------|----------------------|
| 1873. | <i>h.</i> | <i>h. m. s.</i> | <i>s.</i> |
| Sept. 13 | 22.0 | — 0 10 31.44 | + 0.033 |
| Sept. 14 | 21.0 | 10 32.17 | + 0.034 |
| Sept. 15 | 20.5 | 10 32.99 | + 0.031 |
| Sept. 16 | 21.5 | 10 33.68 | + 0.026 |
| Sept. 17 | 20.5 | 10 34.22 | + 0.028 |
| Sept. 18 | 20.7 | — 0 10 35.03 | + 0.033 |

CHRONOMETER AT SALT LAKE CITY.—NEGUS, No. 1511.

| Date. | Local sidereal time. | Correction of chronometer. | Adopted hourly rate. |
|----------|----------------------|----------------------------|----------------------|
| 1873. | <i>h.</i> | <i>h. m. s.</i> | <i>s.</i> |
| Sept. 13 | 20.5 | + 8 07 01.32 | + 0.010 |
| Sept. 15 | 20.1 | 07 00.79 | + 0.011 |
| Sept. 16 | 19.7 | 07 00.53 | + 0.014 |
| Sept. 17 | 19.7 | 07 00.10 | + 0.023 |
| Sept. 19 | 19.5 | + 8 06 58.70 | + 0.030 |

Final results of longitude.

| Signals sent from— | Recorded at— | Mean of signals sent and received. | Time-corrections. | Corrected time. | Difference of longitude. | Double-wave time. | Means. |
|---------------------|-------------------|------------------------------------|-------------------|-----------------|--------------------------|-------------------|-----------|
| | | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> |
| September 13, 1873: | | | | | | | |
| Salt Lake City. | Trinidad | 20 34 16.97 | — 0 10 31.39 | 20 23 45.58 | 0 29 34.95 | 34.62 | 34.785 |
| | Salt Lake City... | 11 47 09.30 | + 8 07 01.33 | 19 54 10.63 | | | |
| | Trinidad | 20 42 10.00 | — 0 10 31.39 | 20 31 38.61 | | | |
| | Salt Lake City... | 11 55 02.67 | + 8 07 01.32 | 20 02 03.99 | | | |
| September 15, 1873: | | | | | | | |
| Salt Lake City. | Trinidad | 20 32 47.59 | — 0 10 32.99 | 20 22 14.60 | 34.93 | 34.61 | 34.770 |
| | Salt Lake City... | 11 45 38.88 | + 8 07 00.79 | 19 52 39.67 | | | |
| | Trinidad | 20 42 40.00 | — 0 10 32.99 | 20 32 07.01 | | | |
| | Salt Lake City... | 11 55 31.61 | + 8 07 00.79 | 20 02 32.40 | | | |
| September 16, 1873: | | | | | | | |
| Salt Lake City. | Trinidad | 20 32 33.19 | — 0 10 33.65 | 20 21 59.54 | 34.76 | 0 29 34.59 | 34.675 |
| | Salt Lake City... | 11 45 24.25 | + 8 07 00.53 | 19 52 24.78 | | | |
| | Trinidad | 20 36 35.01 | — 0 10 33.65 | 20 26 01.36 | | | |
| | Salt Lake City... | 11 49 26.24 | + 8 07 00.53 | 19 56 26.77 | | | |

Final results of longitude—Continued.

| Signals sent from— | Recorded at— | Mean of sig- nals sent and received. | Time-correc- tions. | Corrected time. | Difference of longitude. | Double-wave time. | Means. |
|---------------------|--------------------|--|------------------------|--------------------|-----------------------------|----------------------|-----------|
| | | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> |
| September 17, 1873: | | | | | | | |
| Salt Lake City. { | Trinidad | 20 41 20.08 | -0 10 34.22 | 20 30 45.86 | 0 29 34.91 | 34.73 | 34.820 |
| | Salt Lake City.... | 11 54 10.86 | +8 07 00.09 | 20 01 10.95 | | | |
| Trinidad | Trinidad | 20 45 10.00 | -0 10 34.22 | 20 34 35.78 | | | |
| | Salt Lake City.... | 11 58 00.96 | +8 07 00.09 | 20 05 01.05 | | | |
| September 18, 1873: | | | | | | | |
| Salt Lake City. { | Trinidad | 20 55 07.55 | -0 10 35.03 | 20 44 32.52 | 34.79 | 0.12 | 34.730 |
| | Salt Lake City.... | 12 07 58.35 | +8 06 59.38 | 20 14 57.73 | | | |
| Trinidad | Trinidad | 20 59 15.00 | -0 10 35.03 | 20 48 39.97 | | | |
| | Salt Lake City.... | 12 12 05.92 | +8 06 59.38 | 20 19 05.30 | | | |

Trinidad east of Salt Lake City 0^h 29^m 34^s.765 ± 0^s.020.

NOTE.—September 16, 1873, has the weight $\frac{1}{2}$; the observations for time at Salt Lake City were taken on that date by eye and ear. The signals were repeated on the 13th and 15th of September at Denver and Cheyenne; the last three days they went through to Cheyenne; therefore the difference in the wave-time.

Mean places of stars for 1873.0 used for determination of latitude of Trinidad, Colorado.

| No. of pair. | No. in B. A. C. | Approximate right ascen- sion. | Declination. | No. of pair. | No. in B. A. C. | Approximate right ascen- sion. | Declination. |
|--------------|--------------------|--------------------------------------|--------------|--------------|--------------------|--------------------------------------|--------------|
| | | <i>h. m. s.</i> | <i>° ' "</i> | | | <i>h. m. s.</i> | <i>° ' "</i> |
| 1..... | 6731 | 19 32 42 | 44 24 56.3 | 16..... | 7598 | 21 42 06 | 48 43 20.7 |
| | 6740 | 34 21 | 29 51 42.0 | | 7627 | 47 17 | 25 19 41.8 |
| 2..... | 6762 | 38 43 | 26 49 58.6 | | 7641 | 50 45 | 11 28 27.5 |
| | 6799 | 43 44 | 47 35 40.5 | 17..... | 7658 | 53 04 | 63 01 16.3 |
| 3..... | 6827 | 48 04 | 23 45 01.9 | | 7696 | 59 46 | 59 11 57.7 |
| | 6865 | 53 17 | 50 33 42.5 | 18..... | 7742 | 22 05 43 | 15 24 56.0 |
| 4..... | 6883 | 56 38 | 24 35 01.0 | | 7766 | 08 25 | 62 39 50.4 |
| | 6895 | 57 46 | 49 45 07.3 | 19..... | 7796 | 15 16 | 11 33 57.3 |
| 5..... | 6912 | 20 01 25 | 23 14 58.4 | | 7810 | 17 58 | 66 03 54.9 |
| | 6959 | 09 00 | 51 04 56.4 | 20..... | 7833 | 22 48 | 8 28 52.7 |
| 6..... | 6990 | 13 06 | 37 38 20.8 | | 7865 | 28 06 | 0 03 24.1 |
| | 7006 | 15 03 | 36 44 01.3 | 21..... | 7907 | 34 29 | 74 42 41.4 |
| 7..... | 7061 | 22 52 | 38 01 27.5 | | 8010 | 53 42 | 9 33 35.7 |
| | 7084 | 26 10 | 36 30 32.7 | 22..... | 8026 | 55 19 | 83 39 58.8 |
| 8..... | 7160 | 35 19 | 14 07 56.3 | | 8036 | 58 29 | 49 21 43.4 |
| | 7176 | 37 36 | 60 02 47.6 | 23..... | 8052 | 23 00 56 | 24 46 59.5 |
| 9..... | 7198 | 40 24 | 46 50 12.6 | | 8070 | 03 07 | 7 59 20.5 |
| | 7256 | 49 08 | 27 34 33.1 | 24..... | 8077 | 04 55 | 66 33 09.8 |
| 10..... | 7268 | 51 33 | 46 55 54.0 | | 8110 | 11 18 | 44 28 25.3 |
| 11..... | 7320 | 58 09 | 38 09 23.7 | 25..... | 8133 | 14 36 | 29 43 19.8 |
| 12..... | 7337 | 21 01 15 | 38 07 27.8 | | 8152 | 17 00 | 0 24 20.0 |
| | 7373 | 08 20 | 36 06 36.2 | 26..... | 8187 | 24 00 | 74 31 33.0 |
| 13..... | 7401 | 13 26 | 55 15 54.4 | | 8206 | 27 39 | 30 37 27.6 |
| | 7418 | 16 13 | 19 15 43.2 | 27..... | 8223 | 31 20 | 43 43 37.0 |
| 14..... | 7448 | 19 43 | 51 06 42.3 | | 8237 | 34 09 | 43 37 51.6 |
| | 7474 | 24 11 | 23 05 00.2 | 28..... | 8256 | 37 36 | 28 39 30.3 |
| 15..... | 7489 | 27 11 | 52 03 36.3 | | 8261 | 23 39 45 | 45 42 55.1 |
| | 7585 | 21 40 13 | 22 21 52.7 | 29..... | | | |

Mean places of stars for 1873.0—Continued.

| No. of pair. | No. in B. A. C. | Approximate right ascen- sion. | Declination. | No. of pair. | No. in B. A. C. | Approximate right ascen- sion. | Declination. |
|--------------|--------------------|--------------------------------------|--------------|--------------|--------------------|--------------------------------------|--------------|
| | | <i>h. m. s.</i> | <i>° ' "</i> | | | <i>h. m. s.</i> | <i>° ' "</i> |
| 30..... | 8277 | 23 42 31 | 64 10 16.1 | 41..... | 416 | 1 17 32 | 59 34 27.0 |
| | 8300 | 46 08 | 10 14 27.3 | | 453 | 24 41 | 14 41 25.1 |
| 31..... | 8338 | 54 16 | 61 28 14.4 | | 476 | 28 57 | 14 00 40.0 |
| | 8370 | 59 10 | 12 41 21.3 | 42..... | 509 | 34 03 | 59 54 19.4 |
| 32..... | 4 | <i>α</i> Andromedæ. | | 43..... | 515 | 34 45 | 59 54 33.7 |
| | 13 | 0 03 28 | 45 41 03.6 | 44..... | Gr. 374 | 36 42 | 45 30 03.2 |
| 33..... | 48 | 10 12 | 13 12 39.2 | 45..... | 540 | 40 01 | 45 35 46.4 |
| | 80 | 17 49 | 61 07 37.6 | | 569 | 45 51 | 28 57 32.7 |
| 34..... | 121 | 24 46 | 53 49 15.2 | 46..... | 600 | 52 38 | 71 48 18.4 |
| | 168 | 32 45 | 20 33 57.1 | | 631 | 56 25 | 2 44 18.7 |
| 35..... | 182 | 35 13 | 58 03 24.6 | 47..... | 650 | 2 00 48 | 17 25 24.2 |
| | 223 | 42 18 | 16 15 16.3 | | 658 | 02 39 | 57 02 42.2 |
| 36..... | 244 | 47 28 | 58 17 04.3 | 48..... | 686 | 06 49 | 19 01 06.0 |
| 37..... | 270 | 51 44 | 6 09 26.5 | 49..... | 712 | 12 05 | 19 06 19.9 |
| 38..... | 293 | 57 02 | 6 04 57.7 | | 721 | 2 13 31 | 55 15 47.3 |
| | 327 | 1 02 05 | 58 05 07.6 | | | | |
| 39..... | 349 | 04 40 | 29 24 53.4 | | | | |
| 40..... | 358 | 06 00 | 29 23 25.0 | | | | |
| | 404 | 1 14 52 | 44 51 44.8 | | | | |

Observations and computations for latitude.

TRINIDAD, COLORADO.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|----------------------|-----------------|------------------------|-------------------|-------------------|---|-----------------------------|------------------------|------------------|------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1873. September 4 | 6731 | <i>t. d.</i> 7 59.6 | <i>d.</i> 20.3 | <i>d.</i> 19.3 | Heavy wind from south; tent partly closed. | <i>° ' "</i> 37 08 31.1 | <i>' "</i> + 2 13.8 | <i>"</i> +0.9 | 37 10 45.8 |
| | 6740 | 11 90.5 | 21.0 | 18.9 | | | | | |
| | 6762 | 7 83.9 | 21.3 | 18.8 | | 13 01.5 | — 2 17.7 | +1.6 | 45.4 |
| | 6799 | 12 27.2 | 21.5 | 18.3 | | | | | |
| | 6827 | 10 97.7 | 24.6 | 16.2 | | 09 34.1 | + 1 12.0 | +0.7 | 46.8 |
| | 6865 | 8 66.0 | 17.0 | 22.8 | | | | | |
| | 6883 | 10 75.0 | 21.3 | 18.2 | | 10 16.2 | + 0 29.5 | +0.3 | 46.0 |
| | 6895 | 9 79.9 | 19.0 | 21.0 | | | | | |
| | 6912 | 10 97.5 | 21.0 | 19.0 | | 10 09.4 | + 0 39.2 | —3.4 | 45.2 |
| | 6959 | 9 71.4 | 12.9 | 27.3 | | | | | |
| | 6990 | 11 05.0 | 22.0 | 18.3 | Changed in- clination. | 11 23.6 | — 0 35.6 | —2.6 | 45.4 |
| | 7006 | 9 90.5 | 13.5 | 26.9 | | | | | |
| | 7160 | 15 14.7 | 25.9 | 16.0 | | 05 33.6 | + 5 15.5 | —2.8 | 46.3 |
| | 7176 | 4 99.0 | 11.0 | 31.0 | | | | | |
| | 7198 | 8 76.1 | 17.8 | 24.7 | | 12 38.4 | — 1 45.9 | —2.7 | 46.8 |
| | 7256 | 5 35.1 | 19.8 | 22.8 | | | | | |
| | 7268 | 14 29.5 | 19.0 | 23.6 | | 37 15 26.1 | — 4 37.8 | —2.1 | 37 10 46.2 |

LATITUDE DETERMINATIONS.

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Observations and computations—Continued.

TRINIDAD, COLORADO.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|----------------------|-----------------|----------------------|-----------|-----------|----------|-----------------------------|----------------------|----------|--------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1873. September 4 | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | <i>° ' "</i> | <i>' "</i> | <i>"</i> | <i>° ' "</i> |
| | 7320 | 8 81.4 | 19.0 | 23.4 | | 37 08 13.9 | + 2 34.2 | -0.2 | 37 10 47.9 |
| | 7337 | 7 07.9 | 17.9 | 24.6 | | 07 19.1 | + 3 28.1 | -0.9 | 46.3 |
| | 7373 | 13 78.0 | 23.4 | 19.8 | | | | | |
| | 7401 | 14 98.9 | 20.3 | 22.9 | | | | | |
| | 7418 | 4 91.6 | 18.3 | 25.1 | | 16 01.2 | - 5 12.9 | -2.6 | 45.7 |
| | 7448 | 5 69.1 | 23.0 | 20.3 | | | | | |
| | 7474 | 14 84.9 | 17.0 | 26.3 | | 06 03.8 | + 4 44.5 | -1.8 | 46.5 |
| | 7489 | 12 01.0 | 18.0 | 25.3 | | | | | |
| | 7585 | 7 94.2 | 17.9 | 26.0 | | 12 57.1 | - 2 06.4 | -4.2 | 46.5 |
| | 7598 | 0 20.5 | 19.0 | 24.8 | | | | | |
| | 7627 | 17 70.0 | 22.4 | 21.2 | | 01 43.9 | + 9 03.4 | -1.3 | 46.0 |
| | 7641 | 4 63.2 | 27.0 | 16.9 | | | | | |
| | 7658 | 12 85.8 | 13.9 | 29.8 | | 15 03.8 | - 4 15.5 | -1.6 | 46.7 |
| | 7696 | 18 37.8 | 20.0 | 23.7 | | | | | |
| | 7742 | 3 20.6 | 18.9 | 24.9 | | 18 39.1 | - 7 51.2 | -2.7 | 45.2 |
| | 7766 | 6 55.3 | 22.0 | 21.9 | | | | | |
| | 7796 | 13 65.2 | 21.0 | 22.9 | | 07 05.9 | + 3 40.5 | -0.5 | 45.9 |
| | 7810 | 14 92.6 | 21.0 | 23.0 | | | | | |
| | 7833 | 3 65.6 | 23.3 | 20.8 | | 16 35.6 | - 5 50.0 | +0.1 | 45.7 |
| | 7865 | 0 79.0 | 26.4 | 17.9 | | | | | |
| | 7907 | 18 29.3 | 19.6 | 24.7 | | 19 49.6 | - 9 03.6 | +0.9 | 46.9 |
| | 8036 | 3 71.4 | 15.0 | 29.0 | | | | | |
| | 8052 | 15 72.3 | 27.0 | 17.0 | | 04 33.6 | + 6 13.0 | -1.1 | 45.5 |
| | 8110 | 4 71.0 | 21.4 | 22.8 | | | | | |
| | 8133 | 13 83.0 | 19.3 | 24.9 | | 06 04.6 | + 4 43.3 | -1.9 | 46.0 |
| | 8152 | 16 60.1 | 24.9 | 19.4 | | | | | |
| | 8187 | 3 01.0 | 13.7 | 30.6 | | 03 47.4 | + 7 02.1 | -3.1 | 46.4 |
| | 8206 | 12 22.2 | 15.0 | 29.7 | | | | | |
| | 8223 | 12 09.0 | 24.8 | 20.3 | | 10 44.1 | + 0 04.1 | -2.8 | 45.4 |
| | 8237 | 6 52.9 | 24.6 | 20.5 | | 07 51.4 | + 2 56.8 | -2.9 | 45.3 |
| | 8256 | 9 32.6 | 19.5 | 25.0 | | | | | |
| | 8261 | 10 59.1 | 27.6 | 17.0 | | 11 24.4 | - 0 39.3 | +1.4 | 46.5 |
| | 8277 | 11 35.1 | 21.0 | 23.6 | | | | | |
| | 8300 | 7 32.8 | 26.9 | 17.9 | | 12 33.0 | - 1 49.4 | +1.8 | 45.4 |
| | 8338 | 5 10.3 | 21.7 | 23.4 | | | | | |
| | 8370 | 16 29.4 | 21.8 | 23.4 | | 04 59.1 | + 5 47.6 | -0.9 | 45.8 |
| | 4 | 17 35.4 | 25.0 | 20.2 | | | | | |
| | 13 | 1 10.4 | 17.0 | 28.4 | | 02 24.0 | + 8 24.7 | -1.8 | 46.9 |
| | 48 | 10 00.0 | 23.3 | 22.2 | | | | | |
| | 80 | 9 12.8 | 22.0 | 23.4 | | 37 10 19.3 | + 0 27.1 | -0.1 | 37 10 46.3 |

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Observations and computations—Continued.

TRINIDAD, COLORADO.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|----------------------|--------------|-------------------|-----------|-----------|-----------------------------------|--------------------------|-------------------|----------|--------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1873. September 4 | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | <i>o ' "</i> | <i>' "</i> | <i>"</i> | <i>o ' "</i> |
| | 121 | 10 02.8 | 26.7 | 19.0 | | | | | |
| | 168 | 8 16.5 | 15.0 | 30.7 | | 37 11 46.9 | — 0 57.9 | —2.2 | 37 10 46.8 |
| | 182 | 3 86.7 | 21.8 | 24.2 | | 09 30.9 | + 1 17.2 | —1.8 | 46.3 |
| | 223 | 6 35.1 | 21.0 | 25.2 | | | | | |
| | 244 | 17 09.0 | 22.9 | 23.3 | | 16 20.5 | — 5 33.6 | —1.2 | 45.7 |
| | 270 | 9 68.7 | 25.8 | 20.2 | | 07 57.1 | + 2 52.0 | —2.8 | 46.3 |
| | 293 | 14 03.2 | 25.8 | 20.3 | | 05 42.7 | + 5 06.9 | —2.8 | 46.8 |
| | 327 | 4 15.0 | 15.2 | 31.0 | | | | | |
| | 349 | 10 93.5 | 23.2 | 23.0 | | 08 28.9 | + 2 18.8 | —2.1 | 45.6 |
| | 358 | 12 35.0 | 23.0 | 23.2 | | 07 44.7 | + 3 02.8 | —2.2 | 45.3 |
| | 404 | 6 46.6 | 19.1 | 27.0 | | | | | |
| | 416 | 7 35.5 | 28.0 | 18.3 | | | | | |
| | 453 | 12 58.9 | 13.7 | 32.8 | | 37 08 05.8 | + 2 42.6 | —2.6 | 45.8 |
| | 476 | 22 69.8 | 22.6 | 24.0 | | | | | |
| | 509 | — 2 67.0 | 22.5 | 24.6 | | 36 57 39.2 | +13 07.9 | —1.0 | 46.1 |
| | 515 | — 2 43.8 | 22.2 | 24.9 | | 36 57 46.3 | +13 00.7 | —1.1 | 45.9 |
| | Gr. 374 | 6 36.1 | 20.2 | 27.0 | | 37 13 57.0 | — 3 06.8 | —3.2 | 47.0 |
| | 540 | 11 92.0 | 20.8 | 27.0 | | 16 48.5 | — 5 59.5 | —3.1 | 45.9 |
| | 569 | 0 34.6 | 21.7 | 26.7 | | | | | |
| | 650 | 5 97.2 | 24.2 | 25.3 | | | | | |
| | 658 | 12 55.2 | 24.0 | 25.7 | | 14 11.3 | — 3 24.4 | —0.8 | 46.1 |
| | 686 | 13 11.9 | 24.4 | 25.4 | | 08 35.1 | + 2 13.0 | —1.4 | 46.7 |
| | 712 | 8 09.2 | 24.3 | 25.8 | | 11 11.9 | — 0 23.2 | —1.5 | 47.2 |
| | 721 | 8 83.7 | 23.0 | 27.0 | | | | | |
| September 5 | 6731 | 7 66.9 | 17.0 | 21.9 | Wind N. E.; moderate. | | | | |
| | 6740 | 11 97.1 | 28.0 | 10.9 | | 08 31.3 | + 2 13.6 | +3.3 | 48.2 |
| | 6762 | 7 92.0 | 20.0 | 18.9 | | | | | |
| | 6799 | 12 19.3 | 15.0 | 23.9 | | 13 01.7 | — 2 12.7 | —1.9 | 47.1 |
| | 6827 | 10 33.0 | 20.2 | 19.0 | | | | | |
| | 6865 | 7 93.3 | 18.0 | 21.3 | | 09 34.3 | + 1 14.4 | —0.6 | 48.1 |
| | 6883 | 9 92.0 | 18.9 | 20.8 | | | | | |
| | 6895 | 8 90.0 | 18.0 | 21.4 | | 10 16.4 | + 0 31.7 | —1.5 | 46.6 |
| | 6912 | 11 02.2 | 22.3 | 17.2 | | | | | |
| | 6959 | 9 71.3 | 11.0 | 28.4 | | 10 09.6 | + 0 40.7 | —3.4 | 46.9 |
| | 6990 | 11 13.4 | 17.4 | 22.2 | | | | | |
| | 7006 | 10 05.4 | 17.2 | 22.4 | | 11 23.7 | — 0 33.5 | —2.8 | 47.5 |
| | 7061 | 14 66.4 | 15.8 | 23.9 | | | | | |
| | 7084 | 4 18.6 | 23.2 | 16.3 | Through clouds. | 16 12.9 | — 5 25.4 | —0.3 | 47.2 |
| September 9 | 7766 | 6 28.8 | 15.5 | 23.3 | Very cold; heavy wind from south. | | | | |
| | 7796 | 13 43.7 | 19.8 | 19.0 | | 37 07 06.1 | + 3 42.1 | —1.9 | 37 10 46.3 |

LATITUDE DETERMINATIONS.

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Observations and computations—Continued.

TRINIDAD, COLORADO.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|----------------------|--------------|-------------------|-----------|-----------|---------------------------|--------------------------|--------------------|--------|------------|
| | | | N. | S. | | | Microm. and r. fr. | Level. | |
| 1873. September 9 | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | ° ' " |
| | 7810 | 14 88.5 | 22.7 | 15.3 | | | | | |
| | 7833 | 3 67.1 | 13.6 | 26.0 | | 37 16 35.8 | — 5 48.3 | —1.4 | 37 10 46.1 |
| | 7865 | 1 21.0 | 22.0 | 17.2 | | | | | |
| | 7907 | 18 51.8 | 6.0 | 33.5 | | 19 50.7 | — 8 57.6 | —6.2 | 46.9 |
| | 8010 | 16 91.3 | 23.3 | 16.4 | Changed in- clination. | | | | |
| | 8026 | 2 68.5 | 20.0 | 19.6 | | 03 23.0 | + 7 21.9 | +2.0 | 46.9 |
| | 8036 | 3 30.5 | 19.1 | 20.3 | | | | | |
| | 8052 | 15 27.2 | 20.7 | 18.8 | | 04 35.0 | + 6 11.7 | +0.1 | 46.8 |
| | 8110 | 4 70.0 | 16.6 | 23.0 | | | | | |
| | 8133 | 13 72.4 | 25.0 | 14.5 | | 06 06.0 | + 4 40.3 | +1.1 | 47.4 |
| | 8152 | 16 46.0 | 21.8 | 18.0 | | | | | |
| | 8157 | 2 90.1 | 14.1 | 25.5 | | 03 48.6 | + 7 01.1 | —2.1 | 47.6 |
| | 8206 | 12 56.2 | 22.8 | 17.0 | | | | | |
| | 8223 | 12 49.1 | 14.7 | 25.0 | | 10 45.5 | + 0 02.2 | —1.2 | 46.5 |
| | 8237 | 6 91.9 | 14.0 | 25.9 | | 07 52.8 | + 2 55.3 | —1.7 | 46.4 |
| | 8256 | 9 22.8 | 21.9 | 18.0 | | | | | |
| | 8261 | 10 40.5 | 14.5 | 25.4 | | 11 25.7 | — 0 36.6 | —1.9 | 47.2 |
| | 8277 | 11 12.2 | 21.8 | 18.2 | | | | | |
| | 8300 | 7 58.1 | 22.0 | 18.0 | | 12 34.3 | — 1 50.0 | +2.1 | 46.4 |
| | 8338 | 4 35.0 | 19.0 | 21.3 | | | | | |
| | 8370 | 15 55.2 | 18.5 | 22.0 | | 05 00.4 | + 5 47.9 | —1.6 | 46.7 |
| | 4 | 17 67.8 | 21.4 | 19.0 | | | | | |
| | 13 | 1 50.5 | 17.9 | 22.7 | | 02 25.3 | + 8 22.3 | —0.7 | 46.9 |
| | 48 | 9 47.0 | 20.3 | 20.3 | | | | | |
| | 80 | 8 68.9 | 23.7 | 17.0 | | 10 20.5 | + 0 24.3 | +1.8 | 46.6 |
| | 121 | 9 82.1 | 19.0 | 21.9 | | | | | |
| | 168 | 7 83.0 | 24.5 | 16.6 | | 11 48.2 | — 1 01.8 | +1.4 | 47.8 |
| | 182 | 3 52.3 | 17.8 | 23.5 | | | | | |
| | 223 | 5 87.4 | 27.0 | 14.6 | | 09 32.3 | + 1 13.0 | +1.8 | 47.1 |
| | 244 | 16 66.9 | 13.0 | 28.5 | | 16 21.9 | — 5 35.3 | —0.9 | 45.7 |
| | 270 | 9 94.8 | 24.0 | 17.4 | | | | | |
| | 293 | 14 30.4 | 24.0 | 18.0 | | 07 58.2 | + 2 48.9 | —0.8 | 46.3 |
| | 327 | 4 51.0 | 16.0 | 25.5 | | 05 43.9 | + 5 04.2 | —1.0 | 47.1 |
| | 349 | 10 88.4 | 23.0 | 18.8 | | | | | |
| | 358 | 12 28.4 | 23.0 | 18.9 | | 08 30.2 | + 2 17.8 | —1.6 | 46.4 |
| | 404 | 6 44.6 | 15.0 | 26.0 | | 07 46.0 | + 3 01.3 | —1.7 | 45.6 |
| | 416 | 6 22.6 | 17.5 | 24.3 | | | | | |
| | 453 | 11 30.7 | 26.4 | 15.9 | | 37 08 07.0 | + 2 37.8 | +1.0 | 37 10 45.8 |

Observations and computations—Continued.

TRINIDAD, COLORADO.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|----------------------|--------------|-------------------|-----------|-----------|---|--------------------------|-------------------|--------|------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1873. September 9 | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | ° ' " |
| | 476 | 22 20.2 | 24.0 | 18.0 | | | | | |
| | 509 | — 3 09.5 | 17.4 | 24.6 | | 36 57 40.3 | +13 05.7 | —0.3 | 37 10 45.7 |
| | 515 | — 2 85.0 | 17.4 | 24.6 | | 36 57 47.4 | +12 58.4 | —0.3 | 45.5 |
| | Gr. 374 | 6 21.6 | 16.3 | 25.6 | | 37 13 58.2 | — 3 10.7 | —0.5 | 47.0 |
| | 540 | 11 74.9 | 16.0 | 25.9 | | 16 49.7 | — 6 02.6 | —0.7 | 46.4 |
| | 569 | 0 07.6 | 24.7 | 17.3 | | | | | |
| | 650 | 6 03.0 | 22.4 | 20.0 | | | | | |
| | 658 | 12 73.8 | 25.0 | 17.4 | | 14 12.8 | — 3 28.4 | +2.8 | 47.2 |
| | 686 | 13 21.3 | 22.0 | 20.3 | | 08 36.1 | + 2 11.5 | —0.7 | 46.9 |
| | 712 | 8 18.6 | 22.0 | 20.3 | | 11 13.0 | — 0 24.7 | —0.7 | 47.6 |
| | 721 | 8 98.0 | 19.0 | 23.4 | | | | | |
| September 10 | 8110 | 5 15.0 | 21.0 | 20.3 | Very heavy wind from S.E.; partly cloudy. | | | | |
| | 8133 | 14 24.5 | 17.3 | 24.2 | | 06 06.2 | + 4 42.5 | —1.7 | 47.0 |
| | 8152 | 16 27.0 | 23.3 | 18.4 | | | | | |
| | 8187 | 2 78.7 | 16.0 | 25.9 | | 03 48.8 | + 6 58.8 | —1.4 | 46.2 |
| | 8206 | 12 24.2 | 21.0 | 21.0 | | | | | |
| | 8223 | 12 11.8 | 17.0 | 24.9 | | 10 45.8 | + 0 03.9 | —2.2 | 47.5 |
| | 8237 | 6 59.5 | 16.1 | 25.8 | | 07 53.1 | + 2 55.4 | —2.7 | 45.8 |
| | 8256 | 9 90.2 | 22.3 | 19.7 | | | | | |
| | 8261 | 11 15.3 | 19.0 | 23.0 | | 11 26.0 | — 0 38.9 | —0.4 | 46.7 |
| | 8277 | 11 08.5 | 13.9 | 28.0 | | | | | |
| | 8300 | 7 67.0 | 26.0 | 16.0 | | 12 34.5 | — 1 46.1 | —1.1 | 47.3 |
| | 8338 | 4 25.7 | 19.9 | 22.0 | Thro' clouds. | | | | |
| | 8370 | 15 41.7 | 20.0 | 21.9 | | 05 00.6 | + 5 46.6 | —1.1 | 46.1 |
| | 4 | 17 91.9 | 20.8 | 21.2 | | | | | |
| | 13 | 1 86.6 | 26.6 | 15.4 | | 02 25.6 | + 8 18.6 | +3.0 | 47.2 |
| | 48 | 10 27.4 | 23.3 | 18.8 | | | | | |
| | 80 | 9 34.8 | 14.0 | 27.9 | | 10 20.7 | + 0 28.8 | —2.6 | 46.9 |
| | 121 | 9 62.9 | 13.6 | 28.3 | | | | | |
| | 168 | 7 61.3 | 30.8 | 11.4 | | 11 48.5 | — 1 02.6 | +1.3 | 47.2 |
| | 182 | 4 25.0 | 19.0 | 23.0 | | | | | |
| | 223 | 6 55.3 | 27.9 | 14.4 | | 09 32.6 | + 1 11.5 | +2.6 | 46.7 |
| | 244 | 17 38.4 | 15.3 | 27.0 | | 16 22.1 | — 5 36.4 | +0.5 | 46.2 |
| | 270 | 9 81.6 | 26.3 | 16.0 | Thro' clouds. | | | | |
| | 293 | 14 15.7 | 26.4 | 16.0 | | 07 58.4 | + 2 45.8 | +2.2 | 46.4 |
| | 327 | 4 47.9 | 20.0 | 22.3 | | 05 44.1 | + 4 60.6 | +2.2 | 46.9 |
| | 349 | 10 88.1 | 23.0 | 19.3 | | | | | |
| | 358 | 12 29.0 | 23.4 | 19.0 | | 08 30.4 | + 2 17.8 | —1.9 | 46.3 |
| | 404 | 6 44.5 | 15.9 | 26.4 | | 07 46.2 | + 3 01.6 | —1.7 | 46.1 |
| | 416 | 7 15.0 | 18.2 | 23.2 | | | | | |
| | 453 | 12 20.5 | 26.2 | 16.2 | | | | | |
| | | | | | | 37 08 07.2 | + 2 37.0 | +1.4 | 37 10 45.6 |

LATITUDE DETERMINATIONS.

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Observations and computations—Continued.

TRINIDAD, COLORADO.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|-----------------------|--------------|-------------------|-----------|-----------|---|--------------------------|-------------------|----------|--------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1873. September 10 | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | <i>° ' "</i> | <i>' "</i> | <i>"</i> | <i>° ' "</i> |
| | 476 | 22 41.0 | 26.0 | 16.3 | | 36 57 40.5 | +13 07.6 | -1.4 | 37 10 46.7 |
| | 509 | - 2 94.8 | 13.7 | 28.6 | | 57 47.6 | +12 59.5 | -1.4 | 45.7 |
| | 515 | - 2 68.5 | 13.7 | 23.6 | | | | | |
| | Gr. 374 | 6 33.8 | 19.8 | 22.2 | | 13 58.4 | - 3 10.8 | -1.7 | 45.9 |
| | 540 | 11 86.9 | 19.8 | 22.3 | | 16 49.9 | - 6 02.6 | -1.7 | 45.6 |
| | 569 | 0 19.6 | 19.3 | 22.9 | | | | | |
| | 650 | 7 46.4 | 18.3 | 23.7 | | | | | |
| | 658 | 14 18.1 | 28.6 | 13.3 | | 14 13.1 | - 3 28.6 | +2.7 | 47.2 |
| | 686 | 13 27.9 | 22.3 | 19.6 | | 08 36.3 | + 2 07.3 | +2.9 | 46.5 |
| | 712 | 8 27.0 | 21.9 | 20.2 | | 11 13.2 | - 0 28.3 | +2.6 | 47.5 |
| | 721 | 9 18.0 | 25.0 | 17.1 | | | | | |
| September 11 | 7448 | 5 11.9 | 18.0 | 27.7 | Air undulating; wind from E.N.E., moderate. | | | | |
| | 7474 | 14 17.8 | 29.9 | 15.8 | | 06 05.4 | + 4 41.4 | +1.2 | 48.0 |
| | 7489 | 12 40.2 | 28.0 | 18.0 | | | | | |
| | 7585 | 8 19.7 | 17.0 | 30.2 | | 12 58.7 | - 2 10.6 | -0.9 | 47.2 |
| | 7598 | 1 04.3 | 19.2 | 27.8 | | | | | |
| | 7627 | 18 35.0 | 31.9 | 15.8 | | 01 45.6 | + 8 57.6 | +2.1 | 45.3 |
| | 7641 | 5 29.0 | 28.6 | 19.0 | | | | | |
| | 7658 | 13 60.0 | 16.0 | 31.6 | | 15 05.4 | - 4 18.1 | -1.6 | 45.7 |
| | 7696 | 18 45.5 | 24.0 | 24.3 | | | | | |
| | 7742 | 3 12.0 | 28.5 | 20.0 | | 18 40.7 | - 7 56.3 | +2.3 | 46.7 |
| | 7766 | 7 10.7 | 25.3 | 23.3 | | | | | |
| | 7796 | 14 21.5 | 20.3 | 29.0 | | 07 07.5 | + 3 40.8 | -1.8 | 46.5 |
| | 7810 | 14 83.8 | 22.4 | 27.0 | | | | | |
| | 7833 | 3 61.0 | 24.3 | 25.2 | | 16 37.2 | - 5 48.7 | -1.5 | 47.0 |
| | 7865 | 1 20.1 | 24.8 | 25.0 | | | | | |
| | 7907 | 18 63.5 | 19.3 | 30.6 | | 19 51.2 | - 9 01.5 | -3.2 | 46.5 |
| | 8010 | 16 77.9 | 23.0 | 19.8 | Changed length of bubble. | | | | |
| | 8026 | 2 50.4 | 21.0 | 21.8 | | 03 23.4 | + 7 23.4 | +0.7 | 47.5 |
| | 8036 | 4 39.2 | 21.7 | 21.0 | | | | | |
| | 8052 | 16 49.0 | 11.6 | 31.0 | | 04 35.5 | + 6 15.8 | -5.1 | 46.2 |
| | 8110 | 5 26.0 | 20.9 | 22.1 | | | | | |
| | 8133 | 14 44.2 | 12.3 | 30.9 | | 06 06.5 | + 4 45.2 | -5.5 | 46.2 |
| | 8152 | 16 71.0 | 24.3 | 19.0 | | | | | |
| | 8187 | 3 13.7 | 11.9 | 32.0 | | 03 49.0 | + 7 01.6 | -4.1 | 46.5 |
| | 8206 | 12 05.0 | 21.0 | 22.9 | Changed inclination. | | | | |
| | 8223 | 12 08.9 | 25.1 | 18.8 | | 10 46.0 | - 0 01.2 | +1.2 | 46.0 |
| | 8237 | 6 52.2 | 25.2 | 18.8 | | 36 07 53.4 | + 2 51.7 | +1.2 | 37 10 46.3 |

Observations and computations—Continued.

TRINIDAD, COLORADO.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|-----------------------|--------------|-------------------|-----------|-----------|---------------------------|--------------------------|-------------------|------------|-------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1873. September 11 | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | Changed in- clination. | <i>o' "</i> | <i>' "</i> | <i>" "</i> | <i>o' "</i> |
| | 8256 | 9 79.9 | 22.8 | 21.3 | | 37 11 26.2 | — 0 43.8 | +5.1 | 37 10 47.5 |
| | 8261 | 11 21.0 | 30.8 | 13.8 | | | | | |
| | 8277 | 12 11.3 | 19.6 | 25.0 | | 12 34.8 | — 1 52.2 | +3.7 | 46.3 |
| | 8300 | 8 50.2 | 31.9 | 13.0 | | | | | |
| | 8338 | 5 19.4 | 22.7 | 22.3 | | 05 00.9 | + 5 43.4 | +2.8 | 47.1 |
| | 8370 | 16 25.0 | 27.3 | 17.5 | | | | | |
| | 4 | 18 08.0 | 21.8 | 23.6 | | 02 25.8 | + 8 17.3 | +3.5 | 46.6 |
| | 13 | 2 07.0 | 30.3 | 15.8 | | | | | |
| | 48 | 10 24.6 | 22.0 | 24.0 | | 10 21.0 | + 0 23.8 | +1.5 | 46.3 |
| | 80 | 9 48.0 | 26.6 | 19.3 | | | | | |
| | 121 | 10 22.5 | 22.7 | 23.3 | | 11 48.7 | — 1 02.9 | —2.0 | 47.8 |
| | 168 | 8 20.1 | 26.9 | 19.0 | | | | | |
| | 182 | 4 04.6 | 21.6 | 24.6 | | 09 32.8 | + 1 16.7 | —3.5 | 46.0 |
| | 223 | 6 51.5 | 18.3 | 28.0 | | | | | |
| | 270 | 10 30.0 | 26.5 | 19.4 | | 07 58.7 | + 2 50.4 | —2.6 | 46.5 |
| | 293 | 14 65.8 | 27.0 | 19.0 | | 05 44.3 | + 5 05.8 | —2.3 | 47.8 |
| | 327 | 4 81.3 | 14.8 | 31.3 | | | | | |
| | 349 | 10 70.8 | 25.0 | 21.0 | | 08 30.7 | + 2 17.3 | —1.4 | 46.6 |
| | 358 | 12 10.9 | 25.8 | 20.2 | | 07 46.5 | + 3 00.8 | —1.0 | 46.3 |
| | 404 | 6 28.8 | 18.7 | 27.9 | | | | | |
| | 416 | 6 72.9 | 20.0 | 26.4 | | | | | |
| | 453 | 11 75.5 | 31.0 | 15.8 | | 37 08 07.4 | + 2 36.1 | +2.4 | 45.9 |
| | 476 | 22 54.0 | 29.8 | 17.0 | | | | | |
| | 509 | — 2 84.3 | 11.0 | 35.8 | | 36 57 40.7 | +13 08.4 | —3.3 | 45.8 |
| | 515 | — 2 60.0 | 11.0 | 35.8 | | 36 57 47.9 | +13 00.9 | —3.3 | 45.5 |
| | Gr. 374 | 6 62.1 | 23.3 | 23.5 | | 37 13 58.7 | — 3 10.7 | —1.8 | 46.2 |
| | 540 | 12 14.2 | 23.0 | 23.5 | | 16 50.2 | — 6 02.1 | —1.9 | 46.2 |
| | 569 | 0 48.3 | 20.0 | 26.3 | | | | | |
| | 650 | 5 92.3 | 25.6 | 21.0 | | | | | |
| | 658 | 12 46.8 | 16.0 | 30.5 | | 14 13.3 | — 3 23.3 | —2.7 | 47.3 |
| | 712 | 8 08.0 | 27.7 | 19.6 | | | | | |
| | 721 | 8 84.0 | 14.3 | 33.0 | | 11 13.4 | — 0 23.6 | —2.9 | 46.9 |
| September 12 | 7810 | 14 91.0 | 20.2 | 18.9 | Heavy wind from S. W. | | | | |
| | 7833 | 3 56.0 | 20.3 | 19.0 | | 16 37.4 | — 5 52.5 | +0.7 | 45.6 |
| | 7865 | 1 20.0 | 23.3 | 16.1 | | | | | |
| | 7907 | 18 83.2 | 21.5 | 17.8 | | 19 51.4 | — 9 07.7 | +3.0 | 46.7 |
| | 8036 | 3 70.0 | 11.3 | 27.7 | | | | | |
| | 8052 | 15 53.2 | 34.4 | 4.7 | | 04 35.7 | + 6 07.5 | +3.7 | 46.9 |
| | 8110 | 4 96.0 | 13.1 | 22.9 | | | | | |
| | 8133 | 13 90.6 | 27.7 | 11.4 | | 37 06 06.8 | + 4 37.9 | +2.6 | 37 10 47.3 |

LATITUDE DETERMINATIONS.

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Observations and computations—Continued.

TRINIDAD, COLORADO.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|-----------------------|--------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|--------|------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1873. September 12 | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | ° ' " |
| | 8152 | 16 70.5 | 23.3 | 15.9 | | | | | |
| | 8187 | 3 23.5 | 13.8 | 25.5 | | 37 03 49.3 | + 6 58.4 | —1.2 | 37 10 46.5 |
| | 8206 | 12 20.3 | 23.6 | 15.8 | | | | | |
| | 8223 | 12 20.9 | 15.5 | 23.9 | | 10 46.3 | — 0 00.2 | —0.2 | 45.9 |
| | 8237 | 6 65.0 | 15.5 | 24.0 | | 07 53.6 | + 2 52.5 | —0.2 | 45.9 |
| | 8256 | 9 17.0 | 22.0 | 17.5 | | | | | |
| | 8261 | 10 54.7 | 23.3 | 16.2 | | 11 26.5 | — 0 42.8 | +3.2 | 46.9 |
| | 8277 | 11 20.8 | 16.4 | 23.1 | | | | | |
| | 8300 | 7 49.9 | 33.3 | 6.2 | | 12 35.0 | — 1 55.2 | +5.6 | 45.4 |
| | 8338 | 4 51.9 | 19.3 | 20.2 | | | | | |
| | 8370 | 15 53.2 | 26.9 | 12.8 | | 05 01.1 | + 5 42.1 | +3.6 | 46.8 |
| | 4 | 17 79.6 | 26.3 | 13.3 | | | | | |
| | 13 | 1 69.0 | 12.8 | 27.0 | | 02 26.1 | + 8 20.3 | —0.3 | 46.1 |
| | 48 | 10 61.0 | 26.5 | 13.3 | | | | | |
| | 80 | 9 77.1 | 11.9 | 28.0 | | 10 21.2 | + 0 26.4 | —0.8 | 46.8 |
| | 121 | 9 80.7 | 20.0 | 19.8 | | | | | |
| | 168 | 7 86.3 | 17.3 | 22.6 | | 11. 49.0 | — 1 00.4 | —1.4 | 47.2 |
| | 102 | 4 09.0 | 17.4 | 22.4 | | 09 33.1 | + 1 14.2 | —0.6 | 46.7 |
| | 223 | 6 48.0 | 21.3 | 18.6 | | | | | |
| | 244 | 17 37.0 | 21.0 | 18.7 | | 16 22.6 | — 5 32.2 | +1.4 | 45.8 |
| | 270 | 9 88.9 | 24.5 | 15.2 | | 07 58.9 | + 2 48.1 | —0.3 | 46.7 |
| | 293 | 14 22.5 | 24.4 | 15.3 | | 05 44.5 | + 5 03.0 | —0.3 | 47.2 |
| | 327 | 4 46.9 | 14.7 | 25.0 | | | | | |
| | 416 | 6 73.9 | 19.3 | 20.5 | | | | | |
| | 453 | 11 91.9 | 17.1 | 22.8 | | 37 08 07.6 | + 2 40.9 | —1.9 | 46.6 |
| | 476 | 22 51.9 | 21.0 | 18.9 | | | | | |
| | 509 | — 2 65.4 | 24.1 | 15.8 | | 36 57 40.9 | +13 01.9 | +2.8 | 45.6 |
| | 515 | — 2 40.7 | 24.1 | 15.8 | | 36 57 42.1 | +12 54.2 | +2.8 | 45.1 |
| | Gr. 374 | 6 75.8 | 18.7 | 21.2 | | 37 13 58.9 | — 3 12.7 | +1.2 | 47.4 |
| | 540 | 12 29.0 | 18.8 | 21.0 | | 16 50.4 | — 6 04.6 | +1.3 | 47.1 |
| | 569 | 0 55.3 | 23.3 | 16.5 | | | | | |
| | 650 | 6 33.3 | 24.5 | 16.0 | | | | | |
| | 658 | 13 03.5 | 19.5 | 21.3 | | 14 13.5 | — 3 23.2 | +1.8 | 47.1 |
| | 686 | 13 49.6 | 23.3 | 18.0 | | 08 36.7 | + 2 07.5 | +2.3 | 46.5 |
| | 712 | 8 47.6 | 22.1 | 19.0 | | 37 11 13.6 | — 0 23.4 | +1.7 | 37 10 46.9 |
| | 721 | 9 39.0 | 22.0 | 18.9 | | | | | |

In addition to the above, some observations were taken on pair 8070 and 8077 and pair 600 and 631. The results agree very well, but the star-places seem to be bad or wrong. Nevertheless, the observations and results are inserted here, so that they may be used when better star-places are found:—

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|--------------|--------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|----------|-------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1873. | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | <i>o' "</i> | <i>' "</i> | <i>"</i> | <i>o' "</i> |
| September 4 | 8070 | 4 33.0 | 26.2 | 17.9 | | 37 16 26.5 | — 5 40.0 | —1.6 | 37 10 44.9 |
| | 8077 | 15 27.8 | 15.0 | 29.0 | | | | | |
| | 600 | 15 51.8 | 30.2 | 18.6 | | 16 24.8 | — 5 43.7 | —1.3 | 39.8 |
| | 631 | 4 45.2 | 16.6 | 32.8 | | | | | |
| September 9 | 8070 | 4 29.7 | 24.0 | 15.5 | | 16 27.7 | — 5 40.1 | —2.6 | 45.0 |
| | 8077 | 15 24.7 | 10.9 | 28.7 | | | | | |
| | 600 | 15 30.6 | 20.0 | 22.3 | | 16 25.9 | — 5 44.1 | —1.7 | 40.1 |
| | 631 | 4 22.8 | 18.9 | 23.7 | | | | | |
| September 10 | 600 | 15 73.0 | 17.7 | 24.4 | | 16 26.2 | — 5 48.8 | +1.6 | 39.1 |
| | 631 | 4 50.1 | 27.2 | 14.8 | | | | | |
| September 11 | 8070 | 4 77.0 | 25.5 | 17.1 | | 16 28.2 | — 5 38.7 | —4.5 | 45.0 |
| | 8077 | 15 67.4 | 9.0 | 33.7 | | | | | |
| | 600 | 15 14.5 | 21.8 | 24.6 | | 16 26.7 | — 5 48.9 | —2.1 | 39.9 |
| | 631 | 3 91.3 | 28.4 | 18.0 | | | | | |
| September 12 | 8070 | 4 52.3 | 24.6 | 14.5 | | 16 28.4 | — 5 42.4 | —1.2 | 44.8 |
| | 8077 | 15 54.7 | 12.3 | 26.7 | | | | | |
| | 600 | 15 37.3 | 23.1 | 16.8 | | 37 16 26.7 | — 5 45.8 | —1.0 | 37 10 39.9 |
| | 631 | 4 24.0 | 15.0 | 25.0 | | | | | |

The mean latitude is found to be $37^{\circ} 10' 46''.53 \pm 0''.02$.

The probable error of one observation is derived from all observations of pairs taken more than twice, and found $= \pm 0''.29$.

ASTRONOMICAL CO-ORDINATES OF TRINIDAD.

Longitude.... $6^h 58^m 00^s.095$ or $104^{\circ} 30' 01''.42$ west from Greenwich.

Longitude.... $1^h 49^m 47^s.975$ or $27^{\circ} 26' 59''.62$ west from U. S. Naval Observatory,
Washington, D. C.

Latitude $37^{\circ} 10' 46''.53 \pm 0''.02$ north.

U. S. GEOGRAPHICAL SURVEYS WEST OF THE ONE HUNDREDTH MERIDIAN,
1ST LIEUT. GEO. M. WHEELER, CORPS OF ENGINEERS, U. S. ARMY, IN CHARGE.

RESULTS
OF
OBSERVATIONS MADE BY PROF. T. H. SAFFORD AND JOHN H. CLARK IN THE
DETERMINATION OF THE ASTRONOMICAL CO-ORDINATES
OF FORT UNION, NEW MEXICO.
SEASON OF 1873.

COMPUTATIONS BY
PROF. T. H. SAFFORD AND JOHN H. CLARK.

FORT UNION, NEW MEXICO.

GEOGRAPHICAL POSITION OF STATION.

Longitude, . . . $105^{\circ} 00' 51''.15 \pm 0''.13$ west from Greenwich.

Latitude, . . . $35^{\circ} 54' 24''.86 \pm 0''.22$ north.

Barometric altitude of observatory above sea-level, 6744.1 feet.

Fort Union is a military post and supply depot, situated near a branch of Mora Creek. East of it is Turkey Hill, and in the west is a range of mountains which rise between it and Santa Fé. An ordnance depot, in charge of a military storekeeper, lies about $1\frac{1}{2}$ miles west of the post, on the opposite side of the adjacent stream. Some miles northwest is a mesa of picturesque shape, and in a more northerly direction and farther from the post there stands a mountain which is seemingly an extinct volcano. The neighboring tributary of the Mora issues from the mesa by a cañon whose mouth is perhaps $3\frac{1}{2}$ miles from the post in a direction nearly west. It is manifestly an insignificant stream in ordinary circumstances, but subject to heavy freshets.

In latitude the position of this post nearly corresponds with Emory's camp 40, near the crossing of Mora Creek, and in its neighborhood to the town of Mora and in other circumstances it agrees well with Emory's description. The latitude of his camp was $35^{\circ} 54' 21''$; the chronometric longitude was $6^h 59^m 49^s$ or $104^{\circ} 57' 15''$ west of Greenwich. The latter result places his station nearer to the present post than it would be after allowing for the error in the assumed longitude of Fort Leavenworth, and adding, as a correction, $10' 35''$, which would change Emory's determination to $105^{\circ} 07' 50''$, and place his camp some miles up the cañon to the west.

METEOROLOGICAL CONDITIONS.

The temperature was very equable during the time of occupation. As the astronomer was accompanied by no trained assistant and had no meteor-

ological instruments he could only possess himself of such data as could be extracted from the hospital records, which were obligingly put at his disposal by Captain Peter Moffat, assistant surgeon, U. S. A.

In general, the climate is similar to that of Santa Fé, which station was occupied during the previous month, July. The annual rain-fall at the two places is about equal, and the wet season is of simultaneous occurrence, including the months of July and August. It was observed that the operations at Fort Union, in August, were more interrupted by rainy weather than those at Santa Fé, in July.

So far as noticed, the productions of the country are nearly the same on both sides of the mountains. From Fort Union to Las Vegas the apparent fertility of the country and its opportunities for irrigation increase, as does, apparently, the observed yearly rain-fall.

DESCRIPTION OF OBSERVATORY.

The observatory was a condemned Army wall-tent, with suitable apertures in its sides. The sun-dial of the supply-depot was used as an observing-pier. The stone monument, with an inscription in blank, reached Fort Union the day before the departure of the observer, and was planted about eight feet due south of the sun-dial. The dial, though rather too high for convenience, was very firm and solid. Some inconvenience arose from shifts in azimuth produced by the working of the foot-screws in channels cut in the stone.

In the minor details of the work, such as copying, care of implements, and the preparation of manuscript blanks, of which there were no printed forms in the astronomical outfit, assistance was rendered by Sergeant W. H. Andy of the Fifteenth Infantry, who showed faithfulness and zeal in the discharge of his duties. Lieutenant Eckles, then in command of the post, was kind enough to detail also an additional soldier for a night or two to relieve the sergeant. The lines of the Western Union Telegraph Company, operated by Mr. Theodore Ruthenbeck, were used in the transmission of signals.

The instruments and instrumental values were the same as at Santa Fé, described in the following report on that station.

The length of circuit, from Fort Union to Salt Lake City, was about 1,000 miles. Repeaters were used at Denver, Cheyenne, and Corinne.

CONNECTIONS.—OBSERVERS.—COMPUTERS.

Connection was made with the station at Salt Lake City, John H. Clark, observer, on August 14, 16, 18 and 25. Latitude observations with the zenith telescope were taken upon the nights of August 24, 28, 29 and 30, and with the transit instrument in the prime vertical on August 11 and 12. The latter, however, are not included in the discussion.

The observations at Fort Union were made and computed by Prof. T. H. Safford.

| | | FORT UNION, NEW MEXICO. | | | | | | | SALT LAKE CITY, UTAH. | | | | | | |
|----------------|--------------------------|-------------------------|------------|------------|------------|------------|------------|------------|-----------------------|------------|------------|------------|------------|------------|------------|
| Name of star. | | August 14. | August 16. | August 18. | August 19. | August 25. | August 26. | August 27. | August 14. | August 15. | August 16. | August 18. | August 19. | August 25. | August 26. |
| κ | Ophiuchi | | | | | | | | x | . | . | . | . | . | . |
| d | Herculis | | | | | | | | . | . | . | . | . | . | . |
| e | Ursæ Minoris | | | x | x | | x | x | . | . | . | . | . | . | . |
| ζ | Draconis | | | x | | | | | x | x | x | . | . | . | . |
| a ¹ | Herculis | | | | | | | | . | . | . | . | . | . | . |
| δ | Herculis | | | | x | | x | x | . | . | . | . | . | . | . |
| v | Serpentis | | | | | | | | x | x | . | x | . | . | . |
| 72 | Herculis | | | | | | x | | . | . | . | . | . | . | . |
| | Groombr. 966, S. P. | | | | | | | | x | x | . | . | . | . | . |
| λ | Herculis | | | | | | | | . | . | . | . | . | . | . |
| a | Ophiuchi | | | x | | | x | | x | x | . | x | . | . | . |
| i | Herculis | | | | | | x | x | . | . | . | . | . | . | . |
| ω | Draconis | | | | | | | | x | x | x | x | . | . | . |
| μ | Herculis | | | | x | | | x | x | x | x | x | . | x | . |
| ψ | Draconis | | | | | | x | | . | . | . | . | . | . | . |
| 88 | Herculis | | | | | | | | . | . | . | . | . | . | . |
| 89 | Herculis | | | | | | | | . | . | . | . | . | x | x |
| ξ | Draconis | | | | | | | x | . | . | . | . | . | x | x |
| γ | Draconis | | | | | | | | x | x | x | . | . | x | x |
| 67 | Ophiuchi | | | | x | | | | . | . | . | x | . | . | . |
| 72 | Ophiuchi | | | | | | | | x | x | x | x | x | x | x |
| o | Herculis | | | | x | | x | | . | . | . | . | . | x | . |
| μ^1 | Sagittarii | | | | | | | | x | x | x | x | x | x | x |
| A | Herculis | | | | | | | x | . | . | . | . | . | . | . |
| δ | Ursæ Minoris | | | | | | x | x | . | . | . | . | . | . | . |
| η | Serpentis | | | | | | | | x | x | x | x | x | x | x |
| 109 | Herculis | | | | | | x | x | . | . | . | . | . | x | . |
| | Bradl. 2313 | | | | | | | | . | . | . | . | . | x | x |
| ϕ | Draconis | | | | | | | x | . | . | . | . | . | . | . |
| χ | Draconis | | | | x | | x | | . | . | . | . | . | . | . |
| 1 | Aquilæ | | | | | | | | . | . | . | . | . | x | x |
| a | Lyræ | | | x | x | | | | . | . | . | . | . | . | . |
| 110 | Herculis | | | | x | | x | x | . | . | . | . | . | x | x |
| ζ^1 | Lyræ | | | | | | | | . | . | . | . | . | . | . |
| ζ^2 | Lyræ | | | | | | | | . | . | . | . | . | x | x |
| β | Lyræ | | | | x | | x | x | . | . | . | . | . | x | x |
| 50 | Draconis | | | | | | | | . | . | . | . | . | x | x |
| o | Draconis | | | x | | | | | . | . | . | . | . | . | . |
| e | Aquilæ | | | x | | | | | . | . | . | . | . | . | . |
| ζ | Aquilæ | | | x | | | | | . | . | . | . | . | . | . |
| θ | Cygni | | | | | | | | . | . | . | . | . | . | . |
| γ | Aquilæ | | | | | | | | . | . | . | . | . | . | . |
| a | Aquilæ | | | | | | | | . | . | . | . | . | . | . |
| e | Draconis | | | | | | | | . | . | . | . | . | . | . |
| β | Aquilæ | | | | | | | | . | . | . | . | . | . | . |
| τ | Aquilæ | | | | | | | | . | . | . | . | . | . | . |
| θ | Aquilæ | | | | | | | | . | . | . | . | . | . | . |
| a ² | Capricorni | | | | | | | | . | . | . | . | . | . | . |
| κ | Cephei | | | | x | | | | | | | | | | |

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Tabulation of stars, &c.—Continued.

| Name of star. | | FORT UNION, NEW MEXICO. | | | | | | | SALT LAKE CITY, UTAH. | | | | | | |
|---------------|-----------------|-------------------------|------------|------------|------------|------------|------------|------------|-----------------------|------------|------------|------------|------------|------------|------------|
| | | August 14. | August 16. | August 18. | August 19. | August 25. | August 26. | August 27. | August 14. | August 15. | August 16. | August 18. | August 19. | August 25. | August 26. |
| β | Delphini | . | . | . | x | . | . | . | . | . | . | . | . | . | . |
| α | Delphini | x | . | . | . | . | . | . | . | . | . | . | . | . | . |
| α | Cygni | . | . | . | . | . | . | x | . | . | . | . | . | . | . |
| δ | Delphini | . | . | . | x | . | . | . | . | . | . | x | . | x | x |
| γ | Delphini | x | . | . | . | . | . | . | . | . | . | . | . | . | . |
| ϵ | Aquarii | . | . | . | . | . | . | . | . | . | . | . | . | x | x |
| ϵ | Cygni | . | . | . | x | . | . | . | . | . | . | . | . | . | . |
| η | Cephei | . | . | . | . | . | . | x | . | . | . | . | . | . | . |
| μ | Aquarii | . | . | . | . | . | . | . | x | . | . | . | . | . | . |
| ν | Cygni | . | . | . | . | . | . | x | x | . | . | . | . | x | x |
| ξ | Cygni | . | . | x | . | . | . | . | x | x | . | . | . | x | x |
| 61 | Cygni | . | . | . | . | . | . | . | . | . | . | . | . | x | x |
| ζ | Cygni | . | . | . | x | . | . | x | . | . | . | . | . | x | x |
| α | Equulei | . | . | . | . | . | . | x | . | . | . | . | . | . | . |
| α | Cephei | . | x | . | . | . | . | . | . | . | . | . | x | x | . |
| 1 | Pegasi | . | . | . | x | . | . | . | . | . | . | . | . | . | . |
| g | Cygni | . | x | . | . | . | . | . | x | . | . | . | . | . | . |
| β | Aquarii | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| β | Cephei | x | . | . | x | x | . | x | . | . | . | . | . | x | x |
| 74 | Cygni | . | x | . | . | . | . | . | . | . | . | . | . | . | . |
| ϵ | Pegasi | . | x | . | . | . | . | . | . | . | . | . | . | . | . |
| κ | Pegasi | . | . | x | . | . | . | . | . | . | . | . | . | . | . |
| 16 | Pegasi | x | . | x | . | x | . | x | . | . | . | . | . | . | . |
| 20 | Pegasi | x | . | x | . | x | . | x | . | . | . | . | . | . | . |
| α | Aquarii | . | . | . | . | . | . | . | x | . | . | . | . | . | . |
| ι | Pegasi | . | x | . | . | . | . | . | . | . | . | . | . | . | . |
| ζ | Cephei | . | x | . | . | . | . | . | . | . | . | . | . | . | . |
| 24 | Cephei | . | . | x | . | . | . | . | . | . | . | . | . | . | . |
| 31 | Pegasi | . | x | . | . | . | . | x | . | . | . | . | . | . | . |
| 3 | Lacertæ | x | . | . | . | . | . | . | . | . | . | . | . | . | . |
| δ | Cephei | . | x | . | . | . | . | . | . | . | . | . | . | . | . |
| 7 | Lacertæ | . | . | x | . | . | . | x | . | . | . | . | . | . | . |
| 31 | Cephei | . | x | x | . | . | . | . | . | . | . | . | . | . | . |
| η | Pegasi | x | . | . | . | . | . | x | . | . | . | . | . | . | . |
| λ | Pegasi | . | . | x | . | . | . | . | . | . | . | . | . | . | . |
| μ | Pegasi | x | . | x | . | . | . | . | . | . | . | . | . | . | . |
| ι | Cephei | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| β | Pegasi | . | . | . | . | . | . | x | . | . | . | . | . | . | . |
| α | Pegasi | . | x | . | . | . | . | . | . | . | . | . | . | . | . |
| τ | Pegasi | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| ν | Pegasi | . | . | . | . | . | . | x | . | . | . | . | . | . | . |
| 70 | Pegasi | . | x | . | . | . | . | . | . | . | . | . | . | . | . |
| γ | Cephei | . | x | . | . | . | . | . | . | . | . | . | . | . | . |
| ω | Piscium | . | x | . | . | . | . | . | . | . | . | . | . | . | . |
| α | Andromedæ | . | x | . | . | . | . | . | . | . | . | . | . | . | . |

Observations and reductions for time taken at sending station.

FORT UNION, NEW MEXICO, AUGUST 14, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|-------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | <i>θ</i> Cephei | 10 51 55.10 | + 6.91 | + 0.82 | - 3.54 | 10 51 59.29 | 20 27 29.46 | +9 35 30.17 |
| E. | <i>α</i> Delphini | 58 20.07 | - 2.57 | + 0.50 | - 1.69 | 58 16.31 | 33 46.69 | 30.38 |
| E. | <i>γ</i> Delphini | 11 05 21.87 | - 2.56 | + 0.55 | - 1.69 | 11 05 18.17 | 40 48.20 | 30.03 |
| W. | <i>β</i> Cephei | 51 18.80 | +11.64 | - 1.26 | + 4.77 | 51 33.95 | 21 27 03.97 | 30.02 |
| W. | 16 Pegasi | 12 11 49.05 | - 1.44 | - 0.54 | + 1.81 | 12 11 48.88 | 47 19.35 | 30.47 |
| W. | 20 Pegasi | 19 28.31 | - 2.89 | - 0.45 | + 1.67 | 19 26.64 | 54 56.54 | 29.90 |
| W. | 3 Lacertæ | 43 01.22 | + 3.10 | - 0.75 | + 2.63 | 43 06.20 | 22 18 36.56 | 30.36 |
| W. | <i>η</i> Pegasi | 13 01 34.62 | - 0.90 | - 0.58 | + 1.88 | 13 01 35.02 | 37 05.34 | 30.32 |
| W. | <i>μ</i> Pegasi | 13 08 25.09 | - 1.61 | - 0.56 | + 1.79 | 13 08 24.71 | 22 43 54.78 | +9 35 30.07 |

NORMAL EQUATIONS.

$$\begin{aligned}
0 &= +0.023 + 10.535 \delta t - 2.089 \delta c - 0.192 \delta a & \delta t &= -0^s.050 & \Delta T_0 &= +9^h 35^m 30^s.25 \\
0 &= -0.051 - 2.089 \delta t + 24.398 \delta c - 0.081 \delta a & \delta c &= -0^s.052 & c_0 &= -1^s.58 \\
0 &= -0.107 - 0.192 \delta t - 0.081 \delta c + 4.606 \delta a & \delta a &= +0^s.010 & a_0 &= -7^s.11
\end{aligned}$$

Weight of $\Delta T = 6.49$ Weight of $c = 12.08$ Weight of $a = 1.90$

FORT UNION, NEW MEXICO, AUGUST 16, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|--------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | <i>α</i> Cephei | 11 32 16.98 | - 2.95 | - 0.13 | + 3.42 | 11 32 17.32 | 21 15 35.55 | +9 43 18.23 |
| W. | <i>γ</i> Cygni | 41 28.65 | - 0.79 | - 0.05 | + 2.30 | 41 30.11 | 24 48.11 | 18.00 |
| W. | 74 Cygni | 48 34.12 | - 0.28 | - 0.02 | + 2.09 | 48 35.91 | 31 53.90 | 17.99 |
| W. | <i>ε</i> Pegasi | 11 54 38.06 | + 1.42 | 0.00 | + 1.62 | 11 54 41.10 | 21 37 59.30 | +9 43 18.20 |
| E. | <i>ι</i> Pegasi | 12 17 23.78 | + 14.19 | - 0.28 | - 1.76 | 12 17 35.93 | 22 01 08.28 | +9 43 32.35 |
| E. | <i>ζ</i> Cephei | 23 46.62 | - 45.78 | - 0.42 | - 3.98 | 22 57.44 | 06 29.56 | 32.12 |
| E. | 31 Pegasi | 31 19.97 | + 27.97 | - 0.20 | - 1.63 | 31 46.11 | 15 18.38 | 32.27 |
| E. | <i>δ</i> Cephei | 41 47.77 | - 46.43 | - 0.29 | - 3.00 | 40 58.05 | 24 30.12 | 32.07 |
| E. | 31 Cephei | 51 31.89 | -136.96 | - 0.27 | - 5.47 | 49 09.19 | 32 41.30 | 32.11 |
| E. | <i>α</i> Pegasi | 13 14 32.94 | + 25.05 | - 0.09 | - 1.65 | 13 14 56.25 | 58 28.46 | 32.21 |
| W. | 70 Pegasi | 38 45.65 | + 27.49 | - 0.69 | + 1.64 | 39 14.09 | 23 22 46.22 | 32.13 |
| W. | <i>γ</i> Cephei | 53 45.35 | -192.85 | - 2.90 | + 7.07 | 50 36.67 | 34 09.06 | 32.39 |
| W. | <i>ω</i> Piscium | 14 08 43.57 | + 33.18 | - 0.76 | + 1.61 | 14 09 17.60 | 52 49.59 | 31.99 |
| W. | <i>α</i> Andromedæ | 14 18 08.62 | + 9.88 | - 0.86 | + 1.82 | 14 18 19.46 | 23 01 51.69 | +9 43 32.23 |

NORMAL EQUATIONS.

First series.

$$\begin{aligned}
0 &= +0^s.046 + 3.207 \delta t - 0.346 \delta a & \delta t &= -0.003 & \Delta T_0 &= +9^h 43^m 18^s.10 & \text{Weight of } \Delta T &= 3.05 \\
0 &= -0^s.077 - 0.346 \delta t + 0.748 \delta a & \delta a &= +0.101 & a_0 &= +3^s.037 & a &= 0.71
\end{aligned}$$

Second series.

$$\begin{aligned}
0 &= +0^s.767 + 7.328 \delta t + 2.367 \delta c + 0.164 \delta a & \delta t &= -0^s.135 & \Delta T_0 &= +9^h 43^m 32^s.32 \\
0 &= -1^s.186 + 2.367 \delta t + 17.752 \delta c - 1.118 \delta a & \delta c &= +0^s.089 & c_0 &= -1^s.69 \\
0 &= -0^s.126 + 0.164 \delta t - 1.118 \delta c + 3.858 \delta a & \delta a &= +0^s.064 & a_0 &= +66^s.42
\end{aligned}$$

Weight of $\Delta T = 6.99$ Weight of $c = 16.63$ Weight of $a = 3.77$

N. B.—The value of $c = -1^s.601$ was taken from the observations after ϵ Pegasi. The instrument was somewhat disturbed by the reversal, and, in attempting its adjustment, it was put much more out in azimuth.

Observations and reductions for time taken at sending station—Continued.

FORT UNION, NEW MEXICO, AUGUST 18, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|--------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | ε Ursæ Minoris.... | 7 08 46.69 | -18.86 | + 0.13 | + 5.62 | 7 08 33.78 | 16 59 05.22 | +9 50 31.44 |
| W. | ζ Draconis | 17 57.02 | - 4.29 | 0.00 | + 1.85 | 17 54.58 | 17 08 26.87 | 32.29 |
| W. | α Ophiuchi..... | 38 29.75 | + 1.42 | - 0.02 | + 0.78 | 38 31.93 | 29 04.11 | 32.18 |
| W. | α Lyræ | 8 42 07.48 | - 0.22 | + 0.10 | + 0.97 | 8 42 08.33 | 18 33 40.23 | 31.90 |
| E. | ο Draconis | 58 52.92 | - 2.72 | + 0.72 | - 1.48 | 58 49.44 | 49 21.56 | 32.12 |
| E. | ε Aquilæ | 9 03 20.67 | + 1.30 | + 0.38 | - 0.78 | 9 03 21.57 | 53 53.58 | 32.01 |
| E. | ζ Aquilæ | 9 09 03.46 | + 1.37 | + 0.37 | - 0.78 | 9 09 04.42 | 18 59 36.42 | +9 50 32.00 |
| E. | ξ Cygni | 11 09 11.29 | - 0.63 | + 0.46 | - 0.92 | 11 09 10.20 | 21 00 21.05 | +9 51 10.85 |
| E. | κ Pegasi | 47 44.59 | + 0.72 | + 0.44 | - 0.74 | 47 45.01 | 58 55.97 | 10.96 |
| E. | 16 Pegasi | 56 07.92 | + 0.71 | + 0.45 | - 0.74 | 56 81.34 | 47 19.38 | 11.04 |
| E. | 20 Pegasi | 12 03 44.45 | + 1.43 | + 0.41 | - 0.68 | 12 03 45.61 | 54 56.57 | 10.96 |
| E. | 24 Cephei | 16 21.03 | - 6.53 | + 1.26 | - 2.13 | 16 13.63 | 22 07 25.12 | 11.49 |
| W. | 7 Lacertæ..... | 34 55.32 | - 1.28 | + 0.10 | + 1.03 | 34 55.17 | 26 06.08 | 10.91 |
| W. | 31 Cephei | 41 35.53 | - 7.22 | + 0.13 | + 2.29 | 41 30.73 | 32 41.33 | 10.60 |
| W. | λ Pegasi | 49 14.38 | + 0.86 | + 0.03 | + 0.72 | 49 15.99 | 40 27.21 | 11.22 |
| W. | μ Pegasi | 12 52 41.85 | + 0.79 | + 0.02 | + 0.73 | 12 52 43.39 | 22 43 54.84 | +9 51 11.45 |

NORMAL EQUATIONS.

First series.

$$\begin{aligned}
 0 &= -0^s.321 + 4.544 \delta t - 0.690 \delta c - 0.185 \delta a & \delta t &= + 0^s.057 & \Delta T_0 &= + 9^h 50^m 32^s.00 \\
 0 &= + 1^s.044 - 0.690 \delta t + 11.290 \delta c + 2.498 \delta a & \delta c &= + 0^s.098 & c_0 &= - 0^s.66 \\
 0 &= + 0^s.149 - 0.185 \delta t + 2.498 \delta c + 2.642 \delta a & \delta a &= + 0^s.041 & a_0 &= + 3^s.477
 \end{aligned}$$

Weight of $\Delta T = 4.50$ Weight of $c = 8.89$ Weight of $a = 2.09$ *Second series.*

$$\begin{aligned}
 0 &= -0^s.007 + 6.091 \delta t + 0.364 \delta c - 0.308 \delta a & \delta t &= + 0^s.003 & \Delta T_0 &= + 9^h 51^m 11^s.08 \\
 0 &= + 0^s.112 + 0.364 \delta t + 13.595 \delta c - 0.020 \delta a & \delta c &= - 0^s.008 & c_0 &= - 0^s.66 \\
 0 &= -0^s.075 - 0.308 \delta t - 0.020 \delta c + 2.400 \delta a & \delta a &= + 0^s.031 & a_0 &= + 3^s.471
 \end{aligned}$$

Weight of $\Delta T = 6.04$ Weight of $c = 13.57$ Weight of $a = 2.38$

21 AST

Observations and reductions for time taken at sending station—Continued.

FORT UNION, NEW MEXICO, AUGUST, 19, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|-----------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | <i>ε</i> Ursæ Minoris . . . | 7 05 01.36 | —11.36 | —1.00 | —5.51 | 7 04 43.49 | 16 59 05.02 | +9 54 21.53 |
| E. | <i>δ</i> Herculis . . . | 15 29.44 | +0.44 | —0.21 | —0.82 | 15 28.85 | 17 09 50.50 | 21.65 |
| E. | <i>μ</i> Herculis . . . | 47 10.10 | +0.34 | —0.33 | —0.84 | 47 09.27 | 41 31.00 | 21.73 |
| E. | 67 Ophiuchi . . . | 59 57.34 | +1.15 | —0.27 | —0.74 | 59 57.48 | 54 19.00 | 21.52 |
| E. | <i>o</i> Herculis . . . | 8 08 16.63 | +0.30 | —0.40 | —0.85 | 8 08 15.68 | 18 02 37.10 | 21.42 |
| W. | <i>χ</i> Draconis . . . | 29 08.08 | —9.20 | —0.22 | +2.50 | 29 01.16 | 23 22.81 | 21.65 |
| W. | <i>α</i> Lyræ . . . | 38 18.23 | —0.28 | —0.08 | +0.95 | 38 18.82 | 32 40.21 | 21.39 |
| W. | 110 Herculis . . . | 45 50.08 | +1.30 | —0.05 | +0.79 | 45 52.12 | 40 13.83 | 21.71 |
| W. | <i>β</i> Lyræ . . . | 8 51 02.65 | +0.26 | —0.04 | +0.89 | 8 51 03.76 | 18 45 25.36 | +9 54 21.60 |
| W. | <i>κ</i> Cephei . . . | 10 18 29.23 | —11.85 | —0.70 | +3.35 | 10 18 20.03 | 20 13 10.99 | +9 54 50.96 |
| W. | <i>ζ</i> Delphini . . . | 34 31.47 | +1.50 | —0.16 | +0.76 | 34 33.57 | 29 24.47 | 50.90 |
| W. | <i>θ</i> Delphini . . . | 33 44.83 | +1.50 | —0.16 | +0.76 | 36 46.93 | 31 37.89 | 50.96 |
| W. | <i>δ</i> Delphini . . . | 42 41.07 | +1.47 | —0.15 | +0.76 | 42 43.15 | 37 34.11 | 50.96 |
| W. | <i>ε</i> Cygni . . . | 46 14.61 | +0.20 | —0.18 | +0.88 | 46 15.51 | 41 06.68 | 51.17 |
| E. | <i>ζ</i> Cygni . . . | 11 12 43.61 | +0.18 | +0.46 | —0.87 | 11 12 43.38 | 21 07 34.28 | 50.90 |
| E. | 1 Pegasi . . . | 21 24.15 | +0.45 | +0.47 | —0.78 | 21 24.29 | 16 15.16 | 50.87 |
| E. | <i>β</i> Cephei . . . | 11 32 16.40 | —2.42 | +1.19 | —2.15 | 11 32 13.02 | 21 27 03.93 | +9 54 50.91 |

NORMAL EQUATIONS.

First series.

Before reversal—

$$\begin{aligned}
 0 &= -0^s.071 + 3.606 \delta t + 4.365 dc + 0.581 da & \Delta T_0 &= +9^h 54^m 21^s.56 \\
 0 &= -0^s.128 + 4.365 \delta t + 7.917 dc - 1.663 da & a_0 &= +2^s.136 \\
 0 &= +0^s.037 + 0.581 \delta t - 1.663 dc + 2.266 da & c_0 &= -0^s.75
 \end{aligned}$$

After reversal—

$$\begin{aligned}
 0 &= +0^s.094 + 2.824 \delta t - 3.926 dc - 0.318 da & \Delta T_0 &= +9^h 54^m 21^s.56 \\
 0 &= -0^s.463 - 3.926 \delta t + 6.623 dc + 1.576 da & a_0 &= +4^s.272 \\
 0 &= -0^s.354 - 0.318 \delta t + 1.576 dc + 1.149 da & c_0 &= -0^s.75
 \end{aligned}$$

Eliminating both values of da —

$$\begin{aligned}
 0 &= -0^s.084 + 6.193 \delta t + 1.301 dc & \delta t &= +0^s.011 \\
 0 &= -0^s.078 + 1.301 \delta t + 11.157 dc & dc &= +0^s.006
 \end{aligned}$$

Before reversal $da = -0^s.015$
After reversal $da = +0^s.303$

Weight of $\Delta T = 6.04$ Weight of $c = 10.88$ *Second series.*

Before reversal—

$$\begin{aligned}
 0 &= +0^s.091 + 4.025 \delta t - 4.876 dc + 0.684 da & \Delta T_0 &= +9^h 54^m 50^s.94 \\
 0 &= +0^s.077 - 4.876 \delta t + 7.817 dc + 1.013 da & a_0 &= +4^s.272 \\
 0 &= +0^s.631 + 0.684 \delta t + 1.013 dc + 1.900 da & c_0 &= -0^s.75
 \end{aligned}$$

After reversal—

$$\begin{aligned}
 0 &= +0^s.103 + 2.268 \delta t + 3.159 dc - 0.290 da & \Delta T_0 &= +9^h 54^m 50^s.94 \\
 0 &= +0^s.159 + 3.159 \delta t + 5.444 dc - 1.305 da & a_0 &= +1^s.432 \\
 0 &= -0^s.024 - 0.290 \delta t - 1.305 dc + 1.082 da & c_0 &= -0^s.75
 \end{aligned}$$

Eliminating both values of da —

$$\begin{aligned}
 0 &= -0^s.039 + 5.970 \delta t - 2.432 dc & \delta t &= +0^s.012 \\
 0 &= -0^s.129 - 2.432 \delta t + 11.147 dc & dc &= +0^s.014
 \end{aligned}$$

Before reversal $da = -0^s.344$
After reversal $da = +0^s.042$

Weight of $\Delta T = 5.44$

Observations and reductions for time taken at sending station—Continued.

FORT UNION, NEW MEXICO, AUGUST 25, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|-----------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | β Cephei | 11 09 57.68 | -80.25 | + 0.55 | - 2.02 | 11 09 35.96 | 21 27 03.86 | +10 18 27.90 |
| E. | κ Pegasi | 20 18.56 | +10.16 | + 0.21 | - 0.77 | 20 28.16 | 38 55.99 | 27.83 |
| E. | 16 Pegasi | 28 42.22 | + 9.93 | + 0.17 | - 0.76 | 28 51.56 | 47 19.41 | 27.85 |
| E. | 20 Pegasi | 36 09.53 | +19.91 | + 0.13 | - 0.71 | 36 28.86 | 54 56.61 | 27.75 |
| E. | 24 Cephei | 50 30.47 | -91.30 | + 0.22 | - 2.21 | 48 57.18 | 22 07 25.10 | 27.92 |
| E. | 31 Pegasi | 56 30.77 | +20.59 | + 0.05 | - 0.71 | 56 50.71 | 15 18.45 | 27.74 |
| E. | 7 Lacertæ | 12 07 57.73 | -17.93 | + 0.03 | - 1.07 | 12 07 38.76 | 26 06.13 | 27.37 |
| E. | η Pegasi | 18 31.87 | + 6.22 | + 0.00 | - 0.80 | 18 37.29 | 37 05.46 | 28.17 |
| W. | ι Cephei | 27 42.68 | -59.50 | - 0.11 | + 1.67 | 26 44.74 | 45 12.80 | 28.06 |
| W. | β Pegasi | 39 02.79 | + 8.31 | - 0.08 | + 0.78 | 39 11.80 | 57 39.54 | 27.74 |
| W. | Br. 3077 | 49 16.37 | -31.69 | - 0.14 | + 1.25 | 48 45.79 | 23 07 13.30 | 27.51 |
| W. | τ Pegasi | 55 42.93 | +12.06 | - 0.09 | + 0.76 | 55 55.66 | 14 23.56 | 27.90 |
| W. | v Pegasi | 13 00 24.16 | +12.33 | - 0.10 | + 0.75 | 13 00 37.14 | 23 19 04.94 | +10 18 27.80 |

NOTE.—The Y's of the instrument were bent, as noticed in the Santa Fé report. Before the signals, a few stars were observed in the W. position of the clamp; but on reversing the axis it was found that the pivots did not rest properly in the Y's.

NORMAL EQUATIONS.

Before reversal—

$$\begin{aligned} 0 &= +0^s.682 + 6.221 \delta t + 8.341 dc - 0.087 da & \Delta T_0 &= +10^h 18^m 27^s.70 \\ 0 &= +1^s.087 + 8.341 \delta t + 13.500 dc - 2.507 da & a_0 &= +49^s.02 \\ 0 &= -0^s.198 - 0.087 \delta t - 2.507 dc + 2.538 da & c_0 &= -0^s.53 \end{aligned}$$

After reversal—

$$\begin{aligned} 0 &= -0^s.914 + 3.895 \delta t - 5.368 dc - 0.465 da & \Delta T_0 &= +10^h 18^m 27^s.70 \\ 0 &= +0^s.668 - 5.368 \delta t + 8.250 dc + 1.556 da & a_0 &= +49^s.02 \\ 0 &= -0^s.589 - 0.378 \delta t + 1.556 dc + 1.076 da & c_0 &= -0^s.53 \end{aligned}$$

Eliminating both values of da —

$$\begin{aligned} 0 &= -0^s.446 + 9.980 \delta t + 3.434 dc & \delta t &= +0^s.100 \\ 0 &= +2^s.411 + 3.434 \delta t + 17.022 dc & dc &= -0^s.162 \\ & & \text{Before reversal } da &= -0^s.078 \\ & & \text{After reversal } da &= +0^s.816 \end{aligned}$$

Weight of $\Delta T = 9.29$

Observations and reductions for time taken at sending station—Continued.

FORT UNION, NEW MEXICO, AUGUST 26, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|--------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | ε Ursæ Minoris... | 6 37 24.22 | + 4.28 | — 1.74 | — 5.22 | 6 37 21.54 | 16 59 03.80 | +10 21 42.26 |
| E. | δ Herculis | 48 10.05 | — 0.17 | — 0.37 | — 0.78 | 48 08.73 | 17 09 50.37 | 41.64 |
| E. | 72 Herculis | 54 15.77 | — 0.05 | — 0.42 | — 0.83 | 54 14.47 | 15 56.12 | 41.65 |
| E. | λ Herculis | 7 03 57.66 | — 0.15 | — 0.41 | — 0.78 | 7 03 56.32 | 25 37.81 | 41.49 |
| E. | ι Herculis | 14 14.16 | + 0.20 | — 0.56 | — 1.02 | 14 12.78 | 35 54.23 | 41.45 |
| E. | ψ Draconis | 22 33.73 | + 1.55 | — 1.08 | — 2.30 | 22 31.90 | 44 13.32 | 41.42 |
| W. | o Herculis | 40 54.06 | + 0.13 | + 0.41 | + 0.80 | 40 55.40 | 18 02 36.98 | 41.58 |
| W. | δ Ursæ Minoris... | 51 36.73 | —11.63 | + 3.34 | +11.90 | 51 40.34 | 13 20.93 | 40.59 |
| W. | 109 Herculis | 56 36.05 | + 0.23 | + 0.50 | + 0.76 | 56 37.34 | 18 18.96 | 41.62 |
| W. | χ Draconis | 8 01 39.46 | — 1.79 | + 0.70 | + 2.36 | 8 01 40.73 | 23 22.34 | 41.61 |
| W. | 110 Herculis | 18 31.03 | + 0.25 | + 0.18 | + 0.77 | 18 32.23 | 40 13.74 | 41.51 |
| W. | β Lyræ | 8 23 42.67 | + 0.05 | + 0.17 | + 0.84 | 8 23 43.73 | 18 45 25.24 | +10 21 41.51 |
| W. | η Cephei | 10 20 26.57 | — 0.33 | + 0.72 | + 1.56 | 10 20 28.52 | 20 42 44.71 | +10 22 16.19 |
| W. | ν Cygni | 30 11.38 | — 0.04 | + 0.46 | + 0.99 | 30 12.79 | 52 28.62 | 15.83 |
| W. | ξ Cygni | 38 03.73 | — 0.07 | + 0.44 | + 1.03 | 38 05.13 | 21 00 21.01 | 15.88 |
| W. | α Equulei | 47 13.93 | + 0.19 | + 0.25 | + 0.75 | 47 15.12 | 09 30.94 | 15.82 |
| E. | β Cephei | 11 04 49.83 | — 0.60 | + 0.96 | — 2.20 | 11 04 47.99 | 27 03.84 | 15.85 |
| E. | κ Pegasi | 16 40.35 | + 0.08 | + 0.51 | — 0.83 | 16 40.11 | 38 55.99 | 15.88 |
| E. | 16 Pegasi | 25 03.76 | + 0.07 | + 0.56 | — 0.83 | 25 03.56 | 47 19.41 | 15.85 |
| E. | α Aquarii | 11 37 02.19 | + 0.22 | + 0.38 | — 0.75 | 11 37 02.04 | 21 59 18.18 | +10 22 16.14 |

NORMAL EQUATIONS.

First series.

Before reversal—

$$\begin{aligned} 0 &= +0^s.477 + 3.860 \delta t + 5.466 dc - 0.531 da & \Delta T_0 &= +10^h 21^m 41^s.68 \\ 0 &= +0^s.732 + 5.466 \delta t + 10.098 dc - 2.950 da & c_0 &= -0^s.71 \\ 0 &= -0^s.137 - 0.531 \delta t - 2.950 dc + 2.142 da & a_0 &= -0^s.84 \end{aligned}$$

After reversal—

$$\begin{aligned} 0 &= +0^s.519 + 4.050 \delta t - 5.173 dc + 0.039 da & \Delta T_0 &= +10^h 21^m 41^s.68 \\ 0 &= -0^s.575 - 5.173 \delta t + 8.606 dc + 1.684 da & c_0 &= -0^s.71 \\ 0 &= +0^s.103 + 0.039 \delta t + 1.684 dc + 1.760 da & a_0 &= +0^s.95 \end{aligned}$$

Eliminating both values of da —

$$\begin{aligned} 0 &= +0^s.960 + 7.777 \delta t - 0.475 dc & \delta t &= -0^s.123 \\ 0 &= -0^s.130 - 0.475 \delta t + 13.031 dc & dc &= +0^s.006 \end{aligned}$$

Before reversal $da = +0^s.042$

After reversal $da = -0^s.061$

Weight of $\Delta T = 7.76$

Weight of $c = 13.01$

Second series.

$$\begin{aligned} 0 &= -0^s.801 + 6.458 \delta t - 0.160 dc + 0.213 da & \delta t &= +0^s.119 & \Delta T_0 &= +10^h 22^m 15^s.80 \\ 0 &= +0^s.539 - 0.160 \delta t + 12.714 dc + 0.045 da & dc &= -0^s.041 & c_0 &= -0^s.71 \\ 0 &= -0^s.303 + 0.213 \delta t + 0.045 dc + 2.136 da & da &= +0^s.131 & a_0 &= +0^s.235 \end{aligned}$$

Weight of $\Delta T = 6.44$

Weight of $c = 12.71$

Weight of $a = 2.13$

Observations and reductions for time taken at sending station—Continued.

FORT UNION, NEW MEXICO, AUGUST 27, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|--------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | ε Ursæ Minoris... | 6 33 29.06 | — 7.26 | + 1.24 | + 4.50 | 6 33 27.54 | 16 59 03.62 | + 9 25 36.08 |
| W. | δ Herculis | 44 13.53 | + 0.28 | + 0.26 | + 0.67 | 44 14.74 | 17 09 50.35 | 35.61 |
| W. | α Ophiuchi | 7 03 26.98 | + 0.55 | + 0.20 | + 0.62 | 7 03 28.35 | 29 03.97 | 35.62 |
| W. | ι Herculis | 10 17.88 | — 0.34 | + 0.30 | + 0.88 | 10 18.72 | 35 54.21 | 35.49 |
| W. | μ Herculis | 15 54.20 | + 0.22 | + 0.23 | + 0.69 | 15 55.34 | 41 30.86 | 35.52 |
| W. | ζ Draconis | 25 45.57 | — 0.89 | + 0.34 | + 1.11 | 25 46.13 | 51 21.49 | 35.36 |
| E. | Α Herculis | 41 34.21 | + 0.07 | + 0.04 | — 0.71 | 41 33.61 | 18 07 09.17 | 35.56 |
| E. | δ Ursæ Minoris... | 48 03.85 | — 9.61 | + 0.68 | — 10.28 | 47 44.64 | 13 20.50 | 35.86 |
| E. | 109 Herculis | 52 43.74 | + 0.19 | + 0.09 | — 0.65 | 52 43.37 | 18 18.94 | 35.57 |
| E. | φ Draconis | 57 03.80 | — 1.33 | + 0.27 | — 1.90 | 57 00.84 | 22 36.46 | 35.62 |
| E. | 110 Herculis | 8 14 38.37 | + 0.21 | + 0.17 | — 0.65 | 8 14 38.10 | 40 13.73 | 35.63 |
| E. | β Lyræ | 8 19 50.34 | + 0.04 | + 0.20 | — 0.73 | 8 19 49.85 | 18 45 25.24 | + 9 25 35.39 |
| E. | κ Cephei | 9 47 10.07 | — 2.45 | + 0.78 | — 3.34 | 9 47 05.06 | 20 13 10.52 | + 10 26 05.46 |
| E. | ε Delphini | 10 01 06.18 | + 0.35 | + 0.19 | — 0.75 | 10 01 05.97 | 27 11.01 | 05.04 |
| E. | α Cygni | 11 04.47 | — 0.18 | + 0.24 | — 1.03 | 11 03.50 | 37 08.37 | 04.87 |
| E. | ν Cygni | 26 24.65 | — 0.09 | + 0.15 | — 0.97 | 26 23.74 | 52 28.61 | 04.87 |
| W. | ζ Cygni | 41 27.81 | + 0.10 | + 0.40 | + 0.84 | 41 29.15 | 21 07 34.26 | 05.11 |
| W. | ι Pegasi | 50 08.70 | + 0.25 | + 0.31 | + 0.78 | 50 10.04 | 16 15.16 | 05.12 |
| W. | β Cephei | 11 00 57.58 | — 1.33 | + 0.62 | + 2.14 | 11 00 59.01 | 27 03.82 | 04.81 |
| W. | κ Pegasi | 11 12 49.73 | + 0.17 | + 0.22 | + 0.81 | 11 12 50.93 | 21 38 55.99 | + 10 26 05.06 |

NORMAL EQUATIONS.

First series.

Before reversal—

$$\begin{aligned} 0 &= +0^s.986 + 4.384 \delta t - 5.797 \delta c - 0.118 \delta a \\ 0 &= -2^s.301 - 5.797 \delta t + 9.687 \delta c + 2.046 \delta a \\ 0 &= -1^s.034 - 0.118 \delta t + 2.046 \delta c + 1.838 \delta a \end{aligned}$$

After reversal—

$$\begin{aligned} 0 &= -0^s.086 + 3.938 \delta t + 5.013 \delta c + 0.125 \delta a \\ 0 &= -0^s.571 + 5.013 \delta t + 8.111 \delta c - 1.454 \delta a \\ 0 &= +0^s.397 + 0.125 \delta t - 1.454 \delta c + 1.528 \delta a \end{aligned}$$

Eliminating both values of δa —

$$\begin{aligned} 0 &= +0^s.802 + 8.304 \delta t - 0.534 \delta c & \delta t &= -0^s.091 & \Delta T_0 &= 10^h 25^m 35^s.63 \\ 0 &= -1^s.343 - 0.534 \delta t + 14.136 \delta c & \delta c &= +0^s.092 & c_0 &= -0^s.70 \\ & & \delta a' &= +0^s.454 & a_0 &= +0^s.90 \\ & & \delta a'' &= -0^s.165 & a_0 &= +0^s.90 \end{aligned}$$

Weight of $\Delta T = 8.28$

Weight of $c = 14.10$

Second series.

$$\begin{aligned} 0 &= -0^s.340 + 5.856 \delta t + 0.023 \delta c - 0.349 \delta a & \delta t &= +0^s.053 & \Delta T_0 &= 10^h 26^m 4^s.96 \\ 0 &= +0^s.367 + 0.023 \delta t + 13.853 \delta c - 1.054 \delta a & \delta c &= -0^s.033 & c_0 &= -0^s.70 \\ 0 &= +0^s.228 - 0.349 \delta t - 1.054 \delta c + 2.826 \delta a & \delta a &= -0^s.087 & a_0 &= +0^s.90 \end{aligned}$$

Weight of $\Delta T = 5.81$

Weight of $c = 13.46$

Weight of $a = 2.72$

Observations and reductions for time taken at receiving station.

SALT LAKE CITY, UTAH, AUGUST 14, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|--------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. κ | Ophiuchi..... | 8 44 35.67 | — 0.86 | + 0.06 | + 0.08 | 8 44 34.95 | 16 51 41.03 | +8 07 06.08 |
| E. δ | Herculis | 49 50.51 | — 0.24 | + 0.12 | + 0.09 | 49 50.48 | 56 56.48 | 06.00 |
| E. α ¹ | Herculis | 9 01 47.49 | — 0.75 | + 0.09 | + 0.08 | 9 01 46.91 | 17 08 53.11 | 06.20 |
| E. ν | Serpentis..... | 06 38.05 | — 1.34 | + 0.06 | + 0.08 | 06 36.85 | 13 43.02 | 06.17 |
| E. | Groom. 966, S. P.. | 15 45.94 | — 5.66 | — 0.18 | — 0.28 | 15 39.82 | 5 22 45.93 | 06.11 |
| E. α | Ophiuchi..... | 21 58.62 | — 0.73 | + 0.10 | + 0.08 | 21 58.07 | 17 29 04.15 | 06.18 |
| W. ω | Draconis | 30 35.49 | + 2.12 | + 0.29 | — 0.21 | 30 37.69 | 37 43.83 | 06.14 |
| W. μ | Herculis | 34 25.45 | — 0.41 | + 0.12 | — 0.08 | 34 25.08 | 41 31.10 | 06.02 |
| W. γ | Draconis | 46 34.77 | + 0.49 | + 0.17 | — 0.12 | 46 35.31 | 53 41.43 | 03.12 |
| W. 72 | Ophiuchi..... | 54 16.55 | — 0.86 | + 0.09 | — 0.08 | 54 15.70 | 18 01 21.65 | 05.95 |
| W. μ ¹ | Sagittarii..... | 59 07.84 | — 1.55 | + 0.05 | — 0.08 | 59 06.26 | 06 12.41 | 06.15 |
| W. η | Serpentis..... | 10 07 41.47 | — 1.12 | + 0.08 | — 0.08 | 10 07 40.35 | 18 14 46.33 | +8 07 05.98 |
| Mean at 17 ^h .5 local sidereal time | | | | | | | | +8 07 03.08 |

NORMAL EQUATIONS.

$$\begin{aligned}
 +12.00 \delta t + 6.70 a - 7.15 c &= -10.54 & \delta t &= +0^s.08 \\
 +6.70 \delta t + 16.92 a - 9.33 c &= -27.76 & a &= -1^s.630 \\
 -7.15 \delta t - 9.33 a + 35.18 c &= +17.31 & c &= +0^s.075
 \end{aligned}$$

SALT LAKE CITY, UTAH, AUGUST 15, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|--------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. α ¹ | Herculis | 9 01 47.33 | — 0.82 | + 0.03 | + 0.14 | 9 01 46.68 | 17 08 53.09 | +8 07 06.41 |
| E. ν | Serpentis..... | 06 37.95 | — 1.46 | + 0.03 | + 0.14 | 06 36.66 | 13 43.01 | 06.35 |
| E. | Groom. 966, S. P.. | 15 46.35 | — 6.18 | — 0.13 | — 0.52 | 15 39.52 | 22 46.03 | 06.51 |
| E. α | Ophiuchi..... | 21 58.49 | — 0.80 | + 0.04 | + 0.14 | 21 57.87 | 29 04.14 | 06.27 |
| E. ω | Draconis | 30 34.62 | + 2.31 | — 0.10 | + 0.38 | 30 37.21 | 37 43.77 | 06.56 |
| E. μ | Herculis | 34 24.96 | — 0.45 | — 0.09 | + 0.15 | 34 24.57 | 41 31.08 | 06.51 |
| W. γ | Draconis | 46 34.73 | + 0.53 | 0.00 | — 0.22 | 46 35.04 | 53 41.41 | 06.37 |
| W. 72 | Ophiuchi..... | 54 16.34 | — 0.94 | — 0.01 | — 0.14 | 54 15.25 | 18 01 21.64 | 06.39 |
| W. μ ¹ | Sagittarii..... | 59 07.86 | — 1.69 | — 0.02 | — 0.15 | 59 06.00 | 06 12.40 | 06.40 |
| W. η | Serpentis..... | 10 07 41.38 | — 1.23 | — 0.01 | — 0.14 | 10 07 40.00 | 14 46.33 | 06.33 |
| W. | Bradl. 2313 | 14 55.02 | — 1.51 | + 0.02 | — 0.14 | 14 53.39 | 21 59 80 | 06.41 |
| W. 1 | Aquilæ..... | 10 21 15.10 | — 1.35 | + 0.03 | — 0.14 | 10 21 13.64 | 18 28 19.91 | +8 07 06.27 |
| Mean at 18 ^h .0 local sidereal time | | | | | | | | +8 07 06.40 |

NORMAL EQUATIONS.

$$\begin{aligned}
 +12.00 \delta t + 7.63 a - 3.60 c &= -9.31 & \delta t &= +0^s.40 \\
 +7.63 \delta t + 17.92 a - 18.34 c &= -31.40 & a &= -1^s.780 \\
 -3.60 \delta t - 18.34 a + 34.80 c &= -36.10 & c &= +0^s.136
 \end{aligned}$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, AUGUST 18, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--|--|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | <i>ν</i> Serpentis | 9 06 38.42 | — 1.36 | — 0.01 | + 0.15 | 9 06 37.20 | 17 13 42.97 | +8 07 05.77 |
| E. | <i>α</i> Ophiuchi | 21 58.88 | — 0.80 | — 0.03 | + 0.15 | 21 58.20 | 29 04.10 | 05.90 |
| E. | <i>ω</i> Draconis | 30 35.50 | + 2.16 | — 0.22 | + 0.39 | 30 37.83 | 37 43.61 | 05.78 |
| E. | <i>μ</i> Herculis | 34 25.33 | — 0.42 | — 0.13 | + 0.16 | 34 24.94 | 41 31.03 | 06.09 |
| W. | <i>γ</i> Draconis | 46 35.00 | + 0.50 | + 0.12 | — 0.23 | 46 35.39 | 53 41.33 | 05.94 |
| W. | 72 Ophiuchi | 54 16.79 | — 0.88 | + 0.05 | — 0.14 | 54 15.82 | 18 01 21.61 | 05.79 |
| W. | <i>μ</i> ¹ Sagittarii | 59 08.23 | — 1.58 | + 0.02 | — 0.15 | 59 06.52 | 06 12.37 | 05.85 |
| W. | <i>η</i> Serpentis | 10 07 41.77 | — 1.15 | + 0.04 | — 0.14 | 10 07 40.52 | 14 46.30 | 05.78 |
| W. | Bradl. 2313 | 14 55.51 | — 1.41 | + 0.05 | — 0.15 | 14 54.00 | 21 59.77 | 05.77 |
| W. | 1 Aquilæ | 10 21 15.34 | — 1.26 | + 0.07 | — 0.14 | 10 21 14.01 | 18 28 19.89 | +8 07 05.88 |
| Mean at 17 ^h .5 local sidereal time | | | | | | | | +8 07 05.85 |

NORMAL EQUATIONS.

$$\begin{aligned}
 +10.00 \delta t + 3.73 a - 0.78 c &= -7.75 & \delta t &= -0^s.15 \\
 +3.73 \delta t + 5.70 a - 5.43 c &= -10.83 & a &= -1^s.660 \\
 -0.78 \delta t - 5.43 a + 18.92 c &= +11.83 & c &= +0^s.142
 \end{aligned}$$

SALT LAKE CITY, UTAH, AUGUST 18, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|---|--|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | <i>β</i> Aquilæ | 11 42 01.93 | — 1.03 | + 0.06 | — 0.15 | 11 42 00.81 | 19 49 03.76 | +8 07 05.95 |
| W. | <i>θ</i> Aquilæ | 57 42.81 | — 1.21 | + 0.06 | — 0.15 | 57 41.51 | 20 04 47.44 | 05.93 |
| W. | <i>α</i> ² Capricorni | 12 03 58.60 | — 1.49 | + 0.03 | — 0.15 | 12 03 57.02 | 10 02.98 | 05.96 |
| W. | <i>π</i> Capricorni | 13 01.64 | — 1.64 | + 0.05 | — 0.15 | 13 59.90 | 20 05.71 | 05.81 |
| W. | <i>ε</i> Delphini | 20 05.97 | — 0.92 | + 0.09 | — 0.15 | 20 04.99 | 27 11.03 | 05.04 |
| E. | <i>α</i> Cygni | 30 01.90 | + 0.15 | + 0.24 | + 0.21 | 30 02.50 | 37 08.45 | 05.95 |
| E. | <i>μ</i> Aquarii | 38 45.91 | — 1.40 | + 0.09 | + 0.15 | 38 44.75 | 45 50.70 | 05.95 |
| E. | <i>ν</i> Cygni | 12 45 22.35 | 0.00 | + 0.16 | + 0.20 | 12 45 22.71 | 20 52 23.62 | +8 07 05.91 |
| Mean at 20 ^h local sidereal time | | | | | | | | +8 07 05.94 |

NORMAL EQUATIONS.

$$\begin{aligned}
 +8.00 \delta t + 4.18 a - 1.37 c &= -8.23 & \delta t &= -0^s.06 \\
 +4.18 \delta t + 3.16 a - 2.90 c &= -6.42 & a &= -1^s.800 \\
 -1.37 \delta t - 2.90 a + 9.97 c &= +6.82 & c &= +0^s.152
 \end{aligned}$$

The observations for time taken at Salt Lake City August 16, 19, 25 and 26 are printed in the report on Labran, Colorado.

The following tables show the corrections and rates of the chronometers used at Fort Union and Salt Lake City:

CHRONOMETER AT FORT UNION.—FRODSHAM, No. 1974.

| Date. | Local sidereal time. | Correction of chronometer. | Adopted hourly rate. |
|---------|----------------------|----------------------------|----------------------|
| 1873. | <i>h.</i> | <i>h. m. s.</i> | <i>s.</i> |
| Aug. 14 | 21.5 | 9 35 30.200±0.041 | +9.725 |
| Aug. 16 | 22.5 | 43 27.489±0.033 | 9.766 |
| Aug. 18 | 20.0 | 50 51.570±0.033 | 9.775 |
| Aug. 19 | 19.0 | 54 36.352±0.031 | 9.792 |
| Aug. 25 | 22.0 | 10 18 27.800±0.034 | 9.750 |
| Aug. 26 | 19.75 | 21 58.738±0.028 | 9.752 |
| Aug. 27 | 19.50 | 10 25 50.276±0.029 | 9.772 |

CHRONOMETER AT SALT LAKE CITY.—NEGUS, No. 1511.

| Date. | Local sidereal time. | Correction of chronometer. | Adopted hourly rate. |
|---------|----------------------|----------------------------|----------------------|
| 1873. | <i>h.</i> | <i>h. m. s.</i> | <i>s.</i> |
| Aug. 14 | 17.5 | + 8 07 06.08 | — 0.013 |
| Aug. 15 | 18.0 | | 03.40 |
| Aug. 16 | 19.0 | | 06.05 |
| Aug. 18 | 18.8 | | 05.90 |
| Aug. 19 | 20.0 | | 06.04 |
| Aug. 25 | 19.5 | | 04.37 |
| Aug. 26 | 19.5 | + 8 07 04.16 | + 0.009 |

NOTE.—The probable error of a star at the equator was found to be $\pm 0^{\circ}.105$ by the combination of all the observations.

Final results of longitude.

| Signals sent from— | Recorded at— | Mean of signals sent and received. | Time-corrections. | Corrected time. | Difference of longitude. | Double wave time. | Means. |
|--------------------|-----------------|------------------------------------|-------------------|-----------------|--------------------------|-------------------|--------------|
| | | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> | <i>s.</i> | <i>m. s.</i> |
| August 14, 1873: | | | | | | | |
| Fort Union | Fort Union | 10 02 50.00 | + 9 35 12.05 | 19 38 02.05 | | | |
| | Salt Lake City. | 11 03 24.66 | + 8 07 06.10 | 19 10 30.76 | 27 31.29 | | |
| | Fort Union | 10 13 57.53 | + 9 35 13.86 | 19 49 11.39 | | | |
| Salt Lake City. } | Salt Lake City. | 11 14 33.76 | + 8 07 06.10 | 19 21 39.86 | 31.53 | 0.24 | 27 31.410 |
| August 16, 1873: | | | | | | | |
| Salt Lake City. } | Fort Union | 9 33 41.54 | + 9 42 56.99 | 19 22 38.53 | | | |
| | Salt Lake City. | 10 48 00.77 | + 8 07 06.05 | 18 55 03.82 | 31.71 | | |
| | Fort Union | 9 54 38.18 | + 9 42 59.43 | 19 37 37.61 | | | |
| Fort Union } | Salt Lake City. | 11 03 00.32 | + 8 07 06.05 | 19 10 06.37 | 31.24 | 0.47 | 31.475 |
| August 18, 1873: | | | | | | | |
| Salt Lake City. } | Fort Union | 10 01 15.35 | + 9 50 50.28 | 19 52 05.63 | | | |
| | Salt Lake City. | 11 17 28.11 | + 8 07 05.90 | 19 24 34.01 | 31.62 | | |
| | Fort Union | 10 11 30.00 | + 9 50 52.44 | 20 05 22.44 | | | |
| Fort Union } | Salt Lake City. | 11 30 45.24 | + 8 07 05.90 | 19 37 51.14 | 27 31.30 | 0.32 | 27 31.460 |

Final results of longitude—Continued.

| Signals sent from— | Recorded at— | Mean of signals sent and received. | Time-corrections. | Corrected time. | Difference of longitude. | Double-wave time. | Means. |
|--------------------|-----------------|------------------------------------|-------------------|-----------------|--------------------------|-------------------|--------------|
| August 25, 1873: | | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> | <i>s.</i> | <i>m. s.</i> |
| Salt Lake City { | Fort Union | 10 20 18.39 | +10 18 14.57 | 20 38 32.96 | | | |
| | Salt Lake City. | 12 03 56.96 | + 8 07 04.36 | 20 11 01.32 | 27 31.64 | | |
| Fort Union } | Fort Union | 10 25 00.00 | +10 18 15.30 | 20 43 15.30 | | | |
| | Salt Lake City. | 12 08 39.68 | + 8 07 04.36 | 20 15 44.04 | 27 31.26 | 0.38 | 27 31.450 |

Fort Union east of Salt Lake City. 0^h 27^m 31^s.45 ± 0^s.009
 Adopted longitude of Salt Lake City 7^h 27^m 34^s.86
 Fort Union west of Greenwich..... 7^h 00^m 03^s.41, or 105° 00' 51".15
 Fort Union west of Washington 1^h 51^m 51^s.29, or 27° 57' 49".35

Mean places of stars for 1873.0 used for determination of latitude of Fort Union, New Mexico.

| No. of pair. | No. in B. A. C. | Right ascension. | Declination. | No. of pair. | No. in B. A. C. | Right ascension. | Declination. |
|--------------|-----------------|------------------|--------------|--------------|-----------------|------------------|--------------|
| | | <i>h. m. s.</i> | <i>° ' "</i> | | | <i>h. m. s.</i> | <i>° ' "</i> |
| 1..... | 6006 | 17 37 42 | 68 48 58.70 | 22..... | 7105 | 20 28 40 | 56 20 56.96 |
| | 6020 | 41 31 | 2 45 24.30 | | 7149 | 33 44 | 15 27 55.44 |
| 2..... | 6091 | 17 53 39 | 51 30 16.38 | | 7176 | 20 37 36 | 60 02 47.64 |
| | 6159 | 18 03 24 | 20 01 37.50 | 23..... | 7223 | 43 35 | 12 04 18.22 |
| 3..... | (Gr. 2494) | 17 55 15 | 45 29 04.32 | | 7188 | 20 39 23 | 24 49 02.94 |
| | 6151 | 18 02 42 | 26 04 55.72 | 24..... | 7198 | 40 25 | 46 50 12.56 |
| 4..... | 6203 | 18 11 42 | 42 07 01.44 | | (XX 358) | 20 46 05 | 27 46 26.00 |
| | 6232 | 14 58 | 29 36 45.28 | 25..... | 7253 | 48 45 | 43 54 26.14 |
| 5..... | 6237 | 18 16 04 | 29 47 59.32 | | 7275 | 20 52 36 | 21 50 10.50 |
| | (Gr. 2563) | 20 15 | 42 23 58.10 | 26..... | 7294 | 54 26 | 49 58 09.92 |
| 6..... | 6302 | 18 23 20 | 72 40 37.00 | | 7368 | 21 07 32 | 29 42 25.30 |
| | 6307 | 25 24 | 1 05 28.20 | 27..... | (Gr. 3424) | 12 34 | 42 09 08.02 |
| 7..... | 6438 | 18 46 51 | 21 16 24.66 | | 7324 | 21 04 10 | 9 37 15.80 |
| | 6470 | 50 05 | 50 33 04.20 | 28..... | 7416 | 15 33 | 62 02 51.86 |
| 8..... | 6500 | 18 55 23 | 58 03 02.80 | | 7418 | 21 16 13 | 19 15 43.66 |
| | 6528 | 59 35 | 13 40 34.58 | 29..... | 7468 | 22 34 | 52 20 50.98 |
| 9..... | 6566 | 19 05 19 | 50 09 34.52 | | 7444 | 21 18 56 | 25 37 44.78 |
| | 6574 | 07 10 | 21 20 31.60 | 30..... | 7455 | 20 40 | 46 09 53.74 |
| 10..... | 6602 | 19 12 21 | 22 47 54.24 | | 7493 | 21 27 01 | 70 00 11.44 |
| | 6626 | 15 15 | 49 20 04.46 | 31..... | 7527 | 33 07 | 1 40 25.38 |
| 11..... | 6678 | 19 23 48 | 20 01 10.64 | | 7542 | 21 34 31 | 61 30 34.18 |
| | 6697 | 26 30 | 51 27 35.72 | 32..... | 7553 | 36 21 | 10 14 46.14 |
| 12..... | 6690 | 19 25 36 | 27 41 40.22 | | 7567 | 21 38 30 | 16 46 07.36 |
| | 6731 | 32 42 | 44 24 56.30 | 33..... | 7631 | 47 44 | 55 12 00.92 |
| 13..... | (*) | 19 32 27 | 29 19 42.56 | | 7664 | 21 54 54 | 12 30 44.60 |
| | 6745 | 35 18 | 42 31 33.70 | 34..... | 7698 | 22 00 04 | 59 15 04.56 |
| 14..... | 6762 | 19 38 44 | 26 49 58.24 | | 7742 | 22 05 43 | 15 24 56.48 |
| | 6779 | 41 00 | 44 49 18.34 | 35..... | 7754 | 07 14 | 56 12 30.64 |
| 15..... | 6799 | 19 43 44 | 47 35 40.54 | | 7807 | 22 17 33 | 20 12 25.96 |
| | 6835 | 49 08 | 23 59 16.08 | 36..... | 7815 | 18 34 | 51 35 35.94 |
| 16..... | 6824 | 19 47 26 | 52 39 58.84 | | 7850 | 22 25 00 | 42 28 22.38 |
| | 6858 | 53 07 | 19 08 54.82 | 37..... | 7923 | 37 03 | 20 33 27.72 |
| 17..... | (Gr. 2977) | 19 51 17 | 47 12 18.48 | | 7961 | 22 44 32 | 55 13 45.34 |
| | 6883 | 56 38 | 24 35 01.68 | 38..... | 7975 | 46 47 | 16 10 04.62 |
| 18..... | 6895 | 19 57 46 | 49 45 07.30 | | 8058 | 23 01 51 | 45 42 04.78 |
| | 6927 | 20 03 11 | 21 47 09.14 | 39..... | 8079 | 05 30 | 26 09 42.44 |
| 19..... | 6918 | 20 01 40 | 51 28 32.38 | | 8097 | 09 34 | 27 33 21.26 |
| | 6933 | 04 20 | 20 32 21.06 | 40..... | 8110 | 11 18 | 44 28 25.30 |
| 20..... | 6941 | 20 05 28 | 20 45 28.82 | | 8153 | 23 16 53 | 59 26 14.62 |
| | 6959 | 09 00 | 51 04 56.40 | 41..... | 8182 | 23 22 44 | 12 03 35.63 |
| 21..... | 6943 | 20 06 29 | 26 25 52.82 | | 6231 | 18 14 56 | 21 51 33.56 |
| | (Gr. 3110) | 11 53 | 45 11 30.36 | 5 bis..... | 6252 | 17 56 | 49 39 50.26 |

* A star following B. A. C. 6714.

Observations and computations for latitude.

FORT UNION, NEW MEXICO.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half sum of declination. | Corrections. | | Latitude. |
|--------------------|------------------|---|------------------------|------------------------|----------|--------------------------|-------------------|---------|-------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1873. August 24 | Gr. 2494 6151 | <i>t.</i> 34 <i>d.</i> 30.7 26 72.2 | <i>d.</i> 36.0 41.0 | <i>d.</i> 28.0 43.5 | | ° ' " | ' " " | " | ° ' " |
| | 6231 6251 | 29 92.0 26 93.0 | 35.0 49.5 | 49.5 35.0 | | | | | |
| | 6438 6470 | 23 57.5 24 27.0 | 29.0 52.0 | 57.0 35.0 | | 35 54 53.58 | — 0 22.37 | — 3.00 | 35 54 28.21 |
| | 6500 6528 | 21 43.0 26 08.3 | 42.7 32.5 | 43.7 54.0 | | 35 51 57.36 | + 2 29.76 | — 6.40 | 20.72 |
| | 6690 6731 | 19 70.0 36 64.2 | 56.0 40.0 | 30.0 47.0 | | 36 03 28.01 | — 9 05.28 | + 5.18 | 27.91 |
| | 6762 6779 | 26 46.0 17 93.0 | 49.0 41.5 | 37.5 45.0 | | 35 49 48.04 | + 4 34.53 | + 2.18 | 24.75 |
| | 6824 6858 | 25 79.0 20 60.3 | 35.5 35.0 | 51.5 52.0 | | 54 36.42 | — 0 06.02 | — 8.99 | 21.41 |
| | 7105 7149 | 23 37.2 22 66.7 | 54.0 27.0 | 6.0 33.0 | | 35 54 35.71 | — 0 22.69 | + 11.44 | 24.46 |
| | 7176 7223 | 28 27.0 11 17.7 | 30.5 22.0 | 29.5 38.0 | | 36 03 42.30 | — 9 10.14 | — 1.36 | 30.80 |
| | 7275 7294 | 15 43.6 15 81.1 | 50.0 41.0 | 9.5 18.0 | | 35 54 19.40 | — 0 12.07 | + 17.30 | 24.63 |
| | 7324 7416 | 23 54.2 14 94.4 | 23.5 44.0 | 36.0 16.0 | | 50 12.81 | + 4 04.54 | + 4.22 | 21.57 |
| | 7444 7455 | 20 80.2 18 90.4 | 32.5 24.0 | 27.0 35.0 | | 53 59.16 | + 0 28.90 | — 1.50 | 26.56 |
| | 7493 7527 | 10 40.5 17 61.4 | 36.7 32.0 | 22.5 28.0 | | 50 27.18 | + 3 52.02 | + 4.93 | 24.16 |
| August 28 | 6438 6470 | 17 40.0 18 35.4 | 35.0 39.0 | 38.7 35.0 | | 54 54.27 | — 0 30.71 | + 0.08 | 23.61 |
| | 6500 6528 | 20 39.5 24 81.6 | 48.0 33.0 | 26.0 41.0 | | 51 57.95 | + 2 23.25 | + 3.82 | 25.02 |
| | 6673 6697 | 30 52.9 12 09.5 | 52.5 24.0 | 23.0 52.0 | | 44 13.30 | + 9 53.30 | + 1.77 | 28.37 |
| | 6762 6779 | 33 08.9 24 73.7 | 32.0 52.0 | 45.0 18.5 | | 49 48.83 | + 4 28.81 | + 7.22 | 24.89 |
| | 6799 6835 | 14 85.5 27 75.5 | 19.0 35.0 | 57.0 41.0 | | 47 34.86 | + 6 55.19 | — 11.99 | 22.03 |
| | 6895 6927 | 14 24.2 23 62.5 | 24.0 35.0 | 53.0 42.3 | | 35 46 18.78 | + 8 15.10 | — 9.80 | 35 51 27.99 |

LATITUDE DETERMINATIONS.

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Observations and computations—Continued.

FORT UNION, NEW MEXICO.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|--------------------|-----------------|---------------------------|-----------|-----------|----------|--------------------------|-------------------|----------|--------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1873. August 28 | | <i>t. d.</i> <i>d.</i> | <i>d.</i> | <i>d.</i> | | <i>o ' "</i> | <i>' "</i> | <i>"</i> | <i>o ' "</i> |
| | 6943 | 26 70.6 | 36.0 | 41.0 | | | | | |
| | Gr. 3110 | 16 45.5 | 29.2 | 48.8 | | 35 48 52.33 | + 5 29.93 | — 6.70 | 35 54 15.56 |
| | 7105 | 22 74.0 | 52.3 | 26.7 | | | | | |
| | 7149 | 22 23.5 | 35.0 | 45.0 | | 54 36.60 | — 0 16.25 | + 4.25 | 24.60 |
| | 7188 | 23 57.2 | 41.0 | 39.0 | | | | | |
| | 7198 | 15 97.4 | 38.0 | 42.0 | | 49 48.53 | + 4 36.73 | — 0.54 | 24.72 |
| | P.XX. 358 | 25 04.0 | 53.0 | 27.0 | | | | | |
| | 7253 | 28 12.6 | 31.6 | 48.2 | | 50 37.02 | + 3 42.53 | + 2.29 | 21.84 |
| | 7275 | 22 38.4 | 49.5 | 30.5 | | | | | |
| | 7294 | 22 35.6 | 37.0 | 42.8 | | 54 20.36 | + 0 00.90 | + 3.60 | 24.86 |
| | 7324 | 23 51.7 | 39.3 | 20.7 | | | | | |
| | 7416 | 15 68.7 | 44.0 | 37.0 | | 50 13.74 | + 4 12.01 | + 1.53 | 27.28 |
| | 7444 | 20 43.7 | 59.0 | 21.5 | | | | | |
| | 7455 | 20 00.2 | 45.5 | 35.0 | | 54 00.18 | + 0 14.00 | +13.08 | 27.26 |
| | 7542 | 18 34.5 | 45.2 | 35.5 | | | | | |
| | 7553 | 21 03.4 | 50.3 | 30.7 | | 52 49.15 | + 1 26.54 | + 7.98 | 23.67 |
| | 7664 | 23 24.5 | 49.0 | 33.0 | | | | | |
| | 7698 | 20 81.6 | 34.0 | 48.5 | | 53 04.84 | + 1 18.17 | + 0.41 | 23.42 |
| August 29 | 6006 | — 86.7 | 32.0 | 36.0 | | | | | |
| | 6020 | 27 23.3 | 46.0 | 23.0 | | | | | |
| | 6091 | 14 39.7 | 19.0 | 51.0 | | | | | |
| | 6059 | 30 27.2 | 27.5 | 43.0 | | 46 05.98 | + 8 30.93 | —12.94 | 23.97 |
| | 6203 | 19 25.0 | 39.0 | 32.0 | | | | | |
| | 6232 | 23 50.5 | 35.0 | 36.0 | | 52 03.16 | + 2 16.95 | + 1.64 | 21.75 |
| | 6302 | 14 73.2 | 37.0 | 35.0 | | | | | |
| | 6307 | 27 47.2 | 23.3 | 49.0 | | 47 41.47 | + 6 50.04 | — 6.46 | 25.05 |
| | 6438 | 22 10.0 | 41.0 | 32.0 | | | | | |
| | 6470 | 22 96.7 | 29.0 | 24.0 | | 54 54.44 | — 0 27.90 | — 1.64 | 24.90 |
| | 6500 | 20 37.9 | 41.0 | 32.0 | | | | | |
| | 6528 | 24 75.5 | 35.5 | 37.5 | | 51 58.10 | + 2 20.85 | + 1.91 | 20.86 |
| | 6566 | 62.5 | 45.0 | 23.0 | | | | | |
| | 6574 | 29 77.5 | 29.5 | 43.5 | | 35 45 13.20 | + G. 11.93 | + 0.82 | 26.00 |
| | 6602 | 11 40.0 | 35.0 | 33.0 | | | | | |
| | 6626 | 29 49.4 | 30.0 | 43.0 | | 36 04 09.68 | — 9 42.33 | — 4.36 | 22.96 |
| | 6678 | 30 39.0 | 23.5 | 50.0 | | | | | |
| | 6697 | 11 76.7 | 39.0 | 35.0 | | 35 44 33.48 | + 9 59.38 | — 6.13 | 26.73 |
| | 6714 | 16 40.7 | 41.0 | 33.0 | | | | | |
| | 6745 | 19 19.6 | 40.0 | 34.0 | | 35 55 48.76 | — 1 29.77 | + 3.82 | 35 54 22.81 |

Observations and computations—Continued.

FORT UNION, NEW MEXICO.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|--------------------|-----------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|----------|--------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1873. August 29 | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | <i>° ' "</i> | <i>' "</i> | <i>"</i> | <i>° ' "</i> |
| | 6762 | 26 04.5 | 15.0 | 59.0 | | | | | |
| | 6779 | 17 05.6 | 31.5 | 42.0 | | 35 49 49.07 | + 4 49.31 | -14.85 | 35 54 23.53 |
| | 6799 | 21 17.2 | 38.0 | 35.3 | | | | | |
| | 6835 | 28 99.0 | 28.0 | 46.0 | | 47 39.07 | + 6 52.55 | - 4.17 | 27.45 |
| | Gr. 2977 | 20 42.3 | 39.0 | 35.0 | | | | | |
| | 6883 | 21 57.8 | 46.0 | 29.0 | | 53 50.94 | + 0 37.17 | + 5.72 | 33.83 |
| | 6941 | 21 25.7 | 44.0 | 31.0 | | | | | |
| | 6959 | 23 13.5 | 40.0 | 35.0 | | 55 23.32 | - 1 00.44 | + 4.90 | 27.78 |
| | 7105 | 21 59.8 | 44.0 | 32.0 | | | | | |
| | 7149 | 21 42.2 | 22.0 | 54.0 | | 54 36.82 | - 0 05.66 | - 5.45 | 25.71 |
| | 7188 | 26 13.5 | 44.2 | 31.6 | | | | | |
| | 7198 | 16 58.5 | 40.5 | 35.2 | | 49 46.71 | + 4 35.18 | - 0.57 | 23.32 |
| | P.XX. 358 | 20 38.8 | 31.0 | 45.0 | | | | | |
| | 7253 | 13 12.5 | 30.0 | 46.0 | | 50 37.25 | + 3 53.76 | - 8.18 | 22.83 |
| | 7275 | 20 75.1 | 34.0 | 42.0 | | | | | |
| | 7294 | 20 52.0 | 33.2 | 42.2 | | 54 20.60 | + 0 07.44 | - 4.63 | 23.41 |
| | 7368 | 18 81.4 | 32.0 | 44.0 | | | | | |
| | ----- | 21 58.5 | 24.0 | 52.0 | | 55 57.90 | - 1 21.04 | -10.90 | 25.96 |
| | 7418 | 28 81.4 | 32.0 | 44.0 | | | | | |
| | 7468 | 17 58.5 | 40.0 | 35.0 | | 48 28.22 | + 6 01.41 | - 1.91 | 27.72 |
| | 7493 | 17 65.5 | 40.0 | 35.2 | | | | | |
| | 7527 | 25 12.6 | 47.5 | 28.0 | | 50 28.38 | + 4 01.10 | + 6.62 | 36.10 |
| | 7567 | 12 18.7 | 35.0 | 41.0 | | | | | |
| | 7631 | 20 87.4 | 21.0 | 56.0 | | 59 14.84 | - 4 39.59 | -11.17 | 24.08 |
| | 7664 | 24 81.2 | 33.5 | 43.0 | | | | | |
| | 7698 | 22 22.0 | 35.0 | 42.0 | | 35 05.17 | + 1 23.42 | - 4.50 | 21.00 |
| | 7742 | 25 64.1 | 44.5 | 33.0 | | | | | |
| | 7754 | 15 42.3 | 42.0 | 35.0 | | 43 54.31 | + 5 28.87 | + 5.04 | 25.22 |
| | 7807 | 21 10.5 | 33.0 | 43.5 | | | | | |
| | 7815 | 20 54.5 | 34.5 | 42.5 | | 35 54 11.54 | + 0 18.02 | - 2.32 | 27.24 |
| | 7850 | 27 23.5 | 41.5 | 35.0 | | | | | |
| | 7923 | 14 83.3 | 35.0 | 43.0 | | 36 01 05.93 | - 6 39.16 | - 0.41 | 26.19 |
| | 7961 | 11 23.8 | 31.5 | 47.0 | | | | | |
| | 7975 | 34 82.4 | 31.0 | 47.5 | | 35 42 05.58 | +12 23.02 | - 8.72 | 19.88 |
| | 8058 | 24 90.2 | 33.0 | 46.0 | | | | | |
| | 8079 | 21 02.0 | 35.0 | 43.0 | | 35 56 04 17 | - 1 32.76 | - 5.72 | 25.69 |
| | 8097 | 16 43.2 | 35.5 | 43.0 | | | | | |
| | 8110 | 28 68.0 | 35.0 | 43.0 | | 36 01 03.78 | - 6 34.50 | - 4.22 | 35 54 25.36 |

LATITUDE DETERMINATIONS.

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Observations and computations—Continued.

FORT UNION, NEW MEXICO.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|-----------|-----------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|----------|--------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1873. | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | <i>o ' "</i> | <i>' "</i> | <i>"</i> | <i>o ' "</i> |
| August 29 | 8153 | 11 79.1 | 31.5 | 46.5 | | | | | |
| | 8182 | 29 21.1 | 43.0 | 36.0 | | 35 45 05.41 | + 9 20.63 | — 2.18 | 35 54 23.86 |
| August 30 | 6091 | 13 00.0 | 42.0 | 55.0 | | | | | |
| | 6159 | 23 57.6 | 49.0 | 49.0 | | 35 46 06.15 | + 8 21.32 | — 3.54 | 23.93 |
| | 6237 | 12 03.0 | 28.0 | 50.0 | | | | | |
| | Gr. 2563 | 30 61.4 | 28.0 | 50.0 | | 36 06 08.73 | —11 34.68 | —11.99 | 22.06 |
| | 6302 | 16 42.7 | 35.5 | 32.0 | | | | | |
| | 6307 | 28 82.9 | 32.0 | 35.5 | | 35 47 41.64 | + 6 41.31 | — 0.00 | 22.95 |
| | 6438 | 20 21.0 | 22.5 | 45.5 | | | | | |
| | 6470 | 21 01.7 | 37.5 | 30.5 | | 54 54.01 | — 0 25.97 | — 4.36 | 24.68 |
| | 6500 | 21 45.8 | 37.5 | 30.5 | | | | | |
| | 6528 | 26 08.5 | 13.0 | 56.0 | | 51 58.25 | + 2 28.85 | — 9.81 | 17.29 |
| | 6566 | 11 91.6 | 16.0 | 53.0 | | | | | |
| | 6574 | 29 43.0 | 28.0 | 41.0 | | 35 45 13.38 | + 9 23.69 | —13.62 | 23.45 |
| | 6602 | 11 75.9 | 45.0 | 24.0 | | | | | |
| | 6626 | 30 43.0 | 49.5 | 20.5 | | 36 04 09.84 | —10 00.93 | +13.62 | 22.53 |
| | 6690 | 13 03.0 | 27.0 | 43.0 | | | | | |
| | 6731 | 29 75.4 | 35.0 | 35.0 | | 36 03 29.14 | — 8 58.26 | — 1.64 | 29.24 |
| | 6762 | 24 37.0 | 44.0 | 26.0 | | | | | |
| | 6779 | 15 76.8 | 24.0 | 46.0 | | 35 49 49.28 | + 4 36.85 | — 1.09 | 25.04 |
| | 6824 | 22 60.0 | 35.0 | 35.0 | | | | | |
| | 6858 | 22 24.7 | 32.0 | 39.0 | | 35 54 37.54 | — 0 11.36 | — 1.91 | 24.27 |
| | 6918 | 23 42.0 | 36.0 | 35.0 | | | | | |
| | 6933 | 16 92.0 | 35.0 | 36.0 | | 36 00 37.63 | — 6 10.13 | — 0.00 | 27.50 |
| | 7105 | 20 97.0 | 19.0 | 53.0 | | | | | |
| | 7149 | 20 73.7 | 42.0 | 31.0 | | 35 54 37.04 | — 0 07.50 | — 6.27 | 23.27 |
| | 7176 | 27 21.5 | 34.0 | 39.0 | | | | | |
| | 7223 | 10 07.5 | 32.0 | 41.0 | | 36 03 43.61 | — 9 11.66 | — 3.82 | 28.13 |
| | Ll. 40335 | 24 90.0 | 41.0 | 32.0 | | | | | |
| | 7253 | 18 22.2 | 45.0 | 28.0 | | 35 50 37.49 | + 3 34.93 | + 7.09 | 19.51 |
| | 7275 | 23 04.5 | 38.5 | 34.0 | | | | | |
| | 7294 | 23 18.9 | 38.0 | 34.5 | | 54 20.84 | — 0 04.64 | + 1.64 | 17.84 |
| | 7368 | 18 41.7 | 38.0 | 34.0 | | | | | |
| | Gr. 3424 | 21 19.5 | 29.0 | 43.0 | | 55 58.14 | — 1 29.41 | — 2.72 | 26.01 |
| | 7444 | 19 57.5 | 35.0 | 37.0 | | | | | |
| | 7455 | 18 83.9 | 33.5 | 38.5 | | 54 00.68 | + 0 23.69 | — 1.91 | 22.46 |
| | 7493 | 19 24.1 | 42.0 | 30.0 | | | | | |
| | 7527 | 26 56.8 | 26.5 | 45.5 | | 35 50 28.53 | + 3 55.77 | — 0.76 | 35 54 23.54 |

Observations and computations—Continued.

FORT UNION, NEW MEXICO.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|--------------------|-----------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|----------|--------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1873. August 30 | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | <i>° ' "</i> | <i>' "</i> | <i>"</i> | <i>° ' "</i> |
| | 7567 | 14 85.1 | 32.0 | 40.5 | | | | | |
| | 7631 | 23 68.5 | 29.5 | 43.0 | | 35 59 15.10 | — 4 44.32 | — 6.00 | 35 54 24.78 |
| | 7664 | 21 88.2 | 42.5 | 30.0 | | | | | |
| | 7698 | 19 51.4 | 37.5 | 35.0 | | 53 05.50 | + 1 16.22 | + 4.09 | 25.81 |
| | 7807 | 20 59.9 | 35.5 | 37.5 | | | | | |
| | 7815 | 20 09.0 | 21.0 | 52.0 | | 35 54 11.98 | + 0 14.77 | — 8.99 | 17.76 |
| | 7850 | 27 51.5 | 37.0 | 35.0 | | | | | |
| | 7923 | 15 12.5 | 41.0 | 31.5 | | 36 01 06.24 | — 6 38.77 | + 3.13 | 35 54 30.60 |

Notes.

A single observation of pair 1, made August 29, was rejected. The whole number of micrometer readings is not given, and there is probably other error in it.

In pair 3, observed August 24, a wrong star appears to have been taken.

The observations made August 30 on pair 8, August 29 on pair 17, and on pair 31, have been rejected. They differ from the final mean — 7".5 + 9".1 + 11".4 respectively, and their level corrections are— 9".8 + 5".7 + 6".6.

Individual results.

| No. of pair. | No. of obs. | Latitude uncorrected. | Δm | $\Delta \phi$ | No. of pair. | No. of obs. | Latitude uncorrected. | Δm | $\Delta \phi$ |
|--------------|-------------|-----------------------|------------|---------------|--------------|-------------|-----------------------|------------|---------------|
| | | <i>° ' "</i> | <i>'</i> | <i>"</i> | | | <i>° ' "</i> | <i>'</i> | <i>"</i> |
| 38 | 1 | 35 54 19.88 | +12.4 | + 1.61 | 32 | 1 | 35 54 23.67 | + 1.4 | + 0.18 |
| 5 | 1 | 22.06 | +11.6 | + 1.51 | 34 | 3 | 24.44 | + 1.3 | + 0.17 |
| 11 | 2 | 27.55 | + 9.9 | + 1.29 | 30 | 3 | 25.43 | + 0.4 | + 0.05 |
| 9 | 2 | 24.72 | + 9.3 | + 1.21 | 36 | 2 | 22.50 | + 0.3 | + 0.04 |
| 41 | 1 | 23.86 | + 9.3 | + 1.21 | 26 | 4 | 22.66 | 0.0 | 0.00 |
| 2 | 2 | 23.95 | + 8.4 | + 1.09 | 16 | 2 | 22.84 | — 0.1 | — 0.01 |
| 18 | 1 | 23.99 | + 8.3 | + 1.08 | 22 | 4 | 24.51 | — 0.2 | — 0.03 |
| 5 bis | 1 | 25.28 | + 7.1 | + 0.92 | 7 | 4 | 25.26 | — 0.4 | — 0.05 |
| 15 | 2 | 24.76 | + 6.9 | + 0.90 | 20 | 1 | 27.78 | — 1.0 | — 0.13 |
| 6 | 2 | 24.00 | + 6.8 | + 0.88 | 27 | 2 | 25.98 | — 1.4 | — 0.18 |
| 29 | 1 | 27.72 | + 6.0 | + 0.78 | 39 | 1 | 25.69 | — 1.5 | — 0.20 |
| 35 | 1 | 28.22 | + 5.5 | + 0.72 | 13 | 1 | 22.81 | — 1.5 | — 0.20 |
| 14 | 4 | 24.55 | + 4.6 | + 0.60 | 33 | 2 | 24.43 | — 4.7 | — 0.61 |
| 24 | 2 | 24.02 | + 4.6 | + 0.60 | 19 | 1 | 27.50 | — 6.2 | — 0.81 |
| 28 | 2 | 24.42 | + 4.1 | + 0.53 | 40 | 1 | 25.37 | — 6.6 | — 0.86 |
| 31 | 2 | 23.85 | + 3.9 | + 0.51 | 37 | 2 | 28.44 | — 6.6 | — 0.86 |
| 25 | 3 | 21.39 | + 3.7 | + 0.48 | 12 | 2 | 28.58 | — 9.0 | — 1.17 |
| 8 | 3 | 22.20 | + 2.4 | + 0.31 | 23 | 2 | 29.46 | — 9.2 | — 1.20 |
| 4 | 1 | 35 54 21.75 | + 2.3 | + 0.30 | 10 | 2 | 35 54 22.74 | — 9.9 | — 1.29 |

In the preceding table $\Delta \varphi$ is obtained by adding $0''.140$ for each micrometer revolution, or $0''.130 \left(= 0''.140 \frac{60''}{64''.37} \right)$ for each minute of Δm .

Final results corrected for $\Delta \varphi$:

| | ° | ' | '' |
|---|----|----|-------|
| 14 pairs observed once each | 35 | 54 | 25.12 |
| 16 pairs observed twice each | 35 | 54 | 25.31 |
| 4 pairs observed three times each | 35 | 54 | 23.62 |
| 4 pairs observed four times each | 35 | 54 | 24.38 |

Giving each pair once observed a weight of 1; each pair twice observed a weight of $1\frac{1}{2}$; each pair three times observed a weight of 2; and each pair four times observed a weight of $2\frac{1}{2}$, this final result is derived:

Latitude of Fort Union (sun-dial), $35^{\circ} 54' 24''.86$ Wt. = 56.

Probable error (weight = 1):

| | |
|---------------------------------------|--------------|
| From pairs observed once | $\pm 1''.58$ |
| From pairs observed twice | $\pm 1''.74$ |
| From pairs observed three times | $\pm 1''.89$ |
| From pairs observed four times | $\pm 1''.11$ |
| Mean result about | $\pm 1''.63$ |

Hence the final probable error of the latitude will be $\pm 0''.22$.

ASTRONOMICAL CO-ORDINATES OF FORT UNION, NEW MEXICO.

| | | |
|--------------|---|--|
| Longitude.. | $7^{\text{h}} 00^{\text{m}} 03^{\text{s}}.41$ or $105^{\circ} 00' 51''.15 \pm 0''.13$ | west from Greenwich. |
| " .. | $1^{\text{h}} 51^{\text{m}} 51^{\text{s}}.29$ or $27^{\circ} 57' 49''.35$ | west from U. S. Naval Observatory, Washington, D. C. |
| Latitude ... | $35^{\circ} 54' 24''.86 \pm 0''.22$ | north. |

U. S. GEOGRAPHICAL SURVEYS WEST OF THE ONE HUNDREDTH MERIDIAN,
1ST LIEUT. GEO. M. WHEELER, CORPS OF ENGINEERS, U. S. ARMY, IN CHARGE.

RESULTS

OF

OBSERVATIONS MADE BY PROF. T. H. SAFFORD, JOHN H. CLARK, AND DR.
F. KAMPF IN THE DETERMINATION OF THE ASTRONOMICAL
CO-ORDINATES OF SANTA FÉ, NEW MEXICO.

SEASON OF 1873.

COMPUTATIONS BY

PROF. T. H. SAFFORD, JOHN H. CLARK, AND DR. F. KAMPF.

SANTA FE, NEW MEXICO.

GEOGRAPHICAL POSITION OF STATION.

Longitude, . . . $105^{\circ} 56' 45''.22 \pm 0''.32$ west from Greenwich.
 Latitude, . . . $35^{\circ} 41' 19''.29 \pm 0''.15$ north.
 Barometric altitude of observatory above sea-level, 7044.2 feet.

Various determinations of the position of this town have been made, of which the earliest known is Lafora's, given in the astronomical results of Humboldt's Travels, and since repeated year by year in the *Connaissance des Temps*. He places Santa Fé in longitude $107^{\circ} 13'$ west of Paris and latitude $36^{\circ} 12'$ north, which is about a degree east and half a degree north of the true position.

Lieut. W. H. Emory, who accompanied Kearney's column as chief engineer when New Mexico and California were occupied by the United States forces, determined a series of positions along the march which have been of great value in constructing the geography of New Mexico and neighboring regions. Among these occurs Santa Fé, which he fixes in longitude $106^{\circ} 01' 23''$, and in latitude $35^{\circ} 41' 06''$. His latitudes are manifestly as accurate as the sextant would give them; any additional discussion, as, for instance, of the difference between north and south stars, would alter the value but a few seconds at most. The longitude he gives as quite uncertain. It is derived from the chronometer, which may not have gone quite regularly in passing over the road to Santa Fé. Moreover, for the longitude of Fort Leavenworth, his starting-point, he has assumed Nicollet's determination, which is $94^{\circ} 44' 00''$, a value now known to be wide of the truth.

Comparing Nicollet's longitude of Fort Leavenworth with Lieutenant Ruffner's determination of the same, as computed by Professor Safford, the result gives the correction necessary to be applied to Emory's work:—

| | |
|---|-------------|
| Ruffner's longitude of Fort Leavenworth..... | 94° 54' 35" |
| Nicollet's longitude of Fort Leavenworth..... | 94° 44' 00" |
| Correction | + 10' 35" |

| | |
|--|---------------|
| Emory's chronometer-longitude of Santa Fé..... | 106° 01' 23'' |
| Correction of error at Fort Leavenworth | + 10' 35'' |
| Emory's corrected longitude..... | 106° 11' 58'' |

Lieutenant Emory also determined the longitude of Santa Fé by one night's observations of lunar distances, which gave $106^{\circ} 04' 38''.4$. This requires a correction for the error in the moon's place as given by Burckhardt's tables, which would be about $+7''$, as the lunar tables gave the moon's longitude too great by about $15''$.

After Lieutenant Emory had left Santa Fé, his junior officers, Lieutenants Abert and Peck, who were detained by illness, made a reconnaissance of New Mexico, and executed a map from a triangulation of the Territory with the sextant. This gave Lieutenant Whipple the means of locating Santa Fé in nearly its true position with respect to Albuquerque, of which town he determined the longitude by several months of lunar culminations. Upon his map, in the third volume of the Pacific Railway Reports, Santa Fé is placed in longitude $105^{\circ} 55'$, a closer approximation to the truth.

The situation of Emory's station in Santa Fé is no longer known, but that is a matter of comparatively little importance, as the town is not very large. From a comparison of his latitude with Mr. Safford's it may be inferred that it was near the church of St. Francis, or, perhaps, in the plaza.

PHYSICAL GEOGRAPHY DETAILS.

The town is situated on Santa Fé Creek, a tributary of the Rio Grande. During the time of observations here this stream was very diminutive, and its waters were pretty thoroughly used in irrigating, as the season had been one of severe drought. According to Abert's report the creek disappears in the sand a few miles below the town. In exceptional years it sometimes overflows, and has been known to carry away bridges. The houses in Santa Fé bear abundant testimony to the dryness of the climate. One of the churches is said to be over two hundred years old, although built of adobe, like most of the houses in the town.

Santa Fé lies on a plain gradually sloping to the creek, which is surrounded on all sides by hills and mesas. Its situation is very picturesque when seen from a distance. Directly to the east is a chain of high mount-

ains, to be designated upon the published maps of the survey as the Santa Fé range.

The town is the seat of an extensive trade, of which the commodities are brought from the railways of Colorado and Western Kansas by ox and mule teams and distributed throughout New Mexico. The agriculture of this region is quite primitive in its methods, but, with the help of irrigation, produces fair results. The wheat of the Territory is especially good. Great opportunities for pasturage exist, but, as the common beast of burden is the *burro*, or small donkey, it is probably difficult to keep horses in good condition; these are sometimes fed on hay made from a species of rush.

METEOROLOGICAL CONDITIONS.

The yearly rain-fall is about 17 inches, according to Schott's map. This is nearly the same as at San Francisco, and larger than at Los Angeles, to which Schott assigns about 12 inches, or at Denver, where it is about 14 inches. When this station was occupied, it was in the early part of the rainy season. Little rain fell, but the clouds interfered much with observations. Otherwise the climate was extremely agreeable, being dry and mild. The transparency of the atmosphere was not so great as might have been expected. The test-objects employed to determine this have often been seen by the astronomer almost as distinctly at Denver, or even at Fort Hays or Chicago, all of them at less altitudes. The reason for this may be found in the season of the year.

OBSERVATORY.—ASSISTANTS.

The astronomical station is situated upon the military reservation, in that portion which is known as the old Fort Marcy parade-ground. In order to admit of the location of the meridian-line, the monument, since Mr. Safford's determination, has been moved due west 5.83 feet, or $0^{\circ} 00' 00''.07$, giving the value for longitude which stands at the head of this report. The new position of the station is marked by a heavy stone pillar, about 4 feet high. On the mesa, 1,926.428 feet north of this monument, a stone meridian-mark was planted.

The customary wall-tent, with suitable openings, was used as an observatory. This was afterwards framed, to guard against accidents. As there were two instruments engaged, and but one observing-pier, the former were set up when their use demanded and were removed every night when work was done.

The astronomer was assisted by Private Winkler, Company D, Battalion of Engineers, who was found very capable and painstaking. The drill of this corps appears to attract good men and make them more competent to perform the duties of an assistant astronomer than any other persons save the very best mathematicians from college classes or technical schools. Mr. Gough, the telegraph-operator, rendered excellent assistance. The line employed was the Western Union; the route was from Santa Fé to Salt Lake City, via Denver and Cheyenne.

DESCRIPTION OF INSTRUMENTS.

The instruments used were a zenith telescope and the Würdemann transit No. 18. They were originally made for the northwestern boundary, some twenty years ago, and were not in the best of repair. The transit was twenty-six inches in focal length and two inches in aperture. Its optical quality was excellent, but its mechanical parts needed a thorough repair. The frame of the transit and the side adjusting-screws of the levels were badly bent. It was with great difficulty that accurate results were obtained, as the level would vary unexpectedly from time to time, although every care was taken to place it correctly and delicately in position. Apparently the motion of the telescope was irregular, and the pivots did not retain a fixed position in the Y's, which were somewhat bent. The probable error of the observations with this instrument, and the difficulty of their reduction, had been constantly increasing during this astronomer's experience with it. The observations were so arranged that the instrumental defects would be thoroughly eliminated from the result. The observed stars were as near the zenith as could be found, including, of course, sufficient polars for the application of the azimuth correction in each group.

As the packing-boxes of the instrument were somewhat out of repair, it may have suffered by transportation over the Kansas Pacific Railway

and the roads of New Mexico. Efforts were made to secure some trifling repairs at Santa Fé, but with little success.

The zenith-telescope had a larger aperture, two and three-fourths inches, but was not sensibly better in optical power. The observer found it quite unstable, and would have taken it to pieces had he been sufficiently acquainted with its parts to feel assured of his powers to reconstruct it properly. It is thought that the newer constructions of the zenith-telescope are to be preferred for stability and substantial and lasting firmness.

CONNECTIONS.—OBSERVERS.—COMPUTERS.

Telegraphic connection was made with John H. Clark, at Salt Lake City, on June 25, July 1, 2, 12, 14, and 17, and with Dr. F. Kampf, at Hughes, on July 12, 14, 17, 19, and 21. The longitude of Santa Fé, therefore, depends on eight nights of work. The two nights on which Dr. Kampf, at Hughes, was accessible, and Mr. Clark, at Salt Lake City, could not be reached, undoubtedly strengthen the determinations much, as Dr. Kampf had a chronograph and an admirable transit-instrument of Würdemann's largest size, and his longitude of Hughes is consequently very accurate.

Latitude observations were made by Prof. T. H. Safford, observer at Santa Fé, on June 27, 28, July 4, 23, 26, 27, 28, 29, and 30, nine nights in all. These were much interrupted by the clouds, and affected by instrumental difficulties.

In addition, time-determinations were made on seven nights on which the telegraph failed.

The observations at each station were reduced by the astronomer at that place.

Professor Safford submits the following notes upon the tables of time-reductions for Santa Fé and Fort Union. In all these cases the first operation was to compute approximate values of azimuth and collimation, which was accomplished in the following manner:

Every group of about five stars gave a corresponding number of equations of the form $\alpha = T + dt + Aa + Bb + Cc$; or $\alpha - T - Bb = dt + Aa + Cc$, in which ΔT , a , and c were unknown quantities. These were now so arranged that the equations derived from stars of nearly equal declinations

came together, and the means of the right and left hand members of the equations were so taken that each group gave two equations, one with a positive co-efficient of a , the other with a negative co-efficient of the same unknown quantity. Eliminating a , there was left one equation from each group, in which ΔT and c were the unknown quantities. The two groups which make up a complete time-determination then gave, by proper elimination, the values of these quantities. As an example, we may select the last time-determination for Fort Union:

| | Name of star. | Clamp. | $a - T - Bb$. | A. | C. |
|-----|------------------------------|--------|-----------------|--------|--------|
| | | | <i>h. m. s.</i> | | |
| (1) | κ Cephei | E. | 10 25 59.67 | — 3.02 | + 4.56 |
| (2) | ε Delphini | E. | 26 04.64 | + 0.43 | + 1.02 |
| (3) | α Cygni | E. | 26 03.66 | — 0.22 | + 1.41 |
| (4) | ν Cygni | E. | 26 03.81 | — 0.11 | + 1.32 |
| (5) | ζ Cygni | W. | 23 06.05 | + 0.12 | — 1.15 |
| (6) | ι Pegasi | W. | 26 06.15 | + 0.31 | — 1.06 |
| (7) | β Cephei | W. | 26 05.62 | — 1.64 | — 2.92 |
| (8) | κ Pegasi | W. | 10 26 06.04 | + 0.21 | — 1.10 |

The equation from the first star is—

$$10^{\text{h}} 25^{\text{m}} 59^{\text{s}}.67 = \Delta T - 3.02 a + 4.56 c$$

that from the mean result of (2), (3), (4), is—

$$10^{\text{h}} 26^{\text{m}} 4^{\text{s}}.04 = \Delta T + 0.03 a + 1.25 c$$

Hence, by elimination—

$$4^{\text{s}}.37 = 3.05 a - 3.31 c$$

$$1^{\text{s}}.43 = a - 1.09 c$$

$$10^{\text{h}} 26^{\text{m}} 4^{\text{s}}.00 = \Delta T + 1.28 c$$

Similarly from (5), (6), (8)—

$$10^{\text{h}} 26^{\text{m}} 6^{\text{s}}.08 = \Delta T + 0.21 a - 1.10 c$$

And from (7)—

$$10^{\text{h}} 26^{\text{m}} 5^{\text{s}}.62 = \Delta T - 1.64 a - 2.92 c$$

By elimination—

$$0^{\text{s}}.46 = 1.85 a + 1.82 c$$

$$0^{\text{s}}.25 = a + 0.98 c$$

$$10^{\text{h}} 26^{\text{m}} 6^{\text{s}}.03 = \Delta T - 1.31 c$$

The two equations containing a and c only give

$$a = + 0^s.81$$

$$c = - 0^s.57$$

and the two containing

$$\Delta T \text{ and } c$$

$$\Delta T = 10^h 26^m 5^s.00$$

$$c = - 0^s.78$$

The difference between the two values of c arises partly from error of observation, partly from small changes in the azimuth at reversal, partly from uncertainty in the adopted rate.

There was a previous time-determination on the same evening; for these provisional values I assumed, *combining the two*,

$$\Delta T_0 = 10^h 26^m 4^s.96$$

$$a_0 = + 0^s.90$$

$$c_0 = - 0^s.70$$

and the least square solution from the eight equations above cited gave

$$\Delta T = 10^h 26^m 5^s.013 \pm 0^s.044$$

$$c = - 0^s.733 \pm 0^s.029$$

$$a = + 0^s.813 \pm 0^s.064$$

In case the values of c had differed much more than $0^s.21 = - 0^s.57 + 0^s.78$, I should have assumed a sudden change in a at reversal; this was, indeed, often necessary, because the axis of the telescope did not properly fit its Y's.

The next step was to form and solve the least square equations. I employed the notation

$$a = a_0 + da$$

$$c = c_0 + dc$$

and, of course, made $\Delta_0 T$ = resulting error of the chronometer after the mean of wires is corrected for rate, level, *and approximate azimuth and collimation*. The advantage of this is that there is much less danger of mistake, as the resulting da and dc should be very small, if the instrument is steady at reversal, and, if not, the fact is at once indicated.

As I have always been doubtful about the stability of Würdemann 18, I have arranged the observations so that each group of about five stars contains time-stars as near the zenith as possible, as well as one or two polars; a precaution useful always in giving a resulting ΔT with a large weight.

The formation of the least square equations was facilitated by tables. I gave as a weight to each observation the quantity

$$w = pp^1$$

$$\text{where } p = \frac{1.3}{1 + 0.3 \sec^2 \delta}$$

$$\begin{aligned} \text{and } p^1 &= 0.2 \text{ for 1 wire} \\ &= 0.4 \text{ for 2 wires} \\ &= 0.6 \text{ for 3 wires} \\ &= 0.8 \text{ for 4 wires} \\ &= 0.9 \text{ for 5 wires} \\ &= 1.0 \text{ for 6-9 wires} \end{aligned}$$

The values $A \sqrt{p} = \sin(\varphi - \delta) c \sqrt{p}$

$$c \sqrt{p} = \sec \delta \sqrt{p} = \sqrt{\frac{1.3}{\cos^2 \delta + 0.3}}$$

as well as \sqrt{p} , can be readily tabulated. This I did, however, only with their squares and products.

$$\left. \begin{aligned} ee &= p \\ ef &= cp \\ eg &= A p \\ ff &= c^2 p \\ fg &= A c p \\ gg &= A^2 p \end{aligned} \right\} \begin{array}{l} \text{Changing the signs of } ef \text{ and } fg \text{ for} \\ \text{clamp west.} \end{array}$$

The notations ee , ef , eg , &c., I employed in the solution, following Gauss's model.

If then $\delta T \sqrt{p} = n$, the equation for each star will be

$$0 = n + e \delta T + fdc + gda$$

Of the stars quoted as observed August 27, κ Cephei was observed on 5 wires and ζ Cygni on 4; all the others on 6 at least. From these the following squares and products were computed:—

| | $\delta T = \frac{n}{e}$ | nn | en | fn | gn | er | ef | eg | ff | fg | gg |
|------------------------|--------------------------|-------|--------|--------|--------|---------------|--------|--------|--------|--------|-------|
| | s | | | | | <i>Weight</i> | | | | | |
| κ Cephei | - 0.61 | 0.060 | -0.099 | -0.449 | +0.298 | 0.162 | +0.736 | -0.488 | 3.362 | -2.224 | 1.472 |
| ϵ Delphini .. | 0.00 | 0.000 | 0.000 | 0.000 | 0.000 | 0.992 | +1.010 | +0.427 | 1.029 | +0.435 | 0.184 |
| α Cygni | + 0.11 | 0.010 | +0.090 | +0.126 | -0.020 | 0.814 | +1.148 | -0.178 | 1.619 | -0.255 | 0.039 |
| ν Cygni | + 0.13 | 0.014 | +0.111 | +0.146 | -0.012 | 0.854 | +1.127 | -0.094 | 1.486 | -0.124 | 0.010 |
| ζ Cygni | - 0.16 | 0.019 | -0.119 | +0.136 | -0.015 | 0.744 | -0.850 | +0.092 | 0.986 | -0.106 | 0.011 |
| ι Pegasi | - 0.18 | 0.031 | -0.175 | +0.186 | -0.053 | 0.973 | -1.031 | +0.293 | 1.093 | -0.310 | 0.088 |
| β Cephei | - 0.09 | 0.003 | -0.034 | +0.096 | +0.054 | 0.365 | -1.066 | -0.598 | 3.118 | +1.748 | 0.980 |
| κ Pegasi | - 0.12 | 0.014 | -0.114 | +0.126 | -0.024 | 0.952 | -1.051 | +0.197 | 1.160 | -0.218 | 0.042 |
| Sums | | 0.151 | -0.340 | +0.367 | +0.228 | 5.856 | +0.023 | -0.349 | 13.853 | -1.054 | 2.826 |

The total increase of labor owing to the introduction of weights is very trifling, and is fully counterbalanced by the saving in the solution; where the co-efficients $[ef]$, $[eg]$, $[fg]$, are much smaller in proportion to $[ee]$ and $[ff]$ than they are where the weights are all made = 1.

The opinion has been expressed by good authority (Wagner, of Pulcova) that this last process is no more accurate than the approximate solution itself.

INSTRUMENTAL VALUES.—TELEGRAPHIC COMMUNICATION.

The wires of the transit instrument employed on June 25 were found broken the next morning. A new set was inserted by Lieut. C. C. Morrison. They were rather too fine, it is true, but still they served a good purpose. Their intervals were carefully determined for clamp east, and in the mean were about

89^s.64, 67^s.32, 44^s.32, 23^s.06, —1^s.28, —22^s.92, —45^s.04, —66^s.04, —89^s.07, with signs changed for clamp west. There were some indications of change in the intervals, and so the reduction to mean of wires was made in the field, giving values slightly different from time to time. These were always very carefully revised.

The value of one division of the level was taken as 1^{''}.00; it was not in condition to be very accurately determined by the means at hand. The

uncertainty remaining in the longitude on this account will be very small and quite fully exhibited in the probable error.

The value of one revolution of the micrometer of the zenith-telescope, as determined by Mr. Safford in 1872 at Denver, was $64''.37$. The present observations afford means for correcting this value, which will not affect the result, however, as the stars were so selected that the micrometer-corrections for the different pairs were about as often positive as negative. One division of the zenith-telescope level was equal to $1''.09$. The length of the telegraphic circuit, from Santa Fé to Salt Lake, via Corinne, was about 1,100 miles. Repeaters were used at Denver, Cheyenne, and Corinne. From Santa Fé to Hughes the distance is 450 miles.

The batteries used were those of the telegraph company, as there was no electro-magnetic apparatus in the astronomical outfit. On some of the nights the chronometer was carried to the office at the headquarters of the district of New Mexico; on other occasions it was taken to the ordinary telegraph-office at Mr. Gough's house, not quite one-fourth of a mile from the station. No sensible inconvenience was caused by this.

[illegible]

Tabulation of stars, &c.—Continued.

| Name of star. | SANTA FÉ, NEW MEXICO. | | | | | | | | SALT LAKE CITY, UTAH. | | | | | | |
|-----------------------------|-----------------------|---------|---------|----------|----------|----------|----------|----------|-----------------------|---------|---------|---------|----------|----------|----------|
| | June 25. | July 1. | July 2. | July 12. | July 14. | July 17. | July 19. | July 21. | June 25. | July 1. | July 2. | July 3. | July 12. | July 14. | July 17. |
| 72 Ophiuchi | | | | | | | | | | | | | | | |
| μ^1 Sagittarii | | | | | | | | | | | X | X | X | X | X |
| Groombridge 2533 | | | | | | X | X | | | | | | X | X | X |
| 36 Draconis | | | X | | | | | | | | | | | | |
| δ Ursæ Minoris | | | | X | | | | | | | | | | | |
| η Serpentis | | | | | | | | | X | | X | X | X | X | |
| 109 Herculis | | X | X | X | | X | X | | | | | | | | |
| χ Draconis | | X | | X | | X | X | | | | | | | | |
| 1 Aquilæ | | | | | | | | | X | | | | X | X | X |
| α Lyrae | X | X | X | X | | X | X | | X | | X | | X | X | X |
| Groombridge 2655 | X | | | | | | | | | | | | | | |
| 110 Herculis | X | X | X | X | X | | | X | | | | | | | |
| β Lyrae | | | | X | X | X | | X | X | | | | X | X | X |
| α Draconis | | X | X | X | X | X | X | X | | | | | | | |
| θ Serpentis | X | | | | | | | | | | | | | | |
| 50 Draconis | | | | | | | | | X | | | | X | X | X |
| ϵ Aquilæ | | | | | | | X | | | | | | | | |
| γ Lyrae | X | | | | | | | | | | | | | | |
| 1 Lyrae | | | | | | | | X | | | | | | | |
| ϵ Draconis | | | X | | | | | | | | | | | | |
| ζ Aquilæ | X | X | X | X | X | X | X | | X | | | | X | X | X |
| 25 Camelopardalis | | | | X | | | | | | | | | | | |
| δ Sagittarii | | | | | | | | | X | | X | | X | | |
| ω Aquilæ | | | X | | | | | | | | | | | | |
| δ Draconis | X | X | | X | X | X | | X | | | | | X | | |
| τ Draconis | | X | | | | | | | | | | | X | | |
| δ Aquilæ | | | X | | X | X | | X | | | | | | | |
| β Cygni | | X | | | X | X | | X | | | | | | | |
| δ Draconis | | | | | X | | | | | | | | | | |
| θ Cygni | | X | | | | | | X | | | | | | | |
| γ Aquilæ | | | | | X | | | X | | | | | | | |
| α Aquilæ | | | | | X | | | X | | | | | | | |
| ϵ Draconis | | | | | X | | | | | | | | | | |
| Groombridge 2984 | | | | | X | | | | | | | | | | |
| 28 Cygni | | | | | X | | | | | | | | | | |
| 31 Cygni | | | | | X | | | | | | | | | | |
| κ Cephei | | | | | X | | | X | | | | | | | |
| γ Cygni | | | | | | | | X | | | | | | | |
| 39 Cygni | | | | | X | | | | | | | | | | |
| ϵ Delphini | | | | | X | | | | | | | | | | |
| θ Cephei | | | | | | | | X | | | | | | | |
| α Delphini | | | | | | | | X | | | | | | | |
| γ Delphini | | | | | | | | X | | | | | | | |

Observations and reductions for time taken at sending station.

SANTA FE, NEW MEXICO, JUNE 25, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|---------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | Groombr. 2125... | 8 15 06.61 | + 1.13 | + 0.25 | - 1.86 | 8 15 06.13 | 14 28 18.28 | +6 13 12.15 |
| W. | ζ Bootis | 21 55.79 | - 0.49 | + 0.13 | - 0.94 | 21 54.49 | 35 03.57 | 12.08 |
| W. | Piazzi XIV, 221. | 37 04.49 | - 0.48 | + 0.12 | - 0.94 | 37 03.19 | 50 15.25 | 12.06 |
| W. | 2H. Ursæ Minoris... | 42 25.27 | + 1.66 | + 0.24 | - 2.27 | 42 24.90 | 55 37.37 | 12.47 |
| W. | ψ Bootis | 45 50.86 | - 0.21 | + 0.10 | - 1.02 | 45 49.73 | 59 01.93 | 12.20 |
| E. | δ Bootis | 57 11.90 | - 0.05 | - 0.51 | + 1.09 | 57 12.43 | 15 10 24.82 | 12.39 |
| E. | γ Ursæ Minoris... | 9 07 44.44 | + 2.55 | - 0.88 | + 2.98 | 9 07 49.09 | 21 00.88 | 11.79 |
| E. | ν Bootis, pr | 9 13 10.76 | + 0.17 | - 0.44 | + 1.21 | 9 13 11.70 | 15 26 24.05 | +6 13 12.35 |
| E. | α Coronæ | 9 15 38.06 | - 0.41 | + 0.47 | + 1.18 | 9 15 39.30 | 15 29 20.47 | +6 13 41.17 |
| E. | γ Coronæ | 23 43.88 | - 0.43 | + 0.32 | + 1.17 | 23 44.94 | 37 26.46 | 41.52 |
| E. | 12H. Draconis | 31 01.14 | + 2.49 | + 0.14 | + 2.31 | 31 06.08 | 44 47.14 | 41.06 |
| E. | α Lyræ | 12 18 57.57 | + 0.17 | + 0.08 | + 1.34 | 12 18 59.16 | 18 32 40.47 | 41.31 |
| E. | Groombr. 2655... | 22 03.63 | + 7.56 | + 0.21 | + 4.82 | 22 16.22 | 35 57.96 | 41.74 |
| E. | 110 Herculis | 26 31.82 | - 0.69 | + 0.06 | + 1.12 | 26 32.31 | 40 13.85 | 41.54 |
| W. | θ Serpentis | 36 17.88 | - 1.96 | + 0.14 | - 1.05 | 36 15.01 | 49 56.27 | 41.26 |
| W. | γ Lyræ | 40 33.68 | - 0.24 | + 0.07 | - 1.24 | 40 32.27 | 54 13.66 | 41.39 |
| W. | ζ Aquilæ | 45 57.37 | - 1.43 | - 0.02 | - 1.08 | 45 54.84 | 59 36.28 | 41.44 |
| W. | δ Draconis | 12 58 50.81 | + 5.11 | - 0.13 | - 2.74 | 12 58 53.05 | 19 12 34.38 | +6 13 41.33 |

NORMAL EQUATIONS.

First series.

$$\begin{aligned}
 0 &= -1.386 + 6.01 \delta t - 2.18 c^1 - 0.87 a^1 & \delta t &= + 0^s.144 & \Delta T_0 &= + 6^h 13^m 12^s.06 \\
 0 &= + 1.485 - 2.18 \delta t + 114.67 c^1 - 0.52 a^1 & c^1 &= - 0^s.093 & c_0 &= + 1^s.00 \\
 0 &= + 1.045 - 0.87 \delta t - 0.52 c^1 + 2.66 a^1 & a^1 &= - 0^s.364 & a_0 &= - 0^s.936
 \end{aligned}$$

Second series.

Before reversal—

$$\begin{aligned}
 0 &= -0^s.162 + 4.43 \delta t + 6.25 c^1 - 0.54 a^1 & a_0 &= - 2^s.426 \\
 0 &= + 0^s.225 - 0.54 \delta t - 2.96 c^1 + 2.34 a^1 & c_0 &= + 1^s.000
 \end{aligned}$$

After reversal—

$$\begin{aligned}
 0 &= + 0^s.427 + 3.33 \delta t - 4.21 c^1 + 0.38 a^1 & a_0 &= - 3^s.485 \\
 0 &= + 0^s.289 + 0.38 a^1 + 0.57 c^1 + 1.24 a^1 & c_0 &= + 1^s.000
 \end{aligned}$$

Eliminating a^1 from each—

$$\begin{aligned}
 0 &= -0^s.113 + 4.43 \delta t + 5.73 c^1 & \delta t &= - 0^s.038 \\
 0 &= + 0^s.351 + 3.33 \delta t - 4.55 c^1 & c^1 &= + 0^s.049
 \end{aligned}$$

Observations and reductions for time taken at sending station—Continued.

SANTA FÉ, NEW MEXICO, JULY 1, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|--------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | δ Bootis | 8 33 34.65 | — 0.06 | + 0.05 | + 1.13 | 8 33 35.77 | 15 10 24.77 | +6 36 49.00 |
| W. | γ Ursæ Minoris... | 44 05.76 | + 2.91 | + 0.10 | + 3.10 | 44 11.87 | 21 00.58 | 48.71 |
| W. | α Coronæ | 52 30.54 | — 0.25 | + 0.04 | + 1.06 | 52 31.39 | 29 20.43 | 49.04 |
| W. | γ Coronæ | 9 00 36.42 | — 0.26 | + 0.02 | + 1.05 | 9 00 37.23 | 37 26.42 | 49.19 |
| W. | κ Serpentis | 06 13.61 | — 0.46 | + 0.01 | + 0.99 | 06 14.15 | 43 03.19 | 49.04 |
| W. | ζ Ursæ Minoris... | 11 44.97 | + 4.91 | — 0.02 | + 4.60 | 11 54.46 | 48 43.38 | 48.92 |
| W. | θ Draconis | 22 41.36 | + 1.13 | — 0.05 | + 1.82 | 22 44.26 | 59 33.22 | 48.96 |
| E. | γ Herculis | 39 33.97 | — 0.44 | — 0.31 | — 1.00 | 39 32.22 | 16 16 20.95 | 48.73 |
| E. | η Draconis | 45 31.72 | + 1.38 | — 1.01 | — 1.99 | 45 30.10 | 22 19.48 | 49.38 |
| E. | σ Herculis | 9 53 15.78 | + 0.25 | — 0.88 | — 1.28 | 9 53 13.87 | 16 30 02.73 | +6 36 48.86 |
| E. | 109 Herculis | 11 41 01.98 | — 0.49 | + 0.07 | — 0.79 | 11 41 00.77 | 18 18 19.25 | +6 37 18.48 |
| E. | χ Draconis | 46 04.52 | + 3.77 | + 0.30 | — 2.46 | 46 06.13 | 23 24.72 | 18.59 |
| E. | α Lyræ | 55 23.12 | + 0.12 | + 0.21 | — 0.94 | 55 22.51 | 32 40.51 | 18.00 |
| E. | 110 Herculis | 12 02 56.42 | — 0.52 | + 0.17 | — 0.78 | 12 02 55.29 | 40 13.91 | 18.62 |
| E. | ο Draconis | 12 03.74 | + 1.46 | + 0.29 | — 1.43 | 12 04.06 | 49 22.22 | 18.16 |
| W. | ζ Aquilæ | 22 17.69 | — 0.72 | + 0.30 | + 0.75 | 22 18.02 | 59 36.35 | 18.33 |
| W. | δ Draconis | 35 11.55 | + 2.56 | — 0.07 | + 1.91 | 35 15.95 | 19 12 34.43 | 18.48 |
| W. | τ Draconis | 40 38.17 | + 3.91 | — 0.18 | + 2.52 | 40 44.42 | 18 02.81 | 18.39 |
| W. | β Cygni | 48 19.24 | — 0.29 | — 0.12 | — 0.83 | 48 19.66 | 25 38.02 | 18.36 |
| W. | θ Cygni | 12 55 44.35 | + 0.71 | — 0.18 | + 1.14 | 12 55 46.02 | 19 33 04.36 | +6 37 18.34 |

NORMAL EQUATIONS.

First series.

$$\begin{aligned}
0 &= +0^s.226 + 6.86 \delta t - 3.34 c^1 - 1.01 a^1 & \delta t &= -0^s.008 & \Delta T_0 &= +6^h 36^m 49^s.00 \\
0 &= +0^s.009 - 3.34 \delta t + 17.00 c^1 + 2.72 a^1 & c^1 &= -0^s.062 & c_0 &= -0^s.88 \\
0 &= -1^s.024 - 1.01 \delta t + 2.72 c^1 + 3.18 a^1 & a^1 &= +0^s.372 & a_0 &= -1^s.860
\end{aligned}$$

Second series.

$$\begin{aligned}
0 &= -0^s.832 + 6.85 \delta t + 0.20 c^1 - 1.25 a^1 & \delta t &= +0^s.116 & \Delta T_0 &= +6^h 37^m 19^s.25 \\
0 &= -2^s.666 + 0.20 \delta t + 17.89 c^1 + 0.46 a^1 & c^1 &= +0^s.148 & c_0 &= -0^s.88 \\
0 &= +0^s.099 - 1.25 \delta t + 0.46 c^1 + 3.51 a^1 & a^1 &= -0^s.006 & a_0 &= -1^s.860
\end{aligned}$$

Observations and reductions for time taken at sending station—Continued.

SANTA FE, NEW MEXICO, JULY 2, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|---------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | δ Bootis..... | 8 29 42.25 | — 0.08 | + 0.63 | — 0.86 | 8 29 41.94 | 15 10 24.76 | +6 40 42.82 |
| E. | γ Ursæ Minoris... | 40 14.10 | + 3.90 | + 1.97 | — 2.35 | 40 17.62 | 21 00.53 | 42.91 |
| E. | α Coronæ..... | 48 38.05 | — 0.33 | + 0.90 | — 0.80 | 48 37.82 | 29 20.43 | 42.61 |
| E. | γ Coronæ..... | 56 45.26 | — 0.35 | — 0.82 | — 0.80 | 56 43.29 | 37 26.42 | 43.13 |
| E. | 12 H. Draconis..... | 9 04 05.36 | + 2.01 | — 1.96 | — 1.57 | 9 04 03.84 | 44 46.96 | 43.12 |
| W. | θ Draconis..... | 18 47.68 | + 1.52 | 0.00 | + 1.38 | 18 50.58 | 59 33.20 | 42.62 |
| W. | δ Ophiuchi..... | 27 00.87 | — 1.26 | — 0.03 | + 0.72 | 27 00.30 | 16 07 43.33 | 43.03 |
| W. | γ Herculis..... | 35 37.93 | — 0.59 | — 0.07 | + 0.76 | 35 38.03 | 16 20.95 | 42.92 |
| W. | η Draconis..... | 41 33.12 | + 1.86 | — 0.16 | + 1.51 | 41 36.33 | 22 19.45 | 43.12 |
| W. | σ Herculis..... | 9 49 18.68 | + 0.33 | — 0.14 | + 0.97 | 9 49 19.84 | 30 02.72 | +6 40 42.88 |
| W. | 36 Draconis..... | 11 31 57.09 | + 2.34 | — 0.36 | + 1.82 | 11 32 00.95 | 18 13 13.05 | +6 41 12.10 |
| W. | 109 Herculis..... | 37 06.92 | — 0.55 | — 0.13 | + 0.85 | 37 07.09 | 18 19.25 | 12.16 |
| W. | α Lyrae..... | 51 27.63 | + 0.14 | — 0.05 | + 1.01 | 51 28.73 | 32 40.52 | 11.79 |
| W. | 110 Herculis..... | 59 01.52 | — 0.59 | — 0.02 | + 0.84 | 59 01.75 | 40 13.92 | 12.17 |
| E. | o Draconis..... | 12 08 09.92 | + 1.65 | + 0.53 | — 1.54 | 12 08 10.56 | 49 22.22 | 11.66 |
| E. | v Draconis..... | 14 45.52 | + 3.78 | + 1.01 | — 2.44 | 14 47.87 | 56 00.47 | 12.60 |
| E. | ζ Aquilæ..... | 18 25.46 | — 0.81 | + 0.42 | — 0.81 | 18 24.26 | 59 36.37 | 12.11 |
| E. | α Aquilæ..... | 30 42.50 | — 0.89 | + 0.52 | — 0.81 | 30 41.32 | 19 11 53.35 | 12.03 |
| E. | δ Aquilæ..... | 12 37 57.11 | — 1.14 | + 0.53 | — 0.79 | 12 37 55.71 | 19 19 07.77 | +6 41 12.06 |

NORMAL EQUATIONS.

First series.

$$\begin{aligned}
 0 &= +0^s.857 + 7.44 \delta t - 0.46 c^1 - 0.88 a^1 & \delta t &= -0^s.094 & \Delta T_0 &= +6^h 40^m 43^s.00 \\
 0 &= -0^s.851 - 0.46 \delta t + 17.27 c^1 - 1.21 a^1 & c^1 &= +0^s.056 & c_0 &= -0^s.77 \\
 0 &= -0^s.458 - 0.88 \delta t - 1.21 c^1 + 2.94 a^1 & a^1 &= +0^s.149 & a_0 &= -2^s.143
 \end{aligned}$$

Second series.

$$\begin{aligned}
 0 &= -0^s.299 + 7.11 \delta t + 0.81 c^1 + 0.35 a^1 & \delta t &= +0^s.046 & \Delta T_0 &= +6^h 41^m 12^s.00 \\
 0 &= +0^s.225 + 0.81 \delta t + 14.00 c^1 - 0.41 a^1 & c^1 &= -0^s.020 & c_0 &= -0^s.77 \\
 0 &= -0^s.109 + 0.35 \delta t - 0.41 c^1 + 2.54 a^1 & a^1 &= +0^s.034 & a_0 &= -2^s.143
 \end{aligned}$$

23 AST

Observations and reductions for time taken at sending station—Continued.

SANTA FE, NEW MEXICO, JULY 12, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|--------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | <i>γ</i> Ursæ Minoris... | 8 01 10.34 | — 0.42 | + 0.61 | + 1.33 | 8 01 11.86 | 15 20 59.97 | +7 19 48.11 |
| W. | <i>α</i> Coronæ | 09 31.57 | + 0.04 | + 0.26 | + 0.46 | 09 31.33 | 29 20.33 | 48.00 |
| W. | <i>γ</i> Coronæ | 17 37.55 | + 0.04 | + 0.26 | + 0.45 | 17 38.30 | 37 26.33 | 48.03 |
| W. | <i>κ</i> Serpentis | 23 14.87 | + 0.07 | + 0.23 | + 0.43 | 23 15.60 | 43 03.10 | 47.50 |
| W. | <i>γ</i> Serpentis | 30 48.52 | + 0.08 | + 0.23 | + 0.42 | 30 49.25 | 50 37.00 | 47.75 |
| W. | <i>θ</i> Draconis | 39 44.16 | — 0.16 | + 0.41 | + 0.78 | 39 45.19 | 59 32.95 | 47.76 |
| E. | <i>ε</i> Ophiuchi | 51 50.24 | + 0.12 | + 0.03 | — 0.41 | 51 49.98 | 16 11 37.97 | 47.99 |
| E. | <i>γ</i> Herculis | 56 33.19 | + 0.06 | + 0.03 | — 0.43 | 56 32.85 | 16 20.89 | 48.04 |
| E. | <i>η</i> Draconis | 9 02 32.25 | — 0.20 | + 0.06 | — 0.86 | 9 02 31.25 | 22 19.20 | 47.95 |
| E. | <i>σ</i> Herculis | 9 10 15.58 | — 0.04 | + 0.04 | — 0.55 | 9 10 15.03 | 16 30 02.61 | +7 19 47.58 |
| E. | <i>δ</i> Ursæ Minoris... | 10 53 23.27 | — 2.53 | + 2.79 | — 6.16 | 10 53 17.37 | 18 13 34.12 | +7 20 16.75 |
| E. | 109 Herculis | 58 07.12 | + 0.05 | + 0.28 | — 0.39 | 58 07.06 | 18 19.29 | 12.23 |
| E. | <i>χ</i> Draconis | 11 03 13.21 | — 0.39 | + 0.71 | — 1.22 | 11 03 12.31 | 23 24.54 | 12.23 |
| E. | <i>α</i> Lyræ | 12 28.40 | — 0.01 | + 0.33 | — 0.47 | 12 28.25 | 32 40.55 | 12.30 |
| W. | 110 Herculis | 20 01.17 | + 0.05 | — 0.21 | + 0.39 | 20 01.40 | 40 13.99 | 12.59 |
| W. | <i>β</i> Lyræ | 25 12.92 | + 0.01 | — 0.25 | + 0.44 | 25 13.12 | 45 25.60 | 12.48 |
| W. | <i>ο</i> Draconis | 29 09.61 | — 0.15 | — 0.37 | + 0.71 | 29 09.80 | 49 22.11 | 12.31 |
| W. | <i>ζ</i> Aquilæ | 39 23.67 | + 0.07 | — 0.20 | + 0.38 | 39 23.92 | 59 36.46 | 12.54 |
| W. | 25 Camelop., H. sq. | 43 54.82 | + 1.33 | + 0.76 | — 2.85 | 43 54.06 | 19 04 07.51 | 13.45 |
| W. | <i>δ</i> Draconis | 11 52 21.77 | — 0.26 | — 0.46 | + 0.95 | 11 52.22.00 | 19 12 34.45 | +7 20 12.45 |

NORMAL EQUATIONS.

First series.

$$\begin{aligned}
 0 &= +0^s.227 + 7.32 \delta t - 1.09 c^1 + 0.03 a^1 & \delta t &= -0^s.031 & \Delta T_0 &= +7^h 19^m 47^s.90 \\
 0 &= -0^s.234 - 1.09 \delta t + 15.03 c^1 + 1.54 a^1 & c^1 &= +0^s.005 & c_0 &= -0^s.410 \\
 0 &= -0^s.230 + 0.03 \delta t + 1.54 c^1 + 2.65 a^1 & a^1 &= +0^s.084 & a_0 &= +0^s.131
 \end{aligned}$$

Second series.

$$\begin{aligned}
 0 &= -0^s.306 + 5.85 d \Delta T - 1.95 dc - 0.51 da & da &= +0^s.070 & \Delta T_0 &= +7^h 20^m 12^s.35 \\
 0 &= -0^s.631 - 1.95 d \Delta T + 16.87 dc + 0.33 da & dc &= +0^s.045 & c_0 &= -0^s.41 \\
 0 &= -0^s.307 - 0.51 d \Delta T + 0.33 dc + 4.70 da & d \Delta T &= +0^s.073 & a_0 &= +0^s.123
 \end{aligned}$$

Weight of $a = 4.65$ Weight of $c = 16.17$ Weight of $\Delta T = 5.57$

Observations and reductions for time taken at sending station—Continued.

SANTA FÉ, NEW MEXICO, JULY 14, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT . |
|--------|---------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | 110 Herculis | 11 12 02.68 | — 0.62 | + 0.16 | — 0.49 | 11 12 01.73 | 18 40 14.00 | +7 28 12.27 |
| E. | <i>o</i> Draconis | 21 08.88 | + 1.72 | + 1.27 | — 0.90 | 21 09.97 | 49 22.23 | 12.26 |
| E. | ζ Aquilæ | 31 25.02 | — 0.85 | + 0.15 | — 0.47 | 31 23.85 | 59 36.48 | 12.63 |
| W. | δ Draconis | 44 19.04 | + 3.02 | — 0.89 | + 1.20 | 44 22.37 | 19 12 34.44 | 12.07 |
| W. | δ Aquilæ | 50 56.65 | — 1.19 | — 0.34 | + 0.46 | 50 55.58 | 19 07.90 | 12.32 |
| W. | β Cygni | 57 25.42 | — 0.35 | + 0.05 | + 0.52 | 57 25.70 | 25 38.20 | 12.50 |
| W. | σ Draconis | 12 04 21.95 | + 3.49 | + 0.10 | + 1.31 | 12 04 26.85 | 32 39.40 | 12.55 |
| W. | γ Aquilæ | 12 03.75 | — 0.96 | + 0.04 | + 0.47 | 12 03.30 | 40 15.48 | 12.18 |
| W. | α Aquilæ | 16 25.81 | — 1.02 | + 0.04 | + 0.47 | 16 25.30 | 44 37.40 | 12.10 |
| W. | ϵ Draconis | 20 21.16 | + 3.62 | + 0.10 | + 1.35 | 20 26.23 | 48 38.94 | 12.71 |
| W. | Groombr. 2984 .. | 24 38.50 | + 0.22 | + 0.06 | + 0.60 | 24 39.38 | 52 51.31 | 11.93 |
| E. | 28 Cygni | 36 33.42 | + 0.04 | + 0.19 | — 0.57 | 36 33.08 | 20 04 44.90 | 11.82 |
| E. | 31 Cygni | 41 28.21 | + 0.59 | + 0.22 | — 0.67 | 41 28.35 | 09 40.21 | 11.86 |
| E. | κ Cephei | 44 53.84 | + 6.67 | + 0.52 | — 2.10 | 44 58.93 | 13 11.89 | 12.96 |
| E. | 39 Cygni | 50 37.52 | — 0.18 | + 0.18 | — 0.55 | 50 36.97 | 18 49.44 | 12.47 |
| E. | ϵ Delphini | 12 58 59.41 | — 0.94 | + 0.14 | — 0.47 | 12 58 58.14 | 20 27 10.81 | +7 28 12.67 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -0^s.028 + 11.53 \, d\Delta T - 0.52 \, dc + 0.11 \, da & d\Delta T &= +0^s.005 & \Delta T_0 &= +7^h 28^m 12^s.28 \\
 0 &= +0^s.822 - 0.52 \, d\Delta T + 24.00 \, dc + 1.44 \, da & dc &= -0^s.044 & c_0 &= -0^s.417 \\
 0 &= -0^s.444 + 0.11 \, d\Delta T + 1.44 \, dc + 4.46 \, da & da &= +0^s.120 & a_0 &= +2^s.321
 \end{aligned}$$

Weight of $\Delta T = 11.52$ Weight of $c = 23.51$ Weight of $a = 4.37$

Observations and reductions for time taken at sending station—Continued.

SANTA FE, NEW MEXICO, JULY 17, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|--------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | <i>ε</i> Ophiuchi..... | 8 32 10.26 | + 0.18 | + 0.14 | + 0.41 | 8 32 10.99 | 16 11 37.33 | +7 39 26.94 |
| W. | <i>γ</i> Herculis | 36 53.92 | + 0.10 | + 0.19 | + 0.43 | 36 54.64 | 16 20.85 | 26.21 |
| W. | <i>η</i> Draconis | 42 51.95 | − 0.30 | + 0.35 | + 0.86 | 42 52.86 | 22 19.06 | 26.20 |
| E. | <i>ζ</i> Herculis | 57 05.67 | + 0.03 | + 0.38 | − 0.48 | 57 05.60 | 36 31.86 | 26.26 |
| E. | <i>κ</i> Ophiuchi | 9 12 15.04 | + 0.14 | + 0.29 | − 0.41 | 9 12 15.06 | 51 41.29 | 26.23 |
| E. | <i>ε</i> Ursæ Minoris... | 9 19 44.98 | − 1.72 | + 1.65 | − 2.97 | 9 19 41.94 | 16 59 10.05 | +7 39 28.11 |
| E. | Groombr. 2533 .. | 10 31 59.68 | − 0.01 | + 0.08 | − 0.83 | 10 31 58.92 | 18 11 43.95 | +7 39 45.03 |
| E. | 109 Herculis | 38 34.14 | + 0.02 | + 0.06 | − 0.66 | 38 33.56 | 18 19.29 | 45.73 |
| E. | <i>λ</i> Draconis | 43 40.43 | − 0.13 | + 0.16 | − 2.08 | 43 38.38 | 23 24.38 | 46.00 |
| E. | <i>α</i> Lyræ | 52 55.87 | 0.00 | + 0.07 | − 0.79 | 52 55.15 | 32 40.55 | 45.40 |
| E. | <i>β</i> Lyræ | 11 05 40.79 | 0.00 | + 0.07 | − 0.74 | 11 05 40.12 | 45 25.61 | 45.49 |
| E. | <i>ο</i> Draconis | 09 38.07 | − 0.05 | + 0.10 | − 1.21 | 09 36.91 | 49 22.18 | 45.27 |
| E. | <i>ζ</i> Aquilæ | 19 51.32 | + 0.03 | + 0.06 | − 0.63 | 19 50.78 | 59 36.49 | 45.71 |
| W. | <i>δ</i> Draconis | 32 47.21 | − 0.09 | + 0.07 | + 1.61 | 32 48.80 | 19 12 34.41 | 45.61 |
| W. | <i>δ</i> Aquilæ | 39 21.81 | + 0.04 | + 0.03 | + 0.62 | 39 22.50 | 19 07.92 | 45.42 |
| W. | <i>β</i> Cygni | 11 45 52.01 | + 0.01 | + 0.03 | + 0.70 | 11 45 52.75 | 19 25 38.18 | +7 39 45.43 |

Four stars, *α* Coronæ, *γ* Coronæ, *ζ* Ursæ Minoris, *θ* Draconis, were rejected, owing to an accidental disturbance of the azimuth. This was noted at the time, and care taken that the determination should be completed; but at best the instrument was very unsteady.

NORMAL EQUATIONS.

First series.

$$0 = -0^s.590 + 4.13 \, d\Delta T - 1.10 \, dc + 0.80 \, da$$
$$0 = -0^s.420 - 1.10 \, d\Delta T + 7.85 \, dc - 0.63 \, da$$
$$0 = -0^s.666 + 0.80 \, d\Delta T - 0.63 \, dc + 1.99 \, da$$

$$d\Delta T = +0^s.106$$
$$dc = +0^s.094$$
$$da = +0^s.321$$

$$\Delta T_0 = +7^h \, 39^m \, 26^s.300$$
$$c_0 = -0^s.500$$
$$a_0 = 0^s.000$$

$$\text{Weight of } \Delta T = 3.72$$
$$\text{Weight of } c = 7.46$$
$$\text{Weight of } a = 1.81$$

Second series.

$$0 = +0^s.135 + 7.71 \, d\Delta T + 4.22 \, dc - 0.24 \, da$$
$$0 = +1^s.864 + 4.22 \, d\Delta T + 15.91 \, dc - 1.18 \, da$$
$$0 = -0^s.600 - 0.24 \, d\Delta T - 1.18 \, dc + 2.50 \, da$$

$$d\Delta T = +0^s.053$$
$$dc = -0^s.117$$
$$da = +0^s.189$$

$$\Delta T_0 = +7^h \, 39^m \, 45^s.43$$
$$c_0 = -0^s.50$$
$$a_0 = 0^s.123$$

Observations and reductions for time taken at sending station—Continued.

SANTA FE, NEW MEXICO, JULY 19, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|--------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | γ Herculis | 8 29 03.20 | — 0.81 | — 0.04 | — 0.48 | 8 29 01.87 | 16 16 20.83 | +7 47 18.96 |
| E. | η Draconis | 34 58.18 | + 2.55 | — 0.08 | — 0.95 | 34 59.70 | 22 18.99 | 19.29 |
| E. | σ Herculis | 42 44.13 | + 0.45 | — 0.06 | — 0.61 | 42 43.91 | 30 02.51 | 18.60 |
| E. | ζ Herculis | 49 13.64 | — 0.22 | — 0.05 | — 0.53 | 49 12.84 | 36 31.84 | 19.00 |
| E. | Groombr. 2377 .. | 55 30.38 | + 1.83 | — 0.07 | — 0.83 | 55 36.31 | 42 55.71 | 19.40 |
| W. | Groombr. 2415 .. | 9 16 20.60 | + 0.32 | — 0.14 | + 0.59 | 9 16 21.37 | 17 03 40.26 | 18.89 |
| W. | ζ Draconis | 27 05.21 | + 3.36 | — 0.32 | + 1.10 | 21 09.35 | 08 28.18 | 18.83 |
| W. | 72 Herculis | 28 37.12 | — 0.17 | — 0.24 | + 0.53 | 28 37.24 | 15 56.50 | 19.26 |
| W. | α Ophiuchi | 9 41 45.94 | — 1.10 | — 0.24 | + 0.46 | 9 41 45.06 | 17 29 04.38 | +7 47 19.32 |
| W. | Groombr. 2533 .. | 10 24 08.74 | + 0.44 | — 0.01 | + 0.70 | 10 24 09.87 | 18 11 43.95 | +7 47 34.08 |
| W. | 109 Herculis | 30 45.59 | — 0.76 | + 0.05 | + 0.56 | 30 45.44 | 18 19.29 | 33.85 |
| W. | χ Draconis | 35 43.01 | + 5.90 | + 0.52 | + 1.73 | 35 51.16 | 23 24.32 | 33.16 |
| W. | α Lyræ | 45 05.62 | + 0.20 | + 0.46 | + 0.66 | 45 06.94 | 32 40.54 | 33.60 |
| E. | ο Draconis | 11 01 47.12 | + 2.28 | — 0.19 | — 1.01 | 11 01 48.20 | 49 22.19 | 33.99 |
| E. | ε Aquilæ | 06 21.97 | — 1.07 | — 0.10 | — 0.53 | 06 20.27 | 53 53.68 | 33.41 |
| E. | ζ Aquilæ | 11 12 04.65 | — 1.12 | — 0.10 | — 0.53 | 11 12 02.90 | 18 59 36.50 | +7 47 33.60 |

NORMAL EQUATIONS.

First series.

$$\begin{aligned}
0 &= +0^s.219 + 6.89 d\Delta T + 1.02 dc - 0.80 da & d\Delta T &= -0^s.019 & \Delta T_0 &= +7^h 47^m 19^s.07 \\
0 &= -0^s.877 + 1.02 d\Delta T + 14.32 dc - 0.58 da & dc &= +0^s.071 & c_0 &= -0^s.52 \\
0 &= -0^s.303 - 0.80 d\Delta T - 0.58 dc + 1.64 da & da &= +0^s.202 & a_0 &= -2^s.938
\end{aligned}$$

Weight of $\Delta T = 6.46$ Weight of $c = 14.03$ Weight of $a = 1.53$

Second series.

$$\begin{aligned}
0 &= -0^s.024 + 5.33 d\Delta T - 0.76 dc - 0.22 da & d\Delta T &= +0^s.006 & \Delta T_0 &= +7^h 47^m 33^s.70 \\
0 &= -0^s.066 - 0.76 d\Delta T + 11.29 dc + 1.66 da & dc &= +0^s.004 & c_0 &= -0^s.52 \\
0 &= -0^s.037 - 0.22 d\Delta T + 1.66 dc + 1.81 da & da &= +0^s.018 & a_0 &= -2^s.938
\end{aligned}$$

Observations and reductions for time taken at sending station—Continued.

SANTA FE, NEW MEXICO, JULY 21, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|--------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | 110 Herculis | 10 44 45.51 | + 1.26 | + 0.26 | — 0.41 | 10 44 46.62 | 18 40 14.00 | +7 55 27.38 |
| E. | β Lyræ | 49 58.37 | + 0.23 | + 0.26 | — 0.46 | 49 58.40 | 45 25.61 | 27.21 |
| E. | o Draconis | 53 58.34 | — 3.52 | + 0.36 | — 0.75 | 53 54.43 | 49 22.14 | 27.71 |
| E. | 1 Lyræ | 58 46.16 | + 0.29 | + 0.21 | — 0.46 | 58 46.20 | 54 13.80 | 27.60 |
| W. | δ Draconis | 11 17 11.68 | — 6.18 | + 0.33 | + 1.00 | 11 17 06.83 | 19 12 34.36 | 27.53 |
| W. | δ Aquilæ | 23 37.49 | + 2.44 | + 0.15 | + 0.38 | 23 40.46 | 19 07.95 | 27.49 |
| W. | β Cygni | 30 09.04 | + 0.71 | + 0.26 | + 0.43 | 30 10.44 | 25 38.20 | 27.76 |
| W. | θ Cygni | 11 37 38.03 | — 1.72 | + 0.43 | + 0.59 | 11 37 37.33 | 19 33 04.49 | +7 55 27.16 |
| W. | γ Aquilæ | 11 44 35.93 | + 1.72 | — 0.09 | + 0.50 | 11 44 38.06 | 19 40 15.53 | +7 55 37.47 |
| W. | α Aquilæ | 48 58.02 | + 1.83 | — 0.09 | + 0.50 | 49 00.26 | 44 37.46 | 37.22 |
| W. | κ Cephei | 12 17 44.50 | —11.98 | — 0.34 | + 2.24 | 12 17 34.42 | 20 13 11.88 | 37.42 |
| W. | γ Cygni | 21 05.30 | — 0.38 | — 0.13 | + 0.64 | 21 05.43 | 17 42.48 | 37.04 |
| E. | θ Cephei | 31 56.12 | — 2.49 | — 0.37 | — 1.06 | 31 52.30 | 27 29.57 | 37.28 |
| E. | α Delphini | 38 09.11 | + 0.87 | — 0.19 | — 0.51 | 38 09.28 | 33 46.55 | 37.27 |
| E. | γ Delphini | 12 46 10.63 | + 0.87 | — 0.19 | — 0.51 | 12 46 10.80 | 20 40 48.05 | +7 55 37.26 |

NORMAL EQUATIONS.

First series..

$$\begin{aligned}
 0 &= -0^s.062 + 6.41 d\Delta T + 0.03 dc - 0.18 da & d\Delta T &= +0^s.019 & \Delta T_0 &= +7^h 55^m 27^s.45 \\
 0 &= -0^s.581 + 0.03 d\Delta T + 12.41 dc + 0.70 da & dc &= +0^s.027 & c_0 &= -0^s.41 \\
 0 &= -0^s.588 - 0.18 d\Delta T + 0.70 dc + 1.56 da & da &= +0^s.348 & a_0 &= +4^s.16
 \end{aligned}$$

Weight of $\Delta T = 6.39$ Weight of $c = 12.10$ Weight of $a = 1.52$

Second series.

The assumed azimuth was different before and after reversal, as a change took place then.

Before reversal—

$$\begin{aligned}
 0 &= -0^s.416 + 3.01 d\Delta T - 3.88 dc + 0.32 da^1 & \Delta T_0 &= +7^h 55^m 37^s.20 \\
 0 &= +1^s.122 - 3.88 d\Delta T + 6.87 dc + 1.44 da^1 & c_0 &= -0^s.41 \\
 0 &= +0^s.489 + 0.32 d\Delta T + 1.44 dc + 1.89 da^1 & a_0 &= +4^s.16
 \end{aligned}$$

After reversal—

$$\begin{aligned}
 0 &= +0^s.092 + 2.45 d\Delta T + 3.09 dc + 0.23 da^{11} & \Delta T_0 &= +7^h 55^m 37^s.20 \\
 0 &= +0^s.124 + 3.09 d\Delta T + 4.40 dc - 0.30 da^{11} & c_0 &= -0^s.41 \\
 0 &= 0^s.000 + 0.23 d\Delta T - 0.30 dc + 0.72 da^{11} & a_0 &= +2^s.494
 \end{aligned}$$

First eliminating da^1 and da^{11} , and then combining the resulting equations, we get—

$$\begin{aligned}
 d\Delta T &= +0^s.062 & \Delta T &= +7^h 55^m 37^s.262 \\
 dc &= -0^s.081 & c &= -0^s.491 \\
 da^1 &= -0^s.208 & a^1 &= +3^s.952 \\
 da^{11} &= -0^s.053 & a^{11} &= +2^s.441
 \end{aligned}$$

Weight of $\Delta T = 5.24$

The observations for time taken at Salt Lake are printed for June 25, July 1, July 2, and July 3, in the report on Georgetown; those for July 12, July 14, and July 17, in the report on Hughes.

The following tables show the corrections and rates of the chronometers used at Santa Fé and Salt Lake City :—

CHRONOMETER AT SANTA FÉ—FRODSHAM, No. 1974.

| Date. | Local sidereal time. | Correction of chronometer. | Adopted hourly rate. |
|---------|----------------------|----------------------------|----------------------|
| 1873. | <i>h.</i> | <i>h. m. s.</i> | <i>s.</i> |
| June 25 | 16.5 | 6 13 26.783 \pm 0.043 | + 9.772 |
| July 1 | 17.5 | 37 03.679 \pm 0.043 | + 9.779 |
| July 2 | 17.5 | 40 57.476 \pm 0.040 | + 9.728 |
| July 12 | 17.25 | 7 20 00.146 \pm 0.043 | + 9.728 |
| July 14 | 19.5 | 28 12.285 \pm 0.045 | + 9.783 |
| July 17 | 18.0 | 39 40.714 \pm 0.048 | + 9.680 |
| July 19 | 17.75 | 47 26.378 \pm 0.045 | + 9.791 |
| July 21 | 19.50 | 7 55 32.366 \pm 0.045 | + 9.760 |

CHRONOMETER AT SALT LAKE CITY—NEGUS, No. 1511.

| Date. | Local sidereal time. | Correction of chronometer. | Adopted hourly rate. |
|---------|----------------------|----------------------------|----------------------|
| 1873. | <i>h.</i> | <i>h. m. s.</i> | <i>s.</i> |
| June 25 | 16.5 | + 8 07 24.61 | + 0.052 |
| July 1 | 15.0 | 15.84 | + 0.046 |
| July 2 | 16.5 | 14.68 | + 0.049 |
| July 3 | 16.2 | 13.50 | 0.000 |
| July 12 | 17.5 | 08.48 | + 0.025 |
| July 14 | 16.0 | 07.61 | + 0.021 |
| July 17 | 17.25 | + 8 07 05.85 | + 0.010 |

NOTE.—In calculating the probable errors, Professor Safford used the probable error of one star at the equator, ± 0.152 , as derived from the mean of all the observations, considering it always unsafe to employ a probable error derived from a few observations.

Final results of longitude.

| Signals sent from— | Recorded at— | Mean of signals sent and received. | Time-corrections. | Corrected time. | Difference of longitude. | Double-wave time. | Means. | |
|--------------------|------------------|------------------------------------|-------------------|-----------------|--------------------------|-------------------|-----------|---------|
| | | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> | <i>s.</i> | <i>s.</i> | |
| June 25, 1873: | | | | | | | | |
| Salt Lake City. | Santa Fé | 11 18 53.61 | +6 13 36.89 | 17 32 30.50 | 23 47.89 | } 47.885 | 47.80 | |
| | Salt Lake City | 9 01 18.03 | +8 07 24.58 | 17 08 42.61 | | | | |
| | Santa Fé | 11 42 46.67 | +6 13 40.86 | 17 56 27.53 | 47.83 | | | |
| | Salt Lake City | 9 25 15.09 | +8 07 24.56 | 17 32 39.65 | | | | |
| Santa Fé | Santa Fé | 11 31 30.00 | +6 13 39.02 | 17 45 09.02 | 47.66 | } 47.715 | | |
| | Salt Lake City | 9 13 56.79 | +8 07 24.57 | 17 21 21.36 | | | | |
| | Santa Fé | 11 51 30.00 | +6 13 42.29 | 18 05 12.29 | 47.77 | | | } 0.170 |
| | Salt Lake City | 9 33 59.97 | +8 07 24.55 | 17 41 24.52 | | | | |
| July 1, 1873: | | | | | | | | |
| Santa Fé | Santa Fé | 10 42 40.00 | +6 37 02.00 | 17 19 42.00 | 47.85 | 0.26 | 47.98 | |
| | Salt Lake City | 8 48 38.40 | +8 07 15.75 | 16 55 54.15 | | | | |
| Salt Lake City. | Santa Fé | 11 00 32.78 | +6 37 04.92 | 17 37 37.70 | 23 48.11 | | | |
| | Salt Lake City | 9 06 33.85 | +8 07 15.74 | 17 13 49.59 | | | | |

Final results of longitude—Continued.

| Signals sent from— | Recorded at— | Mean of signals sent and received. | Time-corrections. | Corrected time. | Difference of longitude. | Double-wave time. | Means. |
|--------------------|----------------|------------------------------------|-------------------|-----------------|--------------------------|-------------------|-----------|
| | | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> | <i>s.</i> | <i>s.</i> |
| July 2, 1873: | | | | | | | |
| Santa Fé | Santa Fé | 10 51 30.00 | +6 40 57.87 | 17 32 27.87 | 23 47.76 | (0.19) | 47.86 |
| | Salt Lake City | 9 01 25.46 | +8 07 14.65 | 17 08 40.11 | | | |
| July 12, 1873: | | | | | | | |
| Salt Lake City. | Santa Fé | 10 07 42.55 | +7 20 02.22 | 17 27 44.77 | 48.10 | | |
| | Salt Lake City | 8 56 48.18 | +8 07 08.49 | 17 03 56.67 | | | |
| | Santa Fé | 10 13 44.21 | +7 20 03.21 | 17 33 47.42 | 47.85 | 0.25 | 47.98 |
| | Salt Lake City | 9 02 51.08 | +8 07 08.49 | 17 09 59.57 | | | |
| July 14, 1873: | | | | | | | |
| Salt Lake City. | Santa Fé | 10 18 15.96 | +7 27 55.36 | 17 46 11.32 | 47.92 | | |
| | Salt Lake City | 9 15 15.82 | +8 07 07.58 | 17 22 23.40 | | | |
| | Santa Fé | 10 23 49.50 | +7 27 56.27 | 17 51 45.77 | 47.76 | 0.16 | 47.84 |
| | Salt Lake City | 9 20 50.43 | +8 07 07.58 | 17 27 58.01 | | | |
| July 17, 1873: | | | | | | | |
| Salt Lake City. | Santa Fé | 9 38 56.07 | +7 39 34.02 | 17 18 30.09 | 47.77 | | |
| | Salt Lake City | 8 47 36.47 | +8 07 05.85 | 16 54 42.32 | | | |
| | Santa Fé | 9 48 10.00 | +7 39 35.51 | 17 27 45.51 | 23 47.65 | 0.12 | 47.71 |
| | Salt Lake City | 8 56 52.01 | +8 07 05.85 | 17 03 57.86 | | | |

Santa Fé east of Salt Lake City..... 0^h 23^m 47^s.86

Final results of longitude.

| Signals sent from— | Recorded at— | Mean of signals sent and received. | Time-corrections. | Corrected time. | Difference of longitude. | Double-wave time. | Means. |
|--------------------|----------------|------------------------------------|-------------------|-----------------|--------------------------|-------------------|--------------|
| | | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> | <i>s.</i> | <i>m. s.</i> |
| July 12, 1873: | | | | | | | |
| Hughes | Hughes | 17 05 55.00 | —0 10 13.33 | 16 55 41.67 | 4 31.04 | | |
| | Santa Fé | 9 31 14.37 | +7 19 56.26 | 16 51 10.63 | | | |
| | Hughes | 17 48 37.14 | —0 10 13.32 | 17 38 23.82 | 31.11 | 0.07 | 4 31.075 |
| | Santa Fé | 10 13 49.50 | +7 20 03.21 | 17 33 52.71 | | | |
| July 14, 1873: | | | | | | | |
| Hughes | Hughes | 18 21 33.06 | —0 10 12.10 | 18 11 20.96 | 31.19 | | |
| | Santa Fé | 10 38 51.05 | +7 27 58.72 | 18 06 49.77 | | | |
| | Hughes | 18 33 33.63 | —0 10 12.10 | 18 23 21.53 | 31.30 | 0.11 | 31.245 |
| | Santa Fé | 10 50 49.50 | +7 28 00.73 | 18 18 50.23 | | | |
| July 17, 1873: | | | | | | | |
| Hughes | Hughes | 18 09 20.00 | —0 10 11.34 | 17 59 08.66 | 31.12 | (0.08) | 31.160 |
| | Santa Fé | 10 14 57.69 | +7 39 39.85 | 17 54 37.54 | | | |
| July 21, 1873: | | | | | | | |
| Hughes | Hughes | 17 46 40.00 | —0 10 09.96 | 17 36 30.04 | 31.04 | | |
| | Santa Fé | 9 36 45.83 | +7 55 13.17 | 17 31 59.00 | | | |
| | Hughes | 17 58 35.67 | —0 10 09.96 | 17 48 25.71 | 4 31.10 | 0.06 | 4 31.070 |
| | Santa Fé | 9 48 39.50 | +7 55 15.11 | 17 43 54.61 | | | |

Hughes east of Santa Fé..... 0^h 04^m 31^s.138
 Hughes east of Salt Lake City..... 0^h 28^m 18^s.938
 Santa Fé east of Salt Lake City, (by way of Hughes)..... 0^h 23^m 47^s.80
 Santa Fé east of Salt Lake City, (by direct connection)..... 0^h 23^m 47^s.86
 Santa Fé east of Salt Lake City, (adopted value)..... 0^h 23^m 47^s.85 ± 0^s.021
 Salt Lake City west of Greenwich..... 7^h 27^m 34^s.86
 Santa Fé west of Greenwich..... 7^h 03^m 47^s.01, or 105° 56' 45".15
 Santa Fé west of Washington..... 1^h 55^m 34^s.89, or 28° 53' 43".35
 Applying the correction, + 0^s.07, for change of position of station at Santa Fé—
 Longitude of Santa Fé, (present monument)..... 105° 56' 45".22

DETERMINATION OF LATITUDE.

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Mean places of stars for 1873.0 used for determination of latitude of Santa Fé, New Mexico.

| No. of pair. | Number in B. A. C. | Right ascension. | Declination. | No. of pair. | Number in B. A. C. | Right ascension. | Declination. |
|--------------|--------------------|------------------|--------------|--------------|--------------------|------------------|--------------|
| | | <i>h. m. s.</i> | <i>° ' "</i> | | | <i>h. m. s.</i> | <i>° ' "</i> |
| 1.... | 5131 | 15 47 28 | 31 47 19.92 | 27.... | 6496 | 18 54 36 | 57 38 48.76 |
| | 5155 | 30 35 | 39 25 59.10 | | 6528 | 59 34 | 13 40 34.58 |
| 2.... | 5204 | 15 38 59 | 32 55 05.36 | 28.... | 6566 | 19 05 18 | 50 09 34.52 |
| | 5295 | 51 10 | 38 18 54.36 | | 6574 | 07 10 | 21 20 31.60 |
| 3.... | 5210 | 15 39 23 | 52 45 45.02 | 29.... | 6589 | 19 10 45 | 21 10 04.34 |
| | 5234 | 43 01 | 18 32 07.38 | | 6659 | 20 04 | 50 01 25.36 |
| 4.... | 5284 | 15 50 35 | 16 04 39.68 | 30.... | 6678 | 19 23 48 | 20 01 10.64 |
| | 5313 | 54 47 | 55 06 33.34 | | 6697 | 26 30 | 51 27 35.92 |
| 5.... | 5315 | 15 55 32 | 18 10 15.56 | 31.... | 6695 | 19 26 31 | 20 39 39.60 |
| | 5341 | 58 51 | 53 16 09.72 | | 6723 | 31 02 | 50 57 54.06 |
| 6.... | 5367 | 16 02 21 | 17 23 12.32 | 32.... | (R. C. 4379) | 19 31 10 | 59 52 53.96 |
| | (Gr. 2325) | 12 41 | 53 33 15.20 | | 6749 | 36 35 | 11 31 45.86 |
| 7.... | 5466 | 16 16 19 | 19 27 10.52 | 33.... | 6740 | 19 34 22 | 29 51 42.58 |
| | 5503 | 21 47 | 52 00 17.76 | | 6769 | 39 31 | 41 28 09.62 |
| 8.... | 5520 | 16 24 31 | 2 15 49.34 | 34.... | 6762 | 19 38 44 | 26 49 58.24 |
| | 5545 | 28 14 | 69 02 34.08 | | 6779 | 41 00 | 44 49 18.34 |
| 9.... | 5530 | 16 25 47 | 22 28 12.82 | 35.... | 6794 | 19 43 20 | 18 49 30.24 |
| | 5596 | 35 18 | 49 10 39.40 | | 6824 | 47 26 | 52 39 58.84 |
| 10.... | 5604 | 16 36 30 | 31 50 03.46 | 36.... | 6800 | 19 44 00 | 33 07 15.10 |
| | 5617 | 38 33 | 39 09 54.04 | | 6813 | 46 04 | 38 23 48.62 |
| 11.... | 5629 | 16 40 22 | 55 55 24.64 | 37.... | 6835 | 19 49 08 | 23 59 16.08 |
| | 5674 | 46 18 | 15 11 20.00 | | (Gr. 2977) | 51 17 | 47 12 18.48 |
| 12.... | 5677 | 16 46 29 | 24 52 17.40 | 38.... | 6851 | 19 51 32 | 34 44 49.86 |
| | 5706 | 50 40 | 46 44 44.24 | | 6875 | 55 16 | 36 41 45.20 |
| 13.... | 5765 | 16 59 29 | 12 55 00.94 | 39.... | 6881 | 19 55 54 | 51 42 30.36 |
| | 5797 | 17 05 07 | 58 26 04.90 | | 6901 | 59 32 | 19 37 43.02 |
| 14.... | (Gr. 2431) | 17 14 07 | 38 56 32.36 | 40.... | 6933 | 20 04 20 | 20 32 21.06 |
| | 5863 | 15 55 | 32 37 56.94 | | 6959 | 09 00 | 51 04 56.40 |
| 15.... | 5828 | 17 09 49 | 24 59 25.30 | 41.... | 6975 | 20 10 45 | 21 12 37.60 |
| | 5871 | 16 46 | 46 21 58.58 | | 6985 | 12 02 | 49 50 32.14 |
| 16.... | 5883 | 17 18 48 | 23 04 48.22 | 42.... | 6998 | 20 13 46 | 34 35 13.28 |
| | 5911 | 23 22 | 48 22 02.94 | | 7006 | 15 03 | 36 44 01.28 |
| 17.... | 5918 | 17 24 11 | 58 45 29.84 | 43.... | 7022 | 20 17 40 | 39 51 04.58 |
| | 5941 | 29 02 | 12 39 15.80 | | 7029 | 18 48 | 31 46 52.94 |
| 18.... | 5997 | 17 36 47 | 43 32 00.84 | 44.... | 7084 | 20 26 10 | 36 30 32.70 |
| | 6021 | 41 29 | 27 47 47.28 | | 7103 | 28 58 | 34 49 01.08 |
| 19.... | 6056 | 17 46 44 | 48 25 45.06 | 45.... | *7131 | 20 32 22 | 31 07 47.84 |
| | 6116 | 57 12 | 22 55 26.60 | | 7158 | 34 54 | 40 07 53.90 |
| 20.... | (Gr. 2536) | 18 00 41 | 22 12 31.70 | 46.... | 7174 | 20 37 21 | 41 15 46.96 |
| | 6134 | 11 42 | 49 06 53.22 | | 7194 | 40 25 | 30 15 26.08 |
| 21.... | 6147 | 18 02 12 | 30 32 42.86 | 47.... | 7241 | 20 45 34 | 43 34 54.04 |
| | 6218 | 13 05 | 40 53 15.48 | | 7256 | 49 09 | 27 34 32.32 |
| 22.... | 6231 | 18 14 56 | 21 54 33.56 | 48.... | 7275 | 20 52 36 | 21 50 10.30 |
| | 6252 | 17 56 | 49 39 50.26 | | 7294 | 54 26 | 49 58 09.92 |
| 23.... | 6302 | 18 23 20 | +72 40 37.00 | 49.... | 7350 | 21 08 18 | 9 29 35.94 |
| | 6307 | 25 24 | -1 05 28.20 | | 7416 | 15 33 | 62 02 51.86 |
| 24.... | (Arg. LXIII) | 18 27 58 | 30 27 37.50 | 50.... | 7444 | 21 18 56 | 25 37 44.78 |
| | 6364 | 35 27 | 40 49 11.90 | | 7455 | 20 40 | 46 09 53.74 |
| 25.... | 6355 | 18 32 38 | 38 40 00.02 | 51.... | 7482 | 21 25 19 | 66 15 17.80 |
| | 6426 | 45 02 | 32 40 03.98 | | 7522 | 32 10 | 5 11 59.58 |
| 26.... | 6392 | 18 40 24 | 37 28 24.52 | | | | |
| | 6468 | 50 13 | 33 48 27.32 | | | | |

* On July 26, B. A. C. 7132, A. R. 20^h 32^m 23^s declination 31° 04' 50".44, was used instead of 7131.

Observations and computations for latitude.

SANTA FE, NEW MEXICO.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|---------------------|--------------|----------------------|-----------|-----------|-----------|-----------------------------|------------------------|----------|-------------|
| | | | N. | S. | | | Microm. & and refr. | Level. | |
| 1873. June 27 .. | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | <i>o' "</i> | <i>' "</i> | <i>"</i> | <i>o' "</i> |
| | 5131 | 3 55.5 | 59.0 | 14.5 | Set poor. | 35 36 41.49 | + 4 37.30 | - 2.04 | 35 41 16.75 |
| | 5155 | 4 93.9 | 11.0 | 63.0 | | | | | |
| | 5204 | 19 33.9 | 35.5 | 38.0 | | 37 01.23 | + 4 15.74 | + 0.41 | 17.38 |
| | 5295 | 6 39.3 | 39.0 | 35.0 | | | | | |
| | 5315 | 11 02.1 | 14.0 | 60.0 | | 43 13.42 | - 1 41.83 | -10.35 | 21.24 |
| | 5341 | 14 18.5 | 41.0 | 33.0 | | | | | |
| | 5466 | 11 74.2 | 35.0 | 40.0 | | 43 44.10 | - 2 17.18 | -10.22 | 16.70 |
| | 5503 | 16 00.4 | 21.5 | 54.0 | | | | | |
| | 5677 | 12 89.3 | 57.5 | 19.0 | | 48 29.92 | - 7 21.48 | +12.13 | 20.57 |
| | 5706 | 26 61.0 | 41.0 | 35.0 | | | | | |
| | 5765 | 12 24.2 | 21.0 | 55.0 | | 40 31.19 | + 0 54.94 | -10.90 | 15.23 |
| | 5797 | 10 53.5 | 35.0 | 41.0 | | | | | |
| | 5828 | 10 29.0 | 62.0 | 13.0 | | 40 40.14 | + 0 22.98 | +14.72 | 17.84 |
| | 5871 | 9 57.6 | 40.0 | 35.0 | | | | | |
| | 5918 | 12 24.0 | 54.0 | 21.0 | | 42 20.44 | - 0 41.90 | -10.08 | 28.46 |
| | 5941 | 10 93.8 | 2.5 | ----- | | | | | |
| | 6056 | 7 90.0 | 17.0 | 57.0 | | 40 32.92 | + 0 30.06 | + 3.27 | 6.25 |
| | 6116 | 8 83.4 | 63.0 | 11.0 | | | | | |
| | 6147 | 10 56.0 | 23.0 | 51.0 | | 42 55.70 | - 1 24.96 | -13.62 | 17.12 |
| | 6218 | 13 20.0 | 26.0 | 48.0 | | | | | |
| | 6355 | 8 16.4 | 44.5 | 29.0 | | 39 57.76 | + 1 24.45 | - 4.50 | 17.71 |
| | 6426 | 9 78.8 | 21.0 | 53.0 | | | | | |
| | 6496 | 8 46.9 | 41.0 | 32.0 | | 39 36.94 | + 1 53.55 | - 8.46 | 22.03 |
| | 6528 | 11 59.7 | 17.0 | 57.0 | | | | | |
| | 6566 | 15 06.2 | 40.0 | 33.0 | | 44 58.06 | - 3 32.52 | - 6.43 | 19.11 |
| | 6574 | 8 45.9 | 21.4 | 52.0 | | | | | |
| | 6589 | 20 13.5 | 14.5 | 38.5 | | 35 39.53 | + 5 53.71 | -10.90 | 22.34 |
| | 6659 | 4 14.5 | 39.0 | 35.0 | | | | | |
| | 6678 | 8 11.2 | 35.3 | 39.3 | | 44 17.84 | - 2 56.47 | + 0.54 | 21.91 |
| | 6697 | 13 59.5 | 40.0 | 34.0 | | | | | |
| | 6740 | 11 66.2 | 35.0 | 37.0 | | 39 50.30 | + 1 34.08 | -15.26 | 9.12 |
| | 6769 | 8 73.9 | 11.0 | 63.0 | | | | | |
| | 6794 | 10 31.3 | 28.0 | 45.0 | | 44 38.64 | - 3 17.04 | - 0.14 | 21.46 |
| | 6824 | 16 43.5 | 43.0 | 31.0 | | | | | |
| | 6851 | 9 69.1 | 35.0 | 38.0 | | 43 11.38 | - 1 47.08 | - 5.45 | 18.85 |
| | 6875 | 13 01.8 | 28.0 | 45.0 | | | | | |
| | 6933 | 4 43.6 | 22.5 | 50.5 | | 35 48 32.44 | - 7 07.06 | - 4.96 | 35 41 20.42 |
| | 6959 | 17 70.5 | 41.5 | 31.7 | | | | | |

LATITUDE DETERMINATIONS.

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Observations and computations—Continued.

SANTA FE, NEW MEXICO.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|------------|--------------|----------------------|-----------|-----------|----------|-----------------------------|----------------------|----------|--------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1873. | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | <i>o ' "</i> | <i>' "</i> | <i>"</i> | <i>o ' "</i> |
| June 27 .. | 6998 | 26 77.2 | 23.0 | 50.0 | | | | | |
| | 7006 | 13 13.7 | 38.5 | 34.5 | | 35 39 30.79 | + 1 57.00 | - 6.27 | 35 40 21.52 |
| | 7131 | 14 77.2 | 34.0 | 39.0 | | | | | |
| | 7158 | 7 63.3 | 16.5 | 57.7 | | 37 44.10 | + 3 49.77 | -12.68 | 41 21.19 |
| | 7174 | 16 26.3 | 41.5 | 32.7 | | | | | |
| June 28 .. | 7194 | 18 91.0 | 5.0 | ..... |  | 45 29.70 | - 3 56.66 | -15.10 | 17.94 |
| | 5131 | 27 95.4 | 33.5 | 11.5 | | | | | |
| | 5155 | 19 52.8 | 22.5 | 23.3 | | 30 41.68 | + 4 31.19 | + 5.72 | 18.59 |
| | 5210 | 20 33.2 | 20.0 | 29.0 | | | | | |
| | 5234 | 24 64.5 | 35.2 | 14.8 | | 38 57.62 | + 2 18.82 | + 3.11 | 19.55 |
| | 5284 | 26 73.1 | 2.6 | 48.4 | | | | | |
| | 5313 | 16 36.1 | 57.0 | ..... |  | 35 36.61 | + 5 33.76 | + 4.81 | 15.18 |
| | 5367 | 33 95.8 | 41.0 | 11.0 | | | | | |
| | Gr. 2325 | 9 69.5 | 20.5 | 33.0 | | 28 14.14 | +13 00.91 | + 4.77 | 19.82 |
| | 5466 | 16 15.7 | 35.0 | 17.0 | | | | | |
| | 5503 | 20 76.1 | 16.5 | 34.5 | | 43 44.30 | - 2 28.18 | - 0.00 | 16.12 |
| | 5530 | 13 18.5 | 35.3 | 14.3 | | | | | |
| | 5596 | 28 54.1 | 28.7 | 17.5 | | 49 25.96 | - 8 14.23 | + 8.77 | 20.50 |
| | 5629 | 13 78.9 | 11.0 | 35.2 | | | | | |
| | 5674 | 23 54.2 | 46.0 | 0.0 | | 33 21.62 | + 7.54.82 | + 5.94 | 22.38 |
| | 5765 | 21 94.0 | 34.2 | 14.2 | | | | | |
| | 5797 | 20 55.3 | 18.4 | 31.6 | | 40 31.42 | + 0 44.64 | + 1.84 | 17.90 |
| | Gr. 2431 | 25 83.8 | 17.0 | 35.0 | | | | | |
| | 5863 | 14 72.0 | 35.5 | 17.0 | | 17 12.95 | + 5 57.83 | + 0.14 | 15.26 |
| | 5918 | 23 60.0 | 21.0 | 31.0 | | | | | |
| | 5941 | 21 58.0 | 35.0 | 18.0 | | 42 20.66 | - 1 05.01 | + 1.91 | 17.56 |
| | 6056 | 22 30.5 | 23.5 | 31.3 | | | | | |
| | 6116 | 23 87.5 | 21.0 | 35.0 | | 40 33.18 | + 0 50.53 | - 5.94 | 17.77 |
| | 6134 | 23 65.0 | 21.0 | 34.0 | | | | | |
| | Gr. 2536 | 20 58.6 | 43.0 | 14.0 | | 34 39.24 | + 1 38.61 | + 4.36 | 22.21 |
| | 6231 | 16 56.0 | 23.5 | 33.0 | | | | | |
| | 6252 | 27 47.8 | 37.0 | 19.5 | | 47 08.43 | - 5 51.40 | + 2.18 | 19.21 |
| | Arg. LXIII | 24 23.5 | 23.5 | 33.5 | | | | | |
| | 6364 | 18 61.3 | 24.0 | 33.5 | | 38 20.80 | + 3 00.95 | - 5.31 | 16.44 |
| | 6392 | 17 20.1 | 30.0 | 27.0 | | | | | |
| | 6468 | 32 02.0 | 62.0 | ..... |  | 38 21.72 | + 2 35.10 | +19.08 | 15.90 |
| | 6496 | 22 41.5 | 46.0 | 11.5 | | | | | |
| | 6528 | 25 35.3 | 22.5 | 35.0 | | 35 39 37.22 | + 1 34.56 | + 6.00 | 35 41 17.78 |

Observations and computations—Continued.

SANTA FÉ, NEW MEXICO.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|---------------------|--------------|----------------------|-----------|-----------|----------|-----------------------------|----------------------|----------|--------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1873. June 28 .. | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | <i>o ' "</i> | <i>' "</i> | <i>"</i> | <i>o ' "</i> |
| | 6566 | 26 23.4 | 21.5 | 35.0 | | | | | |
| | 6574 | 19 37.6 | 35.0 | 21.5 | | 35 44 58.35 | — 3 40.73 | — 0.00 | 35 41 17.62 |
| | 6589 | 22 70.7 | 21.0 | 37.0 | | | | | |
| | 6659 | 12 33.3 | 47.3 | 9.5 | | 35 39.82 | + 5 33.89 | + 5.94 | 19.65 |
| | 6695 | 13 95.9 | 11.8 | 25.6 | | | | | |
| | 6723 | 27 80.0 | 52.0 | 5.0 | | 48 41.52 | — 7 25.47 | + 3.60 | 19.65 |
| | 6762 | 11 64.7 | 31.0 | 26.5 | | | | | |
| | 6779 | 27 08.6 | 34.0 | 23.0 | | 49 32.66 | — 8 16.91 | + 4.23 | 19.98 |
| | 6800 | 12 38.0 | 33.7 | 23.0 | | | | | |
| | 6813 | 20 15.7 | 21.5 | 35.0 | | 45 26.24 | — 4 10.30 | — 0.49 | 15.45 |
| | 6835 | 25 95.0 | 2.5 | 54.0 | | | | | |
| | Gr. 2977 | 14 80.1 | 21.4 | 35.0 | | 35 41.58 | + 5 58.83 | —17.74 | 22.67 |
| July 4.... | 5131 | 26 06.0 | 29.0 | 33.0 | | | | | |
| | 5155 | 17 41.5 | 36.5 | 30.5 | | 36 42.68 | + 4 38.24 | + 0.54 | 21.46 |
| | 5210 | 20 30.9 | 37.2 | 29.2 | | | | | |
| | 5234 | 24 77.5 | 26.2 | 40.6 | | 38 58.66 | + 2 23.74 | — 1.74 | 20.66 |
| | 5284 | 27 13.6 | 29.7 | 37.3 | | | | | |
| | 5313 | 16 45.2 | 34.0 | 34.0 | | 35 37.38 | + 5 43.86 | — 2.07 | 19.17 |
| | 5367 | 29 91.1 | 35.0 | 34.0 | | | | | |
| | Gr. 2325 | 5 54.1 | 35.0 | 35.0 | | 28 15.22 | +13 04.35 | + 0.27 | 19.84 |
| | 5466 | 25 56.0 | 62.0 | 8.0 | | | | | |
| | 5503 | 19 88.9 | 6.5 | 63.5 | | 43 45.50 | — 2 30.40 | — 0.82 | 14.28 |
| | 5604 | 28 39.6 | 35.0 | 33.0 | | | | | |
| | 5617 | 7 23.5 | 33.5 | 35.0 | | 29 59.96 | +11 21.06 | + 0.14 | 21.16 |
| | 5765 | 21 77.0 | 30.5 | 39.2 | | | | | |
| | 5797 | 20 25.2 | 41.2 | 29.0 | | 40 32.78 | + 0 48.86 | + 0.87 | 22.51 |
| | Gr. 2431 | 26 16.5 | 35.2 | 35.8 | | | | | |
| | 5863 | 15 21.5 | 35.5 | 35.5 | | 47 14.43 | — 5 52.43 | — 0.17 | 21.83 |
| | 5883 | 18 83.2 | 41.0 | 30.2 | | | | | |
| | 5911 | 22 80.2 | 36.0 | 35.0 | | 43 25.20 | — 2 07.77 | + 3.22 | 20.65 |
| | 5997 | 22 95.9 | 30.2 | 40.5 | | | | | |
| | 6021 | 25 52.3 | 48.0 | 22.5 | | 39 53.18 | + 1 22.52 | + 4.14 | 19.84 |
| | 6056 | 19 73.7 | 35.0 | 35.5 | | | | | |
| | 6116 | 21 21.0 | 41.0 | 30.0 | | 40 34.76 | + 0 47.41 | + 2.86 | 25.03 |
| | 6134 | 23 38.0 | 22.0 | 48.5 | | | | | |
| | Gr. 2536 | 19 90.2 | 36.0 | 35.0 | | 39 40.92 | + 1 51.94 | — 6.95 | 25.91 |
| | 6231 | 13 73.0 | 36.0 | 36.0 | | | | | |
| | 6252 | 24 97.8 | 45.0 | 27.0 | | 35 47 10.06 | — 6 02.01 | + 4.90 | 35 41 12.95 |

LATITUDE DETERMINATIONS.

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Observations and computations—Continued.

SANTA FÉ, NEW MEXICO.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|---------------------|--------------|----------------------|-----------|-----------|----------|-----------------------------|----------------------|----------|--------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1873. July 23... | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | <i>° ' "</i> | <i>' "</i> | <i>"</i> | <i>° ' "</i> |
| | 5828 | 20 61.3 | 26.2 | 34.5 | | | | | |
| | 5871 | 19 78.9 | 45.0 | 15.8 | | 35 40 45.87 | + 0 26.52 | + 5.69 | 35 41 18.08 |
| | 5918 | 22 00.2 | 52.0 | 9.7 | | | | | |
| | 5941 | 19 72.0 | 22.0 | 40.0 | | 42 26.00 | — 1 13.45 | + 6.62 | 19.17 |
| | 5997 | 17 55.0 | 33.5 | 28.5 | | | | | |
| | 6021 | 19 85.9 | 35.2 | 27.5 | | 39 57.60 | + 1 14.32 | + 3.46 | 15.38 |
| | 6056 | 19 77.5 | 34.5 | 29.0 | | | | | |
| | 6116 | 20 90.0 | 35.2 | 27.7 | | 40 39.27 | + 0 36.20 | + 3.54 | 19.01 |
| | 6392 | 18 55.5 | 27.8 | 35.2 | | | | | |
| | 6468 | 23 45.5 | 56.0 | 6.5 | | 38 28.68 | + 2 37.71 | +11.47 | 17.86 |
| | 6496 | 17 99.6 | 34.5 | 28.5 | | | | | |
| | 6528 | 20 73.2 | 35.5 | 27.3 | | 39 43.98 | + 1 28.06 | + 2.23 | 14.27 |
| | 6566 | 23 52.5 | 28.3 | 35.1 | | | | | |
| | 6574 | 16 20.6 | 48.7 | 13.8 | | 45 05.31 | — 3 55.56 | + 7.66 | 17.41 |
| | 6589 | 22 12.0 | 18.7 | 44.0 | | | | | |
| | 6659 | 11 90.8 | 52.5 | 10.8 | | 35 46.88 | + 5 28.68 | + 4.47 | 20.03 |
| July 26... | 6566 | 25 45.8 | 9.0 | 35.0 | | | | | |
| | 6574 | 18 84.5 | 23.0 | 21.5 | | 45 06.12 | — 3 32.84 | — 6.68 | 26.60 |
| | 6589 | 21 35.5 | 21.0 | 24.0 | | | | | |
| | 6659 | 11 09.0 | 34.0 | 11.0 | | 35 47.66 | + 5 30.38 | + 5.45 | 23.49 |
| | 6678 | 17 32.0 | 13.5 | 32.0 | | | | | |
| | 6697 | 22 94.8 | 25.3 | 20.0 | | 44 26.07 | — 3 01.14 | — 3.60 | 21.33 |
| | 6740 | 18 55.0 | 35.0 | 10.7 | | | | | |
| | 6769 | 15 84.2 | 10.5 | 35.5 | | 39 58.85 | + 1 27.16 | — 0.19 | 25.82 |
| | 6794 | 18 00.8 | 20.5 | 25.0 | | | | | |
| | 6824 | 24 15.0 | 10.5 | 35.0 | | 44 46.88 | — 3 17.68 | — 7.90 | 21.30 |
| | 6881 | 22 47.2 | 12.4 | 33.6 | | | | | |
| | 6901 | 19 60.6 | 35.3 | 11.0 | | 40 09.08 | + 1 08.68 | + 0.84 | 18.60 |
| | 6933 | 12 11.8 | 47.2 | 1.0 | | | | | |
| | 6959 | 26 04.0 | 14.2 | 32.0 | | 48 40.95 | — 7 28.08 | + 8.28 | 21.15 |
| | 7084 | 19 84.8 | 11.5 | 35.0 | | | | | |
| | 7103 | 22 54.6 | 45.5 | 1.0 | | 39 49.03 | + 1 26.83 | + 5.72 | 21.58 |
| | 7131 | 15 30.9 | 23.0 | 23.0 | | | | | |
| | 7158 | 5 89.2 | 14.0 | 33.0 | | 36 24.24 | + 5 03.09 | — 5.19 | 22.14 |
| | 7174 | 23 65.3 | 36.5 | 10.0 | | | | | |
| | 7194 | 15 50.0 | 10.0 | 37.0 | | 45 37.82 | — 4 22.41 | — 0.14 | 15.27 |
| | 7241 | 13 63.2 | 14.5 | 32.0 | | | | | |
| | 7256 | 26 15.4 | 17.0 | 30.0 | | 35 34 44.82 | + 6 43.02 | — 8.31 | 35 41 19.53 |

Observations and computations—Continued.

SANTA FE, NEW MEXICO.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|---------------------|--------------|----------------------|-----------|-----------|----------|-----------------------------|----------------------|--------|-------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1873. July 27... | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | ° ' " |
| | 5828 | 19 17.4 | 17.0 | 45.0 | | | | | |
| | 5871 | 18 20.5 | 48.0 | 13.0 | | 35 40 46.70 | + 0 31.19 | + 1.91 | 35 41 19.80 |
| | 5883 | 17 22.5 | 34.0 | 27.0 | | | | | |
| | 5911 | 21 38.0 | 37.0 | 23.0 | | 43 30.07 | — 2 13.73 | + 5.72 | 22.06 |
| | 6134 | 24 38.5 | 35.0 | 26.0 | | | | | |
| | Gr. 2536 | 21 63.0 | 34.0 | 27.0 | | 39 46.94 | + 1 28.67 | + 4.36 | 19.97 |
| | 6355 | 15 29.0 | 37.5 | 23.5 | | | | | |
| | 6426 | 17 68.5 | 17.0 | 44.0 | | 40 05.95 | + 1 17.08 | — 3.54 | 19.49 |
| | 6496 | 17 72.9 | 48.0 | 13.5 | | | | | |
| | 6528 | 20 67.4 | 13.0 | 48.0 | | 39 44.75 | + 1 34.79 | — 0.00 | 19.54 |
| | 6589 | 20 22.5 | 35.0 | 26.0 | | | | | |
| | 6659 | 9 77.1 | 26.0 | 35.5 | | 35 47.90 | + 5 36.46 | — 0.14 | 24.22 |
| | 6794 | 16 39.8 | 23.5 | 39.0 | | | | | |
| | 6824 | 22 91.2 | 37.0 | 26.0 | | 44 47.17 | — 3 29.65 | — 1.23 | 16.29 |
| July 28... | 5520 | 24 81.5 | 19.0 | 47.5 | | | | | |
| | 5545 | 21 01.0 | 50.5 | 16.5 | | 39 15.06 | + 2 02.46 | + 1.50 | 19.02 |
| | 5604 | 29 97.2 | 32.0 | 35.0 | | | | | |
| | 5617 | 9 10.6 | 40.0 | 26.5 | | 30 04.44 | +11 11.57 | + 2.86 | 18.87 |
| | 5677 | 12 96.4 | 34.0 | 33.0 | | | | | |
| | 5706 | 26 74.0 | 37.0 | 11.0 | | 48 36.02 | — 7 23.38 | +12.81 | 25.45 |
| | 5828 | 18 80.8 | 34.0 | 35.0 | | | | | |
| | 5871 | 17 97.3 | 46.0 | 22.5 | | 40 46.90 | + 0 26.88 | + 6.13 | 19.91 |
| | 5883 | 17 37.0 | 44.0 | 24.0 | | | | | |
| | 5911 | 21 83.0 | 48.0 | 19.0 | | 43 30.28 | — 2 23.54 | +13.35 | 20.09 |
| | 5997 | 18 76.8 | 38.0 | 30.0 | | | | | |
| | 6021 | 21 14.0 | 35.0 | 34.0 | | 39 58.48 | + 1 16.35 | + 2.45 | 17.28 |
| | 6056 | 19 50.0 | 62.0 | 7.0 | | | | | |
| | 6116 | 20 47.5 | 17.5 | 52.0 | | 40 40.30 | + 0 31.38 | + 2.86 | 14.54 |
| | 6134 | 23 51.0 | 35.5 | 34.0 | | | | | |
| | Gr. 2536 | 20 52.0 | 18.0 | 52.0 | | 39 47.18 | + 1 36.24 | — 8.86 | 14.56 |
| | 6231 | 14 21.6 | 36.0 | 34.0 | | | | | |
| | 6252 | 25 13.0 | 12.5 | 56.5 | | 47 16.00 | — 5 51.27 | —11.44 | 13.29 |
| | 6302 | 24 98.5 | 34.0 | 34.0 | | | | | |
| | 6307 | 13 09.5 | 35.0 | 34.0 | | 47 36.74 | — 6 22.68 | + 0.27 | 14.33 |
| | Arg. LXIII | 19 05.4 | 31.0 | 37.5 | | | | | |
| | 6364 | 13 69.0 | 39.0 | 29.0 | | 38 28.80 | + 2 52.64 | + 0.95 | 22.39 |
| | 6566 | 24 93.0 | 31.5 | 35.5 | | | | | |
| | 6574 | 17 86.0 | 35.0 | 32.0 | | 35 45 06.60 | — 3 47.54 | — 0.27 | 35 41 18.79 |

LATITUDE DETERMINATIONS.

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Observations and computations—Continued.

SANTA FÉ, NEW MEXICO.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|---------------------|-----------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|----------|--------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1873. July 29... | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | <i>o ' "</i> | <i>' "</i> | <i>"</i> | <i>o ' "</i> |
| | 5466 | 13 20.6 | 27.0 | 46.0 | | | | | |
| | 5503 | 17 97.2 | 52.0 | 21.5 | | 35 43 49.42 | — 2 33.39 | + 3.13 | 35 41 19.16 |
| | 5520 | 22 41.5 | 23.0 | 50.0 | | | | | |
| | 5545 | 18 60.0 | 51.0 | 22.5 | | 39 15.16 | + 2 02.79 | + 0.41 | 18.36 |
| | Arg. LXIII | 22 56.3 | 28.0 | 40.0 | | | | | |
| | 6364 | 17 19.3 | 40.5 | 27.5 | | 38 29.07 | + 2 52.83 | — 0.14 | 22.04 |
| | 6566 | 23 56.0 | 24.0 | 44.0 | | | | | |
| | 6574 | 16 52.5 | 35.0 | 33.0 | | 45 06.85 | — 3 46.42 | — 4.90 | 15.53 |
| | 6589 | 24 16.5 | 32.0 | 36.0 | | | | | |
| | 6659 | 14 15.1 | 45.0 | 23.0 | | 35 48.38 | + 5 22.30 | + 4.90 | 15.58 |
| | 6678 | 16 84.2 | 32.0 | 36.0 | | | | | |
| | 6697 | 22 73.8 | 42.0 | 26.5 | | 44 26.80 | — 3 09.76 | + 3.13 | 20.17 |
| | R. C. 4379 | 18 45.0 | 45.0 | 23.5 | | | | | |
| | 6749 | 16 60.6 | 18.0 | 51.0 | | 42 23.17 | — 0 59.35 | — 3.13 | 20.69 |
| | 6762 | 7 67.0 | 53.0 | 16.0 | | | | | |
| | 6779 | 23 40.9 | 25.0 | 45.0 | | 49 41.80 | — 8 26.56 | + 4.63 | 19.87 |
| | 6794 | 16 59.0 | 44.5 | 25.5 | | | | | |
| | 6824 | 23 17.5 | 35.0 | 35.0 | | 44 47.76 | — 3 31.94 | + 5.18 | 21.00 |
| | 6881 | 17 91.5 | 36.5 | 35.0 | | | | | |
| | 6901 | 19 93.0 | 43.0 | 29.0 | | 40 09.88 | + 1 04.85 | + 4.23 | 18.96 |
| | 6933 | 10 61.5 | 36.0 | 37.0 | | | | | |
| | 6959 | 24 30.6 | 28.0 | 44.5 | | 48 41.84 | — 7 20.64 | — 4.77 | 16.43 |
| | 6975 | 28 45.4 | 35.0 | 37.0 | | | | | |
| | 6985 | 10 45.0 | 37.0 | 35.5 | | 31 37.93 | + 9 39.59 | — 0.14 | 17.38 |
| | 7022 | 28 97.4 | 38.0 | 34.0 | | | | | |
| | 7029 | 14 64.8 | 33.0 | 39.0 | | 49 01.89 | — 7 41.08 | — 0.54 | 20.27 |
| | 7084 | 15 37.7 | 29.0 | 42.5 | | | | | |
| | 7103 | 18 24.4 | 35.0 | 36.5 | | 39 49.92 | + 1 32.28 | — 4.09 | 18.11 |
| | 7131 | 19 72.3 | 23.5 | 48.5 | | | | | |
| | 7158 | 13 42.1 | 53.0 | 19.0 | | 37 53.80 | + 3 22.83 | + 2.45 | 19.08 |
| | 7174 | 21 67.0 | 36.5 | 35.5 | | | | | |
| | 7194 | 13 62.1 | 35.5 | 37.0 | | 45 38.92 | — 4 19.06 | — 0.27 | 19.59 |
| | 7275 | 7 04.0 | 21.5 | 51.0 | | | | | |
| | 7294 | 30 96.0 | 47.2 | 25.0 | | 54 12.75 | — 12 49.85 | — 1.99 | 20.90 |
| July 30... | 5520 | 21 12.5 | 18.5 | 59.5 | | | | | |
| | 5545 | 17 04.0 | 43.0 | 35.0 | | 39 15.27 | + 2 13.40 | — 8.99 | 19.68 |
| | 5604 | 28 31.6 | 35.0 | 44.0 | | | | | |
| | 5617 | 7 27.6 | 36.0 | 43.5 | | 35 30 04.80 | + 11 17.17 | — 4.50 | 35 41 17.47 |

Observations and computations--Continued.

SANTA FE, NEW MEXICO.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|---------------------|--------------|----------------------|-----------|-----------|----------|-----------------------------|----------------------|--------|-------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1873. July 30... | | <i>t.</i> <i>d.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | ° ' " |
| | 5677 | 11 01.7 | 35.5 | 44.0 | | | | | |
| | 5706 | 19 74.0 | 50.0 | 29.0 | | 35 48 36.30 | - 7 21.67 | + 3.41 | 35 41 18.04 |
| | 5828 | 17 40.0 | 35.5 | 32.0 | | | | | |
| | 5871 | 16 39.1 | 32.5 | 35.0 | | 40 47.20 | + 0 32.47 | + 0.27 | 19.94 |
| | 5918 | 18 54.7 | 38.0 | 29.0 | | | | | |
| | 5941 | 16 61.8 | 29.0 | 48.0 | | 42 27.20 | - 1 02.08 | - 5.18 | 19.94 |
| | 5997 | 21 15.6 | 33.0 | 35.0 | | | | | |
| | 6021 | 18 62.2 | 35.0 | 33.0 | | 39 58.98 | + 1 21.55 | 0.00 | 20.53 |
| | 6056 | 19 00.8 | 52.5 | 14.5 | | | | | |
| | 6116 | 19 95.0 | 29.5 | 39.0 | | 40 40.70 | + 0 30.32 | + 7.77 | 18.79 |
| | 6147 | 21 57.0 | 35.0 | 33.0 | | | | | |
| | 6218 | 19 70.8 | 33.0 | 35.0 | | 35 43 04.30 | - 1 40.99 | - 0.00 | 35 41 23.31 |

NOTE.—The following observations were rejected:

June 27, pairs 17, 19, 33; deviations, $+9''.0$, $-13''.2$, $-10''.3$.

July 4, pair 22; deviation, $-6''.5$.

July 26, pairs 28, 33; deviations, $+7''.2$, $+6''.4$.

July 28, pair 22; deviation, $-6''.2$.

The limit of rejection was set at $6''.0$.

A preliminary discussion with reference to a correction of one revolution of the micrometer-screw showed that it was insensible for this station; and also that pairs observed n times would give probable errors essentially equal by making the weight of the mean of the n observations $= \frac{1}{2} + \frac{1}{2} n$

Results for latitude.

| Pair. | Latitude. | Number of observations. | Weight. | Pair. | Latitude. | Number of observations. | Weight. |
|-------|-------------|-------------------------|---------|-------|-------------|-------------------------|---------|
| | ° ' " | | | | ° ' " | | |
| 1 | 35 41 18.93 | 3 | 2 | 25 | 35 41 18.60 | 2 | 1.5 |
| 2 | 17.38 | 1 | 1 | 26 | 16.88 | 2 | 1.5 |
| 3 | 20.10 | 2 | 1.5 | 27 | 18.40 | 4 | 2.5 |
| 4 | 17.18 | 2 | 1.5 | 28 | 17.67 | 5 | 3 |
| 5 | 21.24 | 1 | 1 | 29 | 20.88 | 6 | 3.5 |
| 6 | 19.83 | 2 | 1.5 | 30 | 21.14 | 3 | 2 |
| 7 | 16.56 | 4 | 2.5 | 31 | 19.65 | 1 | 1 |
| 8 | 19.02 | 3 | 2 | 32 | 20.69 | 1 | 1 |
| 9 | 20.50 | 1 | 1 | 33 | ----- | ----- | ----- |
| 10 | 19.17 | 3 | 2 | 34 | 19.92 | 2 | 1.5 |
| 11 | 22.33 | 1 | 1 | 35 | 20.01 | 4 | 2.5 |
| 12 | 21.34 | 3 | 2 | 36 | 15.45 | 1 | 1 |
| 13 | 18.55 | 3 | 2 | 37 | 22.67 | 1 | 1 |
| 14 | 18.55 | 2 | 1.5 | 38 | 18.85 | 1 | 1 |
| 15 | 19.09 | 5 | 3 | 39 | 18.78 | 2 | 1.5 |
| 16 | 20.93 | 3 | 2 | 40 | 19.33 | 3 | 2 |
| 17 | 19.56 | 3 | 2 | 41 | 17.38 | 1 | 1 |
| 18 | 18.26 | 4 | 2.5 | 42 | 21.52 | 1 | 1 |
| 19 | 19.03 | 5 | 3 | 43 | 20.27 | 1 | 1 |
| 20 | 18.91 | 3 | 2 | 44 | 19.84 | 2 | 1.5 |
| 21 | 20.22 | 2 | 1.5 | 45 | 20.80 | 3 | 2 |
| 22 | 19.21 | 1 | 1 | 46 | 17.60 | 3 | 2 |
| 23 | 14.33 | 1 | 1 | 47 | 19.53 | 1 | 1 |
| 24 | 35 41 20.29 | 3 | 2 | 48 | 35 41 20.90 | 1 | 1 |

Mean by weights—

35° 41' 19".29 (weight 79).

Probable error (weight 1) = $\pm 1''.35$.Probable error of final result, = $\pm 0''.152$.

I have omitted the trifling meridian correction. Without it the stars observed *late* give a somewhat larger latitude, indicating that the wire was slightly inclined. There were some stars observed before transit, so that both these very nearly counterbalance each other.

ASTRONOMICAL CO-ORDINATES OF SANTA FÉ, NEW MEXICO.

Longitude.. 7^h 03^m 47^s.015 or 105° 54' 45".22 \pm 0".32 west from Greenwich.Longitude.. 1^h 55^m 34^s.895 or 28° 53' 43".42 west from U. S. Naval Observatory, Washington, D. C.Latitude ... 35° 41' 19".29 \pm 0".15 north.

U. S. GEOGRAPHICAL SURVEYS WEST OF THE ONE HUNDREDTH MERIDIAN,
1ST LIEUT. GEO. M. WHEELER, CORPS OF ENGINEERS, U. S. ARMY, IN CHARGE.

RESULTS

OF

OBSERVATIONS MADE BY JOHN H. CLARK AND DR. F. KAMPF IN THE
DETERMINATION OF THE ASTRONOMICAL CO-ORDINATES
OF BOZEMAN, MONTANA.

SEASON OF 1873.

COMPUTATIONS BY

JOHN H. CLARK AND DR. F. KAMPF.

BOZEMAN, MONTANA.

GEOGRAPHICAL POSITION OF STATION.

Longitude, . . . $111^{\circ} 02' 36''.64 \pm 0''.53$ west from Greenwich.
Latitude, . . . $45^{\circ} 40' 51''.92 \pm 0''.06$ north.
Barometric altitude of observatory above sea-level, 4838.6 feet.

The station at Bozeman is situated on the western edge of the village, south of the principal east and west street. It may be easily found by means of the grave of Bozeman, the founder of the town, a well-known spot, which is about 100 feet southwest from the block of wood upon which the transit was mounted. For many miles northward, westward, and southward the country is gently rolling. In the east, not more than two miles away, are the foot-hills of the mountains, along whose base the eastern fork of the East Gallatin River pursues its way, upon which, three miles distant, lies Fort Ellis. The East Gallatin, formed by the junction of this and the western branch, which traverses the eastern limits of Bozeman, continues its course through the Gallatin Valley in a direction generally northwest.

Besides this river there are two other large streams in the Gallatin Valley, called the West Fork and Middle Fork, which contribute to the river of that name. These, of which the West Fork is the largest, carry at all times an abundance of pure water, which could be easily diverted for use in irrigation. In every direction are heavy masses of mountains, which inclose the beautiful and fertile Gallatin Valley and make it an amphitheatre of vast proportions. Its soil yields abundantly of those agricultural products that grow in this latitude, especially potatoes and wheat.

Bozeman has a population of 400 or 500 people. In its private residences, mills, and warehouses it is a place of considerable pretension. Much of this enterprise, previously displayed, was probably due to the

anticipation of the introduction of the Northern Pacific Railroad, but at this time the town was laboring under the stagnation consequent upon the failure of this great corporation, and its business affairs were much depressed and its prospects were gloomy. There are no mineral deposits developed as yet in this immediate vicinity, and the settlement is dependent for its prosperity upon the grazing of the surrounding mountains and valleys, the agricultural products of Gallatin Valley, and such trade as is furnished by Fort Ellis, the Crow agency, and the neighboring hunters and stock-raisers.

METEOROLOGICAL CONDITIONS.

The station at Bozeman was occupied from October 12 to November 5, inclusive, a period of twenty-five days. In all this time there were but nine days favorable for observations; they were October 17, 18, 19, 28, 29, 30, 31, and November 1 and 2. Even on these nights the extreme cold prevented any advantageous work after midnight, the fingers of the operator becoming so benumbed by that time that they would no longer obey his will in manipulating the instrument. Such rigorous weather at so early a season had never been experienced before by the oldest inhabitant. Though the days were very short, yet it would be pleasant and comfortable when it was sufficiently clear for the sun to shine. At night, however, the wind would sweep down from the snow-covered mountains, penetrate all ordinary clothing, and chill the stoutest frame.

DESCRIPTION OF OBSERVATORY.

The observatory was an ordinary wall-tent, which was drawn over a frame and furnished with the flaps and curtains necessary to exclude wind and dust. The observations were conducted by Mr. John H. Clark, who was assisted by Mr. L. P. Smith. An hourly meteorological record was kept by Messrs. O'Brien and Storer, soldiers of the Engineer Battalion. The telegraph-line with which transmission of signals was made is an independent branch line, the property of Mr. Largy, connecting at Helena with the Western Union. The operator was Mr. King.

DESCRIPTION OF INSTRUMENTS.

The transit employed was the Würdemann, No. 27, with a focal length of 28 inches, and aperture of object-glass $2\frac{1}{4}$ inches. It was mounted on a block of wood 2 feet across and 6 feet in length, which was firmly planted in the ground. The chronometer in use here was the Negus break-circuit, No. 1499, whose electro-magnetic capacity could not be tested, however, as the observations were made by the eye-and-ear method. The signals were sent and received at the telegraph-office, about a half-mile distant from the observatory, to which place the chronometer was removed for that purpose.

CONNECTIONS.—OBSERVERS.—COMPUTERS.

The connection was made over Largy's line to Helena; thence, by way of Virginia City, over the Western Union, with the observatory at Ogden, at which station Dr. F. Kampf was observer. Exchanges were made for longitude on three days, the 29th and 31st of October and the 1st of November being devoted to that purpose. The nights of October 17, 18, and 19, and November 2 and 4, were given to latitude-work; but, in consequence of interruption by the clouds, one of these series was without valuable results. The computations were made in the office, in the course of the winter, by Mr. John H. Clark, and were subsequently reviewed by Dr. F. Kampf.

INSTRUMENTAL VALUES.—TELEGRAPHIC COMMUNICATION.

Each division of the striding-level had a value of $1''.03$; each division of the zenith-telescope level was equivalent to $0''.93$; one revolution of the micrometer-screw produced an effect of $77''.078$. The signals were all interchanged by sound, and even by this method it was difficult to take them, in consequence of the very imperfect line through which the circuit ran. Its length, in an air-line, was over 300 miles. At Helena there was a heavy battery, and probably a repeater, but at Bozeman the telegraphic process was effected without the use of either.

Tabulation of stars used for determination of time at Bozeman, Montana, and Ogden, Utah, 1873.

| Name of star. | BOZEMAN. | | | OGDEN. | | | Name of star. | BOZEMAN. | | | OGDEN. | | |
|---------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|
| | October 29. | October 31. | November 1. | October 29. | October 31. | November 1. | | October 29. | October 31. | November 1. | October 29. | October 31. | November 1. |
| <i>a</i> Andromedæ | ... | × | ... | ... | ... | ... | 226 Cephei | ... | ... | ... | × | × | × |
| <i>a</i> Aquilæ | ... | × | ... | ... | ... | ... | <i>ζ</i> Pegasi | × | × | × | ... | × | ... |
| <i>κ</i> Cephei | × | × | ... | ... | ... | ... | <i>ι</i> Cephei | × | × | × | × | × | ... |
| <i>π</i> Capricorni | × | × | × | ... | ... | ... | <i>λ</i> Aquarii | ... | × | × | ... | ... | ... |
| <i>ε</i> Delphini | × | × | × | ... | ... | ... | <i>α</i> Piscis Aus. | × | × | × | ... | ... | ... |
| Groombr. 3241 | × | × | × | ... | ... | ... | <i>ο</i> Andromedæ | ... | ... | × | × | × | × |
| <i>a</i> Cygni | × | × | × | ... | ... | ... | <i>α</i> Pegasi | ... | ... | × | × | × | × |
| <i>μ</i> Aquarii | × | × | × | ... | ... | ... | <i>φ</i> Aquarii | ... | × | ... | ... | ... | ... |
| <i>ν</i> Cygni | × | × | × | ... | ... | ... | <i>γ</i> Piscium | ... | × | ... | ... | ... | ... |
| 61 Cygni | ... | × | × | ... | × | × | <i>ο</i> Cephei | ... | ... | × | × | × | × |
| <i>ζ</i> Cygni | ... | × | × | ... | × | × | <i>κ</i> Piscium | ... | × | ... | ... | ... | ... |
| <i>α</i> Cephei | ... | ... | × | ... | × | × | <i>θ</i> Piscium | ... | ... | ... | × | × | × |
| <i>β</i> Cephei | ... | ... | ... | ... | × | × | <i>λ</i> Draconis, L. C. | × | ... | × | ... | ... | ... |
| <i>ε</i> Pegasi | ... | ... | ... | ... | × | × | <i>γ</i> Cephei | ... | ... | × | ... | ... | ... |
| <i>θ</i> Aquarii | ... | ... | ... | × | ... | ... | 26 Piscium | ... | ... | × | ... | ... | ... |
| <i>π</i> Aquarii | ... | ... | ... | × | ... | × | <i>ω</i> Piscium | ... | × | × | ... | ... | ... |
| <i>η</i> Aquarii | × | × | ... | ... | ... | ... | <i>c</i> ³ Piscium | ... | × | × | ... | ... | ... |

Observations and reductions for time taken at sending station—Continued.

BOZEMAN, MONTANA, OCTOBER 29, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|-------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | <i>κ</i> Cephei | 18 13 01.78 | +24.50 | 0.00 | — 0.20 | 18 13 23.47 | 20 13 04.70 | +1 59 38.23 |
| E. | <i>π</i> Capricorni | 20 36.84 | — 9.90 | + 0.01 | — 0.05 | 20 26.90 | 20 04.91 | 38.01 |
| E. | <i>ε</i> Delphini | 27 37.96 | — 6.04 | + 0.02 | — 0.04 | 27 31.90 | 27 10.20 | 38.30 |
| E. | Groombr. 3241 | 30 38.16 | +15.11 | + 0.17 | — 0.15 | 30 53.29 | 30 31.25 | 37.95 |
| E. | <i>α</i> Cygni | 37 29.14 | — 0.21 | + 0.10 | — 0.06 | 37 28.97 | 37 07.03 | 38.06 |
| E. | <i>μ</i> Aquarii | 46 20.67 | — 8.65 | + 0.05 | — 0.05 | 45 12.02 | 45 50.02 | 38.00 |
| E. | <i>ν</i> Cygni | 52 50.25 | — 1.14 | + 0.11 | — 0.06 | 52 49.16 | 52 27.43 | 38.27 |
| W. | <i>η</i> Aquarii | 20 29 21.52 | — 7.55 | — 0.02 | + 0.04 | 20 29 13.99 | 22 28 52.12 | 38.13 |
| W. | <i>ζ</i> Pegasi | 35 37.90 | — 6.15 | — 0.04 | + 0.05 | 35 31.76 | 35 09.89 | 38.13 |
| W. | <i>ι</i> Cephei | 45 25.00 | + 8.55 | — 0.15 | + 0.11 | 45 33.51 | 45 11.69 | 38.18 |
| W. | <i>α</i> Piscis Aus. | 51 14.20 | —11.67 | — 0.02 | + 0.05 | 51 02.56 | 50 40.67 | 38.11 |
| W. | <i>λ</i> Draconis, L. C. | 20 24 40.66 | —27.50 | — 0.21 | — 0.13 | 20 24 12.82 | 22 23 51.01 | +1 59 38.19 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -0.69 + 12.00 \delta t + 2.90 a^1 + 10.99 c \\
 0 &= +1.65 + 2.90 \delta t + 19.52 a^1 - 5.93 c \\
 0 &= +0.45 + 10.99 \delta t - 5.93 a^1 + 56.71 c
 \end{aligned}$$

$$\begin{aligned}
 \text{Adopted } a &= -10^s.300 \\
 a^1 &= -0^s.117
 \end{aligned}$$

$$\begin{aligned}
 \text{Azimuth} &= -10^s.447 \\
 c &= -0^s.045
 \end{aligned}$$

Observations and reductions for time taken at sending station—Continued.

BOZEMAN, MONTANA, OCTOBER, 31, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|------------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | <i>α</i> Aquilæ..... | 17 44 46.37 | + 3.98 | + 0.06 | — 0.19 | 17 44 50.22 | 19 44 36.48 | +1 59 46.26 |
| E. | <i>κ</i> Cephei..... | 18 13 34.14 | —15.59 | + 0.31 | — 0.83 | 18 13 18.03 | 20 13 04.48 | 46.45 |
| E. | <i>π</i> Capricorni..... | 20 12.48 | + 6.20 | + 0.02 | — 0.19 | 20 18.51 | 20 04.84 | 46.33 |
| E. | <i>ε</i> Delphini..... | 27 20.16 | + 3.79 | + 0.01 | — 0.19 | 27 23.77 | 27 10.17 | 46.40 |
| E. | Groombr. 3241.... | 30 54.81 | — 9.47 | + 0.12 | — 0.60 | 30 44.86 | 30 31.11 | 46.25 |
| E. | <i>α</i> Cygni..... | 37 20.62 | + 0.13 | + 0.07 | — 0.26 | 37 20.56 | 37 06.98 | 46.42 |
| E. | <i>μ</i> Aquarii..... | 45 58.33 | + 5.42 | + 0.03 | — 0.19 | 45 03.59 | 44 49.99 | 46.40 |
| E. | <i>ν</i> Cygni..... | 52 40.40 | + 0.74 | + 0.09 | — 0.24 | 52 40.99 | 52 27.39 | 46.40 |
| E. | 61 Cygni..... | 19 01 26.45 | + 1.09 | + 0.10 | — 0.23 | 19 01 27.41 | 21 01 13.86 | 46.45 |
| E. | <i>ζ</i> Cygni..... | 07 45.09 | + 2.07 | + 0.09 | — 0.21 | 07 47.04 | 07 33.29 | 46.25 |
| W. | <i>η</i> Aquarii..... | 20 29 01.02 | + 4.73 | — 0.03 | + 0.18 | 20 29 05.90 | 28 52.10 | 46.20 |
| W. | <i>ζ</i> Pegasi..... | 35 19.34 | + 3.85 | — 0.03 | + 0.19 | 35 23.35 | 35 09.87 | 46.52 |
| W. | <i>ι</i> Cephei..... | 45 30.28 | — 5.35 | — 0.07 | + 0.44 | 45 25.30 | 45 11.65 | 46.35 |
| W. | <i>α</i> Piscis Aus..... | 50 46.80 | + 7.34 | — 0.01 | + 0.21 | 50 54.34 | 50 40.64 | 46.30 |
| W. | <i>φ</i> Aquarii..... | 21 07 55.43 | + 5.21 | — 0.01 | + 0.18 | 21 07 00.81 | 22 06 47.28 | 46.47 |
| W. | <i>γ</i> Piscium..... | 10 46.30 | + 4.46 | — 0.01 | + 0.18 | 10 50.93 | 10 37.31 | 46.38 |
| W. | <i>κ</i> Piscium..... | 20 36.69 | + 4.63 | — 0.01 | + 0.18 | 20 41.49 | 20 27.84 | 46.35 |
| W. | <i>ω</i> Piscium..... | 52 59.31 | + 4.18 | 0.00 | + 0.19 | 52 03.68 | 51 50.10 | 46.42 |
| W. | <i>c</i> ² Piscium..... | 56 12.17 | + 4.04 | + 0.05 | + 0.18 | 56 16.44 | 56 02.95 | 46.51 |
| W. | <i>α</i> Andromedæ..... | 22 02 03.31 | + 2.20 | + 0.14 | + 0.21 | 22 02 05.86 | 23 01 52.19 | +1 59 46.33 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -1.56 + 20.00 \delta t + 5.15 a^1 + 5.34 c & \text{Adopted } a &= + 6^s.700 & \text{Azimuth} &= + 6^s.526 \\
 0 &= -1.15 + 5.15 \delta t + 15.56 a^1 - 16.29 c & a^1 &= - 0^s.174 & c &= - 0^s.183 \\
 0 &= + 6.93 + 5.34 \delta t - 16.29 a^1 + 58.49 c
 \end{aligned}$$

BOZEMAN, MONTANA, NOVEMBER 1, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|------------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | <i>π</i> Capricorni..... | 18 20 07.51 | + 6.42 | + 0.05 | + 0.17 | 18 20 14.15 | 20 20 04.37 | +1 59 50.72 |
| W. | <i>ε</i> Delphini..... | 27 14.86 | + 3.92 | + 0.06 | + 0.16 | 27 19.00 | 27 10.15 | 51.15 |
| W. | Groombr. 3241.... | 30 49.49 | — 9.78 | + 0.32 | + 0.51 | 30 40.54 | 30 31.03 | 50.49 |
| W. | <i>α</i> Cygni..... | 37 15.42 | + 0.14 | + 0.15 | + 0.22 | 37 15.93 | 37 06.95 | 51.02 |
| W. | <i>μ</i> Aquarii..... | 45 53.31 | + 5.61 | + 0.06 | + 0.16 | 45 59.14 | 45 49.98 | 50.84 |
| W. | <i>ν</i> Cygni..... | 52 35.35 | + 0.77 | + 0.14 | + 0.20 | 52 36.46 | 52 27.36 | 50.90 |
| W. | 61 Cygni..... | 19 01 21.29 | + 1.13 | + 0.15 | + 0.20 | 19 01 22.77 | 21 01 13.84 | 51.07 |
| W. | <i>ζ</i> Cygni..... | 07 39.75 | + 2.13 | + 0.13 | + 0.18 | 07 42.19 | 07 33.27 | 51.08 |
| W. | <i>α</i> Cephei..... | 15 45.87 | — 4.06 | + 0.25 | + 0.33 | 15 42.39 | 15 33.36 | 50.97 |
| E. | <i>ζ</i> Pegasi..... | 20 35 15.12 | + 3.98 | + 0.01 | — 0.16 | 20 35 18.95 | 22 35 09.85 | 50.90 |
| E. | <i>λ</i> Aquarii..... | 46 05.47 | + 5.51 | + 0.06 | — 0.16 | 46 10.88 | 46 01.70 | 50.82 |
| E. | <i>α</i> Piscis Aus..... | 50 92.30 | + 7.59 | + 0.03 | — 0.18 | 50 49.74 | 50 40.63 | 50.89 |
| E. | <i>α</i> Pegasi..... | 58 34.09 | + 3.60 | + 0.18 | — 0.16 | 58 37.71 | 58 28.45 | 50.74 |
| E. | <i>ο</i> Cephei..... | 21 13 43.37 | — 6.52 | + 0.31 | — 0.41 | 21 13 36.75 | 23 13 27.53 | 50.78 |
| E. | <i>λ</i> Draconis, L. C.... | 23 42.74 | +17.80 | — 0.16 | + 0.45 | 23 00.83 | 22 51.18 | 50.35 |
| E. | <i>γ</i> Cephei..... | 34 37.66 | —15.49 | + 0.17 | — 0.69 | 34 21.65 | 34 12.26 | 50.61 |
| E. | 26 Piscium..... | 48 45.78 | + 4.25 | — 0.02 | — 0.15 | 48 49.86 | 48 40.61 | 50.75 |
| E. | <i>ω</i> Piscium..... | 52 55.00 | + 4.32 | + 0.01 | — 0.16 | 52 59.17 | 52 50.09 | 50.92 |
| E. | <i>c</i> ² Piscium..... | 21 56 08.17 | + 4.18 | + 0.02 | — 0.15 | 21 56 12.22 | 23 56 02.96 | +1 59 50.74 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= + 1.31 + 19.00 \delta t + 5.27 a^1 - 2.28 c & \text{Adopted } a &= + 6^s.700 & \text{Azimuth} &= + 6^s.755 \\
 0 &= - 2.39 + 5.27 \delta t + 21.42 a^1 - 11.34 c & a^1 &= + 0^s.055 & c &= - 0^s.156 \\
 0 &= + 10.97 - 2.28 \delta t - 11.34 a^1 + 68.04 c
 \end{aligned}$$

Observations and reductions for time taken at receiving station.

OGDEN, UTAH, OCTOBER 29, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | θ Aquarii | 22 52 44.10 | + 0.94 | + 0.01 | + 0.39 | 22 52 45.44 | 22 10 10.22 | — 42 35.22 |
| E. | π Aquarii | 23 01 23.64 | + 0.79 | + 0.02 | + 0.38 | 23 01 24.83 | 18 49.72 | 35.11 |
| E. | 226 Cephei | 12 39.78 | — 2.74 | + 0.16 | + 1.53 | 12 38.73 | 30 03.65 | 35.08 |
| E. | ι Cephei | 27 47.18 | — 1.20 | + 0.24 | + 0.92 | 27 47.14 | 45 11.69 | 35.45 |
| W. | ο Andromedæ | 38 42.68 | 0.00 | + 0.14 | — 0.51 | 38 42.31 | 56 07.03 | 35.28 |
| W. | α Pegasi | 41 03.26 | + 0.57 | + 0.11 | — 0.40 | 41 03.54 | 58 28.50 | 35.04 |
| W. | ο Cephei | 56 04.89 | — 1.46 | + 0.33 | — 0.99 | 56 02.83 | 23 13 27.63 | 35.20 |
| W. | θ Piscium | 0 04 08.91 | + 0.72 | + 0.12 | — 0.39 | 0 04 09.36 | 23 21 34.06 | — 42 35.30 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= +7.05 + 8.00 \delta t - 1.92 a + 2.44 c & a &= +1^s.215 \\
 0 &= -9.18 - 1.92 \delta t + 8.99 a - 8.12 c & c &= +0^s.382 \\
 0 &= -1.60 + 2.44 \delta t - 8.12 a + 34.57 c
 \end{aligned}$$

OGDEN, UTAH, OCTOBER 31, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | 226 Cephei | 23 12 40.88 | + 3.70 | + 0.13 | + 1.53 | 23 12 38.84 | 22 30 03.51 | — 42 35.33 |
| E. | ζ Pegasi | 17 44.08 | + 0.85 | + 0.05 | + 0.39 | 17 45.37 | 35 09.87 | 35.50 |
| E. | ι Cephei | 27 47.66 | — 1.62 | + 0.18 | + 0.92 | 27 47.14 | 45 11.61 | 35.53 |
| E. | α Pegasi | 41 02.59 | + 0.77 | + 0.10 | + 0.40 | 41 03.86 | 58 28.49 | 35.37 |
| E. | ο Cephei | 56 04.04 | — 1.88 | + 0.30 | + 0.99 | 56 03.45 | 23 13 27.56 | 35.89 |
| E. | θ Piscium | 0 04 08.14 | + 0.97 | + 0.12 | + 0.39 | 0 04 09.62 | 23 21 34.04 | — 42 35.58 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= +4.21 + 6.00 \delta t - 2.82 a & a &= +1^s.638 \\
 0 &= -13.32 - 2.82 \delta t + 8.25 a & c &= +0^s.382 \text{ adopted.}
 \end{aligned}$$

Observations and reductions for time taken at receiving station—Continued.

OGDEN, UTAH, NOVEMBER 1, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|-----------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | 61 Cygni..... | 21 43 48.56 | + 0.08 | + 0.20 | + 0.50 | 21 43 49.34 | 21 01 13.84 | — 42 35.50 |
| E. | ζ Cygni..... | 50 07.90 | + 0.27 | + 0.17 | + 0.45 | 50 08.79 | 07 33.27 | 35.52 |
| E. | a Cephei..... | 58 08.87 | — 0.91 | + 0.24 | + 0.63 | 58 09.03 | 15 33.36 | 35.67 |
| E. | β Cephei..... | 22 09 36.71 | — 1.63 | + 0.26 | + 1.14 | 22 09 36.43 | 27 00.90 | 35.53 |
| E. | ε Pegasi..... | 20 33.05 | + 0.65 | + 0.07 | + 0.39 | 20 34.16 | 37 58.83 | 35.33 |
| W. | π Aquarii..... | 23 01 24.68 | + 0.78 | + 0.17 | — 0.39 | 23 01 25.24 | 22 18 49.68 | 35.56 |
| W. | 226 Cephei..... | 12 42.39 | — 2.70 | + 0.72 | — 1.56 | 12 38.85 | 30 03.44 | 35.41 |
| W. | o Andromedæ.... | 38 42.86 | 0.00 | + 0.28 | — 0.52 | 38 42.62 | 56 06.97 | 35.65 |
| W. | a Pegasi..... | 41 03.82 | + 0.56 | + 0.18 | — 0.40 | 41 04.16 | 58 28.47 | 35.69 |
| W. | o Cephei..... | 56 05.11 | — 1.37 | + 0.45 | — 1.01 | 56 03.18 | 23 13 27.52 | 35.66 |
| W. | θ Piscium..... | 0 04 09.01 | + 0.71 | + 0.14 | — 0.39 | 0 04 09.47 | 23 21 34.03 | — 42 35.44 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= + 5.03 + 11.00 \delta t - 3.03 a - 2.50 c & a &= + 1^s.195 \\
 0 &= - 14.60 - 3.03 \delta t + 10.33 a + 5.47 c & c &= + 0^s.390 \\
 0 &= - 24.09 - 2.50 \delta t + 5.47 a + 44.76 c
 \end{aligned}$$

The following tables show the corrections and rates of the chronometers used at Bozeman and Ogden:—

CHRONOMETER AT BOZEMAN—NEGUS, No. 1499.

| Date. | Local sidereal time. | Correction of chronometer. | Adopted hourly rate. |
|------------|----------------------|----------------------------|----------------------|
| 1873. | <i>h.</i> | <i>h. m. s.</i> | <i>s.</i> |
| October 29 | 22.0 | + 1 59 38.13 | — 0.171 |
| October 31 | 23.0 | 46.37 | — 0.179 |
| November 1 | 20.0 | + 1 59 50.83 | — 0.186 |

CHRONOMETER AT OGDEN—NEGUS, No. 1491.

| Date. | Local sidereal time. | Correction of chronometer. | Adopted hourly rate. |
|------------|----------------------|----------------------------|----------------------|
| 1873. | <i>h.</i> | <i>h. m. s.</i> | <i>s.</i> |
| October 29 | 22.6 | — 0 42 35.21 | 0.00 |
| October 31 | 23.0 | 35.53 | 0.00 |
| November 1 | 22.0 | — 0 42 35.54 | 0.00 |

Final results of longitude.

| Signals sent from— | Recorded at— | Mean of signals sent and received. | Time-corrections. | Corrected time. | Difference of longitude. | Double-wave time. | Means. |
|--------------------|---------------|------------------------------------|-------------------|-----------------|--------------------------|-------------------|--------------|
| | | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> | <i>s.</i> | <i>m. s.</i> |
| October 29, 1873: | | | | | | | |
| Bozeman | Ogden | 22 23 40.42 | — 0 42 35.21 | 21 41 05.21 | 3 49.20 | | |
| | Bozeman | 19 45 16.32 | + 1 59 38.09 | 21 44 54.41 | | | |
| Ogden | Ogden | 22 28 45.15 | — 0 42 35.21 | 21 46 09.94 | 49.00 | 0.20 | 3 49.10 |
| | Bozeman | 19 50 20.84 | + 1 59 38.10 | 21 49 58.94 | | | |
| October 31, 1873: | | | | | | | |
| Bozeman | Ogden | 22 23 05.47 | — 0 42 35.53 | 21 40 29.94 | 49.30 | | |
| | Bozeman | 19 44 33.10 | + 1 59 46.14 | 21 44 19.24 | | | |
| Ogden | Ogden | 22 37 35.25 | — 0 42 35.53 | 21 54 59.72 | 49.16 | 0.14 | 49.23 |
| | Bozeman | 19 59 02.69 | + 1 59 46.19 | 21 58 48.88 | | | |
| November 1, 1873: | | | | | | | |
| Bozeman | Ogden | 22 25 55.52 | — 0 42 35.54 | 21 43 19.98 | 49.35 | | |
| | Bozeman | 19 47 18.17 | + 1 59 51.16 | 21 47 09.33 | | | |
| Ogden | Ogden | 22 33 44.49 | — 0 42 35.54 | 21 51 08.95 | 3 49.19 | 0.16 | 3 49.27 |
| | Bozeman | 19 55 06.96 | + 1 59 51.18 | 21 54 58.14 | | | |

Bozeman east of Ogden.....0^h 03^m 49^s.20 ± 0^s.035

Observations and computations for latitude.

BOZEMAN, MONTANA.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|--------------|--------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|----------|----------|--------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1873. | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | <i>° ' "</i> | <i>' "</i> | <i>"</i> | <i>"</i> | <i>° ' "</i> |
| October 18.. | 7029 | 27 09.5 | 24.0 | 31.0 | | | | | | |
| | 7060 | 9 21.5 | 40.0 | 16.0 | | 45 29 18.8 | +11 29.2 | + 3.9 | ..... | 45 40 51.9 |
| | 7337 | 20 85.3 | 0.0 | 0.0 | | | | | | |
| | 7365 | 12 45.0 | 0.0 | 0.0 | | 35 26.4 | + 5 23.9 | + 3.7 | ..... | 54.0 |
| | 7373 | 17 94.0 | 47.0 | 9.0 | | | | | | |
| | 7401 | 19 15.5 | 17.0 | 39.0 | | 41 36.4 | — 0 46.7 | + 3.7 | ..... | 53.4 |
| | 7428 | 18 79.5 | 16.0 | 39.0 | | | | | | |
| | 7461 | 16 78.0 | 51.0 | 4.0 | | 42 03.6 | — 1 17.7 | + 5.6 | ..... | 51.5 |
| | 7505 | 7 75.0 | 35.5 | 20.0 | | | | | | |
| | 7530 | 11 88.0 | 26.5 | 31.0 | | 43 26.9 | — 2 39.2 | + 2.6 | ..... | 50.3 |
| | 7593 | 20 85.5 | 43.0 | 13.0 | | | | | | |
| | 7598 | 13 82.5 | 21.0 | 35.0 | | 36 16.5 | + 4 31.0 | + 3.7 | ..... | 51.2 |
| | 7621 | 21 96.5 | 25.0 | 31.0 | | | | | | |
| | 7627 | 13 40.0 | 42.0 | 14.5 | | 46 17.0 | — 5 30.2 | + 5.0 | + 1.0 | 52.8 |
| | 7658 | 17 49.0 | 16.0 | 40.0 | | | | | | |
| | 7693 | 16 51.0 | 44.0 | 13.0 | | 45 41 25.9 | — 0 37.8 | + 1.6 | | 45 40 49.7 |

LATITUDE DETERMINATIONS.

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Observations and computations—Continued.

BOZEMAN, MONTANA.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|--------------|--------------|---------------------|-----------|-----------|----------|--------------------------|-------------------|--------|--------|------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1873. | | <i>t.</i> <i>d.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | " | ° ' " |
| October 18.. | 7820 | 17 17.5 | 26.0 | 30.0 | | | | | | |
| | 7850 | 19 15.5 | 34.0 | 22.0 | | 45 39 33.1 | + 1 16.7 | + 1.9 | ..... | 45 40 51.7 |
| | 7995 | 2 34.0 | 9.0 | 48.5 | | 21 22.4 | +19 26.9 | + 3.6 | ..... | 52.9 |
| | 8023 | 32 61.0 | 0.0 | 0.0 | | 30 33.9 | +10 13.3 | + 3.6 | ..... | 50.8 |
| | 8036 | 16 70.0 | 0.0 | 0.0 | | | | | | |
| | 8076 | 20 72.0 | 40.0 | 17.0 | | | | | | |
| | 8114 | 13 18.8 | 29.0 | 29.0 | | 35 53.8 | + 4 50.4 | + 5.3 | + 0.5 | 50.0 |
| | 8126 | 11 22.0 | 24.0 | 33.0 | | | | | | |
| | 8135 | 22 40.0 | 41.0 | 16.0 | | 33 36.8 | + 7 11.0 | + 3.7 | ..... | 51.5 |
| | 8180 | 19 39.3 | 28.0 | 28.0 | | | | | | |
| | 8203 | 14 16.5 | 37.5 | 19.5 | | 44 08.6 | - 3 21.6 | + 4.1 | ..... | 51.1 |
| | 8231 | 18 81.3 | 4.0 | 53.0 | | 43 13.6 | - 2 23.0 | + 2.8 | ..... | 53.4 |
| | 8326 | 17 19.8 | 8.0 | 50.0 | | | | | | |
| | 8345 | 15 10.3 | 0.0 | -2.0 | | 42 07.8 | - 1 20.8 | + 2.8 | ..... | 49.8 |
| | 28 | 23 79.0 | 27.0 | 30.0 | | | | | | |
| | 54 | 10 41.5 | 39.0 | 19.0 | | 32 12.9 | + 8 35.6 | + 3.9 | ..... | 52.4 |
| | 67 | 23 98.0 | 29.0 | 29.0 | | | | | | |
| | 121 | 11 79.0 | 43.0 | 14.5 | | 32 56.0 | + 7 49.9 | + 6.6 | ..... | 52.5 |
| October 19.. | 6640 | 23 65.5 | 25.5 | 30.0 | | | | | | |
| | 6698 | 12 65.3 | 28.5 | 29.0 | | 47 57.2 | - 7 04.8 | - 1.2 | ..... | 51.4 |
| | 6730 | 18 97.0 | 23.0 | 35.0 | | 43 00.2 | - 2 09.4 | + 1.5 | ..... | 52.3 |
| | 6734 | 17 70.8 | 23.0 | 35.0 | | | | | | |
| | 6769 | 15 61.3 | 38.5 | 20.0 | | 42 11.7 | - 1 20.8 | + 1.5 | ..... | 52.4 |
| | 6806 | 23 13.5 | 39.0 | 21.0 | | 32 01.1 | + 8 47.7 | + 2.7 | + 1.0 | 52.5 |
| | 6813 | 22 88.0 | 39.0 | 21.0 | | | | | | |
| | 6824 | 9 44.5 | 27.0 | 33.5 | | 32 11.1 | + 8 37.9 | + 2.7 | + 1.0 | 52.7 |
| | 6879 | 9 32.0 | 32.0 | 28.5 | | | | | | |
| | 6913 | 24 70.5 | 34.0 | 26.5 | | 50 42.9 | - 9 53.1 | + 2.6 | ..... | 52.4 |
| | 6930 | 29 28.0 | 16.0 | 35.0 | | | | | | |
| | 6957 | 6 67.8 | 47.0 | 15.0 | | 55 20.8 | -14 31.3 | + 3.0 | ..... | 52.5 |
| | 6973 | 5 66.5 | 29.0 | 33.0 | | | | | | |
| | 6994 | 26 67.0 | 37.0 | 24.5 | | 54 19.2 | -13 29.8 | + 2.0 | ..... | 51.4 |
| | 7041 | 25 19.5 | 41.0 | 21.0 | | 34 54.7 | + 5 52.7 | + 2.6 | ..... | 50.0 |
| | 7062 | 16 04.5 | 27.0 | 35.5 | | | | | | |
| | 7091 | 8 07.5 | 27.0 | 36.0 | | 29 48.0 | +11 00.0 | + 2.6 | ..... | 50.6 |
| | 7112 | 13 27.0 | 33.0 | 30.0 | | 44 39.6 | - 3 50.1 | + 1.9 | ..... | 51.4 |
| | 7161 | 7 30.0 | 34.0 | 29.0 | | | | | | |
| | 7171 | 25 61.2 | 34.0 | 29.0 | | 32 54.9 | + 7 55.8 | + 1.8 | ..... | 52.5 |
| | 7188 | 25 40.5 | 30.0 | 33.0 | | | | | | |
| | 7211 | 9 62.2 | 35.0 | 28.0 | | 45 30 42.5 | +10 08.5 | + 0.9 | ..... | 45 40 51.9 |

Observations and computations—Continued.

BOZEMAN, MONTANA.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|-----------------------|-----------------|----------------------|-----------|-----------|----------|-----------------------------|----------------------|--------|--------|------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1873. October 19.. | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | " ' " | " | " | ° ' " |
| | 7336 | 19 23.5 | 47.0 | 16.0 | | 45 35 30.7 | + 5 20.2 | + 1.4 | ..... | 45 40 52.3 |
| | 7337 | 19 32.5 | 47.0 | 16.0 | | 35 26.4 | + 5 23.6 | + 1.4 | ..... | 51.4 |
| | 7365 | 10 93.0 | 19.0 | 44.0 | | | | | | |
| | 7373 | 23 28.8 | 34.5 | 29.0 | | | | | | |
| | 7401 | 24 45.0 | 30.0 | 33.0 | | 41 36.5 | - 0 44.8 | + 0.6 | ..... | 52.3 |
| | 7455 | 19 30.5 | 24.0 | 39.0 | | 44 02.8 | - 3 13.5 | + 2.8 | ..... | 52.1 |
| | 16159 | 12 02.5 | 24.0 | 39.0 | | 36 14.5 | + 4 36.2 | + 2.8 | - 0.4 | 53.1 |
| | 7480 | 10 73.0 | 24.0 | 39.0 | | 39 22.1 | + 1 27.1 | + 2.8 | ..... | 52.0 |
| | 7501 | 14 28.5 | 45.0 | 18.0 | | 31 33.8 | + 9 15.6 | + 2.8 | - 0.4 | 51.8 |
| | 7503 | 26 47.0 | 45.0 | 18.0 | | 38 32.1 | + 2 17.0 | + 2.8 | ..... | 51.9 |
| | 7593 | 19 90.0 | 30.0 | 32.0 | | | | | | |
| | 7598 | 12 80.5 | 35.0 | 27.0 | | 36 16.6 | + 4 33.9 | + 1.4 | ..... | 51.9 |
| | 7621 | 21 13.0 | 32.0 | 30.0 | | | | | | |
| | 7627 | 12 71.8 | 30.0 | 31.0 | | 46 17.1 | - 5 24.3 | + 0.2 | ..... | 53.0 |
| | 7658 | 18 11.0 | 15.5 | 46.0 | | | | | | |
| | 7693 | 17 28.0 | 43.0 | 18.0 | | 41 26.1 | - 0 32.0 | - 1.3 | ..... | 52.8 |
| | 7749 | 15 16.2 | 22.0 | 39.0 | | | | | | |
| | 7753 | 5 53.2 | 42.5 | 19.0 | | 47 01.9 | - 6 11.2 | + 1.5 | ..... | 52.2 |
| | 7820 | 17 45.8 | 22.0 | 40.0 | | | | | | |
| | 7850 | 19 51.3 | 38.0 | 24.0 | | 39 33.3 | + 1 19.2 | - 0.9 | ..... | 51.6 |
| | 7945 | 30 63.8 | 34.5 | 28.0 | | | | | | |
| | 7963 | 4 69.0 | 28.0 | 35.5 | | 24 11.2 | +16 40.5 | - 0.2 | ..... | 51.5 |
| | 7995 | 2 19.3 | 29.5 | 34.0 | | 21 22.4 | +19 31.5 | - 0.9 | ..... | 53.0 |
| | 8023 | 32 58.2 | 32.0 | 31.5 | | 34 18.5 | + 6 34.0 | - 0.9 | - 1.0 | 50.6 |
| | 8028 | 12 41.3 | 32.0 | 31.5 | | 30 33.6 | +10 16.6 | - 0.9 | + 0.2 | 49.5 |
| | 8036 | 16 58.6 | 32.0 | 31.5 | | 43 29.7 | - 2 40.9 | - 0.9 | + 1.0 | 48.9 |
| | 8076 | 21 44.5 | 31.0 | 33.0 | | | | | | |
| | 8114 | 13 69.5 | 33.0 | 31.0 | | 35 54.0 | + 4 58.7 | 0.0 | - 1.0 | 51.7 |
| | 8126 | 12 49.5 | 32.0 | 32.0 | | | | | | |
| | 8135 | 23 83.0 | 33.0 | 31.5 | | 33 37.0 | + 7 17.0 | + 0.1 | - 0.5 | 53.6 |
| | 8180 | 19 34.2 | 24.0 | 40.0 | | | | | | |
| | 8203 | 14 18.8 | 42.5 | 21.5 | | 44 08.8 | - 3 18.7 | + 1.2 | ..... | 51.3 |
| | 8231 | 18 87.0 | 21.0 | 43.0 | | 43 14.2 | - 2 22.0 | 0.0 | ..... | 52.2 |
| | 8326 | 17 16.0 | 17.0 | 48.0 | | 42 08.1 | - 1 16.1 | 0.0 | ..... | 52.0 |
| | 8345 | 15 18.5 | 46.0 | 19.0 | | | | | | |
| | 13 | 10 23.0 | 25.0 | 40.5 | | | | | | |
| | 16 | 24 39.5 | 38.0 | 29.5 | | 31 51.8 | + 9 05.9 | - 1.6 | - 4.0 | 52.1 |
| November 2. | 6879 | 9 82.2 | 30.0 | 33.0 | | | | | | |
| | 6913 | 25 06.5 | 28.0 | 33.0 | | 50 42.7 | - 9 47.6 | - 1.9 | ..... | 53.2 |
| | 6930 | 28 80.8 | 20.5 | 42.0 | | | | | | |
| | 6957 | 6 31.5 | 35.0 | 29.0 | | 45 55 20.7 | -14 27.1 | - 3.6 | | 45 40 50.0 |

LATITUDE DETERMINATIONS.

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Observations and computations—Continued.

BOZEMAN, MONTANA.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|----------------------|-----------------|----------------------|-----------|-----------|----------|-----------------------------|----------------------|----------|----------|--------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1873. November 2. | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | <i>° ' "</i> | <i>' "</i> | <i>"</i> | <i>"</i> | <i>° ' "</i> |
| | 6973 | 5 31.0 | 37.0 | 27.5 | | | | | | |
| | 6994 | 26 28.5 | 29.0 | 35.5 | | 45 54 18.9 | -13 28.6 | + 0.7 | ..... | 45 40 51.0 |
| | 7041 | 25 93.5 | 28.5 | 36.0 | | | | | | |
| | 7062 | 16 64.8 | 35.5 | 30.0 | | 34 54.7 | + 5 58.0 | - 0.5 | ..... | 52.2 |
| | 7112 | 13 72.0 | 34.0 | 32.0 | | | | | | |
| | 7161 | 7 89.8 | 26.0 | 40.0 | | 44 39.8 | - 3 44.4 | - 2.8 | ..... | 52.6 |
| | 7171 | 26 17.0 | 26.0 | 40.0 | | 32 55.2 | + 7 59.9 | - 2.8 | ..... | 52.3 |
| | 7188 | 26 52.0 | 33.5 | 32.5 | | | | | | |
| | 7211 | 10 69.0 | 29.0 | 38.0 | | 30 42.9 | +10 10.3 | - 1.9 | ..... | 51.3 |
| | 7336 | 19 86.0 | 33.0 | 29.0 | | | | | | |
| | 7337 | 19 96.5 | 38.0 | 29.0 | | 35 31.7 | + 5 21.4 | - 0.9 | ..... | 52.2 |
| | 7365 | 11 52.2 | 27.0 | 40.0 | | 35 27.4 | + 5 25.5 | - 0.9 | ..... | 52.0 |
| | 7373 | 15 89.8 | 44.0 | 23.0 | | | | | | |
| | 7401 | 17 03.0 | 20.0 | 48.0 | | 41 37.4 | - 0 43.6 | - 1.6 | ..... | 52.2 |
| | 7455 | 19 69.5 | 34.0 | 34.0 | | 44 04.0 | - 3 08.7 | - 2.8 | ..... | 52.5 |
| | 16159 | 12 40.5 | 34.0 | 34.0 | | 36 15.7 | + 4 39.3 | - 2.8 | ..... | 52.2 |
| | 7480 | 11 09.5 | 34.0 | 34.5 | | 39 23.2 | + 1 32.3 | - 2.8 | ..... | 52.7 |
| | 7501 | 14 80.0 | 28.0 | 40.0 | | 31 34.9 | + 9 20.3 | - 2.8 | ..... | 52.4 |
| | 7503 | 26 94.0 | 28.0 | 40.0 | | 38 33.8 | + 2 22.8 | - 2.8 | ..... | 53.8 |
| | 7593 | 21 13.2 | 31.5 | 36.0 | | | | | | |
| | 7598 | 14 05.0 | 36.0 | 37.0 | | 36 18.0 | + 4 33.0 | - 1.3 | ..... | 49.7 |
| | 7621 | 21 89.5 | 18.0 | 49.5 | | | | | | |
| | 7627 | 13 53.0 | 45.0 | 23.0 | | 46 18.5 | - 5 22.5 | - 2.2 | ..... | 53.8 |
| | 7658 | 18 83.2 | 26.0 | 42.0 | | | | | | |
| | 7693 | 17 99.0 | 34.0 | 34.0 | | 41 27.6 | - 0 32.5 | - 3.7 | ..... | 51.4 |
| | 7749 | 14 47.0 | 34.0 | 34.0 | | | | | | |
| | 7753 | 4 95.0 | 27.0 | 40.0 | | 47 03.6 | - 6 07.0 | - 3.0 | ..... | 53.6 |
| | 7945 | 30 99.5 | 35.5 | 32.0 | | | | | | |
| | 7963 | 5 16.5 | 32.0 | 35.5 | | 24 13.3 | +16 35.8 | + 0.0 | ..... | 49.1 |
| | 7995 | 3 68.5 | 31.0 | 35.5 | | | | | | |
| | 8023 | 34 01.8 | 31.0 | 36.0 | | 21 24.7 | +19 29.3 | - 2.7 | ..... | 51.3 |
| | 8028 | 13 87.0 | 31.0 | 36.0 | | | | | | |
| | 8036 | 17 95.5 | 30.5 | 37.0 | | 43 32.0 | - 2 37.5 | - 2.7 | ..... | 51.8 |
| | 8076 | 20 97.3 | 34.0 | 32.5 | | | | | | |
| | 8114 | 13 28.8 | 32.0 | 35.5 | | 35 56.5 | + 4 56.3 | - 0.5 | ..... | 52.3 |
| | 8180 | 21 48.5 | 26.0 | 40.5 | | | | | | |
| | 8203 | 16 43.5 | 32.0 | 35.0 | | 44 11.3 | - 3 14.7 | - 4.0 | ..... | 52.6 |
| | 8231 | 19 07.5 | 35.0 | 31.5 | | | | | | |
| | 8326 | 17 38.2 | 36.0 | 32.0 | | 43 17.0 | - 2 20.6 | - 3.7 | ..... | 52.7 |
| | 8345 | 15 42.8 | 24.5 | 44.0 | | 45 42 11.0 | - 1 15.3 | - 3.7 | ..... | 45 40 52.0 |

Observations and computations—Continued.

BOZEMAN, MONTANA.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|-------------|-----------------|----------------------|-----------|-----------|----------|-----------------------------|----------------------|--------|--------|------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1873. | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | " | ° ' " |
| November 2. | 28 | 24 43.0 | 33.5 | 35.0 | | | | | | |
| | 54 | 10 99.5 | 33.0 | 36.0 | | 45 32 16.2 | + 8 37.9 | — 1.0 | ..... | 45 40 53.1 |
| November 4. | 7621 | 22 82.3 | 20.0 | 35.5 | | | | | | |
| | 7627 | 14 48.8 | 29.0 | 27.0 | | 45 46 17.6 | — 5 21.3 | — 3.2 | ..... | 45 40 53.1 |

The final result for latitude is obtained by giving each double pair the weight of a single result.

ASTRONOMICAL CO-ORDINATES OF STATION AT BOZEMAN, MONTANA.

Longitude.. $7^h 24^m 10^s.443 \pm 0^s.035$ or $111^\circ 02' 36''.64 \pm 0''.53$ west from Greenwich.
Longitude.. $2^h 15^m 58^s.323$ or $33^\circ 59' 34''.84$ west from U. S. Naval
Observatory at Wash-
ington, D. C.
Latitude ... $45^\circ 40' 51''.92 \pm 0''.06$ north.

U. S. GEOGRAPHICAL SURVEYS WEST OF THE ONE HUNDREDTH MERIDIAN.
1ST LIEUT. GEO. M. WHEELER, CORPS OF ENGINEERS, U. S. ARMY, IN CHARGE.

RESULTS
OF
OBSERVATIONS MADE BY DR. F. KAMPF AND JOHN H. CLARK IN THE
DETERMINATION OF THE ASTRONOMICAL CO-ORDINATES
OF LAS VEGAS, NEW MEXICO.

SEASON OF 1874.

COMPUTATIONS BY
DR. F. KAMPF.

LAS VEGAS, NEW MEXICO.

GEOGRAPHICAL POSITION OF STATION.

Longitude $105^{\circ} 13' 27''.57 \pm 0''.10$ west from Greenwich.

Latitude $35^{\circ} 35' 27''.66 \pm 0''.07$ north.

Barometric altitude of observatory above sea-level, 6418.0 feet.

Las Vegas, situated in the county of San Miguel, is a village of nearly 2,000 inhabitants, two-thirds of whom are Mexicans. The astronomical monument is in the center of the plaza, occupying a position which affords an open view to the east, so that this point can be connected with natural objects by geodetical work. In the east, south, and west the country is nearly level, but on the north side the neighboring mountains rise to a considerable height. The Gallinas River crosses the eastern part of the town, but is dry except in the rainy season or after a summer freshet.

METEOROLOGICAL CONDITIONS.

This station was occupied from the 22d of July to the 17th of August, 1874. During that time the weather was very unfavorable for observations, which had to be discontinued and resumed three or four times in the course of the night. As a rule it became cloudy at two o'clock in the afternoon, followed, two or three hours later, by a heavy rain-storm. At eleven o'clock the clouds would break away for a brief period, only to return again and obscure the sky until three o'clock in the morning, when it would become clear for the remainder of the night, throughout which the observations were continued until daylight interfered. On examination of the books of record, the work of the two meteorological assistants is found to be lacking in system and correctness.

OBSERVATORY AND OBSERVERS.

The observations were made in a common wall-tent, supported by a very slender but strong frame-work. The observing pier in the center of

the tent was of limestone, and was built upon a very good foundation, so that its position can always be discovered, even should the superstructure be removed by accident or malicious design.

The observations were conducted by Dr. F. Kampf, who was assisted in the details of meteorological records and the care of implements by Charles Morrison and Ireno Chavez. Mr. Rutenbeck, operator of the Western Union Telegraph office, kindly gave his aid in the transmission of signals to the connected station.

There was but one wire from Pueblo to Las Vegas; it was the property of the Western Union Company, and had been kept in repair for the last two years by employés of the Army. In the season of 1873 there was already report that the line worked badly and was grounded in many places, but this year, 1874, it was still worse. Between 10 a. m. and 1 p. m. the line was apparently in good order, but after that, on the approach of electrical storms from the south and east, it was almost impossible to communicate with the adjacent offices at Fort Union and Santa Fé. Through the kindness of Mr. Woodward, superintendent of this division, resident at Denver, the use of the line was granted for any time of day or night, and so it became possible to exchange at least three times with Ogden, the connected station.

DESCRIPTION OF INSTRUMENTS.

Würdemann's combined transit instrument, No. 27, was used at Las Vegas. It had a focal length of 28 inches; aperture, $2\frac{1}{2}$ inches; and magnifying power of 40. In its focus nine wires were placed, grouped in numbers of 1, 2, 3, 2, and 1, successively; but, as the observations had to be made by eye and ear, only the wires 1, 2, 5, 8, and 9, clamp east, were utilized. From observations on pole-stars the distances of those wires is computed to be

$$+ 24^s.14, + 12^s.17, 0^s.07, - 12^s.27, - 23^s.98.$$

The observations for time at Ogden were made with Würdemann's transit instrument, No. 29, which was provided with three sets of focal wires, five in each set. This instrument was placed on the east (normal) pier, and Würdemann's combined transit, No. 28, occupied the western

pier. Although the entire number of wires were used in the observations, only the results from the middle group of five were retained. A chronograph was used in recording observations at Ogden. The exchange of signals was by sound at each station. In each exchange there were nineteen signals sent and received at intervals of 10''.

The chronometer used at Las Vegas was the Negus, No. 1344; at Ogden, the Negus, No. 1491.

CONNECTIONS.—OBSERVERS.—COMPUTERS.

Exchanges of time with Ogden were made on the nights of August 8 and 15, 1874, and also at noon of August 15. Observations for latitude took place July 31, and August 1, 2, 3, and 4. Mr. John H. Clark was in charge of the connected station; his observations were computed by Dr. F. Kampf after his return to the office. The computations for the work of the latter gentleman, for both latitude and time, were also made by himself, partially while in the field.

INSTRUMENTAL VALUES —TELEGRAPHIC COMMUNICATION.

The value of one division of the striding-level used at Las Vegas was 1''.00; of the zenith-level, 0''.93; and of one revolution of the micrometer screw, 77''.078.

The length of the telegraphic circuit was about 900 miles. In the transmission of signals use was made of the local battery in the office at Las Vegas; it was an apparatus of ordinary force. The only repeater on the circuit was at Cheyenne.

Tabulation of stars used for determination of time at Las Vegas, New Mexico, and Ogden, Utah, 1874.

| Name of star. | LAS VEGAS. | | | OGDEN. | | | | Name of star. | LAS VEGAS. | | | OGDEN. | | | |
|---------------------------|------------|------------|------------|-----------|-----------|------------|------------|-----------------------------|------------|------------|------------|-----------|-----------|------------|------------|
| | August 8. | August 15. | August 16. | August 7. | August 8. | August 15. | August 16. | | August 8. | August 15. | August 16. | August 7. | August 8. | August 15. | August 16. |
| α Andromedæ | ... | X | ... | ... | ... | ... | ... | μ Herculis | ... | ... | ... | ... | X | ... | X |
| γ Pegasi | ... | X | ... | ... | ... | ... | ... | γ Draconis | ... | ... | ... | ... | X | ... | X |
| ι Ceti | ... | X | ... | ... | ... | ... | ... | δ Draconis | X | ... | ... | ... | ... | ... | ... |
| κ Cassiopeiæ | ... | X | ... | ... | ... | ... | ... | τ Draconis | X | ... | ... | ... | ... | ... | ... |
| ζ Cassiopeiæ | ... | X | ... | ... | ... | ... | ... | β Cygni | X | ... | ... | ... | ... | ... | ... |
| η Cassiopeiæ | ... | X | ... | ... | ... | ... | ... | κ Aquilæ | X | ... | ... | ... | ... | ... | ... |
| γ Cassiopeiæ | ... | X | ... | ... | ... | ... | ... | θ Cygni | X | X | ... | ... | ... | ... | ... |
| ϵ Piscium | ... | X | ... | ... | ... | ... | ... | γ Aquilæ | X | X | ... | ... | ... | ... | ... |
| β Andromedæ | ... | X | ... | ... | ... | ... | ... | ϵ Draconis | X | ... | ... | ... | ... | ... | ... |
| τ Piscium | ... | X | ... | ... | ... | ... | ... | ψ Cygni | X | X | ... | ... | ... | ... | ... |
| α Scorpii | ... | ... | ... | X | ... | X | X | τ Aquilæ | X | ... | ... | ... | ... | ... | ... |
| β Herculis | ... | ... | ... | ... | X | X | X | θ Aquilæ | X | X | ... | ... | ... | ... | ... |
| Δ Draconis | ... | ... | ... | X | X | X | X | α^2 Capricorni | X | X | ... | ... | ... | ... | ... |
| ζ Herculis | ... | ... | ... | X | ... | X | X | θ Cephei | ... | X | ... | ... | ... | ... | ... |
| η Herculis | ... | ... | ... | ... | X | X | X | β Delphini | ... | X | ... | ... | ... | ... | ... |
| 9 Camelop., L. C. | ... | ... | ... | X | ... | X | X | α Delphini | ... | X | ... | ... | ... | ... | ... |
| κ Ophiuchi | X | ... | ... | X | X | X | X | α Cygni | ... | X | ... | ... | ... | ... | ... |
| ϵ Herculis | X | ... | ... | ... | ... | ... | ... | γ Delphini | ... | X | ... | ... | ... | ... | ... |
| d Herculis | ... | ... | ... | X | X | X | X | μ Aquarii | ... | X | ... | ... | ... | ... | ... |
| 60 Herculis | X | ... | ... | ... | ... | ... | ... | ζ Pegasi | ... | ... | X | ... | ... | ... | ... |
| Groom. 2415 | X | ... | ... | ... | ... | ... | ... | λ Pegasi | ... | ... | X | ... | ... | ... | ... |
| ζ Draconis | X | ... | ... | ... | ... | ... | X | ι Cephei | ... | ... | X | ... | ... | ... | ... |
| α^1 Herculis | ... | ... | ... | X | X | X | ... | α Piscis Aus. | ... | ... | X | ... | ... | ... | ... |
| π Herculis | ... | ... | ... | X | ... | X | ... | Bradley 3077 | ... | ... | X | ... | ... | ... | ... |
| 44 Ophiuchi | X | ... | ... | X | X | X | X | v Pegasi | ... | ... | X | ... | ... | ... | ... |
| Groom. 966, L. C. | ... | ... | ... | ... | X | X | ... | 72 Pegasi | ... | ... | X | ... | ... | ... | ... |
| χ Herculis | X | ... | ... | ... | ... | ... | ... | γ Cephei | ... | ... | X | ... | ... | ... | ... |
| β Draconis | X | ... | ... | ... | ... | X | X | 41 Cassiopeiæ (H) .. | ... | ... | X | ... | ... | ... | ... |
| ω Draconis | ... | ... | ... | ... | ... | X | X | ψ Pegasi | ... | ... | X | ... | ... | ... | ... |

Observations and reductions for time taken at sending station.

LAS VEGAS, NEW MEXICO, AUGUST 8, 1874.

| Clamp. | Name of star. | T. | | Aa. | Bb. | Cc. | T'. | | AR. | $\Delta T.$ | |
|--------|-----------------------------|-----------------|-----------|-----------|-----------|-------------|-----------------|-----------|-----------------|--------------|-----------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>m. s.</i> | <i>s.</i> |
| E. | κ Ophiuchi..... | 16 58 03.94 | — 0.54 | + 0.18 | — 0.38 | 16 58 03.20 | 16 51 44.18 | — 6 19.02 | | | |
| E. | ϵ Herculis | 17 01 49.44 | — 0.11 | + 0.23 | — 0.44 | 17 01 49.12 | 55 30.06 | 19.06 | | | |
| E. | 60 Herculis | 05 53.91 | — 0.49 | + 0.19 | — 0.38 | 05 53.23 | 59 34.15 | 19.08 | | | |
| E. | Groombr. 2415.... | 10 01.20 | + 0.15 | + 0.26 | — 0.49 | 10 01.12 | 17 03 41.87 | 19.25 | | | |
| E. | ζ Draconis | 14 45.56 | + 1.51 | + 0.42 | — 0.92 | 14 46.57 | 08 27.58 | 18.99 | | | |
| W. | 44 Ophiuchi..... | 25 02.69 | — 1.16 | + 0.11 | + 0.41 | 25 02.05 | 18 43.05 | 19.00 | | | |
| W. | χ Herculis | 29 43.76 | + 0.41 | + 0.32 | + 0.56 | 29 45.05 | 23 25.78 | 19.27 | | | |
| W. | β Draconis..... | 17 33 54.50 | + 0.58 | + 0.39 | + 0.61 | 17 33 56.08 | 17 27 37.19 | — 6 18.89 | | | |
| W. | δ Draconis | 19 18 49.68 | + 1.47 | + 0.82 | + 1.00 | 19 18 52.97 | 19 12 33.92 | — 6 19.05 | | | |
| W. | τ Draconis | 24 15.50 | + 2.25 | + 1.17 | + 1.32 | 24 20.24 | 18 00.81 | 19.43 | | | |
| W. | β Cygni | 31 59.28 | — 0.17 | + 0.43 | + 0.43 | 31 00.02 | 24 40.79 | 19.23 | | | |
| W. | κ Aquilæ | 36 28.90 | — 0.74 | + 0.32 | + 0.39 | 36 28.87 | 30 09.42 | 19.45 | | | |
| W. | θ Cygni | 39 23.68 | + 0.42 | + 0.66 | + 0.60 | 39 25.36 | 33 06.08 | 19.28 | | | |
| W. | γ Aquilæ | 46 37.66 | — 0.46 | + 0.40 | + 0.39 | 46 37.99 | 40 18.67 | 19.32 | | | |
| E. | ϵ Draconis | 54 55.64 | + 1.77 | + 1.22 | — 1.12 | 54 57.51 | 48 38.18 | 19.33 | | | |
| E. | ψ Cygni | 58 43.44 | + 0.49 | + 0.69 | — 0.63 | 58 43.99 | 52 24.73 | 19.26 | | | |
| E. | τ Aquilæ | 20 04 21.44 | — 0.51 | + 0.37 | — 0.39 | 20 04 20.91 | 58 01.65 | 19.26 | | | |
| E. | θ Aquilæ | 11 10.86 | — 0.64 | + 0.34 | — 0.38 | 11 10.18 | 20 04 50.87 | 19.31 | | | |
| E. | α^2 Capricorni | 20 17 26.72 | — 0.82 | + 0.30 | — 0.39 | 20 17 25.81 | 20 11 06.61 | — 6 19.20 | | | |

NORMAL EQUATIONS.

First series.

$$\begin{aligned} 0 &= -1.16 + 8.00 \delta t - 0.28 a + 2.75 c \\ 0 &= +3.15 - 0.28 \delta t + 3.09 a - 1.97 c \\ 0 &= +3.49 + 2.75 \delta t - 1.97 a + 17.37 c \end{aligned}$$

$$\begin{aligned} a &= -1^{\text{m}}.23 \\ c &= -0^{\text{s}}.374 \end{aligned}$$

Second series.

$$\begin{aligned} 0 &= -5.56 + 11.00 \delta t - 2.84 a - 3.17 c \\ 0 &= +14.83 - 2.84 \delta t + 11.24 a + 6.37 c \\ 0 &= +22.05 - 3.17 \delta t + 6.37 a + 38.65 c \end{aligned}$$

$$\begin{aligned} a &= -1^{\text{m}}.070 \\ c &= -0^{\text{s}}.384 \end{aligned}$$

Observations and reductions for time taken at sending station—Continued.

LAS VEGAS, NEW MEXICO, AUGUST 15, 1874.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|---------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | θ Cygni | 19 39 38.14 | + 0.39 | — 0.04 | — 0.53 | 19 39 37.96 | 19 33 05.96 | — 6 32.00 |
| E. | γ Aquilæ | 46 51.46 | — 0.43 | — 0.01 | — 0.35 | 46 50.67 | 40 18.65 | 32.02 |
| E. | ψ Cygni | 58 56.76 | + 0.45 | — 0.01 | — 0.55 | 58 56.65 | 52 24.61 | 32.04 |
| E. | θ Aquilæ | 20 11 23.76 | — 0.60 | — 0.03 | — 0.34 | 20 11 22.79 | 20 04 50.86 | 31.93 |
| E. | α ² Capricorni | 17 39.60 | — 0.76 | — 0.04 | — 0.35 | 17 38.45 | 11 06.62 | 31.83 |
| W. | θ Cephei | 34 00.54 | + 0.97 | — 0.04 | + 0.74 | 34 02.21 | 27 30.38 | 31.83 |
| W. | β Delphini | 38 12.86 | — 0.37 | + 0.04 | + 0.35 | 38 12.88 | 31 40.92 | 31.96 |
| W. | α Delphini | 40 21.62 | — 0.36 | + 0.07 | + 0.35 | 40 21.68 | 33 49.69 | 31.99 |
| W. | α Cygni | 43 41.87 | + 0.23 | + 0.15 | + 0.48 | 43 42.73 | 37 10.61 | 32.12 |
| W. | γ Delphini | 47 23.06 | — 0.35 | + 0.15 | + 0.35 | 47 23.21 | 40 51.18 | 32.03 |
| W. | μ Aquarii | 20 52 26.48 | — 0.71 | + 0.16 | + 0.34 | 20 52 26.27 | 20 45 54.24 | — 6 32.03 |
| W. | α Andromedæ | 0 08 26.84 | — 0.10 | + 0.08 | + 0.46 | 0 08 27.28 | 0 01 54.96 | — 6 32.32 |
| W. | γ Pegasi | 13 19.26 | — 0.26 | + 0.08 | + 0.41 | 13 19.49 | 06 47.29 | 32.20 |
| W. | ι Ceti | 19 35.30 | — 0.50 | + 0.06 | + 0.40 | 19 35.26 | 13 03.00 | 32.26 |
| W. | κ Cassiopeia | 32 24.20 | + 0.67 | + 0.19 | + 0.86 | 32 25.92 | 25 53.66 | 32.26 |
| W. | ζ Cassiopeia | 36 30.88 | + 0.36 | + 0.22 | + 0.67 | 36 32.13 | 30 00.01 | 32.12 |
| E. | η Cassiopeia | 48 03.96 | + 0.47 | + 0.34 | — 0.74 | 48 04.03 | 41 31.62 | 32.41 |
| E. | γ Cassiopeia | 55 41.58 | + 0.58 | + 0.27 | — 0.80 | 55 41.63 | 49 09.49 | 32.14 |
| E. | ε Piscium | 1 02 59.38 | — 0.33 | + 0.08 | — 0.40 | 1 02 58.73 | 56 26.51 | 32.22 |
| E. | β Andromedæ | 09 15.76 | — 0.01 | + 0.08 | — 0.49 | 09 15.34 | 1 02 43.10 | 32.24 |
| E. | τ Piscium | 1 11 18.38 | — 0.08 | + 0.06 | — 0.46 | 1 11 17.90 | 1 04 45.80 | — 6 32.10 |

NORMAL EQUATIONS.

First series.

$$\begin{aligned}
 0 &= -3.57 + 11.00 \delta t + 1.55 a - 1.47 c & a &= -0^s.994 \\
 0 &= +3.12 + 1.55 \delta t + 3.41 a + 1.10 c & c &= -0^s.340 \\
 0 &= +8.20 - 1.47 \delta t + 1.10 a + 19.11 c
 \end{aligned}$$

Second series.

$$\begin{aligned}
 0 &= +1.56 + 10.00 \delta t - 1.14 a + 0.22 c & a &= -0^s.697 \\
 0 &= +1.74 - 1.14 \delta t + 3.25 a - 0.63 c & c &= -0^s.401 \\
 0 &= +8.43 + 0.22 \delta t - 0.63 a + 22.01 c
 \end{aligned}$$

Observations and reductions for time taken at sending station—Continued.

LAS VEGAS, NEW MEXICO, AUGUST 16, 1874.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|---------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | ζ Pegasi | 22 41 47.30 | — 0.32 | + 0.05 | — 0.30 | 22 41 46.73 | 22 35 13.23 | — 6 33.50 |
| E. | λ Pegasi | 47 04.24 | — 0.17 | + 0.05 | — 0.32 | 47 03.80 | 40 30.26 | 33.54 |
| E. | ι Cephei | 51 47.88 | + 0.87 | + 0.06 | — 0.71 | 51 48.10 | 45 14.70 | 33.40 |
| E. | α Piscium Aus. | 57 18.86 | — 0.76 | + 0.01 | — 0.34 | 57 17.77 | 50 44.35 | 33.42 |
| E. | Bradley 3077 | 23 13 49.38 | + 0.47 | + 0.03 | — 0.54 | 23 13 49.34 | 23 07 16.04 | 33.30 |
| W. | ν Pegasi | 25 41.14 | — 0.17 | + 0.04 | + 0.32 | 25 41.33 | 19 08.00 | 33.33 |
| W. | 72 Pegasi | 34 17.68 | — 0.07 | + 0.08 | + 0.34 | 34 18.03 | 27 44.57 | 33.46 |
| W. | γ Cephei | 40 44.80 | + 2.10 | + 0.40 | + 1.31 | 40 48.61 | 34 15.10 | 33.51 |
| W. | 41 Cassiopeæ (H)... | 48 27.78 | + 0.96 | + 0.37 | + 0.76 | 48 29.57 | 41 56.62 | 33.25 |
| W. | ψ Pegasi | 23 52 40.30 | — 0.22 | + 0.23 | + 0.31 | 23 52 40.62 | 23 46 07.19 | — 6 33.43 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -3.38 + 10.00 \delta t - 3.73 a - 2.80 c & a &= -0^s.719 \\
 0 &= +13.83 - 3.73 \delta t - 13.75 a + 13.48 c & c &= -0^s.296 \\
 0 &= +22.22 - 2.80 \delta t + 13.48 a + 42.40 c
 \end{aligned}$$

Observations and reductions for time taken at receiving station.

OGDEN, UTAH, AUGUST 7, 1874.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|-------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | α Scorpii | 16 26 25.10 | — 6.27 | + 0.13 | + 0.03 | 16 26 18.89 | 16 21 43.20 | — 4 35.69 |
| E. | β Herculis | 29 27.96 | — 2.13 | + 0.09 | + 0.02 | 29 25.94 | 24 50.05 | 35.89 |
| E. | Δ Draconis | 32 43.81 | + 7.98 | + 0.32 | + 0.07 | 32 52.18 | 28 16.36 | 35.82 |
| E. | ζ Herculis | 41 10.82 | — 1.10 | + 0.20 | + 0.03 | 41 09.95 | 36 34.07 | 35.88 |
| E. | 9 Camelop., L. C. ... | 46 23.25 | — 14.31 | — 0.15 | — 0.06 | 46 08.73 | 41 32.95 | 35.78 |
| W. | κ Ophiuchi | 56 23.23 | — 3.23 | + 0.12 | — 0.02 | 56 20.10 | 51 44.22 | 35.88 |
| W. | δ Herculis | 17 01 35.65 | — 0.98 | + 0.18 | — 0.03 | 17 01 34.82 | 56 59.03 | 35.79 |
| W. | α ¹ Herculis | 13 34.66 | — 2.74 | + 0.14 | — 0.02 | 13 32.04 | 17 08 56.18 | 35.86 |
| W. | π Herculis | 15 17.65 | — 0.55 | + 0.17 | — 0.03 | 15 17.24 | 10 41.58 | 35.66 |
| W. | 44 Ophiuchi | 17 23 25.10 | — 6.03 | + 0.07 | — 0.03 | 17 23 19.11 | 17 18 43.06 | — 4 36.05 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= +1.78 + 10.00 \delta t + 4.82 a^1 - 1.92 c & \text{Adopted } a &= -6^s.00 \\
 0 &= +1.78 + 4.82 \delta t + 9.95 a^1 - 10.11 c & a^1 &= -0^s.091 \\
 0 &= -1.75 - 1.92 \delta t - 10.11 a^1 + 24.00 c & c &= +0^s.024
 \end{aligned}$$

Observations and reductions for time taken at receiving station—Continued.

OGDEN, UTAH, AUGUST 8, 1874.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|-------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | A Draconis | 16 32 49.62 | + 3.15 | + 0.02 | + 0.15 | 16 32 52.94 | 16 28 16.29 | — 4 36.65 |
| W. | η Herculis | 43 13.19 | — 0.12 | — 0.04 | + 0.07 | 43 13.10 | 38 36.43 | 36.67 |
| W. | κ Ophiuchi | 56 22.22 | — 1.28 | — 0.07 | + 0.06 | 56 20.93 | 51 44.21 | 36.72 |
| W. | δ Herculis | 17 01 36.16 | — 0.38 | + 0.07 | + 0.06 | 17 01 35.91 | 56 59.02 | 36.89 |
| E. | α ¹ Herculis | 13 34.03 | — 1.08 | + 0.05 | — 0.06 | 13 32.94 | 17 08 56.17 | 36.77 |
| E. | 44 Ophiuchi | 23 22.10 | — 2.38 | + 0.04 | — 0.06 | 23 19.70 | 1843.05 | 36.65 |
| E. | Groom. 966, L. C. . | 27 38.89 | — 8.35 | — 0.17 | + 0.21 | 27 30.58 | 22 53.95 | 36.63 |
| E. | μ Herculis | 17 46 11.04 | — 0.63 | + 0.18 | — 0.06 | 17 46 10.53 | 17 41 33.74 | — 4 36.79 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= +0.17 + 8.00 \delta t + 4.60 a^1 - 6.90 c & \text{Adopted } a &= -2^s.5 \\
 0 &= -1.58 + 4.60 \delta t + 15.32 a^1 - 13.14 c & a^1 &= +0^s.093 \\
 0 &= +2.04 - 6.90 \delta t - 13.14 a^1 + 30.31 c & c &= -0^s.055
 \end{aligned}$$

OGDEN, UTAH, AUGUST 15, 1874.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|-------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | α Scorpii | 16 26 22.45 | + 0.92 | 0.00 | — 0.05 | 16 26 23.32 | 16 21 43.09 | — 4 40.23 |
| W. | β Herculis | 29 29.83 | + 0.31 | + 0.01 | — 0.05 | 29 30.10 | 24 49.93 | 40.17 |
| W. | A Draconis | 32 57.04 | — 1.18 | + 0.05 | — 0.13 | 32 55.78 | 28 15.88 | 39.90 |
| W. | ζ Herculis | 41 13.93 | + 0.16 | + 0.03 | — 0.05 | 41 14.07 | 36 33.93 | 40.14 |
| W. | η Herculis | 43 16.33 | + 0.04 | + 0.05 | — 0.06 | 43 16.36 | 38 36.28 | 40.08 |
| E. | κ Ophiuchi | 56 24.01 | + 0.48 | + 0.13 | + 0.05 | 56 24.67 | 51 44.12 | 40.55 |
| E. | δ Herculis | 17 01 39.19 | + 0.14 | + 0.18 | + 0.06 | 17 01 39.57 | 56 58.89 | 40.68 |
| E. | α ¹ Herculis | 13 36.01 | + 0.40 | + 0.14 | + 0.05 | 13 36.60 | 17 08 56.08 | 40.52 |
| E. | π Herculis | 15 21.54 | + 0.08 | + 0.16 | + 0.06 | 15 21.84 | 10 41.44 | 40.40 |
| E. | 44 Ophiuchi | 23 22.59 | + 0.89 | + 0.05 | + 0.05 | 23 23.58 | 18 42.97 | 40.61 |
| E. | Groom. 966, L. C. . | 26 32.07 | + 3.11 | — 0.17 | — 0.18 | 26 34.83 | 21 54.61 | 40.22 |
| E. | β Draconis | 32 17.54 | — 0.28 | + 0.16 | + 0.07 | 32 17.49 | 27 36.97 | 40.52 |
| E. | ω Draconis | 17 42 24.68 | — 1.16 | + 0.25 | + 0.13 | 17 42 23.90 | 17 37 43.43 | — 4 40.47 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= +0.63 + 13.00 \delta t + 4.39 a - 1.28 c & a &= +0^s.897 \\
 0 &= -14.02 + 4.39 \delta t + 18.23 a - 17.99 c & c &= +0^s.046 \\
 0 &= +13.67 - 1.28 \delta t - 17.99 a + 44.74 c
 \end{aligned}$$

Observations and reductions for time taken at receiving station—Continued.

OGDEN, UTAH, AUGUST 16, 1874.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|-------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | <i>a</i> Scorpii..... | 16 26 22.10 | + 1.34 | 0.00 | 0.00 | 16 26 23.44 | 16 21 43.08 | — 4 40.36 |
| E. | <i>β</i> Herculis | 29 29.89 | + 0.46 | — 0.02 | 0.00 | 29 30.33 | 24 49.92 | 40.41 |
| E. | <i>ζ</i> Herculis | 41 14.17 | + 0.23 | — 0.05 | 0.00 | 41 14.35 | 36 33.91 | 40.44 |
| E. | <i>η</i> Herculis | 43 16.82 | + 0.07 | — 0.07 | 0.00 | 43 16.82 | 38 36.26 | 40.56 |
| E. | 9 Camelop., L. C.... | 45 10.94 | + 3.06 | + 0.06 | 0.00 | 45 14.06 | 40 33.50 | 40.56 |
| E. | <i>κ</i> Ophiuchi | 56 24.00 | + 0.69 | — 0.10 | 0.00 | 56 24.59 | 51 44.11 | 40.48 |
| E. | <i>δ</i> Herculis | 17 01 39.49 | + 0.21 | — 0.21 | 0.00 | 17 01 39.49 | 56 58.87 | 40.62 |
| W. | <i>ζ</i> Draconis | 13 07.05 | + 1.32 | — 0.47 | 0.00 | 13 07.90 | 17 08 27.24 | 40.66 |
| W. | 44 Ophiuchi | 23 25.00 | — 1.29 | — 0.10 | 0.00 | 23 23.61 | 18 42.95 | 40.66 |
| W. | <i>β</i> Draconis | 32 17.52 | + 0.40 | — 0.40 | 0.00 | 32 17.52 | 27 36.94 | 40.58 |
| W. | <i>ω</i> Draconis | 42 22.80 | + 1.67 | — 0.62 | 0.00 | 42 23.85 | 37 43.38 | 40.47 |
| W. | <i>μ</i> Herculis | 46 14.57 | — 0.34 | — 0.30 | 0.00 | 46 13.93 | 41 33.62 | 40.31 |
| W. | <i>γ</i> Draconis | 17 58 23.33 | + 0.36 | — 0.43 | 0.00 | 17 58 23.26 | 17 53 42.89 | — 4 40.37 |

NORMAL EQUATIONS.

$$\begin{aligned} \text{For E.: } 0 &= -1.93 + 7.00 \delta t + 4.65 a \\ 0 &= -6.42 + 4.65 \delta t + 7.04 a \end{aligned} \quad a = + 1^s.300$$

$$\begin{aligned} \text{For W.: } 0 &= +1.53 + 6.00 \delta t - 1.65 a \\ 0 &= +4.09 - 1.05 \delta t + 3.93 a \end{aligned} \quad a = + 1^s.298$$

The following tables show the corrections and rates of the chronometers used at Las Vegas and Ogden :

CHRONOMETER AT LAS VEGAS—NEGUS, No. 1344.

| Date. | Local sidereal time. | Correction of chronometer. | Adopted hourly rate. |
|-----------|----------------------|----------------------------|----------------------|
| 1874. | <i>h.</i> | <i>h. m. s.</i> | <i>s.</i> |
| August 8 | 17.2 | — 0 06 19.07 | + 0.080 |
| August 8 | 19.7 | 19.28 | |
| August 15 | 20.1 | 31.98 | + 0.055 |
| August 15 | 0.6 | 32.23 | |
| August 16 | 23.2 | — 0 06 33.41 | + 0.055 |

CHRONOMETER AT OGDEN—NEGUS, No. 1491.

| Date. | Local sidereal time. | Correction of chronometer. | Adopted hourly rate. |
|-----------|----------------------|----------------------------|----------------------|
| 1874. | <i>h.</i> | <i>h. m. s.</i> | <i>s.</i> |
| August 7 | 16.8 | — 0 04 35.83 | + 0.040 |
| August 8 | 17.1 | 36.72 | |
| August 15 | 17.0 | 40.35 | + 0.006 |
| August 16 | 17.1 | — 0 04 40.50 | |

Final results of longitude.

| Signals sent from— | Recorded at— | Mean of signals sent and received. | Time-corrections. | Corrected time. | Difference of longitude. | Double-wave time. | Means. |
|--------------------|--------------|------------------------------------|-------------------|-----------------|--------------------------|-------------------|--------------|
| August 8, 1874: | | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> | <i>s.</i> | <i>m. s.</i> |
| Ogden..... | Las Vegas... | 18 47 42.33 | — 0 06 19.18 | 18 41 23.15 | | | |
| | Ogden..... | 18 18 53.92 | — 0 04 36.76 | 18 14 17.16 | 27 05.99 | | |
| Las Vegas..... | Las Vegas... | 18 51 40.25 | — 0 06 19.18 | 18 45 21.07 | | | |
| | Ogden..... | 18 22 52.26 | — 0 04 36.77 | 18 18 15.49 | 05.58 | 0.41 | 27 05.785 |
| August 15, 1874: | | | | | | | |
| Ogden..... | Las Vegas... | 19 02 26.26 | — 0 06 31.91 | 18 55 54.35 | | | |
| | Ogden..... | 18 33 28.78 | — 0 04 40.36 | 18 28 48.42 | 05.93 | | |
| Las Vegas..... | Las Vegas... | 19 10 45.11 | — 0 06 31.92 | 19 24 13.19 | | | |
| | Ogden..... | 18 41 47.84 | — 0 04 40.36 | 18 37 07.48 | 05.71 | 0.22 | 05.820 |
| August 15, 1874: | | | | | | | |
| Ogden..... | Las Vegas... | 9 01 16.34 | — 0 06 32.65 | 8 54 43.69 | | | |
| | Ogden..... | 8 32 18.15 | — 0 04 40.45 | 8 27 37.70 | 05.99 | | |
| Las Vegas..... | Las Vegas... | 9 14 28.94 | — 0 06 32.66 | 9 07 56.28 | | | |
| | Ogden..... | 8 45 31.09 | — 0 04 40.45 | 8 40 50.64 | 27 05.64 | 0.35 | 27 05.815 |

Las Vegas east of Ogden..... $0^h 27^m 05^s.807 \pm 0^s.007$
 Or, $6^\circ 46' 27''.10$

Observations and computations for latitude.

LAS VEGAS, NEW MEXICO.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|---------------------|-----------------|-------------------|-----------|-----------|-----------------------|--------------------------|-------------------|------------|------------|--------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1874. July 31... | | <i>i. d.</i> | <i>d.</i> | <i>d.</i> | | <i>o ' "</i> | <i>' "</i> | <i>" "</i> | <i>" "</i> | <i>o ' "</i> |
| | 6553 | 6 92.6 | 23.0 | 13.8 | | | | | | |
| | 6581 | 9 42.0 | 10.5 | 27.0 | | 35 37 06.2 | — 1 36.1 | —1.7 | ..... | 35 35 28.4 |
| | 6654 | 9 91.7 | 19.8 | 18.4 | | 30 30.1 | + 4 57.9 | —0.2 | ..... | 27.8 |
| | 6697 | 2 18.3 | 18.0 | 20.2 | | | | | | |
| | 6709 | 12 43.9 | 18.0 | 20.0 | | 28 53.8 | + 6 35.4 | —1.0 | ..... | 28.2 |
| | 6731 | 11 06.0 | 20.0 | 17.3 | | | | | | |
| | 6762 | 7 80.7 | 5.7 | 32.4 | | 37 38.2 | — 2 05.3 | —5.5 | ..... | 27.4 |
| | 6799 | 11 21.0 | 19.3 | 18.0 | | 40 32.7 | — 5 00.1 | —3.8 | ..... |  |
| | 6827 | 3 42.6 | 10.0 | 27.5 | | | | | | |
| | 6830 | 11 77.0 | 24.0 | 13.4 | 25 ^s p. m. | 40 51.3 | — 5 21.6 | —1.6 | +0.1 | 28.2 |
| | 6851 | 2 04.0 | 23.5 | 13.7 | | | | | | |
| | 6875 | 14 55.3 | 12.3 | 24.8 | | 43 30.1 | — 8 02.3 | —0.6 | ..... | 27.2 |
| | 6893 | 3 41.2 | 16.0 | 21.0 | | | | | | |
| | 6905 | 13 38.0 | 29.0 | 8 7 | | 35 41 48.4 | — 6 24.3 | +3.6 | | 35 35 27.6 |

LATITUDE DETERMINATIONS.

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Observations and computations—Continued.

LAS VEGAS, NEW MEXICO.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|---------------------|-----------------|-------------------|-----------|-----------|-----------------------|--------------------------|-------------------|----------|----------|--------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1874. July 31... | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | <i>° ' "</i> | <i>' "</i> | <i>"</i> | <i>"</i> | <i>° ' "</i> |
| | 6937 | 8 01.2 | 17.0 | 19.8 | | 35 31 51.1 | + 3 41.3 | -5.5 | ..... | 35 35 26.9 |
| | 6967 | 5 74.0 | 16.2 | 21.2 | | 30 21.1 | + 5 09.5 | -6.0 | ..... | 27.6 |
| | 6998 | 13 76.8 | 8.3 | 29.4 | | | | | | |
| | 7067 | 13 49.3 | 22.3 | 15.2 | Changed | 29 51.1 | + 5 29.5 | +10.3 | ..... | 30.9 |
| | 7101 | 4 94.3 | 38.0 | 0.3 | inclina- tion. | | | | | |
| | 7119 | 13 04.7 | 33.5 | 4.3 | | 40 30.9 | - 5 06.8 | +2.9 | ..... | 27.0 |
| | 7152 | 5 08.7 | 10.4 | 27.0 | | | | | | |
| | 7166 | 9 88.5 | 25.7 | 12.0 | | 37 02.1 | - 1 42.1 | +7.0 | ..... | 27.0 |
| | 7200 | 7 23.5 | 27.2 | 10.7 | | | | | | |
| | 7241 | 2 63.0 | 17.0 | 20.5 | Changed | 34 59.6 | + 0 35.0 | -8.6 | ..... | 26.0 |
| | 7256 | 3 53.7 | 2.3 | 36.0 | inclina- tion. | | | | | |
| | 7290 | 21 24.0 | 26.0 | 12.9 | | 46 52.2 | -11 22.2 | -4.8 | ..... | 25.2 |
| | 7309 | 10 01.8 | 17.8 | 20.0 | | 38 52.3 | - 3 32.8 | -2.8 | ..... | 26.7 |
| | 7334 | 1 25.0 | 18.0 | 20.0 | | 46 04.9 | -10 37.0 | -2.8 | ..... | 25.1 |
| | 7381 | 15 28.0 | 14.2 | 24.2 | | | | | | |
| | 7394 | 3 49.5 | 18.2 | 20.2 | | 43 05.0 | - 7 37.2 | +0.9 | ..... | 28.7 |
| | 7404 | 5 68.0 | 17.8 | 20.7 | | 41 41.6 | - 6 13.0 | +0.6 | ..... | 29.2 |
| | 7438 | 15 35.6 | 22.2 | 16.5 | | | | | | |
| | 7450 | 7 91.0 | 18.2 | 20.0 | | 37 05.2 | - 1 33.6 | -4.3 | ..... | 27.3 |
| | 7483 | 10 34.0 | 11.0 | 27.9 | | | | | | |
| | 7488 | 12 68.0 | 5.3 | 33.5 | 30 ^s p. m. | 40 07.9 | - 4 35.1 | -6.8 | +0.1 | 26.1 |
| | 7528 | 5 54.2 | 18.8 | 21.0 | | | | | | |
| | 7548 | 19 46.3 | 10.3 | 29.0 | | 44 27.6 | - 8 59.9 | -2.0 | ..... | 25.7 |
| | 7585 | 5 45.9 | 25.0 | 14.8 | | 32 55.1 | + 2 35.7 | -3.6 | ..... | 27.2 |
| | 7598 | 1 42.0 | 7.3 | 33.0 | | | | | | |
| | 7605 | 18 55.7 | 19.8 | 19.9 | | 47 40.5 | -12 06.9 | -6.8 | ..... | 26.8 |
| | 7641 | 0 30.0 | 5.5 | 34.7 | | | | | | |
| | 7788 | 7 39.2 | 21.8 | 19.0 | | 36 53.7 | - 1 21.1 | -3.7 | ..... | 28.9 |
| | 7810 | 9 49.5 | 11.7 | 30.4 | | | | | | |
| August 1. | 6553 | 6 85.6 | 23.3 | 18.0 | | 37 06.4 | - 1 38.8 | +0.8 | ..... | 28.4 |
| | 6581 | 9 42.0 | 20.0 | 22.0 | | | | | | |
| | 6654 | 8 86.3 | 18.5 | 23.0 | | 30 30.3 | + 4 51.4 | +6.8 | ..... | 28.5 |
| | 6697 | 1 30.4 | 37.5 | 4.0 | | 28 54.0 | + 6 31.7 | +2.0 | ..... | 27.7 |
| | 6709 | 11 46.5 | 8.0 | 33.0 | | | | | | |
| | 6731 | 10 62.5 | 20.2 | 20.7 | | 37 38.4 | - 2 11.6 | +2.5 | ..... | 29.3 |
| | 6762 | 7 21.0 | 56.4 | 15.0 | | | | | | |
| | 6799 | 11 60.0 | 21.3 | 19.8 | | 40 33.0 | - 5 01.1 | -3.8 | ..... | 28.1 |
| | 6827 | 3 79.0 | 12.0 | 29.7 | | | | | | |
| | 6851 | 2 66.0 | 19.0 | 22.0 | | 35 43 30.4 | - 8 04.7 | +3.3 | ..... | 35 35 29.0 |
| | 6875 | 15 23.5 | 29.4 | 12.0 | | | | | | |

Observations and computations—Continued.

LAS VEGAS, NEW MEXICO.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|--------------------|-----------------|---------------------|-----------|-----------|----------|--------------------------|-------------------|--------|--------|------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1874. August 1. | | <i>t.</i> <i>d.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | " | ° ' " |
| | 6893 | 3 83.0 | 21.3 | 19.7 | | | | | | |
| | 6905 | 13 82.2 | 31.0 | 10.3 | | 35 36 48.6 | — 6 25.2 | +5.2 | ..... | 35 35 28.6 |
| | 6937 | 8 23.3 | 19.2 | 22.0 | | 31 51.5 | + 3 33.2 | +3.6 | ..... | 28.3 |
| | 6967 | 5 96.8 | 17.9 | 23.6 | | 30 24.4 | + 5 00.6 | +2.9 | ..... | 27.9 |
| | 6998 | 13 76.5 | 30.0 | 11.7 | | | | | | |
| | 7067 | 12 97.3 | 22.3 | 20.0 | | | | | | |
| | 7101 | 4 40.0 | 36.8 | 5.6 | | 29 50.5 | + 5 30.5 | +7.8 | ..... | 28.8 |
| | 7119 | 13 49.9 | 19.5 | 22.5 | | | | | | |
| | 7152 | 5 64.2 | 22.8 | 18.9 | | 40 31.2 | — 5 02.9 | +0.2 | ..... | 28.7 |
| | 7166 | 9 86.9 | 18.0 | 23.9 | | | | | | |
| | 7200 | 7 28.3 | 33.0 | 9.0 | | 37 02.3 | — 1 39.7 | +4.2 | ..... | 26.8 |
| | 7241 | 3 19.9 | 22.5 | 20.0 | | 34 59.9 | + 0 34.0 | —6.4 | ..... | 27.5 |
| | 7256 | 4 08.2 | 6.0 | 36.0 | | | | | | |
| | XX, 401 | 17 71.6 | 40.0 | 2.0 | | 44 10.6 | — 8 45.5 | +1.9 | ..... | 27.0 |
| | 7309 | 9 87.0 | 21.6 | 19.8 | | 38 52.5 | — 3 29.2 | +5.6 | ..... | 28.9 |
| | 7334 | — 1 42.5 | 23.0 | 18.9 | | 46 05.2 | —10 44.7 | +6.1 | ..... | 26.6 |
| | 7381 | 15 29.9 | 32.6 | 10.2 | | | | | | |
| | 7394 | 2 61.3 | 20.0 | 22.0 | | 43 05.1 | — 7 36.2 | —2.0 | ..... | 26.9 |
| | 7404 | 4 79.0 | 19.0 | 22.2 | | 41 41.7 | — 6 12.3 | —2.2 | ..... | 27.2 |
| | 7438 | 14 44.8 | 17.4 | 24.0 | | | | | | |
| | 7450 | 7 41.5 | 20.7 | 19.8 | | | | | | |
| | 7483 | 9 97.8 | 20.4 | 20.0 | | 37 05.5 | — 1 38.8 | +0.3 | ..... | 27.0 |
| | 7488 | 12 78.5 | 23.0 | 17.8 | | | | | | |
| | 7528 | 5 52.5 | 12.0 | 29.0 | | 40 08.2 | — 4 39.8 | —3.0 | ..... | 25.4 |
| | 7548 | 20 13.6 | 19.7 | 21.0 | | 44 27.9 | — 8 57.0 | —3.8 | ..... | 27.1 |
| | 7585 | 6 20.5 | 12.6 | 27.6 | | | | | | |
| | 7598 | 2 32.9 | 33.0 | 8.0 | | 32 55.5 | + 2 29.4 | +2.3 | ..... | 27.2 |
| | 7605 | 17 08.2 | 21.3 | 19.2 | | | | | | |
| | 7641 | — 1 94.4 | 19.0 | 22.7 | | 47 40.9 | —12 13.4 | —0.4 | ..... | 27.1 |
| | 7695 | 12 82.9 | 22.2 | 20.2 | | | | | | |
| | 7706 | 4 73.1 | 21.5 | 21.2 | | 40 37.6 | — 5 12.1 | +0.5 | ..... | 26.0 |
| | 7721 | — 2 27.7 | 25.0 | 17.2 | | 49 29.9 | —14 04.3 | +2.6 | ..... | 28.2 |
| | 7731 | — 2 43.0 | 25.0 | 17.3 | | 49 34.6 | —14 10.2 | +2.6 | ..... | 27.0 |
| | 7765 | 19 62.0 | 23.3 | 19.8 | | | | | | |
| | 7788 | 7 49.5 | 20.3 | 22.3 | | | | | | |
| | 7810 | 9 84.5 | 36.0 | 7.0 | | 36 54.0 | — 1 30.6 | +6.3 | ..... | 29.7 |
| | 7843 | 10 96.0 | 23.0 | 19.5 | | | | | | |
| | 7858 | 5 51.7 | 32.0 | 11.2 | | 31 52.7 | + 3 29.8 | +5.6 | ..... | 28.1 |
| | 7875 | 13 21.5 | 18.0 | 24.8 | | | | | | |
| | 7908 | 7 50.8 | 25.5 | 18.0 | | 35 39 05.6 | — 3 39.8 | +0.2 | | 35 35 26.0 |

LATITUDE DETERMINATIONS.

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Observations and computations—Continued.

LAS VEGAS, NEW MEXICO.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|-----------|-----------------|-------------------|-----------|-----------|---------------|--------------------------|-------------------|------------|--------|--------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1874. | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | <i>° ' "</i> | <i>' "</i> | <i>" "</i> | | <i>° ' "</i> |
| August 1. | 7963 | 5 23.6 | 21.8 | 22.3 | | | | | | |
| | 7996 | 11 76.0 | 33.2 | 11.0 | | 35 31 09.6 | + 4 11.4 | +5.0 | ..... | 35 35 26.0 |
| | 8034 | 15 77.3 | 15.0 | 29.0 | | | | | | |
| | 8083 | 7 51.0 | 36.0 | 8.8 | | 30 04.8 | + 5 18.6 | +3.1 | ..... | 26.5 |
| | 8114 | 13 61.6 | 21.2 | 23.0 | | | | | | |
| August 2. | 8131 | 4 45.7 | 13.0 | 31.0 | | 41 24.1 | - 5 53.1 | -4.6 | ..... | 26.4 |
| | 6967 | 6 68.4 | 21.2 | 21.9 | | | | | | |
| | 6998 | 14 44.2 | 29.3 | 13.8 | | 30 24.7 | + 4 59.1 | +3.4 | ..... | 27.2 |
| | 6553 | 7 14.3 | 17.0 | 17.0 | Cloudy again. | | | | | |
| | 6581 | 9 84.0 | 32.0 | 2.0 | | 37 06.9 | - 1 43.9 | +7.0 | ..... | 30.0 |
| August 3. | 6654 | 9 53.0 | 21.0 | 13.0 | | 30 30.8 | + 4 57.5 | -1.1 | ..... | 27.2 |
| | 6697 | 1 81.0 | 11.2 | 23.9 | | | | | | |
| | 6709 | 12 04.0 | 20.2 | 14.5 | | 28 54.5 | + 6 34.4 | -1.6 | ..... | 27.3 |
| | 6731 | 10 22.0 | 19.3 | 15.0 | | | | | | |
| | 6762 | 6 84.2 | 17.7 | 17.3 | | 37 38.9 | - 2 10.2 | +1.1 | ..... | 29.8 |
| | 6799 | 11 56.7 | 21.2 | 13.8 | | | | | | |
| | 6827 | 3 82.4 | -0.3 | 35.7 | | 40 33.5 | - 4 58.4 | -6.6 | ..... | 28.5 |
| | 6851 | 2 89.2 | 15.0 | 20.0 | | | | | | |
| | 6875 | 15 50.5 | 28.2 | 7.0 | | 43 31.0 | - 8 06.2 | +3.7 | ..... | 28.5 |
| | 6893 | 2 20.9 | 17.0 | 17.6 | | | | | | |
| | 6905 | 11 92.9 | 5.8 | 29.0 | | 41 49.1 | - 6 14.7 | -5.5 | ..... | 28.9 |
| | 6937 | 7 84.0 | 18.1 | 16.0 | | 31 52.0 | + 3 38.1 | -1.2 | ..... | 28.9 |
| | 6967 | 5 58.5 | 17.9 | 17.0 | | 30 25.0 | + 5 05.0 | -1.4 | ..... | 28.6 |
| | 6998 | 13 50.0 | 14.0 | 21.1 | | | | | | |
| | 7067 | 12 08.5 | 12.3 | 22.6 | | | | | | |
| | 7101 | 3 37.5 | 23.6 | 11.6 | | 29 51.2 | + 5 35.8 | +0.4 | ..... | 27.4 |
| | 7119 | 12 53.4 | 14.8 | 20.0 | | | | | | |
| | 7152 | 4 77.1 | 12.2 | 22.7 | | 40 31.7 | - 4 59.2 | -3.7 | ..... | 28.8 |
| | 7166 | 10 27.0 | 17.1 | 17.4 | | | | | | |
| | 7200 | 7 95.6 | 7.0 | 27.7 | | 37 03.0 | - 1 29.2 | -4.9 | ..... | 28.9 |
| | 7241 | 2 82.2 | 18.7 | 16.0 | | 35 00.5 | + 0 32.3 | -7.0 | ..... | 25.8 |
| | 7256 | 3 66.0 | 1.0 | 34.0 | | | | | | |
| | XX, 401 | 17 21.9 | 31.9 | 3.6 | | 44 11.2 | - 8 42.7 | -1.1 | ..... | 27.4 |
| | 7309 | 9 48.8 | 12.3 | 22.7 | | 38 52.9 | - 3 27.1 | +2.9 | ..... | 28.7 |
| | 7334 | - 1 81.0 | 14.0 | 21.1 | | 46 05.6 | -10 42.7 | +3.6 | ..... | 26.5 |
| | 7381 | 14 86.1 | 29.7 | 6.9 | | | | | | |
| | 7394 | 1 83.5 | 22.7 | 13.7 | | 43 05.6 | - 7 34.1 | -3.5 | ..... | 28.0 |
| | 7404 | 3 99.7 | ..... | ..... |  | 35 41 42.2 | - 6 10.8 | -3.6 | ..... | 35 35 27.8 |
| | 7438 | 13 61.9 | 6.3 | 30.5 | | | | | | |

Observations and computations—Continued.

LAS VEGAS, NEW MEXICO.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|--------------------|-----------------|-------------------|-----------|-----------|-----------------------|--------------------------|-------------------|--------|--------|------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1874. August 3. | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | " | ° ' " |
| | 7450 | 6 35.0 | 21.3 | 15.6 | | 35 37 06.0 | — 1 40.6 | +0.9 | ..... | 35 35 26.3 |
| | 7483 | 8 96.0 | 18.0 | 20.0 | | | | | | |
| | 7585 | 5 84.2 | 1.0 | 36.7 | | | | | | |
| | 7598 | 1 86.8 | 33.3 | 4.7 | | 32 56.0 | + 2 33.2 | —1.7 | ..... | 27.5 |
| | 7605 | 18 00.4 | 15.3 | 22.5 | | | | | | |
| | 7641 | — 0 89.6 | 9.8 | 28.0 | | 47 41.4 | —12 08.6 | —5.9 | ..... | 26.9 |
| | 7695 | 11 94.0 | 16.0 | 22.7 | | | | | | |
| | 7706 | 3 81.7 | 23.3 | 15.3 | | 40 38.2 | — 5 13.1 | +0.3 | ..... | 25.4 |
| | 7721 | — 2 80.0 | ..... | ..... |  | 49 30.6 | —14 06.3 | +2.2 | ..... | 26.5 |
| | 7731 | — 2 94.0 | 21.5 | 16.0 | | 49 35.3 | —14 11.7 | +2.2 | ..... | 25.8 |
| | 7765 | 19 15.0 | 21.3 | 17.2 | | | | | | |
| | 7788 | 6 43.5 | 17.0 | 21.2 | | | | | | |
| | 7810 | 8 76.0 | 28.1 | 11.0 | | 36 54.5 | — 1 29.6 | +3.0 | ..... | 27.9 |
| | 7829 | 8 02.8 | 18.0 | 20.1 | | | | | | |
| | 7833 | 8 33.2 | 15.0 | 23.0 | | 35 17.9 | + 0 11.7 | —2.3 | ..... | 27.3 |
| | 7843 | 10 80.3 | 20.0 | 18.0 | 25 ^a p. m. | | | | | |
| | 7858 | 5 11.3 | 7.9 | 30.3 | | 31 53.3 | + 3 39.3 | —4.7 | +0.1 | 28.0 |
| | 7875 | 11 57.1 | 17.9 | 20.0 | | | | | | |
| | 7908 | 6 07.5 | 2.3 | 36.0 | | 39 06.2 | — 3 31.8 | —8.3 | ..... | 26.1 |
| | 7933 | 4 37.6 | 17.7 | 20.5 | | | | | | |
| | 7996 | 11 21.5 | 7.3 | 31.0 | | 31 10.2 | + 4 23.6 | —6.1 | ..... | 27.1 |
| | 8024 | 4 71.8 | 18.3 | 20.0 | | | | | | |
| | 8034 | 15 31.5 | 3.8 | 34.8 | | 28 46.3 | + 6 48.5 | —7.6 | ..... | 27.2 |
| | 8083 | 6 90.7 | 27.0 | 12.3 | | 30 05.4 | + 5 24.1 | —3.5 | ..... | 26.0 |
| | 8114 | 13 12.1 | 19.8 | 19.0 | | | | | | |
| | 8131 | 3 85.9 | 19.0 | 20.0 | | 41 24.3 | — 5 57.0 | 0.0 | ..... | 27.3 |
| August 4. | 6553 | 6 50.0 | 24.5 | 24.0 | | | | | | |
| | 6581 | 9 08.7 | 24.0 | 23.6 | | 37 07.2 | — 1 39.7 | +0.2 | ..... | 27.7 |
| | 6654 | 9 16.5 | 24.0 | 22.8 | | | | | | |
| | 6697 | 1 42.0 | 19.6 | 27.9 | | 30 31.1 | + 4 58.5 | —1.6 | ..... | 28.0 |
| | 6709 | 11 59.2 | 29.0 | 18.2 | | 28 54.8 | + 6 32.1 | +0.6 | ..... | 27.5 |
| | 6731 | 10 44.6 | 20.6 | 26.4 | | | | | | |
| | 6762 | 7 09.3 | 26.0 | 21.0 | | 37 38.7 | — 2 09.2 | —0.2 | ..... | 29.3 |
| | 7241 | 2 71.9 | 22.5 | 13.1 | | | | | | |
| | 7256 | 3 37.4 | 18.2 | 16.3 | | 35 00.8 | + 0 25.2 | —2.6 | ..... | 28.6 |
| | 7290 | 21 21.0 | 17.1 | 17.4 | | 46 53.4 | —11 27.5 | +0.4 | ..... | 26.3 |
| | 7309 | 9 64.2 | 17.0 | 17.2 | | | | | | |
| | 7381 | 14 83.7 | 13.7 | 21.9 | | 35 38 53.2 | — 3 22.5 | —2.0 | ..... | 35 35 28.7 |

Observations and computations—Continued.

LAS VEGAS, NEW MEXICO.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|--------------------|-----------------|---------------------|-----------|-----------|----------|----------------------------|-------------------|----------|----------|----------------------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1874. August 4. | | <i>t.</i> <i>d.</i> | <i>d.</i> | <i>d.</i> | | <i>°</i> <i>'</i> <i>"</i> | <i>'</i> <i>"</i> | <i>"</i> | <i>"</i> | <i>°</i> <i>'</i> <i>"</i> |
| | 7394 | 2 55.1 | 17.0 | 18.0 | | 35 43 05.8 | — 7 42.4 | +5.5 | ..... | 35 35 28.9 |
| | 7404 | 4 70.1 | 17.7 | 17.7 | | 41 42.4 | — 6 19.4 | +5.7 | ..... | 28.7 |
| | 7438 | 14 54.3 | 30.1 | 5.5 | | | | | | |
| | 7450 | 6 72.3 | 17.9 | 17.0 | | | | | | |
| | 7483 | 9 42.9 | 28.2 | 7.4 | | 35 37 06.4 | — 1 44.3 | +5.0 | ..... | 35 35 27.1 |

As ascertained by observations at Ogden, the longitude of the observatory at that place is $7^{\text{h}} 27^{\text{m}} 59^{\text{s}}.643$ west of Greenwich. Adopting this result in the determination for station at Las Vegas, we have—

Longitude.. $7^{\text{h}} 00^{\text{m}} : 3^{\text{s}}.836$ or $105^{\circ} 13' 27''.57 \pm 0''.10$ west from Greenwich.

Longitude.. $1^{\text{h}} 52^{\text{m}} 41^{\text{s}}.716$ or $28^{\circ} 10' 25''.77$ west from U. S. Naval Observatory, Washington, D. C.

with a probable error of $0^{\text{s}}.007$ in relation to Ogden.

Latitude ... $35^{\circ} 35' 27''.66 \pm 0''.07$ north.

U. S. GEOGRAPHICAL SURVEYS WEST OF THE ONE HUNDREDTH MERIDIAN,
1ST LIEUT. GEO. M. WHEELER, CORPS OF ENGINEERS, U. S. ARMY, IN CHARGE.

RESULTS

OF

OBSERVATIONS MADE BY DR. F. KAMPF AND JOHN H. CLARK IN THE
DETERMINATION OF THE ASTRONOMICAL CO-ORDINATES
OF CIMARRON, NEW MEXICO.

SEASON OF 1874.

COMPUTATIONS BY

DR. F. KAMPF AND JOHN H. CLARK.

CIMARRON, NEW MEXICO.

GEOGRAPHICAL POSITION OF STATION.

Longitude, $104^{\circ} 54' 59''.04 \pm 0''.20$ west from Greenwich.

Latitude, $36^{\circ} 30' 10''.01 \pm 0''.09$ north.

Barometric altitude of observatory above sea-level, 6384.5 feet.

Cimarron, Colfax County, New Mexico, is a settlement of 500 inhabitants, half of whom are Mexicans. The town is surrounded on the west and north by high mountains and by mesas in the east and south. It is crossed by the Cimarron River, which flows from west to east. The principal part of the town and an extensive tract of the adjacent territory are the property of an association of English capitalists called the Maxwell Land-Grant and Railway Company. The country is rich in coal and gold, and is well adapted for agriculture and the raising of cattle.

By permission of Mr. Morley, vice-president of the Maxwell Company, the astronomical monument was fixed in the corner of a lot in the southern part of the town, from which there is good opportunity to make connection with natural objects. The meridian is marked by two pillars of solid stone planted in the earth and extending three feet below and one and a half feet above the surface of the same. The center of the south meridian-mark is exactly in the meridian of the middle point between the two iron pieces which connect the platform and the foundation of the astronomical station; the center of the cross on the north mark is about $0''.7$ east of the meridian line.

METEOROLOGICAL CONDITIONS.

The weather was exceedingly bad. It rained incessantly from August 21 to August 27, and although the observer arrived at this point on the 18th of the month, he found no night suitable for observations until the 31st. Regularly at 11 p. m. a heavy wind arose, blowing from the west.

The observatory, instruments, &c., were the same as at the previous

station, Las Vegas. The telegraph-line was in the same bad condition as at Las Vegas. In sending and receiving signals, assistance was kindly rendered by Mr. McCullough, postmaster. Mr. Charles Morrison was meteorological assistant and also in charge of lamps and other material.

Exchanges for time were made with Mr. John H. Clark, at Ogden, on September 6, in the daytime, and on the nights of September 7 and 8. Observations for latitude were taken August 31, September 4, and September 5. The observer at Cimarron was Dr. F. Kampf. Each astronomer made the computations necessary for his own work.

The only explanation for the irregularity of seventeen seconds in the chronometer on September 6 is, that the chain may have slipped a little from its cylinder.

TABULATION OF STARS—TIME DETERMINATIONS.

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Tabulation of stars used for determination of time at Cimarron, New Mexico, and Ogden, Utah, 1874.

| | | CIMARRON. | | | | OGDEN. | | | | | CIMARRON. | | | | OGDEN. | | |
|-----------------------|----------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|----------|------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| | | September 5. | September 6. | September 7. | September 8. | September 6. | September 7. | September 8. | | | September 5. | September 6. | September 7. | September 8. | September 6. | September 7. | September 8. |
| <i>a</i> | Scorpii ..... | ..... | ..... | ..... | ..... | ..... | × | ..... | <i>δ</i> | Aquilæ ..... | ..... | ..... | ..... | ..... | × | ..... | ..... |
| <i>β</i> | Herculis ..... | ..... | ..... | ..... | ..... | ..... | × | ..... | <i>β</i> | Cygni ..... | ..... | ..... | × | ..... | × | ..... | ..... |
| <i>ζ</i> | Ophiuchi ..... | ..... | ..... | ..... | ..... | ..... | × | ..... | <i>κ</i> | Aquilæ ..... | ..... | ..... | × | ..... | × | ..... | ..... |
| <i>κ</i> | Herculis ..... | ..... | ..... | ..... | ..... | ..... | × | ..... | <i>γ</i> | Aquilæ ..... | ..... | ..... | × | ..... | × | ..... | ..... |
| <i>ζ</i> | Ophiuchi ..... | ..... | ..... | ..... | ..... | ..... | × | × | <i>a</i> | Aquilæ ..... | ..... | ..... | ..... | ..... | × | ..... | ..... |
| <i>ζ</i> | Draconis ..... | ..... | ..... | ..... | ..... | ..... | × | ..... | <i>e</i> | Draconis ..... | ..... | ..... | ..... | ..... | × | ..... | ..... |
| <i>a</i> ¹ | Herculis ..... | ..... | ..... | ..... | ..... | ..... | × | ..... | <i>a</i> | Delphini ..... | ..... | ..... | ..... | × | ..... | ..... | ..... |
| <i>π</i> | Herculis ..... | ..... | ..... | ..... | ..... | ..... | × | ..... | <i>a</i> | Cygni ..... | ..... | ..... | ..... | × | ..... | ..... | ..... |
| 44 | Ophiuchi ..... | ..... | ..... | ..... | ..... | ..... | × | ..... | <i>γ</i> | Delphini ..... | ..... | ..... | ..... | × | ..... | ..... | ..... |
| <i>β</i> | Draconis ..... | ..... | ..... | ..... | ..... | ..... | × | × | <i>μ</i> | Aquarii ..... | ..... | ..... | ..... | × | ..... | ..... | ..... |
| <i>a</i> | Ophiuchi ..... | ..... | ..... | ..... | ..... | ..... | × | × | 76 | Draconis ..... | ..... | ..... | ..... | × | ..... | ..... | ..... |
| <i>ι</i> | Herculis ..... | ..... | ..... | ..... | ..... | ..... | × | × | <i>ζ</i> | Cygni ..... | ..... | ..... | ..... | × | ..... | ..... | ..... |
| <i>ω</i> | Draconis ..... | ..... | ..... | ..... | ..... | ..... | × | × | <i>a</i> | Equulei ..... | ..... | ..... | × | ..... | ..... | ..... | ..... |
| <i>u</i> | Herculis ..... | ..... | ..... | ..... | ..... | ..... | × | × | <i>τ</i> | Cygni ..... | ..... | ..... | ..... | × | ..... | ..... | ..... |
| <i>ψ</i> ¹ | Draconis ..... | ..... | ..... | ..... | ..... | ..... | × | × | <i>a</i> | Cephei ..... | ..... | ..... | × | × | ..... | ..... | ..... |
| <i>γ</i> | Draconis ..... | ..... | ..... | ..... | ..... | ..... | × | ..... | <i>β</i> | Aquarii ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 22 | Camelop., L. C. .... | ..... | ..... | ..... | ..... | ..... | × | × | <i>β</i> | Cephei ..... | ..... | ..... | ..... | × | ..... | ..... | ..... |
| <i>χ</i> | Draconis ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | <i>ξ</i> | Aquarii ..... | ..... | ..... | × | ..... | ..... | ..... | ..... |
| 1 | Aquilæ ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | <i>e</i> | Pegasi ..... | ..... | ..... | × | × | ..... | ..... | ..... |
| <i>a</i> | Lyræ ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | <i>μ</i> | Capricorni ..... | ..... | ..... | × | ..... | ..... | ..... | ..... |
| 110 | Herculis ..... | ..... | ..... | × | ..... | ..... | ..... | ..... | 79 | Draconis ..... | ..... | ..... | × | ..... | ..... | ..... | ..... |
| <i>β</i> | Lyræ ..... | ..... | ..... | × | ..... | ..... | ..... | ..... | <i>a</i> | Aquarii ..... | ..... | ..... | × | ..... | ..... | ..... | ..... |
| <i>o</i> | Draconis ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | <i>ι</i> | Pegasi ..... | ..... | ..... | × | ..... | ..... | ..... | ..... |
| 50 | Draconis ..... | ..... | ..... | × | ..... | ..... | ..... | ..... | <i>θ</i> | Aquarii ..... | ..... | ..... | × | ..... | ..... | ..... | ..... |
| <i>ε</i> | Aquilæ ..... | ..... | ..... | × | ..... | ..... | ..... | ..... | <i>γ</i> | Piscium ..... | ..... | × | ..... | ..... | ..... | ..... | ..... |
| <i>ζ</i> | Aquilæ ..... | ..... | ..... | × | ..... | ..... | ..... | ..... | <i>o</i> | Cephei ..... | ..... | × | ..... | ..... | ..... | ..... | ..... |
| <i>d</i> | Sagittarii ..... | ..... | ..... | × | ..... | ..... | ..... | ..... | 4 | Cassiopeiæ ..... | ..... | × | ..... | ..... | ..... | ..... | ..... |
| <i>δ</i> | Draconis ..... | ..... | ..... | ..... | ..... | × | ..... | ..... | 72 | Pegasi ..... | ..... | × | ..... | ..... | ..... | ..... | ..... |
| <i>τ</i> | Draconis ..... | ..... | ..... | × | ..... | ..... | ..... | ..... | <i>ι</i> | Piscium ..... | ..... | × | ..... | ..... | ..... | ..... | ..... |

Observations and reductions for time taken at sending station.

CIMARRON, NEW MEXICO, SEPTEMBER 5, 1874.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|-------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | <i>χ</i> Draconis | 18 28 39.48 | +15.88 | — 0.16 | — 1.75 | 18 28 53.45 | 18 23 20.44 | — 5 33.01 |
| E. | 1 Aquilæ | 34 02.18 | — 5.69 | — 0.04 | — 0.53 | 34 55.92 | 29 23.23 | 32.69 |
| E. | <i>a</i> Lyræ | 38 15.22 | + 0.40 | — 0.07 | — 0.67 | 38 14.88 | 32 42.06 | 32.82 |
| W. | <i>β</i> Lyræ | 51 00.64 | — 0.56 | — 0.17 | + 0.62 | 51 00.53 | 45 27.51 | 33.02 |
| W. | <i>o</i> Draconis | 54 48.64 | + 6.10 | — 0.23 | + 1.01 | 54 55.52 | 49 22.85 | 32.67 |
| W. | <i>ε</i> Aquilæ | 18 59 32.12 | — 3.05 | — 0.11 | + 0.54 | 18 59 29.50 | 18 53 56.32 | — 5 33.18 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -12.91 + 6.00 \delta t - 1.63 a + 1.47 c & a &= -8^{\circ}.02 \\
 0 &= +38.83 - 1.63 \delta t + 5.14 a - 4.98 c & c &= -0^{\circ}.52 \\
 0 &= -29.56 + 1.47 \delta t - 4.98 a + 20.25 c
 \end{aligned}$$

Observations and reductions for time taken at sending station—Continued.

CIMARRON, NEW MEXICO, SEPTEMBER 6, 1874.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|--------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | γ Piscium | 23 16 12.28 | + 2.93 | — 0.23 | + 0.39 | 23 16 15.37 | 23 10 40.86 | — 5 34.51 |
| W. | ο Cephei | 19 11.96 | — 7.02 | — 0.58 | + 1.01 | 19 05.37 | 13 30.84 | 34.53 |
| W. | 4 Cassiopeiæ | 24 56.76 | — 4.66 | — 0.44 | + 0.82 | 24 52.48 | 19 17.85 | 34.63 |
| W. | 72 Pegasi | 33 18.70 | + 0.63 | — 0.23 | + 0.45 | 33 19.55 | 27 44.83 | 34.72 |
| W. | ι Piscium | 23 39 02.70 | + 2.78 | — 0.15 | + 0.39 | 23 39 05.72 | 23 33 31.08 | — 5 34.64 |

NORMAL EQUATIONS.

c taken from the next day's observations = — 0^s.39
a from high and low stars = + 5^s.24

CIMARRON, NEW MEXICO, SEPTEMBER 7, 1874.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|--------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | 110 Herculis | 18 46 08.36 | — 0.56 | — 0.01 | + 0.38 | 18 46 08.17 | 18 40 16.35 | — 5 51.82 |
| W. | β Lyræ | 51 19.10 | — 0.13 | — 0.06 | + 0.43 | 51 19.34 | 45 27.47 | 51.87 |
| W. | 50 Draconis | 56 12.64 | + 4.61 | — 0.27 | + 1.41 | 56 18.39 | 50 26.40 | 51.99 |
| W. | ε Aquilæ | 59 48.72 | — 0.71 | — 0.12 | + 0.37 | 59 48.26 | 53 56.30 | 51.96 |
| W. | ζ Aquilæ | 19 05 31.64 | — 0.75 | — 0.16 | + 0.37 | 19 05 31.10 | 59 39.15 | 51.95 |
| E. | δ Sagittarii | 16 12.40 | — 1.63 | — 0.08 | — 0.38 | 16 10.31 | 19 10 18.36 | 51.95 |
| E. | τ Draconis | 23 49.10 | + 3.83 | — 0.75 | — 1.23 | 23 50.95 | 17 59.11 | 51.84 |
| E. | β Cygni | 31 33.28 | — 0.32 | — 0.32 | — 0.41 | 31 33.23 | 25 40.46 | 51.77 |
| E. | κ Aquilæ | 36 03.08 | — 1.42 | — 0.20 | — 0.36 | 36 01.10 | 30 09.24 | 51.86 |
| E. | γ Aquilæ | 19 46 11.88 | — 0.84 | — 0.29 | — 0.37 | 19 46 10.38 | 19 40 18.46 | — 5 51.92 |
| E. | α Equulei | 21 15 27.98 | — 1.05 | — 0.19 | — 0.43 | 21 15 26.31 | 21 09 34.16 | — 5 52.15 |
| E. | α Cephei | 21 28.52 | + 1.82 | — 0.54 | — 0.92 | 21 28.88 | 15 36.66 | 52.22 |
| E. | β Aquarii | 30 52.36 | — 1.24 | — 0.23 | — 0.44 | 30 50.35 | 24 58.39 | 51.96 |
| E. | ξ Aquarii | 36 59.62 | — 1.40 | — 0.23 | — 0.43 | 36 57.56 | 31 05.52 | 52.04 |
| E. | ε Pegasi | 43 56.28 | — 0.91 | — 0.28 | — 0.44 | 43 54.65 | 38 02.57 | 52.03 |
| W. | μ Capricorni | 52 22.08 | — 1.58 | — 0.26 | + 0.44 | 52 20.68 | 46 28.61 | 52.07 |
| W. | 79 Draconis | 57 08.40 | + 4.05 | — 1.02 | + 1.49 | 57 12.92 | 51 20.88 | 52.04 |
| W. | α Aquarii | 22 05 14.76 | — 1.20 | — 0.27 | + 0.43 | 22 05 13.72 | 59 21.57 | 52.15 |
| W. | ι Pegasi | 07 03.90 | — 0.43 | — 0.32 | + 0.47 | 07 03.62 | 22 01 11.33 | 52.29 |
| W. | θ Aquarii | 22 16 07.40 | — 1.40 | — 0.22 | + 0.44 | 22 16 06.22 | 22 10 14.04 | — 5 52.18 |

NORMAL EQUATIONS.

First series.

$$\begin{aligned}
 0 &= -8.36 + 10.00 \delta t - 1.12 a - 0.61 c & a &= -1^s.868 \\
 0 &= +24.87 - 1.12 \delta t + 12.26 a + 3.82 c & c &= -0^s.359 \\
 0 &= +19.89 - 0.61 \delta t + 3.82 a + 36.51 c
 \end{aligned}$$

Second series.

$$\begin{aligned}
 0 &= +1.01 + 10.00 \delta t + 1.75 a - 1.42 c & a &= -1^s.974 \\
 0 &= +17.80 + 1.75 \delta t + 8.06 a + 5.11 c & c &= -0^s.432 \\
 0 &= +21.02 - 1.42 \delta t + 5.11 a + 24.72 c
 \end{aligned}$$

Observations and reductions for time taken at sending station—Continued.

CIMARRON, NEW MEXICO, SEPTEMBER 8, 1874.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|-------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | <i>a</i> Delphini | 20 39 43.94 | — 0.28 | — 0.06 | + 0.51 | 20 39 44.11 | 20 33 49.59 | — 5 54.52 |
| W. | <i>a</i> Cygni | 43 04.26 | + 0.15 | — 0.08 | + 0.55 | 43 04.88 | 37 10.36 | 54.52 |
| W. | <i>γ</i> Delphini | 46 45.60 | — 0.28 | — 0.05 | + 0.51 | 46 45.78 | 40 51.09 | 54.69 |
| W. | <i>μ</i> Aquarii | 51 49.12 | — 0.55 | — 0.03 | + 0.39 | 51 48.93 | 45 54.19 | 54.74 |
| W. | 76 Draconis | 57 26.10 | + 3.88 | — 0.20 | + 2.82 | 57 32.60 | 51 38.05 | 54.55 |
| E. | <i>ζ</i> Cygni | 21 13 31.92 | — 0.11 | — 0.08 | — 0.45 | 21 13 31.28 | 21 07 36.83 | 54.45 |
| E. | <i>τ</i> Cygni | 16 43.14 | + 0.01 | — 0.10 | — 0.49 | 16 42.56 | 10 48.06 | 54.50 |
| E. | <i>α</i> Cephei | 21 31.38 | + 0.69 | — 0.19 | — 0.83 | 21 31.05 | 15 36.64 | 54.41 |
| E. | <i>β</i> Cephei | 32 59.10 | + 1.21 | — 0.24 | — 1.14 | 32 58.93 | 26 04.13 | 54.80 |
| E. | <i>e</i> Pegasi | 21 43 57.90 | — 0.35 | — 0.09 | — 0.39 | 21 43 57.07 | 21 37 02.57 | — 5 54.50 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -5.17 + 10.00 \delta t - 5.85 a - 3.81 c & a &= -0^s.751 \\
 0 &= +34.71 - 5.85 \delta t + 31.25 a + 29.95 c & c &= -0^s.389 \\
 0 &= +51.76 - 3.81 \delta t + 29.95 a + 75.87 c
 \end{aligned}$$

Observations and reductions for time taken at receiving station.

OGDEN, UTAH, SEPTEMBER 6, 1874.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|-------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | <i>δ</i> Draconis | 19 17 29.54 | — 0.68 | + 0.21 | 0.00 | 19 17 29.07 | 19 12 32.73 | — 4 56.34 |
| E. | <i>δ</i> Aquilæ | 24 07.01 | + 0.37 | + 0.07 | 0.00 | 24 07.45 | 19 11.01 | 56.44 |
| E. | <i>β</i> Cygni | 30 36.52 | + 0.16 | + 0.10 | 0.00 | 30 36.78 | 25 40.47 | 56.31 |
| E. | <i>κ</i> Aquilæ | 35 05.24 | + 0.45 | + 0.07 | 0.00 | 35 05.76 | 30 19.25 | 56.51 |
| E. | <i>γ</i> Aquilæ | 45 14.57 | + 0.31 | + 0.09 | 0.00 | 45 14.97 | 40 18.47 | 56.50 |
| E. | <i>α</i> Aquilæ | 49 36.56 | + 0.32 | + 0.09 | 0.00 | 49 36.97 | 44 40.50 | 56.47 |
| E. | <i>ε</i> Draconis | 19 53 34.15 | — 0.83 | + 0.28 | 0.00 | 19 53 33.60 | 19 48 37.03 | — 4 56.57 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= +1.64 + 7.00 \delta t + 0.17 a & a &= +0^s.592 \\
 0 &= -2.85 + 0.17 \delta t + 4.88 a & c &\text{adopted } 0^s.0
 \end{aligned}$$

Observations and reductions for time taken at receiving station—Continued.

OGDEN, UTAH, SEPTEMBER 7, 1874.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|-------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | <i>a</i> Scorpii | 16 26 39.40 | + 0.66 | — 0.08 | — 0.13 | 16 26 39.85 | 16 21 42.72 | — 4 57.13 |
| E. | <i>β</i> Herculis | 29 46.66 | + 0.23 | — 0.19 | — 0.13 | 29 46.57 | 24 49.53 | 57.04 |
| E. | <i>ζ</i> Ophiuchi | 35 11.78 | + 0.51 | — 0.13 | — 0.12 | 35 12.04 | 30 14.91 | 57.13 |
| E. | <i>ζ</i> Herculis | 41 30.70 | + 0.12 | — 0.23 | — 0.14 | 41 30.45 | 36 33.46 | 56.99 |
| E. | <i>κ</i> Ophiuchi | 56 40.92 | + 0.34 | — 0.18 | — 0.12 | 56 40.96 | 51 43.76 | 57.20 |
| W. | <i>ζ</i> Draconis | 17 13 23.89 | — 0.66 | — 0.22 | + 0.30 | 17 13 23.31 | 17 08 26.03 | 57.28 |
| W. | 44 Ophiuchi | 23 39.13 | + 0.64 | — 0.05 | + 0.13 | 23 39.85 | 18 42.63 | 57.22 |
| W. | <i>β</i> Draconis | 32 33.74 | — 0.20 | — 0.18 | + 0.20 | 32 33.56 | 27 36.24 | 57.32 |
| W. | <i>a</i> Ophiuchi | 34 03.62 | + 0.32 | — 0.11 | + 0.12 | 34 03.95 | 29 06.83 | 57.12 |
| W. | <i>ι</i> Herculis | 40 53.00 | — 0.08 | — 0.18 | + 0.17 | 40 52.91 | 35 56.10 | 56.81 |
| W. | <i>ω</i> Draconis | 42 40.08 | — 0.83 | — 0.32 | + 0.33 | 42 39.26 | 37 42.07 | 57.19 |
| W. | <i>μ</i> Herculis | 46 30.15 | + 0.17 | — 0.15 | + 0.14 | 46 30.31 | 41 33.22 | 57.09 |
| W. | <i>γ</i> Draconis | 58 39.58 | — 0.18 | — 0.42 | + 0.19 | 58 39.17 | 53 42.25 | 56.92 |
| W. | 22 Camelop., L. C. ... | 18 09 55.55 | + 1.57 | + 0.23 | — 0.35 | 18 09 57.00 | 18 04 59.81 | — 4 57.19 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= +1.23 + 14.00 \delta t + 4.04 a - 4.85 c & a &= +0^s.643 \\
 0 &= -4.71 + 4.04 \delta t + 12.27 a + 15.85 c & c &= -0^s.120 \\
 0 &= -7.06 - 4.85 \delta t + 15.85 a + 38.85 c
 \end{aligned}$$

OGDEN, UTAH, SEPTEMBER 8, 1874.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|--------------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | <i>κ</i> Ophiuchi | 16 56 41.37 | + 0.33 | 0.00 | 0.00 | 16 56 41.70 | 16 51 43.74 | — 4 57.96 |
| W. | <i>α</i> ¹ Herculis | 17 13 53.34 | + 0.28 | — 0.01 | + 0.01 | 17 13 53.62 | 17 08 55.69 | 57.93 |
| W. | <i>π</i> Herculis | 15 38.72 | + 0.06 | — 0.02 | + 0.01 | 15 38.77 | 10 40.85 | 57.92 |
| W. | <i>β</i> Draconis | 32 34.52 | — 0.19 | — 0.05 | + 0.01 | 32 34.29 | 27 36.20 | 58.09 |
| W. | <i>a</i> Ophiuchi | 34 04.41 | + 0.30 | — 0.04 | 0.00 | 34 04.67 | 29 06.81 | 57.86 |
| E. | <i>ι</i> Herculis | 40 53.90 | — 0.08 | — 0.06 | — 0.01 | 40 53.75 | 35 56.07 | 57.68 |
| E. | <i>ω</i> Draconis | 42 40.97 | — 0.80 | — 0.09 | — 0.01 | 42 40.07 | 37 42.00 | 58.07 |
| E. | <i>μ</i> Herculis | 46 31.00 | + 0.16 | — 0.03 | 0.00 | 46 31.13 | 41 33.20 | 57.93 |
| E. | <i>ψ</i> ¹ Draconis | 49 10.55 | — 1.05 | — 0.06 | — 0.02 | 49 09.42 | 44 11.30 | 58.12 |
| E. | <i>γ</i> Draconis | 57 40.43 | — 0.17 | — 0.02 | — 0.01 | 57 40.23 | 52 42.22 | 58.01 |
| E. | 22 Camelop., L. C. ... | 18 09 56.53 | + 1.52 | 0.00 | + 0.01 | 18 09 58.06 | 18 04 59.89 | — 4 58.17 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= +2.69 + 11.00 \delta t + 0.56 a + 1.34 c & a &= +0^s.622 \\
 0 &= -7.07 + 0.56 \delta t + 11.47 a - 17.33 c & c &= -0^s.005 \\
 0 &= +11.34 + 1.34 \delta t - 17.33 a + 40.18 c
 \end{aligned}$$

The following tables show the corrections and rates of the chronometers used at Cimarron and Ogden:

CHRONOMETER AT CIMARRON.—NEGUS, No. 1344.

| Date. | Local sidereal time. | Correction of chronometer. | Adopted hourly rate. |
|---------|----------------------|----------------------------|----------------------|
| 1874. | <i>h.</i> | <i>h. m. s.</i> | <i>s.</i> |
| Sept. 5 | 18.63 | — 0 05 32.900 | + 0.0594 |
| Sept. 6 | 23.35 | 34.606 | |
| Sept. 7 | 20.40 | 52.010 | + 0.1036 |
| Sept. 8 | 21.10 | — 0 05 54.570 | |

CHRONOMETER AT OGDEN.—NEGUS, No. 1491.

| Date. | Local sidereal time. | Correction of chronometer. | Adopted hourly rate. |
|---------|----------------------|----------------------------|----------------------|
| 1874. | <i>h.</i> | <i>h. m. s.</i> | <i>s.</i> |
| Sept. 6 | 19.52 | — 0 04 56.45 | + 0.0309 |
| Sept. 7 | 17.22 | 57.12 | + 0.0352 |
| Sept. 8 | 17.64 | — 0 04 57.98 | |

Final results of longitude.

| Signals sent from— | Recorded at— | Mean of signals sent and received. | Time-corrections. | Corrected time. | Difference of longitude. | Double-wave time. | Means. |
|--------------------|----------------|------------------------------------|-------------------|-----------------|--------------------------|-------------------|--------------|
| September 6, 1874: | | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> | <i>s.</i> | <i>m. s.</i> |
| Ogden | Cimarron | 10 44 32.50 | —0 05 35.28 | 10 38 57.22 | 28 19.88 | 0.34 | 28 19.710 |
| | Ogden | 10 15 34.24 | —0 04 56.90 | 10 10 37.34 | | | |
| | Cimarron | 10 48 15.16 | —0 05 35.28 | 10 42 39.88 | | | |
| | Ogden | 10 19 17.24 | —0 04 56.90 | 10 14 20.34 | | | |
| | | | | | 19.54 | | |
| September 7, 1874: | | | | | | | |
| Ogden | Cimarron | 20 26 48.62 | —0 05 52.00 | 20 20 56.62 | 19.80 | 0.26 | 19.670 |
| | Ogden | 19 57 34.02 | —0 04 57.20 | 19 52 36.82 | | | |
| | Cimarron | 20 30 30.00 | —0 05 52.01 | 20 24 37.99 | | | |
| | Ogden | 20 01 15.66 | —0 04 57.21 | 19 56 18.45 | | | |
| | | | | | 19.54 | | |
| September 8, 1874: | | | | | | | |
| Ogden | Cimarron | 20 04 49.28 | —0 05 54.46 | 19 58 54.82 | 19.83 | 0.18 | 28 19.740 |
| | Ogden | 19 35 33.04 | —0 04 58.05 | 19 30 34.99 | | | |
| | Cimarron | 20 11 03.85 | —0 05 54.47 | 20 05 09.38 | | | |
| | Ogden | 19 41 47.78 | —0 04 58.05 | 19 36 49.73 | | | |
| | | | | | 28 19.65 | | |

Cimarron east of Ogden 0^h 28^m 19^s.707 ± 0^s.014.
Or, 7° 04' 55".60 ± 0".21.

Observations and computations for latitude.

CIMARRON, NEW MEXICO.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|-------------------------|--------------|-------------------|-----------|-----------|-------------|--------------------------|-------------------|----------|--------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1874. August 31 | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | <i>° ' "</i> | <i>' "</i> | <i>"</i> | <i>° ' "</i> |
| | 6940 | 5 86.0 | 20.3 | 24.6 | S. W. wind. | 36 29 11.7 | + 0 56.6 | +2.9 | 36 30 11.2 |
| | 6943 | 10 42.9 | 20.5 | 24.0 | | 26 17.3 | + 3 52.7 | +3.1 | 13.1 |
| | 6962 | 4 39.2 | 31.0 | 14.0 | | | | | |
| | 6997 | 0 51.0 | 29.8 | 15.0 | | | | | |
| | 7006 | 16 52.0 | 9.0 | 35.8 | | 40 28.4 | -10 17.0 | -2.8 | 08.6 |
| | 7065 | 7 27.0 | 29.6 | 15.8 | | | | | |
| | 7098 | 9 54.1 | 27.3 | 17.8 | | 31 33.0 | - 1 27.5 | +5.4 | 10.9 |
| | 7137 | 10 21.0 | 26.8 | 18.9 | | | | | |
| | 7176 | 6 81.0 | 32.0 | 13.3 | | 27 53.7 | + 2 11.1 | +6.2 | 11.0 |
| | 7200 | 13 40.3 | 20.3 | 25.2 | | | | | |
| | 7215 | 4 09.9 | 30.0 | 15.7 | | 24 10.4 | + 5 58.7 | +2.2 | 11.3 |
| | 7233 | 13 42.0 | 21.2 | 24.6 | | | | | |
| | 7256 | 2 94.0 | 9.3 | 37.0 | | 36 59.4 | - 6 44.0 | -7.2 | 08.2 |
| | 7333 | 10 87.5 | 27.0 | 20.3 | | 34 18.5 | - 4 09.3 | +2.6 | 11.8 |
| | 7368 | 4 41.0 | 25.7 | 21.3 | | | | | |
| | 7402 | 10 41.1 | 22.8 | 23.5 | | 34 01.4 | - 3 51.4 | +0.9 | 10.9 |
| | 7455 | 13 50.0 | 31.3 | 15.0 | | | | | |
| | 7461 | 2 74.5 | 11.8 | 35.3 | | 37 06.3 | - 6 53.6 | -1.7 | 11.0 |
| | 7520 | 7 05.3 | 27.9 | 18.3 | | | | | |
| | 7555 | 9 54.9 | 18.0 | 28.0 | | 31 46.2 | - 1 36.2 | -0.1 | 09.9 |
| | 7606 | 15 71.0 | 18.0 | 28.0 | | | | | |
| | 7643 | 2 52.9 | 37.0 | 8.7 | | 21 40.4 | + 8 28.2 | +4.2 | 12.8 |
| | 7742 | 8 33.0 | 23.2 | 23.0 | | | | | |
| | 7749 | 8 49.8 | 31.0 | 15.3 | | 30 13.6 | - 0 06.5 | +3.7 | 10.8 |
| | 7833 | 8 67.1 | 33.9 | 13.7 | | | | | |
| | 7837 | 7 57.5 | 10.4 | 36.9 | | 29 27.4 | + 0 42.2 | -1.5 | 08.1 |
| | 7857 | 14 80.9 | 20.3 | 26.8 | | | | | |
| | 7884 | 2 38.1 | 17.3 | 30.7 | | 38 10.5 | - 7 59.0 | -1.6 | 09.9 |
| | 7902 | 10 29.9 | 20.8 | 26.8 | | | | | |
| | 7908 | 5 47.1 | 17.3 | 30.7 | | 33 19.3 | - 3 06.2 | -4.5 | 08.6 |
| | 7958 | 11 24.3 | 26.8 | 21.0 | | | | | |
| | 7995 | 11 27.1 | 28.2 | 19.0 | | 30 08.2 | - 0 01.1 | +3.5 | 10.6 |
| | 8020 | 10 96.5 | 26.0 | 21.3 | | | | | |
| | 8048 | 4 24.5 | 29.8 | 17.8 | | 25 46.1 | + 4 19.2 | +3.9 | 09.2 |
| | 8058 | 12 84.0 | 21.3 | 26.0 | | | | | |
| | 8091 | 8 42.1 | 33.0 | 14.9 | | 32 57.6 | - 2 50.3 | +3.1 | 10.4 |
| | 8097 | 0 13.0 | 33.9 | 14.0 | | 38 14.5 | - 8 10.0 | +3.5 | 08.0 |
| | 8128 | 12 06.1 | 29.0 | 18.4 | | | | | |
| | 8156 | 1 51.9 | 9.0 | 39.0 | | 37 01.1 | - 6 46.4 | -4.5 | 10.2 |
| | 8159 | 8 35.3 | 9.0 | 39.0 | | 36 32 39.4 | - 2 22.9 | -4.5 | 36 30 12.0 |

LATITUDE DETERMINATIONS.

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Observations and computations—Continued.

CIMARRON, NEW MEXICO.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|----------------|----------------------|-------------------------------|----------------------|----------------------|----------|--------------------------|----------------------|--------------|--------------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1874. | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | <i>o ' "</i> | <i>' "</i> | <i>"</i> | <i>o ' "</i> |
| August 31 | 8171 8206 | 5 13.2 12 14.8 | 24.0 28.5 | 23.5 19.2 | | 36 25 39.6 | + 4 30.5 | +2.3 | 36 30 12.4 |
| September 4.. | 6895 6912 | 8 62.6 8 23.7 | 15.0 28.0 | 27.0 14.5 | No wind. | 30 24.2 | — 0 15.0 | +0.3 | 09.5 |
| | 6940 6943 6962 | 5 09.8 9 65.0 3 61.7 | 27.0 27.8 13.9 | 14.8 14.0 28.0 | | 29 12.4 26 18.1 | + 0 57.1 + 3 52.5 | —0.4 —0.1 | 09.1 10.5 |
| | 7065 7098 | 6 35.9 8 56.0 | 21.3 22.3 | 20.8 19.7 | | 31 33.7 | — 1 24.8 | +0.7 | 09.6 |
| | 7137 7176 | 9 32.0 5 87.0 | 21.5 24.0 | 20.1 18.5 | | 27 54.6 | + 2 13.0 | +1.8 | 09.4 |
| | 7200 7215 | 12 00.3 2 66.3 | 34.4 6.5 | 7.8 35.7 | | 24 11.3 | + 6 00.1 | —0.6 | 10.8 |
| | 7233 7256 | 13 87.2 3 22.8 | 22.7 17.9 | 19.0 24.0 | | 37 00.3 | — 6 50.3 | —0.5 | 09.5 |
| | 7333 7368 7402 | 10 17.9 3 70.0 9 73.2 | 11.8 31.7 10.0 | 31.0 12.0 34.0 | | 34 19.5 34 02.4 | — 4 09.8 — 3 52.5 | +0.1 —1.0 | 09.8 08.9 |
| | 7455 7461 | 13 18.0 2 34.2 | 34.2 10.0 | 9.8 34.0 | | 37 07.2 | — 6 57.8 | +0.1 | 09.5 |
| | 7520 7555 | 5 64.7 8 15.9 | 26.2 17.3 | 17.8 27.0 | | 31 47.2 | — 1 36.8 | —0.3 | 10.1 |
| | 7606 7643 | 14 23.7 1 11.0 | 13.8 37.0 | 30.2 7.6 | | 21 41.3 | + 8 26.1 | +3.0 | 10.4 |
| | 7676 7712 | 16 75.1 — 0 42.8 | 13.2 32.9 | 31.0 11.7 | | 41 11.0 | —11 02.2 | +0.8 | 09.6 |
| | 7742 7749 | 7 18.1 7 37.0 | 16.0 33.6 | 28.3 10.8 | | 30 14.7 | — 0 07.3 | +2.4 | 09.8 |
| | 7857 7884 | 14 15.1 1 69.0 | 26.0 17.0 | 18.9 23.4 | | 38 11.4 | — 8 00.3 | —1.0 | 10.1 |
| | 7902 7908 | 9 97.7 5 01.5 | 33.2 14.8 | 11.8 30.3 | | 33 20.3 | — 3 11.2 | +1.4 | 10.5 |
| | 7958 7995 | 10 21.0 10 23.5 | 33.0 12.9 | 12.3 32.8 | | 30 09.3 | — 0 01.0 | +0.2 | 08.5 |
| | 8020 8048 | 10 46.6 3 73.8 | 17.9 33.3 | 27.3 12.0 | | 25 47.1 | + 4 19.4 | +2.8 | 09.3 |
| | 8058 8091 8097 | 11 97.0 7 59.2 — 0 67.0 | 30.3 16.0 16.9 | 14.7 29.7 29.0 | | 32 58.8 36 38 15.6 | — 2 43.7 — 8 07.3 | +0.4 +0.8 | 10.5 33 30 09.1 |

Observations and computations—Continued.

CIMARRON, NEW MEXICO.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|---------------|--------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|----------|--------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1874. | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | <i>o ' "</i> | <i>' "</i> | <i>"</i> | <i>o ' "</i> |
| September 4.. | 8128 | 11 56.0 | 34.8 | 10.3 | | | | | |
| | 8156 | 0 84.9 | 11.5 | 34.3 | | 36 37 02.1 | — 6 52.0 | +0.4 | 36 30 10.5 |
| | 8159 | 7 67.0 | 11.4 | 34.3 | | 32 40.6 | — 2 29.9 | +0.4 | 11.1 |
| | 8171 | 2 71.6 | 17.1 | 28.2 | | | | | |
| | 8206 | 9 67.0 | 32.4 | 13.6 | | 25 40.7 | + 4 28.1 | +1.8 | 10.6 |
| September 5.. | 6895 | 8 44.2 | 22.7 | 15.0 | | | | | |
| | 6912 | 8 09.5 | 14.0 | 23.5 | | 30 24.3 | — 0 13.4 | —0.4 | 10.5 |
| | 6940 | 5 19.2 | 39.8 | ..... |  | 29 12.6 | + 1 01.7 | —2.9 | 11.4 |
| | 6943 | 9 69.1 | 40.0 | ..... |  | 26 18.3 | + 3 55.1 | —2.8 | 10.6 |
| | 6962 | 3 59.1 | ..... | 46.0 | | | | | |
| | 7065 | 6 82.2 | 9.8 | 27.0 | | | | | |
| | 7098 | 9 07.3 | 34.3 | 2.3 | | 31 34.0 | — 1 26.8 | +3.4 | 10.6 |
| | 7137 | 9 56.0 | 15.9 | 20.7 | | | | | |
| | 7176 | 6 19.6 | 32.8 | 4.0 | | 27 54.7 | + 2 09.7 | +5.6 | 10.0 |
| | 7200 | 12 35.8 | 21.0 | 15.7 | | | | | |
| | 7215 | 3 08.0 | 17.0 | 19.5 | | 24 11.4 | + 5 57.7 | +0.6 | 09.7 |
| | 7233 | 12 18.6 | 27.9 | 8.2 | | | | | |
| | 7256 | 1 53.9 | 4.0 | 32.3 | | 37 00.5 | — 6 50.4 | —2.0 | 08.1 |
| | 7333 | 10 24.2 | ..... | 38.3 | | 34 19.8 | — 4 08.2 | —2.7 | 08.9 |
| | 7368 | 3 80.4 | 32.4 | 5.4 | | 34 02.6 | — 3 52.2 | —1.6 | 08.8 |
| | 7402 | 9 82.6 | 2.5 | 36.7 | | | | | |
| | 7455 | 13 79.0 | 9.0 | 28.7 | | | | | |
| | 7461 | 2 97.0 | 24.0 | 14.0 | | 37 07.5 | — 6 57.1 | —2.2 | 08.2 |
| | 7520 | 5 81.2 | 11.2 | 27.0 | | | | | |
| | 7555 | 8 40.1 | 32.0 | 7.0 | | 31 47.4 | — 1 39.8 | +2.1 | 09.7 |
| | 7606 | 12 95.4 | 3.7 | 35.7 | | | | | |
| | 7643 | — 0 22.0 | 38.6 | 0.7 | | 21 41.6 | + 8 27.8 | +1.4 | 10.8 |
| | 7676 | 17 07.9 | 18.2 | 21.0 | | | | | |
| | 7712 | — 0 08.1 | 18.0 | 21.2 | | 41 11.2 | —11 01.5 | —1.4 | 08.3 |
| | 7742 | 7 04.2 | 34.3 | 4.7 | | | | | |
| | 7749 | 7 19.4 | 5.0 | 34.0 | | 30 14.9 | — 0 05.8 | +0.1 | 09.2 |
| | 7833 | 8 73.2 | 20.3 | 20.0 | | | | | |
| | 7837 | 7 77.1 | 26.3 | 14.4 | | 29 28.6 | + 0 37.0 | +2.8 | 08.4 |
| | 7857 | 14 78.8 | 7.6 | 32.0 | | | | | |
| | 7884 | 2 30.1 | 32.0 | 7.8 | | 38 11.6 | — 8 01.3 | 0.0 | 10.3 |
| | 7902 | 8 98.9 | 19.0 | 20.3 | | | | | |
| | 7908 | 4 08.0 | 16.0 | 24.0 | | 33 20.5 | — 3 09.2 | —2.1 | 09.2 |
| | 7958 | 9 65.0 | 17.9 | 22.2 | | | | | |
| | 7995 | 9 69.9 | 25.3 | 15.2 | | 36 30 09.5 | — 0 01.9 | +1.3 | 36 30 08.9 |

Observations and computations—Continued.

CIMARRON, NEW MEXICO.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|------------------------|--------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|----------|--------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1874. September 5.. | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | <i>o ' "</i> | <i>' "</i> | <i>"</i> | <i>o ' "</i> |
| | 8020 | 10 70.1 | 18.7 | 21.2 | | | | | |
| | 8048 | 3 94.2 | 25.3 | 15.0 | | 36 25 47.4 | + 4 20.6 | +1.8 | 36 30 09.8 |
| | 8058 | 12 88.6 | 31.0 | 9.0 | | | | | |
| | 8091 | 8 52.2 | 9.0 | 32.0 | | 32 59.0 | - 2 48.2 | -0.2 | 10.6 |
| | 8128 | 11 61.1 | 19.6 | 20.8 | | | | | |
| | 8156 | 0 91.2 | 21.0 | 20.0 | | 37 02.4 | - 6 52.4 | 0.0 | 10.0 |
| | 8159 | 7 73.1 | 28.8 | 20.0 | | 32 40.9 | - 2 29.5 | -0.1 | 11.3 |
| | 8171 | 3 50.3 | 15.1 | 24.7 | | | | | |
| | 8206 | 10 52.5 | 21.2 | 18.9 | | 36 25 41.0 | + 4 30.7 | -1.7 | 36 30 10.0 |

ASTRONOMICAL CO-ORDINATES OF CIMARRON, NEW MEXICO.

Longitude.... $6^h 59^m 39^s.936 \pm 0^s.014$ or $104^\circ 54' 59''.04 \pm 0''.21$ west from Greenwich.

Longitude.... $1^h 51^m 27^s.815 \pm 0^s.014$ or $27^\circ 51' 57''.24 \pm 0''.20$ west from U. S. Naval Observatory, Washington, D. C.

Latitude $36^\circ 30' 10''.01 \pm 0''.09$ north.

U. S. GEOGRAPHICAL SURVEYS WEST OF THE ONE HUNDREDTH MERIDIAN.
1ST LIEUT. GEO. M. WHEELER, CORPS OF ENGINEERS, U. S. ARMY, IN CHARGE.

RESULTS

OF

OBSERVATIONS MADE BY DR. F. KAMPF AND JOHN H. CLARK IN THE
DETERMINATION OF THE ASTRONOMICAL CO-ORDINATES
OF SIDNEY BARRACKS, NEBRASKA.

SEASON OF 1874.

COMPUTATIONS BY

DR. F. KAMPF.

SIDNEY BARRACKS, NEBR.

GEOGRAPHICAL POSITION OF STATION.

Longitude, $102^{\circ} 58' 13''.32 \pm 0''.45$ west from Greenwich.

Latitude, $41^{\circ} 08' 36''.75 \pm 0''.05$ north.

Barometric altitude of observatory above sea-level (from railroad surveys), 4,073.0 feet.

The astronomical station was located in the parade-ground of the military post. Two thousand feet from the barracks is the railway-station of Sidney, a town of about five hundred inhabitants. It is traversed by the Union Pacific Railroad, and has an east and west extension along that line. The surrounding country is a prairie, very nearly level. Only in the northwest is the plain broken by hills, and these are few in number and inconsiderable in height, not rising above 500 feet. South of the station, two miles away, is the Platte River.

METEOROLOGICAL CONDITIONS.

With the exception of one night, on which a heavy wind made it impossible to accomplish satisfactory work, the weather was very favorable during the entire time of observations at this point. The temperature was low in the night-time, being generally below 40° F. at 2 o'clock a. m.

OBSERVATORY.—INSTRUMENTS.—INSTRUMENTAL VALUES.

These were the same as at Las Vegas, in the report upon which station they are described and discussed in full.

The line of the Western Union Telegraph Company was used. The length of circuit to Ogden, the connected station, was about 600 miles. In the transmission of signals the local battery in the office at Sidney was employed, and this was assisted by a repeater at Cheyenne.

Thanks are due to General Morrow, in command of the post, for his assistance in constructing the tent and station, and for his ready co-operation during the whole time of observations.

Dr. F. Kampf was the observer at Sidney, and Mr. John H. Clark at Ogden, the connected station. All observations for time and the exchange of signals were made by sound. Transmission of signals took place September 23, 24, 25, 26, and 27; observations for latitude were made September 24, 26, and 27. All computations were made by Dr. Kampf in the office.

| Name of star. | | SIDNEY BARRACKS. | | | | OGDEN. | | | | Name of star. | | SIDNEY BARRACKS. | | | | OGDEN. | | | |
|---------------|--------------------------|------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---|------------------|---------------|---------------|---------------|---------------|---------------|---------------|--|
| | | September 23. | September 24. | September 25. | September 26. | September 27. | September 23. | September 24. | September 25. | | | September 26. | September 27. | September 23. | September 24. | September 25. | September 26. | September 27. | |
| μ | Herculis | | | | | X | | | | | | | | | | | | | |
| γ | Draconis | | | | | X | | | | | | | | | | | | | |
| γ^2 | Sagittarii | | | | | | | | | | | X | | | | | | | |
| μ^1 | Sagittarii | | | | | | | | | | | | | | | | | | |
| η | Serpentis | | | | | | | | | | | | | | | | | | |
| 109 | Herculis | | | | | X | | | | | | | | | | | | | |
| α | Lyræ | | | | | X | | | | | | | | | | | | | |
| β | Lyræ | | | | | X | | | | | | | | | | | | | |
| 50 | Draconis | | | | | X | | | | | | | | | | | | | |
| ϵ | Aquilæ | | X | | | | | | | | | | | | | | | | |
| ζ | Aquilæ | | X | | | | | | | | | | | | | | | | |
| δ | Sagittarii | | | | | X | | | | | | | | | | | | | |
| δ | Draconis | X | X | | X | | X | X | X | X | X | | | | | | | | |
| τ | Draconis | X | X | | X | | X | X | X | X | X | | | | | | | | |
| β | Cygni | X | X | X | X | | X | X | X | X | X | | | | | | | | |
| κ | Aquilæ | X | | X | X | | X | X | X | X | X | | | | | | | | |
| θ | Cygni | | | X | X | | | | X | X | | | | | | | | | |
| γ | Aquilæ | X | X | X | X | | X | X | X | X | X | | | | | | | | |
| ϵ | Aquilæ | X | X | X | X | | X | X | X | X | X | | | | | | | | |
| α | Draconis | X | X | X | X | | X | X | X | X | X | | | | | | | | |
| ψ | Sagittarii | | | | X | | | | X | X | | | | | | | | | |
| γ | Cygni | X | | X | X | | | | X | X | | | | | | | | | |
| τ | Aquilæ | | X | X | X | | | | X | X | | | | | | | | | |
| 3 | Ursæ Majoris, L. C. | | | | X | | | | X | X | | | | | | | | | |
| θ | Aquilæ | | | X | X | | | | X | X | | | | | | | | | |
| 31 α | Cygni | | | X | X | | | | X | X | | | | | | | | | |
| π | Cephei | | | X | X | | | | X | X | | | | | | | | | |
| γ | Cygni | | | | | | | | | | | | | | | | | | |
| α | Groombr. 3241 | | | | | | | | | | | X | | | | | | | |
| a | Delphini | | | | | | | | | | | | | | | | | | |
| a | Cygni | | | | | | | | | | | | X | | | | | | |
| ϵ | Aquarii | | | | | | | | | | | | | | | | | | |
| μ | Aquarii | | | | | | | | | | | | | | | | | | |
| ν | Cygni | | | | | | | | | | | | X | | | | | | |
| ν^2 | Ursæ Majoris, L. C. | | | | | | | | | | | | | | X | | | | |
| 61 | Cygni | | | | | | | | | | | | X | | | | | | |
| ζ | Cygni | | | | | | | | | | | | X | | | | | | |
| τ | Cygni | | | | | | | | | | | </ | | | | | | | |

Observations and reductions for time taken at sending station.

SIDNEY BARRACKS, NEBRASKA, SEPTEMBER 23, 1874.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|-------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | δ Draconis | 19 11 05.04 | +10.91 | + 0.61 | — 2.20 | 19 11 14.36 | 19 12 31.80 | + 1 17.44 |
| E. | τ Draconis | 16 25.38 | +17.26 | + 0.87 | — 2.90 | 16 40.61 | 17 57.92 | 17.31 |
| E. | β Cygni | 24 25.93 | — 2.47 | + 0.30 | — 0.95 | 24 22.81 | 25 40.19 | 17.38 |
| E. | κ Aquilæ | 28 59.60 | — 7.11 | + 0.12 | — 0.85 | 28 51.76 | 30 09.02 | 17.26 |
| W. | γ Aquilæ | 39 04.90 | — 4.93 | + 0.10 | + 0.86 | 39 00.93 | 40 18.24 | 17.31 |
| W. | α Aquilæ | 43 27.14 | — 5.12 | + 0.06 | + 0.85 | 43 22.93 | 44 40.27 | 17.34 |
| W. | ε Draconis | 47 02.94 | +13.37 | + 0.05 | + 2.46 | 47 18.82 | 48 36.06 | 17.24 |
| W. | ψ Cygni | 19 51 01.86 | + 2.94 | — 0.05 | + 1.38 | 19 51 06.13 | 19 52 23.75 | + 1 17.62 |
| W. | θ Aquarii | 22 09 01.24 | — 5.41 | + 0.04 | + 0.94 | 22 09 56.81 | 22 11 14.01 | + 1 17.20 |
| W. | γ Aquarii | 13 58.38 | — 4.77 | + 0.04 | + 0.93 | 13 54.58 | 15 11.71 | 17.13 |
| W. | π Aquarii | 17 39.88 | — 4.56 | + 0.03 | + 0.92 | 17 36.27 | 18 53.36 | 17.09 |
| W. | δ Cephei | 23 09.68 | + 3.79 | + 0.05 | + 1.73 | 23 15.25 | 24 32.26 | 17.01 |
| W. | 226 Cephei | 28 29.52 | +15.94 | + 0.07 | + 3.73 | 28 49.26 | 30 06.42 | 17.16 |
| E. | ι Cephei | 43 52.77 | + 7.02 | + 0.18 | — 2.23 | 43 57.74 | 45 14.73 | 16.99 |
| E. | ο Andromedæ | 54 54.10 | + 0.07 | 0.00 | — 1.24 | 54 52.93 | 56 10.27 | 17.34 |
| E. | α Pegasi | 57 18.94 | — 3.23 | — 0.06 | — 0.95 | 57 14.70 | 58 31.92 | 17.22 |
| E. | ο Cephei | 23 12 08.30 | + 8.07 | — 0.28 | — 2.41 | 23 12 13.68 | 23 13 30.82 | 17.14 |
| E. | θ Piscium | 23 20 25.62 | — 4.07 | — 0.03 | — 0.93 | 23 20 20.59 | 23 21 37.49 | + 1 16.90 |

NORMAL EQUATIONS.

First series.

$$\begin{aligned}
 0 &= + 7.80 + 8.00 \delta t - 2.62 a^1 + 1.61 c & a^1 &= + 0^s.515 \\
 0 &= - 9.67 - 2.62 \delta t + 7.91 a^1 - 4.65 c & c &= - 0^s.844 \\
 0 &= + 32.28 + 1.61 \delta t - 4.65 a^1 + 34.19 c & a &= - 9^s.485
 \end{aligned}$$

Adopted $a = -10^s.00$ *Second series.*

$$\begin{aligned}
 0 &= + 0.65 + 10.00 \delta t - 1.83 a^1 - 0.52 c & a^1 &= + 0^s.182 \\
 0 &= + 1.49 - 1.83 \delta t + 9.78 a^1 + 3.67 c & c &= - 0^s.927 \\
 0 &= + 35.67 - 0.52 \delta t + 3.67 a^1 + 39.11 c & a &= - 7^s.018
 \end{aligned}$$

Adopted $a = -7^s.20$

Observations and reductions for time taken at sending station—Continued.

SIDNEY BARRACKS, NEBRASKA, SEPTEMBER 24, 1874.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|---------------|----------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. ϵ | Aquilæ | 18 52 47.69 | — 7.68 | — 0.10 | — 0.95 | 18 52 38.96 | 18 53 56.02 | + 1 17.06 |
| E. ζ | Aquilæ | 58 30.86 | — 7.85 | — 0.15 | — 0.95 | 58 21.91 | 59 38.87 | 16.96 |
| E. δ | Draconis | 19 10 58.32 | +19.20 | — 0.56 | — 2.41 | 19 10 14.55 | 19 11 31.73 | 17.18 |
| E. τ | Draconis | 16 14.31 | +30.38 | — 0.88 | — 3.17 | 16 40.64 | 17 57.84 | 17.20 |
| E. β | Cygni | 24 28.68 | — 4.34 | — 0.41 | — 1.04 | 24 22.89 | 25 40.17 | 17.28 |
| W. γ | Aquilæ | 39 09.20 | — 8.68 | — 0.36 | + 0.94 | 39 01.10 | 40 18.23 | 17.13 |
| W. α | Aquilæ | 43 31.55 | — 9.02 | — 0.37 | + 0.93 | 43 23.09 | 44 40.26 | 17.17 |
| W. ϵ | Draconis | 46 53.80 | +23.54 | — 1.13 | + 2.69 | 46 18.90 | 47 36.00 | 17.10 |
| W. τ | Aquilæ | 19 56 52.87 | — 9.52 | — 0.37 | + 0.93 | 19 56 43.91 | 19 58 01.28 | + 1 17.37 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -3.33 + 9.00 \delta t - 1.56 a^1 + 3.28 c & a^1 &= + 0^s.306 \\
 0 &= -6.38 - 1.56 \delta t + 8.00 a^1 - 5.55 c & c &= - 0^s.922 \\
 0 &= +30.23 + 3.28 \delta t - 5.55 a^1 + 33.65 c & a &= - 16^s.694
 \end{aligned}$$

Adopted $a = -17^s.00$

SIDNEY BARRACKS, NEBRASKA, SEPTEMBER 25, 1874.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|---------------|----------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. β | Cygni | 19 24 23.80 | + 0.49 | — 0.30 | — 1.08 | 19 24 22.91 | 19 25 40.15 | + 1 17.24 |
| E. κ | Aquilæ | 28 51.52 | + 1.42 | — 0.20 | — 0.96 | 28 51.78 | 30 08.99 | 17.21 |
| E. θ | Cygni | 31 50.48 | — 0.45 | — 0.50 | — 1.47 | 31 48.06 | 33 15.02 | 16.96 |
| E. γ | Aquilæ | 39 01.04 | + 0.98 | — 0.33 | — 0.97 | 39 01.04 | 40 18.21 | 17.17 |
| E. α | Aquilæ | 43 23.22 | + 1.02 | — 0.36 | — 0.96 | 43 22.92 | 44 40.24 | 17.32 |
| E. ϵ | Draconis | 47 25.40 | — 2.66 | — 1.18 | — 2.78 | 47 18.78 | 48 35.94 | 17.16 |
| W. τ | Aquilæ | 56 42.12 | + 1.08 | + 0.07 | + 0.96 | 56 44.23 | 58 01.27 | 17.04 |
| W. θ | Aquilæ | 20 03 31.16 | + 1.26 | + 0.07 | + 0.95 | 20 03 33.44 | 20 04 50.55 | 17.11 |
| W. β | Cygni | 08 23.26 | — 0.24 | + 0.08 | + 1.38 | 08 24.48 | 09 41.48 | 17.00 |
| W. κ | Cephei | 11 49.40 | — 5.08 | + 0.07 | + 4.34 | 11 48.73 | 13 05.91 | 17.18 |
| W. γ | Cygni | 20 16 25.62 | + 0.06 | — 0.04 | + 1.24 | 20 16 26.88 | 20 17 44.21 | + 1 17.38 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= +10.85 + 11.00 \delta t - 1.13 a - 0.68 c & a &= + 1^s.887 \\
 0 &= -13.86 - 1.13 \delta t + 11.27 a + 8.80 c & c &= - 0^s.952 \\
 0 &= +22.68 - 0.68 \delta t + 8.80 a + 41.89 c
 \end{aligned}$$

Observations and reductions for time taken at sending station—Continued.

SIDNEY BARRACKS, NEBRASKA, SEPTEMBER 26, 1874.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|----------|----------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. δ | Draconis | 19 11 12.12 | + 0.13 | — 0.14 | + 2.18 | 19 11 14.29 | 19 12 31.62 | + 1 17.33 |
| W. τ | Draconis | 16 37.53 | + 0.21 | — 0.23 | + 2.88 | 16 40.39 | 17 57.69 | 17.30 |
| W. β | Cygni | 24 21.80 | — 0.03 | — 0.11 | + 0.95 | 24 22.61 | 25 40.13 | 17.52 |
| W. κ | Aquilæ | 28 51.02 | — 0.09 | — 0.09 | + 0.84 | 28 51.68 | 30 08.97 | 17.29 |
| W. α | Aquilæ | 43 22.08 | — 0.06 | — 0.13 | + 0.35 | 43 22.74 | 44 40.23 | 17.49 |
| W. ε | Draconis | 47 16.34 | + 0.16 | — 0.41 | + 2.44 | 47 18.53 | 48 35.88 | 17.35 |
| E. ψ | Cygni | 51 08.14 | + 0.04 | — 0.11 | — 1.36 | 51 06.71 | 52 23.66 | 16.95 |
| E. τ | Aquilæ | 56 45.01 | — 0.07 | — 0.16 | — 0.85 | 56 43.93 | 58 01.25 | 17.32 |
| E. θ | Aquilæ | 20 03 34.28 | — 0.08 | — 0.22 | — 0.84 | 20 03 33.14 | 20 04 50.54 | 17.40 |
| E. 31 o¹ | Cygni | 08 25.98 | + 0.01 | — 0.58 | — 1.21 | 08 24.20 | 09 41.47 | 17.27 |
| E. κ | Cephei | 20 11 53.72 | + 0.31 | — 1.88 | — 3.82 | 20 11 48.33 | 20 13 05.82 | + 1 17.49 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -4.05 + 11.00 \delta t - 4.72 a - 2.47 c & a &= -0^s.115 \\
 0 &= +2.49 - 4.72 \delta t + 15.67 a + 0.07 c & c &= -0^s.837 \\
 0 &= +48.93 - 2.47 \delta t + 0.07 a + 58.06 c
 \end{aligned}$$

SIDNEY BARRACKS, NEBRASKA, SEPTEMBER 27, 1874.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|----------|----------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. δ | Draconis | 19 11 19.36 | — 0.87 | — 0.70 | — 2.48 | 19 11 15.31 | 19 12 31.56 | + 1 16.25 |
| E. τ | Draconis | 16 47.00 | — 1.37 | — 0.89 | — 3.27 | 16 41.47 | 17 57.61 | 16.14 |
| E. β | Cygni | 24 25.03 | + 0.20 | — 0.43 | — 1.08 | 24 23.72 | 25 40.11 | 16.39 |
| E. κ | Aquilæ | 28 53.36 | + 0.56 | — 0.25 | — 0.96 | 28 52.71 | 30 08.96 | 16.25 |
| E. θ | Cygni | 31 51.06 | — 0.18 | — 0.52 | — 1.47 | 31 48.89 | 33 04.96 | 16.07 |
| E. γ | Aquilæ | 39 02.62 | + 0.39 | — 0.29 | — 0.97 | 39 01.75 | 40 18.18 | 16.43 |
| W. α | Aquilæ | 43 22.82 | + 0.41 | — 0.21 | + 0.96 | 43 23.98 | 44 40.21 | 16.23 |
| W. ε | Draconis | 47 18.52 | — 1.06 | — 0.64 | + 2.78 | 47 19.60 | 48 35.82 | 16.22 |
| W. τ | Aquilæ | 56 43.99 | + 0.43 | — 0.22 | + 0.96 | 56 45.16 | 58 01.24 | 16.08 |
| W. θ | Aquilæ | 20 03 33.08 | + 0.51 | — 0.20 | + 0.95 | 20 03 34.34 | 20 04 50.53 | 16.19 |
| W. 31 o¹ | Cygni | 08 24.50 | — 0.10 | — 0.42 | + 1.38 | 08 25.36 | 09 41.44 | 16.08 |
| W. κ | Cephei | 20 11 48.23 | — 2.03 | — 1.14 | + 4.34 | 20 11 49.40 | 20 13 05.71 | + 1 16.31 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= +10.13 + 12.00 \delta t - 4.13 a - 1.19 c & a &= +0^s.754 \\
 0 &= -8.38 - 4.13 \delta t + 15.90 a + 6.74 c & c &= -0^s.952 \\
 0 &= +50.14 - 1.19 \delta t + 6.74 a + 58.84 c
 \end{aligned}$$

Observations and reductions for time taken at receiving station.

OGDEN, UTAH, SEPTEMBER 23, 1874.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|---------------|------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. μ | Herculis | 17 46 54.50 | + 0.40 | — 0.02 | + 0.03 | 17 46 54.91 | 17 41 32.88 | — 5 22.03 |
| W. γ | Draconis | 59 04.08 | — 0.43 | — 0.08 | + 0.04 | 59 03.61 | 53 41.70 | 21.91 |
| W. γ^2 | Sagittarii | 18 03 05.28 | + 1.69 | — 0.03 | + 0.03 | 18 03 06.97 | 57 45.03 | 21.94 |
| W. μ^1 | Sagittarii | 11 36.45 | + 1.46 | — 0.06 | + 0.02 | 11 37.87 | 18 06 15.75 | 22.12 |
| W. η | Serpentis | 20 10.37 | + 1.06 | — 0.10 | + 0.02 | 20 11.35 | 14 49.17 | 22.18 |
| W. 109 | Herculis | 23 42.86 | + 0.55 | — 0.17 | + 0.03 | 23 43.27 | 18 21.25 | 22.02 |
| E. α | Lyræ | 38 03.92 | + 0.09 | — 0.22 | — 0.03 | 38 03.76 | 32 41.63 | 22.13 |
| E. β | Lyræ | 50 49.15 | + 0.26 | — 0.24 | — 0.03 | 50 49.14 | 45 27.13 | 22.01 |
| E. 50 | Draconis | 55 51.45 | — 3.37 | — 0.72 | — 0.10 | 55 57.26 | 50 24.96 | 22.30 |
| E. ζ | Aquilæ | 19 05 00.49 | + 0.73 | — 0.22 | — 0.02 | 19 05 00.98 | 59 38.89 | 22.09 |
| E. δ | Draconis | 17 56.27 | — 1.76 | — 0.59 | — 0.07 | 17 53.85 | 19 12 31.79 | 22.06 |
| E. τ | Draconis | 19 23 23.54 | — 2.79 | — 0.79 | — 0.09 | 19 23 19.87 | 19 17 57.92 | — 5 21.95 |
| E. | Groombr. 3241 .. | 20 35 58.78 | — 2.66 | + 0.14 | — 0.46 | 20 35 55.80 | 20 30 33.32 | — 5 22.48 |
| E. α | Cygni | 42 32.59 | — 0.16 | + 0.07 | — 0.20 | 42 32.30 | 37 10.09 | 22.21 |
| E. μ | Aquarii | 51 15.04 | + 1.26 | + 0.02 | — 0.14 | 51 16.18 | 45 54.07 | 22.11 |
| E. ν | Cygni | 57 52.95 | + 0.02 | + 0.03 | — 0.18 | 57 52.82 | 52 30.62 | 22.20 |
| E. 61 | Cygni | 21 03 39.58 | + 0.11 | + 0.01 | — 0.18 | 21 06 39.52 | 21 01 17.42 | 22.10 |
| W. ζ | Cygni | 12 58.61 | + 0.36 | — 0.23 | + 0.16 | 12 58.90 | 07 36.68 | 22.22 |
| W. α | Cephei | 20 59.83 | — 1.21 | — 0.40 | + 0.30 | 20 58.52 | 15 36.25 | 22.27 |
| W. β | Aquarii | 30 19.66 | + 1.18 | — 0.13 | + 0.14 | 30 20.85 | 24 58.31 | 22.54 |
| W. β | Cephei | 32 28.03 | — 2.24 | — 0.43 | + 0.41 | 32 25.77 | 27 03.60 | 22.17 |
| W. ξ | Aquarii | 21 36 26.69 | + 1.22 | — 0.11 | + 0.14 | 21 36 27.94 | 21 31 05.45 | — 5 22.49 |

NORMAL EQUATIONS.

First series.

$$\begin{aligned}
 0 &= + 1.82 + 12.00 \delta t - 1.38 a + 6.50 c & a &= + 1^s.532 \\
 0 &= - 20.18 - 1.38 \delta t + 12.60 a - 20.34 c & c &= - 0^s.027 \\
 0 &= + 33.00 + 6.50 \delta t - 20.34 a + 46.79 c
 \end{aligned}$$

Second series.

$$\begin{aligned}
 0 &= + 0.92 + 10.00 \delta t - 1.33 a + 0.04 c & a &= + 1^s.590 \\
 0 &= - 11.35 - 1.33 \delta t + 7.18 a - 0.73 c & c &= - 0^s.140 \\
 0 &= + 5.83 + 0.04 \delta t - 0.73 a + 33.39 c
 \end{aligned}$$

TIME DETERMINATIONS.

425

Observations and reductions for time taken at receiving station—Continued.

OGDEN, UTAH, SEPTEMBER 24, 1874.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|--------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | β Lyrae | 18 50 50.47 | + 0.27 | — 0.09 | + 0.11 | 18 50 50.76 | 18 45 27.11 | — 5 23.65 |
| W. | 50 Draconis | 55 52.10 | + 3.54 | — 0.26 | + 0.35 | 55 48.65 | 50 24.87 | 23.78 |
| W. | ζ Aquilæ | 19 05 01.83 | + 0.77 | — 0.08 | + 0.09 | 19 05 02.61 | 59 38.87 | 23.74 |
| W. | δ Sagittarii | 15 40.38 | + 1.48 | — 0.05 | + 0.10 | 15 41.91 | 19 10 18.12 | 23.79 |
| W. | δ Draconis | 17 57.33 | — 1.85 | — 0.21 | + 0.24 | 17 55.51 | 12 31.74 | 23.77 |
| W. | τ Draconis | 23 24.35 | — 2.93 | — 0.26 | + 0.31 | 23 21.47 | 17 57.85 | 23.62 |
| E. | β Cygni | 31 03.44 | + 0.43 | — 0.06 | — 0.10 | 31 03.71 | 25 40.17 | 23.54 |
| E. | κ Aquilæ | 35 31.77 | + 1.22 | — 0.03 | — 0.09 | 35 32.87 | 30 09.00 | 23.87 |
| E. | γ Aquilæ | 45 41.25 | + 0.84 | — 0.05 | — 0.09 | 45 41.95 | 40 18.23 | 23.72 |
| E. | α Aquilæ | 50 03.18 | + 0.87 | — 0.05 | — 0.09 | 50 03.91 | 44 40.26 | 23.65 |
| E. | ε Draconis | 19 54 02.47 | — 2.25 | — 0.15 | — 0.26 | 19 54 59.81 | 19 49 36.01 | — 5 23.80 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= + 6.55 + 11.00 \delta t - 2.91 a - 6.18 c & a &= + 1^s.609 \\
 0 &= - 21.50 - 2.91 \delta t + 13.76 a + 14.28 c & c &= - 0^s.090 \\
 0 &= - 19.79 - 6.18 \delta t + 14.28 a + 50.73 c
 \end{aligned}$$

OGDEN, UTAH, SEPTEMBER 25, 1874.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|----------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | 50 Draconis | 18 55 53.19 | — 3.20 | — 0.13 | + 0.30 | 18 55 50.16 | 18 50 24.77 | — 5 25.39 |
| W. | ζ Aquilæ | 19 05 03.33 | + 0.70 | — 0.06 | + 0.08 | 19 05 04.05 | 59 38.86 | 25.19 |
| W. | δ Sagittarii | 15 42.01 | + 1.34 | — 0.05 | + 0.08 | 15 43.38 | 19 10 18.10 | 25.28 |
| W. | δ Draconis | 17 58.53 | — 1.67 | — 0.33 | + 0.19 | 17 56.72 | 12 31.68 | 25.04 |
| W. | τ Draconis | 23 25.52 | — 2.64 | — 0.52 | + 0.26 | 23 22.62 | 17 57.77 | 24.85 |
| E. | β Cygni | 31 04.90 | + 0.39 | — 0.05 | — 0.08 | 31 05.16 | 25 40.15 | 25.01 |
| E. | κ Aquilæ | 35 33.13 | + 1.10 | — 0.04 | — 0.07 | 35 34.12 | 30 08.99 | 25.13 |
| E. | γ Aquilæ | 45 42.70 | + 0.76 | — 0.07 | — 0.08 | 45 43.31 | 40 18.21 | 25.10 |
| E. | α Aquilæ | 50 04.68 | + 0.78 | — 0.07 | — 0.07 | 50 05.32 | 44 40.24 | 25.08 |
| E. | ε Draconis | 19 54 03.68 | — 2.03 | — 0.26 | — 0.22 | 19 54 01.17 | 19 48 35.94 | — 5 25.23 |
| E. | Groombr. 3241 | 20 36 01.35 | — 2.49 | — 0.08 | — 0.83 | 20 36 57.95 | 21 31 33.19 | — 5 24.76 |
| E. | α Delphini | 39 14.11 | + 0.67 | — 0.04 | — 0.27 | 39 14.47 | 33 49.42 | 25.05 |
| E. | α Cygni | 42 35.51 | — 0.15 | — 0.06 | — 0.36 | 42 34.94 | 37 10.05 | 24.89 |
| E. | μ Aquarii | 51 18.39 | + 1.18 | — 0.03 | — 0.26 | 51 19.28 | 45 54.04 | 25.24 |
| W. | 61 Cygni | 21 06 42.51 | + 0.10 | — 0.26 | + 0.32 | 21 06 42.67 | 21 01 17.39 | 25.28 |
| W. | ζ Cygni | 13 01.62 | + 0.34 | — 0.24 | + 0.29 | 13 02.01 | 07 36.65 | 25.36 |
| W. | τ Cygni | 15 13.01 | + 0.10 | — 0.26 | + 0.32 | 15 13.17 | 09 47.87 | 25.30 |
| W. | α Cephei | 21 02.73 | — 1.13 | — 0.44 | + 0.54 | 21 01.70 | 15 36.18 | 25.52 |
| W. | δ Ursæ Maj. L. C. .. | 21 28 41.27 | + 4.13 | + 0.24 | — 0.75 | 21 28 44.89 | 21 23 19.89 | — 5 25.00 |

NORMAL EQUATIONS.

First series.

$$\begin{aligned}
 0 &= + 5.38 + 10.00 \delta t - 3.08 a - 4.98 c & a &= + 1^s.453 \\
 0 &= - 19.25 - 3.08 \delta t + 13.73 a + 14.52 c & c &= - 0^s.075 \\
 0 &= - 18.03 - 4.98 \delta t + 14.52 a + 49.29 c
 \end{aligned}$$

Second series.

$$\begin{aligned}
 0 &= - 2.15 + 9.00 \delta t + 1.85 a + 3.89 c & a &= + 1^s.491 \\
 0 &= - 16.54 + 1.85 \delta t + 11.92 a + 5.13 c & c &= - 0^s.255 \\
 0 &= + 0.51 + 3.89 \delta t + 51.13 a + 32.61 c
 \end{aligned}$$

Observations and reactions for time taken at receiving station—Continued.

OGDEN, UTAH, SEPTEMBER 26, 1874.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|---------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | <i>α</i> Lyræ | 18 38 08.45 | + 0.10 | — 0.09 | + 0.13 | 18 38 08.59 | 18 32 41.55 | — 5 27.04 |
| W. | <i>β</i> Lyræ | 50 53.93 | + 0.29 | — 0.09 | + 0.12 | 50 54.25 | 45 27.06 | 27.19 |
| W. | 50 Draconis | 54 55.42 | — 3.69 | — 0.29 | + 0.39 | 54 51.83 | 49 24.68 | 27.15 |
| W. | <i>ζ</i> Aquilæ | 19 05 05.27 | + 0.81 | — 0.08 | + 0.10 | 19 05 06.10 | 59 38.84 | 27.26 |
| E. | <i>δ</i> Sagittarii | 15 43.81 | + 1.54 | + 0.01 | — 0.11 | 15 45.25 | 19 10 18.09 | 27.16 |
| E. | <i>δ</i> Draconis | 18 00.91 | — 1.93 | + 0.02 | — 0.26 | 18 58.74 | 13 31.62 | 27.12 |
| E. | <i>τ</i> Draconis | 23 28.31 | — 3.05 | 0.00 | — 0.34 | 23 24.92 | 17 57.69 | 27.23 |
| E. | <i>β</i> Cygni | 31 06.82 | + 0.45 | — 0.02 | — 0.11 | 31 07.14 | 25 40.13 | 27.01 |
| E. | <i>κ</i> Aquilæ | 35 35.04 | + 1.28 | — 0.03 | — 0.10 | 35 36.19 | 30 08.98 | 27.21 |
| E. | <i>γ</i> Aquilæ | 45 44.63 | + 0.87 | — 0.05 | — 0.11 | 45 45.34 | 40 18.20 | 27.14 |
| E. | <i>α</i> Aquilæ | 50 06.61 | + 0.90 | — 0.06 | — 0.10 | 50 07.35 | 44 40.22 | 27.13 |
| E. | <i>ε</i> Draconis | 19 54 05.92 | — 2.35 | — 0.28 | — 0.29 | 19 54 03.00 | 19 48 35.88 | — 5 27.12 |
| E. | Groombr. 3241... | 20 36 02.75 | — 1.74 | — 0.31 | — 0.30 | 20 36 00.40 | 20 30 33.13 | — 5 27.27 |
| E. | <i>α</i> Delphini | 39 16.23 | + 0.47 | — 0.15 | — 0.09 | 39 16.46 | 33 49.40 | 27.06 |
| E. | <i>α</i> Cygni | 42 37.46 | — 0.10 | — 0.21 | — 0.13 | 42 37.02 | 37 10.02 | 27.00 |
| E. | <i>ε</i> Aquarii | 46 20.53 | + 0.82 | — 0.10 | — 0.09 | 46 21.16 | 40 53.91 | 27.25 |
| E. | <i>μ</i> Aquarii | 51 20.72 | + 0.82 | — 0.10 | — 0.09 | 51 21.35 | 45 54.03 | 27.32 |
| W. | <i>ν</i> Cygni | 57 57.79 | + 0.01 | — 0.12 | + 0.12 | 57 57.80 | 52 30.53 | 27.27 |
| W. | 61 Cygni | 21 06 44.57 | + 0.07 | — 0.18 | + 0.12 | 21 06 44.58 | 21 01 17.38 | 27.20 |
| W. | <i>ζ</i> Cygni | 13 03.72 | + 0.24 | — 0.19 | + 0.10 | 13 03.87 | 07 36.63 | 27.24 |
| W. | <i>τ</i> Cygni | 21 15 14.95 | + 0.07 | — 0.21 | + 0.11 | 21 15 14.92 | 21 09 47.85 | — 5 27.07 |

NORMAL EQUATIONS.

First series.

$$\begin{aligned}
 0 &= + 7.22 + 12.00 \delta t - 2.85 a + 6.75 c & a &= + 1^s.678 \\
 0 &= - 23.74 - 2.85 \delta t + 13.76 a - 2.32 c & c &= - 0^s.100 \\
 0 &= + 10.12 + 6.75 \delta t - 2.32 a + 52.39 c
 \end{aligned}$$

Second series.

$$\begin{aligned}
 0 &= - 0.53 + 9.00 \delta t + 0.64 a + 2.74 c & a &= + 1^s.050 \\
 0 &= - 4.87 + 0.64 \delta t + 4.29 a - 3.94 c & c &= - 0^s.091 \\
 0 &= + 6.10 + 2.74 \delta t - 3.94 a + 21.97 c
 \end{aligned}$$

Observations and reductions for time taken at receiving station—Continued.

OGDEN, UTAH, SEPTEMBER 27, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|-----------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | ε ⁰ Draconis | 18 55 56.02 | — 2.84 | 0.00 | + 0.41 | 18 55 53.59 | 18 50 24.58 | — 5 29.01 |
| W. | ζ Aquilæ | 19 05 07.02 | + 0.62 | 0.00 | + 0.11 | 19 05 07.75 | 59 38.82 | 28.93 |
| W. | δ Sagittarii | 15 45.71 | + 1.19 | — 0.01 | + 0.11 | 15 47.00 | 19 10 18.07 | 28.93 |
| W. | δ Draconis | 18 01.49 | — 1.49 | — 0.04 | + 0.27 | 18 00.23 | 12 31.56 | 28.67 |
| W. | τ Draconis | 23 28.39 | — 2.35 | — 0.08 | + 0.36 | 23 26.32 | 17 57.60 | 28.72 |
| E. | β Cygni | 31 08.52 | + 0.35 | + 0.08 | — 0.12 | 31 08.83 | 25 40.11 | 28.72 |
| E. | κ Aquilæ | 35 36.99 | + 0.98 | + 0.04 | — 0.11 | 35 37.90 | 30 08.96 | 28.94 |
| E. | γ Aquilæ | 45 46.40 | + 0.67 | + 0.06 | — 0.11 | 45 47.02 | 40 18.18 | 28.84 |
| E. | α Aquilæ | 50 08.36 | + 0.70 | + 0.06 | — 0.10 | 50 09.02 | 44 40.21 | 28.81 |
| E. | ε Draconis | 54 06.72 | — 1.81 | + 0.20 | — 0.31 | 54 04.80 | 48 35.82 | 28.98 |
| E. | γ Sagittarii | 58 39.44 | + 0.52 | + 0.08 | — 0.11 | 58 39.93 | 53 11.21 | 28.72 |
| E. | τ Aquilæ | 20 03 29.36 | + 0.73 | + 0.07 | — 0.10 | 20 03 30.06 | 58 01.24 | 28.82 |
| E. | 3 Ursæ Maj. L. C. .. | 20 05 43.00 | + 3.36 | — 0.09 | + 0.29 | 20 05 46.56 | 20 00 17.70 | — 5 28.86 |
| E. | Groombr. 3241. | 20 37 04.27 | — 1.98 | + 0.11 | — 0.38 | 20 37 02.02 | 20 31 33.06 | — 5 28.96 |
| E. | α Delphini | 39 17.62 | + 0.53 | + 0.04 | — 0.12 | 39 18 07 | 33 49.39 | 28.68 |
| E. | α Cygni | 42 38.98 | — 0.12 | + 0.06 | — 0.16 | 42 38 76 | 37 10.00 | 28.76 |
| E. | ε Aquarii | 46 21.80 | + 0.94 | + 0.02 | — 0.12 | 46 22.64 | 40 53.90 | 28.74 |
| E. | μ Aquarii | 51 22.12 | + 0.94 | + 0.02 | — 0.12 | 51 22.96 | 45 54.02 | 28.94 |
| W. | ν Cygni | 57 59.13 | + 0.01 | + 0.09 | + 0.15 | 57 59.38 | 52 30.51 | 28.87 |
| W. | σ ² Ursæ Maj. L. C. .. | 21 04 45.06 | + 2.96 | — 0.06 | — 0.31 | 21 04 47.65 | 59 18.67 | 28.98 |
| W. | 61 Cygni | 06 45.98 | + 0.08 | + 0.09 | + 0.15 | 06 46.30 | 21 01 17.36 | 28.94 |
| W. | ζ Cygni | 21 13 05.08 | + 0.27 | + 0.08 | + 0.13 | 21 13 05.56 | 21 07 36.62 | — 5 28.94 |

NORMAL EQUATIONS.

First series.

$$\begin{aligned} 0 &= + 1.93 + 13.00 \delta t + 0.49 a - 5.68 c & a &= + 1^s.292 \\ 0 &= - 26.12 + 0.49 \delta t + 20.97 a + 8.32 c & c &= - 0^s.105 \\ 0 &= - 5.79 - 5.68 \delta t + 8.32 a + 59.10 c \end{aligned}$$

Second series.

$$\begin{aligned} 0 &= - 2.24 + 9.00 \delta t + 3.06 a + 6.63 c & a &= + 1^s.188 \\ 0 &= - 11.93 + 3.06 \delta t + 10.49 a + 2.70 c & c &= - 0^s.116 \\ 0 &= + 0.42 + 6.63 \delta t + 2.70 a + 27.30 c \end{aligned}$$

The following tables show the corrections and rates of the chronometers used at Sidney Barracks and Ogden :

CHRONOMETER AT SIDNEY BARRACKS.—NEGUS, No. 1344.

| Date. | Local sidereal time. | Correction of chronometer. | Adopted hourly rate. |
|----------|----------------------|----------------------------|----------------------|
| 1874. | <i>h.</i> | <i>h. m. s.</i> | <i>s.</i> |
| Sept. 23 | 21.15 | + 0 01 17.240 | 0.000 |
| Sept. 24 | 19.43 | 17.160 | 0.000 |
| Sept. 25 | 19.70 | 17.160 | 0.000 |
| Sept. 26 | 19.70 | 17.340 | 0.000 |
| Sept. 27 | 19.70 | + 0 01 16.220 | + 0.040 |

CHRONOMETER AT OGDEN.—NEGUS, No. 1491.

| Date. | Local sidereal time. | Correction of chronometer. | Adopted hourly rate. |
|----------|----------------------|----------------------------|----------------------|
| 1874. | <i>h.</i> | <i>h. m. s.</i> | <i>s.</i> |
| Sept. 23 | 19.75 | — 0 05 22.168 | + 0.065 |
| Sept. 24 | 19.30 | | + 0.059 |
| Sept. 25 | 20.12 | | + 0.084 |
| Sept. 26 | 20.00 | | + 0.070 |
| Sept. 27 | 20.10 | — 0 05 28.855 | |

Final results of longitude.

| Signals sent from— | Recorded at— | Mean of signals sent and received. | Time-corrections. | Corrected time. | Difference of longitude. | Double-wave time. | Means. | | |
|----------------------|-------------------|------------------------------------|-------------------|-----------------|--------------------------|-------------------|--------------|--|--|
| | | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> | <i>s.</i> | <i>m. s.</i> | | |
| September 23, 1874 : | | | | | | | | | |
| Ogden | Sidney Barracks . | 20 26 51.56 | +0 01 17.25 | 20 28 08.81 | 36 06.84 | 0.02 | 36 06.830 | | |
| | Ogden | 19 57 24.14 | —0 05 22.17 | 19 52 01.97 | | | | | |
| | Sidney Barracks . | 20 30 50.11 | +0 01 17.25 | 20 32 07.36 | 06.82 | | | | |
| | Ogden | 20 01 22.72 | —0 05 22.18 | 19 56 00.54 | | | | | |
| September 24, 1874 : | | | | | | | | | |
| Ogden | Sidney Barracks . | 20 31 49.22 | +0 01 17.16 | 20 33 06.38 | 06.79 | 0.05 | 06.765 | | |
| | Ogden | 20 02 23.35 | —0 05 23.76 | 19 56 59.59 | | | | | |
| | Sidney Barracks . | 20 35 30.03 | +0 01 17.16 | 20 36 47.19 | 06.74 | | | | |
| | Ogden | 20 06 04.21 | —0 05 23.76 | 20 00 40.45 | | | | | |
| September 25, 1874 : | | | | | | | | | |
| Ogden | Sidney Barracks . | 20 46 16.97 | +0 01 17.16 | 20 47 34.13 | 06.92 | 0.09 | 06.875 | | |
| | Ogden | 20 16 52.36 | —0 05 25.15 | 20 11 27.21 | | | | | |
| | Sidney Barracks . | 20 49 50.10 | +0 01 17.16 | 20 51 07.26 | 06.83 | | | | |
| | Ogden | 20 20 25.58 | —0 05 25.15 | 20 15 00.43 | | | | | |
| September 26, 1874 : | | | | | | | | | |
| Ogden | Sidney Barracks . | 20 52 06.19 | +0 01 17.34 | 20 53 23.53 | 06.68 | 0.08 | 06.640 | | |
| | Ogden | 20 22 44.04 | —0 05 27.19 | 20 17 16.85 | | | | | |
| | Sidney Barracks . | 20 56 00.21 | +0 01 17.34 | 20 57 17.55 | 06.60 | | | | |
| | Ogden | 20 26 38.14 | —0 05 27.19 | 20 21 10.95 | | | | | |
| September 27, 1874 : | | | | | | | | | |
| Ogden | Sidney Barracks . | 20 41 41.03 | +0 01 16.18 | 20 42 57.21 | 06.70 | 36 06.63 | 36 06.665 | | |
| | Ogden | 20 12 19.36 | —0 05 28.85 | 20 06 50.51 | | | | | |
| | Sidney Barracks . | 20 45 20.11 | +0 01 16.18 | 20 46 36.29 | 06.70 | | | | |
| | Ogden | 20 15 58.52 | —0 05 28.86 | 20 10 29.66 | | | | | |

Sidney Barracks east of Ogden..... $0^h 36^m 06^s.755 \pm 0^s.030$
Or, $9^\circ 01' 41''.32 \pm 0''.45$

LATITUDE DETERMINATIONS.

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Observations and computations.

SIDNEY BARRACKS, NEBRASKA.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|-------------------|--------------|-------------------|-----------|-----------|---|--------------------------|-------------------|------------|------------|--------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1874. Sept. 24 | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | <i>o ' "</i> | <i>' " "</i> | <i>" "</i> | <i>" "</i> | <i>o ' "</i> |
| | 7706 | 7 55.9 | 30.0 | 8.0 | Heavy wind from south-west; cloudy. 25 th p.m. | 41 09 37.6 | - 0 59.0 | -2.0 | ..... | 41 08 36.6 |
| | 7749 | 9 09.0 | 3.7 | 34.5 | | | | | | |
| | 7824 | 15 49.8 | 28.3 | 8.7 | | 16 37.6 | - 8 01.4 | -1.2 | +0.1 | 35.1 |
| | 7843 | 3 01.0 | 6.4 | 31.2 | | | | | | |
| | 7856 | 3 61.5 | 16.0 | 21.3 | | 15 38.0 | - 7 00.4 | -1.7 | ..... | 35.9 |
| | 7902 | 14 52.0 | 18.0 | 20.0 | | | | | | |
| | 7917 | 14 94.0 | 10.2 | 27.9 | | 01 43.5 | + 6 53.7 | -1.8 | ..... | 35.4 |
| | 7932 | 4 21.0 | 24.0 | 14.0 | | 05 34.2 | + 3 01.4 | -1.1 | ..... | 34.5 |
| | 7962 | 10 23.6 | 25.0 | 12.3 | | | | | | |
| | 7972 | 8 69.8 | 16.0 | 22.0 | | 10 45.9 | - 2 08.8 | -1.8 | ..... | 35.3 |
| | 7984 | 5 35.6 | 18.3 | 20.0 | | | | | | |
| | 7994 | -1 60.7 | 20.0 | 18.0 | | 17 44.2 | - 9 05.8 | -4.2 | ..... | 34.2 |
| | 8023 | 12 55.1 | 9.0 | 29.0 | | | | | | |
| | 8106 | 12 65.0 | 21.5 | 17.0 | | 08 16.3 | + 0 22.2 | -4.3 | ..... | 34.2 |
| | 8173 | 2 84.9 | 21.3 | 17.8 | | 02 00.2 | + 6 40.1 | -4.5 | ..... | 35.6 |
| | 8182 | 13 22.5 | 8.0 | 31.0 | | | | | | |
| | 8195 | 12 16.7 | 22.7 | 15.9 | No wind now. Clear. | 08 36.5 | + 0 04.9 | -4.4 | ..... | 37.0 |
| | 8223 | 12 03.9 | 6.6 | 32.3 | | 05 43.8 | + 2 58.3 | -4.7 | ..... | 37.4 |
| | 8237 | 7 54.1 | 6.0 | 33.1 | | 12 02.6 | - 3 22.3 | -2.5 | ..... | 37.8 |
| | 8268 | 6 95.9 | 15.8 | 23.5 | | 21 25.4 | -12 45.8 | -2.6 | ..... | 37.0 |
| | 8282 | 21 57.8 | 15.5 | 23.8 | | | | | | |
| | 8324 | 1 71.3 | 18.3 | 21.3 | | 19 32.5 | -10 53.0 | -3.2 | ..... | 36.3 |
| | 16 | 18 19.9 | 17.3 | 22.9 | | 14 13.4 | - 5 33.1 | -4.2 | ..... | 36.1 |
| | 67 | 1 26.1 | 16.3 | 24.7 | | 17 05.2 | - 8 25.4 | -5.0 | ..... | 34.8 |
| | 100 | 11 05.1 | 25.1 | 14.9 | | | | | | |
| | 152 | 15 52.0 | 24.0 | 17.0 | | 02 43.6 | + 5 56.7 | -2.9 | ..... | 37.4 |
| | 173 | 2 41.0 | 6.3 | 34.8 | | 02 37.3 | + 6 05.4 | -5.4 | ..... | 37.3 |
| | 215 | 13 70.0 | 17.7 | 23.0 | | 14 50.9 | - 6 06.6 | -6.5 | ..... | 37.8 |
| | 254 | 4 44.9 | 17.0 | 24.0 | | 05 16.0 | + 3 28.3 | -4.9 | ..... | 39.4 |
| | 283 | 13 46.9 | 22.4 | 18.8 | | 13 55.4 | - 5 12.3 | -5.4 | ..... | 37.7 |
| | 337 | 3 99.0 | 7.3 | 34.0 | | | | | | |
| | 368 | 4 38.0 | 27.0 | 13.9 | | 18 11.8 | - 9 30.9 | -2.8 | ..... | 38.1 |
| | 387 | 13 89.0 | 0.0 | 41.0 | | 41 03 31.8 | + 5 09.6 | -4.8 | ..... | 41 08 36.6 |
| | 412 | 3 25.0 | 13.7 | 26.9 | | | | | | |
| | 444 | 16 76.0 | 12.2 | 28.0 | | | | | | |
| | 453 | 8 65.5 | 16.0 | 24.0 | | | | | | |
| | 487 | 17 67.5 | 33.0 | 6.9 | | | | | | |
| | 516 | 2 86.6 | 1.0 | 39.0 | | | | | | |
| | 540 | 6 61.1 | 21.0 | 19.2 | | | | | | |
| | 576 | 14 64.2 | 9.3 | 31.8 | | | | | | |

Observations and computations—Continued.

SIDNEY BARRACKS, NEBRASKA.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|-------------------|--------------|-------------------|-----------|-----------|----------------|--------------------------|-------------------|--------|--------|--------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1874. Sept. 24 | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | " | ° ' " |
| | 600 | 7 83.1 | 27.0 | 13.7 | | | | | | |
| | 629 | 10 67.0 | 4.0 | 36.8 | | 41 06 44.8 | + 1 49.4 | -4.5 | ..... | 41 08 (29.7) |
| | 647 | 17 26.7 | 22.7 | 18.0 | | 04 49.0 | + 3 55.0 | -4.7 | ..... | 39.3 |
| | 658 | 11 17.1 | 7.9 | 33.0 | | | | | | |
| | 666 | 6 06.0 | 25.5 | 15.5 | | 11 59.1 | - 3 17.0 | -3.5 | ..... | 38.6 |
| | 691 | 9 00.0 | 13.5 | 27.3 | | | | | | |
| | 715 | 11 92.6 | 16.0 | 24.8 | | 10 33.5 | - 1 52.8 | -5.2 | ..... | 35.5 |
| | 731 | 5 34.9 | 14.5 | 26.3 | | 06 24.2 | + 2 19.2 | -5.9 | ..... | 37.5 |
| Sept. 26 | 7706 | 7 00.0 | 27.0 | 7.6 | Wind moderate. | | | | | |
| | 7749 | 8 62.4 | 8.4 | 26.2 | | 09 37.9 | - 1 02.6 | +0.4 | ..... | 35.7 |
| | 7789 | 12 43.9 | 11.5 | 23.0 | | | | | | |
| | 7807 | 7 37.0 | 26.3 | 9.0 | | 11 52.0 | - 3 15.4 | +1.3 | ..... | 37.9 |
| | 7824 | 15 57.2 | 0.0 | 34.8 | | | | | | |
| | 7843 | 3 03.0 | 36.0 | ..... |  | 16 38.0 | - 8 03.5 | +0.6 | ..... | 35.1 |
| | 7856 | 3 34.9 | 29.7 | 5.0 | | | | | | |
| | 7902 | 14 30.0 | 7.1 | 28.7 | | 15 38.4 | - 7 02.2 | +0.7 | ..... | 36.9 |
| | 7917 | 14 91.2 | 16.9 | 18.7 | | | | | | |
| | 7932 | 4 21.8 | 19.3 | 16.5 | | 01 44.0 | + 5 52.2 | +0.2 | ..... | 36.4 |
| | 7962 | 10 21.2 | 20.0 | 16.6 | | 05 34.7 | + 3 01.2 | +0.4 | ..... | 36.3 |
| | 7972 | 8 70.9 | 11.8 | 24.6 | | | | | | |
| | 7978 | 14 98.7 | 23.7 | 12.6 | | 04 34.1 | + 4 02.1 | -0.4 | ..... | 35.8 |
| | 7984 | 5 26.9 | 26.5 | 9.8 | | 10 46.4 | - 2 12.6 | +0.9 | ..... | 34.7 |
| | 7994 | - 1 59.0 | 16.4 | 19.8 | | | | | | |
| | 8023 | 12 65.4 | 20.0 | 17.0 | | 17 44.7 | - 9 09.1 | -0.1 | ..... | 35.5 |
| | 8106 | 12 32.8 | 14.6 | 22.9 | | | | | | |
| | 8173 | 2 52.2 | 13.0 | 24.9 | | 08 16.7 | + 0 18.5 | +1.6 | ..... | 36.8 |
| | 8182 | 12 80.7 | 26.5 | 11.4 | | 02 00.7 | + 6 36.5 | +0.7 | ..... | 37.9 |
| | 8195 | 11 87.8 | 28.7 | 9.0 | | | | | | |
| | 8223 | 11 89.5 | 10.5 | 27.4 | | 08 37.0 | - 0 00.7 | +0.6 | ..... | 36.9 |
| | 8237 | 7 41.0 | 9.0 | 29.0 | | 05 44.4 | + 2 52.2 | -0.1 | ..... | 36.5 |
| | 8268 | 7 00.0 | 17.3 | 20.5 | | | | | | |
| | 8282 | 21 62.5 | 17.2 | 20.8 | | 12 03.1 | - 3 26.4 | +1.0 | ..... | 37.3 |
| | 8324 | 1 64.6 | 22.8 | 15.5 | | 21 26.1 | -12 50.2 | +0.9 | ..... | 36.8 |
| | 16 | 17 92.9 | 15.9 | 22.9 | | | | | | |
| | 67 | 0 86.6 | 25.6 | 13.4 | | 19 33.4 | -10 57.8 | +1.2 | ..... | 36.8 |
| | 100 | 11 81.6 | 12.0 | 26.3 | | | | | | |
| | 152 | 16 28.0 | 11.6 | 27.2 | | 14 13.8 | - 5 37.4 | +1.0 | ..... | 37.4 |
| | 173 | 3 06.5 | 28.8 | 10.0 | | 17 05.8 | - 8 29.4 | +0.7 | ..... | 37.1 |
| | 215 | 13 42.0 | 23.2 | 15.7 | | | | | | |
| | 254 | 4 24.9 | 18.0 | 20.9 | | 41 02 44.1 | + 5 53.5 | +1.1 | | 41 08 38.7 |

LATITUDE DETERMINATIONS.

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Observations and computations—Continued.

SIDNEY BARRACKS, NEBRASKA.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|-------------------|--------------|-------------------|-----------|-----------|---------------------------|--------------------------|-------------------|------------|------------|--------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1874. Sept. 26 | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | <i>° ' "</i> | <i>' "</i> | <i>" "</i> | <i>" "</i> | <i>° ' "</i> |
| | 283 | 13 18.0 | 20.0 | 18.4 | | | | | | |
| | 337 | 3 86.5 | 19.8 | 19.0 | | 41 02 37.8 | + 5 59.1 | +0.6 | ..... | 41 08 37.5 |
| | 368 | 4 44.0 | 29.5 | 8.9 | | | | | | |
| | 387 | 14 12.4 | 8.1 | 30.5 | | 14 51.3 | — 6 13.3 | —0.4 | ..... | 37.6 |
| | 412 | 4 03.0 | 10.0 | 28.0 | | 05 16.4 | + 3 20.7 | +0.4 | ..... | 37.5 |
| | 444 | 17 52.5 | 10.3 | 28.6 | | 13 55.9 | — 5 19.5 | +0.3 | ..... | 36.7 |
| | 453 | 9 23.7 | 29.4 | 9.8 | | | | | | |
| | 487 | 16 73.0 | 17.1 | 21.5 | | | | | | |
| | 513 | 1 81.9 | 23.7 | 15.5 | | 18 12.3 | — 9 34.8 | +0.9 | ..... | 38.4 |
| | 540 | 6 79.2 | 23.4 | 15.7 | | | | | | |
| | 576 | 14 64.3 | 19.7 | 20.0 | | 03 32.3 | + 5 02.6 | +1.7 | ..... | 36.6 |
| | 600 | 7 11.9 | ..... | 41.9 | | | | | | |
| | 629 | 9 83.0 | 43.9 | ..... |  | 06 45.2 | + 1 44.5 | +0.9 | ..... | (30.6) |
| | 647 | 16 89.2 | 19.9 | 19.7 | | 04 49.5 | + 3 49.8 | —0.9 | ..... | 38.4 |
| | 658 | 10 93.0 | 18.0 | 21.9 | | | | | | |
| | 666 | 5 71.0 | 22.0 | 17.9 | | 11 59.5 | — 3 21.2 | 0.0 | ..... | 38.3 |
| | 691 | 7 77.0 | 26.8 | 13.0 | | | | | | |
| | 715 | 10 81.2 | 14.0 | 26.2 | | 10 34.0 | — 1 57.3 | +0.4 | ..... | 37.1 |
| | 731 | 4 31.1 | 13.8 | 26.8 | | 06 24.6 | + 2 13.3 | +0.2 | ..... | 38.1 |
| Sept. 27 | 7706 | 7 90.4 | 15.0 | 21.5 | | | | | | |
| | 7749 | 9 45.0 | 17.2 | 19.8 | | 09 38.1 | — 0 59.6 | —2.1 | ..... | 36.4 |
| | 7789 | 12 62.0 | 10.8 | 26.4 | | | | | | |
| | 7807 | 7 61.9 | 21.3 | 16.1 | | 11 52.2 | — 3 12.8 | —2.4 | ..... | 37.0 |
| | 7824 | 15 59.3 | —0.2 | 37.0 | | | | | | |
| | 7843 | 3 10.0 | 35.5 | 1.7 | | 16 38.3 | — 8 01.6 | —0.8 | ..... | 35.9 |
| | 7856 | 3 66.9 | 13.8 | 22.9 | | | | | | |
| | 7902 | 14 55.1 | 17.8 | 20.0 | | 15 38.6 | — 6 59.5 | —2.6 | ..... | 36.5 |
| | 7917 | 15 05.6 | 19.7 | 17.8 | | | | | | |
| | 7932 | 4 26.5 | 12.0 | 25.3 | | 01 44.2 | + 6 56.0 | —2.6 | ..... | 37.6 |
| | 7962 | 10 26.3 | 12.0 | 26.6 | | 05 34.9 | + 3 04.8 | —2.9 | ..... | 36.8 |
| | 7972 | 8 23.8 | 14.0 | 23.8 | | | | | | |
| | 7984 | 4 91.7 | 15.9 | 22.0 | | 10 46.6 | — 2 03.0 | —3.7 | ..... | 34.9 |
| | 7994 | —0 91.2 | 21.0 | 17.2 | 30 ^s p. m. | | | | | |
| | 8023 | 13 24.0 | 10.7 | 28.0 | | 17 44.9 | — 9 05.7 | —3.1 | +0.1 | 36.2 |
| | 8106 | 11 97.0 | 26.2 | 12.5 | Changed incli- nation. | 08 17.0 | + 0 17.0 | +1.3 | ..... | 35.3 |
| | 8173 | 2 15.6 | 24.6 | 14.0 | | 02 01.0 | + 6 35.3 | +0.5 | ..... | 36.8 |
| | 8182 | 12 41.0 | 15.0 | 23.3 | | | | | | |
| | 8195 | 11 76.1 | 17.7 | 19.9 | | | | | | |
| | 8223 | 11 83.2 | 20.0 | 17.7 | | 08 37.3 | — 0 02.7 | 0.0 | ..... | 34.6 |
| | 8237 | 7 31.0 | 17.9 | 20.0 | | 41 05 44.6 | + 2 51.6 | —1.0 | ..... | 41 08 35.2 |

Observations and computations—Continued.

SIDNEY BARRACKS, NEBRASKA.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|-------------------|--------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|----------|----------|--------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1874. Sept. 27 | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | <i>° ' "</i> | <i>' "</i> | <i>"</i> | <i>"</i> | <i>° ' "</i> |
| | 8268 | 7 03.2 | 13.8 | 23.7 | | 41 12 03.4 | — 3 28.2 | +2.1 | ..... | 41 08 37.3 |
| | 8282 | 21 64.8 | 11.3 | 26.4 | | 21 26.3 | —12 51.7 | +0.9 | ..... | 35.5 |
| | 8324 | 1 63.1 | 25.6 | 9.7 | | | | | | |
| | 16 | 16 88.0 | 11.1 | 27.3 | | | | | | |
| | 67 | —0 21.6 | 31.0 | 7.9 | | 19 33.1 | —10 59.1 | +1.6 | ..... | 35.6 |
| | 100 | 12 08.0 | 22.9 | 15.9 | | 14 14.2 | — 5 39.2 | +2.1 | ..... | 37.1 |
| | 152 | 16 54.0 | 20.2 | 18.5 | | 17 06.1 | — 8 31.1 | +0.9 | ..... | 35.9 |
| | 173 | 3 28.2 | 20.5 | 18.3 | | | | | | |
| | 215 | 13 41.1 | 23.3 | 14.9 | | | | | | |
| | 254 | 4 24.1 | 15.0 | 23.6 | | 02 44.3 | + 5 53.5 | 0.0 | ..... | 37.8 |
| | 283 | 13 44.4 | 15.7 | 22.9 | | | | | | |
| | 337 | 4 12.2 | 20.8 | 18.0 | | 02 38.1 | + 5 59.4 | —1.0 | ..... | 36.5 |
| | 368 | 4 36.9 | 18.2 | 19.8 | | | | | | |
| | 387 | 14 10.3 | 19.9 | 19.0 | | 14 51.5 | — 6 15.3 | —0.2 | ..... | 36.0 |
| | 412 | 3 53.0 | 15.1 | 22.4 | | 05 16.6 | + 3 19.3 | +2.0 | ..... | 37.9 |
| | 444 | 17 04.6 | 13.4 | 24.5 | | 13 56.1 | — 5 21.7 | +1.1 | ..... | 35.5 |
| | 453 | 8 70.0 | 27.0 | 11.2 | | | | | | |
| | 487 | 16 23.9 | 20.1 | 17.8 | | | | | | |
| | 516 | 1 26.2 | 20.0 | 18.1 | | 18 12.5 | — 9 37.4 | +1.0 | ..... | 36.1 |
| | 540 | 4 98.0 | 12.1 | 25.6 | | | | | | |
| | 576 | 12 85.3 | 28.8 | 9.0 | | 41 03 32.5 | + 5 03.5 | +1.5 | ..... | 41 08 37.5 |

NOTE.—The observations on pairs 600 and 629 were excluded in obtaining the mean.

ASTRONOMICAL CO-ORDINATES OF STATION AT SIDNEY BARRACKS, NEBRASKA.

Longitude.. $6^h 51^m 52^s.888 \pm 0^s.030$ or $102^\circ 58' 13''.32 \pm 0''.45$ west from Greenwich.

Longitude.. $1^h 43^m 40^s.768$ or $25^\circ 55' 11''.52$ west from U. S. Naval Observatory, Washington, D. C.

Latitude..... $41^\circ 08' 36''.75 \pm 0''.05$ north.

The latitude was obtained by taking the separate results given by each pair, and thus securing twenty-eight individual results. Cf. report on Colorado Springs, p. 78.

U. S. GEOGRAPHICAL SURVEYS WEST OF THE ONE HUNDREDTH MERIDIAN,
1ST LIEUT. GEO. M. WHEELER, CORPS OF ENGINEERS, U. S. ARMY, IN CHARGE.

RESULTS

OF

OBSERVATIONS MADE BY DR. F. KAMPF AND JOHN H. CLARK IN THE
DETERMINATION OF THE ASTRONOMICAL CO-ORDINATES
OF JULESBURG, COLORADO.

SEASON OF 1874.

COMPUTATIONS BY

DR. F. KAMPF.

JULESBURG, COLORADO.

GEOGRAPHICAL POSITION OF STATION.

Longitude, $102^{\circ} 21' 32''.30 \pm 0''.43$ west from Greenwich.

Latitude, $40^{\circ} 59' 07''.63 \pm 0''.04$ north.

Altitude of observatory above sea-level (from railroad surveys), 3,500.0 feet.

The astronomical station was established at a distance of about 45 feet from the side-track of the Union Pacific Railroad, and 27 feet from the southwest corner of the warehouse belonging to the same.

About twenty-five years ago the settlement of Julesburg was of considerable size, but, the town being attacked and destroyed by the Indians in 1852, the greater part of its population removed to Sidney and North Platte. At the time of the occupation of this station there were but five houses in the place, and three of these were the property of the railroad company.

The surrounding country is level, except in the southeast, where, four miles away, the plains are broken by hills. At a distance of two miles the Platte River flows by in an easterly direction. On its banks some efforts at agriculture have been made, but with very little success.

METEOROLOGICAL CONDITIONS.

During the time of occupation the weather was fair, with the exception of two days, when it rained. In general the air was calm until 10 o'clock in the evening, when the atmosphere began to grow undulatory, and after 12 o'clock, midnight, it became so hazy that stars of the sixth magnitude were invisible.

For description of observatory and instruments, *personnel* of party, name of computer, and other information omitted here, the reader may consult the report on the Las Vegas station, which possessed many circumstances of observation in common with this.

The use of the Atlantic and Pacific Telegraph line was kindly granted by the superintendent at Omaha, and over this route exchanges for time were made with Ogden on October 7, 8, 9, 10, and 11. The latitude was determined by observations on the nights of October 9, 10, and 11.

The length of circuit was 650 miles. For the transmission of signals the local battery in the office at Julesburg was employed, and this was assisted by a repeater at Cheyenne.

Tabulation of stars used for determination of time at Julesburg, Colorado, and Ogden, Utah, 1874.

| | | JULESBURG. | | | | OGDEN. | | | | | | JULESBURG. | | | | OGDEN. | | | | | | | |
|--------------------------|-----------------|------------|------------|------------|-------------|-------------|------------|------------|------------|-------------|-------------|---------------|-------------------------|------------|------------|------------|-------------|-------------|------------|------------|------------|-------------|-------------|
| Name of star. | | October 7. | October 8. | October 9. | October 10. | October 11. | October 7. | October 8. | October 9. | October 10. | October 11. | Name of star. | | October 7. | October 8. | October 9. | October 10. | October 11. | October 7. | October 8. | October 9. | October 10. | October 11. |
| <i>a</i> | Lyræ..... | | | | | | X | X | X | X | X | <i>β</i> | Delphini..... | X | | | | | | | | | |
| 42 | Lyræ..... | | | | | | X | X | X | X | X | <i>a</i> | Delphini..... | | | X | X | | | | | | |
| <i>β</i> | Lyræ..... | | | | | | X | X | X | X | X | <i>a</i> | Cygni..... | | | X | | | | | | | |
| 50 | Draconis..... | | | | | | X | X | X | X | X | <i>β</i> | Aquarii..... | | | | | | | | | | |
| <i>γ</i> | Lyræ..... | | | | | | X | X | X | X | X | <i>β</i> | Cephei..... | | | | | X | X | | | | |
| <i>ζ</i> | Aquilæ..... | | | | | | X | X | X | X | X | <i>ξ</i> | Aquarii..... | | | X | | | X | X | | X | X |
| <i>ι</i> | Lyræ..... | | | | | | X | X | X | X | X | <i>ε</i> | Pegasi..... | | | X | | | X | X | | X | X |
| <i>d</i> | Sagittarii..... | | | | | | X | X | X | X | X | 11 | Cephei..... | | | X | | | X | X | | X | X |
| <i>δ</i> | Draconis..... | | | | | | X | X | X | X | X | <i>μ</i> | Capricorni..... | | | X | | | X | X | | X | X |
| <i>τ</i> | Draconis..... | | | | | | X | X | X | X | X | 79 | Draconis..... | | | X | | | X | X | | X | X |
| <i>δ</i> | Aquilæ..... | X | | | | | | | | | | <i>a</i> | Aquarii..... | | | | | | X | X | | X | X |
| <i>ι</i> | Cygni..... | X | | | | | | | | | | <i>ζ</i> | Cephei..... | | | | | | X | X | | X | X |
| <i>β</i> | Cygni..... | X | | | | | X | X | X | X | X | 32 | Ursæ Majoris, L. C..... | | | | | X | | | | X | |
| <i>κ</i> | Aquilæ..... | X | | | | | X | X | X | X | X | <i>θ</i> | Aquarii..... | | | | | | X | X | | X | X |
| <i>θ</i> | Cygni..... | | | | | | | | | | | <i>γ</i> | Aquarii..... | | | | | | X | X | | X | X |
| <i>γ</i> | Aquilæ..... | X | X | X | X | X | X | X | X | X | X | <i>π</i> | Aquarii..... | | | | | | X | X | | X | X |
| <i>a</i> | Aquilæ..... | X | X | X | X | X | X | X | X | X | X | 9 | Draconis, L. C..... | | | | | | X | | | X | X |
| <i>ε</i> | Draconis..... | X | X | X | X | X | X | X | X | X | X | 226 | Cephei..... | | | | | | | | | X | X |
| <i>ψ</i> | Cygni..... | X | X | X | X | X | | | | | | <i>ζ</i> | Pegasi..... | | | | | | X | X | | X | X |
| <i>τ</i> | Aquilæ..... | | | | | | | | | | | <i>η</i> | Pegasi..... | | | | | | X | X | | X | X |
| <i>θ</i> | Aquilæ..... | X | X | X | X | X | | | | | | <i>λ</i> | Pegasi..... | | | | | | X | X | | X | X |
| 31 <i>o</i> ¹ | Cygni..... | X | X | X | X | X | | | | | | <i>ι</i> | Cephei..... | | | | | | X | X | | X | X |
| <i>κ</i> | Cephei..... | X | X | X | X | X | | | | | | <i>o</i> | Andromedæ..... | | | | | | | X | | | |
| <i>γ</i> | Cygni..... | X | X | X | X | X | | | | | | <i>γ</i> | Pegasi..... | | | | | | | X | | | |
| <i>π</i> | Capricorni..... | X | X | X | X | X | | | | | | <i>π</i> | Cephei..... | | | | | | | X | | | |
| <i>θ</i> | Cephei..... | X | X | X | X | X | | | | | | <i>v</i> | Pegasi..... | | | | | | | | | | X |

TIME DETERMINATIONS.

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Observations and reductions for time taken at sending station.

JULESBURG, COLORADO, OCTOBER 7, 1874.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|-----------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | δ Aquilæ | 19 15 20.58 | + 3.32 | 0.00 | + 0.20 | 19 15 24.10 | 19 19 10.55 | + 3 46.45 |
| E. | ι Cygni | 22 47.58 | — 1.55 | — 0.03 | + 0.32 | 22 46.32 | 26 32.55 | 46.23 |
| E. | κ Aquilæ | 26 18.06 | + 4.01 | — 0.03 | + 0.20 | 26 22.24 | 30 08.81 | 46.57 |
| E. | γ Aquilæ | 36 28.50 | + 2.78 | — 0.05 | + 0.20 | 36 31.43 | 40 18.02 | 46.59 |
| E. | α Aquilæ | 40 50.42 | + 2.89 | — 0.03 | + 0.20 | 40 53.48 | 44 40.05 | 46.57 |
| E. | ε Draconis | 44 55.52 | — 7.54 | — 0.05 | + 0.58 | 44 48.51 | 48 35.16 | 46.65 |
| E. | ψ Cygni | 48 38.30 | — 1.66 | 0.00 | + 0.33 | 48 36.97 | 52 23.32 | 46.35 |
| W. | θ Aquilæ | 20 01 00.60 | + 3.58 | — 0.11 | — 0.20 | 20 01 03.87 | 20 04 50.37 | 46.50 |
| W. | 31 ^o Cygni | 05 55.92 | — 0.75 | — 0.22 | — 0.29 | 05 54.66 | 09 41.17 | 46.51 |
| W. | κ Cephei | 09 34.12 | — 14.45 | — 0.55 | — 0.91 | 09 18.21 | 13 04.70 | 46.49 |
| W. | γ Cygni | 13 57.64 | + 0.16 | — 0.19 | — 0.26 | 13 57.35 | 17 43.94 | 46.59 |
| W. | π Capricorni | 16 18.06 | + 4.87 | — 0.08 | — 0.21 | 16 22.64 | 20 09.03 | 46.39 |
| W. | θ Cephei | 23 47.38 | — 4.28 | — 0.34 | — 0.43 | 23 42.33 | 27 28.76 | 46.43 |
| W. | β Delphini | 20 27 51.84 | + 2.51 | — 0.18 | — 0.21 | 20 27 53.96 | 20 31 40.46 | + 3 46.50 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= +13.77 + 14.00 \delta t - 1.14 a - 2.38 c & a &= + 5^s.350 \\
 0 &= -72.68 - 1.14 \delta t + 13.12 a + 9.48 c & c &= + 0^s.200 \\
 0 &= -62.02 - 2.38 \delta t + 9.48 a + 50.30 c
 \end{aligned}$$

JULESBURG, COLORADO, OCTOBER 8, 1874.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|--------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | β Cephei | 21 23 18.20 | — 0.84 | — 0.43 | — 0.48 | 21 23 16.45 | 21 27 02.90 | + 3 46.45 |
| W. | ξ Aquarii | 27 18.59 | + 0.46 | — 0.11 | — 0.16 | 27 18.78 | 31 05.30 | 46.52 |
| W. | ε Pegasi | 34 15.74 | + 0.31 | — 0.15 | — 0.16 | 34 15.74 | 38 02.37 | 46.63 |
| W. | 11 Cephei | 36 21.03 | — 0.89 | — 0.45 | — 0.49 | 36 19.25 | 40 05.73 | 46.48 |
| E. | μ Capricorni | 21 42 41.42 | + 0.50 | — 0.10 | + 0.17 | 21 42 41.99 | 21 46 28.42 | + 3 46.43 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= +0.95 + 5.00 \delta t - 0.77 a & a &= + 0^s.591 \\
 0 &= -3.54 - 0.77 \delta t + 5.86 a \\
 &\text{Adopted } \sigma + 0^s.163
 \end{aligned}$$

Observations and reductions for time taken at sending station—Continued.

JULESBURG, COLORADO, OCTOBER 9, 1874.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|-----------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | γ Aquilæ..... | 19 36 31.56 | + 0.27 | — 0.10 | + 0.12 | 19 36 31.85 | 19 40 17.99 | + 3 46.14 |
| E. | α Aquilæ..... | 40 53.56 | + 0.28 | — 0.13 | + 0.12 | 40 53.83 | 44 40.02 | 46.19 |
| E. | ε Draconis..... | 44 49.82 | — 8.74 | — 0.49 | + 0.35 | 44 48.94 | 48 35.04 | 46.10 |
| E. | ψ Cygni..... | 48 37.44 | — 0.16 | — 0.35 | + 0.20 | 48 37.13 | 52 23.25 | 46.12 |
| E. | τ Aquilæ..... | 54 14.70 | + 0.29 | — 0.21 | + 0.12 | 54 14.90 | 58 01.06 | 46.16 |
| E. | θ Aquilæ..... | 20 01 03.90 | + 0.35 | — 0.19 | + 0.12 | 20 01 04.18 | 20 04 50.34 | 46.16 |
| W. | 31σ ¹ Cygni..... | 05 55.38 | — 0.07 | — 0.13 | — 0.18 | 05 55.00 | 09 41.11 | 46.11 |
| W. | γ Cygni..... | 13 58.12 | + 0.01 | — 0.16 | — 0.16 | 13 57.81 | 17 43.89 | 46.08 |
| W. | π Capricorni..... | 16 22.66 | + 0.47 | — 0.07 | — 0.13 | 16 22.93 | 20 09.00 | 46.07 |
| W. | θ Cephei..... | 23 43.52 | — 0.42 | — 0.34 | — 0.26 | 23 42.50 | 27 28.67 | 46.17 |
| W. | α Delphini..... | 30 03.16 | + 0.24 | — 0.18 | — 0.12 | 30 03.10 | 33 49.21 | 46.11 |
| W. | α Cygni..... | 20 33 24.04 | — 0.05 | — 0.30 | — 0.17 | 20 33 23.52 | 20 37 09.71 | + 3 46.19 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= +0.32 + 12.00 \delta t + 0.93 a + 0.16 c & a &= +0^{\text{s}}.525 \\
 0 &= -2.41 + 0.93 \delta t + 5.10 a - 1.70 c & c &= +0^{\text{s}}.121 \\
 0 &= -2.48 + 0.16 \delta t - 1.70 a + 27.96 c
 \end{aligned}$$

JULESBURG, COLORADO, OCTOBER 10, 1874.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|-----------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | β Cygni..... | 19 21 53.36 | + 0.28 | — 0.11 | + 0.18 | 19 21 53.71 | 19 25 39.84 | + 3 46.13 |
| E. | κ Aquilæ..... | 26 22.02 | + 0.81 | — 0.12 | + 0.16 | 26 22.87 | 30 08.76 | 45.89 |
| E. | θ Cygni..... | 29 18.90 | — 0.26 | — 0.38 | + 0.25 | 29 18.51 | 33 04.56 | 46.05 |
| E. | γ Aquilæ..... | 36 31.56 | + 0.56 | — 0.26 | + 0.16 | 36 32.02 | 40 17.97 | 45.95 |
| E. | α Aquilæ..... | 40 53.56 | + 0.59 | — 0.29 | + 0.16 | 40 54.02 | 44 40.00 | 45.98 |
| E. | ε Draconis..... | 44 50.84 | — 1.53 | — 0.97 | + 0.47 | 44 48.81 | 48 34.97 | 46.16 |
| E. | ψ Cygni..... | 48 37.92 | — 0.34 | — 0.67 | + 0.26 | 48 37.17 | 52 23.22 | 46.05 |
| W. | θ Aquilæ..... | 20 01 03.92 | + 0.73 | — 0.11 | — 0.16 | 20 01 04.38 | 20 04 50.32 | 45.94 |
| W. | 31σ ¹ Cygni..... | 05 55.68 | — 0.15 | — 0.22 | — 0.23 | 05 55.08 | 09 41.09 | 46.01 |
| W. | κ Cephei..... | 09 22.74 | — 2.93 | — 0.51 | — 0.73 | 09 18.57 | 13 04.40 | 45.83 |
| W. | γ Cygni..... | 13 58.16 | + 0.03 | — 0.17 | — 0.21 | 13 57.81 | 17 43.87 | 46.06 |
| W. | π Capricorni..... | 16 22.16 | + 0.99 | — 0.06 | — 0.17 | 16 22.92 | 20 08.98 | 46.06 |
| W. | θ Cephei..... | 23 43.90 | — 0.87 | — 0.12 | — 0.35 | 23 42.56 | 27 28.62 | 46.06 |
| W. | β Delphini..... | 20 27 54.22 | + 0.51 | 0.00 | — 0.16 | 20 27 54.57 | 20 31 40.41 | + 3 45.84 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= +3.34 + 14.00 \delta t - 1.45 a - 2.30 c & a &= +1^{\text{s}}.085 \\
 0 &= -15.50 - 1.45 \delta t + 12.79 a + 9.24 c & c &= +0^{\text{s}}.160 \\
 0 &= -18.34 - 2.30 \delta t + 9.24 a + 50.42 c
 \end{aligned}$$

Observations and reductions for time taken at sending station—Continued.

JULESBURG, COLORADO, OCTOBER 11, 1874.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------------------|-----------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. κ | Aquilæ..... | 19 26 22.08 | + 0.53 | 0.00 | + 0.17 | 19 26 22.78 | 19 30 08.75 | + 3 45.97 |
| E. θ | Cygni..... | 29 18.58 | — 0.17 | — 0.15 | + 0.26 | 29 18.52 | 33 14.52 | 46.00 |
| E. γ | Aquilæ..... | 36 31.58 | + 0.37 | — 0.09 | + 0.17 | 36 32.03 | 40 17.95 | 45.92 |
| E. α | Aquilæ..... | 40 53.70 | + 0.39 | — 0.08 | + 0.17 | 40 54.18 | 44 39.99 | 45.81 |
| E. ε | Draconis..... | 44 49.74 | — 1.01 | — 0.26 | + 0.50 | 44 48.97 | 48 34.90 | 45.93 |
| E. ψ | Cygni..... | 48 37.20 | — 0.22 | — 0.16 | + 0.28 | 48 37.10 | 52 23.18 | 46.08 |
| E. τ | Aquilæ..... | 54 14.70 | + 0.40 | — 0.08 | + 0.17 | 54 15.19 | 58 01.03 | 45.84 |
| W. θ | Aquilæ..... | 20 01 04.18 | + 0.48 | — 0.14 | — 0.17 | 20 01 04.35 | 20 04 50.31 | 45.96 |
| W. 31 ^o | Cygni..... | 05 55.78 | — 0.10 | — 0.28 | — 0.25 | 05 55.15 | 09 41.06 | 45.91 |
| W. κ | Cephei..... | 09 21.86 | — 1.93 | — 0.73 | — 0.78 | 09 18.42 | 13 04.29 | 45.87 |
| W. γ | Cygni..... | 13 58.32 | + 0.02 | — 0.27 | — 0.22 | 13 57.85 | 17 43.85 | 46.00 |
| W. π | Capricorni..... | 16 22.66 | + 0.65 | — 0.11 | — 0.18 | 16 23.02 | 20 08.97 | 45.95 |
| W. θ | Cephei..... | 23 43.86 | — 0.57 | — 0.46 | — 0.37 | 23 42.46 | 27 28.57 | 46.11 |
| W. β | Delphini..... | 20 27 54.46 | + 0.34 | — 0.20 | — 0.17 | 20 27 54.43 | 20 31 40.39 | + 3 45.96 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= + 4.73 + 14.00 \delta t - 1.15 a - 2.42 c & a &= + 0^s.713 \\
 0 &= - 11.18 - 1.15 \delta t + 13.03 a + 9.52 c & c &= + 0^s.170 \\
 0 &= - 15.88 - 2.42 \delta t + 9.52 a + 50.16 c
 \end{aligned}$$

Observations and reductions for time taken at receiving station.

OGDEN, UTAH, OCTOBER 7, 1874.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|---------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | <i>α</i> Lyræ | 18 38 41.09 | — 0.10 | + 0.08 | — 0.06 | 18 38 41.01 | 18 32 41.28 | — 5 59.73 |
| W. | 42 Lyræ | 46 10.64 | — 0.08 | + 0.09 | — 0.06 | 46 10.59 | 40 10.79 | 59.80 |
| W. | <i>β</i> Lyræ | 51 26.78 | — 0.27 | + 0.08 | — 0.06 | 51 26.53 | 45 26.81 | 59.72 |
| W. | 50 Draconis | 55 19.94 | + 3.50 | + 0.19 | — 0.19 | 55 23.44 | 49 23.62 | 59.82 |
| W. | <i>γ</i> Lyræ | 19 00 15.02 | — 0.29 | + 0.07 | — 0.06 | 19 00 14.74 | 54 15.06 | 59.68 |
| W. | <i>ζ</i> Aquilæ | 05 39.34 | — 0.76 | + 0.06 | — 0.05 | 05 38.59 | 59 38.64 | 59.95 |
| E. | <i>δ</i> Sagittarii | 16 19.08 | — 1.46 | + 0.09 | + 0.05 | 16 17.76 | 19 10 17.90 | 59.86 |
| E. | <i>δ</i> Draconis | 18 28.28 | + 1.83 | + 0.42 | + 0.13 | 18 30.66 | 12 30.97 | 59.69 |
| E. | <i>τ</i> Draconis | 23 52.97 | + 2.89 | + 0.46 | + 0.17 | 23 56.49 | 17 56.79 | 59.70 |
| E. | <i>β</i> Cygni | 31 39.84 | — 0.43 | + 0.15 | + 0.06 | 31 39.66 | 25 39.90 | 59.76 |
| E. | <i>κ</i> Aquilæ | 36 09.56 | — 1.21 | + 0.09 | + 0.05 | 36 08.49 | 30 08.81 | 59.68 |
| E. | <i>γ</i> Aquilæ | 46 18.51 | — 0.82 | + 0.10 | + 0.05 | 46 17.84 | 40 18.02 | 59.82 |
| E. | <i>α</i> Aquilæ | 50 40.61 | — 0.86 | + 0.08 | + 0.05 | 50 39.88 | 44 40.05 | 59.83 |
| E. | <i>ε</i> Draconis | 19 54 32.55 | + 2.23 | + 0.23 | + 0.14 | 19 54 35.15 | 19 48 35.17 | — 5 59.98 |
| E. | <i>β</i> Aquarii | 21 30 58.93 | — 1.26 | — 0.16 | + 0.08 | 21 30 57.59 | 21 24 58.17 | — 5 59.42 |
| E. | <i>β</i> Cephei | 33 00.96 | + 2.40 | — 0.62 | + 0.22 | 33 02.96 | 27 02.95 | 60.01 |
| E. | <i>ξ</i> Aquarii | 37 06.11 | — 1.31 | — 0.16 | + 0.08 | 37 04.72 | 31 05.31 | 59.41 |
| E. | <i>ε</i> Pegasi | 44 02.80 | — 0.92 | — 0.22 | + 0.08 | 44 01.74 | 38 02.36 | 59.38 |
| E. | 11 Cephei | 46 03.30 | + 2.53 | — 0.71 | + 0.23 | 46 05.35 | 40 05.78 | 59.57 |
| E. | <i>μ</i> Capricorni | 51 29.54 | — 1.45 | — 0.17 | + 0.08 | 51 28.00 | 45 28.43 | 59.57 |
| W. | 79 Draconis | 57 17.42 | + 3.10 | — 0.93 | — 0.26 | 57 19.33 | 51 19.64 | 59.69 |
| W. | <i>α</i> Aquarii | 22 05 22.69 | — 1.14 | — 0.23 | — 0.07 | 22 05 21.25 | 59 21.42 | 59.83 |
| W. | <i>ζ</i> Cephei | 12 30.58 | + 0.88 | — 0.54 | — 0.14 | 12 30.78 | 22 06 31.15 | 59.63 |
| W. | 32 Ursæ Maj., L. C.. | 14 56.49 | — 3.96 | + 0.22 | + 0.18 | 14 52.93 | 08 53.15 | 59.78 |
| W. | <i>γ</i> Aquarii | 21 12.91 | — 1.16 | — 0.23 | — 0.07 | 21 11.45 | 15 11.64 | 59.81 |
| W. | <i>π</i> Aquarii | 24 54.59 | — 1.10 | — 0.24 | — 0.08 | 24 53.17 | 18 53.28 | 59.89 |
| W. | 9 Draconis, L. C... | 22 30 26.18 | — 6.40 | + 0.65 | + 0.32 | 22 30 20.75 | 22 24 20.98 | — 5 59.77 |

NORMAL EQUATIONS.

First series.

$$\begin{aligned}
 0 &= + 6.63 + 14.00 \delta t - 2.62 a + 4.25 c & a &= - 1^s.590 \\
 0 &= + 19.99 - 2.62 \delta t + 13.79 a - 2.60 c & c &= + 0^s.049 \\
 0 &= - 3.50 + 4.25 \delta t - 2.60 a + 55.09 c
 \end{aligned}$$

Second series.

$$\begin{aligned}
 0 &= + 4.89 + 13.00 \delta t + 5.75 a + 8.40 c & a &= - 1^s.701 \\
 0 &= + 48.96 + 5.75 \delta t + 30.84 a + 21.17 c & c &= + 0^s.076 \\
 0 &= + 28.37 + 8.40 \delta t + 21.17 a + 64.10 c
 \end{aligned}$$

Observations and reductions for time taken at receiving station—Continued.

OGDEN, UTAH, OCTOBER 8, 1874.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|-------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | <i>α</i> Lyræ | 18 38 42.23 | + 0.02 | — 0.06 | — 0.09 | 18 38 42.10 | 18 32 41.25 | — 6 00.85 |
| W. | <i>β</i> Lyræ | 51 27.67 | + 0.07 | — 0.09 | — 0.08 | 51 27.57 | 45 26.79 | 00.78 |
| W. | 50 Draconis | 56 25.79 | — 0.85 | — 0.33 | — 0.27 | 56 24.34 | 50 23.53 | 00.81 |
| W. | <i>γ</i> Lyræ | 19 00 15.84 | + 0.07 | — 0.13 | — 0.08 | 19 00 15.70 | 54 15.04 | 00.66 |
| W. | <i>ζ</i> Aquilæ | 05 39.38 | + 0.18 | — 0.12 | — 0.07 | 05 39.37 | 59 38.62 | 00.75 |
| W. | <i>ι</i> Lyræ | 08 50.31 | + 0.04 | — 0.16 | — 0.08 | 08 50.21 | 19 02 49.52 | 00.59 |
| E. | <i>δ</i> Draconis | 18 31.89 | — 0.44 | — 0.07 | + 0.18 | 18 31.56 | 12 30.91 | 00.65 |
| E. | <i>τ</i> Draconis | 23 57.84 | — 0.70 | — 0.09 | + 0.23 | 23 57.28 | 17 56.72 | 00.56 |
| E. | <i>β</i> Cygni | 31 40.37 | + 0.10 | — 0.04 | + 0.08 | 31 40.51 | 25 39.88 | 00.63 |
| E. | <i>κ</i> Aquilæ | 36 09.31 | + 0.29 | — 0.03 | + 0.07 | 36 09.64 | 30 08.79 | 00.85 |
| E. | <i>γ</i> Aquilæ | 46 18.52 | + 0.20 | — 0.03 | + 0.07 | 46 18.76 | 40 18.00 | 00.76 |
| E. | <i>α</i> Aquilæ | 50 40.60 | + 0.21 | — 0.02 | + 0.06 | 50 40.85 | 44 40.03 | 00.82 |
| E. | <i>ε</i> Draconis | 19 54 36.55 | — 0.54 | — 0.08 | + 0.20 | 19 54 36.13 | 19 48 35.10 | — 6 01.03 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -2.13 + 13.00 \delta t - 3.48 a + 3.26 c \\
 0 &= -3.86 - 3.48 \delta t + 12.95 a - 3.65 c \\
 0 &= -3.26 + 3.26 \delta t - 3.65 a + 54.15 c
 \end{aligned}$$

$$\begin{aligned}
 a &= + 0^s.385 \\
 c &= + 0^s.068
 \end{aligned}$$

Observations and reductions for time taken at receiving station—Continued.

OGDEN, UTAH, OCTOBER 9, 1874.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|-------------|------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. <i>a</i> | Lyræ | 18 38 43.87 | + 0.02 | — 0.10 | — 0.12 | 18 38 43.67 | 18 32 41.23 | — 6 02.44 |
| W. <i>β</i> | Lyræ | 51 29.44 | + 0.06 | — 0.10 | — 0.12 | 51 29.28 | 45 26.76 | 02.52 |
| W. 50 | Draconis | 56 27.43 | — 0.73 | — 0.29 | — 0.38 | 56 26.03 | 50 23.43 | 02.60 |
| W. <i>γ</i> | Lyræ | 19 00 17.59 | + 0.06 | — 0.10 | — 0.11 | 19 00 17.44 | 54 15.02 | 02.42 |
| W. <i>ζ</i> | Aquilæ | 05 41.22 | + 0.16 | — 0.09 | — 0.10 | 05 41.19 | 59 38.60 | 02.59 |
| W. <i>ι</i> | Lyræ | 08 52.17 | + 0.04 | — 0.12 | — 0.12 | 08 51.97 | 19 02 49.49 | 02.48 |
| E. <i>d</i> | Sagittarii | 16 20.22 | + 0.30 | — 0.09 | + 0.10 | 16 20.53 | 10 17.87 | 02.66 |
| E. <i>δ</i> | Draconis | 18 33.81 | — 0.38 | — 0.42 | + 0.25 | 18 33.26 | 12 30.85 | 02.41 |
| E. <i>τ</i> | Draconis | 23 59.91 | — 0.60 | — 0.52 | + 0.33 | 23 59.12 | 17 56.63 | 02.49 |
| E. <i>β</i> | Cygni | 31 42.22 | + 0.09 | — 0.19 | + 0.11 | 31 42.23 | 25 39.86 | 02.37 |
| E. <i>κ</i> | Aquilæ | 36 11.22 | + 0.25 | — 0.11 | + 0.10 | 36 11.46 | 30 08.78 | 02.68 |
| E. <i>γ</i> | Aquilæ | 46 20.31 | + 0.17 | — 0.13 | + 0.10 | 46 20.45 | 40 17.99 | 02.46 |
| E. <i>α</i> | Aquilæ | 50 42.39 | + 0.18 | — 0.13 | + 0.10 | 50 42.54 | 44 40.02 | 02.52 |
| E. <i>ε</i> | Draconis | 19 54 38.31 | — 0.46 | — 0.40 | + 0.28 | 19 54 37.73 | 19 48 35.04 | — 6 02.69 |
| E. <i>β</i> | Cephei | 21 33 05.40 | — 0.40 | + 0.17 | + 0.22 | 21 33 05.39 | 21 27 02.85 | — 6 02.54 |
| E. <i>ξ</i> | Aquarii | 37 07.38 | + 0.22 | + 0.03 | + 0.07 | 37 07.70 | 31 05.29 | 02.41 |
| E. <i>ε</i> | Pegasi | 44 04.42 | + 0.16 | + 0.02 | + 0.08 | 44 04.68 | 38 02.34 | 02.34 |
| E. 11 | Cephei | 46 08.13 | — 0.43 | 0.00 | + 0.22 | 46 07.92 | 40 05.68 | 02.24 |
| E. <i>μ</i> | Capricorni | 52 30.50 | + 0.24 | — 0.01 | + 0.08 | 52 30.81 | 46 28.41 | 02.40 |
| E. 79 | Draconis | 57 22.37 | — 0.52 | — 0.09 | + 0.25 | 57 22.01 | 51 19.54 | 02.47 |
| E. <i>α</i> | Aquarii | 22 05 23.53 | + 0.19 | — 0.02 | + 0.08 | 22 05 23.78 | 59 21.40 | 02.38 |
| W. <i>ζ</i> | Cephei | 12 34.78 | — 0.77 | — 0.23 | — 0.14 | 12 33.64 | 22 06 31.09 | 02.55 |
| W. <i>θ</i> | Aquarii | 16 15.52 | + 1.15 | — 0.09 | — 0.08 | 16 16.50 | 10 13.90 | 02.60 |
| W. <i>γ</i> | Aquarii | 21 13.40 | + 1.01 | — 0.09 | — 0.07 | 21 14.25 | 15 11.62 | 02.63 |
| W. <i>π</i> | Aquarii | 24 55.05 | + 0.96 | — 0.10 | — 0.07 | 24 55.84 | 18 53.26 | 02.58 |
| W. 226 | Cephei | 36 12.34 | — 3.27 | — 0.46 | — 0.30 | 36 08.31 | 30 05.70 | 02.61 |
| W. <i>ζ</i> | Pegasi | 41 15.34 | + 0.77 | — 0.13 | — 0.08 | 41 15.90 | 35 13.33 | 02.57 |
| W. <i>η</i> | Pegasi | 43 10.66 | + 0.34 | — 0.17 | — 0.09 | 43 10.74 | 37 08.39 | 02.35 |
| W. <i>λ</i> | Pegasi | 46 32.61 | + 0.49 | — 0.15 | — 0.08 | 46 32.87 | 40 30.36 | 02.51 |
| W. <i>ι</i> | Cephei | 22 51 18.85 | — 1.47 | — 0.33 | — 0.18 | 22 51 16.87 | 22 45 14.40 | — 6 02.47 |

NORMAL EQUATIONS.

First series.

$$\begin{aligned}
 0 &= -0.65 + 14.00 \delta t - 2.56 a + 4.32 c & a &= + 0^s.331 \\
 0 &= -4.12 - 2.56 \delta t + 13.80 a - 2.67 c & c &= + 0^s.096 \\
 0 &= -4.74 + 4.32 \delta t - 2.67 a + 55.27 c
 \end{aligned}$$

Second series.

$$\begin{aligned}
 \text{For E.: } 0 &= + 0.42 + 7.00 \delta t - 1.89 a & a &= + 0^s.287 \\
 &0 = - 2.71 - 1.89 \delta t + 9.57 a \\
 \text{For W.: } 0 &= + 2.96 + 9.00 \delta t - 0.53 a & a &= + 1^s.480 \\
 &0 = -12.04 - 0.53 \delta t + 8.05 a \\
 &\text{Adopted } c = + 0^s.074.
 \end{aligned}$$

Observations and reductions for time taken at receiving station—Continued.

OGDEN, UTAH, OCTOBER 10, 1874.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|---------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | <i>α</i> Lyræ | 18 38 45.65 | + 0.09 | — 0.13 | — 0.12 | 18 38 45.49 | 18 32 41.20 | — 6 04.29 |
| W. | <i>β</i> Lyræ | 51 31.02 | + 0.24 | — 0.16 | — 0.12 | 51 30.98 | 45 26.74 | 04.24 |
| W. | 50 Draconis | 56 31.92 | — 3.16 | — 0.39 | — 0.38 | 56 27.99 | 50 23.33 | 04.66 |
| W. | <i>γ</i> Lyræ | 19 00 19.29 | + 0.26 | — 0.14 | — 0.11 | 19 00 19.30 | 54 15.00 | 04.30 |
| W. | <i>ζ</i> Aquilæ | 05 42.58 | + 0.69 | — 0.13 | — 0.10 | 05 43.04 | 59 38.59 | 04.45 |
| E. | <i>ι</i> Lyræ | 08 53.90 | + 0.16 | — 0.18 | — 0.12 | 08 53.76 | 19 02 49.47 | 04.29 |
| E. | <i>δ</i> Sagittarii | 16 21.06 | + 1.32 | — 0.03 | — 0.10 | 16 22.25 | 10 17.85 | 04.40 |
| E. | <i>δ</i> Draconis | 18 36.53 | — 1.65 | 0.00 | + 0.25 | 18 35.13 | 12 30.79 | 04.34 |
| E. | <i>τ</i> Draconis | 24 03.08 | — 2.62 | + 0.09 | + 0.33 | 24 00.88 | 17 56.55 | 04.33 |
| E. | <i>β</i> Cygni | 31 43.74 | + 0.39 | + 0.03 | + 0.11 | 31 44.27 | 25 39.84 | 04.43 |
| E. | <i>κ</i> Aquilæ | 36 12.22 | + 1.09 | 0.00 | + 0.10 | 36 13.41 | 30 08.76 | 04.65 |
| E. | <i>γ</i> Aquilæ | 46 21.78 | + 0.75 | — 0.02 | + 0.10 | 46 22.61 | 40 17.97 | 04.64 |
| E. | <i>α</i> Aquilæ | 50 43.74 | + 0.78 | — 0.03 | + 0.09 | 50 44.58 | 44 40.00 | 04.58 |
| E. | <i>ε</i> Draconis | 19 54 41.26 | — 2.01 | — 0.10 | + 0.28 | 19 54 39.43 | 19 48 34.97 | — 6 04.46 |
| E. | 32 Ursæ Maj., L. C. | 22 14 55.16 | + 2.97 | — 0.07 | — 0.18 | 22 14 57.88 | 22 08 53.30 | — 6 04.58 |
| E. | <i>γ</i> Aquarii | 21 15.30 | + 0.87 | + 0.05 | + 0.07 | 21 16.29 | 15 11.61 | 04.63 |
| E. | <i>π</i> Aquarii | 24 56.97 | + 0.83 | + 0.03 | + 0.07 | 24 57.90 | 18 53.26 | 04.64 |
| E. | 226 Cephei | 36 12.63 | — 2.82 | + 0.07 | + 0.30 | 36 10.18 | 30 05.64 | 04.54 |
| E. | <i>ζ</i> Pegasi | 41 17.14 | + 0.66 | 0.00 | + 0.08 | 41 17.88 | 35 13.32 | 04.56 |
| E. | <i>η</i> Pegasi | 43 12.49 | + 0.29 | — 0.01 | + 0.09 | 43 12.86 | 37 08.38 | 04.48 |
| E. | <i>λ</i> Pegasi | 46 34.46 | + 0.42 | — 0.02 | + 0.08 | 46 34.94 | 40 30.35 | 04.59 |
| E. | <i>ι</i> Cephei | 51 20.19 | — 1.26 | — 0.04 | + 0.18 | 51 19.07 | 45 14.37 | 04.70 |
| W. | <i>ο</i> Andromedæ | 23 02 14.84 | 0.00 | — 0.19 | — 0.10 | 23 02 14.55 | 56 10.16 | 04.39 |
| W. | <i>γ</i> Pegasi | 04 36.35 | + 0.28 | — 0.13 | — 0.08 | 04 36.42 | 58 31.85 | 04.57 |
| W. | <i>π</i> Cephei | 10 13.33 | — 1.24 | — 0.43 | — 0.28 | 10 01.38 | 23 03 56.79 | 04.59 |
| W. | <i>υ</i> Pegasi | 23 25 13.02 | + 0.20 | — 0.14 | — 0.08 | 23 25 13.00 | 23 19 08.31 | — 6 04.69 |

NORMAL EQUATIONS.

First series.

$$\begin{aligned}
 0 &= + 5.32 + 14.00 \delta t - 2.56 a + 2.20 c & a &= + 1^s.438 \\
 0 &= - 19.72 - 2.56 \delta t + 13.80 a - 4.63 c & c &= + 0^s.097 \\
 0 &= + 1.50 + 2.20 \delta t - 4.63 a + 55.27 c
 \end{aligned}$$

Second series.

$$\begin{aligned}
 \text{For E. : } 0 &= - 1.19 + 8.00 \delta t + 1.54 a & a &= + 1^s.274 \\
 0 &= - 15.91 + 1.54 \delta t + 12.60 a \\
 \text{For W. : } 0 &= + 0.20 + 4.00 \delta t - 1.29 a & a &= + 0^s.595 \\
 0 &= - 2.62 - 1.29 \delta t + 4.71 a \\
 \text{Adopted } c &= + 0^s.074
 \end{aligned}$$

Observations and reductions for time taken at receiving station—Continued.

OGDEN, UTAH, OCTOBER 11, 1874.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|---------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| W. | <i>a</i> Lyræ | 18 38 48.03 | + 0.03 | — 0.24 | — 0.08 | 18 38 47.74 | 18 32 41.18 | — 6 06.56 |
| W. | <i>β</i> Lyræ | 51 33.60 | + 0.08 | — 0.23 | — 0.07 | 51 33.38 | 45 26.71 | 06.67 |
| W. | 50 Draconis | 56 32.19 | — 1.02 | — 0.58 | — 0.23 | 56 30.39 | 50 23.24 | 07.15 |
| W. | <i>γ</i> Lyræ | 19 00 21.81 | + 0.08 | — 0.18 | — 0.07 | 19 00 21.64 | 54 14.97 | 06.67 |
| W. | <i>ζ</i> Aquilæ | 05 45.42 | + 0.22 | — 0.14 | — 0.06 | 05 45.44 | 59 38.57 | 06.87 |
| W. | <i>ι</i> Lyræ | 08 56.43 | + 0.05 | — 0.18 | — 0.07 | 08 56.23 | 19 02 49.44 | 06.79 |
| E. | <i>d</i> Sagittarii | 16 24.39 | + 0.43 | — 0.01 | + 0.06 | 16 24.87 | 10 17.83 | 07.04 |
| E. | <i>δ</i> Draconis | 18 37.81 | — 0.53 | — 0.05 | + 0.16 | 18 37.39 | 12 30.73 | 06.66 |
| E. | <i>τ</i> Draconis | 24 03.88 | — 0.85 | — 0.06 | + 0.20 | 24 03.17 | 17 56.46 | 06.71 |
| E. | <i>β</i> Cygni | 31 46.54 | + 0.13 | — 0.01 | + 0.07 | 31 46.73 | 25 39.82 | 06.91 |
| E. | <i>κ</i> Aquilæ | 36 15.38 | + 0.35 | 0.00 | + 0.06 | 36 15.79 | 30 08.75 | 07.04 |
| E. | <i>γ</i> Aquilæ | 46 24.63 | + 0.24 | 0.00 | + 0.06 | 46 24.93 | 40 17.96 | 06.97 |
| E. | <i>α</i> Aquilæ | 50 46.75 | + 0.25 | 0.00 | + 0.06 | 50 47.06 | 44 39.99 | 07.07 |
| E. | <i>e</i> Draconis | 19 54 42.43 | — 0.65 | 0.00 | + 0.18 | 19 54 41.96 | 19 48 34.90 | — 6 07.06 |
| E. | <i>β</i> Cephei | 21 33 09.78 | — 0.45 | + 0.28 | + 0.22 | 21 33 09.83 | 21 27 02.74 | — 6 07.09 |
| E. | <i>ξ</i> Aquarii | 37 11.86 | + 0.25 | + 0.06 | + 0.08 | 37 12.25 | 31 05.27 | 06.98 |
| E. | <i>e</i> Pegasi | 44 08.88 | + 0.17 | + 0.06 | + 0.07 | 44 09.18 | 38 02.32 | 06.86 |
| E. | 11 Cephei | 46 12.36 | — 0.48 | + 0.18 | + 0.22 | 46 12.28 | 40 05.57 | 06.71 |
| E. | <i>μ</i> Capricorni | 52 34.96 | + 0.27 | + 0.03 | + 0.08 | 52 35.34 | 46 28.39 | 06.95 |
| E. | 79 Draconis | 57 26.66 | — 0.58 | + 0.12 | + 0.25 | 57 26.45 | 51 19.43 | 07.02 |
| E. | <i>α</i> Aquarii | 22 05 28.01 | + 0.22 | + 0.03 | + 0.07 | 22 05 28.33 | 59 21.38 | 06.95 |
| W. | <i>ζ</i> Cephei | 12 37.73 | + 0.47 | — 0.16 | — 0.14 | 12 37.90 | 22 06 31.02 | 06.88 |
| W. | <i>θ</i> Aquarii | 16 21.65 | — 0.70 | — 0.06 | — 0.08 | 16 20.81 | 10 13.89 | 06.92 |
| W. | <i>γ</i> Aquarii | 21 19.22 | — 0.61 | — 0.07 | — 0.07 | 21 18.47 | 15 11.60 | 06.87 |
| W. | <i>π</i> Aquarii | 25 00.80 | — 0.58 | — 0.08 | — 0.07 | 25 00.07 | 18 53.25 | 06.82 |
| W. | 226 Cephei | 36 11.16 | + 1.98 | — 0.40 | — 0.30 | 36 12.44 | 30 05.59 | 06.85 |
| W. | <i>ζ</i> Pegasi | 22 41 20.75 | — 0.47 | — 0.10 | — 0.08 | 22 41 20.10 | 22 35 13.31 | — 6 06.79 |

NORMAL EQUATIONS.

First series.

$$\begin{aligned}
0 &= +1.79 + 14.00 \delta t - 2.56 a + 4.32 c \\
0 &= -6.41 - 2.56 \delta t + 13.80 a - 2.67 c \\
0 &= -1.79 + 4.32 \delta t - 2.67 a + 55.27 c
\end{aligned}
\qquad
\begin{aligned}
a &= -0^s.465 \\
c &= +0^s.060
\end{aligned}$$

Second series.

$$\begin{aligned}
\text{For E. : } 0 &= +0.86 + 7.00 \delta t - 1.89 a \\
&0 = -3.14 - 1.89 \delta t + 9.57 a \\
\text{For W. : } 0 &= -0.36 + 6.00 \delta t - 0.10 a \\
&0 = +6.21 - 0.10 \delta t + 6.91 a
\end{aligned}
\qquad
\begin{aligned}
a &= +0^s.321 \\
a &= -0^s.898
\end{aligned}$$

Adopted $c = +0^s.074$

The following tables show the corrections and rates of the chronometers used at Julesburg and Ogden :

CHRONOMETER AT JULESBURG.—NEGUS, No. 1344.

| Date. | Local sidereal time. | Correction of chronometer. | Adopted hourly rate. |
|---------|----------------------|----------------------------|----------------------|
| 1874. | <i>h.</i> | <i>h. m. s.</i> | <i>s.</i> |
| Oct. 7 | 19.9 | + 0 03 46.49 | 0.00 |
| Oct. 8 | 21.6 | 46.50 | 0.00 |
| Oct. 9 | 20.1 | 46.13 | 0.00 |
| Oct. 10 | 20.0 | 46.00 | 0.00 |
| Oct. 11 | 20.0 | + 0 03 45.95 | 0.00 |

CHRONOMETER AT OGDEN.—NEGUS, No. 1511.

| Date. | Local sidereal time. | Correction of chronometer. | Adopted hourly rate. |
|---------|----------------------|----------------------------|----------------------|
| 1874. | <i>h.</i> | <i>h. m. s.</i> | <i>s.</i> |
| Oct. 7 | 20.6 | — 0 05 05.730 | + 0.042 |
| Oct. 8 | 19.3 | 06 00.750 | + 0.057 |
| Oct. 9 | 20.7 | 02.491 | + 0.073 |
| Oct. 10 | 21.0 | 04.503 | + 0.084 |
| Oct. 11 | 20.7 | — 0 06 06.878 | + 0.099 |

Final results of longitude.

| Signals sent from— | Recorded at— | Mean of signals sent and received. | Time-corrections. | Corrected time. | Difference of longitude. | Double-wave time. | Means. |
|------------------------------|----------------|------------------------------------|-------------------|-----------------|---|-------------------|--------------|
| | | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> | <i>s.</i> | <i>m. s.</i> |
| October 7, 1874: | | | | | | | |
| Ogden..... | Julesburg | 21 05 33.12 | +0 03 46.49 | 21 09 19.61 | 38 33.61 | | |
| | Ogden..... | 20 36 45.73 | —0 05 59.73 | 20 30 46.00 | | | |
| Julesburg..... | Julesburg | 21 09 04.88 | +0 03 46.49 | 21 12 51.37 | 33.54 | 0.07 | 38 33.575 |
| | Ogden..... | 20 40 17.56 | —0 05 59.73 | 20 34 17.83 | | | |
| October 8, 1874: | | | | | | | |
| Ogden..... | Julesburg | 21 12 12.57 | +0 03 46.50 | 21 15 59.07 | 33.65 | | |
| | Ogden..... | 20 43 26.24 | —0 06 00.82 | 20 37 25.42 | | | |
| Julesburg..... | Julesburg | 21 15 34.84 | +0 03 46.50 | 21 19 21.34 | 33.54 | 0.11 | 33.595 |
| | Ogden..... | 20 46 48.62 | —0 06 00.82 | 20 40 47.80 | | | |
| October 9, 1874: | | | | | | | |
| Ogden..... | Julesburg | 21 16 43.09 | +0 03 46.13 | 21 20 29.22 | 33.45 | | |
| | Ogden..... | 20 47 58.26 | —0 06 02.49 | 20 41 55.77 | | | |
| Julesburg..... | Julesburg | 21 20 04.85 | +0 03 46.13 | 21 23 50.98 | 33.40 | 0.05 | 33.425 |
| | Ogden..... | 20 51 20.07 | —0 06 02.49 | 20 45 17.58 | | | |
| October 10, 1874: | | | | | | | |
| Ogden..... | Julesburg | 21 01 54.81 | +0 03 46.00 | 21 05 40.81 | 33.53 | | |
| | Ogden..... | 20 33 11.74 | —0 06 04.46 | 20 27 07.28 | | | |
| Julesburg..... | Julesburg | 21 05 14.89 | +0 03 46.00 | 21 09 00.89 | 33.42 | 0.11 | 33.475 |
| | Ogden..... | 20 36 31.93 | —0 06 04.46 | 20 30 27.47 | | | |
| October 11, 1874: | | | | | | | |
| Ogden..... | Julesburg | 21 04 30.42 | +0 03 45.95 | 21 08 16.37 | 33.45 | | |
| | Ogden..... | 20 35 49.78 | —0 06 06.86 | 20 29 42.92 | | | |
| Julesburg..... | Julesburg | 21 07 49.85 | +0 03 45.95 | 21 11 35.80 | 38 33.30 | 0.15 | 38 33.375 |
| | Ogden..... | 20 39 09.36 | —0 06 06.86 | 20 33 02.50 | | | |
| Julesburg east of Ogden..... | | | | | 0 ^h 38 ^m 33 ^s .469 ± 0 ^s .029 | | |
| | | | | | Or, 9° 38' 22".34 ± 0".43 | | |

Observations and computations for latitude.

JULESBURG, COLORADO.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|------------------------|-----------------|-------------------|-----------|-----------|-----------|--------------------------|-------------------|----------|-------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1874. October 9 ... | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | <i>o' "</i> | <i>' "</i> | <i>"</i> | <i>o' "</i> |
| | 8146 | 14 40.0 | 26.5 | 9.3 | | | | | |
| | 8162 | 3 67.6 | 9.0 | 27.0 | | 40 52 14.5 | + 6 53.4 | -0.2 | 40 59 07.7 |
| | 8195 | 0 38.2 | 8.0 | 27.6 | | | | | |
| | 8223 | 15 30.0 | 33.7 | 2.4 | | 68 40.2 | - 9 35.1 | +2.7 | 07.8 |
| | 8237 | 10 80.9 | 31.3 | 5.0 | | 65 47.6 | - 6 42.0 | +1.6 | 07.2 |
| | 8247 | 4 36.0 | 9.5 | 26.0 | | | | | |
| | 8277 | 13 08.4 | 29.0 | 7.0 | | 64 43.2 | - 5 36.3 | +1.3 | 08.2 |
| | 8293 | 0 47.1 | 26.9 | 8.5 | | | | | |
| | 8314 | 17 50.6 | 7.0 | 28.8 | | 70 04.4 | -10 56.7 | -0.8 | 06.9 |
| | 8324 | 1 82.0 | 14.0 | 21.5 | | | | | |
| | 8364 | 16 46.0 | 24.0 | 12.5 | | 68 30.1 | - 9 24.3 | +0.9 | 06.7 |
| | 8372 | 11 94.0 | 23.0 | 13.8 | | 65 36.8 | - 6 30.1 | +0.4 | 07.1 |
| | Gr. 4237 | 6 23.0 | 18.5 | 17.8 | | 53 34.6 | + 5 32.3 | +1.5 | 08.4 |
| | 13 | 6 34.0 | 18.5 | 17.8 | | 53 39.5 | + 5 28.0 | +1.5 | 09.0 |
| | 58 | 14 85.0 | 21.2 | 15.5 | | | | | |
| | 102 | 12 80.0 | 15.0 | 22.0 | | | | | |
| | 131 | 5 50.9 | 21.3 | 16.0 | | 54 27.1 | + 4 41.0 | -0.4 | 07.7 |
| | Gr. 95 | 12 77.7 | 17.0 | 19.8 | | | | | |
| | 146 | 11 16.2 | 17.0 | 19.8 | | 64 25.4 | - 5 17.2 | -0.4 | 07.8 |
| | 164 | 4 54.6 | 19.0 | 18.0 | | 63 23.0 | - 4 15.0 | -0.4 | 07.6 |
| | 178 | 7 86.1 | 18.8 | 18.0 | | | | | |
| | 182 | 9 76.6 | 17.3 | 19.8 | | 60 21.5 | - 1 13.4 | -0.4 | 07.7 |
| | 215 | 9 25.5 | 9.3 | 28.0 | | | | | |
| | 244 | 5 16.1 | 30.0 | 7.5 | | 56 27.9 | + 2 37.8 | +0.9 | 06.6 |
| | 254 | 14 95.4 | 29.8 | 8.0 | | 62 47.3 | - 3 39.7 | +0.7 | 08.3 |
| | 293 | 4 90.7 | 38.3 | ..... |  |  |  |  |  |
| | 337 | 10 43.2 | ..... | 39.4 | | 62 41.1 | - 3 33.0 | -0.5 | 07.6 |
| | 351 | 11 87.2 | 19.4 | 17.8 | | | | | |
| | 376 | 6 01.6 | 17.5 | 19.5 | | 55 22.6 | + 3 45.7 | -0.1 | 08.2 |
| | 393 | 12 93.9 | 23.0 | 13.8 | | | | | |
| | 408 | 4 38.0 | 13.0 | 24.3 | | 64 37.7 | - 5 30.0 | -0.5 | 07.2 |
| | 444 | 5 11.3 | 17.3 | 20.2 | | | | | |
| | 476 | 13 68.1 | 20.9 | 17.2 | | 53 36.1 | + 5 30.4 | +0.2 | 06.7 |
| | 502 | 1 60.7 | 13.9 | 23.3 | | | | | |
| | 510 | - 0 33.0 | 23.0 | 14.5 | | 57 52.3 | + 1 14.7 | -0.2 | 06.8 |
| | 535 | 10 72.2 | 7.0 | 29.8 | | 57 28.2 | + 1 40.9 | -0.8 | 08.3 |
| | 564 | 2 26.1 | 6.0 | 31.4 | | 52 00.5 | + 7 07.1 | -1.4 | 05.2 |
| | 572 | 13 33.9 | 28.3 | 9.1 | Dpl. med. | | | | |
| | 610 | 5 62.2 | 18.0 | 19.5 | | 58 27.7 | + 0 41.9 | -0.9 | 08.7 |
| | 620 | 15 20.2 | 18.0 | 19.6 | | 40 64 35.8 | - 5 27.4 | -0.9 | 40 59 07.2 |
| | 632 | 6 71.0 | 17.7 | 20.0 | | | | | |

LATITUDE DETERMINATIONS.

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Observations and computations—Continued.

JULESBURG, COLORADO.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|------------------------|-----------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|--------|------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1874. October 10 .. | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | ° ' " |
| | 8071 | 4 78.9 | 18.5 | 21.1 | | | | | |
| | 8122 | 13 16.2 | 18.0 | 21.5 | | 40 64 32.7 | — 5 22.8 | —1.4 | 40 59 08.5 |
| | 8146 | 14 02.0 | 26.7 | 13.0 | | | | | |
| | 8162 | 3 24.2 | 8.7 | 31.0 | | 52 14.7 | + 6 55.4 | —2.0 | 08.1 |
| | 8173 | 10 96.5 | 28.4 | 11.2 | | | | | |
| | 8182 | 6 42.8 | 5.0 | 34.7 | | 62 03.7 | — 2 54.9 | —2.9 | 05.9 |
| | 8195 | 0 97.0 | 25.0 | 14.3 | | | | | |
| | 8223 | 15 78.1 | 11.0 | 29.3 | | 68 40.4 | — 9 31.0 | —1.8 | 07.6 |
| | 8237 | 11 29.9 | 11.0 | 29.8 | | 65 47.8 | — 6 38.2 | —1.9 | 07.7 |
| | 8247 | 3 71.2 | 37.3 | 3.0 | | | | | |
| | 8277 | 12 38.0 | 0.0 | 41.0 | | 64 43.4 | — 5 34.1 | —1.6 | 07.7 |
| | 8293 | 0 19.0 | 22.0 | 18.5 | | | | | |
| | 8314 | 17 15.3 | 11.2 | 29.7 | | 70 04.6 | —10 53.9 | —3.5 | 07.2 |
| | 8324 | 0 93.0 | 31.3 | 9.0 | | | | | |
| | 8364 | 15 55.0 | 7.0 | 34.0 | | 68 30.3 | — 9 23.6 | —1.1 | 05.6 |
| | 8372 | 11 04.0 | 5.8 | 35.4 | | 65 37.0 | — 6 29.7 | —1.7 | 05.6 |
| | Gr. 4237 | 6 41.9 | 25.6 | 15.0 | | 53 34.9 | + 5 34.8 | —2.4 | 07.3 |
| | 13 | 6 52.2 | 25.0 | 15.7 | | 53 39.7 | + 5 30.8 | —2.7 | 07.8 |
| | 58 | 15 10.5 | 10.2 | 31.3 | | | | | |
| | 102 | 11 95.5 | 43.0 | ..... |  |  |  |  |  |
| | 131 | 4 58.5 | ..... | 47.2 | | 54 27.3 | + 4 44.1 | —2.0 | 09.4 |
| | Gr. 96 | 12 73.1 | 12.5 | 29.3 | | | | | |
| | 146 | 11 12.0 | 12.5 | 29.3 | | 64 25.7 | — 5 17.8 | —1.1 | 06.8 |
| | 164 | 4 48.8 | 27.0 | 15.1 | | 63 23.2 | — 4 15.7 | —1.1 | 06.4 |
| | 178 | 8 07.2 | 25.7 | 16.0 | | | | | |
| | 182 | 9 96.0 | 15.6 | 26.3 | | 60 21.7 | — 1 12.8 | —0.2 | 08.7 |
| | 215 | 8 77.0 | 28.6 | 13.3 | | | | | |
| | 244 | 4 61.0 | 9.7 | 33.0 | | 56 28.1 | + 2 40.4 | —1.9 | 06.6 |
| | 254 | 14 38.1 | 7.9 | 35.0 | | 62 47.5 | — 3 36.3 | —2.7 | 08.5 |
| | 283 | 5 30.8 | 30.4 | 12.0 | | | | | |
| | 337 | 10 75.3 | 5.0 | 38.0 | | 62 41.4 | — 3 29.9 | —3.4 | 08.1 |
| | 351 | 11 58.5 | 24.3 | 18.0 | | | | | |
| | 376 | 5 59.4 | 10.2 | 32.2 | | 55 22.8 | + 3 50.9 | —3.6 | 10.1 |
| | 393 | 12 47.1 | 24.2 | 18.0 | | | | | |
| | 408 | 3 99.1 | 8.8 | 34.0 | | 64 38.0 | — 5 27.0 | —4.4 | 06.6 |
| | 444 | 4 00.4 | 19.1 | 23.0 | | | | | |
| | 476 | 12 64.7 | 19.0 | 23.3 | | 53 36.4 | + 3 33.3 | —1.9 | 07.8 |
| | 502 | 1 64.1 | 28.5 | 13.5 | | | | | |
| | 510 | — 0 36.2 | 8.8 | 33.0 | | 40 57 52.5 | + 1 17.2 | —2.1 | 40 59 07.6 |

Observations and computations—Continued.

JULESBURG, COLORADO.

| Date. | Number of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | Latitude. |
|---------------|-----------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|----------|--------------|
| | | | N. | S. | | | Microm. and refr. | Level. | |
| 1874. | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | <i>° ' "</i> | <i>' "</i> | <i>"</i> | <i>° ' "</i> |
| October 10 .. | 535 | 13 36.7 | 31.3 | 10.2 | | 40 57 28.5 | + 1 42.9 | —3.3 | 40 59 08.1 |
| | 564 | 4 94.0 | 32.0 | 9.8 | | 52 00.7 | + 7 07.8 | —3.1 | 05.4 |
| | 572 | 16 03.7 | 3.3 | 38.7 | | | | | |
| | 610 | 6 11.4 | 25.2 | 16.9 | | 58 27.9 | + 0 44.8 | —4.8 | 07.9 |
| | 620 | 15 69.2 | 27.0 | 15.0 | | 64 36.0 | — 5 24.3 | —3.9 | 07.8 |
| | 632 | 7 27.7 | 6.5 | 35.3 | | | | | |
| October 11 .. | 8146 | 14 52.2 | 22.4 | 17.0 | Cloudy. | | | | |
| | 8162 | 3 73.1 | 9.6 | 30.0 | | 52 14.9 | + 6 56.0 | —3.5 | 07.4 |
| | 8293 | 0 07.9 | 21.0 | 18.6 | | | | | |
| | 8314 | 17 01.6 | 9.3 | 29.8 | | 70 04.8 | —10 52.9 | —4.2 | 07.7 |
| | 146 | 11 75.0 | 18.0 | 22.0 | | | | | |
| | 164 | 5 01.9 | 28.0 | 12.2 | | 63 23.4 | — 4 19.5 | +2.7 | 06.6 |
| | 178 | 8 05.4 | 22.6 | 17.3 | | | | | |
| | 182 | 10 01.8 | 23.5 | 16.6 | | 60 21.9 | — 1 15.7 | +2.8 | 09.0 |
| | 215 | 9 03.2 | 33.0 | 7.0 | | | | | |
| | 244 | 4 99.0 | 12.2 | 28.5 | | 56 28.3 | + 2 35.8 | +2.3 | 06.4 |
| | 254 | 14 78.5 | 12.0 | 29.0 | | 62 47.7 | — 3 41.7 | +2.1 | 08.1 |
| | 283 | 5 06.9 | 16.0 | 24.6 | Hazy. | | | | |
| | 337 | 10 67.5 | 29.5 | 12.0 | | 62 41.6 | — 3 36.1 | +2.1 | 07.6 |
| | 351 | 11 22.1 | 26.5 | 14.0 | | | | | |
| | 376 | 5 39.5 | 16.0 | 25.0 | | 55 23.0 | + 3 44.6 | +0.8 | 08.4 |
| | 444 | 4 55.8 | 23.2 | 17.7 | | | | | |
| | 476 | 13 23.0 | 13.9 | 27.7 | | 53 36.6 | + 5 34.2 | —2.0 | 08.8 |
| | 502 | 1 66.0 | 26.8 | 14.0 | | | | | |
| | 510 | — 0 25.0 | 15.7 | 25.8 | | 57 52.8 | + 1 13.6 | +0.6 | 07.0 |
| | 535 | 10 95.2 | 20.0 | 21.0 | | | | | |
| | 572 | 13 52.8 | 20.3 | 21.3 | | 57 28.7 | + 1 39.3 | —0.5 | 07.5 |
| | 610 | 6 35.5 | 21.3 | 20.2 | | 58 28.1 | + 0 41.1 | 0.0 | 09.2 |
| | 620 | 15 94.8 | 20.2 | 21.6 | | 40 64 36.3 | — 5 28.7 | —0.6 | 40 59 07.0 |
| | 632 | 7 42.1 | 20.4 | 21.6 | | | | | |

For the final result of latitude, the pairs 8173 and 8182 and 564 and 572 are excluded, on account of the star positions. The probable error is derived from the single observations belonging to one pair and the mean taken from 23 individual results.

ASTRONOMICAL CO-ORDINATES OF ASTRONOMICAL STATION AT JULESBURG, COLORADO.

Longitude: $6^h 49^m 26^s.15 \pm 0^s.029$ or $102^\circ 21' 32''.30 \pm 0''.43$ west from Greenwich.
 Longitude: $1^h 41^m 14^s.03$ or $25^\circ 18' 30''.50$ west from U. S. Naval Observatory, Washington, D. C.

Latitude: $40^\circ 59' 07''.63 \pm 0''.04$ north.

U. S. GEOGRAPHICAL SURVEYS WEST OF THE ONE HUNDREDTH MERIDIAN,
1ST LIEUT. GEO. M. WHEELER, CORPS OF ENGINEERS, U. S. ARMY, IN CHARGE.

RESULTS

OF

OBSERVATIONS MADE BY DR. F. KAMPF AND JOHN H. CLARK IN THE
DETERMINATION OF THE ASTRONOMICAL CO-ORDINATES
OF NORTH PLATTE, NEBRASKA.

SEASON OF 1874

COMPUTATIONS BY

Dr. F. KAMPF.

NORTH PLATTE, NEBRASKA.

GEOGRAPHICAL POSITION OF STATION.

Longitude, . . . $100^{\circ} 45' 53''.14 \pm 0''.95$ west from Greenwich.

Latitude, . . . $41^{\circ} 08' 18''.33 \pm 0''.06$ north.

Altitude of observatory above sea-level from railroad surveys, 2789.0 feet.

North Platte is one of the principal stations of the Union Pacific Railroad, and possesses a population of three or four thousand. On the west side of the town, in the center of the military reservation, the astronomical station was fixed.

The adjacent country is level and better fitted for agriculture than the western part of the State. North of the town, distant two miles, is the Platte River, flowing from west to east.

METEOROLOGICAL CONDITIONS.

The weather was fair until the night of October 17. Then the rainy season commenced, compelling the relinquishment of all observations. The ensuing storm continued for three weeks without intermission.

The observatory, instruments, and instrumental values were the same as at Las Vegas. For transmission of signals to Ogden the use of the wire of the Atlantic and Pacific Telegraph Company was kindly granted by the superintendent at Omaha. The local battery at North Platte and a repeater at Cheyenne were employed. The length of circuit, from North Platte to Ogden, was 738 miles.

The astronomer at this station would express his obligations to Captain Mills, in command of the military post, for the assistance rendered by him in erecting the tent and building the monument.

CONNECTIONS.—OBSERVERS.—COMPUTERS.

The longitude was determined by three exchanges with Ogden on October 15, 16, and 17. Observations for latitude were taken on the nights of October 15, 16, and 17. Mr. John H. Clark was observer at Ogden, and Dr. F. Kampf at North Platte. All computations were made by the latter.

Tabulation of stars used for determination of time at Ogden, Utah, and North Platte, Nebraska, 1874.

| Name of star. | | OGDEN. | | | NORTH PLATTE. | | | Name of star. | | OGDEN. | | | NORTH PLATTE. | | |
|---------------|--------------------------|-------------|-------------|-------------|---------------|-------------|-------------|---------------|-------------------------------|-------------|-------------|-------------|---------------|-------------|-------------|
| | | October 15. | October 16. | October 17. | October 15. | October 16. | October 17. | | | October 15. | October 16. | October 17. | October 15. | October 16. | October 17. |
| α | Lyræ | x | x | x | | | | α | Cygni | | | | | | |
| β | Lyræ | x | x | x | | | | ϵ | Aquarii | | | | x | x | x |
| σ | Sagittarii | x | x | x | | | | μ | Aquarii | | | | x | x | x |
| 50 | Draconis | x | x | x | | | | | 12-Year Catalogue, 1879 | | | | x | x | x |
| γ | Lyræ | x | x | x | | | | 61 | Cygni | | | | x | x | x |
| ζ | Aquilæ | x | x | x | | | | ζ | Cygni | | | | x | x | x |
| ι | Lyræ | x | x | x | | | | τ | Cygni | | | | x | x | x |
| d | Sagittarii | x | x | x | | | | α | Cephei | | | | x | x | x |
| τ | Draconis | x | x | x | | | | 1 | Pegasi | | x | | | | |
| β | Cygni | x | x | x | | | | β | Aquarii | | x | | | | |
| κ | Aquilæ | x | x | x | | | | β | Cephei | | x | | | | |
| γ | Aquilæ | x | x | x | | | | ξ | Aquarii | | x | | | | |
| α | Aquilæ | x | x | x | | | | ϵ | Pegasi | | x | | | | |
| ϵ | Draconis | x | x | x | | | | 11 | Cephei | | x | | | | |
| ψ | Cygni | x | x | x | | | | μ | Capricorni | | x | | | | |
| γ | Sagittarii | x | x | x | | | | 79 | Draconis | | x | | | | |
| τ | Aquilæ | | | | x | x | x | α | Aquarii | | x | | | | |
| 3 | Ursæ Minoris, L. C. | x | x | | | | | ζ | Cephei | | x | | | | |
| 0 | Aquilæ | | | | x | x | x | θ | Aquarii | | x | | | | |
| 31 | Cygni | | | | x | x | x | γ | Aquarii | | x | | | | |
| α^2 | Capricorni | | | | x | x | x | π | Aquarii | | x | | | | |
| κ | Cephei | | | | x | x | x | 9 | Draconis, L. C. | | x | | | | |
| γ | Cygni | | | | x | x | x | 225 | Cephei | | x | | | | |
| θ | Cephei | | | | x | x | x | ζ | Pegasi | | x | | | | |
| β | Delphini | | | | x | x | x | | | | | | | | |

Observations and reductions for time taken at sending station.

NORTH PLATTE, NEBRASKA, OCTOBER 15, 1874.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|---------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | τ Aquilæ | 19 47 51.66 | — 0.80 | 0.00 | — 0.31 | 19 47 50.55 | 19 58 00.96 | + 10 10.41 |
| E. | θ Aquilæ | 54 41.14 | — 0.94 | — 0.05 | — 0.31 | 54 39.84 | 20 04 50.25 | 10.41 |
| E. | 31o Cygni | 95 31.00 | + 0.18 | — 0.14 | — 0.45 | 59 30.59 | 09 40.94 | 10.35 |
| E. | α ² Capricorni | 20 00 57.18 | — 1.17 | — 0.08 | — 0.32 | 20 00 55.61 | 11 06.03 | 10.42 |
| E. | κ Cephei | 02 51.66 | + 3.79 | — 0.70 | — 1.40 | 02 53.35 | 13 03.87 | 10.52 |
| E. | γ Cygni | 07 33.92 | — 0.04 | — 0.30 | — 0.40 | 07 33.18 | 17 43.74 | 10.56 |
| E. | ε Cephei | 17 18.10 | + 1.11 | — 0.53 | — 0.67 | 17 18.01 | 27 28.40 | 10.39 |
| E. | β Delphini | 21 31.08 | — 0.66 | — 0.25 | — 0.32 | 21 29.85 | 31 40.33 | 10.48 |
| W. | α Aquarii | 30 44.14 | — 1.11 | — 0.16 | + 0.31 | 30 43.18 | 40 53.66 | 10.48 |
| W. | μ Aquarii | 35 44.26 | — 1.10 | — 0.16 | + 0.31 | 35 43.31 | 45 53.78 | 10.47 |
| W. | 12-Yr. Cat., 1879 | 42 56.30 | + 5.14 | — 0.99 | + 1.79 | 42 02.24 | 52 12.66 | 10.42 |
| W. | 61 Cygni | 51 06.42 | — 0.10 | — 0.25 | + 0.39 | 51 06.46 | 21 01 17.03 | 10.57 |
| W. | τ Cygni | 59 36.92 | — 0.11 | — 0.25 | + 0.39 | 59 36.95 | 09 47.49 | 10.54 |
| W. | α Cephei | 21 05 23.66 | + 1.07 | — 0.36 | + 0.66 | 21 05 25.03 | 21 15 35.47 | + 10 10.44 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -4.39 + 14.00 \delta t - 3.73 a + 1.06 c \\
 0 &= +37.56 - 3.73 \delta t + 24.70 a + 9.45 c \\
 0 &= +37.07 + 1.06 \delta t + 9.45 a + 76.87 c
 \end{aligned}
 \qquad
 \begin{aligned}
 a &= -1^s.408 \\
 c &= -0^s.308
 \end{aligned}$$

NORTH PLATTE, NEBRASKA, OCTOBER 16, 1874.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|-------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|--------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> |
| E. | τ Aquilæ | 19 47 51.16 | — 0.66 | — 0.16 | — 0.32 | 19 47 50.02 | 19 58 00.95 | + 10 10.93 |
| E. | θ Aquilæ | 54 40.64 | — 0.78 | — 0.20 | — 0.32 | 54 39.34 | 20 04 50.23 | 10.89 |
| E. | 31o Cygni | 59 30.54 | + 0.15 | — 0.39 | — 0.46 | 59 29.84 | 09 40.91 | 11.07 |
| E. | κ Cephei | 20 02 51.94 | + 3.13 | — 0.96 | — 1.45 | 20 02 52.66 | 13 03.76 | 11.10 |
| E. | γ Cygni | 07 33.48 | — 0.03 | — 0.34 | — 0.41 | 07 32.70 | 17 43.72 | 11.02 |
| W. | θ Cephei | 17 16.28 | + 0.92 | — 0.57 | + 0.69 | 17 17.32 | 27 28.35 | 11.03 |
| W. | β Delphini | 21 29.74 | — 0.55 | — 0.27 | + 0.33 | 21 29.25 | 31 10.32 | 11.07 |
| W. | α Cygni | 26 58.20 | + 0.10 | — 0.36 | + 0.45 | 26 58.39 | 37 09.53 | 11.14 |
| W. | ε Aquarii | 30 43.40 | — 0.92 | — 0.15 | + 0.33 | 30 42.66 | 40 53.64 | 10.98 |
| W. | μ Aquarii | 30 43.62 | — 0.91 | — 0.13 | + 0.32 | 30 42.90 | 40 53.76 | 10.86 |
| W. | 12-Yr. Cat., 1879 | 42 56.24 | + 4.25 | — 0.72 | + 1.85 | 42 01.62 | 52 12.53 | 10.91 |
| W. | 61 Cygni | 51 05.68 | — 0.08 | — 0.16 | + 0.41 | 51 05.85 | 21 01 17.01 | 11.16 |
| E. | ζ Cygni | 57 26.16 | — 0.27 | — 0.14 | — 0.37 | 57 25.38 | 07 36.31 | 10.93 |
| E. | α Cephei | 21 05 24.86 | + 0.89 | — 0.40 | — 0.68 | 21 05 24.67 | 21 15 35.43 | + 10 10.76 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -5.46 + 14.00 \delta t - 4.50 a - 1.11 c \\
 0 &= +30.65 - 4.50 \delta t + 24.06 a + 8.31 c \\
 0 &= +34.43 - 1.11 \delta t + 8.31 a + 77.53 c
 \end{aligned}
 \qquad
 \begin{aligned}
 a &= -1^s.165 \\
 c &= -0^s.319
 \end{aligned}$$

Observations and reductions for time taken at sending station—Continued.

NORTH PLATTE, NEBRASKA, OCTOBER 17, 1874.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|---------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | γ Aquilæ | 19 30 07.48 | + 0.32 | — 0.10 | — 0.25 | 19 30 07.45 | 19 40 17.85 | + 10 10.40 |
| E. | α Aquilæ | 34 29.46 | + 0.33 | — 0.17 | — 0.25 | 34 29.37 | 44 39.89 | 10.52 |
| E. | ϵ Draconis | 38 26.16 | — 0.89 | — 0.56 | — 0.71 | 38 24.00 | 48 34.49 | 10.49 |
| E. | ψ Cygni | 42 13.28 | — 0.19 | — 0.40 | — 0.40 | 42 12.29 | 52 22.98 | 10.69 |
| E. | τ Aquilæ | 47 50.36 | + 0.35 | — 0.22 | — 0.25 | 47 50.24 | 58 00.93 | 10.69 |
| E. | θ Aquilæ | 54 39.54 | + 0.41 | — 0.22 | — 0.24 | 54 39.49 | 20 04 50.22 | 10.73 |
| E. | 31 α Cygni | 59 30.92 | — 0.08 | — 0.47 | — 0.35 | 59 30.02 | 09 40.89 | 10.87 |
| W. | γ Cygni | 20 07 32.98 | + 0.02 | — 0.42 | + 0.32 | 20 07 32.90 | 17 43.70 | 10.80 |
| W. | θ Cephei | 17 18.22 | — 0.48 | — 0.63 | + 0.53 | 17 17.64 | 27 28.31 | 10.67 |
| W. | β Delphini | 21 29.48 | + 0.29 | — 0.28 | + 0.25 | 21 29.74 | 31 40.30 | 10.56 |
| W. | α Cygni | 26 59.04 | — 0.06 | — 0.40 | + 0.34 | 26 58.92 | 37 09.50 | 10.58 |
| W. | ϵ Aquarii | 30 42.46 | + 0.48 | — 0.16 | + 0.25 | 30 43.03 | 40 53.63 | 10.60 |
| W. | μ Aquarii | 35 42.70 | + 0.48 | — 0.16 | + 0.25 | 35 43.27 | 45 53.75 | 10.48 |
| W. | 12-Yr. Cat., 1879. | 20 43 03.98 | — 2.23 | — 1.35 | + 1.41 | 20 43 01.81 | 20 53 12.40 | + 10 10.59 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -2.72 + 14.00 \delta t - 2.05 a - 3.70 c \\
 0 &= -6.70 - 2.05 \delta t + 18.95 a + 18.29 c \\
 0 &= +4.82 - 3.70 \delta t + 18.29 a + 62.52 c
 \end{aligned}
 \qquad
 \begin{aligned}
 a &= +0^s.612 \\
 c &= -0^s.243
 \end{aligned}$$

NORTH PLATTE, NEBRASKA, OCTOBER 18, 1874.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|--------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | θ Aquilæ | 19 54 38.86 | + 0.51 | — 0.08 | — 0.40 | 19 54 38.89 | 20 04 50.20 | + 10 11.31 |
| E. | 31 α Cygni | 59 30.50 | — 0.10 | — 0.17 | — 0.58 | 59 29.65 | 09 40.86 | 11.21 |
| E. | κ Cephei | 20 02 56.59 | — 2.03 | — 0.44 | — 1.84 | 20 02 52.28 | 13 03.54 | 11.26 |
| E. | γ Cygni | 07 33.04 | + 0.02 | — 0.17 | — 0.52 | 07 32.37 | 17 43.68 | 11.31 |
| E. | θ Cephei | 17 18.96 | — 0.60 | — 0.30 | — 0.87 | 17 17.19 | 27 28.26 | 11.07 |
| E. | β Delphini | 21 29.22 | + 0.35 | — 0.15 | — 0.42 | 21 29.00 | 31 40.28 | 11.28 |
| W. | ϵ Aquarii | 30 41.60 | + 0.60 | — 0.13 | + 0.41 | 30 42.48 | 40 53.62 | 11.14 |
| W. | μ Aquarii | 35 41.64 | + 0.59 | — 0.10 | + 0.41 | 35 42.54 | 45 53.74 | 11.20 |
| W. | 12-Yr. Cat., 1879. | 43 01.74 | — 2.76 | — 0.30 | + 2.34 | 43 01.02 | 53 12.27 | 11.25 |
| W. | 61 α Cygni | 51 05.18 | + 0.05 | — 0.05 | + 0.51 | 51 05.69 | 21 01 16.97 | 11.28 |
| W. | ζ Cygni | 20 57 24.46 | + 0.17 | — 0.03 | + 0.46 | 20 57 25.06 | 21 07 36.27 | + 10 11.21 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= +0.08 + 11.00 \delta t - 4.22 a + 1.26 c \\
 0 &= -13.57 - 4.22 \delta t + 23.15 a + 6.24 c \\
 0 &= +23.09 + 1.26 \delta t + 6.24 a + 69.98 c
 \end{aligned}
 \qquad
 \begin{aligned}
 a &= +0^s.755 \\
 c &= -0^s.403
 \end{aligned}$$

The corresponding observations taken at Ogden, Utah, will be found in the report on determination of longitude of that station, season of 1874.

The following tables show the corrections and rates of the chronometers used at North Platte and Ogden:—

CHRONOMETER AT NORTH PLATTE—NEGUS, No. 1344.

| Date. | Local sidereal time. | Correction of chronometer. | Hourly rate. |
|------------|----------------------|----------------------------|--------------|
| 1874. | <i>h.</i> | <i>h. m. s.</i> | <i>s.</i> |
| October 15 | 20.6 | + 0 10 10.46 | — 0.022 |
| October 16 | 20.1 | 10.99 | + 0.015 |
| October 17 | 20.3 | 10.62 | — 0.025 |
| October 18 | 20.6 | + 0 10 11.23 | |

CHRONOMETERS AT OGDEN.
NEGUS, No. 1511.

| Date. | Local sidereal time. | Correction of chronometer. | Hourly rate. |
|------------|----------------------|----------------------------|--------------|
| 1874. | <i>h.</i> | <i>h. m. s.</i> | <i>s.</i> |
| October 15 | 20.63 | — 0 06 16.972 | + 0.0533 |

NEGUS, No. 1491.

| Date. | Local sidereal time. | Correction of chronometer. | Hourly rate. |
|------------|----------------------|----------------------------|--------------|
| 1874. | <i>h.</i> | <i>h. m. s.</i> | <i>s.</i> |
| October 16 | 20.59 | — 0 06 2.49 | + 0.0801 |
| October 17 | 19.20 | — 0 06 4.26 | + 0.0917 |

Final results of longitude.

| Signals sent from— | Recorded at— | Mean of signals sent and received. | Time-corrections. | Corrected time. | Difference of longitude. | Double-wave time. | Means. |
|--------------------|-----------------|------------------------------------|-------------------|-----------------|--------------------------|-------------------|-----------|
| October 15, 1874: | | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>m. s.</i> | <i>s.</i> | <i>s.</i> |
| Ogden..... | North Platte | 21 43 04.07 | + 0 10 10.49 | 21 53 14.56 | 44 56.35 | 56.16 | 56.255 |
| | Ogden | 21 14 35.21 | — 0 06 17.00 | 21 08 18.21 | | | |
| | North Platte .. | 21 46 45.14 | + 0 10 10.49 | 21 56 55.63 | | | |
| | Ogden | 21 18 16.47 | — 0 06 17.00 | 21 11 59.47 | | | |
| October 16, 1874: | | | | | | | |
| Ogden..... | North Platte | 21 34 51.45 | + 0 10 10.97 | 21 45 02.42 | 56.20 | 0.17 | 56.115 |
| | Ogden | 21 06 08.74 | — 0 06 02.52 | 21 00 06.22 | | | |
| | North Platte... | 21 38 20.47 | + 0 10 10.97 | 21 48 31.44 | | | |
| | Ogden | 21 09 37.93 | — 0 06 02.52 | 21 03 35.41 | 56.03 | | |
| October 17, 1874: | | | | | | | |
| Ogden..... | North Platte | 21 31 23.99 | + 0 10 10.65 | 21 41 34.64 | 56.00 | 0.14 | 55.930 |
| | Ogden | 21 02 43.07 | — 0 06 04.43 | 20 56 38.64 | | | |
| | North Platte | 21 34 55.58 | + 0 10 10.65 | 21 45 06.23 | | | |
| | Ogden | 21 06 14.81 | — 0 06 04.44 | 21 00 10.37 | 44 55.86 | | |

North Platte east of Ogden $0^h 44^m 56^s.100 \pm 0^s.03$;
Or, $11^{\circ} 14' 01''.50 \pm 0^s.95$

Observations and computations for latitude.

NORTH PLATTE, NEBRASKA.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|--------------|--------------|---------------------|-----------|-----------|----------|--------------------------|-------------------|--------|--------|------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1874. | | <i>t.</i> <i>d.</i> | <i>d.</i> | <i>d.</i> | | ° ' " | ' " | " | " | ° ' " |
| October 15.. | 7994 | — 2 54.0 | 35.8 | 5.0 | | | | | | |
| | 8023 | 12 25.0 | 4.0 | 37.5 | | 41 17 49.0 | — 9 30.1 | — 0.6 | ..... | 41 08 18.3 |
| | 8106 | 12 66.7 | 17.9 | 24.7 | | 08 20.8 | — 0 04.5 | + 1.5 | ..... | 17.8 |
| | 8173 | 2 88.1 | 17.3 | 25.8 | | 02 04.7 | + 6 12.7 | + 1.1 | ..... | 18.5 |
| | 8182 | 12 55.0 | 28.2 | 15.0 | | | | | | |
| | 8195 | 8 82.6 | 25.8 | 17.0 | | | | | | |
| | 8223 | 9 47.5 | 22.0 | 21.4 | | 08 41.5 | — 0 25.0 | + 2.2 | ..... | 18.7 |
| | 8237 | 4 94.5 | 20.0 | 23.5 | | 05 48.8 | + 2 29.6 | + 1.2 | ..... | 19.6 |
| | 8268 | 3 36.0 | 37.3 | 6.2 | | 12 07.5 | — 3 49.7 | + 1.6 | ..... | 19.4 |
| | 8282 | 17 97.8 | 36.7 | 7.0 | | 21 30.5 | — 13 13.2 | + 1.3 | ..... | 18.6 |
| | 8324 | — 2 59.8 | 10.0 | 34.0 | | | | | | |
| | 16 | 18 31.0 | 34.2 | 10.1 | | | | | | |
| | 67 | 0 68.8 | 10.5 | 33.8 | | 19 37.4 | — 11 19.4 | + 0.2 | ..... | 18.2 |
| | 100 | 8 84.0 | 21.3 | 23.0 | | 14 18.6 | — 6 01.0 | + 2.2 | ..... | 19.8 |
| | 152 | 13 31.2 | 21.3 | 23.6 | | 17 10.6 | — 8 53.3 | + 2.0 | ..... | 19.3 |
| | 173 | — 0 52.2 | 28.0 | 17.0 | | | | | | |
| | 215 | 13 68.1 | 16.0 | 28.3 | | | | | | |
| | 254 | 5 11.1 | 28.0 | 16.8 | | 02 48.7 | + 5 30.4 | — 0.3 | ..... | 18.8 |
| | 412 | 4 20.2 | 32.3 | 12.2 | | 05 20.5 | + 2 59.9 | — 0.2 | ..... | 20.2 |
| | 444 | 17 68.5 | 31.0 | 14.3 | | 14 00.2 | — 5 39.8 | — 0.9 | ..... | 19.5 |
| | 453 | 8 87.0 | 12.3 | 33.0 | | | | | | |
| | 487 | 16 92.0 | 35.9 | 9.8 | | | | | | |
| | 516 | 1 42.0 | 12.3 | 33.4 | | 18 16.8 | — 9 57.5 | + 1.1 | ..... | 20.4 |
| | 540 | 3 78.5 | 40.3 | 5.3 | | | | | | |
| | 576 | 11 08.9 | 7.2 | 38.7 | | 03 36.8 | + 4 41.5 | + 0.8 | ..... | 19.1 |
| | 658 | 9 49.0 | 31.7 | 13.9 | | | | | | |
| | 666 | 3 70.4 | 11.3 | 34.0 | | 12 03.8 | — 3 43.1 | — 1.1 | ..... | 19.6 |
| | 691 | 7 93.3 | 34.0 | 11.0 | | | | | | |
| | 715 | 11 62.1 | 16.0 | 29.6 | | 10 38.2 | — 2 22.1 | + 2.2 | ..... | 18.3 |
| | 731 | 5 10.7 | 14.0 | 31.3 | | 06 28.9 | + 1 48.9 | + 1.3 | ..... | 19.1 |
| October 16.. | 7856 | 3 13.0 | 17.7 | 19.0 | | | | | | |
| | 7902 | 14 67.0 | 19.7 | 17.5 | | 15 42.4 | — 7 24.9 | + 0.2 | ..... | 17.7 |
| | 7917 | 15 02.4 | 37.7 | ..... |  | 01 48.2 | + 6 33.8 | — 3.3 | ..... | 18.7 |
| | 7932 | 4 80.8 | ..... | 44.7 | | 05 38.9 | + 2 42.4 | — 4.1 | ..... | 17.2 |
| | 7962 | 10 81.0 | ..... | 46.4 | | | | | | |
| | 7972 | 8 66.7 | 19.0 | 18.0 | | | | | | |
| | 7976 | 14 43.0 | 6.5 | 30.0 | | 04 38.4 | + 3 42.2 | — 5.1 | ..... | 15.5 |
| | 7984 | 4 72.6 | 9.6 | 27.0 | | 10 50.7 | — 2 31.9 | — 3.9 | ..... | 14.9 |
| | 7994 | — 1 20.4 | 31.2 | 5.0 | | | | | | |
| | 8023 | 13 51.2 | 1.1 | 36.0 | | 41 17 49.1 | — 9 27.3 | — 2.0 | | 41 08 19.8 |

LATITUDE DETERMINATIONS.

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Observations and computations—Continued.

NORTH PLATTE, NEBRASKA.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude |
|-----------------------|--------------|-------------------|-----------|-----------|----------|--------------------------|-------------------|----------|----------|--------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1874. October 16.. | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | | <i>° ' "</i> | <i>' "</i> | <i>"</i> | <i>"</i> | <i>° ' "</i> |
| | 8106 | 12 28.6 | 9.0 | 28.2 | | 41 08 21.0 | — 0 06.2 | + 1.8 | ..... | 41 08 16.6 |
| | 8173 | 2 47.4 | 5.9 | 31.6 | | 02 04.9 | + 6 12.1 | + 0.3 | ..... | 17.3 |
| | 8182 | 12 12.5 | 32.0 | 5.0 | | | | | | |
| | 8195 | 8 52.1 | 34.0 | 2.3 | | | | | | |
| | 8223 | 9 11.0 | 2.5 | 34.0 | | 08 41.7 | — 0 22.7 | 0.0 | ..... | 19.0 |
| | 8237 | 4 58.7 | 2.0 | 34.7 | | 05 47.1 | + 2 31.6 | — 0.2 | ..... | 18.5 |
| | 8268 | 7 26.1 | 11.8 | 24.8 | | 12 07.8 | — 3 52.0 | + 2.1 | ..... | 17.9 |
| | 8282 | 21 81.7 | 5.0 | 31.7 | | 21 30.6 | — 13 13.2 | — 0.9 | ..... | 16.5 |
| | 8324 | 1 24.1 | 29.8 | 7.8 | | | | | | |
| | 16 | 17 01.6 | 23.2 | 14.3 | | | | | | |
| | 67 | — 0 66.0 | 13.6 | 24.0 | | 19 37.6 | — 11 21.4 | — 0.3 | ..... | 15.9 |
| | 100 | 12 01.5 | 14.3 | 23.0 | | 14 18.8 | — 6 02.0 | + 1.4 | ..... | 18.2 |
| | 152 | 16 47.0 | 13.8 | 24.0 | | 17 10.9 | — 8 53.7 | + 1.0 | ..... | 18.2 |
| | 173 | 2 62.5 | 26.4 | 11.8 | | | | | | |
| | 215 | 13 86.6 | 20.1 | 18.0 | | | | | | |
| | 254 | 5 30.1 | 17.9 | 20.5 | | 02 48.9 | + 5 30.2 | — 0.1 | ..... | 19.0 |
| | 283 | 12 47.2 | 14.7 | 24.0 | | | | | | |
| | 337 | 3 82.0 | 31.0 | 8.3 | | 02 42.8 | + 5 33.5 | + 3.1 | ..... | 19.4 |
| | 412 | 3 95.7 | 11.9 | 26.8 | | 05 20.7 | + 2 53.6 | + 4.8 | ..... | 19.1 |
| | 444 | 17 43.6 | 9.0 | 29.8 | | 14 10.4 | — 5 46.0 | + 3.5 | ..... | 17.9 |
| | 453 | 8 46.1 | 37.3 | 1.6 | | | | | | |
| | 487 | 17 37.2 | 21.2 | 17.6 | | | | | | |
| | 516 | 1 79.2 | 21.3 | 18.0 | | 18 17.0 | — 10 00.6 | + 1.6 | ..... | 18.0 |
| | 540 | 3 20.7 | 17.3 | 22.0 | | | | | | |
| | 576 | 10 57.0 | 19.7 | 20.0 | | 03 37.0 | + 4 43.8 | — 1.2 | ..... | 19.6 |
| | 647 | 14 14.1 | 24.6 | 15.0 | | 04 53.9 | + 3 24.1 | + 1.7 | ..... | 19.7 |
| | 658 | 8 84.5 | 18.8 | 21.0 | | | | | | |
| | 666 | 2 96.9 | 26.5 | 13.3 | | 12 04.0 | — 3 46.6 | + 2.6 | ..... | 20.0 |
| | 691 | 8 04.0 | 21.3 | 18.7 | | | | | | |
| | 715 | 11 77.6 | 25.3 | 14.6 | | 10 38.4 | — 2 24.0 | + 3.1 | ..... | 17.5 |
| | 731 | 5 27.0 | 24.4 | 15.9 | | 06 29.2 | + 1 46.8 | + 2.6 | ..... | 18.6 |
| October 17.. | 7856 | 3 35.7 | 17.3 | 17.9 | | | | | | |
| | 7902 | 14 91.0 | 18.0 | 17.9 | | 15 42.5 | — 7 25.3 | — 0.1 | ..... | 17.1 |
| | 7917 | 15 03.1 | 17.4 | 18.2 | | | | | | |
| | 7932 | 4 90.4 | 19.6 | 16.0 | | 01 48.2 | + 6 30.3 | + 0.6 | ..... | 19.1 |
| | 7962 | 10 92.1 | 18.0 | 18.0 | | 05 39.1 | + 2 38.4 | — 0.2 | ..... | 17.3 |
| | 7972 | 6 33.7 | 16.2 | 19.6 | | | | | | |
| | 7978 | 12 05.7 | 18.0 | 17.7 | | 04 38.6 | + 3 40.5 | — 0.7 | ..... | 18.4 |
| | 7984 | 2 33.0 | 20.5 | 15.0 | | 10 50.9 | — 2 34.4 | + 0.5 | ..... | 17.0 |
| | 7994 | — 0 52.1 | 6.0 | 29.0 | | | | | | |
| | 8023 | 14 32.9 | 32.0 | 4.3 | | 41 17 49.4 | — 9 32.4 | + 1.1 | ..... | 41 08 18.1 |

Observations and computations—Continued.

NORTH PLATTE, NEBRASKA.

| Date. | No. of star. | Microm. readings. | Level. | | Remarks. | Half-sum of declination. | Corrections. | | | Latitude. |
|-----------------------|--------------|-------------------|-----------|-----------|-----------------------|--------------------------|-------------------|--------|--------|------------|
| | | | N. | S. | | | Microm. and refr. | Level. | Merid. | |
| 1874. October 17.. | | <i>t. d.</i> | <i>d.</i> | <i>d.</i> | 25 ^s p. m. | ° ' " | ' " | " | " | ° ' " |
| | 8106 | 12 64.0 | 12.8 | 24.8 | | 41 08 21.2 | — 0 04.7 | + 0.5 | ..... | 41 08 17.0 |
| | 8173 | 2 85.6 | 13.8 | 23.9 | | 02 05.0 | + 6 12.4 | + 0.9 | ..... | 18.3 |
| | 8182 | 12 51.7 | 25.8 | 11.7 | | | | | | |
| | 8195 | 9 02.1 | 17.8 | 19.3 | | | | | | |
| | 8223 | 9 68.3 | 24.0 | 13.5 | | 08 41.9 | — 0 25.5 | + 2.1 | ..... | 18.5 |
| | 8237 | 5 19.0 | 23.0 | 15.0 | | 05 49.2 | + 2 27.6 | + 1.7 | ..... | 18.5 |
| | 8268 | 5 21.1 | 24.0 | 14.0 | | 12 08.0 | — 3 49.7 | + 0.5 | ..... | 18.8 |
| | 8282 | 19 89.4 | 24.6 | 14.0 | | 21 30.8 | —13 15.7 | + 0.7 | + 0.1 | 15.9 |
| | 8324 | — 0 74.7 | 15.8 | 23.4 | | | | | | |
| | 16 | 17 87.0 | 21.2 | 18.3 | | | | | | |
| | 67 | 0 19.8 | 19.7 | 20.0 | | 19 37.8 | —11 21.3 | + 0.6 | ..... | 17.1 |
| | 100 | 8 90.0 | 21.0 | 18.0 | | 14 19.1 | — 6 05.3 | + 4.3 | ..... | 18.1 |
| | 152 | 13 38.5 | 21.2 | 18.2 | | 17 11.1 | — 8 58.1 | + 4.3 | ..... | 17.3 |
| | 173 | — 0 57.4 | 27.3 | 11.8 | | | | | | |
| | 283 | 13 42.2 | 4.8 | 33.2 | | | | | | |
| | 337 | 4 75.1 | 38.7 | —0.4 | | 02 43.0 | + 5 34.3 | + 2.5 | ..... | 19.8 |
| | 368 | 3 91.2 | 17.4 | 20.0 | | | | | | |
| | 387 | 13 27.0 | 23.0 | 15.2 | | 14 55.7 | — 6 39.3 | + 1.2 | ..... | 17.6 |
| | 412 | 4 45.6 | 18.1 | 20.5 | | 05 20.9 | + 2 55.5 | + 1.9 | ..... | 18.3 |
| | 444 | 17 93.3 | 18.8 | 20.6 | | 14 00.7 | — 5 44.1 | + 2.0 | ..... | 18.6 |
| | 453 | 9 00.9 | 24.9 | 14.5 | | | | | | |
| | 487 | 16 18.8 | 23.2 | 15.8 | | | | | | |
| | 516 | 0 54.1 | 27.0 | 12.7 | | 18 17.3 | —10 03.2 | + 5.0 | ..... | 19.1 |
| | 540 | 4 49.2 | 19.6 | 20.2 | | | | | | |
| | 576 | 11 75.0 | 22.3 | 17.9 | | 03 37.3 | + 4 39.8 | + 0.9 | ..... | 18.0 |
| | 647 | 13 46.1 | 17.2 | 22.3 | | 04 54.1 | + 3 22.1 | + 3.5 | ..... | 19.7 |
| | 658 | 8 21.8 | 30.0 | 9.7 | | | | | | |
| | 666 | 2 25.7 | 20.0 | 19.5 | | 12 04.2 | — 3 49.7 | + 4.8 | ..... | 19.3 |
| | 691 | 8 28.8 | 16.6 | 23.0 | | | | | | |
| | 715 | 12 03.7 | 30.5 | 9.2 | | 10 38.6 | — 2 24.5 | + 3.5 | ..... | 17.6 |
| | 731 | 5 52.2 | 30.6 | 9.5 | | 41 06 29.4 | + 1 46.6 | + 3.4 | ..... | 41 08 19.4 |

For the method used in deriving the result for latitude, see the report on Julesburg station.

ASTRONOMICAL CO-ORDINATES OF ASTRONOMICAL STATION AT NORTH PLATTE, NEBRASKA.

Longitude.. $6^h 43^m 03^s.54 \pm 0^s.063$ or $100^\circ 45' 53''.14 \pm 0''.95$ west from Greenwich.
Longitude.. $1^h 34^m 51^s.42$ or $23^\circ 42' 51''.34$ west from U. S. Naval Observatory, Washington, D. C.
Latitude... $41^\circ 08' 18''.33 \pm 0''.06$ north.

U. S. GEÖGRAPHICAL SURVEYS WEST OF THE ONE HUNDREDTH MERIDIAN,
1ST LIEUT. GEO. M. WHEELER, CORPS OF ENGINEERS, U. S. ARMY, IN CHARGE.

APPENDIX TO PART I, VOLUME II,

COMPRISING

- 1.—REPORT OF OPERATIONS AT SALT LAKE OBSERVATORY IN 1873J. H. CLARK.
- 2.—DESCRIPTION OF OGDEN OBSERVATORY AND ITS SURROUNDINGS..LIEUT. WHEELER.
- 3 —DESCRIPTION OF PERSONAL-EQUATION APPARATUS, WITH RESULTS OF OBSERVA-
TIONS FOR RELATIVE PERSONAL ERROR.....Dr. F. KAMPF.
- 4.—LIST OF POSITIONS OF ASTRONOMICAL STATIONS, WITH DESCRIPTION OF LOCA-
TION, &c.LIEUT. WHEELER.

UNITED STATES ENGINEER OFFICE,
GEOGRAPHICAL SURVEYS WEST OF THE 100TH MERIDIAN,
Washington, D. C., March 1, 1874.

SIR: I submit herewith a report of astronomical observations made during the season of 1873, at the main or receiving station, Salt Lake City, Utah.

GEOGRAPHICAL POSITION OF STATION.

The Salt Lake City observatory, belonging to the Mormon Church, was occupied as the main or receiving station, and with it all the primary astronomical points, except Bozeman, Montana, were connected telegraphically for difference of longitude.

It is situated in Temple Square, about one hundred feet from the southeast corner, than which no position more objectionable could have been selected for such a purpose.

PHYSICAL SURROUNDINGS.

By its location the observatory is subject to the dust and smoke of the city, the noise of travel in the adjacent streets, and, worst of all, to the heavy concussions to which, from its construction, the Temple is subject. It is so hemmed in that from the position of the instrument nothing terrestrial can be seen but the top of a distant mountain, by which the city is bounded to the northward. In the south there is no horizontal view possible in consequence of the interposition of the wall of the Temple yard. Eastward this wall again shuts off the prospect, but to the west there is an open view past the Tabernacle and over the trees and house-tops to the Great Salt Lake and the adjacent mountains.

Among the first settlers of the Salt Lake Valley there is a common opinion that the rains are now more abundant than in former times, and the cause is attributed to the growing of trees, and the introduction of the telegraph wires and railroad track. There are probably no sufficient data for such a conclusion, especially as regards the telegraph and railway. However, the meteorological record taken at my astronomical stations for the years 1872 and 1873 favors the popular notion, and shows a cumulative amount of moisture, cloudy weather, storm, and rain.

On several occasions during this season it was not possible to accomplish a complete set of observations on any one night for a week at a time, in consequence of the clouds and rain, and there was one feature about this weather which was especially unfavorable for astronomical work. This was that atmospheric condition in which the sky would become cloudy and remain so during the night, while through the day the sun would dispel the mist and shine with its wonted power. The heaviest rains occurred in the afternoon, accompanied in most instances with many electrical phenomena, and showers in full sunshine were quite frequent. These storms, unlike those of the previous season, came from every quarter, and not alone from the south and west, which are believed to be their prevailing direction during the summer months.

There were seven cloudy nights in June, of which four only were of such a character as to prevent all observations. July 10 and 11 were slightly cloudy; July 20, 21, and 22, quite so; for the rest of the month there was no obscuration of the heavens whatever, the nights being all that the most ardent observer could desire. August 3, 8, 9, 10, 11, 12, 21, 22, 23, 29, 30, and 31, twelve days in all, were more or less cloudy. On September 1, 2, 3, 15, 18, and 27, six days only, observations were impossible. The first week in October was clear; in that time the difference of longitude between Salt Lake City and Ogden observatory was determined, and then the latter place was occupied as the base for astronomical observations.

DESCRIPTION OF OBSERVATORY.

The observatory consists of a double house, one enveloping the other. The inner one of these is of frame-work, and was built by the United

States Coast Survey; the outer is of adobe material, and was constructed by the Mormons. The observing-room presents a space of about ten by fifteen feet and is supplied with two stone pillars, on the western one of which the transit was mounted, and the observations in connection with the various stations of the season were made. The openings in the roof over the eastern pillar are sufficient for latitude work only, and over the western block they extend no farther than the eaves. This arrangement is enough for the purposes of the owners, as they make no other use of their transit than to get the time by the sun, but it is insufficient for complete astronomical work. The pillars are solid blocks of sandstone, pretty well dressed, particularly the western one. They are firmly planted, and, considering the surroundings, stand remarkably steady.

Two soldiers of the Engineer Battalion, Looram and Kirkpatrick, were detailed to assist me and keep a meteorological record. I found them intelligent and attentive to their duty. After a few weeks Kirkpatrick was put in service with Mr. W. D. Wheeler at the Ogden observatory and elsewhere, while Looram remained and rendered all the assistance required.

All connections were made over the Western Union lines of telegraph, except with Green River, which was by way of the Deseret of Utah and the Atlantic and Pacific, and with the secondary stations at Provo and Richfield, which were also connected by the Deseret wires. Mr. Dougall, of the Deseret office, directed or personally performed all the operating done with these and the Atlantic and Pacific wires, while Mr. W. P. Baker, a very efficient operator of the Western Union office, did the telegraphing necessary over this line. At times, when the regular incumbent could not be present, Mr. Oscar G. Sawyer, one of the oldest and most expert operators in the country, gratuitously supplied his place. It is but a small tribute to the many gentlemen of the telegraph lines with whom I have been brought in contact while on duty with your expedition, to say that without exception they always afforded me every facility in their power, although many times it caused them annoyance and interruption, especially when they were pressed with overland business, which was often the case.

Transit.—The transit used was the Würdemann, No. 19, which belongs to the Ogden observatory. Its focal length is 31 inches and its aperture

2½ inches. Originally it had nine wires, but four were broken or were so indistinct that they could not be used in observations. The remaining five were fortunately adjacent, but, since they were on one side of the diaphragm, they had to be adjusted to the central positions. Making observations with this instrument by means of electro-magnetism is unnecessarily tedious, as its equatorial intervals are 23 seconds. The bearings of its axes are a little worn and the illumination is somewhat imperfect; otherwise, it and its appurtenances are in good order.

Chronograph.—The observations were made and recorded by the instrumentality of a local battery and chronograph. A description of this machine is given in the report upon the determination at Cheyenne.* It was run with much less trouble than during the previous season, owing partly to a better knowledge of the workings of the instrument and partly to the improvement which it had undergone. For field-work it should be further improved by covering the axes of the wheels so as to exclude the dirt. On this account I found it necessary on several occasions to take it to pieces, which is a troublesome job in itself, besides necessitating a readjustment of the spring balances for the proper movement, an operation that requires no little time, patience, and skill. A weight of 150 pounds was used, although it is quite probable that the spring would vibrate with more regularity and would altogether act better under a greater driving power. Still I was afraid to apply it, even though the cord was iron, having a vivid recollection of the perplexities that befell me in this line during the previous season. The ordinary glass pen, so universally used in connection with the chronograph, is a great nuisance, failing very often at a critical moment. Dr. Kampf has substituted a simple but very effective contrivance by which an ordinary writing-pen is made to do this work with great certainty and perfection.

Chronometer.—The chronometer that fell to my lot was the Negus, break-circuit, No. 1511. It was received, corked for transportation, from the hands of Mr. Negus, in New York, and placed in motion only after arrival in Salt Lake City. For the month of June and up to July 4 it had a mean gaining rate of one and three-tenths seconds for every 24

* Published in 1874.

hours. Then, to July 19, its average rate was four-tenths of a second, still gaining, and from about July 24 till August 28 it had a mean rate of zero, seldom showing in that time a variation in clock-error of as much as one-tenth of a second from sidereal time in 24 hours. From August 20 to August 25 it gained two seconds, whether gradually or by a jump I had no observations to show. Up to about August 31 it again ran with sidereal time. For September and till October 5, when the observations at Salt Lake City were finished, its average gaining rate per day of 24 hours was two-tenths of a second. The electrical current was kept on only while observing, and, so far as I could perceive, did not affect its rate.

It went the season through without repair, though occasionally making faint half-second breaks, but not so as to interfere with the reading. The meteorological record will show the temperature to which the chronometer was exposed, but only approximately, for the thermometer was necessarily kept on the outside of the observatory, while the chronometer, being within, was in a much cooler and more equable atmosphere.

Battery.—At first I used one of the carbon batteries with which the astronomical parties were furnished. It is very compact, not liable to be broken, and has the great advantage of evolving electrical power almost instantaneously, but exhausts its force in about twenty hours when worked with acids, as was necessary, thus requiring a renewal at every set of observations. Having burnt out the zincs in a few weeks, I resorted to the form used the previous season, known as the Hill battery. With the fluid that belongs with the carbon battery, it would probably work a season through with but few renewals, and for field purposes possibly be superior to any other form.

CONNECTIONS.—OBSERVER.—COMPUTER.

The places with which corresponding observations were made for the determination of the differences of longitude were Green River, Wyoming, and Winnemucca and Virginia City, Nevada, occupied by Mr. Maryatt; Georgetown, Hughes, Colorado Springs, Labran, and Trinidad, Colorado, and Ogden, Utah, occupied by Dr. Kampf; and Santa Fé and Fort Union, New Mexico, occupied by Professor Safford. Besides the stations recounted

above, two connections for longitude were made in conjunction with Lieutenant Hoxie at Provo, Utah, June 1, 2, and 3, and at Richfield, Utah, July 16. The determination of time by Lieutenant Hoxie was with the sextant.

With the assistance of Mr. William Loomam, I read off during the season all the observations from the chronographic sheets, duplicated them, and made some progress in their reduction. Since that time they have been entirely and finally computed by myself in the office. These reductions, with the circumstances of communication with the connected stations, will be found in the accompanying special reports on those stations.

INSTRUMENTAL VALUES.

The value of each division of the striding-level used was $1''.60$, according to Mr. Austin's measurement, a very satisfactory one, made in 1871. The thread of the micrometer-screw was broken, but there was no occasion to use it, even if it had been intact. The collimation, as developed by the computations, remained quite constant, showing a mean value during the season of $0^{\circ}.13$ plus, clamp east. In its variation it depended much upon the number and positions of the stars grouped in eliminating its value by the method of least squares. The azimuth gave me some trouble, not because of any unsteadiness of the instrument, but by reason of the unskillful handling it received from its owners when they came to regulate their time from observations on the sun.

Both chronometric and arbitrary breaks were made use of in the interchange of signals whenever the wires were working well enough to admit of it. In general there was no trouble in this respect, except at side-stations, like Trinidad, or over a long and poor line, as that to Santa Fé. In such cases we resorted to arbitrary signals recorded by sound. Sometimes it was difficult to get chronometric breaks over the main lines, especially where there was much of what the operators called sympathetic escapement, or when a storm, charged with atmospheric electricity, was bursting somewhere on the circuit. Although the observatory was situated between the city office and all the stations with which exchanges were made, the circuit was nevertheless closed through it. This was a fortunate circum-

stance, for my operator always required its assistance to make the necessary switches to enable him to call up the various offices, particularly Corinne, Ogden, and Cheyenne, to know if the line could be got, and, if so, to have them "straighten the wire" and be on hand to adjust the repeaters for the signals.

The work of the season at Salt Lake City extended from May 31 to October 5, 1873, and embraced exchanges with four different parties, as already stated. Having so many to respond to, with weather-reports oftentimes failing, I was necessarily forced, in order to be prepared with clock-error, to observe almost every available night, Sundays included; yet in all this time, though I did not once fail to make the effort, I succeeded in making exchanges but one Sunday night, and those were with the neighboring station, Ogden. The difficulty lay in the fact that the operators could not be kept at hand to see that the circuit was closed and the "wire straightened." I do not mention this as a matter of fault-finding, but simply to assign the reason for failing to utilize the night which would naturally be supposed to be the best opportunity for astronomical work, it being for business a *dies non*.

I have made a complete and final reduction of all the observations by the method of least squares. They show a very small probable error, and I can say of them that I believe that the longitudes deduced from them will compare favorably with any field-determinations heretofore made under your direction.

Very respectfully, your obedient servant,

JOHN H. CLARK.

First Lieut. GEORGE M. WHEELER,

Corps of Engineers, United States Army, in charge.

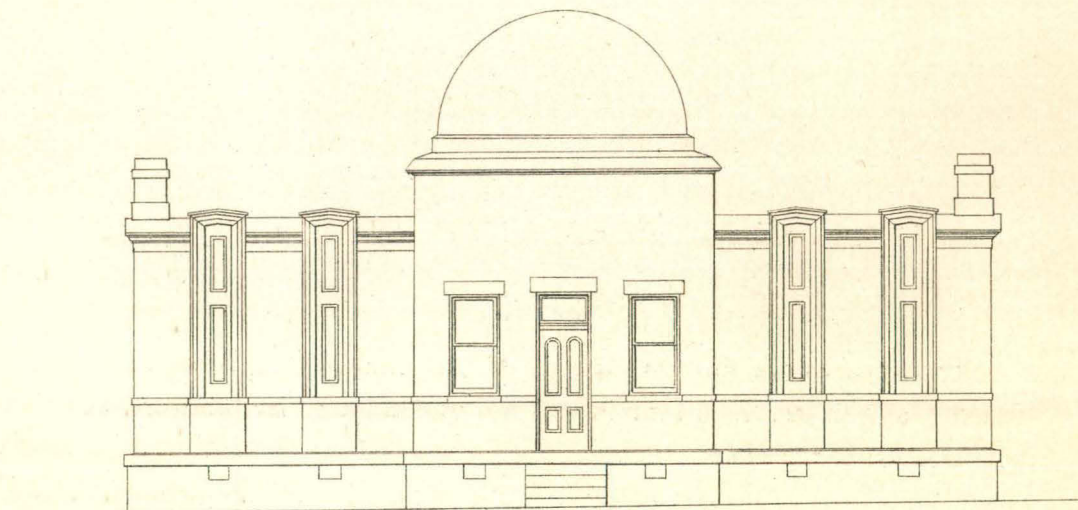
ASTRONOMICAL OBSERVATORY AT OGDEN, UTAH.

The observatory built at Ogden, Weber County, Utah, has been mentioned briefly in the report upon the determination of the astronomical coordinates of that station.

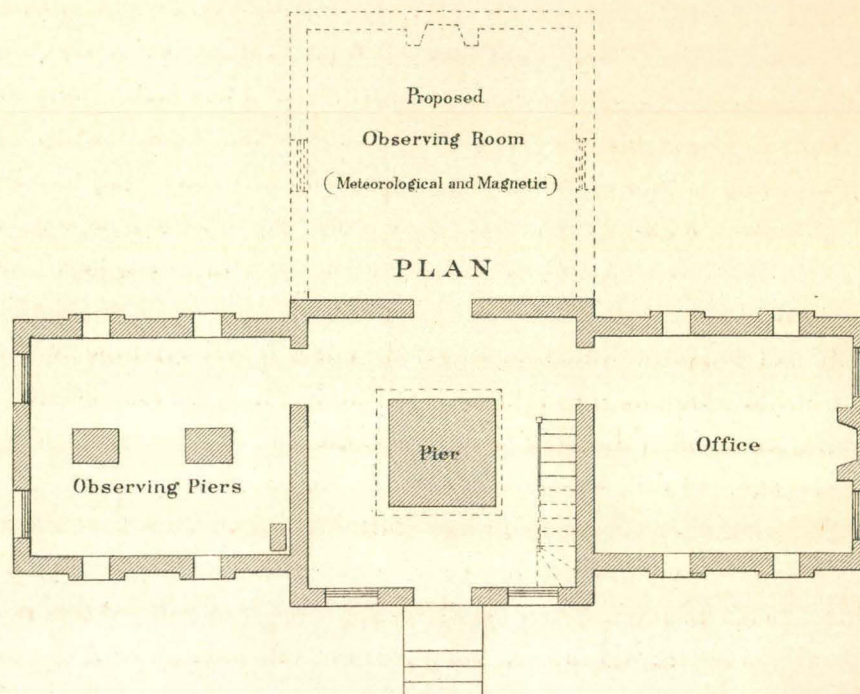
The plan and front elevation of the structure as now completed are shown in Plate I, and also the plan of an additional room intended for meteorological and magnetic observations. The topographical sketch (Plate II) of Ogden and vicinity has located upon it the position of the observatory. The wire of the Western Union Telegraph Company has been conducted to the site, and connection may be readily made also with the wires of the Atlantic and Pacific and Deseret lines. Magnetic observations may also be made in the central room, beneath the dome-room, and also in the basement beneath this same space. An additional room, leading to or adjoining a long hall or gallery for photographic purposes, may be constructed in a position similar to that one shown for the north extension, and thus add, with little expense, to the value of the building as a permanent field-observatory.

It had been the intention to recommend its occupation for a complete series of observations throughout the year by an engineer officer, an assistant observer, and a detail of non-commissioned officers and enlisted men, not exceeding fifteen, from the Engineer Battalion.

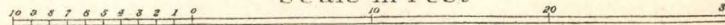
The reduction of the Engineer Battalion occurred at or about the date of establishing this observatory, and request for such authority has consequently been delayed. Any or all of the force stationed at this point could take service during the spring, summer, and fall months with the expedition



FRONT ELEVATION



Scale in Feet



Ch^s Herman, Del.

The Graphic Co. N.Y.

PLAN AND ELEVATION of the ASTRONOMICAL OBSERVATORY at OGDEN, UTAH.
ERECTED 1873.

parties regularly dispatched to regions north and south of the Pacific Railroads.

It will be noticed from the sketch that four railroads leading toward the cardinal points center at Ogden, *i. e.*, (1) Union Pacific Railroad, (2) Central Pacific Railroad, (3) Utah Central Railroad, and (4) Utah Northern Railroad; and hence *sending*-stations embracing a large field in longitude can be reached from this point, while by the establishment of additional receiving-stations, one near the Sierras and another at the east base of the Rocky Mountains, near the fortieth parallel, telegraphic signals may be interchanged with most of the points at which it will prove necessary to determine astronomically longitudes and latitudes in the prosecution to completion of the topographical surveys covering the entire region west of the one hundredth meridian.

The Wahsatch range limits the horizon to the east, and crests of mountains to the westward of the Great Salt Lake on the west. The northwest arm of the Wahsatch and the Promontory ranges lie to the north and east and north and westward, and the Oquirrh range to the southward.

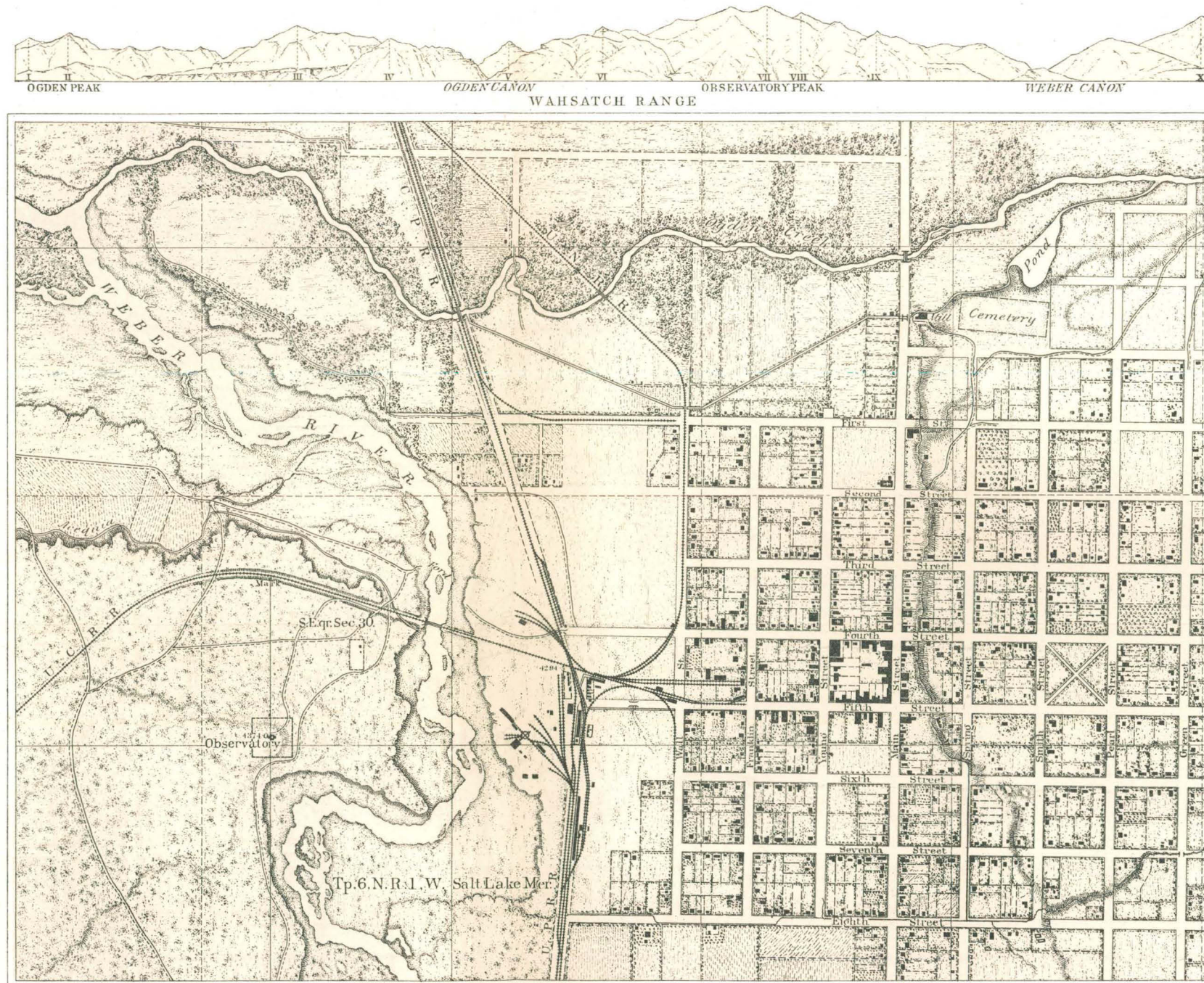
It is to be noticed that, independently of the facilities for telegraphic communication over main lines, a typical point in the Great Salt Lake Basin has been selected at and from which the meteorological conditions of this section of the great interior basin can be studied, and from which surveys of a topographical and hydrographical character may be made to define the conditions of moisture in this part of the extended interior plateaux without ocean drainage, and its other physical peculiarities.

The point named Observatory Peak is believed to be as favorably situated for an observatory at a high altitude as any of the number of mountain-peaks exceeding ten thousand feet in the entire Western mountain region lying in the vicinity of the fortieth parallel. Its accessibility is an element of convenience, and the comparably small number of storms noted about its summit by inhabitants of this section has a practical significance to the observer.

The relative humidity, as shown by the comparison of differences of wet and dry bulb, is less than at peaks ordinarily of elevations of ten thousand feet. The consequent variety and brilliance of the atmosphere lend

accuracy to all observations made. It is intended that a series of meteorological observations shall be taken at this point as soon as the force at disposal permits.

The record at the observatory from August 4 to October 30, 1874, and from July 1 to September 11, 1877, shows that from among one hundred and fifty-five nights, ninety-six were clear and favorable for observing purposes.



Prepared Under the Direction of

Scale in Feet.

1st Lt. Geo. M. Wheeler, Corps of Eng^s U.S. Army.

TOPOGRAPHICAL SKETCH Showing OBSERVATORY SITE And Surroundings AT OGDEN, UTAH.

SURVEYED 1877.

Geographical Position of Centre of East Pier in West Room

Long. 111° 59' 54" 64 Lat. 41° 13' 08" 56.

Altitude 4374.0 ft. Above Sea.

Surveyed by Thompson & Weiss.

Weyss & Lang Del.

The Graphic Co. N.Y.

BY ORDER OF THE HONORABLE THE SECRETARY OF WAR, UNDER THE DIRECTION OF BRIG. GEN. A. A. HUMPHREYS, CHIEF OF ENGINEERS U.S. ARMY.

UNITED STATES ENGINEER OFFICE,
GEOGRAPHICAL SURVEYS WEST OF THE 100TH MERIDIAN,
Washington, D. C., May 5, 1877.

SIR: I have the honor to submit herewith a few brief remarks on the determination for personal equations made by members of the expedition; also a description and representation of the new personal-equation apparatus, together with some of the results obtained by its use.

I am, very respectfully, your obedient servant,

DR. F. KAMPF.

To First Lieut. GEO. M. WHEELER,

Corps of Engineers, in charge of Geographical Survey.

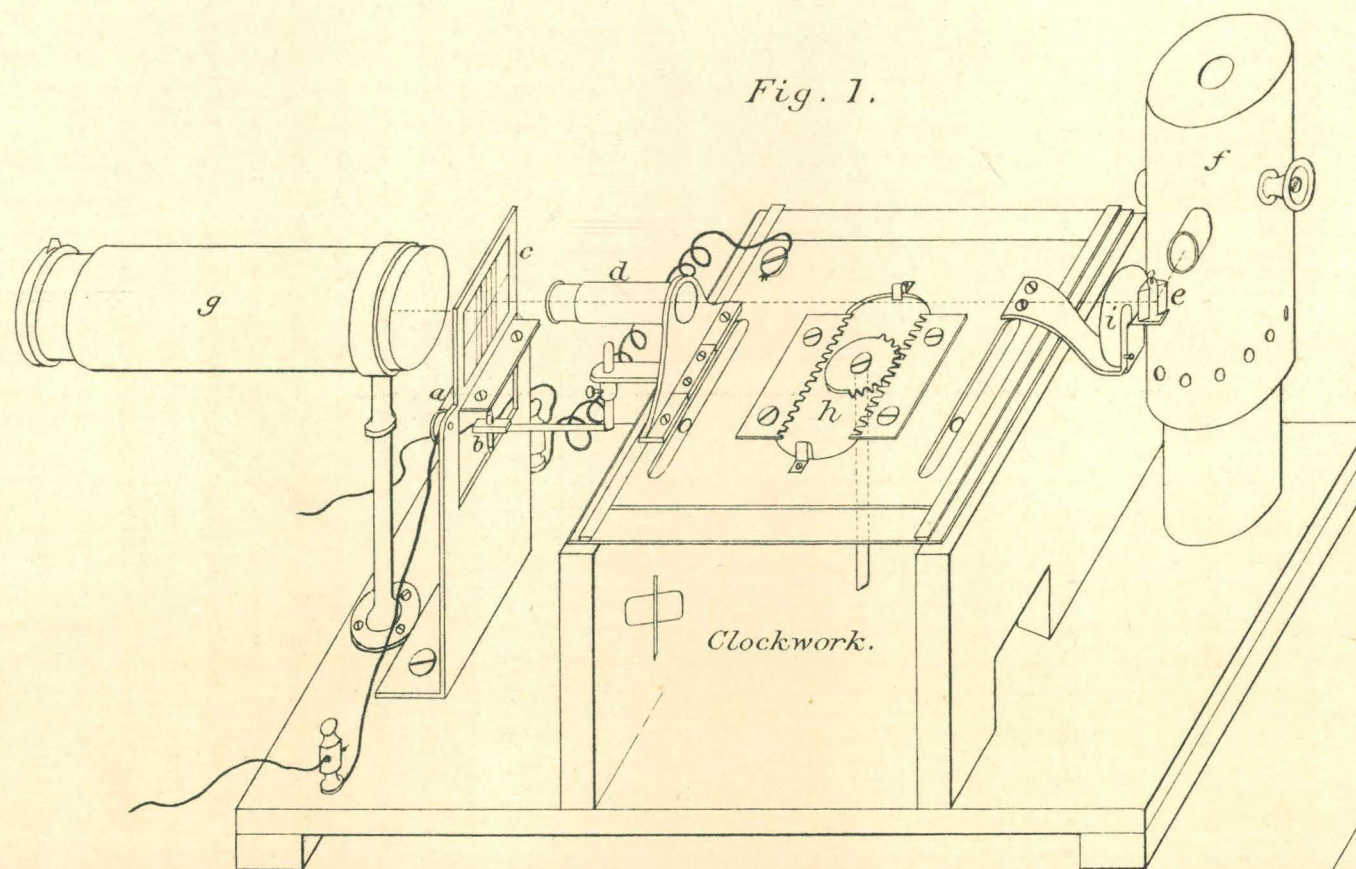
ON THE DETERMINATION OF PERSONAL EQUATIONS.

A knowledge of the personal equation of observers is of the first importance when observations for longitude are to be made. The method of determining this equation before and after a complete set of observations for longitude is unsatisfactory, since it is well established that the personal equation may change even in one night. This fact induced efforts to determine the equation after every observation taken, but all the instruments so far invented for the purpose, several of which I have employed, have proven almost a failure on account of difficulty in adjustment, or have been found objectionable in other respects.

A continuous study of this subject has brought into existence a machine which is recommended for use in all future determinations of longitude from this office, and it is to be regretted that its availability comes so late. The determinations of longitude considered in this report require correction for personal equation, but after reducing the observations for this purpose I find the result of little value. Each observer was always desirous of finishing a station and proceeding to the next as soon as possible, to avoid the probabilities of bad weather. The distance between the stations, and the delay and expense attending a journey to the sending-station, explains why observations for personal equation were not made after each determination of longitude. I recommend, therefore, that no personal equation be applied to any of the observations, and that after the circle is closed, which will be done when Santa Fé is connected with San Diego, an investigation be made to obtain the most probable result for each determination.

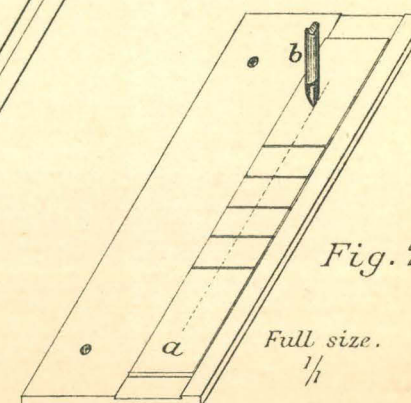
The annexed table gives the observations taken by the different observers for determination of personal equation. It will be seen that John H.

APPARATUS for Determining Absolute PERSONAL EQUATION.



One-third natural size.
 $\frac{1}{3}$

- | | |
|-------------------------|--|
| <i>a</i> Platina Plate. | <i>e</i> Prism. |
| <i>b</i> Transit Point. | <i>f</i> Lantern. |
| <i>c</i> Diaphragm. | <i>g</i> Observing Telescope. |
| <i>d</i> Telescope. | <i>h</i> Movement for converting motion. |



Full size.
 $\frac{1}{1}$

G. Thompson, Del.

Clark and E. P. Austin used different instruments in the same meridian. In other cases, both observers used the same transit and observed alternate stars. The method of reduction of Professor Safford and J. H. Clark's observations can be found in the report on the determination of longitude between Salt Lake City and Santa Fé, page 11.

SALT LAKE CITY, SEPTEMBER 13, 1872.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|-----------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | κ Cephei | 20 15 49.80 | — 0.19 | — 0.04 | + 0.21 | 20 15 49.78 | 20 13 11.80 | — 0 02 37.98 |
| E. | ε Delphini | 28 46.26 | + 0.04 | 0.00 | + 0.05 | 28 46.35 | 26 07.84 | 38.51 |
| E. | α Cygni | 38 44.14 | — 0.01 | + 0.03 | + 0.07 | 38 44.23 | 36 06.06 | 38.17 |
| E. | ν Cygni | 54 04.14 | 0.00 | + 0.05 | + 0.06 | 54 04.25 | 51 26.12 | 38.13 |
| W. | ζ Cygni | 21 09 09.54 | + 0.01 | — 0.03 | — 0.05 | 21 09 09.47 | 21 06 31.45 | 38.02 |
| W. | 1 Pegasi | 17 50.40 | + 0.03 | — 0.03 | — 0.05 | 17 50.35 | 15 12.17 | 38.18 |
| W. | β Cephei | 21 28 41.30 | — 0.10 | — 0.10 | — 0.14 | 21 28 40.96 | 21 26 02.91 | — 0 02 38.05 |
| E. | κ Cephei | 20 15 03.86 | — 7.01 | — 0.15 | — 6.97 | 20 15 49.73 | 20 13 11.80 | — 0 02 37.93 |
| E. | ε Delphini | 28 46.20 | + 1.32 | — 0.04 | — 1.55 | 28 45.93 | 26 07.84 | 38.09 |
| E. | α Cygni | 38 46.52 | — 0.26 | — 0.06 | — 2.15 | 38 44.05 | 36 06.06 | 37.99 |
| E. | ν Cygni | 54 06.76 | 0.00 | — 0.05 | — 2.01 | 54 04.70 | 51 26.12 | 38.58 |
| W. | ζ Cygni | 21 09 06.74 | + 0.57 | + 0.15 | + 1.75 | 21 09 09.21 | 21 06 31.45 | 37.76 |
| W. | 1 Pegasi | 17 47.26 | + 1.01 | + 0.20 | + 1.62 | 17 50.09 | 15 12.17 | 37.92 |
| W. | β Cephei | 21 28 39.80 | — 3.69 | + 0.59 | + 4.45 | 21 28 41.15 | 21 26 02.91 | — 0 02 38.24 |
| | Correction by E. P. Austin | | | | | | | — 0 02 38.149 |
| | Correction by John H. Clark | | | | | | | — 0 02 38.073 |

NORMAL EQUATIONS OF AUSTIN'S OBSERVATIONS.

$$\begin{aligned}
 0 &= +0.41 + 7.00 \delta t - 3.13 a + 3.19 c & \delta t &= -0^s.049 \\
 0 &= -0.46 - 3.13 \delta t + 9.91 a - 8.52 c & a &= +0^s.071 \\
 0 &= -0.95 + 3.19 \delta t - 8.52 a + 36.62 c & c &= +0^s.047
 \end{aligned}$$

NORMAL EQUATIONS OF CLARK'S OBSERVATIONS.

$$\begin{aligned}
 0 &= +1.000 + 7.00 \delta t - 3.13 a^1 + 3.19 c^1 & \delta t &= +0^s.127 \\
 0 &= -5.535 - 3.13 \delta t + 9.91 a^1 - 8.52 c^1 & a^1 &= +0^s.578 \\
 0 &= +5.391 + 3.19 \delta t - 8.52 a^1 + 36.62 c^1 & c^1 &= -0^s.024
 \end{aligned}$$

$$\begin{aligned}
 \text{Adopted azimuth} &= +2.00 \\
 \text{Adopted error of collim.} &= -1.50
 \end{aligned}$$

$$\begin{aligned}
 \text{Therefore } a &= +2^s.578 \\
 c &= -1^s.524
 \end{aligned}$$

SALT LAKE CITY, SEPTEMBER 16, 1872.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|-----------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | δ Draconis | 19 14 15.20 | + 0.12 | — 0.37 | + 0.10 | 19 14 15.05 | 19 11 32.34 | — 0 02 42.71 |
| W. | γ Aquilæ | 41 55.04 | — 0.05 | — 0.12 | + 0.04 | 41 54.91 | 39 12.24 | 42.67 |
| W. | α Aquilæ | 46 16.80 | — 0.06 | — 0.10 | + 0.04 | 46 16.68 | 43 34.10 | 42.58 |
| W. | ε Draconis | 50 19.92 | + 0.14 | — 0.25 | + 0.11 | 50 19.92 | 47 37.32 | 42.60 |
| E. | κ Cephei | 20 14 54.20 | + 0.28 | — 0.11 | — 0.17 | 20 14 54.20 | 20 12 11.54 | 42.66 |
| E. | ε Delphini | 28 50.66 | — 0.05 | 0.00 | — 0.04 | 28 50.57 | 26 07.81 | 42.76 |
| E. | α Cygni | 38 48.66 | + 0.01 | + 0.04 | — 0.05 | 38 48.66 | 36 06.01 | 42.65 |
| E. | ν Cygni | 54 08.50 | 0.00 | + 0.04 | — 0.05 | 54 08.49 | 51 26.08 | 42.41 |
| E. | 61 Cygni | 21 02 54.69 | — 0.01 | + 0.05 | — 0.05 | 21 02 54.68 | 21 00 11.92 | — 0 02 42.76 |
| E. | γ Aquilæ | 19 41 53.72 | + 2.74 | 0.00 | — 1.79 | 19 41 54.67 | 19 39 12.24 | — 0 02 42.43 |
| E. | α Aquilæ | 46 15.38 | + 2.85 | 0.00 | — 1.77 | 46 16.46 | 43 34.10 | 42.36 |
| E. | ε Draconis | 50 32.48 | — 7.49 | 0.00 | — 5.12 | 50 19.87 | 47 37.32 | 42.55 |
| W. | κ Cephei | 20 14 59.76 | — 14.29 | + 0.55 | + 7.98 | 20 14 54.00 | 20 12 11.54 | 42.46 |
| W. | ε Delphini | 28 45.82 | + 2.69 | + 0.20 | + 1.79 | 28 50.50 | 26 07.81 | 42.69 |
| W. | α Cygni | 38 45.98 | — 0.53 | + 0.41 | + 2.48 | 38 48.34 | 36 06.01 | 42.33 |
| W. | ν Cygni | 54 06.14 | 0.00 | + 0.33 | + 2.31 | 54 08.78 | 51 26.08 | 42.70 |
| W. | 61 Cygni | 21 02 51.51 | + 0.32 | + 0.27 | + 2.22 | 21 02 54.32 | 21 00 11.92 | — 0 02 42.40 |
| | Correction by E. P. Austin | | | | | | | — 0 02 42.644 |
| | Correction by John H. Clark | | | | | | | — 0 02 42.490 |

NORMAL EQUATIONS OF AUSTIN'S OBSERVATIONS.

$$\begin{aligned}
 0 &= +0.990 + 9.000 \delta t - 3.770 a + 2.010 c & \delta t &= -0^s.144 \\
 0 &= +0.416 - 3.770 \delta t + 11.565 a - 5.750 c & a &= -0^s.102 \\
 0 &= +1.384 + 2.010 \delta t - 5.750 a + 44.484 c & c &= -0^s.038
 \end{aligned}$$

NORMAL EQUATIONS OF CLARK'S OBSERVATIONS.

$$\begin{aligned}
 0 &= +1.860 + 8.000 \delta t - 2.600 a^1 - 4.620 c^1 & \delta t &= -0^s.290 \\
 0 &= -1.316 - 2.600 \delta t + 10.196 a^1 + 8.804 c^1 & a^1 &= +0^s.273 \\
 0 &= +5.768 - 4.620 \delta t + 8.804 a^1 + 37.672 c^1 & c^1 &= -0^s.253
 \end{aligned}$$

Adopted azimuth + 5^s.00
 Adopted error of collim. — 1^s.50

Therefore $a = + 5^s.273$
 $c = - 1^s.753$

SALT LAKE CITY, SEPTEMBER 17, 1872.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|-----------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | β Lyrae | 18 47 06.70 | — 0.01 | 0.00 | — 0.04 | 18 47 06.65 | 18 44 22.54 | — 0 02 44.11 |
| E. | 50 Draconis | 53 14.42 | + 0.12 | 0.00 | — 0.13 | 53 14.41 | 50 30.05 | 44.36 |
| E. | ζ Aquilæ | 19 01 17.40 | — 0.02 | — 0.01 | — 0.04 | 19 01 17.33 | 58 33.12 | 44.21 |
| E. | δ Draconis | 14 16.06 | + 0.06 | — 0.04 | — 0.09 | 14 15.99 | 19 11 32.28 | 43.71 |
| E. | δ Aquilæ | 20 48.62 | — 0.03 | — 0.03 | — 0.04 | 20 48.52 | 18 04.41 | 44.11 |
| E. | γ Aquilæ | 41 56.42 | — 0.03 | — 0.04 | — 0.03 | 41 56.32 | 39 12.23 | 44.09 |
| W. | ε Draconis | 50 21.35 | + 0.08 | — 0.07 | + 0.10 | 50 21.46 | 47 37.25 | 44.21 |
| W. | τ Aquilæ | 59 39.08 | — 0.03 | — 0.02 | + 0.03 | 59 39.06 | 56 55.09 | 43.97 |
| W. | κ Cephei | 20 14 55.22 | + 0.15 | — 0.04 | + 0.15 | 20 14 55.48 | 20 12 11.44 | 44.04 |
| W. | ε Delphini | 20 28 52.06 | — 0.03 | 0.00 | + 0.04 | 20 28 52.07 | 20 26 07.80 | — 0 02 44.27 |
| W. | δ Draconis | 19 14 17.44 | — 5.46 | — 0.05 | + 4.33 | 19 14 16.26 | 19 11 32.28 | — 0 02 43.98 |
| W. | γ Aquilæ | 41 51.98 | + 2.43 | — 0.01 | + 1.69 | 41 56.09 | 39 12.23 | 43.86 |
| W. | α Aquilæ | 46 13.52 | + 2.52 | 0.00 | + 1.67 | 46 17.71 | 43 34.09 | 43.62 |
| E. | κ Cephei | 20 15 15.64 | — 12.65 | — 0.18 | — 7.54 | 20 14 55.27 | 20 12 11.44 | 43.83 |
| E. | ε Delphini | 20 28 51.26 | + 2.38 | — 0.04 | — 1.69 | 20 28 51.91 | 20 26 07.80 | — 0 02 44.11 |
| | Correction by E. P. Austin | | | | | | | — 0 02 44.078 |
| | Correction by John H. Clark | | | | | | | — 0 02 43.880 |

NORMAL EQUATIONS OF AUSTIN'S OBSERVATIONS.

$$\begin{aligned}
 0 &= -1.130 + 10.000 \delta t - 4.690 a + 1.300 c & \delta t &= + 0^s.092 \\
 0 &= +1.540 - 4.690 \delta t + 17.129 a + 5.430 c & a &= - 0^s.054 \\
 0 &= +2.181 + 1.300 \delta t + 5.430 a + 58.108 c & c &= - 0^s.035
 \end{aligned}$$

NORMAL EQUATIONS OF CLARK'S OBSERVATIONS.

$$\begin{aligned}
 0 &= +0.860 + 5.000 \delta t - 2.310 a^1 + 0.930 c^1 & \delta t &= + 0^s.120 \\
 0 &= -5.193 - 2.310 \delta t + 9.535 a^1 - 9.831 c^1 & a^1 &= + 0^s.668 \\
 0 &= +3.648 + 0.930 \delta t - 9.831 a^1 + 30.615 c^1 & c^1 &= + 0^s.092
 \end{aligned}$$

$$\begin{aligned}
 \text{Adopted azimuth} &= + 4^s.00 \\
 \text{Adopted error of collim.} &= - 1^s.750
 \end{aligned}$$

$$\begin{aligned}
 \text{Therefore } a &= + 4^s.668 \\
 c &= - 1^s.658
 \end{aligned}$$

PERSONAL EQUATIONS.

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SALT LAKE CITY, JULY 2, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|-----------------------------------|--------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | μ Herculis | 9 34 17.16 | - 0.49 | - 0.14 | + 0.18 | 9 34 16.61 | 17 41 31.39 | + 8 07 14.78 |
| E. | 72 Ophiuchi..... | 54 08.04 | - 1.04 | - 0.10 | + 0.16 | 54 07.06 | 18 01 21.79 | 14.73 |
| E. | η Serpentis | 10 07 33.06 | - 1.35 | - 0.08 | + 0.16 | 10 07 31.79 | 14 46.35 | 14.56 |
| W. | α Lyræ | 25 26.18 | - 0.10 | - 0.20 | - 0.21 | 25 25.67 | 32 40.52 | 14.85 |
| W. | 50 Draconis..... | 43 14.17 | + 4.36 | - 0.26 | - 0.64 | 43 17.63 | 50 31.99 | 14.36 |
| W. | δ Sagittarii..... | 11 02 02.03 | - 1.80 | - 0.03 | - 0.17 | 11 02 00.03 | 19 09 14.51 | + 8 07 14.48 |
| Correction by J. H. Clark..... | | | | | | | | + 8 07 14.626 |
| E. | γ Draconis..... | 9 46 26.81 | + 0.59 | - 0.21 | + 0.26 | 9 46 27.45 | 17 53 42.07 | + 8 07 14.62 |
| E. | μ Sagittarii..... | 58 59.71 | - 1.86 | - 0.06 | + 0.17 | 58 57.96 | 18 06 12.43 | 14.47 |
| E. | 1 Aquilæ | 10 21 06.73 | - 1.49 | - 0.08 | + 0.16 | 10 21 05.32 | 28 19.88 | 14.56 |
| W. | β Lyræ | 38 11.54 | - 0.31 | - 0.14 | - 0.19 | 38 10.90 | 45 25.58 | 14.68 |
| W. | ζ Aquilæ | 52 22.68 | - 0.92 | - 0.05 | - 0.17 | 52 21.54 | 59 36.34 | 14.80 |
| W. | τ Draconis..... | 11 10 45.17 | + 3.60 | - 0.15 | - 0.56 | 11 10 48.06 | 19 18 02.87 | + 8 07 14.81 |
| Correction by W. W. Marryatt..... | | | | | | | | + 8 07 14.657 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= + 6.96 + 12.00 \delta t + 0.41 a - 5.11 c + 6.00 x & \delta t &= - 0^s.373 \\
 0 &= + 20.65 + 0.41 \delta t + 11.83 a + 16.25 c + 0.20 x & a &= - 1^s.956 \\
 0 &= + 23.33 - 5.11 \delta t + 16.25 a + 40.68 c - 1.98 x & c &= + 0^s.162 \\
 0 &= + 2.78 + 6.00 \delta t + 0.20 a - 1.98 c + 6.00 x & x &= + 0^s.031
 \end{aligned}$$

SALT LAKE CITY, JULY 3, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|-----------------------------------|---------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | ζ Ophiuchi..... | 8 22 59.89 | - 1.38 | - 0.08 | + 0.13 | 8 22 58.56 | 16 30 11.98 | + 8 07 13.42 |
| E. | κ Ophiuchi..... | 44 28.83 | - 0.92 | - 0.10 | + 0.13 | 44 27.94 | 51 41.34 | 13.40 |
| E. | α_1 Herculis | 9 01 40.71 | - 0.80 | - 0.06 | + 0.13 | 9 01 39.98 | 17 08 53.40 | 13.42 |
| E. | Gr. 966, S. P. } | 15 35.58 | - 6.05 | + 0.05 | - 0.52 | 15 29.06 | 22 42.56 | 13.50 |
| W. | | 15 34.48 | - 6.06 | + 0.05 | + 0.52 | 15 28.99 | 22 42.56 | 13.57 |
| W. | ω Draconis | 30 29.90 | + 2.27 | 0.00 | - 0.37 | 30 31.80 | 37 45.42 | 13.62 |
| W. | 72 Ophiuchi..... | 54 09.34 | - 0.92 | + 0.04 | - 0.14 | 54 08.32 | 18 01 21.80 | 13.48 |
| W. | η Serpentis | 10 07 34.25 | - 1.20 | + 0.06 | - 0.14 | 10 07 32.97 | 18 14 46.36 | + 8 07 13.39 |
| Correction by J. H. Clark | | | | | | | | + 8 07 13.475 |
| E. | η Herculis | 8 31 21.11 | - 0.07 | - 0.16 | + 0.17 | 8 31 21.05 | 16 38 34.66 | + 8 07 13.61 |
| E. | δ Herculis | 49 43.94 | - 0.26 | - 0.10 | + 0.16 | 49 43.74 | 56 56.97 | 13.23 |
| E. | ν Serpentis | 9 06 31.23 | - 1.43 | + 0.03 | + 0.14 | 9 06 29.97 | 17 13 43.21 | 13.24 |
| W. | α Ophiuchi..... | 21 51.92 | - 0.79 | 0.09 | - 0.14 | 21 50.99 | 29 04.33 | 13.39 |
| W. | γ Draconis | 46 28.21 | + 0.52 | + 0.03 | - 0.22 | 46 28.54 | 53 41.70 | 13.16 |
| W. | μ_1 Sagittarii..... | 9 58 00.88 | - 1.66 | + 0.03 | - 0.14 | 9 58 59.11 | 18 06 12.43 | + 8 07 13.32 |
| Correction by W. W. Marryatt..... | | | | | | | | + 8 07 13.325 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= + 13.25 + 14.00 \delta t + 10.75 a - 1.92 c + 6.00 x & \delta t &= + 0^s.475 \\
 0 &= + 46.13 + 10.75 \delta t + 29.51 a + 4.25 c + 2.11 x & a &= - 1^s.745 \\
 0 &= + 1.34 - 1.92 \delta t + 4.25 a + 51.42 c - 0.19 x & c &= + 0^s.135 \\
 0 &= + 1.77 + 6.00 \delta t + 2.11 a - 0.19 c + 6.00 x & x &= - 0^s.150
 \end{aligned}$$

SALT LAKE CITY, JULY 4, 1873.

| Clamp. | Name of star. | T. | | Aa. | Bb. | Cc. | T'. | | AR. | ΔT. |
|-----------------------------------|-----------------------------|-----------------|-----------|-----------|-----------|-----------|-----------------|-----------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | β Ursæ Minoris.. | 6 43 | 53.74 | + 3.62 | + 0.50 | - 0.33 | 6 43 | 57.53 | 14 51 | 09.37 |
| W. | β Libræ..... | 7 03 | 01.55 | - 1.32 | + 0.10 | - 0.09 | 7 03 | 00.24 | 15 10 | 12.07 |
| W. | ζ ³ Libræ..... | 16 22 | 04 | - 1.49 | + 0.12 | - 0.09 | 16 20 | 58 | 23 32 | 36 |
| W. | α Serpentis..... | 30 51 | 38 | - 0.96 | + 0.27 | - 0.09 | 30 50 | 60 | 38 02 | 48 |
| E. | β ₁ Scorpii..... | 50 54 | 54 | - 1.58 | + 0.19 | + 0.09 | 50 53 | 24 | 58 05 | 15 |
| E. | τ Herculis..... | 8 08 | 44.90 | + 0.26 | + 0.54 | + 0.13 | 8 08 | 45.83 | 16 15 | 57.48 |
| E. | η Draconis..... | 8 15 | 05.24 | + 1.30 | + 0.73 | + 0.19 | 8 15 | 07.46 | 16 22 | 19.37 |
| Correction by J. H. Clark | | | | | | | | | | + 8 07 11.828 |
| W. | β Bootis..... | 6 49 | 53.50 | 0.00 | + 0.21 | - 0.12 | 6 49 | 59.59 | 14 57 | 11.48 |
| W. | α ² Libræ..... | 7 08 | 48.10 | - 1.46 | + 0.10 | - 0.09 | 7 08 | 56.65 | 15 16 | 58.50 |
| W. | α Coronæ..... | 22 08 | 65 | - 0.46 | + 0.28 | - 0.10 | 22 08 | 37 | 29 20 | 40 |
| W. | ε Serpentis..... | 37 19 | 66 | - 1.01 | + 0.31 | - 0.09 | 37 18 | 87 | 44 30 | 93 |
| E. | Groombr. 2320. | 58 46 | 98 | + 2.13 | + 0.87 | + 0.24 | 58 50 | 22 | 16 06 | 02.07 |
| E. | A Draconis..... | 8 21 | 02.47 | + 2.26 | + 0.93 | + 0.25 | 8 21 | 05.91 | 28 17 | 95 |
| E. | η Herculis..... | 8 31 | 22.01 | - 0.07 | + 0.49 | + 0.11 | 8 31 | 22.54 | 16 38 | 34.65 |
| Correction by W. W. Marryatt..... | | | | | | | | | | + 8 07 11.976 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= + 0.15 + 14.00 \delta t - 0.71 a + 0.11 c + 7.00 x & \delta t &= - 0^s.172 \\
 0 &= + 20.88 - 0.71 \delta t + 11.98 a - 3.88 c - 0.81 x & a &= - 1^s.715 \\
 0 &= - 11.14 + 0.11 \delta t - 3.88 a + 46.94 c + 2.31 x & c &= + 0^s.089 \\
 0 &= - 1.42 + 7.00 \delta t - 0.81 a + 2.31 c + 7.00 x & x &= + 0^s.148
 \end{aligned}$$

SALT LAKE CITY, SEPTEMBER 25, 1873.

| Clamp. | Name of star. | T. | | Aa. | Bb. | Cc. | T'. | | AR. | ΔT. |
|----------------------------------|---------------------------|-----------------|-----------|-----------|-----------|-----------|-----------------|-----------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| W. | ζ Aquilæ..... | 10 52 | 40.10 | - 0.73 | + 0.11 | - 0.06 | 10 52 | 39.42 | 18 59 | 35.85 |
| W. | δ Draconis..... | 11 05 | 33.17 | + 2.05 | + 0.28 | - 0.14 | 11 05 | 35.26 | 19 12 | 31.73 |
| W. | α Vulpeculæ..... | 16 30 | 55 | - 0.54 | + 0.13 | - 0.06 | 16 30 | 08 | 23 26 | 89 |
| W. | κ Aquilæ..... | 23 10 | 25 | - 1.32 | + 0.08 | - 0.06 | 23 08 | 95 | 30 05 | 46 |
| W. | γ Aquilæ..... | 33 19 | 40 | - 0.91 | + 0.14 | - 0.05 | 33 18 | 58 | 40 15 | 10 |
| E. | β Aquilæ..... | 42 10 | 51 | - 0.95 | + 0.14 | + 0.05 | 42 09 | 75 | 49 06 | 37 |
| E. | θ Aquilæ..... | 57 51 | 53 | - 1.17 | + 0.14 | + 0.06 | 57 50 | 56 | 20 04 | 47.11 |
| E. | Groombr. 3241. | 12 23 | 33.79 | + 2.99 | + 0.55 | + 0.18 | 12 23 | 37.51 | 30 33 | 64 |
| E. | α Cygni..... | 12 30 | 10.63 | + 0.16 | + 0.28 | + 0.09 | 12 30 | 11.16 | 20 37 | 07.88 |
| Correction by J. H. Clark | | | | | | | | | | + 8 06 56.72 |
| W. | ε Aquilæ..... | 10 46 | 57.09 | - 0.79 | + 0.11 | - 0.06 | 10 46 | 56.35 | 18 53 | 53.03 |
| W. | τ Draconis..... | 11 10 | 58.95 | + 3.22 | + 0.35 | - 0.19 | 11 10 | 02.33 | 19 16 | 59.08 |
| W. | μ Aquilæ..... | 20 59 | 25 | - 0.98 | + 0.10 | - 0.05 | 20 58 | 32 | 27 54 | 74 |
| W. | θ Cygni..... | 26 06 | 01 | + 0.44 | + 0.18 | - 0.09 | 26 06 | 54 | 33 03 | 35 |
| E. | α Aquilæ..... | 37 41 | 08 | - 0.94 | + 0.14 | + 0.05 | 37 40 | 33 | 44 37 | 06 |
| E. | τ Aquilæ..... | 51 02 | 13 | - 0.98 | + 0.14 | + 0.06 | 51 01 | 35 | 57 58 | 08 |
| E. | κ Cephei..... | 12 06 | 05.62 | + 4.76 | + 0.69 | + 0.25 | 12 06 | 11.32 | 20 13 | 08.25 |
| E. | ω ₁ Cygni..... | 12 16 | 13.44 | + 0.39 | + 0.30 | + 0.08 | 12 16 | 14.21 | 20 23 | 10.97 |
| Correction by Dr. F. Kampf | | | | | | | | | | + 8 06 56.726 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= - 15.23 + 17.00 \delta t - 2.63 a + 0.96 c + 8.00 x & \delta t &= + 0^s.529 \\
 0 &= + 34.35 - 2.63 \delta t + 18.20 a - 9.46 c - 2.92 x & a &= - 1^s.750 \\
 0 &= - 21.03 + 9.96 \delta t - 9.46 a + 67.32 c + 1.05 x & c &= + 0^s.056 \\
 0 &= - 10.93 + 8.00 \delta t - 2.92 a + 1.05 c + 8.00 x & x &= + 0^s.197
 \end{aligned}$$

PERSONAL EQUATIONS.

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SALT LAKE CITY, SEPTEMBER 26, 1873.

| Clamp. | Name of star. | T. | Aa. | Bb. | Cc. | T'. | AR. | ΔT. |
|--------|----------------------------------|-----------------|-----------|-----------|-----------|-----------------|-----------------|-----------------|
| | | <i>h. m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> |
| E. | ε Aquilæ | 10 16 57.64 | — 0.86 | + 0.09 | + 0.14 | 10 16 57.01 | 18 23 53.01 | + 8 06 56.00 |
| E. | τ Draconis | 11 10 58.60 | + 3.51 | + 0.18 | + 0.48 | 11 10 02.77 | 19 16 59.01 | 56.24 |
| E. | μ Aquilæ | 20 59.65 | — 1.07 | + 0.03 | + 0.14 | 20 58.75 | 27 54.73 | 55.98 |
| E. | θ Cygni | 26 06.31 | + 0.48 | + 0.03 | + 0.21 | 26 07.03 | 33 03.33 | 56.30 |
| W. | α Aquilæ | 37 42.20 | + 1.03 | + 0.11 | — 0.13 | 37 41.15 | 44 37.05 | 55.90 |
| W. | τ Aquilæ | 51 03.18 | + 1.06 | + 0.12 | — 0.14 | 51 02.10 | 57 58.06 | 55.96 |
| W. | κ Cephei | 12 06 06.91 | + 5.18 | + 0.55 | — 0.63 | 12 06 12.01 | 20 13 08.18 | 56.15 |
| W. | ω ¹ Cygni | 12 16 14.72 | + 0.42 | + 0.24 | — 0.21 | 12 16 15.17 | 20 23 10.94 | + 8 06 55.77 |
| E. | ζ Aquilæ | 10 52 40.34 | — 0.90 | + 0.09 | + 0.14 | 10 52 39.67 | 18 59 35.84 | + 8 06 56.17 |
| E. | δ Draconis | 11 05 32.55 | + 2.23 | + 0.10 | + 0.36 | 11 05 35.24 | 19 12 31.67 | 56.43 |
| E. | α Vulpeculæ | 16 31.12 | — 0.59 | + 0.06 | + 0.15 | 16 30.74 | 23 26.87 | 56.13 |
| E. | κ Aquilæ | 23 10.77 | — 1.43 | + 0.03 | + 0.14 | 23 09.51 | 30 05.44 | 55.93 |
| E. | γ Aquilæ | 33 19.81 | — 0.99 | + 0.02 | + 0.14 | 33 18.98 | 40 15.09 | 56.11 |
| W. | β Aquilæ | 42 11.55 | — 1.03 | + 0.11 | — 0.13 | 42 10.50 | 49 06.35 | 55.85 |
| W. | θ Aquilæ | 57 52.48 | — 1.28 | + 0.10 | — 0.14 | 57 51.16 | 20 04 47.10 | 55.94 |
| W. | π Capricorni | 12 13 11.29 | — 1.73 | + 0.08 | — 0.15 | 12 13 09.49 | 20 05.41 | 55.92 |
| W. | roombr. 3241 | 12 23 34.76 | + 3.26 | + 0.44 | — 0.45 | 12 23 38.01 | 20 30 33.57 | + 8 06 55.56 |
| | Correction by J. H. Clark | | | | | | | + 8 06 56.038 |
| | Correction by Dr. F. Kampf | | | | | | | + 8 06 56.004 |

NORMAL EQUATIONS.

$$\begin{aligned}
 0 &= -3.37 + 17.00 \delta t - 1.63 a + 1.49 c + 9.00 x & \delta t &= +0^s.038 \\
 0 &= +35.87 - 1.63 \delta t + 19.02 a - 3.47 c + 1.29 x & a &= -1^s.906 \\
 0 &= +2.51 + 1.49 \delta t - 3.47 a + 66.45 c + 0.44 x & c &= +0^s.138 \\
 0 &= +2.36 + 9.00 \delta t + 1.29 a + 0.44 c + 9.00 x & x &= -0^s.034
 \end{aligned}$$

JANUARY 11, 1874.—PERSONAL EQUATION BETWEEN J. H. CLARK AND T. H. SAFFORD.

| | T. | | | | a. | a-T. | | |
|--------------------|-----------------|--------------|-----------|-----------|-----------|-----------|-----------|-----------|
| | <i>h. m. s.</i> | <i>m. s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> | <i>s.</i> |
| Groombr. 848 | 4 31 00.50 | 31 48.58 | + 7.95 | + 0.11 | 56.64 | 56.14 | 3.92 | — 4.05 |
| μ Er.dani | 4 38 23.18 | 39 09.54 | + 3.00 | 0.00 | 12.54 | 49.36 | — 0.06 | — 1.00 |
| Groombr. 966 | 5 22 10.96 | 22 47.74 | + 7.96 | + 0.25 | 55.95 | 44.99 | 3.71 | 3.84 |
| ζ Tauri | 5 29 20.62 | 30 03.77 | + 3.58 | + 0.03 | 7.38 | 46.76 | + 0.39 | 1.07 |

$$\begin{aligned}
 6.78 &= 3.98 n - 3.05 c & -1.77 &= 3.32 n + 2.77 c \\
 1.70 &= n - 0.77 c & -0.53 &= n + 0.83 c \\
 49.46 &= \delta t - m - 1.05 c & 46.97 &= \delta t + m + 0.75 c \\
 \text{Hence} & -2.49 = 1.80 c & n &= +0.63 \\
 & (-1.38) = c & c &= -1.39 \\
 & -2.23 = 1.60 c & & \\
 & -1.391 = c & & 0.143 n
 \end{aligned}$$

31 AST

| | Decl. | | | Jan. 11, 1874. | | | a. | | | T cor. | C. | S. |
|-----------------------|-------|-------|-------|-------------------|-------|-------|-------|-------|-------|--------|-------------|-------------|
| | o | | | h. m. s. | s. | s. | s. | s. | s. | s. | s. | s. |
| δ Tauri..... | 17 13 | 0.311 | 0.020 | 4 15 36.78 | +3.46 | +0.01 | 40.25 | +0.20 | +1.40 | 52.50 | 47.75 | ..... |
| ϵ Tauri..... | 18 54 | 0.342 | 0.024 | 21 12.26 | 3.50 | +0.01 | 15.77 | +0.25 | +1.47 | 27.85 | ..... | 47.92 |
| α Tauri..... | 16 15 | 0.292 | 0.018 | 28 38.22 | 3.44 | +0.01 | 41.67 | +0.11 | +1.55 | 53.98 | 47.69 | ..... |
| Groombr. 848 | 75 42 | 3.924 | 0.607 | 31 48.58 | +7.95 | +0.15 | 56.68 | +2.47 | +5.64 | 8.61 | ..... | (48.07) |
| γ Tauri..... | 22 41 | 0.418 | 0.035 | 34 37.59 | +3.59 | +0.01 | 41.19 | +0.26 | +1.51 | 39.37 | 47.82 | ..... |
| μ Eridani..... | -3 29 | 0.061 | 0.001 | 39 09.54 | 3.00 | 0.00 | 12.51 | -0.04 | +1.35 | 24.53 | ..... | 48.01 |
| π^4 Orionis..... | +5 23 | 0.094 | 0.002 | 44 26.84 | 3.19 | 0.00 | 30.03 | +0.06 | +1.40 | 42.28 | 47.75 | ..... |
| π^5 Orionis..... | 2 14 | 0.039 | 0.000 | 47 38.50 | 3.12 | 0.00 | 41.63 | +0.01 | +1.35 | 0.79 | ..... | ..... |
| ζ Aurigæ..... | 40 51 | 0.865 | 0.120 | 53 36.50 | 4.18 | 0.04 | 40.72 | +0.54 | +1.85 | 53.09 | 47.63 | ..... |
| η Aurigæ..... | 41 04 | 0.871 | 0.123 | 4 57 37.01 | 4.20 | 0.24 | 41.25 | +0.55 | +1.85 | 53.08 | ..... | 48.17 |
| η Orionis..... | -2 31 | 0.044 | 0.001 | 5 18 05.90 | 3.01 | 0.00 | 8.91 | -0.05 | -1.35 | 21.08 | ..... | 47.83 |
| Groombr. 966 | 74 57 | 3.728 | 0.586 | 22 47.74 | 7.96 | 0.25 | 55.95 | +2.35 | -5.30 | 7.95 | (48.00) | ..... |
| ϕ Orionis..... | 9 25 | 0.165 | 0.004 | 27 51.30 | +3.29 | 0.01 | 54.60 | +0.10 | -1.40 | 6.84 | ..... | 47.76 |
| ζ Tauri..... | 21 04 | 0.385 | 0.030 | 30 03.77 | 3.58 | 0.03 | 7.38 | +0.24 | -1.41 | 19.37 | 48.01 | ..... |
| σ Orionis..... | -2 41 | 0.047 | 0.001 | 32 22.69 | 3.01 | 0.00 | 25.70 | -0.05 | -1.35 | 37.95 | ..... | 47.72 |
| θ Aurigæ..... | 49 46 | 1.182 | 0.190 | 36 04.41 | +4.64 | 0.09 | 9.14 | +0.74 | -2.15 | 21.27 | ..... | 47.87 |
| 130 Tauri..... | 17 41 | 0.315 | 0.021 | 40 02.32 | +3.50 | 0.03 | 5.85 | +0.20 | -1.40 | 17.98 | 47.87 | ..... |
| ν Aurigæ..... | 39 07 | 0.813 | 0.110 | 42 41.76 | +4.15 | 0.07 | 45.98 | +0.51 | -1.75 | 58.04 | ..... | 47.94 |
| α Orionis..... | 5 48 | 0.101 | 0.002 | 48 18.74 | +3.25 | 0.01 | 21.50 | +0.00 | -1.40 | 33.60 | 47.84 | ..... |
| θ Aurigæ..... | 37 12 | 0.759 | 0.099 | 5 51 04.24 | +4.09 | 0.07 | 8.40 | +0.45 | -1.74 | 20.36 | ..... | 48.04 |
| One observation..... | | | | | | | | | | | 47.794 | 47.918 |
| All..... | | | | | | | | | | | ± 0.079 | ± 0.098 |
| | | | | | | | | | | | ± 0.028 | ± 0.033 |

From the observations, the following quantities for personal equation are derived:

J. H. Clark — E. P. Austin, September 13, 1872, + 0^s.076
 September 16, 1872, + 0^s.154
 September 17, 1872, + 0^s.198

J. H. Clark — W. W. Marryatt, July 2, 1873, — 0^s.031
 July 3, 1873, + 0^s.150
 July 4, 1873, — 0^s.148

J. H. Clark — Dr. F. Kampf, September 25, 1873, — 0^s.197
 September 26, 1873, + 0^s.034

J. H. Clark — Professor Safford, January 11, 1874, — 0^s.123

From these results it will be readily seen that it is better to entirely neglect at present the correction for personal equation.

On the accompanying Plate 3 is a drawing of the personal-equation machine which was invented by me in the winter of 1873-'74. At f is a

lamp, from which proceeds a beam of light; this beam is broken by the prism at *e*, passed through the diaphragm at *i*, and brought to a focus on the plate *C* by a small telescope at *d*. This point of light on the plate *C* serves as a star. The ruled lines on the plate *C* make it the reticule. A simple system of clock-work causes the plate *K* to move back and forth on the upper surface of the box-work. By motion of the plate *K*, the prism *e* and telescope *d* are carried, and thus the artificial star is made to transit the reticule. The star is observed through the tube *g*, which is without lenses. At the eye-end of the tube *g* is a prism by means of which the artificial star is given an apparent motion, always in the same direction. This is done by turning the tube *m* about its axis 180° , just as the plate *K* changes the direction of its motion. Connected and moving with the plate *K* is a metallic arm, *b*. This arm presses a point against a platinum plate, *a*. In this platinum plate are ruled fine lines, which are filled with insulating material. One wire of the circuit is attached to the plate *K* and the other to *a*, so that the circuit is broken as the arm *b* passes the insulated lines on *a*.

This automatic break with that of the observer gives in combination the double personal equation. Mr. E. Kahler (Washington, D. C.) is the constructor of the apparatus. Lieutenant Tillman and myself made three sets of observations, and found the following results:

Absolute personal equation of

| | Lieut. Tillman. | Dr. Kampf. |
|--------|-----------------|------------|
| May 1, | — 0.125 | — 0.027 |
| May 2, | — 0.121 | — 0.021 |
| May 3, | — 0.116 | — 0.026. |

I do not consider the construction of the instrument entirely satisfactory as yet. It should be so arranged that the same part of wheel *L* works opposite the same wire or line of the reticule, thus obviating inaccuracy in the construction of the cogs of the wheel. The clock-work has to be very powerful to overcome friction, which can be greatly diminished.

LIST OF GEOGRAPHICAL POSITIONS OF ASTRONOMICAL STATIONS OCCUPIED IN THE YEARS 1869, 1871-'72, '73, AND '74.

The tabulated list herewith of longitudes, latitudes, and altitudes comprises only those points, the longitudes of which have been determined by means of telegraphic signals for comparisons of time.

These positions are the adopted initial points, with which are connected the bases laid out adjacent thereto and the interlying triangles between bases widely separated in latitude or longitude, or both. These initial points prove an important factor in the checking of errors in extended belts of triangles embracing areas within which longitudes and latitudes established with the accuracy attainable by the use of the improved instruments and methods now available, are comparatively few.

A part of the results of the sextant astronomical observations have appeared, from time to time, in the annual and other reports, while the large number of longitudes, latitudes, azimuths, distances, altitudes, &c., resulting from the computation of the main and secondary triangulation, will be embodied in a special report of positions, distances, altitudes, azimuths, &c., soon to be submitted for publication in octavo form. Sketches of the monuments, observing-piers, and meridian-marks at eighteen stations are shown on plats Nos. 4, 5, and 6.

| | | |
|-----------------------------|------------------|----------------------|
| Fort Wingate, N. Mex..... | occupied in 1873 | } <i>Plat No. 4.</i> |
| Fort Fred. Steele, Wyo..... | occupied in 1872 | |
| Fort Laramie, Wyo..... | occupied in 1872 | |
| Green River, Wyo..... | occupied in 1874 | |
| Carlin, Nev..... | occupied in 1871 | |
| Battle Mountain, Nev..... | occupied in 1871 | |

| | | |
|------------------------------|------------------|----------------------|
| Pioche, Nev | occupied in 1872 | } <i>Plat No. 5.</i> |
| Virginia City, Nev | occupied in 1873 | |
| Hughes, Colo | occupied in 1873 | |
| Colorado Springs, Colo | occupied in 1873 | |
| Labran, Colo | occupied in 1873 | |
| Trinidad, Colo | occupied in 1873 | |
| Beaver, Utah | occupied in 1872 | } <i>Plat No. 6.</i> |
| Cheyenne, Wyo | occupied in 1873 | |
| Fort Union, N. Mex | occupied in 1873 | |
| Georgetown, Colo | occupied in 1873 | |
| Saint George, Utah | occupied in 1871 | |
| Santa Fé, N. Mex | occupied in 1873 | |

The difficulty of recognizing at a subsequent period the exact point at which important astronomical observations had been taken has been noted, which is overcome in a measure by permanently recording for reference a sketch of the natural and artificial surroundings of the station. Should the monuments established or to be established be removed or destroyed, the plat will serve to identify the point, so that its value in further surveys shall not be lost. Subsequent special surveys are to be made at the remaining main stations already occupied, at the most practicable date.

The monuments used as observing piers and to mark the stations during the years 1872, '73, and '74 were of granite or sandstone, and of the dimensions shown in Fig. 1 herewith. The pattern employed lately is substantially of the same dimensions, but constructed of brick, with a stone cap for observing purposes. The expense and difficulty of transporting and setting are thereby decreased, and a mark of quite permanent character established. Figures 2 and 3 show the inscriptions cut on the north and south faces.

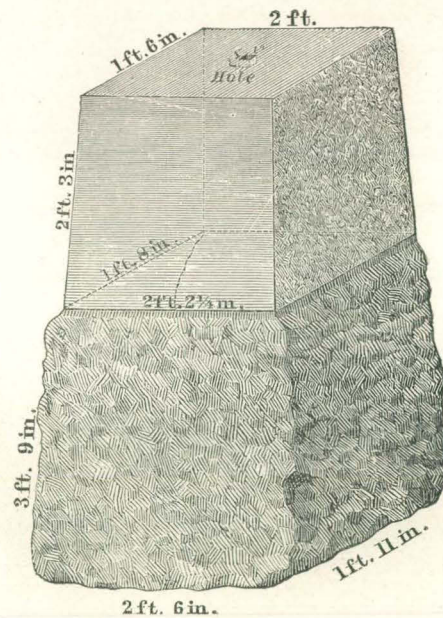


Fig. 1.

NORTH FACE



Fig. 2.

SOUTH FACE

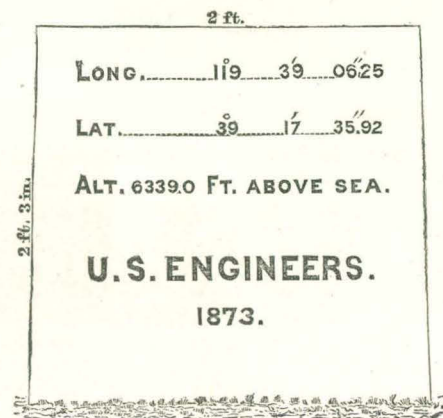


Fig. 3.

GEOGRAPHICAL POSITIONS.

Transit instrument for chronometer error; zenith telescope for latitude (Talcott's method); telegraphic time-signals for difference of longitude.

| Year. | Station. | Atlas-sheet number. | Observer, Sending. Receiving. | Computer, Sending. Receiving. | Report arranged by— | Longitude. | | | Latitude. | | | Altitude above sea-level. | Remarks. |
|---------|----------------------------|---------------------|--|--|------------------------|------------------------|-------------------------|------------------------|-------------------------|-------------|------------------------|------------------------------|---|
| | | | | | | No. of ex- changes. | West from Greenwich. | Probable er- ror ±. | No. of pairs of obs. | North. | Probable er- ror ±. | | |
| | | | | | | | ° ' " | " | | ° ' " | " | Feet. | |
| 1871 | Austin, Nev | 48 | { Prof. J. R. Eastman ... O. B. Wheeler | { Prof. J. R. Eastman ... O. B. Wheeler | Dr. F. Kampf | 3 | 117 03 41.70 | 0.23 | 50 | 39 29 21.92 | 0.20 | 7520.6 | Checks triangulation ex- tending from base near astronomical monument at Virginia City, Nev. |
| 1871 | Battle Mountain, Nev.... | 48 | { O. B. Wheeler | { O. B. Wheeler | Dr. F. Kampf | 3 | 116 56 13.50 | 0.90 | 33 | 40 38 18.74 | 0.21 | 4508.0 | Top astronomical monu- ment. |
| 1872 | Beaver, Utah | 50 | { E. P. Austin | { Dr. F. Kampf | Dr. F. Kampf | 3 | 112 38 35.90 | 0.26 | 94 | 33 16 23.28 | 0.06 | 5915.6 | Near center of the public square. |
| 1873 | Bozeman, Mont. | 14 | { Dr. F. Kampf | { Dr. F. Kampf | Dr. F. Kampf | 3 | 111 02 36.64 | 0.53 | 83 | 45 40 51.92 | 0.06 | 4338.6 | |
| 1871 | Camp Independence, Cal.. | 65 | { J. H. Clark | { J. H. Clark | Dr. F. Kampf | | 118 12 45.00 | | | 36 50 10.00 | | 3956.5 | Longitude by lunar cul- mination. Zenith-tele- scope out of order. |
| 1871 | Carlin, Nev | 40 | { Prof. J. R. Eastman ... O. B. Wheeler | { Prof. J. R. Eastman ... O. B. Wheeler | Dr. F. Kampf | 3 | 116 07 20.60 | 0.75 | 34 | 40 42 26.67 | 0.17 | 4908.2 | Railroad levels, top of monument. |
| 1872 | Cheyenne, Wyo | 44 | { E. P. Austin | { Dr. F. Kampf | J. H. Clark | 6 | 104 48 51.30 | 0.25 | 252 | 41 07 46.62 | 0.08 | 6041.0 | |
| 1874 | Cimarron, N. Mex | 70 (A) | { J. H. Clark | { J. H. Clark | Dr. F. Kampf | 3 | 104 54 59.04 | 0.20 | 69 | 36 30 10.01 | 0.09 | 6384.5 | Checks base-line meas- ured in 1874. |
| 1873 | Colorado Springs, Colo ... | 62 (A) | { Dr. F. Kampf | { Dr. F. Kampf | Dr. F. Kampf | 4 | 104 49 15.10 | 0.13 | 153 | 38 49 41.67 | 0.04 | 6009.7 | Astronomical station. |
| 1872 | Fort Fred. Steele, Wyo... | 43 | { E. P. Austin | { J. H. Clark | Dr. F. Kampf | 6 | 106 56 48.80 | 0.51 | 205 | 41 46 40.24 | 0.05 | 6030.4 | Signal office. |
| 1873 | Fort Union, N. Mex | 70 (B) | { J. H. Clark | { Dr. F. Kampf | Prof. T. H. Safford... | 4 | 105 00 51.15 | 0.13 | 74 | 35 54 24.86 | 0.22 | 6744.1 | |
| 1871 | Fort Whipple, Ariz | 75 | { Prof. T. H. Safford... | { Prof. T. H. Safford... | Dr. F. Kampf | | 112 27 10.20 | | 132 | 34 33 06.12 | 0.07 | 5318.0 | Longitude by lunar cul- minations near and north of Prescott. |
| 1873 | Georgetown, Colo | 52 (D) | { A. R. Marvine | { Dr. F. Kampf | Dr. F. Kampf | 6 | 105 41 27.60 | 0.05 | 118 | 39 42 36.36 | 0.06 | 8587.8 | Barometric. |
| 1872-73 | Green River, Wyo | 42 | { J. H. Clark | { J. H. Clark | Prof. T. H. Safford... | 6 | 109 28 06.57 | 0.40 | 178 | 41 31 38.12 | 0.10 | 6096.9 | Barometric. |
| 1872 | Gunnison, Utah | 50 | { E. P. Austin | { William W. Marryatt | Wm. W. Marryatt... | 5 | 111 49 15.00 | 0.42 | 179 | 39 09 25.62 | 0.05 | 5144.6 | Railroad levels. |
| 1873 | Hughes, Colo | 53 (A) | { William W. Marryatt | { William W. Marryatt | Dr. F. Kampf | 4 | 104 48 58.80 | 0.06 | 149 | 39 59 24.09 | 0.03 | 5021.6 | |

| | | | | | | | | | | | | | |
|---------|---------------------------|----------|---|--------------------------|------------------------|----|--------------|------|-----|-------------|------|--------|--|
| 1874 | Julesburg, Colo | 45 { | Dr. F. Kampf J. H. Clark | Dr. F. Kampf | Dr. F. Kampf | 5 | 102 21 32.30 | 0.43 | 63 | 40 59 07.63 | 0.04 | 3500.0 | Valuable as a point of departure in checking surveys north or south of the Union Pacific Railroad. |
| 1873 | Labran, Colo | 62 (A) { | J. H. Clark | J. H. Clark | Dr. F. Kampf | 4 | 105 06 17.78 | 0.44 | 151 | 38 23 08.97 | 0.03 | 5217.8 | Astronomical station. |
| | | | Dr. F. Kampf | Dr. F. Kampf | | | | | | | | | |
| 1872 | Laramie, Wyo | 43 { | E. P. Austin | J. H. Clark | J. H. Clark | 3 | 105 35 33.60 | 0.12 | 155 | 41 18 51.80 | 0.08 | 7123.0 | |
| | | | J. H. Clark | Prof. R. A. Rodgers.. | | | | | | | | | |
| 1874 | Las Vegas, N. Mex..... | 78 (A) { | Dr. F. Kampf | Dr. F. Kampf | Dr. F. Kampf | 3 | 105 13 27.57 | 0.10 | 99 | 35 35 27.66 | 0.07 | 6418.0 | Checks base-line measured in 1874. |
| | | | J. H. Clark | | | | | | | | | | |
| 1874 | North Platte, Nebr | 45 { | Dr. F. Kampf | Dr. F. Kampf | Dr. F. Kampf | 3 | 100 45 53.14 | 0.95 | 68 | 41 08 18.33 | 0.06 | 2789.0 | On Union Pacific Railroad. |
| | | | J. H. Clark | | | | | | | | | | |
| 1873-74 | Ogden, Utah | 41 { | J. H. Clark | J. H. Clark | Dr. F. Kampf | 16 | 111 59 54.64 | 0.40 | 256 | 41 13 08.56 | 0.03 | 4374.0 | Top of east meridian-stone, west observing-room, War Department Observatory. |
| | | | O. B. Wheeler | Prof. J. R. Eastman .. | | | | | | | | | |
| | | | Prof. J. R. Eastman .. | Dr. F. Kampf | | | | | | | | | |
| | | | Dr. F. Kampf | | | | | | | | | | |
| 1872 | Pioche, Nev..... | 58 { | E. P. Austin | William W. Marryatt | W. W. Marryatt | 5 | 114 26 18.27 | 1.12 | 189 | 37 55 26.07 | 0.07 | 5942.3 | |
| | | | William W. Marryatt | Prof. R. A. Rodgers.. | Dr. F. Kampf | | | | | | | | |
| 1873 | Santa Fé, N. Mex | 69 (D) { | J. H. Clark | J. H. Clark | Prof. T. H. Safford... | 10 | 105 56 45.22 | 0.32 | 112 | 35 41 19.29 | 0.15 | 7044.2 | |
| | | | Prof. T. H. Safford... | Prof. T. H. Safford... | | | | | | | | | |
| | | | Dr. F. Kampf | Dr. F. Kampf | | | | | | | | | |
| 1874 | Sidney Barracks, Nebr.... | 44 { | J. H. Clark | Dr. F. Kampf | Dr. F. Kampf | 5 | 102 58 13.32 | 0.45 | 60 | 41 08 36.75 | 0.05 | 4073.0 | |
| | | | Dr. F. Kampf | | | | | | | | | | |
| 1871 | Saint George, Utah..... | 67 { | E. P. Austin | Dr. F. Kampf | Dr. F. Kampf | 3 | 113 35 00.30 | 0.30 | 103 | 37 06 29.38 | 0.08 | 2611.0 | |
| | | | A. R. Marvine..... | | | | | | | | | | |
| 1873 | Trinidad, Colo | 70 (A) { | J. H. Clark | J. H. Clark | Dr. F. Kampf | 5 | 104 30 01.42 | 0.30 | 162 | 37 10 46.53 | 0.02 | 5989.9 | Astronomical station. |
| | | | Dr. F. Kampf | Dr. F. Kampf | | | | | | | | | |
| 1873 | Virginia City, Nev..... | 47 { | J. H. Clark | J. H. Clark | Prof. T. H. Safford... | 6 | 119 39 06.35 | 0.36 | 161 | 39 17 35.92 | 0.10 | 6339.0 | |
| | | | William W. Marryatt. | Prof. T. H. Safford... | | | | | | | | | |
| 1873 | Winnemucca, Nev | 39 { | J. H. Clark | J. H. Clark | Prof. T. H. Safford... | 6 | 117 43 54.16 | 0.22 | 141 | 40 58 19.97 | 0.17 | 4355.0 | |
| | | | William W. Marryatt | Prof. T. H. Safford... | | | | | | | | | |
| | Salt Lake City, Utah..... | 41 | Coast-Survey determin | ation | | | 111 53 42.90 | | | 40 46 03.76 | | 4330.4 | Mormon observatory, Temple Square. |
| | South Pueblo, Colo..... | 62 (A) | Longitude by trigonom | etrical connection | Dr. F. Kampf | | 104 36 57.53 | | 30 | 38 15 42.84 | 0.17 | 4731.8 | Latitude by Dr. F. Kampf. |

GEOGRAPHICAL POSITIONS.

Sextant and transit for time; sextant for latitude; telegraphic time-signals for difference of longitude.

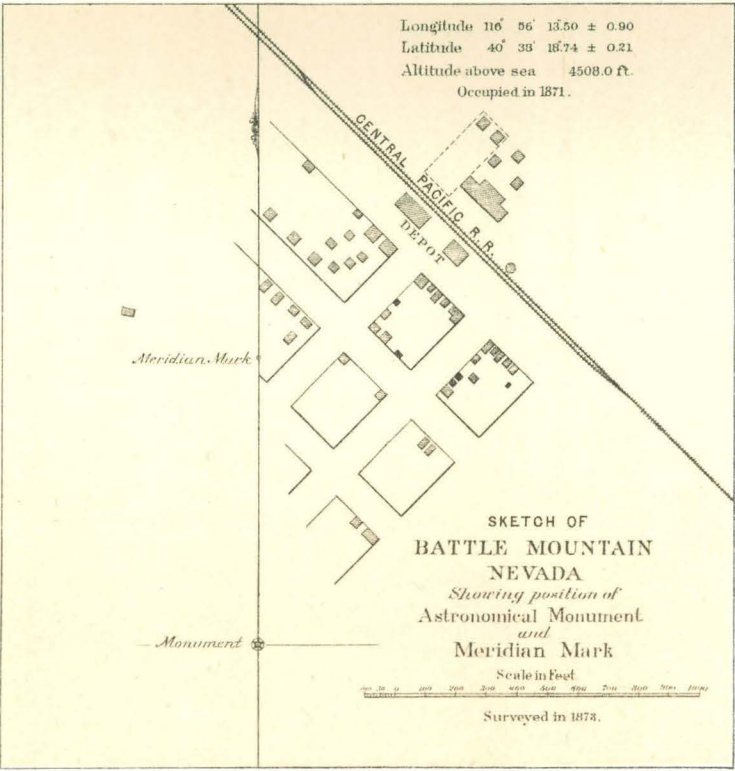
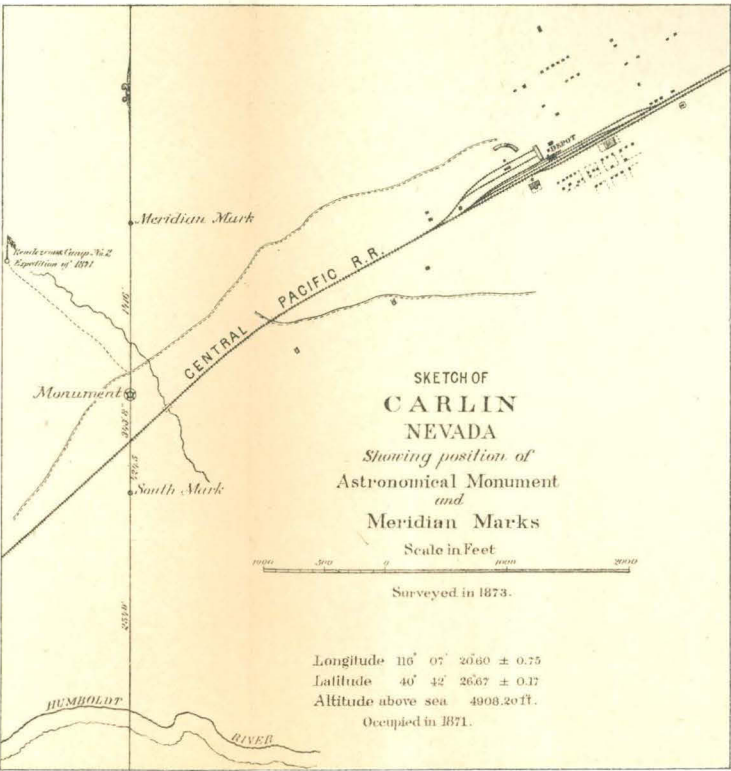
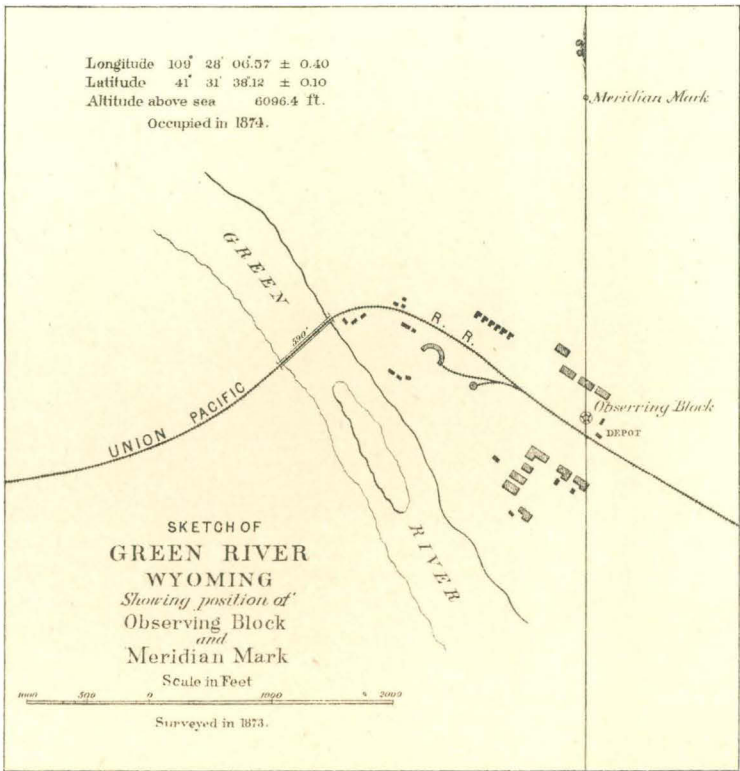
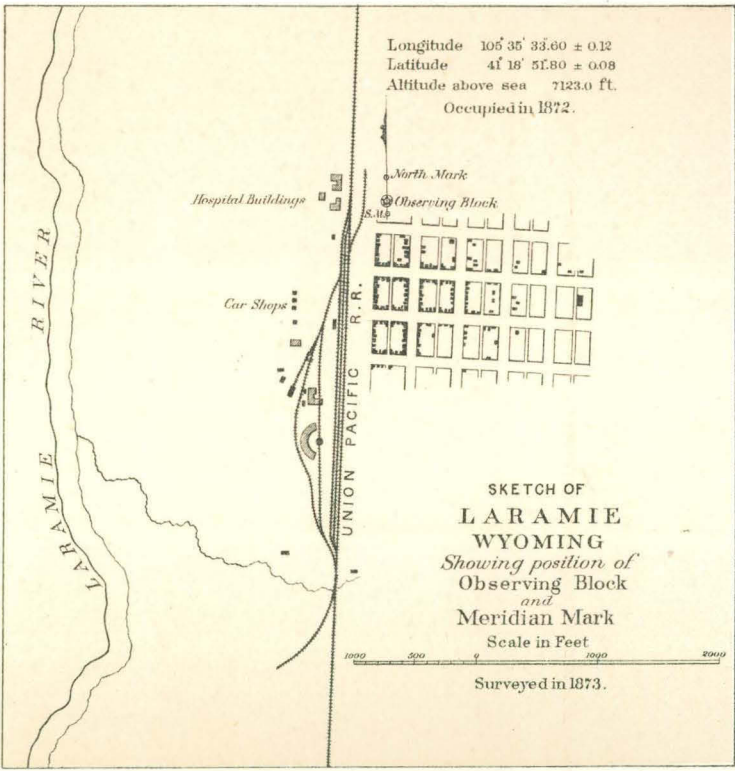
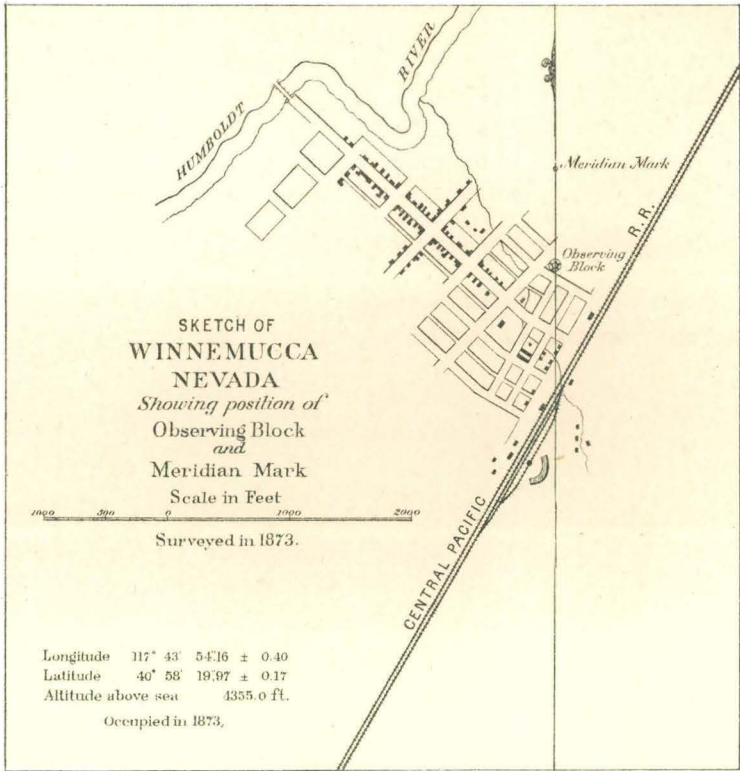
| Year. | Station. | Atlas-sheet No. | Object observed. | Longitude west from Greenwich. | Latitude. | Altitude. | Observers. | Computers. | Remarks. |
|---------|---------------------------|-----------------|-------------------|--------------------------------|-------------------|---------------------|-----------------------|-----------------------|--|
| 1869 | Camp Halleck, Nev..... | 40 | Sun | ° ' " 115 19 34.05 | ° ' " 40 48 34.35 | <i>Feet.</i> 5789.7 | Lieut. Wheeler | Lieut. Wheeler | |
| | | | β Polaris | | | | Maj. Roberts | Lieut. Lockwood | |
| 1869 | Camp Ruby, Nev | 49 | β Scorpii | 115 31 06.75 | 40 03 38.63 | 6152.6 | Lieut. Wheeler | Lieut. Wheeler | |
| | | | α Scorpii | | | | Lieut. Lockwood | Dr. F. Kampf | |
| | | | Sun | | | | Maj. Roberts | | |
| 1872 | Deep Creek, Utah | 49 | α Aquilæ | 113 57 16.05 | 40 06 01.71 | 5236.6 | Lieut. Hoxie | Lieut. Marshall | |
| | | | α Ophiuchi | | | | E. P. Austin | | |
| | | | Sun | | | | | | |
| 1869 | Elko, Nev | 40 | β Polaris | 115 45 37.20 | 40 49 32.44 | 5148.4 | Lieut. Wheeler | Lieut. Wheeler | |
| | | | β Scorpii | | | | Maj. Roberts | Lieut. Lockwood | |
| | | | α Aquilæ | | | | | Dr. F. Kampf | |
| 1872 | Near Fillmore, Utah..... | 59 | Sun | 112 16 54.93 | 38 57 14.94 | 6115.8 | Lieut. Hoxie | Lieut. Marshall | Camp three miles east of; on Chalk Creek. |
| | | | β Polaris | | | | Lieut. Wheeler | E. P. Austin | |
| | | | ε Pegasi | | | | E. P. Austin | | |
| 1869 | Near Hamilton, Nev..... | 49 | α Bootis | 115 25 52.38 | 39 15 42.87 | 7601.3 | Lieut. Wheeler | Lieut. Wheeler | Camp east of, about 2½ miles. |
| | | | Sun | | | | Maj. Roberts | Lieut. Lockwood | |
| | | | β Polaris | | | | | | |
| | | | α Aquilæ | | | | | | |
| 1872 | Kanab, Utah | 67 | Sun | 112 31 39.00 | 27 02 25.43 | 4909.0 | Lieut. Marshall | Lieut. Marshall | Monument in square; front of bishop's residence. |
| | | | β Polaris | | | | E. P. Austin | | |
| | | | α Cygni | | | | | | |
| 1869 | Monte Christo Mill, Nev.. | 49 | α Tauri | 115 34 49.20 | 39 13 16.83 | 7596.0 | Lieut. Wheeler | Lieut. Wheeler | West of Hamilton, Nev. |
| | | | Sun | | | | Maj. Roberts | Dr. F. Kampf | |
| 1869 | Peko, Nev | 40 | β Polaris | 115 30 14.50 | 40 55 46.35 | 5180.0 | Lieut. Wheeler | Lieut. Wheeler | On Central Pacific Railroad. |
| | | | Sun | | | | Maj. Roberts | Dr. F. Kampf | |
| 1872 | Pipe Springs, Ariz..... | 67 | β Polaris | 112 42 57.00 | 36 51 36.34 | 5397.2 | Lieut. Marshall | Lieut. Marshall | Camp near. |
| | | | α Lyræ | | | | E. P. Austin | | |
| 1872-73 | Provo, Utah | 50 | α Cygni | 111 40 27.00 | 40 13 47.84 | 4567.3 | Lieut. Hoxie | Lieut. Hoxie | Old Camp Rawlins; longitude determined by Lieut. Hoxie, 1873; latitude by Lieut. Marshall, 1872. |
| | | | Sun | | | | J. H. Clark | J. H. Clark | |
| | | | β Polaris | | | | | | |
| | | | α Cygni | | | | | | |
| | | | α Lyræ | | | | | | |
| | | | α Bootis | | | | | | |
| | | | α Virginis | | | | | | |
| 1873 | Richfield, Utah | 59 | Jupiter | 112 02 27.00 | 38 46 11.40 | 5282.6 | Lieut. Hoxie | Lieut. Hoxie | Camp at. |
| | | | α Herculis | | | | J. H. Clark | J. H. Clark | |
| | | | Sun | | | | | | |
| | | | β Polaris | | | | | | |
| | | | α Serpentis | | | | | | |
| | | | α Lyræ | | | | | | |
| | | | α Bootis | | | | | | |
| | | | α Aquilæ | | | | | | |
| 1872 | Toquerville, Utah | 67 | α Ophiuchi | 113 16 20.90 | 37 15 19.28 | ..... | Lieut. Wheeler | Lieut. Marshall | Barometric records lost. |
| | | | Sun | | | | Lieut. Marshall | | |
| | | | β Polaris | | | | E. P. Austin | | |

GEOGRAPHICAL POSITIONS.

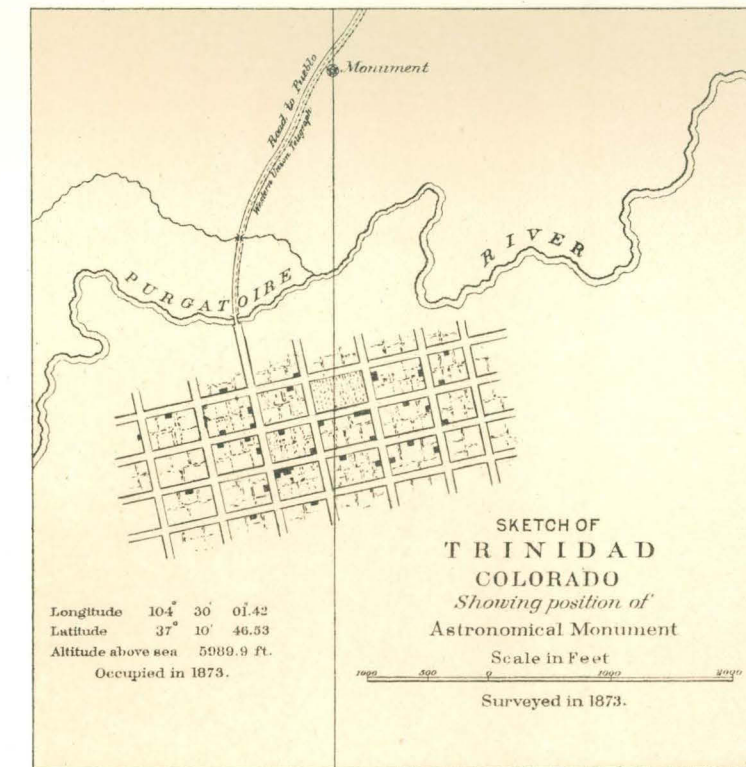
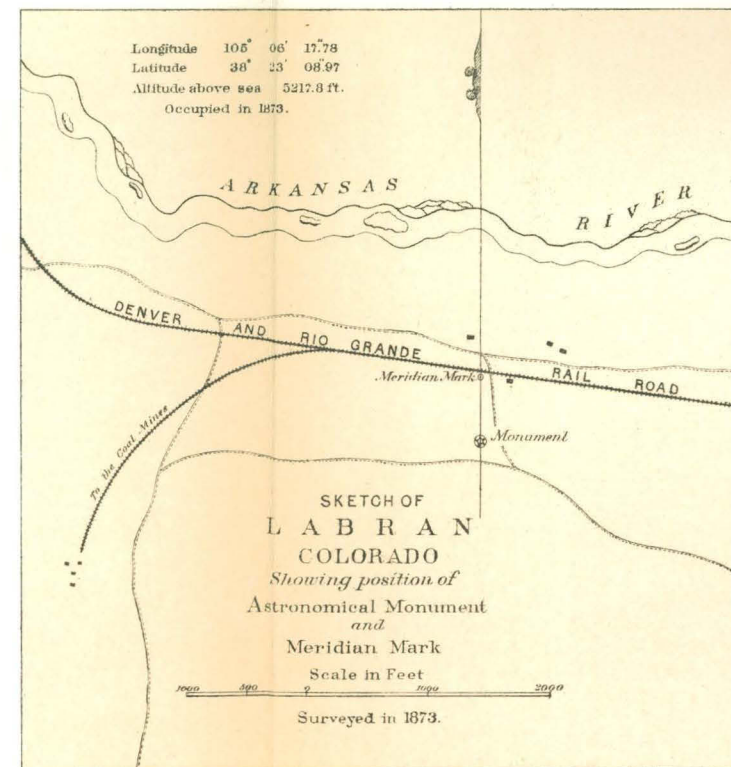
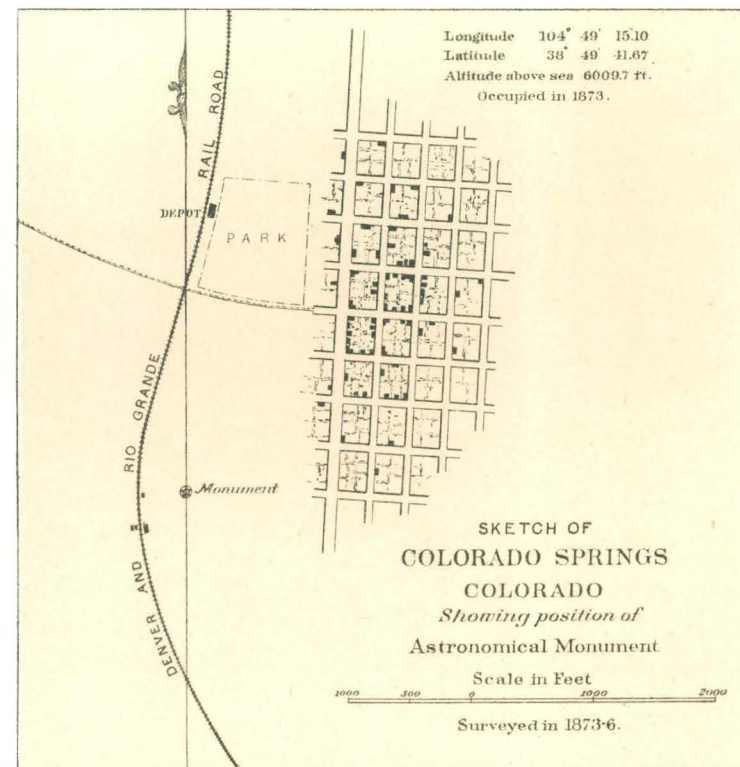
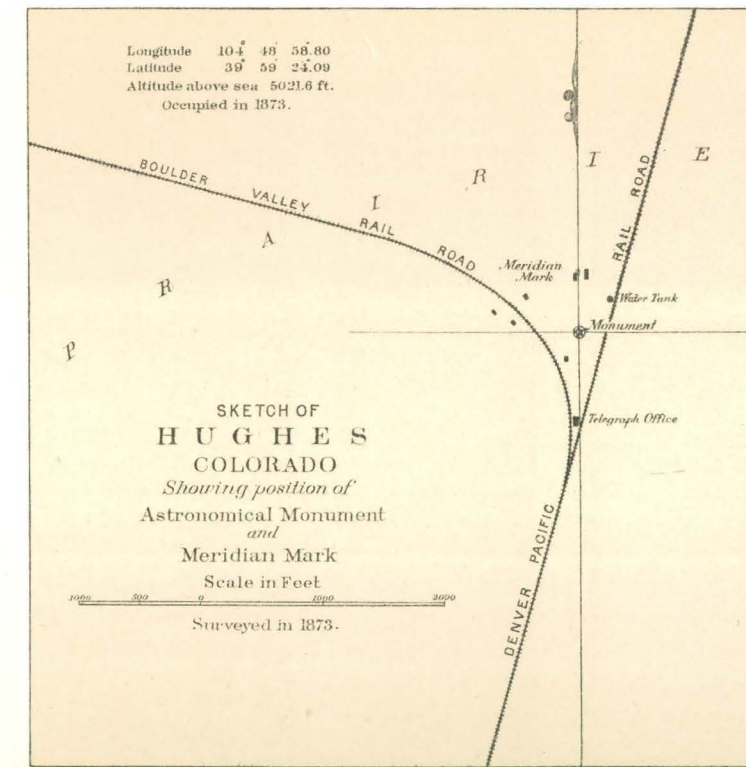
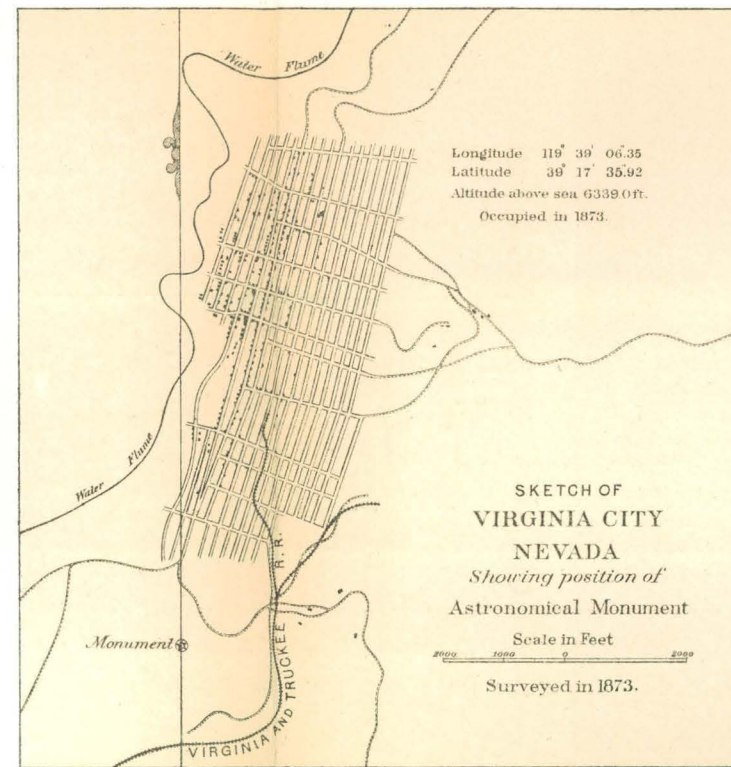
491

Geographical positions by measurement from or by trigonometrical connection with main astronomical points.

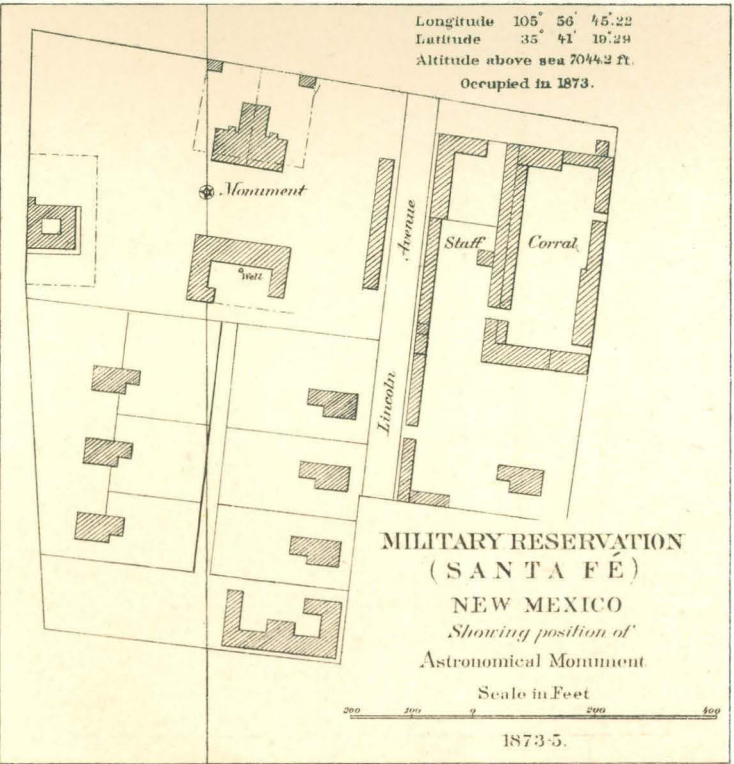
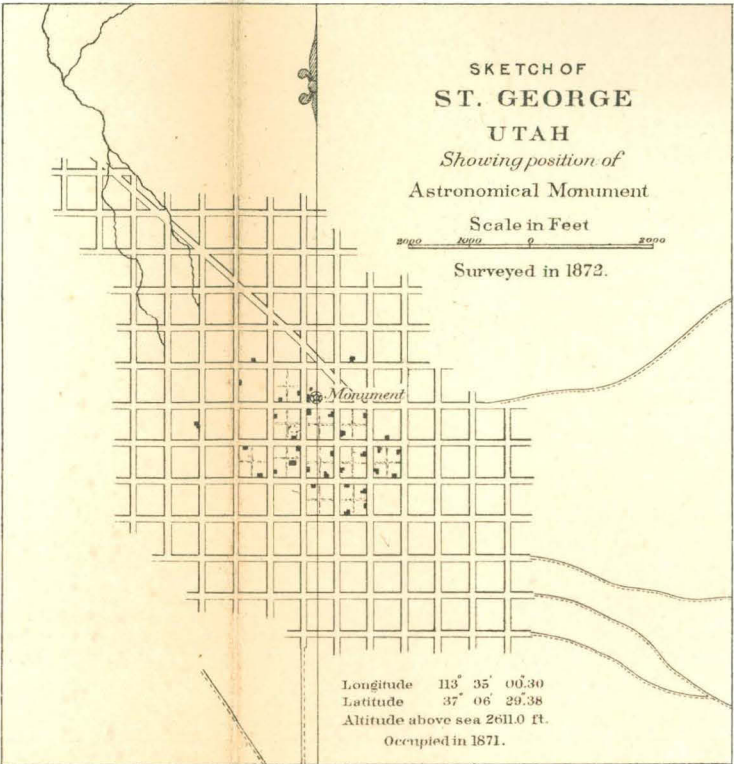
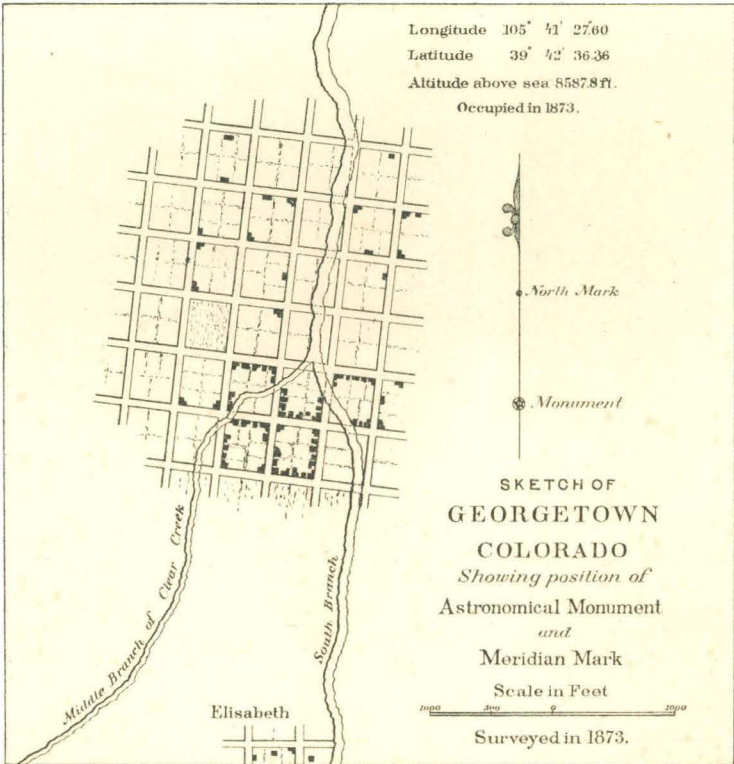
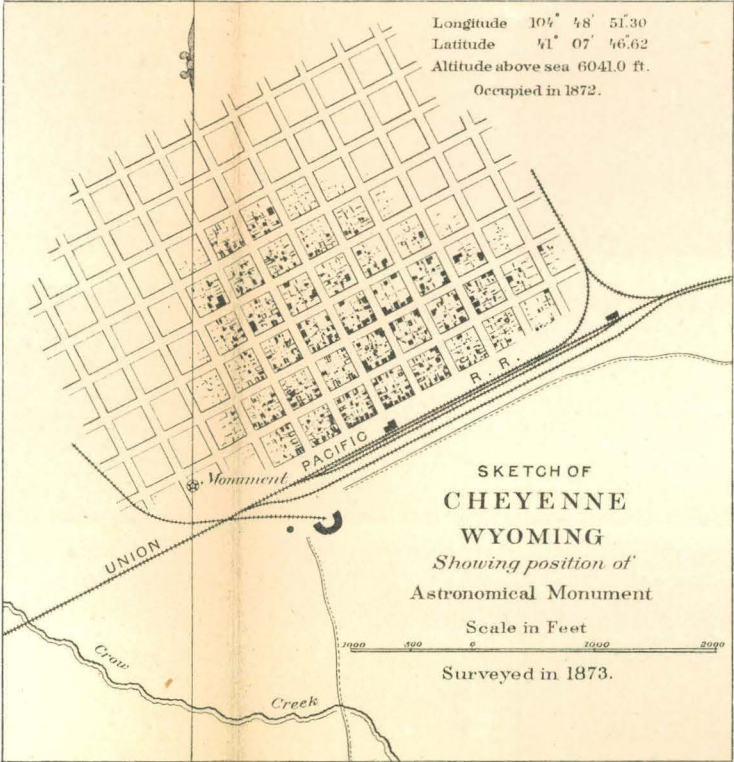
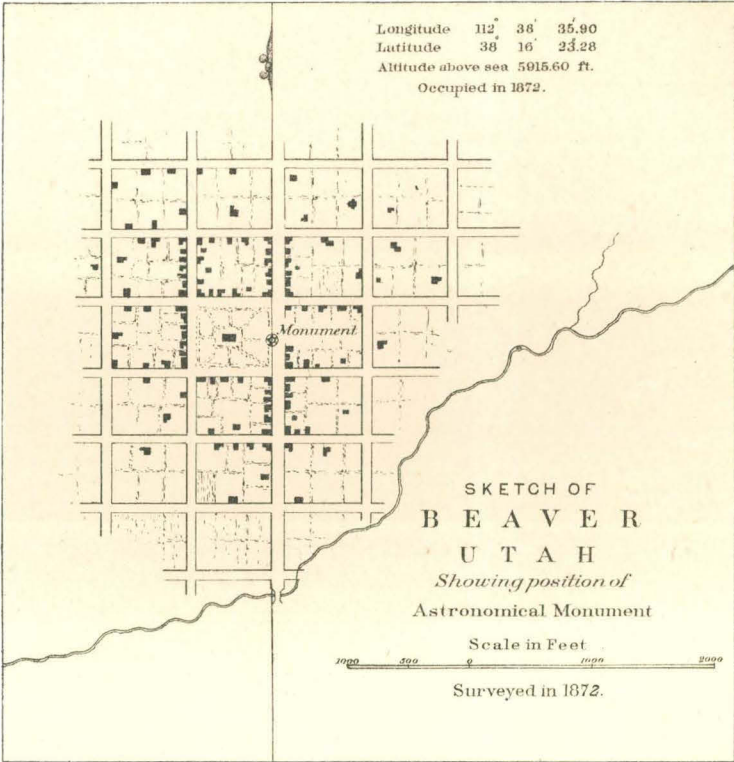
| Year. | Station. | Atlas-sheet No. | Connected with astronomical station at— | Longitude. | Latitude. | Altitude. | Connection made by— | Remarks. |
|----------------------------|---|-----------------|---|--------------------|-------------------|---------------|---------------------|--|
| 1873 } 1874 } 1877 } | Fort Garland, Colo... | 62 | Main triangulation. | ° ' " 105 25 33.73 | ° ' " 37 25 27.33 | Feet. 4,853.7 | ..... |  |
| 1877 | Camp Douglas, Utah (new flag-staff). | 41 | Old flag-staff and sun-dial. | 111 50 14.22 | 40 45 47.50 | 4,902.5 | Dr. F. Kampf. | By trigonometric connection with sun-dial and stone observing pier, established by survey. |
| 1873 | Camp Douglas, Utah (astronomical monument). | 41 | Salt Lake City, Utah. | 111 50 14.07 | 40 45 47.58 | 4,905.0 | G. Thompson. | By chaining; stone monument in same position as old flag-staff. |
| 1873 | Fort Ellis, Mont. | 24 | Bozeman, Mont. | 110 59 49.27 | 45 40 08.00 | 4,878.0 | ..... | Approximate difference between astronomical observing pier and fort, taken from Land-Office plats, and the position of the observing pier as given by J. H. Clark. |
| 1873 | Fort Fred. Steele, Wyo. (flag-staff). | 43 | Fort Fred. Steele, Wyo. | 106 56 54.27 | 41 46 50.63 | 6,850.0 | J. E. Weyss.. | Difference between monument and flag-staff determined from plats and measurements by J. E. Weyss. |
| 1873 | Fort Sanders, Wyo. (flag-staff). | 43 | Laramie, Wyo... | 105 34 59.56 | 41 17 26.89 | 7,168.0 | J. E. Weyss.. | |



George D. Clarke, Del.



George D. Clarke, Del.



George D. Clarke, Del.

U. S. GEOGRAPHICAL SURVEYS WEST OF THE ONE HUNDREDTH MERIDIAN,
1ST LIEUT. GEO. M. WHEELER, CORPS OF ENGINEERS, U. S. ARMY, IN CHARGE.

PART II.

RESULTS
IN
BAROMETRIC HYPSONOMETRY,
OBTAINED DURING
THE YEARS 1871, 1872, 1873, 1874, AND 1875.

REPORTED BY
FIRST LIEUTENANT WM. L. MARSHALL,
CORPS OF ENGINEERS, U. S. ARMY.

WITH TABLES OF BAROMETRICALLY DETERMINED ALTITUDES.

LETTER OF TRANSMISSION.

UNITED STATES ENGINEER OFFICE,
GEOGRAPHICAL SURVEYS WEST OF THE 100TH MERIDIAN,
Washington, D. C., August 5, 1876.

SIR: I have the honor to forward herewith a report upon the meteorological work of the survey since 1871. It is confined to the hypsometrical work proper, since the data accumulated by the Survey is not sufficiently extended for general meteorological discussions; nor has the time at my disposal been sufficient to allow more than the examination and reduction of the observations for the vertical element of the survey.

The computations and reductions prior to 1874 were performed under the direction of Lieut. R. L. Hoxie, Corps of Engineers, to whom is due in great part the systematic organization of this branch of the work. The altitudes computed under his direction have not been re-examined or changed except where subsequent observations have been made, in which case a mean of the altitudes determined have been taken. The hourly work has all been re-examined and in some cases recomputed. Sixteen plates of horary curves deduced therefrom are appended to the report, and will be found interesting as exhibiting the great diurnal movement of temperature and barometric pressure in the drier portions of the continent.

In the reduction of the observations I have been assisted by First Lieut. Rogers Birnie, Thirteenth United States Infantry; First Lieut. C. W. Whipple, Third Artillery, United States Army; First Lieut. Eric Bergland, Corps of Engineers, under whose direction the observations taken by his party in California in 1875 were reduced. Hospital Steward Theodore V. Brown, United States Army; Messrs. F. M. Lee and George M. Dunn; and Privates Wm. Looram and John F. Kirkpatrick, Battalion of Engineers.

The work of computation has been mainly performed by Mr. F. M

Lee and Hospital Steward T. V. Brown, United States Army, who were each attached to the Survey for over four years in this branch of work.

I am, sir, very respectfully, your obedient servant,

W. L. MARSHALL,

First Lieutenant of Engineers.

To First Lieut. G. M. WHEELER,

Corps of Engineers, United States Army, in charge, &c.

INTRODUCTION.

The meteorological observations taken by the Survey have been confined to those necessary for securing the vertical co-ordination of points for the maps, and the work in the office has been almost entirely directed to their discussion for hypsometrical purposes.

General meteorological observations have been taken and recorded, but since these necessarily are somewhat desultory, they can be of but little use to meteorologists for climatological purposes where fuller and more connected observations have been taken, nor can they add much to knowledge where the general climatic conditions of the field of survey are as well understood as in the present case.

INSTRUMENTS.—COMPARISONS AND INSTRUMENTAL ERRORS.

The instruments used in the field have been Green's mercurial cistern barometer, mountain pattern, with brass scales, adjusted in position for capillarity, reading to ".002 by vernier; Green's, Casella's, and Pike's aneroid barometers, pocket-size, compensated for temperature, and with attached thermometers; Green's psychrometers, maximum and minimum pocket-thermometers; and at the astronomical stations anemometers (Thompson's pattern), and the ordinary Smithsonian pattern rain-gauges.

In 1871, '72, '73 the number of instruments at the disposal of the Survey was small, but where practicable two sets of instruments were assigned to each topographical party in the field; ordinarily, however, but one cistern-barometer could be assigned to each, with the necessary thermometers and aneroids. In later years two or more complete sets of instruments were allotted each party, and the instrumental errors were checked by a rigid series of comparisons throughout the field-season; as a consequence, the results possess the greatest claim to confidence.

At all rendezvous-camps in the first three years of the Survey comparisons were made among all the fixed instruments for relative errors, and by these alone the instrumental errors were checked. In after years, the numerous instruments in each party afforded the means of checking their own changes.

Before taking the field, all of the meteorological instruments except the aneroids were compared with the Signal-Office standard, and their relative errors determined. They were then transported to the field by hand, and at the initial points the barometers were again compared among themselves to detect changes in the adjustments of such barometers as were affected by transportation. As a rule, these comparisons were made merely pending the organization of the expedition, and, besides their value in checking instrumental vagaries, they also afforded data for the determination of the diurnal oscillation in barometric pressure. In making the comparisons, the rules laid down in Williamson's "Use of the Barometer," &c., were observed, except that the errors of the barometers and of their attached thermometers were determined separately. In the comparison in the open air of the thermometers and psychrometers, contradictory results were obtained at different comparisons, as a rule showing errors less than the ordinary errors of observation where temperatures are read to the nearest quarter of a degree.

The comparisons have therefore been rejected and the indications of the thermometers assumed as reliable, except in a few cases where the errors are large and well shown.

At present, to avoid the local mutations in air temperature indicated by thermometers in the open air arising from the heat of the observer's body, from the change in temperature caused by currents of air entering the room where the comparisons are made, from the different capacity for absorbing and storing heat and consequent varying temperatures of different parts of the same building, &c., all which make it difficult to secure satisfactory and stable results from comparisons of many thermometers in the open air, the bulbs of all thermometers when being compared are immersed to an equal depth in a tub of mercury, which, secured in a wooden box, is less affected than the stratum of air in contact with both the body of the observer and

the thermometers, and prevents to a very marked and satisfactory extent the local fluctuations already mentioned.

In the field during the past two seasons all of the meteorological instruments of each party were compared at the regular hours for observing, and when from two to five barometers were carried in a party the condition of the instruments at any required date was determined therefrom. Aneroids were compared night and morning with the cisterns, and at culminating points of the trails. In some instances the cisterns of a party were all simultaneously injured, leaving breaks in the chains of comparisons for such parties. In these instances it has generally been practicable, from comparisons with the instruments of another party or with those of the Signal-Service stations in the areas surveyed, to trace back through subsequent comparisons the individual errors of the instruments to the time of injury.

In Party No. 2, Colorado Section, during the field-season, 1875, the tubes of both barometers were accidentally broken at the beginning of the field-season, and the only possible comparison of refilled instruments during the season was with the barometer of the United States Army signal station at Santa Fé, New Mexico. A long series of comparisons was there made with that instrument, which developed a correction in our barometers of more than $-\frac{2}{10}$ of an inch to make them agree with the Signal Service barometer. Since the only probable cause of change in error of a carefully filled barometer is the difference of capillarity of the tubes, and slight difference from want of rigidity where connection is made between tube and cistern, the index being upon a movable piece, and, moreover, since ingress of air into the tube depresses the mercury and causes a positive error, or the barometer to read too low, it was at once evident that the greater part of this error must be in the barometer at Santa Fé. Unfortunately the barometers did not reach the final rendezvous in order, and the entire work of this party depended upon the above comparisons of instruments at Santa Fé.

I had been led by comparisons made the previous year between new instruments and the barometer at Santa Fé, to suppose that that instrument read too low by more than one-tenth of an inch, which was further confirmed as above. Rejecting this comparison, therefore, and referring the

observations made by this party at points previously well determined in altitude to Denver, Colorado Springs, Fort Mohave, and Santa Fé (with its barometric altitude), that error which gave the same or nearly the same altitudes for these points was adopted. With this error the altitudes of other points previously united were checked, and the work of the preceding two years was found to agree well with that of the past season. The results of the various comparisons of barometers are given in the tables below, from which it can be seen that the cistern-barometers seldom varied more than ".03 during an entire field-season, which changes, if undetermined, would have caused errors of from 32 to 38 feet in the resulting heights; this is less than the probable error of a single result due to abnormal oscillation when observations are referred to quite distant reference-stations.

RESULTS OF COMPARISONS OF BAROMETERS AND ATTACHED THERMOMETERS.

Table of errors on Signal-Service standards.

| Date. | Compared at— | With standard. | Barom. No. 1376, error. | Barom. No. 1611, error. | Barom. No. 1613, error. | Barom. No. 1735, error. | Barom. No. 1767, error. | Barom. No. 1768, error. | Barom. No. 1769, error. | Barom. No. 1852, error. | Barom. No. 1853, error. | Barom. No. 1965, error. | Barom. No. 1988, error. | Barom. No. 1989, error. |
|-------------------|-----------------------|----------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|
| July 5-7, 1872 | Washington, D. C. | S. O. standard | .000 | -.003 | -.002 | +.006 | -.005 | +.002 | -.005 | Not used. | Not used. | Not used. | Not used. | Not used. |
| July 13-31, 1872 | Salt Lake City, Utah. | 1376 | .000 | -.001 | -.003 | -.001 | -.001 | ±.000 | -.002 | | | | | |
| May 12-17, 1873 | Washington, D. C. | S. O. standard | +.027 | -.050 | | -.010 | -.001 | -.003 | +.002 | -.002 | -.008 | -.009 | -.002 | |
| May 18-19, 1874 | do | do | | | | | | | | | | | | -.006 |
| June 19-23, 1874 | do | do | -.012 | | | | | | | | | | | |
| June 26-29, 1874 | do | 1376 | -.012 | | | -.013 | -.015 | -.009 | +.002 | -.022 | -.010 | -.005 | -.026 | -.017 |
| July 22-31, 1874 | Pueblo, Colo. | 1769 | -.016 | | | -.009 | | | +.002 | -.018 | -.020 | -.006 | -.021 | +.005 |
| May 5, 10, 1875 | Washington, D. C. | S. O. standard | -.032 | | | -.024 | -.025 | -.025 | -.030 | | | -.032 | -.039 | -.027 |
| May 24, 26, 1875 | do | do | | | | | | | | | | | | |
| June 12, 16, 1875 | Los Angeles, Cal. | 2124 | | | | -.011 | -.013 | | | | | -.040 | -.020 | |
| June 1, 6, 1875 | Pueblo, Colo. | 1989 | -.019 | | | | | -.018 | -.036 | | -.017 | | | -.024 |
| Jan. 26-31, 1876 | Washington, D. C. | S. O. standard | | | | | | | | | | | | -.024 |

| Date. | Compared at— | With standard. | Barom. No. 1978, error. | Barom. No. A, error. | Barom. No. B, error. | Barom. No. 2031, error. | Barom. No. 2032, error. | Barom. No. 1, error. | Barom. No. 2, error. | Barom. No. 1998, error. | Barom. No. 1, error. | Barom. No. 2134, error. | Barom. No. 2143, error. |
|-------------------|-----------------------|----------------|-------------------------------|----------------------------|----------------------------|-------------------------------|-------------------------------|----------------------------|----------------------------|-------------------------------|----------------------------|-------------------------------|-------------------------------|
| July 5-7, 1872 | Washington, D. C. | S. O. standard | Not used. | Not used. | Not used. | Not used. | Not used. | Not used. | Not used. | Not used. | Not used. | Not used. | Not used. |
| July 13-31, 1872 | Salt Lake City, Utah. | 1376 | | | | | | | | | | | |
| May 12-17, 1873 | Washington, D. C. | S. O. standard | | | | | | | | | | | |
| May 18-19, 1874 | do | do | | | | | | | | | | | |
| June 19-23, 1874 | do | do | | | | | | | | | | | |
| June 26-29, 1874 | do | 1376 | -.032 | -.029 | +.111 | | | | | | | | |
| July 22-31, 1874 | Pueblo, Colo. | 1769 | -.014 | | +.004 | | | | | | | | |
| May 5, 10, 1875 | Washington, D. C. | S. O. standard | | -.029 | -.026 | | | | -.024 | -.026 | -.024 | | |
| May 24, 26, 1875 | do | do | | | | | | | | | | -.007 | -.023 |
| June 12, 16, 1875 | Los Angeles, Cal. | 2124 | | -.021 | -.024 | | | | | | -.020 | -.007 | -.016 |
| June 1, 6, 1875 | Pueblo, Colo. | 1989 | -.057 | | | | | | | | | | |
| Jan. 26-31, 1876 | Washington, D. C. | S. O. standard | | | | | | | | | | | |

From the comparisons as above, the following errors of the attached thermometers were deduced:*

| Barom. No. 1376, error. | Barom. No. 1611, error. | Barom. No. 1613, error. | Barom. No. 1735, error. | Barom. No. 1767, error. | Barom. No. 1768, error. | Barom. No. 1769, error. | Barom. No. 1852, error. | Barom. No. 1853, error. | Barom. No. 1985, error. | Barom. No. 1938, error. | Barom. No. 1939, error. | Barom. No. 1978, error. | Barom. No. A, error. | Barom. No. B, error. | Barom. No. 2, error. | Barom. No. 1998, error. | Barom. No. 1, error. | Barom. No. 2134, error. | Barom. No. 2143, error. |
|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------|----------------------------|----------------------------|----------------------------------|----------------------------|----------------------------------|----------------------------------|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| + 1.46 | + 1.23 | + 1.95 | + 1.07 | + 0.93 | + 1.12 | + 1.46 | + 1.36 | + 0.76 | +1.04 | + 1.03 | + 0.56 | + 1.46 | + 0.65 | - 0.75 | + 1.00 | + | + 1.13 | + 0.03 | + 0.35 |

* In the field the attached thermometers nearly invariably read *higher* than the standard open-air thermometers of the several field-parties corrected for errors, except in camps where the barometers, were left hanging a sufficient length of time for the entire volume of the mercury to acquire the air temperature. This resulted, doubtless, from the absorption of heat by the metal of the barometers, which cooled but slowly by radiation. The errors above are affected with the *minus* sign when instruments read *higher* than the standard, and *vice versa* when they read lower.

Table showing the errors of the cistern barometers as deduced from the comparisons of the instruments of the several field-parties among themselves. Field-seasons 1874-1875.

| Date. | Barom. No. 1376, error. | Barom. No. 1735, error. | Barom. No. 1767, error. | Barom. No. 1768, error. | Barom. No. 1769, error. | Barom. No. 1852, error. | Barom. No. 1853, error. | Barom. No. 1925, error. | Barom. No. 1928, error. | Barom. No. 1929, error. | Barom. No. 1978, error. | Barom. No. A, error. | Barom. No. B,* error. | Barom. No. 1, error. | Barom. No. 2, error. | Barom. No. 1898, error. | Barom. No. 2124, error. | Barom. No. 2143, error. |
|-------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------|-----------------------------|----------------------------|----------------------------|----------------------------------|----------------------------------|----------------------------------|
| July 1, 1874 | -.012 | -.013 | -.015 | -.009 | +.002 | -.022 | -.010 | -.005 | -.026 | -.017 | -.032 | -.029 | +.111 | (d) | (d) | ..... | (d) | (d) |
| August 1, 1874 | -.016 | -.009 | -.015 | -.009 | +.002 | -.018 | -.020 | -.006 | +.021 | +.005 | -.014 | (c) | +.004 | (d) | (d) | -.006 | (d) | (d) |
| September 1, 1874 | -.011 | -.009 | +.024 | -.003 | -.003 | -.018 | -.027 | +.014 | -.011 | ..... | -.012 | (c) | +.209 | (d) | (d) | -.006 | (d) | (d) |
| October 1, 1874 | -.011 | -.009 | +.015 | -.003 | -.010 | -.010 | -.005 | +.005 | -.003 | +.014 | -.012 | (c) | +.307 | (d) | (d) | broken | (d) | (d) |
| November 1, 1874 | -.076 | -.009 | broken | -.003 | -.006 | -.010 | -.005 | +.011 | -.003 | broke: | ..... | (c) | broken | (d) | (d) | broken | (d) | (d) |
| June 1, 1875 | -.032 | -.024 | -.025 | -.025 | -.030 | (a) | -.032 | -.039 | -.027 | -.024 | ..... | -.029 | -.026 | -.024 | -.024 | -.026 | -.007 | -.025 |
| July 1, 1875 | -.032 | -.030 | -.019 | -.006 | -.039 | (a) | -.014 | -.047 | -.027 | -.024 | -.012 | ..... | -.019 | -.011 | -.039 | -.047 | -.007 | -.026 |
| August 1, 1875 | -.019 | -.030 | -.019 | -.038 | -.036 | (a) | (b) | -.047 | -.027 | -.024 | -.057 | -.029 | -.037 | -.011 | -.039 | -.047 | -.007 | -.021 |
| September 1, 1875 | +.067 | -.030 | -.010 | -.014 | -.053 | (a) | (b) | -.047 | -.027 | -.024 | -.223† | -.021 | -.017 | -.011 | -.039 | -.047 | -.007 | -.021 |
| October 1, 1875 | -.077 | -.030 | -.010 | -.077 | -.059 | (a) | (b) | -.047 | -.048 | +.04 | -.223 | -.021 | -.022 | -.011 | -.039 | +.012 | -.022 | +.046 |
| November 1, 1875 | -.077 | -.016 | +.002 | +.001 | -.066 | (a) | (b) | -.047 | -.029 | +.024 | -.223 | -.021 | -.025 | -.011 | -.039 | +.012 | -.044 | +.046 |

a Not used in 1875.

b Broken July 7, 1875, and not used after.

c Left in office as standard.

d Not used.

* Barometer B in 1874 had a cylindrical cistern instead of a constricted conical one, which seemed in some way to facilitate the ingress of air to the tube. It was refilled again and again by boiling, and the position of the tubes changed, but, while the other instruments with similar usage remained free from air, a bubble would be found in its tube after short use. The instrument was not, therefore, relied upon for altitudes. In 1875 it had been remedied and worked well. Where comparisons are not shown above, the instruments were in use at the main stations, and their errors, as determined at initial comparisons, constant.

† Barometer 1978, compared at signal office in Santa Fé, shows a greater error than can be possible. Comparisons in 1873 and in 1874 also showed that the signal-office barometer at Santa Fé reads too low, giving too great an altitude for that point.

NOTE.—Attached thermometers assumed to maintain constant errors as determined at initial comparisons. Of the barometers, the errors as adopted for the observations taken near the dates above are given. When a tube was refilled or an accident caused a change in the error of any barometer, a series of comparisons was instituted to determine the new error.

The barometers, with their long tubes unsupported and filled with heavy mercury, are carried slung across the shoulders of the meteorologists, and are subjected to severe jolts from the stumbling or plunging of the riding-animals, by which they are often broken. Many instruments are thus broken during each field-season and refilled, making the tracing of instrumental errors through the field comparisons, where from twelve to thirty barometers are used, a tedious undertaking. An attempt is now made to remedy this objection to the mercurial barometers by inclosing the tube in an outer casing of brass and filling the entire space between the brass and glass tubes with plaster of Paris, save along a narrow slot cut through the outer brass case for twelve inches of the scale for reading the instrument. The tube is thus supported throughout its entire length by a nearly rigid support, and when filled cannot easily be broken save at the top, where it is not inclosed with plaster to allow of its expansion by heat.

The objection to this arrangement is that the attached thermometer, which before gave only approximately the temperature of the mercury, is rendered still more uncertain in its indications of the temperature of a column protected by a porous and bad conductor of heat inclosing it. This can only be avoided by inclosing the attached thermometer also within the outer brass tube, which seems practicable.

ANEROID BAROMETERS.

Since the organization of the survey aneroids have been used by the topographers and geologists for relative altitudes, and when properly handled are useful, convenient, and sufficiently reliable instruments for the purposes to which they have been applied. Prior to the field-season 1873, so little was known by the individuals using them of their action and capabilities under the necessarily rough usage they must encounter in the field, and so much confidence was placed in their indications, that frequent comparisons with the more reliable mercurial barometers, which are absolutely essential if results of value are to be expected, were neglected, and when the aneroid work came to be reduced it was found useful only as indicating the manner in which the instruments should not be used, and their utter worthlessness when not employed in connection with the mercurial barometer or

the level. Like all mechanical combinations of levers, screws, and springs, they are subject to continual shifting of parts when subjected to the jar and jolts encountered in ordinary use in the field, and it is essential that a continual watch be kept upon their indices of error by comparisons with more constant instruments. Besides the continual change in the position of the zero-point, from actual shifting of screws and other points, the following defects seem to be common in a greater or less degree to all aneroids.

1. They are not compensated for temperature.
2. The elasticity of the corrugated steel chamber is affected by repeated changes in pressure.
3. The graduation is not always perfect, and moreover the errors of graduation of an aneroid which has been repeatedly subjected to considerable changes of atmospheric pressure seem to vary. This variation is probably a consequence of the affected elasticity or permanent change in form of the vacuum-box.
4. The weight of the machine itself affects its indications, *i. e.*, the readings of the aneroid will differ when held in different positions. In the aneroids used by us the difference is sometimes as much as $0''.08$; the aneroid reading lower when held with the plane of the face vertical than when held with face horizontal and upward. The amount of this variation will depend upon the construction of the instrument, its size, and the weight of its parts.

To determine and separate the errors due to these various causes, when each of from eighteen to thirty aneroids is involved, calls for more extended, careful, and expensive observations and experiments than have been practicable or advisable, considering the value of the expected results.

During the field-seasons of 1874 and 1875, whenever hourly observations were taken, all aneroids which could be assembled were compared hourly with the cisterns, which gave series of comparisons extending over several days and through quite wide ranges of temperature; when the instruments were undisturbed and read under similar conditions, their permanent adjustments were presumably constant. All of these comparisons have

been examined, and, as far as they furnish data, the effects of temperature upon many aneroids in practice have been determined. The instruments were made by Pike, Ewing, and Casella, principally by the latter, of pocket-size, graduated to $0''.05$, but susceptible of being read to $0''.01$ by estimating the smaller subdivisions. The differences between the readings of each aneroid and the corresponding indications of the cistern barometer at 32° Fahrenheit were first taken to eliminate the movement in the barometric column itself, and these differences and the corresponding temperatures grouped according to the ascending scale of temperature, and the mean of each group taken. The result has been an ascending scale of temperature and a corresponding scale of aneroid differences. In a number of cases no well-marked law of variation has been apparent, which is probably due to the want of a sufficient number of careful comparisons where compensation is nearly attained. Certainly in these cases the want of compensation for ordinary ranges of temperature affects the readings by a quantity less than the errors of observation. Other errors share this want of compensation even in a short series of comparisons. Of these, some are *over-compensated*, or the movement produced by heat is the reverse of that seen in the mercurial barometer; others are *under-compensated*, or the movement is in the same direction as the temperature. It is probable that no aneroid is perfectly compensated, but it is also true that in a number of the aneroids in use by us this desideratum is so nearly approximated that for all intents and purposes it is practically attained for ordinary ranges of temperature.

Of about thirty aneroids examined one was affected $0''.046$ by a change of $39^{\circ}.5$ Fahrenheit. Two others were affected $0''.035$ – $0''.037$ by a change of 40° Fahrenheit, and these three showed the greatest variation. These comparisons indicate but approximately the effects of temperature, but show that in the special cases examined the extreme errors in the results cannot from this cause alone exceed fifty feet. In practice the range of temperature during each day's travel was much less than given above and the errors from this source correspondingly less.

The comparisons were made not so much for determining tables of

corrections for temperature as for getting a definite idea of the value of aneroid results, when corrections for temperature were not applied to the readings. The above-mentioned results, however, are no criterion for judging of the action of aneroids other than those compared, since each instrument possesses its own individual qualities, which may be as unexceptionally bad as the above were unexpectedly good.

The aneroids in use by the survey, though made and graduated to order, have been unaccompanied by tables of scale-error, and it has been impracticable to have them tested under the air-pump after arrival in the office. In following out the system of comparisons, however, the aneroids have been compared with mercurial cistern-barometers at numerous points, varying in altitude from 8,000 to 14,000 feet, which comparisons have all been examined and reduced. As a rule these comparisons are not satisfactory for determining accurately scale-errors when small, since the effects of this source of inaccuracy may be combined with actual changes in the adjustments of the instruments themselves, from which they cannot be separated. Whenever the errors of scale are large, however, they become apparent from the comparisons, and the observations made with such aneroids have been rejected as unreliable.

Below are given comparisons of aneroids by Casella, Nos. 2094, 2075, and 2087, at bases and summits of high mountains. Numerous comparisons of these and other instruments at bases and summits of the higher mountain peaks of Southwestern Colorado and Eastern California give similar results and show good graduation and excellent working when the indices of error remained constant. On the other hand, comparisons of instruments made by the same maker, under the same contract and specifications, show poor graduation, as shown in the table for aneroid 2088.

In the table below all the aneroids in use by two of the field-parties are given as examples. The aneroids used by the other field-parties show similar action.

| Date. | Number of comparisons. | Temperature. | Cistern-barom. at 32° Fahr. | Aneroid errors. | |
|-------------------|------------------------|--------------|-----------------------------|-----------------|-----------|
| | | | | No. 2094. | No. 2094. |
| 1875. | | ° | " | " | " |
| August 8..... | 3 | 53.6 | 21.500 | + .713 | ..... |
| August 7..... | 2 | 48.0 | 18.909 | + .719 | ..... |
| August 7..... | 2 | 64.0 | 19.553 | + .717 | ..... |
| August 9..... | 3 | 59.4 | 18.137 | + .721 | ..... |
| August 10*..... | 4 | 57.4 | 21.501 | + .718 | ..... |
| August 8-10..... | 7 | 57.4 | 21.501 | ..... | + .408 |
| August 11..... | 2 | 49.6 | 18.057 | ..... | + .397 |
| August 13..... | 2 | 56.2 | 18.607 | ..... | + .410 |
| August 11-16..... | 9 | 50.7 | 20.304 | ..... | + .413 |
| August 17†..... | 2 | 56.5 | 18.735 | ± .000 | ..... |
| August 25..... | 3 | 62.9 | 20.968 | + .003 | ..... |
| August 29..... | 5 | 50.2 | 20.950 | + .006 | ..... |
| August 31‡..... | 2 | 56.6 | 19.369 | + .077 | ..... |
| September 1..... | 2 | 41.2 | 21.421 | + .069 | ..... |

* Same place as on August 8.

† Aneroid set to agree with cistern at 32° Fahrenheit.

‡ Index error changed 0".07; 2088, poor graduation; observations rejected.

| Date. | Number of comparisons. | Temperature. | Cistern-barom. at 32° Fahr. | Aneroid errors. | |
|----------------------|------------------------|--------------|-----------------------------|-----------------|-----------|
| | | | | No. 2088. | No. 2087. |
| 1875. | | ° | " | " | " |
| November 18, 19..... | 2 | 57.8 | 26.718 | + .198 | ..... |
| November 22, 23..... | 2 | 70.6 | 28.633 | + .038 | ..... |
| November 23, 24..... | 2 | 74.4 | 29.107 | — .008 | ..... |
| November 24-27..... | 7 | 68.5 | 29.581 | — .028 | ..... |
| September 8..... | 12 | 47.0 | 19.413 | ..... | — .084 |
| September 10..... | 7 | 69.4 | 21.481 | ..... | — .076 |
| June 27..... | 4 | 66.9 | 28.558 | ..... | — .141 |
| June 28..... | 3 | 69.8 | 30.032 | ..... | — .148 |

Under all the circumstances of actual use in the field the merits of the aneroids have been carefully examined, and the sum of the errors due to the above causes determined, and whenever unadjustable errors, which are so great as to materially affect the resulting altitudes, have become apparent from any cause, the observations have been discarded as worthless. So also in nearly every case where no checks have been had upon the changes

for several days, unless the comparisons before and after these intervals show nearly constant index errors. At best, however, there is always a feeling of doubt as to the accuracy of a result from an aneroid observation, unless the greatest care is observed in testing and using it.

OBSERVATIONS.

The observations taken in the field were made in accordance with the printed instructions published by the Survey, and were of the following classes:

1. Hourly observations of cistern-barometers and psychrometers at all of the main astronomical stations established since 1871, for the purpose of securing tables of horary corrections to be used in the reduction of isolated observations and the aneroid work. Such series were from eight to forty days at each station.

2. Hourly observations at rendezvous and other camps for the same purpose.

3. Cistern-barometer and psychrometer observations in camp every three hours, or at 7 a. m., 2 and 9 p. m., at which hours also all meteorological instruments of each party were compared for determining the altitudes of camps, and to furnish the means of detecting changes in instrumental adjustments.

4. Cistern-barometer and psychrometer observations on peaks and topographical stations simultaneously with observations in camp.

From the nature of the case, these observations were taken whenever they could be, and not in all cases at the best hours. The summits of the peaks in most instances were high above the upper limit of arborescent vegetation, where wood for fires could not be secured, making it impracticable to remain over night upon the station for the purpose of observation, and rendering it necessary for the ascending parties to return to camp before nightfall. The observations for these reasons are, as a rule, recorded as taken near the hottest part of the day. When, however, the ascending parties camped high up upon the flanks of the peaks ascended, the bad effects of high-temperature observations have been in a great measure obviated, as will be shown hereafter.

5. Aneroids and thermometers were read in connection with the odometer at meander stations along roads and trails, for securing definite profiles, along meander lines, at towns and settlements, and upon the summits of divides, &c. Cistern barometers and psychrometers were also read.

6. Aneroid and psychrometer readings taken by various members of the different field parties at points which can be identified and located upon the maps without the aid of topographical notes.

In addition to the readings as above given, taken for hypsometrical purposes alone, general meteorological observations, such as are prescribed by the Smithsonian Institution, were taken and recorded. A mass of meteorological data has thus been accumulated which, though not sufficiently extended to be of much use in general meteorological discussions, may be of interest for comparison.

OFFICE REDUCTIONS.

In the computation of altitudes the observations have been compared with simultaneous observations taken at fixed reference stations, determined in altitude by the best practicable means at the disposal of the Survey. The Signal-Service stations at Corinne, Utah; Denver and Colorado Springs, Colorado; Santa Fé, New Mexico; San Francisco and San Diego, California, have been used as well as stations established by the Survey. The altitudes of Corinne, Denver, San Francisco, and San Diego have been determined from lines of level connected with sea-level. The altitude of the zero point of the barometer of signal stations at Colorado Springs and Santa Fé, New Mexico, was determined by referring these stations, by means of five months' tri-daily observations, to corresponding observations at Denver, Colorado. The height above the sea of the top of the meridian-pier in the Mormon observatory at Salt Lake City, Utah, was determined by a line of levels run, under the direction of Lieut. R. L. Hoxie, Corps of Engineers, by Assistant Engineer Gilbert Thompson, of this Survey, from the Central Pacific Railroad bench-mark at Corinne, Utah, using the mean water-level of the Great Salt Lake as a connecting level, and this point assumed as one of the datum points for our barometric work of 1872-'73. A bench-

mark was established in 1875 at Los Angeles, California, with which the zero of the barometer at the reference station there was connected, by level, by Assistant Engineer Frank Carpenter, of this Survey, with the United States engineer tide-gauge at the Wilmington Breakwater, California.

The above-mentioned stations were the points to which all the barometric observations taken by the Survey have been ultimately referred, including those taken at the temporary reference stations established during the progress of the work. These included the main astronomical stations where hourly observations were taken, camps for a longer period than three days, and tri-daily stations established at camps of supply, &c., which secondary reference stations were established sufficiently near the field of operations to give good results for relative heights, when observations were referred to them by daily means; the altitudes of these stations themselves were determined from the means of the series of observations taken at them. A list of the reference stations used during the progress of the work at which observations were taken for a longer period than four days, is given in the following table:

List of reference stations used in the reduction of the hypsometric work.

| Station. | Atlas-sheet. | Altitude above sea (feet). | How determined. | Observations. | | |
|--|--------------|----------------------------|-----------------------|---------------|----------------------|------------|
| | | | | Year. | Dates. | Taken. |
| Beaver, Utah (astronomical station) | 59 | 5,915.6 | Barometer | 1872 | Aug. 8 to Sept. 7 | Hourly. |
| Corinne, Utah (signal-office) | 41 | 4,244.4 | C. P. R. R. levels .. | 1871 | May 1 to Dec. 30 | Tri-daily. |
| Do. | 41 | 4,244.4 | do | 1872 | July 13 to Dec. 31 | Do. |
| Do. | 41 | 4,244.4 | do | 1873 | May 1 to July 24 | Do. |
| Colorado Springs, Colo. (signal-office) | 62a | 6,030.4 | Barometer | 1874 | July 1 to Nov. 30 | Do. |
| Do. | 62a | 6,030.4 | do | 1875 | June 1 to Nov. 19 | Do. |
| Colorado Springs, Colo. (astronomical station) | 62a | 6,009.7 | do | 1873 | July 28 to Aug. 10 | Hourly. |
| Denver, Colo. (signal-station) | 53c | 5,244.6 | K. P. R. R. levels .. | 1872 | July 13 to Dec. 22 | Tri-daily. |
| Do. | 53c | 5,244.6 | do | 1873 | June 1 to Dec. 30 | Do. |
| Do. | 53c | 5,244.6 | do | 1874 | July 1 to Dec. 1 | Do. |
| Gunnison, Utah (astronomical station) | 50 | 5,144.6 | Barometer | 1872 | Oct. 30 to Dec. 2 | Hourly. |
| Georgetown, Colo. (astronomical station) | 52a | 8,427.2 | do | 1873 | June 15 to July 6 | Do. |
| Kanab, Utah | 59 | 5,072.3 | do | 1873 | Nov. 1 to Nov. 21 | Tri-daily. |
| Labran, Colo. (astronomical station) | 62a | 5,217.8 | do | 1873 | Aug. 12 to Aug. 28 | Hourly. |
| Los Angeles, Cal. (rendezvous camp) | 73c | 312.5 | Level by survey .. | 1875 | June 14 to July 3 | Do. |
| Los Angeles, Cal. (Gartner's office) | 73c | 325.6 | do | 1875 | June 29 to Nov. 11 | Tri-daily. |
| Los Angeles, Cal. (Lieut. Berglund's office) .. | 73c | 323.2 | do | 1875 | Oct. 16 to Nov. 15 | Do. |
| Fort Mojave, Ariz. (bench-mark) | 74b | 755.8 | Barometer | 1875 | July 8 to Sept. 5 | Hourly. |
| Ogden, Utah (astronomical station) | 41 | 4,376.8 | do | 1873 | Sept. 26 to Oct. 3 | Do. |
| Pioche, Nev. (astronomical station) | 58 | 5,142.3 | do | 1872 | Sept. 27 to Oct. 14 | Do. |
| Santa Fé, N. Mex. (signal-station) | 69d | 7,044.2 | do | 1871 | Nov. 20 to Dec. 10 | Tri-daily. |
| Do. | 69d | 7,044.2 | do | 1873 | Aug. 1 to Nov. 3 | Do. |
| Do. | 69d | 7,044.2 | do | 1874 | July 1 to Nov. 30 | Do. |
| Do. | 69d | 7,044.2 | do | 1875 | June 1 to Nov. 25 | Do. |
| San Diego, Cal. (signal-office) | 80 | 62.0 | Level | 1875 | June 15 to Nov. 1 | Do. |
| San Francisco, Cal. (signal-office) | 55 | 60.0 | do | 1875 | June 15 to Nov. 1 | Do. |
| Salt Lake City, Utah (observatory) | 41 | 4,330.4 | do | 1873 | June 23 to Oct. 5 | Do. |
| Do. | 41 | 4,330.4 | do | 1872 | July 13 to Aug. 2 | Hourly. |
| Trinidad, Colo. (astronomical station) | 70a | 6,043.1 | Barometer | 1873 | Sept. 3 to Sept. 19 | Tri-daily. |
| Austin, Nev., camp near | 48 | 7,520.6 | do | 1871 | June 10 to June 15 | Do. |
| Amargosa River, Cal. | 65b | 3,106.6 | do | 1875 | Sept. 12 to Sept. 18 | Do. |
| Big Tjongo Cañon | 73c | 1,556.0 | do | 1875 | July 16 to July 22 | Do. |
| Camp Independence, Cal. | 65a | 3,956.5 | do | 1871 | July 18 to Aug. 10 | Hourly. |

REFERENCE STATIONS.

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List of reference stations used in the reduction of the hypsometric work—Continued.

| Station. | Atlas-sheet. | Altitude above sea (feet). | How determined. | Observations. | | |
|--|--------------|----------------------------|-----------------|---------------|----------------------|------------|
| | | | | Year. | Dates. | Taken. |
| Camulas Ranch, Cal..... | 73c | 799.0 | Barometer..... | 1875 | Sept. 11 to Sept. 17 | Tri-daily. |
| Caliente, Cal..... | 73a | 1,344.1 | do..... | 1875 | Oct. 14 to Oct. 19 | Do. |
| Carlin, Nev..... | 40 | 4,849.4 | do..... | 1871 | May 27 to June 5 | Do. |
| Ghama River, Forks, N. Mex..... | 69b | 8,367.1 | do..... | 1875 | June 24 to June 30 | Do. |
| Cañon Station, Cal..... | 65d | 2,650.0 | do..... | 1875 | Aug. 8 to Aug. 23 | Do. |
| Cottonwood Springs, Nev..... | 65b | 3,449.5 | do..... | 1871 | Aug. 31 to Sept. 15 | Hourly. |
| Cottonwood Island, Cal..... | 74b | 787.2 | do..... | 1875 | July 14 to July 28 | Tri-daily. |
| Cottonwood Creek, Puncho Park, Colo..... | 61b | 9,381.1 | do..... | 1875 | June 27 to July 2 | Do. |
| Dolores River, Colo., camp on..... | 61c | 9,020.6 | do..... | 1875 | Sept. 5 to Sept. 11 | Do. |
| Edgar's Spring, Cal..... | 65 | 4,060.8 | do..... | 1871 | Aug. 17 to Aug. 22 | Do. |
| Fort Wingate, N. Mex..... | 76 | 7,037.7 | do..... | 1873 | Aug. 5 to Sept. 9 | Do. |
| Fort Tejon, Cal..... | 73 | 3,245.7 | do..... | 1875 | July 25 to Aug. 14 | Do. |
| Furnace Creek, Cal..... | 65a | 405.1 | do..... | 1875 | Sept. 2 to Sept. 12 | Do. |
| Kincaid Ranch, Cal..... | 73a | 1,769.5 | do..... | 1875 | Sept. 24 to Oct. 1 | Do. |
| Little Yosemite, Cal..... | 65c | 6,442.1 | do..... | 1875 | Sept. 27 to Oct. 14 | Do. |
| Lake City, Colo..... | 61c | 8,753.4 | do..... | 1875 | Aug. 2 to Aug. 8 | Do. |
| Las Vegas, Nev..... | 66 | 2,017.8 | do..... | 1871 | Sept. 15 to Sept. 20 | Do. |
| Leach's Point, Cal..... | 73 | 3,403.6 | do..... | 1871 | Aug. 21 to Aug. 25 | Do. |
| Linn Creek, Colo., camp on..... | 61c | 9,531.2 | do..... | 1871 | Sept. 12 to Sept. 19 | Do. |
| Martin's Ranch, Cal..... | 73d | 2,037.6 | do..... | 1875 | June 25 to July 4 | Do. |
| Moreno Valley, N. Mex. (camp)..... | 70a | 8,152.2 | do..... | 1875 | June 26 to July 6 | Do. |
| Puncho Creek, Colo., camp on..... | 61b | 8,576.0 | do..... | 1875 | July 3 to July 7 | Do. |
| Ray's Creek, Cal. (camp)..... | 73c | 4,978.9 | do..... | 1875 | Aug. 26 to July 1 | Do. |
| San Fernando, Cal..... | 73 | 1,038.0 | do..... | 1875 | July 8 to July 18 | Do. |
| Santa Paula, Cal..... | 73c | 384.0 | do..... | 1875 | Sept. 6 to Sept. 11 | Do. |
| San Pedro, N. Mex..... | 77b | 6,364.0 | do..... | 1875 | Sept. 26 to Oct. 1 | Do. |
| Saguache, Colo..... | 61d | 7,723.1 | do..... | 1875 | July 7 to July 15 | Do. |
| Saguache Creek, South Fork, Colo., camp on..... | 61d | 10,059.7 | do..... | 1875 | July 17 to July 23 | Do. |
| Saguache Creek, West Fork, Colo., camp on..... | 61d | 10,079.9 | do..... | 1875 | July 23 to July 28 | Do. |
| San Miguel and Uncompahgre Divide, Colo. (camp)..... | 61c | 9,689.4 | do..... | 1875 | Aug. 23 to Aug. 28 | Do. |
| San Miguel and South Fork, Colo. (camp)..... | 61c | 9,700.1 | do..... | 1875 | Sept. 1 to Sept. 5 | Do. |
| San Juan City, Colo..... | 61c | 8,900.8 | do..... | 1875 | Oct. 18 to Oct. 26 | Do. |
| Silver Peak, Nev..... | 57 | 4,256.6 | do..... | 1871 | July 6 to July 11 | Do. |
| Silver Cañon, Nev., camp in..... | 58 | 6,661.6 | do..... | 1871 | July 11 to July 20 | Do. |
| Tebachapai Pass, Cal., camp in..... | 73a | 3,531.9 | do..... | 1875 | Oct. 19 to Oct. 22 | Do. |
| Tellurum post-office, Colo. (camp)..... | 61c | 10,878.2 | do..... | 1875 | Aug. 10 to Aug. 16 | Do. |
| Tierra Amarilla, N. Mex..... | 69b | 7,651.0 | do..... | 1875 | June 30 to July 5 | Tri-daily. |
| Weldon, Cal..... | 65c | 2,716.9 | do..... | 1875 | Oct. 18 to Nov. 12 | Do. |
| Walker's Basin, Cal..... | 73c | 3,157.2 | do..... | 1875 | Oct. 11 to Oct. 15 | Do. |

In addition to the stations enumerated above, which have been used as reference stations, hourly observations were taken at Bozeman, Mount Cimmaron, Fort Union, and Las Vegas, New Mexico; Fort Garland, Hughes, Pagosa, Hot Springs, and Julesburg, Colorado; Cheyenne, Fort Steele, Green River Station, and Laramie Station, Wyoming; Prescott and Truxton Springs, Arizona; Virginia City and Winnemucca, Nevada; and Sidney Barracks, Nebraska. These points were occupied at times when they could not be used to advantage in the hypsometric work of the Survey as reference stations, but the horary curves have been deduced and used whenever applicable.

The observations were all corrected for instrumental errors and reduced to 32° Fahrenheit. Those taken at the hourly and main reference stations were then plotted, and the erratic or erroneous observations thus revealed were corrected by interpolation, using for the interpolated values those

derived from an approximate horary curve deduced from all the observations taken at the station under consideration, combined with the abnormal movement for the day. These approximate tables were also used for interpolating observations where wanting; thus reversing the operations of eliminating the abnormal and horary oscillations of the barometer, as given in Williamson's treatise.

The hourly observations were then "reduced to level" by Colonel Williamson's method, and the observations for those days whose well-marked horary fluctuations not materially affected by the non-periodic motion, were selected for the formation of the horary corrections given in the plates and tables hereto appended.

Observations taken at hours other than those which give close approximation to the mean of the day were then corrected for horary oscillation, as far as the tables were deemed applicable. In addition to the horary tables deduced from the work of the Survey, those given by Williamson for points on the Pacific Coast were used for reducing the work of the California parties in 1875, when considered suitable, and approximate daily means thus secured.

At camps and on the march approximate daily mean temperatures were secured from observations at 7 a. m., 2 and 9 p. m.; at other points the observed temperatures approximately reduced were employed. For mountain stations the following method, whenever practicable, was followed. This applied when the ascending parties camped high up on the flanks of the peaks on the nights preceding and following the ascent, viz: For want of more reliable law connecting observed temperatures at two points with the difference in altitude, the observations taken by the ascending party at their timber-line camp at 7 a. m., before the ascent, and at 9 p. m., after the occupation of the peak, were reduced three degrees Fahrenheit for each inch of the mercurial column, between the readings in camp and on the summit, and the reduced temperatures were taken in connection with the 2 p. m. observations on the summit, for an approximate mean daily temperature to be used in the barometric formula, with the observed height of the barometer reduced to 30° Fahrenheit, for determining the height of the

peak above the reference station at its base. In the work of the Colorado section, among the high peaks of that portion of the continental divide, this method gave very satisfactory and uniform results. Where the observed temperatures upon the summits of the peaks in the same area, many of them being occupied during a short time—one nearly every day—were altogether different, and, when used in the ordinary barometric formula, gave results not agreeing with the relative differences as determined by angles of elevation and depression; but when reduced, as above-described, the mean daily temperatures varied among themselves but a few degrees, as we should expect in the same region and season, and gave much more harmonious results.

It is essential in determining the altitudes of high points where it is necessary to refer to stations at their bases, or many feet below their summits, and where the want of wood for fuel makes it impracticable to remain overnight upon the summit, to adopt some device for securing approximate daily mean temperatures. Granting that the barometric formula is correct, it is at best difficult to secure the mean temperature of the stratum of air between base and summit.

The atmosphere is heated only by contact with a heated body; by the absorption of heat-rays; by aqueous vapor; by convection or by freeing of latent heat during the condensation of aqueous vapor in the formation of clouds and dew. In the almost dry air of the Western plains and mountains, little heat is absorbed and little disappears by evaporation where there are so few surfaces of water; but for this very reason the solar and terrestrial radiation is astonishingly great. In a single twenty-four hours the range of temperature in the shade is often equal to or greater than it is during the entire year at points in a more humid climate in the same latitude near the sea. For instance, at Labran, Colorado, at 4 a. m. August 27, 1873, the thermometer registered $52^{\circ}.2$ Fahrenheit in eight hours, or at 12 m. it had risen to $110^{\circ}.6$ Fahrenheit, a difference in air temperature of $58^{\circ}.4$ Fahrenheit. At Hughes, Colorado, at 1 p. m., July 13, 1873, the temperature was $107^{\circ}.1$; at 5 a. m. next morning it was $52^{\circ}.8$, a range of $54^{\circ}.3$ Fahrenheit; and again, at Cheyenne, Wyoming, October 9, 1872, at 6 a. m. the temperature in the shade was $20^{\circ}.0$ Fahrenheit, and at 2 p. m. same day it stood at $76^{\circ}.0$, a range of 56° in air temperature in eight hours.

Such fluctuations are impossible in moist climates where a thick stratum of air intercepts by its moisture and more nearly equalizes the heat received from the sun throughout this stratum, and where so much of the heat received from the sun becomes latent during evaporation and again freed by deposition of dew at night. But they are not unusual, and are no doubt often exceeded in the interior of this continent in localities still drier than those given. The same causes which produce such fluctuations near the surface, prevent to a great degree the dissemination of diurnal heat throughout the upper strata. The action of the sun's rays and their effects on the temperature of the stratum considered in hypsometrical work are supposed to be as follows: The heat-rays pass through the dry air of the region under consideration without great absorption, and heat the surface of the earth. The air in contact with it becomes heated, expands and rises, losing much of its sensible heat in the work of expansion and in overcoming the resistance to its upward motion. A continual current of expanded air ascends, which rapidly cools from radiation and work, and the sensible heat, disappearing from these causes, is not replaced, as in moister regions, by increments of heat absorbed by particles of vapor in the passage of heat-rays through them, nor becomes apparent by the condensation of moisture in the formation of clouds. The heated particles soon radiate or lose their heat, communicating comparatively little heat to others, and are soon sufficiently cooled to again take part in the vertical circulation moving now downward, and before the increased temperature affects materially the upper strata not in direct contact with the earth, the air below is becoming cold, by radiation in the afternoon and night. It is probable then that although there are great fluctuations in temperature, as observed, within a few feet of the heating body of the earth, that the higher strata are not much affected, although there is a gradual change in the general temperature of the atmosphere from one season to another, not only from the effects of the thermal conditions of the earth-crust, but also from the varying position of the sun with reference to the sphere of the atmosphere itself; the lack of perfect freedom of motion of its particles by which equalization of temperature would be brought about; and the capacity it has for absorbing part of the radiated heat of the sun.

In summer the sun is longer above than below the horizon, and consequently the earth receives more heat than it loses by radiation. The mean temperature of the stratum of air in contact with the earth is, therefore, while this increase of heat is being received, too great to represent the mean temperature of the stratum between. In the winter the reverse is the case. The earth loses more heat than it receives, and while in summer it is the heating body, in winter its crust is the cooling surface. Here, too, the transmission of the cooling effect of the earth is not aided by the particles receiving the residual heat of the upper strata by actual contact from actual motion in a vertical direction, but the quantity of the cooled particles being increased they remain near the surface, the lower strata being generally the coldest during this season of the year; therefore the mean of the temperatures, even if correctly taken at two points respectively gives at different heights above the ground-level, too low mean temperatures for the stratum between. The surmise that the diurnal movement of temperature does not extend to a great height is shown by experiment to be confirmed by results by the barometric formula. When it is assumed that the mean of the temperatures at the high and low stations gives the mean temperature of the stratum between, different results are attained for the twenty-four hours, too great temperature-corrections resulting during the warm parts of the day and too small during the night; whereas a constant temperature for the twenty-four hours continued, with the observed heights of the barometer corrected for diurnal movement, gives much more concordant results. If it be true that the diurnal movement of temperature is not very appreciable in the higher strata, remaining nearly constant throughout the day, the yearly movement only being apparent, it would be better to use in the barometric formula the means of the observed temperatures for a longer time than one day, in connection with the observed mean daily height of the barometer at the two stations, disregarding the mean observed temperature for any single day of the series. Now that the Army Signal Service has established stations upon the summit and at the base of one of the lofty peaks in the dry region of this continent, it would be well to discuss the observations taken thereat, if only with reference to the best practice in

regard to the temperature-terms of the formula in use; added to this consideration is the value of the sines in further investigating the constants of the barometric formula which seem to require modification.

It is contended above that even if the thermometers indicated the temperature of the air at the surface, the mean of the readings of the thermometers at two points of different altitudes near the surface would not indicate the true temperature of the stratum between, on account of the various ways that sensible heat may and does disappear and reappear. Besides these reasons, thermometers at the surface of the heating and cooling body are subject to many causes of error in their indications, that tend to produce the same results. When the earth is warmer than the air they are affected by the radiated heat from the earth itself and from all surrounding solid bodies, and by reflected rays of the sun, which make the readings too large. When the earth is colder than the air the reverse takes place. When, therefore, the earth is the heating body, as in summer, the indications will be too great, and *vice versa* in winter.

The consequences of the facts that the earth in summer is the heating and in winter the cooling body, and that the observed temperatures near the surface in the summer are too high and in the winter too low for use in determining the mean temperature of the air, are seen in the results from the application of the barometric formula by which too great differences of level are derived in summer and too low in winter. This may, perhaps, by the investigation of observations taken at such stations as those established by the Signal-Service upon Pike's Peak and Colorado Springs, and at other high and low barometric stations in different parts of the world, be corrected for in the constant of the pressure term of the barometric formula by multiplying the mean value of this constant by a factor of the form $(1 + f(L))$; the second term in the parenthesis giving the values of a periodic function depending not upon the differences in level so much, perhaps, as upon the latitude of the place and declination of the sun, and which, increasing or diminishing the constant factor by a variable quantity, may cause the barometric formula to give identical results throughout the year. Disregarding the effects of influences that are small and complex, it seems reasonable to hope that the form of the function in the second term

of the above value may, by examination, be empirically discovered and not be too complex for ordinary use. Or else the form of a function expressing the law, if there be one, of the relation of the observed to the true temperature of the air.

The observations of the psychrometer were reduced by the use of the tables in Williamson's treatise, neglecting the correction for altitude. So little is known of hygrometry at high altitudes, and the influence of the factor depending on moisture in the barometric formula of Plantamour, is so small, that the neglect of this small correction affects the results so far as altitudes are concerned inappreciably, while its application would call for nearly double the amount of work in computing the humidity only to attain results of doubtful value. From the difficulty of securing good observations and results from the psychrometer, the mean daily humidity, or where practicable, the mean monthly values were taken for use in the barometric formula for the reference station, and the mean for as long a time as practicable at the required station. Each observation has not been separately computed, but the force of vapor and humidity in the tables has been derived from the *mean* wet bulb and *mean* differences.

From the difficulty and expense of establishing numerous reference stations in the thinly-settled regions surveyed, and the increased labor in the reduction of observations at many stations, it has been necessary to refer the observations to places in some cases three hundred miles from points whose altitudes above the sea were sought, which introduces into the results the effects of *differences in phase* of the atmospheric waves continually sweeping over the area surveyed. From the known facts in regard to the motions and variety of contour of these waves it would be practically impossible to make corrections for abnormal oscillations where, as in the case of moving field-parties, the necessary data for determining the barometric gradients cannot be secured. In making corrections for abnormal movements, attempts have been made to reduce the readings at the two stations to the mean values for the entire period covered by the field-work, without reference to the *motion* of the waves or to the differences in barometric gradients at different points or parts of the waves. The motions and shapes of barometric waves or areas of high and low barometer have indeed but

lately, or since the establishment of the Army Weather Bureau, attracted general attention, and as yet in the Territories of the United States, in which this Survey has been engaged, the workings of this bureau are not sufficiently extended. In this connection a few general remarks are made to explain the methods which have been adopted, as far as the data at hand would allow, in reducing our work, and which will be more strictly and fully carried out in future.

The areas of high and low barometer move with varying rates and in directions not constant in a *general* west to east course. The forms of the waves or rather areas of high and low pressure and of the isobars are innumerable: sometimes like troughs or waves of the sea; sometimes nearly circular or elliptical; sometimes irregularly shaped, with projecting arms, as it were, of low barometer, with barometric gradients of different degrees of steepness on different sides of the periphery of the bowls or troughs of low barometer.

The laws of propagation of the waves or the extent of the oscillations seem to be different at different altitudes; or from some cause unknown the same rules of interpretation will not apply to observations taken at high stations as to those taken at low points. This, however, may be due to the defective formulæ for reducing observations to a fixed datum plane for comparison.

From which it results that while we may succeed in eliminating the effects of abnormal oscillation at the fixed station, the application of the corrections deduced thereat to isolated observations at a distance would leave the results with precisely the same errors expressed in inches of the barometric column; and that this correction cannot be made unless from numerous fixed stations the isobars can be accurately traced, and the forms and gradients of the waves correctly determined, from which the observations may be corrected. This process, however, would evidently involve labor and expense wholly incommensurate with the value of the results attained, and practically impossible of application where a great number of observations at different points and at various hours of the day are involved. From the practical difficulty of securing corrections of doubtful utility no attempt has been made to correct directly for abnormal oscillations in the

preparation of the pressure term, but the observations have been referred to the nearest of the reference stations established in the field of survey without such corrections. From the shapes of the surfaces of the waves, as shown by the isobars on the weather maps of the United States Army Signal-Service, it is seen that the surface covered by the crests and troughs of barometric waves, and the width of the areas included between isobars expressing differences of, say, $0''.1$ in barometric height (which would correspond to errors of from 100 to 130 feet from this cause), though great, do not justify distances so great as we have been forced to use between our points of observation and those to which the observations have been referred. To lessen the errors which must necessarily enter the results from this cause, as far as the computing force and the time at our disposal would allow, important points where altitudes have been reached with a closer approximation to accuracy have been referred to several reference stations in presumably different *phases* of abnormal or non-periodic disturbance, the point whose altitude is required falling within the polygon found by connecting the reference stations by right lines. Assuming the formula correct, the resulting computed altitude of the point, if referred to one of the stations, would be too high; if to another, too low; and if to a third, perhaps nearly correct. A mean height in accordance with the relative distances of the point from these reference stations, provided the same wave in its different phases embraced all the reference stations, is evidently better than the result from any one determination.

Reasoning thus theoretically, or without sufficient facts or results from actual experiment, it seems that the following is perhaps the best and most expeditious method for a party working in thinly settled regions of the West, where numerous reference stations well determined in altitude cannot be established near the field of operations, to approximately eliminate the effects of atmospheric waves, from the resulting altitudes from barometric readings, viz: To establish, say at least three stations, near the periphery of the area to be surveyed, and on high points within the area. Each cistern-barometer station made during the progress of the work, or at least each station of importance, should then be referred to each of the three, and a proper mean be taken

for the result. When it is considered that it is at any rate necessary to establish as many stations—we have always had as many—and that the main portion of the labor comes, not in the final computations of results, which, with the full tables in use, are short and simple operations, but in the checking of instrumental vagaries in the field, and in the correction and preparation of the observations, which, for the reference stations, may be done as rapidly as the observations are taken, the amount of additional work in the office for the four stations is not twice that for one, with results probably enhanced in value in proportion to the number of such stations, if judiciously selected. It will be remembered, however, that the hypsometrical work of the Survey is simply intended for general information relating to the physical geography of the regions traversed by the surveying parties, and for the assistance of the topographers in representing on a comparatively small scale the topographical features of the country, and not for special purposes where the greatest attainable accuracy in the results, and consequent nicety in manipulation of instruments and in the treatment of observations are absolutely requisite. The methods used where several thousands of points must be quickly computed in order that the results may be on hand for the use of the topographers in constructing their maps, which are drawn at equal pace with the computations, are such as are most expedient and best adapted to gain at reasonable expense of time and labor such results as are needed for their purposes. We are thus forced to follow such rules as may be most rapidly and effectively applied, rejecting unnecessary refinements, or such as give results not commensurate in value to the labor involved in their application; but it seems at least practicable to cancel the effects of abnormal or non-periodic oscillations from the results, in so far as it may be done as above described, and this without unjustifiable expenditure of time and work. This method presupposes that that portion of the wave included within the reference stations is a plane, which is true only for small areas; nor can the abnormal oscillation be cancelled by this method unless the observations are simultaneous, since the waves, as above stated, are in motion, and time is therefore an essential element.

In the lists of altitudes hereto attached are many points where

observations have been taken either by the same or different parties of the expeditions and at intervals widely separated. It is to be presumed that the relative *phases* of the non-periodic waves at the two stations in each set are different in the several cases, and that the differences in altitude are in great measure due to these differences in phase, and may be taken as representing imperfectly, but approximately, the variations and errors we may expect in other altitudes not so checked. For instance, at Fort Garland, Colorado, the following determinations were made at different times for the height of the same point above the sea:

| Station. | No. of readings. | Dates. | Altitude above sea (feet). | Referred to— |
|-------------------------|------------------|--------------------------|----------------------------|-------------------|
| Fort Garland, Colo..... | 30 | August 10-17, 1874..... | 7,868.0 | Santa Fé, N. Mex. |
| Do | 1 | November 20, 1874..... | 7,849.7 | Do. |
| Do | 2 | August 14, 15, 1874..... | 7,863.6 | Do. |
| Do | 1 | August 17, 1874..... | 7,873.4 | Do. |
| Do | 3 | July 29, 30, 1874..... | 7,847.8 | Do. |
| Do | 1 | November 8, 1874..... | 7,837.5 | Do. |
| Do | 4 | June 19, 1874..... | 7,863.7 | Do. |

An extreme variation of 30.5 feet. Fort Garland, however, is nearly north from the reference station, and since the atmospheric waves move, as a rule, from west to east, their phases were probably nearly the same at the two stations, and we attain results with differences similar to those experienced in barometric determinations where the stations are near together horizontally.

At Fort Wingate the following results were attained:

| Station. | No. of readings. | Dates. | Altitude above sea (feet). | Referred to— |
|--------------------------|------------------|----------------------------|----------------------------|-----------------------------------|
| Fort Wingate, N. Mex.... | 18 | July 11-18, 1873..... | 7,095.4 | Santa Fé, N. Mex. |
| Do | 3 | September 22, 23, 1873.... | 6,918.1 | Do. |
| Do | 18 | July 12-18, 1873..... | 7,067.8 | Denver, Colo. |
| Do | 3 | August 2, 1873..... | 6,998.8 | Santa Fé, N. Mex. |
| Do | 18 | July 22-28, 1875..... | 7,098.8 | Fort Mojave and Santa Fé, N. Mex. |

A difference of 181. feet between the greatest and least determination. Of the determinations above, however, the 1st, 3d, and 5th were from quite long series of tri-daily observations, and the agreement between the results is invariably good, and not to be expected where the distances to reference stations are so great (180 to 400 miles). Other determinations show similar differences, but it is rare that discrepancies of 100 feet occur between independent results. Sometimes, however, discrepancies of over 200 feet appear. From the method of carrying the barometer, on mules, strapped to the back of the rider, and exposed to jars and jolts, and from the improper means for preserving them in the field, it would be strange if changes in their adjustment did not occasionally take place. These, if undetected, would cause many of those discrepancies we attribute to non-periodic motions in the atmosphere and to other causes.

The high station recommended above and prescribed in the instructions printed for the use of the field-parties of the Survey, is for use in reducing the observations taken at similar high points. Where the points occupied are in the vicinity of this station the observations are referred directly to simultaneous observations taken thereat, being mean daily temperatures, thus reducing the errors from defective temperature observations, which are directly proportional to the difference in altitude as given by the barometric pressure term. For points at such a distance from the high station that errors may result from referring the observations direct, the following course is prescribed: A semi-permanent camp will be established for several days, the altitude of which will be determined from a mean of the series of observations taken thereat, and all observations taken in the vicinity of the semi-permanent camp will be referred to it for differences of altitude, to avoid, as far as practicable, the errors from differences in phase of non-periodic waves, which would become apparent if referred to a point at a distance.

The observations taken at the high station will be referred by weekly means to synchronous observations at the permanent base station, and the barometric difference of altitude deduced for each week of the series. The quotients arising from dividing the true by the computed heights will be

tabulated for each week of the field-season, and will give a series of factors by which all barometric differences of altitude determined during the period covered by the table, in latitudes and places where the diurnal range of temperature and other climatic characteristics are similar to the same elements at the permanent high stations, will be multiplied to secure results approximately freed from the effects of the cause of inaccuracy just mentioned; or,

Let

h = the absolute difference of level between high and low station, determined by level, if practicable, or else assumed as determined from the means of the entire six months' observations; and

H = the computed difference in feet; then will

$h - H$ = total correction to be applied to the computed difference of level; and

$\frac{h-H}{H} = \left\{ \begin{array}{l} \text{correction to be applied to each foot of computed differ-} \\ \text{ence in level.} \end{array} \right.$

Now let

h' = computed difference of altitude between two other stations, under similar conditions; then it is assumed that

$\frac{h-H}{H} \times h' = \left\{ \begin{array}{l} \text{correction to be applied to this computed differ-} \\ \text{ence to obtain true result; and} \end{array} \right.$

$\left. \begin{array}{l} h' + \frac{h-H}{H} h' \\ \frac{h}{H} h' \end{array} \right\} \text{ or } = \text{true altitude of station.}$

This method is adopted, instead of referring the observations direct to the high station, to carry out the system by which a semi-permanent reference station shall be established near the point determined, at which observations shall be taken for a sufficient period to proximately eliminate the effects of *differences* in phase of non-periodic waves from the altitude of this camp deduced from them; to do which requires that observations shall be taken at both stations in all phases of the waves or in corresponding phases.

In making the computations for altitude the formula of Plantamour,

as represented by the tables in Williamson's treatise on the use of the barometer, has been used wherever humidity observations have been taken; otherwise the formula of La Place has been employed.

REDUCTION OF ANEROID OBSERVATIONS.

In the reduction of aneroid observations the ordinary defects of these instruments have been kept constantly in mind, and the observations have been closely examined to determine the amount of dependence to be placed upon them. The records of the various aneroids have been examined, and those observations when the instruments were working satisfactorily have been taken for computation. All observations made with an aneroid when used away from a cistern for several days have been given little weight as far as absolute heights are concerned, but have been computed in many instances, and approximate altitudes secured for the use of the topographers in constructing their maps, and in representing the relief of the country surveyed by them. As a rule, the aneroid has been considered as an adjunct of the cistern, to be used in connection with it, and not relied upon for the determination of the altitudes of points other than those along meander lines between camps, as explained below. Along the lines of march continuous profiles have been made with the aneroid; at each meander station the odometer recorders have been required to record the readings of the odometer, aneroids, and attached thermometers, and the topographers have located the points, either trigonometrically or by their meander courses and odometer distances. At culminating points of the trails and at camps the aneroids have been compared with the mercurial barometers, so that their indications are constantly checked. In this manner it has been practicable to furnish the topographers with numerous barometric bases from which by angles of elevation or depression they may determine the approximate heights of surrounding natural objects. Used with frequent checks by comparison with mercurial barometers, the aneroid is merely an indispensable instrument for rapid profiling, since it would be impracticable to set up, adjust, and read a mercurial barometer at such frequent intervals, and at the same time make the progress on the march rendered necessary

by the scarcity of watering-places in the areas surveyed by the various expeditions of this Survey.

In the computation of the profiles between camps the following method has been followed (except in 1874, when observed temperatures were used). The altitudes of camps are determined from a longer or shorter series of cistern-barometer and psychrometer observations, as already described herein. The mean of the errors of the aneroid referred to the mercurial cistern-barometer at 32° Fahrenheit, as determined at the two camps between which the profile is run, is taken as the error of the aneroid for the day, and all observations corrected by it, unless the comparisons with mercurial barometers show that the instrument has materially changed its error between the two camps, in which case the observations are rejected *in toto*, unless from our knowledge of the actual grades of the route we are enabled to detect the place in the profile where the change occurred, and to correct the observations before and after accordingly.

The observations are then reduced to the mean of the day by applying the corrections for horary oscillation, and each station then referred to the preceding one (or to camps), the mean daily temperature, or when that cannot be approximated, the mean of the temperatures observed during the march, being used in the computation. Thus, since the aneroid is referred constantly to its own indications (which, observed by the same person, may be presumed to be affected all in the same direction by personal errors), instrumental errors are nearly eliminated from the final results or enter as differential quantities, and the error in the determination of the place of the zero-point of the aneroid does not appreciably enter the results, unless this differential error is large. Beginning at camp, the successive differences of altitude between the meander stations are then added each to the altitude of the station preceding, and the profile carried over to the next camp by successive steps. The difference in the altitude of this camp, as brought over from the preceding camp by the aneroid differences, and that determined by the series of cistern-barometer observations, is the error to be distributed throughout the profile to make the two coincide. It is evident that in thus computing this profile, we assume that there has been no non-periodic or

abnormal fluctuation in barometric height, whereas the air is seldom or never in a state of equilibrium, and the barometer is therefore continually varying in height. Should the barometer be *rising*, the difference in level between the two camps as determined by this profile will be *too great* if we go from a *higher* to a *lower* camp, and *too small* if we go from a *lower* to a *higher*; and *vice versa* if there be a *falling* barometer. In the first case, when the barometer is *rising*, the altitude of the second camp, as carried over by the aneroid differences, will be *too low* by the amount in feet at that altitude of the abnormal or non-periodic movement, while the profile is being measured, and *vice versa* when the barometer is falling, provided the observations and the barometric formula are perfect.

In distributing the error it is assumed that the non-periodic movement is uniform during the few hours that the party may be engaged in running the profile-line, and that the error from this source in the altitude of each station is directly proportional to the time; or,

Let

E = difference in feet in the altitude of Camp 2, carried by aneroid from Camp 1, and that computed from simultaneous observations of cistern-barometer.

T = entire interval of time in minutes between instant of leaving Camp 1 and arriving at Camp 2.

t = interval in minutes, between leaving Camp 1 and arriving at any profile-station.

C = correction in feet to be applied to the altitude of that station.

Then

$$C = \frac{t}{T} E.$$

In unimportant profiles it is sufficiently accurate for the purposes of map construction to divide the errors equally between the various stations.

By this method of computation the observations are reduced with great rapidity; most of the reductions, indeed all except the final operations, can be performed in the field after the day's field-work is over; the connection between the aneroid differences and the absolute altitudes of the camps

being made after the cistern-barometer observations are computed in the office.

Where important routes of communication are to be profiled, however, the aneroid should not be used, but careful cistern-barometer observations should be substituted and the observations reduced separately.

Appended hereto are condensed tables and summaries, with plates, representing the hourly fluctuations of barometrical pressure, temperature, relative humidity, and force of vapor, at some of the reference stations. The results are given as observed, and the curves are not in all cases smooth, but are published as material for what they are worth, and it is considered best to give the results with only such corrections as are evidently erroneous, shown by plotting the individual observations, and with no discussion. The series are not of sufficient length to cancel in the means erratic, accidental, or abnormal observations of movements, particularly in the barometric and vapor curves, but are perhaps sufficient to show the main peculiarities of the meteorological conditions existing in the interior of the continent for the times of the year to which they relate. Of these, the following are the most striking:—

1. An unusually great diurnal movement in barometric height. At low points, as Fort Mojave, Arizona, 755 feet above sea-level, in the interior, this oscillation reaches in August 0".160. Near the seaboard, at Los Angeles, California, it does not reach half this amount. At high altitudes, as at Georgetown, Colorado, where the barometric pressure is 22 inches, the oscillation is as great, or greater than, in the same latitudes near the seaboard where the pressure is 30 inches. The supposed causes of this will be mentioned briefly below.

2. Very small relative humidities and little change during the day in the absolute quantity of aqueous vapor in the air, and consequent great changes in the relative humidity on the temperature changes and non-formation of dew and clouds, save by condensation by the highest of the mountain ranges. Small rain-fall and great ratio of clear to clouded sky, save in the higher mountains.

3. A great fluctuation in diurnal temperature, due to the dryness of

the air and consequent free terrestrial and solar radiation; to the non-freeing of latent heat in the upper strata by the formation of clouds, and during the colder parts of the night by the deposition of dew, which rarely, if ever, forms; and to the lack of free surfaces of evaporation, by the conversion of the water of which into vapor heat may become latent during the day. Variations of from 40° to 60° Fahrenheit in twenty-four hours are frequent during the summer; and from many degrees below freezing to near summer heat in winter. All of which causes produce a very rigorous continental climate, equalled only by the high interior regions of Asia.

4. Rapid responses of thermometer to the action of the sun, by which the maximum temperature is attained near noon, or some hours before it is near the seaboard, and by which the earth is shown to radiate its heat as rapidly as it is received. The temperature-curves show very abrupt movements of the thermometer during the day, dependent upon the free radiation and non-concentration of heat by moisture.

All of the above are direct consequences of the dryness of the climate. In moister regions such fluctuations of temperature would be impossible in the same latitudes, and, if possible, would render them utterly uninhabitable from the heating and freezing consequent upon the rapid deposition and evaporation of water, which would attend such changes in temperature.

While the diurnal oscillation of the barometer is not materially affected by the change in weight of the atmosphere due to the expansion and contraction from the temperature oscillation and the varying amounts of aqueous vapor in the air, the rapid expansion of the atmosphere by heat received by contact with the earth, puts the entire upper air in motion in a vertical direction, and the barometer by its diurnal oscillation exhibits the effects of the resistance of the inertia of the upper air to the motion developed by expansion below, as far as its maximum, which should occur when the temperature is increasing most rapidly. The motion subsequent to the maximum expresses only the varying effects of the momentum of the moving column of air pressing upon the mercury in the cistern, upon the barometric column.

The weight of the column of air being the same or nearly the same, therefore the oscillation should be and is greatest for the same diurnal motion of temperature at the equator, where the same weight corresponds to a greater mass, and should grow less toward the poles. The weights diminishing as we ascend above the earth, the oscillation should be greatest at the level of the sea, and less as we ascend above it. Hence, three elements should be taken into consideration in comparing the range of the horary oscillation :

1. The mean barometric pressures.
2. The diurnal range of temperature.
3. The latitudes of the places of observation.

The diurnal movements of the barometers at the points occupied by the Survey as reference stations have not been deduced from sufficiently long series to cancel non-periodic motions, nor to properly eliminate individual errors, but they go to confirm the theory that the momentum and inertia of the air developed by the heat of the sun is the efficient cause, though aided by other causes, which produce small motions in the barometric column. It is evident that if the weight of the air is diminished the only way in which, under this theory, the oscillation can be as great as before is by an increased rate of motion developed in this column, or by more rapid expansion and contraction at its base. If, therefore, we have a station at considerable altitude we would expect a less oscillation than at or near sea-level; but if the temperature at the high station increased in the proper ratio the oscillation would be equal at the two stations, or even greater at the higher.

This is supposed to be the explanation of the greater oscillations observed in the interior of the continent, even at high altitudes, given in the plates hereto attached.

SUMMARY OF HOURLY OBSERVATIONS AT GEORGETOWN, COLORADO, FROM JUNE 16 TO JULY 5, 1873.

Latitude, 39° 42'. Altitude above sea-level, 8,587.8 feet.

[Pl. 7, fig. 1; Pl. 11, fig. 25; Pl. 14, fig. 43; Pl. 17, fig. 63; Pl. 20, fig. 79.]

| Hour. | Barometer red. to level. | Temp. (Fah.). | Mean diff. wet and dry thermometers. | Force of vapor. | Relative humidity (per M.). | Winds, mean force (10 max.). | Clouds, amount (10 max.). | REMARKS. |
|-------|--------------------------|---------------|--------------------------------------|-----------------|-----------------------------|------------------------------|---------------------------|--|
| | | | | | | | | PROPORTION OF CLEAR AND CLOUDED SKY. |
| | | | | | | | | Per ct. |
| | | | | | | | | Clear |
| | | | | | | | | Nimbus |
| | | | | | | | | Cumulus |
| | | | | | | | | Cirrus |
| | | | | | | | | Stratus |
| | | | | | | | | Cirro-cumulus |
| | | | | | | | | Cirro-stratus |
| | | | | | | | | Cumulo-stratus |
| | | | | | | | | Total |
| | | | | | | | | WINDS. |
| | | | | | | | | Calms. N. S. E. W. |
| | | | | | | | | Per cent... P. 23 14.20 37.67 0.70 0.02 |
| | | | | | | | | Force 1.7 4.4 0.3 0.1 |
| | | | | | | | | N. E. N. W. S. E. S. W. |
| | | | | | | | | Per cent... 3.28 5.26 19.08 12.06 |
| | | | | | | | | Force 0.4 0.6 2.3 1.4 |
| | | | | | | | | BAROMETER. |
| | | | | | | | | Extreme range of abnormal waves: |
| | | | | | | | | From 32.227 inches on June 22, 1873, (5 a. m.) |
| | | | | | | | | To 21.718 inches on June 27, 1873, (3 p. m.) |
| | | | | | | | | THERMOMETER. |
| | | | | | | | | Extreme range of diurnal temperature: |
| | | | | | | | | From 32.5 F., at 4 p. m., on June 18, 1873, |
| | | | | | | | | To 53.0 F., at 4 a. m., on June 18, 1873. |
| | | | | | | | | GREATEST DIFFERENCE BETWEEN WET AND DRY BULB THERMOMETERS. |
| | | | | | | | | Date. Hour. Dry (Fah.). Wet (Fah.). Diff. (Fah.). F. vapor. Humidity (per M.). |
| | | | | | | | | 1873. June 24 3 p. m. 92.0 61.2 30.8 .270 .170 |

* Maxima.

† Minima.

GENERAL REMARKS UPON METEOROLOGICAL PHENOMENA OBSERVED.

Thunder and rain, 2.13 to 2.23 p. m., June 12; thunder at 2 p. m., June 14; heat-lightning on evening of 14th; thunder and rain at 7.30 p. m., June 17; thunder and lightning at 3 p. m., June 19; thunder at 11 a. m., June 20; heat-lightning at 11.20 p. m., June 28.

Rain, 2.13 to 2.23 p. m., June 12; light shower at 2.45 p. m., June 13; shower, 11 to 10 a. m., 14th; two showers between 4 and 5 p. m., 14th; shower at 5 p. m., June 16; storm in southwest, 3.55 to 4.29 p. m., June 19; rain from 1.25 to 2.35 p. m., June 20; intermitting rain, 9.15 to 9.40 p. m., June 20; rain from 6.10 to 12.30 p. m., June 30; again, at 1.35, July 1; turned to snow at 2.45 a. m., and to rain again 5 a. m. to 6.35 a. m., same date.

Aurora borealis, pale and indistinct, 12.30 p. m., June 20.

Slight *fog*, from 4.10 to 6.50 a. m., June 24.

Snow at 2.45 a. m., July 1 (1½ in.); large flakes, ½ inch in diameter; lasted until 5 a. m., same date.

HOURLY OBSERVATIONS.

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SUMMARY OF HOURLY OBSERVATIONS AT GREEN RIVER, WYOMING, FROM JUNE 5 TO JUNE 29, 1873.

Latitude, 41° 31'. Altitude above sea-level, 6,096 feet.

[Pl. 7, fig. 2; Pl. 11, fig. 26; Pl. 14, fig. 44; Pl. 17, fig. 66; Pl. 20, fig. 84.]

| Hour. | Barometer red. to level. | Temp. (Fah.). | Mean diff. wet and dry ther- mometers. | Force of vapor. | Relative humid- ity (per M.). | Winds, mean force (10 max.). | Clouds, amount (10 max.). | REMARKS. | |
|-------|-----------------------------|---------------|--|-----------------|----------------------------------|---------------------------------|------------------------------|--|-----------------------|
| | | | | | | | | PROPORTION OF CLEAR AND CLOUDED SKY. | |
| | | | | | | | | Per ct. | |
| | | | | | | | | Clear | 75.4 |
| | | | | | | | | Nimbus | 2.3 |
| | | | | | | | | Cumulus | 6.2 |
| | | | | | | | | Cirrus | 4.9 |
| | | | | | | | | Stratus | 1.3 |
| | | | | | | | | Cirro-cumulus | 7.1 |
| | | | | | | | | Cirro-stratus | 2.8 |
| | | | | | | | | Cumulo-stratus | 0.0 |
| | | | | | | | | Total | 100.0 |
| | | | | | | | | WINDS. | |
| | | | | | | | | Calms. | N. S. E. W. |
| | | | | | | | | Per cent .. | 25.5 1.0 5.5 5.0 21.0 |
| | | | | | | | | Force | 2.8 2.0 1.8 2.3 |
| | | | | | | | | N. E. N. W. S. E. S. W. | |
| | | | | | | | | Per cent .. | 0.2 35.0 4.3 2.5 |
| | | | | | | | | Force | 1.0 1.8 1.9 2.1 |
| | | | | | | | | BAROMETER. | |
| | | | | | | | | Extreme range of abnormal waves: | |
| | | | | | | | | From 24.310 inches on June 27 (6 a. m.), 1873 | |
| | | | | | | | | To 23.763 inches on June 21 (9 p. m.), 1873 | |
| | | | | | | | | THERMOMETER. | |
| | | | | | | | | Extreme range of diurnal temperature: | |
| | | | | | | | | From 91° 8, at 11 a. m., on June 27, 1873, | |
| | | | | | | | | To 38° 9, at 4 a. m., on June 28, 1873. | |
| | | | | | | | | GREATEST DIFFERENCE BETWEEN WET AND DRY BULB THERMOMETERS. | |
| | | | | | | | | Date. | Hour. |
| | | | | | | | | Dry (Fah.). | Wet (Fah.). |
| | | | | | | | | Diff. (Fah.). | F. vapor. |
| | | | | | | | | Humidity (per M.). | |
| | | | | | | | | 1873. | |
| | | | | | | | | June 20 | 2 p. m. |
| | | | | | | | | 94.5 | 59.5 |
| | | | | | | | | 35.0 | .233 |
| | | | | | | | | .144 | |

* Maxima.

† Minima.

NOTE.—At 6 p. m., June 17, dry bulb 98.3, wet bulb 54.5. This reading must be erroneous; not used for "extreme range" nor for "greatest difference."

GENERAL REMARKS UPON METEOROLOGICAL PHENOMENA OBSERVED.

Rain, 1.39 to 1.57 p. m., June 6; same, 3.20 to 5.08 p. m., June 7; quantity about 0.20 inch; same (a few drops), at 1 p. m., June 11; same, 4.20 to 4.22 p. m., June 13; same, 8.55 to 9.05, June 14; same, 5.47 to 5.49 a. m., June 22; and from 7.15 to 7.35 a. m., same date.

Thunder-storm from 1.52 to 2.30 p. m., June 7.

SUMMARY OF HOURLY OBSERVATIONS AT LOS ANGELES, CALIFORNIA, FROM JUNE 11 TO JUNE 28, 1875.

Latitude, 34° 03'. Altitude above sea-level, 325 feet.

[Pl. 7, fig. 5; Pl. 11, fig. 27; Pl. 14, fig. 45; Pl. 17, fig. 62; Pl. 20, fig. 82.]

| Hour. | Barometer red. to level. | Temp. (Fah.). | Mean diff. wet and dry ther- mometers. | Force of vapor. | Relative humid- ity (per M.). | Winds, mean force (10 max.). | Clouds, amount (10 max.). | REMARKS. | | | | | | |
|-------------|-----------------------------|---------------|--|-----------------|----------------------------------|---------------------------------|------------------------------|--|--------------|-------------|-------------|---------------|-----------|--------------------|
| | | | | | | | | PROPORTION OF CLEAR AND CLOUDED SKY. | | | | | | |
| | | | | | | | | Clear | Per ct. 60.6 | | | | | |
| | | | | | | | | Nimbus | 26.0 | | | | | |
| | | | | | | | | Cumulus | 4.2 | | | | | |
| | | | | | | | | Cirrus | 2.4 | | | | | |
| | | | | | | | | Stratus | 1.3 | | | | | |
| | | | | | | | | Cirro-cumulus | 2.7 | | | | | |
| | | | | | | | | Cirro-stratus | 0.1 | | | | | |
| | | | | | | | | Cumulo-stratus | 0.8 | | | | | |
| | | | | | | | | Fog | 1.9 | | | | | |
| | | | | | | | | Total | 100.0 | | | | | |
| | | | | | | | | WINDS. | | | | | | |
| | | | | | | | | Calms. | N. | S. | E. | W. | | |
| | | | | | | | | Per cent.... | 44.4 | 1.4 | 6.5 | 0.5 | 30.10 | |
| | | | | | | | | Force | 2.0 | 2.0 | 1.0 | 2.4 | | |
| | | | | | | | | | N. E. | N. W. | S. E. | S. W. | | |
| | | | | | | | | Per cent.... | 2.3 | 2.8 | 0.9 | 10.2 | | |
| | | | | | | | | Force | 1.6 | 1.7 | 1.5 | 2.9 | | |
| | | | | | | | | BAROMETER. | | | | | | |
| | | | | | | | | Extreme range of abnormal waves: | | | | | | |
| | | | | | | | | From 29.797 inches on June 13 (12 m.), 1875. | | | | | | |
| | | | | | | | | To 29.541 inches on June 25 (9 p. m.), 1875. | | | | | | |
| | | | | | | | | THERMOMETER. | | | | | | |
| | | | | | | | | Extreme range of diurnal temperature: | | | | | | |
| | | | | | | | | From 45° 8, at 5 a. m., on June 17, 1875. | | | | | | |
| | | | | | | | | To 82° 1, at 1 p. m., on June 16, 1875. | | | | | | |
| | | | | | | | | GREATEST DIFFERENCE BETWEEN WET AND DRY BULB THERMOMETERS. | | | | | | |
| | | | | | | | | Date. | Hour. | Dry (Fah.). | Wet (Fah.). | Diff. (Fah.). | F. vapor. | Humidity (per M.). |
| | | | | | | | | 1875. | | | | | | |
| | | | | | | | | June 20 | 12 m. | 85.2 | 67.5 | 17.7 | .448 | .371 |
| Grand means | 29.674 | 63.9 | 4.8 | .439 | .744 | 1.28 | 3.97 | | | | | | | |

* Maxima.

† Minima.

HOURLY OBSERVATIONS.

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SUMMARY OF HOURLY OBSERVATIONS AT SANTA FE, NEW MEXICO, FROM JUNE 11 TO JUNE 20, 1873.

Latitude, 35° 41'. Altitude above sea-level, 7,044.2 feet.

[Pl. 7, fig. 6; Pl. 11, fig. 29; Pl. 14, fig. 47; Pl. 17, fig. 65; Pl. 20, fig. 81.]

| Hour. | Barometer red. to level. | Temp. (Fah.). | Mean diff. wet and dry ther- mometers. | Force of vapor. | Relative humid- ity (per M.). | Winds, mean force (10 max.). | Clouds, amount (10 max.). | REMARKS. | |
|-------------|-----------------------------|---------------|--|-----------------|----------------------------------|---------------------------------|------------------------------|--|-------------------|
| | | | | | | | | PROPORTION OF CLEAR AND CLOUDED SKY. | |
| | | | | | | | | Per ct. | |
| | | | | | | | | Clear | 64.2 |
| | | | | | | | | Nimbus | 3.7 |
| | | | | | | | | Cumulus | 8.8 |
| | | | | | | | | Cirrus | 1.3 |
| | | | | | | | | Stratus | 1.9 |
| | | | | | | | | Cirro-cumulus | 6.4 |
| | | | | | | | | Cirro-stratus | 5.3 |
| | | | | | | | | Cumulo-stratus | 8.4 |
| | | | | | | | | Total | 100.0 |
| | | | | | | | | WINDS. | |
| | | | | | | | | Calms. | N. S. E. W. |
| | | | | | | | | Per cent. | 11.3 27.3 3.3 8.0 |
| | | | | | | | | Force | 1.4 1.1 2.3 1.7 |
| | | | | | | | | N. E. N. W. S. E. S. W. | |
| | | | | | | | | Per cent. | 20.8 1.9 15.6 3.8 |
| | | | | | | | | Force | 1.4 1.5 1.8 1.5 |
| | | | | | | | | BAROMETER. | |
| | | | | | | | | Extreme range of abnormal waves: | |
| | | | | | | | | From 23.550 inches on June 12, 1873, | |
| | | | | | | | | To 23.288 inches on June 18, 1873. | |
| | | | | | | | | THERMOMETER. | |
| | | | | | | | | Extreme range of diurnal temperature: | |
| | | | | | | | | From 49° 4, at 4 a. m., on June 15, 1873, | |
| | | | | | | | | To 96° 0, at 2 p. m., on June 15, 1873. | |
| | | | | | | | | GREATEST DIFFERENCE BETWEEN WET AND DRY BULB THERMOMETERS. | |
| | | | | | | | | Date. | Hour. |
| | | | | | | | | Dry (Fah.). | Wet (Fah.). |
| | | | | | | | | Diff. (Fah.). | F. vapor. |
| | | | | | | | | Humidity (per M.) | |
| | | | | | | | | 1873. | |
| | | | | | | | | June 18 | 4 p. m. |
| | | | | | | | | 98.3 | 64.5 |
| | | | | | | | | 33.8 | 299 |
| | | | | | | | | .164 | |
| Grand means | 23.361 | 70.1 | 14.1 | .308 | .449 | 1.4 | 3.5 | | |

* Maxima.

Minima.

SUMMARY OF HOURLY OBSERVATIONS AT COLORADO SPRINGS, COLORADO, FROM JULY 29
TO AUGUST 10, 1873.

Latitude, 38° 49'. Altitude above sea-level, 6,030.4 feet.

[Pl. 7, fig. 4; Pl. 11, fig. 30; Pl. 14, fig. 48; Pl. 17, fig. 61; Pl. 20, fig. 80.]

| Hour. | Barometer red. to level. | Temp. (Fah.). | Mean diff., wet and dry ther- mometers. | Force of vapor. | Relative humid- ity (per M.). | Winds, mean force (10 max.). | Clouds, amount (10 max.). | REMARKS. | |
|-------|-----------------------------|---------------|---|-----------------|----------------------------------|---------------------------------|------------------------------|--|----------------------|
| | | | | | | | | PROPORTION OF CLEAR AND CLOUDED SKY. | |
| | | | | | | | | Clear | Per ct. 41.10 |
| | | | | | | | | Nimbus | 10.20 |
| | | | | | | | | Cumulus | 2.60 |
| | | | | | | | | Cirrus | 3.30 |
| | | | | | | | | Stratus | 3.70 |
| | | | | | | | | Cirro-cumulus | 1.80 |
| | | | | | | | | Cirro-stratus | 9.90 |
| | | | | | | | | Cumulo-stratus | 30.20 |
| | | | | | | | | Total | 100.00 |
| | | | | | | | | WINDS. | |
| | | | | | | | | Calms. | N. S. E. W. |
| | | | | | | | | Per cent.... | 9.4 17.2 5.2 2.8 5.6 |
| | | | | | | | | Force | 1.61 1.80 1.87 2.25 |
| | | | | | | | | N. E. N. W. S. E. S. W. | |
| | | | | | | | | Per cent.... | 9.4 22.00 21.00 7.4 |
| | | | | | | | | Force | 1.89 1.71 1.67 1.43 |
| | | | | | | | | BAROMETER. | |
| | | | | | | | | Extreme range of abnormal waves: | |
| | | | | | | | | From 24.108 inches on July 30 (1 p. m.), 1873, | |
| | | | | | | | | To 24.387 inches on Aug. 2 (9 a. m.), 1873. | |
| | | | | | | | | THERMOMETER. | |
| | | | | | | | | Extreme range of diurnal temperature: | |
| | | | | | | | | From 91° 1, at 4 p. m., on July 31, 1873, | |
| | | | | | | | | To 50° 0, at 4 a. m., on Aug. 1, 1873. | |
| | | | | | | | | GREATEST DIFFERENCE BETWEEN WET AND DRY BULB THERMOMETERS. | |
| | | | | | | | | Date. | Hour. |
| | | | | | | | | Dry (Fah.). | Wet (Fah.). |
| | | | | | | | | Diff. (Fah.). | F. vapor. |
| | | | | | | | | Humidity (per M.). | |
| | | | | | | | | 1873. | |
| | | | | | | | | July 31 | 1 p. m. |
| | | | | | | | | Aug. 4 | 3 p. m. |
| | | | | | | | | Aug. 5 | 2 p. m. |
| | | | | | | | | 91.1 | 63.6 |
| | | | | | | | | 54.9 | 61.0 |
| | | | | | | | | 90.2 | 67.3 |
| | | | | | | | | 27.5 | 20.9 |
| | | | | | | | | .317 | |
| | | | | | | | | .217 | |

* Maxima.

† Minima.

HOURLY OBSERVATIONS.

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SUMMARY OF HOURLY OBSERVATIONS AT SALT LAKE CITY, UTAH, FROM JULY 13 TO AUGUST 1, 1872.

Latitude, 40° 47'. Altitude above sea-level, 4,330.4 feet.

[Pl. 7, fig. 3; Pl. 11, fig. 28; Pl. 14, fig. 46; Pl. 17, fig. 64; Pl. 20, fig. 83.]

| Hour. | Barometer red. to level. | Temp. (Fah.). | Mean diff., wet and dry ther- mometers. | Force of vapor. | Relative humid- ity (per M.). | Winds, mean force (10 max.). | Clouds, amount (10 max.). | REMARKS. | |
|-------|-----------------------------|---------------|---|-----------------|----------------------------------|---------------------------------|------------------------------|--|------------------|
| | | | | | | | | PROPORTION OF CLEAR AND CLOUDED SKY. | |
| | | | | | | | | Clear | Per ct. |
| | | | | | | | | Nimbus | 77.1 |
| | | | | | | | | Cumulus | 3.3 |
| | | | | | | | | Cirrus | 9.3 |
| | | | | | | | | Stratus | 3.3 |
| | | | | | | | | Cirro-cumulus | 0.5 |
| | | | | | | | | Cirro-stratus | 3.4 |
| | | | | | | | | Cumulo-stratus | 0.1 |
| | | | | | | | | Total | 3.0 |
| | | | | | | | | | 100.0 |
| | | | | | | | | WINDS. | |
| | | | | | | | | Calms. | N. S. E. W. |
| | | | | | | | | Per cent. | 61.7 4.6 4.1 7.2 |
| | | | | | | | | Force | 2.2 1.4 1.3 |
| | | | | | | | | N. E. N. W. S. E. S. W. | |
| | | | | | | | | Per cent. | 4.1 8.7 5.9 3.7 |
| | | | | | | | | Force | 1.2 1.7 2.0 1.6 |
| | | | | | | | | BAROMETER. | |
| | | | | | | | | Extreme range of abnormal waves: | |
| | | | | | | | | From 25.953 inches on July 30 (9 a. m.), 1872, | |
| | | | | | | | | To 25.442 inches on July 28 (6 p. m.), 1872. | |
| | | | | | | | | THERMOMETER. | |
| | | | | | | | | Extreme range of diurnal temperature: | |
| | | | | | | | | From 87° 0, at 3 p. m., on July 30, 1872, | |
| | | | | | | | | To 44° 8, at 5 a. m., on July 30, 1872. | |
| | | | | | | | | GREATEST DIFFERENCE BETWEEN WET AND DRY BULB THERMOMETERS. | |
| | | | | | | | | Date. | Hour. |
| | | | | | | | | Dry (Fah.). | Wet (Fah.). |
| | | | | | | | | Diff. (Fah.). | F. vapor. |
| | | | | | | | | Humidity (per M.). | |
| | | | | | | | | 1872. | |
| | | | | | | | | July 19 | 1 p. m. |
| | | | | | | | | 99.0 | 63.7 |
| | | | | | | | | 35.3 | .281 |
| | | | | | | | | .151 | |

* Maxima.

† Minima.

GENERAL REMARKS UPON METEOROLOGICAL PHENOMENA OBSERVED.

Rain-fall, slight sprinkles between 1 and 5 a. m., July 14; from 9 to 9.30 a. m., 14th; at 9 p. m., 18th; and at 1 a. m., 19th. Thunder and lightning, 10 to 12 p. m., 23d; the same, with sprinkling of rain, at 11 a. m., 24th. Thunder to the north, from 11 to 12 a. m., 26th.

SUMMARY OF HOURLY OBSERVATIONS AT HUGHES, COLORADO, FROM JULY 12 TO JULY 23, 1873.

Latitude, 39° 59'. Altitude above sea-level, 5,021 feet.

[Pl. 8, fig. 7; Pl. 12, fig. 35; Pl. 15, fig. 53; Pl. 18, fig. 71; Pl. 21, fig. 87.]

| Hour. | Barometer red. to level. | Temp. (Fah.). | Mean diff., wet and dry ther- mometers. | Force of vapor. | Relative humid- ity (per M.). | Winds, mean force (10 max.). | Clouds, amount (10 max.). | REMARKS. |
|-------------|-----------------------------|---------------|---|-----------------|----------------------------------|---------------------------------|------------------------------|---|
| | | | | | | | | PROPORTION OF CLEAR AND CLOUDED SKY. |
| | | | | | | | | Clear Per ct. 64.1 |
| | | | | | | | | Nimbus 2.6 |
| | | | | | | | | Camulus 3.1 |
| | | | | | | | | Cirrus 0.0 |
| | | | | | | | | Stratus 13.3 |
| | | | | | | | | Cirro-cumulus 1.5 |
| | | | | | | | | Cirro-stratus 4.3 |
| | | | | | | | | Cumulo-stratus 11.2 |
| | | | | | | | | Total 100.0 |
| | | | | | | | | WINDS. |
| | | | | | | | | Calms. N. S. E. W. |
| | | | | | | | | Per cent.... 6.6 9.7 24.0 3.5 3.5 |
| | | | | | | | | Force 1.2 1.2 1.2 1.2 1.4 |
| | | | | | | | | N. E. N. W. S. E. S. W. |
| | | | | | | | | Per cent.... 9.7 7.3 20.1 15.6 |
| | | | | | | | | Force 1.3 1.6 1.2 1.3 |
| | | | | | | | | BAROMETER. |
| | | | | | | | | Extreme range of abnormal waves: |
| | | | | | | | | From 25.404 inches on July 18 (8 a. m.), 1873, |
| | | | | | | | | To 24.829 inches on July 12 (7 p. m.), 1873. |
| | | | | | | | | THERMOMETER. |
| | | | | | | | | Extreme range of diurnal temperature: |
| | | | | | | | | From 107° 1, at 1 p. m., on July 13, 1873, |
| | | | | | | | | To 52° 8, at 5 a. m., on July 14, 1873. |
| | | | | | | | | GREATEST DIFFERENCE BETWEEN WET AND DRY BULB THERMOMETERS. |
| | | | | | | | | Date Hour Dry (Fah.) Wet (Fah.) Diff. (Fah.) F. vapor. Humidity (per M.). |
| | | | | | | | | 1873. July 15 3 p. m. 108.3 62.1 46.2 * 233 * 083 |
| Grand means | 25.094 | 76.8 | 17.1 | .333 | .411 | 1.2 | 3.6 | * Approximate. |

* Maxima.

† Minima.

GENERAL REMARKS UPON METEOROLOGICAL PHENOMENA OBSERVED.

Thunder in the south at 12 m., July 12; same, in southeast, 2.30 p. m., July 22; same, in northwest, 3.25 p. m., July 23.

Thunder and lightning at 4.35 p. m., July 14; same, at 2.35 p. m., July 22; same, at 7 p. m., July 22.

Lightning to the north, 9 p. m., July 16; same, to the south, 10 p. m., July 17; same, to the south, 8 p. m., July 18; same, to the northwest, at 5 p. m., and to the southeast, at 5.20 and 9 p. m., July 23.

Rain, 7.30 to 7.40 p. m., July 14; same, 11.30 to 11.40 a. m., July 16; drizzling rain at 11 p. m., July 17; slight rain at 3.40 p. m., and from 7.30 to 7.40 p. m., July 21; intermittent rains, 3.40 to 7.40 p. m., July 22.

HOURLY OBSERVATIONS.

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SUMMARY OF HOURLY OBSERVATIONS AT CAMP INDEPENDENCE, CALIFORNIA, JULY 19 TO AUGUST 9, 1871.

Latitude, 36° 50'. Altitude above sea-level, 3,956 feet.

[Pl. 8, fig. 8; Pl. 12, fig. 34; Pl. 15, fig. 52; Pl. 18, fig. 72; Pl. 21, fig. 85.]

| Hour. | Barometer red. to level. | Temp. (Fah.). | Mean diff. wet and dry thermometers. | Force of vapor. | Relative humidity (per M.). | Winds, mean force (10 max.). | Clouds, amount (10 max.). | REMARKS. |
|-------|--------------------------|---------------|--------------------------------------|-----------------|-----------------------------|------------------------------|---------------------------|--|
| | | | | | | | | PROPORTION OF CLEAR AND CLOUDED SKY. |
| | | | | | | | | Per ct. |
| | | | | | | | | Clear |
| | | | | | | | | Nimbus |
| | | | | | | | | Cumulus |
| | | | | | | | | Cirrus |
| | | | | | | | | Stratus |
| | | | | | | | | Cirro-cumulus |
| | | | | | | | | Cirro-stratus |
| | | | | | | | | Cumulo-stratus |
| | | | | | | | | Total |
| | | | | | | | | WINDS. |
| | | | | | | | | Calms. N. S. E. W. |
| | | | | | | | | Per cent. |
| | | | | | | | | Force |
| | | | | | | | | N. E. N. W. S. E. S. W. |
| | | | | | | | | Per cent. |
| | | | | | | | | Force |
| | | | | | | | | BAROMETER. |
| | | | | | | | | Extreme range of abnormal waves: |
| | | | | | | | | From 26.126 inches on July 23 (8 a. m.), 1871, |
| | | | | | | | | To 25.684 inches on July 27 (5 p. m.), 1871. |
| | | | | | | | | THERMOMETER. |
| | | | | | | | | Extreme range of diurnal temperature: |
| | | | | | | | | From 94° 5. at 2 p. m., on July 25, 1871, |
| | | | | | | | | To 52° 0. at 5 a. m., on July 26, 1871. |
| | | | | | | | | GREATEST DIFFERENCE BETWEEN WET AND DRY BULB THERMOMETERS. |
| | | | | | | | | Date. Hour. Dry (Fah.). Wet (Fah.). Diff. (Fah.). F. vapor. Humidity (per M.). |
| | | | | | | | | 1871. July 27 12 m. 87.6 55.8 31.8 .207 .159 |

* Maxima.

† Minima.

SUMMARY OF HOURLY OBSERVATIONS AT BEAVER, UTAH, FROM AUGUST 8 TO AUGUST 25, 1872.

Latitude, 38° 16'. Altitude above sea-level, 5,915.6 feet.

[Pl. 8, fig. 9; Pl. 12, fig. 31; Pl. 15, fig. 49; Pl. 13, fig. 67; Pl. 21, fig. 86.]

| Hour. | Barometer red. to level. | Temp. (Fah.). | Mean diff. wet and dry ther- mometers. | Force of vapor. | Relative humid- ity (per M.). | Winds, mean force (10 max.). | Clouds, amount (10 max.). | REMARKS. |
|-------------|-----------------------------|---------------|--|-----------------|----------------------------------|---------------------------------|------------------------------|--|
| | | | | | | | | PROPORTION OF CLEAR AND CLOUDED SKY. |
| | | | | | | | | Per ct. |
| | | | | | | | | Clear |
| | | | | | | | | Nimbus |
| | | | | | | | | Cumulus |
| | | | | | | | | Cirrus |
| | | | | | | | | Stratus |
| | | | | | | | | Cirro-cumulus |
| | | | | | | | | Cirro-stratus |
| | | | | | | | | Cumulo-stratus |
| | | | | | | | | Total |
| | | | | | | | | 100.00 |
| | | | | | | | | WINDS. |
| | | | | | | | | Calms. N. S. E. W. |
| | | | | | | | | Per cent... 40.68 3.02 7.84 0.24 2.70 |
| | | | | | | | | Force |
| | | | | | | | | 1.31 1.53 1.00 1.73 |
| | | | | | | | | N. E. N. W. S. E. S. W. |
| | | | | | | | | Per cent... 1.72 3.68 10.78 28.43 |
| | | | | | | | | Force |
| | | | | | | | | 1.14 1.40 1.50 2.17 |
| | | | | | | | | BAROMETER. |
| | | | | | | | | Extreme range of abnormal waves: |
| | | | | | | | | From 24.140 inches on Aug. 18 (6 p. m.), 1872, |
| | | | | | | | | To 24.450 inches on Aug. 21 (9 a. m.), 1872. |
| | | | | | | | | THERMOMETER. |
| | | | | | | | | Extreme range of diurnal temperature: |
| | | | | | | | | From 42° 0, at 5 a. m., on Aug. 17, 1872, |
| | | | | | | | | To 87° 6, at 6 p. m., on Aug. 17, 1872. |
| | | | | | | | | GREATEST DIFFERENCE BETWEEN WET AND DRY BULB THERMOMETERS. |
| | | | | | | | | Date. Hour. Dry (Fah.). Wet (Fah.). Diff. (Fah.). F. vapor. Humidity (per M.). |
| | | | | | | | | 1872 Aug. 4 3 p. m. 86.9 54.8 32.1 .197 .156 |
| Grand means | 24.288 | 69.5 | 17.8 | .235 | .343 | 1.00 | 2.6 | |

* Maxima.

† Minima.

HOURLY OBSERVATIONS.

539

SUMMARY OF HOURLY OBSERVATIONS AT LABRAN, COLORADO, FROM AUGUST 12 TO AUGUST 27, 1873.

Latitude, 38° 23'. Altitude above sea-level, 5,217.8 feet.

[Pl. 8, fig. 10; Pl. 12, fig. 32; Pl. 15, fig. 50; Pl. 18, fig. 69; Pl. 21, fig. 90.]

| Hour. | Barometer red. to level. | Temp. (Fah.). | Mean diff., wet and dry ther- mometers. | Force of vapor. | Relative humid- ity (per M.). | Winds, mean force (10 max.). | Clouds, amount (10 max.). | REMARKS. |
|-------------|-----------------------------|---------------|---|-----------------|----------------------------------|---------------------------------|------------------------------|--|
| | | | | | | | | PROPORTION OF CLEAR AND CLOUDED SKY. |
| | | | | | | | | Per ct. |
| | | | | | | | | Clear |
| | | | | | | | | Nimbus |
| | | | | | | | | Cumulus |
| | | | | | | | | Cirrus |
| | | | | | | | | Stratus |
| | | | | | | | | Cirro-cumulus |
| | | | | | | | | Cirro-stratus |
| | | | | | | | | Cumulo-stratus |
| | | | | | | | | Nimbus-cumulo-stratus |
| | | | | | | | | Total |
| | | | | | | | | WINDS. |
| | | | | | | | | Calms. N. S. E. W. |
| | | | | | | | | Per cent. |
| | | | | | | | | Force |
| | | | | | | | | N. E. N. W. S. E. S. W. |
| | | | | | | | | Per cent. |
| | | | | | | | | Force |
| | | | | | | | | BAROMETER. |
| | | | | | | | | Extreme range of abnormal waves: |
| | | | | | | | | From 25.137 inches on Aug. 15 (11 a. m.), 1873, |
| | | | | | | | | To 24.739 inches on Aug. 22 (5 p. m.), 1873. |
| | | | | | | | | THERMOMETER. |
| | | | | | | | | Extreme range of diurnal temperature: |
| | | | | | | | | From 110° 6, at 12 m., on Aug. 27, 1873, |
| | | | | | | | | To 52° 2, at 4 a. m., on Aug. 27, 1873. |
| | | | | | | | | GREATEST DIFFERENCE BETWEEN WET AND DRY BULB THERMOMETERS. |
| | | | | | | | | Date. Hour. Dry (Fah.). Wet (Fah.). Diff. (Fah.). F. vapor. Humidity (per M.). |
| | | | | | | | | 1873. Aug. 14 1 p. m. 107.0 70.3 36.7 * 368 * 157 |
| | | | | | | | | * Approximate. |
| Grand means | 24.944 | 74.7 | 13.0 | .408 | .503 | 1.30 | 4.31 | |

* Maxima.

† Minima.

SUMMARY OF HOURLY OBSERVATIONS AT COTTONWOOD SPRINGS, NEVADA, FROM
AUGUST 31 TO SEPTEMBER 14, 1871.

Latitude, 36° 03'. Altitude above sea-level, 3,449 feet.

[Pl. 8, fig. 11; Pl. 12, fig. 36; Pl. 15, fig. 54; Pl. 18, fig. 68; Pl. 21, fig. 88.]

| Hour. | Barometer red. to level. | Temp. (Fah.). | Mean diff., wet and dry ther- mometers. | Force of vapor. | Relative humid- ity (per M.). | Winds, mean force (10 max.). | Clouds, amount (10 max.). | REMARKS. |
|--|-----------------------------|---------------|---|-----------------|----------------------------------|---------------------------------|------------------------------|--|
| PROPORTION OF CLEAR AND CLOUDED SKY. | | | | | | | | |
| | | | | | | | | Per ct. |
| Clear | | | | | | | | 90.6 |
| Nimbus | | | | | | | | 2.9 |
| Cumulus | | | | | | | | 3.8 |
| Cirrus | | | | | | | | 0.6 |
| Stratus | | | | | | | | 0.4 |
| Cirro-cumulus | | | | | | | | 0.9 |
| Cirro-stratus | | | | | | | | 0.8 |
| Cumulo-stratus | | | | | | | | 0.8 |
| Total | | | | | | | | 100.0 |
| WINDS. | | | | | | | | |
| | | | | | | | | Calms. N. S. E. W. |
| Per cent .. | | | | | | | | 17.2 5.0 1.7 4.4 10.3 |
| Force | | | | | | | | 1.4 1.3 1.8 1.4 |
| | | | | | | | | N. E. N. W. S. E. S. W. |
| Per cent .. | | | | | | | | 11.7 23.9 22.8 3.0 |
| Force | | | | | | | | 1.5 1.1 1.5 1.4 |
| BAROMETER. | | | | | | | | |
| Extreme range of abnormal waves: | | | | | | | | |
| From 26.676 inches on Sept. 9 (9 a. m.), 1871, | | | | | | | | |
| To 26.243 inches on Sept. 7 (7 p. m.), 1871. | | | | | | | | |
| THERMOMETER. | | | | | | | | |
| Extreme range of diurnal temperature: | | | | | | | | |
| From 94° 0, at 4 p. m., on Sept. 12, 1871, | | | | | | | | |
| To 53° 0, at 5 a. m., on Sept. 12, 1871. | | | | | | | | |
| GREATEST DIFFERENCE BETWEEN WET AND DRY BULB THERMOMETERS. | | | | | | | | |
| | | | | | | | | Date. Hour. Dry (Fah.). Wet (Fah.). Diff. (Fah.). F. vapor. Humidity (per M.). |
| 1871. | | | | | | | | Sept. 1 2 p. m. 99.2 58.4 40.8 .208 .118 |
| Grand means | 26.468 | 77.9 | 22.8 | .241 | .264 | 1.1 | 1.0 | |

* Maxima.

† Minima.

HOURLY OBSERVATIONS.

541

SUMMARY OF HOURLY OBSERVATIONS AT BEAVER, UTAH, FROM AUGUST 30 TO SEPTEMBER 7, 1872.

Latitude, 38° 16'. Altitude above sea-level, 5,915.6 feet.

[Pl. 8, fig. 12; Pl. 12, fig. 33; Pl. 15, fig. 51; Pl. 18, fig. 70; Pl. 21, fig. 89.]

| Hour. | Barometer red. to level. | Temp. (Fah.). | Mean diff. wet and dry thermometers. | Force of vapor. | Relative humidity (per M.). | Winds, mean force (10 max.). | Clouds, amount (10 max.). | REMARKS. |
|-------|--------------------------|---------------|--------------------------------------|-----------------|-----------------------------|------------------------------|---------------------------|--|
| | | | | | | | | PROPORTION OF CLEAR AND CLOUDED SKY. |
| | | | | | | | | Per ct. |
| | | | | | | | | Clear |
| | | | | | | | | Nimbus |
| | | | | | | | | Cumulus |
| | | | | | | | | Cirrus |
| | | | | | | | | Stratus |
| | | | | | | | | Cirro-cumulus |
| | | | | | | | | Cirro-stratus |
| | | | | | | | | Cumulo-stratus |
| | | | | | | | | Total |
| | | | | | | | | WINDS. |
| | | | | | | | | Calms. N. S. E. W. |
| | | | | | | | | Per cent .. |
| | | | | | | | | Force |
| | | | | | | | | N. E. N. W. S. E. S. W. |
| | | | | | | | | Per cent ... |
| | | | | | | | | Force |
| | | | | | | | | BAROMETER. |
| | | | | | | | | Extreme range of abnormal waves: |
| | | | | | | | | From 24.044 inches on Sept. 3 (3 p. m.), 1872, |
| | | | | | | | | To 24.367 inches on Sept. 7 (10 a. m.), 1872. |
| | | | | | | | | THERMOMETER. |
| | | | | | | | | Extreme range of diurnal temperature: |
| | | | | | | | | From 39° 5, at 5 a. m., on Sept. 7, 1872, |
| | | | | | | | | To 72° 9, at 4 p. m., on Sept. 7, 1872. |
| | | | | | | | | GREATEST DIFFERENCE BETWEEN WET AND DRY BULB THERMOMETERS. |
| | | | | | | | | Date. Hour. Dry (Fah.). Wet (Fah.). Diff. (Fah.). F. vapor. Humidity (per M.). |
| | | | | | | | | 1872. Sept. 5 2 p. m. 77.5 51.1 26.4 .186 .197 |

* Maxima.

† Minima.

SUMMARY OF HOURLY OBSERVATIONS AT TRINIDAD, COLORADO, FROM SEPTEMBER 4 TO SEPTEMBER 19, 1873.

Latitude, 37° 10. Altitude above sea-level, 5,989.9 feet.

[Pl. 9, fig. 13; Pl. 13, fig. 37; Pl. 16, fig. 55; Pl. 19, fig. 75; Pl. 22, fig. 92.]

| Hour. | Baromet. r. red. to level. | Temp. (Fah.). | Mean diff., wet and dry ther- mometers. | Force of vapor. | Relative humid- ity (per M.). | Winds, mean force (10 max.). | Clouds, amount (10 max.). | REMARKS. | | | | | | |
|--|-------------------------------|---------------|---|-----------------|----------------------------------|---------------------------------|------------------------------|--------------------------------------|---------|-------------|-------------|---------------|-----------|--------------------|
| | | | | | | | | PROPORTION OF CLEAR AND CLOUDED SKY. | | | | | | |
| | | | | | | | | Clear | Per ct. | | | | | |
| | | | | | | | | Nimbus | 55.1 | | | | | |
| | | | | | | | | Cumulus | 1.8 | | | | | |
| | | | | | | | | Cirrus | 3.6 | | | | | |
| | | | | | | | | Stratus | 0.4 | | | | | |
| | | | | | | | | Cirro-cumulus | 15.2 | | | | | |
| | | | | | | | | Cirro-stratus | 1.1 | | | | | |
| | | | | | | | | Cumulo-stratus | 8.1 | | | | | |
| | | | | | | | | | 14.7 | | | | | |
| | | | | | | | | Total | 100.0 | | | | | |
| WINDS. | | | | | | | | | | | | | | |
| | | | | | | | | Calms. | N. | S. | E. | W. | | |
| | | | | | | | | Per cent.... | 2.3 | 3.9 | 2.1 | 2.6 | 7.3 | |
| | | | | | | | | Force | 1.3 | 1.9 | 1.2 | 1.7 | | |
| | | | | | | | | N. E. | N. W. | S. E. | S. W. | | | |
| | | | | | | | | Per cent... | 16.7 | 4.7 | 7.0 | 53.4 | | |
| | | | | | | | | Force | 1.7 | 1.1 | 1.6 | 2.3 | | |
| BAROMETER. | | | | | | | | | | | | | | |
| Extreme range of abnormal waves : | | | | | | | | | | | | | | |
| From 24.542 inches on Sept. 7 (8 a. m.), 1873, | | | | | | | | | | | | | | |
| To 24.623 inches on Sept. 17 (4 p. m.), 1873. | | | | | | | | | | | | | | |
| THERMOMETER. | | | | | | | | | | | | | | |
| Extreme range of diurnal temperature : | | | | | | | | | | | | | | |
| From 94° 0, at 12 m., on Sept. 16, 1873, | | | | | | | | | | | | | | |
| To 48° 2, at 5 a. m., on Sept. 16, 1873. | | | | | | | | | | | | | | |
| GREATEST DIFFERENCE BETWEEN WET AND DRY BULB THERMOMETERS. | | | | | | | | | | | | | | |
| | | | | | | | | Date. | Hour. | Dry (Fah.). | Wet (Fah.). | Diff. (Fah.). | F. vapor. | Humidity (per M.). |
| | | | | | | | | 1873. | | ° | ° | ° | " | |
| | | | | | | | | Sept. 16 | 2 p. m. | 93.2 | 62.8 | 30.4 | .291 | .187 |
| Grand means | 24.256 | 65.3 | 11.7 | .288 | .489 | 1.9 | 4.5 | | | | | | | |
| * Maxima. | | | | | | | | | | † Minima. | | | | |

* Maxima.

† Minima.

GENERAL REMARKS UPON METEOROLOGICAL PHENOMENA OBSERVED.

Thunder and lightning, September 5, 2 p. m. to 1 a. m.; same, on 6th, 5 p. m.; same, 10th, 5 to 8 p. m.; same, on 13th, 1 to 9 p. m.

Rain, 2.10 to 2.55 p. m., September 5; same, 12 to 1.50 a. m., September 6; same, 2.45 to 5.20 p. m., September 6; same, 6.25 to 8.15 p. m., 6th; same (slight), 10 p. m., 6th, to 3.40 a. m., 7th; same, 5.40 p. m., 10th; same, 7 to 8 p. m., September 13.

Large circle around moon, 11 p. m., September 7; very plain and increasing in diameter at 3 a. m., September 8; clearing up from the east at 4 a. m., September 8.

Heavy dew at 4 a. m., September 9.

Rainbow in east, 5 p. m., September 11.

Sudden and violent squall of wind at 10.25 a. m., September 17, lasting 10 minutes.

HOURLY OBSERVATIONS.

543

SUMMARY OF HOURLY OBSERVATIONS AT CHEYENNE, WYOMING, FROM SEPTEMBER 15 TO OCTOBER 21, 1872.

Latitude, 41° 08'. Altitude above sea-level, 6,041 feet.

[Pl. 9, fig. 14; Pl. 13, fig. 38; Pl. 16, fig. 56; Pl. 19, fig. 73; Pl. 2, fig. 93.]

| Hour. | Barometer red. to level. | Temp. (Fah.). | Mean diff. wet and dry ther- mometers. | Force of vapor. | Relative humid- ity (per M.). | Winds, mean force (10 max.). | Clouds, amount (10 max.). | REMARKS. |
|-------------|-----------------------------|---------------|--|-----------------|----------------------------------|---------------------------------|------------------------------|--|
| | | | | | | | | PROPORTION OF CLEAR AND CLOUDED SKY. |
| | | | | | | | | Per ct. |
| | | | | | | | | Clear 74.5 |
| | | | | | | | | Nimbus 1.8 |
| | | | | | | | | Cumulus 3.9 |
| | | | | | | | | Cirrus 4.2 |
| | | | | | | | | Stratus 0.0 |
| | | | | | | | | Cirro-cumulus 7.2 |
| | | | | | | | | Cirro-stratus 2.1 |
| | | | | | | | | Cumulo-stratus 6.3 |
| | | | | | | | | Total 100.0 |
| | | | | | | | | WINDS. |
| | | | | | | | | Calms. N. S. E. W. |
| | | | | | | | | Per cent. 43.9 8.9 0.4 0.7 7.1 |
| | | | | | | | | Force 1.5 1.0 1.0 1.5 |
| | | | | | | | | N. E. N. W. S. E. S. W. |
| | | | | | | | | Per cent. 8.7 18.7 3.7 7.9 |
| | | | | | | | | Force 1.3 1.0 1.7 1.3 |
| | | | | | | | | BAROMETER. |
| | | | | | | | | Extreme range of abnormal waves: |
| | | | | | | | | From 23.761 inches on Sept. 23 (3 p. m.), 1872, |
| | | | | | | | | To 24.411 inches on Oct. 9 (8 p. m.), 1872. |
| | | | | | | | | THERMOMETER. |
| | | | | | | | | Extreme range of diurnal temperature: |
| | | | | | | | | From 20° 0, at 6 a. m., on Oct. 9, 1872, |
| | | | | | | | | To 76° 0, at 2 p. m., on Oct. 9, 1872. |
| | | | | | | | | GREATEST DIFFERENCE BETWEEN WET AND DRY BULB THERMOMETERS. |
| | | | | | | | | Date. Hour. Dry (Fah.). Wet (Fah.). Diff. (Fah.). F. vapor. Humidity (per M.). |
| | | | | | | | | 1872. ° ° ° " |
| | | | | | | | | Sept. 19 12 m. 85.0 58.0 27.0 .251 .208 |
| | | | | | | | | Oct. 14 2 p. m. 79.6 54.0 25.6 .216 .214 |
| | | | | | | | | Oct. 15 4 p. m. 69.9 44.3 25.6 .132 .181 |
| Grand means | 24.101 | 51.1 | 9.9 | .182 | .502 | 0.8 | 2.5 | |

* Maxima.

† Minima.

SUMMARY OF HOURLY OBSERVATIONS AT POCHE, NEVADA, FROM SEPTEMBER 27 TO OCTOBER 14, 1872.

Latitude, 37° 55'. Altitude above sea-level, 5,942.3 feet.

[Pl. 9, fig. 15; Pl. 13, fig. 41; Pl. 16, fig. 59; Pl. 19, fig. 73; Pl. 22, fig. 91.]

| Hour. | Barometer red. to level. | Temp. (Fah.). | Mean diff. wet and dry ther- mometers. | Force of vapor. | Relative humid- ity (per M.). | Winds, mean force (10 max.). | Clouds, amount (10 max.). | REMARKS. |
|--|-----------------------------|---------------|--|-----------------|----------------------------------|---------------------------------|------------------------------|--|
| PROPORTION OF CLEAR AND CLOUDED SKY. | | | | | | | | |
| | | | | | | | | Per ct. |
| Clear | | | | | | | | 86.9 |
| Nimbus | | | | | | | | 2.0 |
| Cumulus | | | | | | | | 3.0 |
| Cirrus | | | | | | | | 6.1 |
| Stratus | | | | | | | | 0.0 |
| Cirro-cumulus | | | | | | | | 1.3 |
| Cirro-stratus | | | | | | | | 0.5 |
| Cumulo-stratus | | | | | | | | 0.2 |
| Total | | | | | | | | 100.00 |
| WINDS. | | | | | | | | |
| | | | | | | | | Calms. N. S. E. W. |
| Per cent.... | | | | | | | | 16.2 4.4 2.5 0.7 4.9 |
| Force | | | | | | | | 1.0 1.1 1.0 0.9 |
| | | | | | | | | N. E. N. W. S. E. S. W. |
| Per cent.... | | | | | | | | 5.6 44.6 16.7 4.4 |
| Force | | | | | | | | 1.0 1.3 1.6 1.1 |
| BAROMETER. | | | | | | | | |
| Extreme range of abnormal waves: | | | | | | | | |
| From 24.376 inches on Sept. 29, (8 a. m.), 1872, | | | | | | | | |
| To 24.663 inches on Oct. 3 (10 p. m.), 1872. | | | | | | | | |
| THERMOMETER. | | | | | | | | |
| Extreme range of diurnal temperature: | | | | | | | | |
| From 40° 5, at 3 a. m., on Oct. 5, 1872, | | | | | | | | |
| To 72° 4, at 3 p. m., on Oct. 5, 1872. | | | | | | | | |
| GREATEST DIFFERENCE BETWEEN WET AND DRY BULB THERMOMETERS. | | | | | | | | |
| | | | | | | | | Date. Hour. Dry (Fah.). Wet (Fah.). Diff. (Fah.). F. vapor. Humidity (per M.). |
| 1872. Oct. 3 3 p. m. 81.7 50.6 31.1 .165 .152 | | | | | | | | |
| 7 a. m. | -.022 | + 7.1 | + 4.2 | +.005 | -.057 | 1.5 | 1.2 | |
| 8 a. m. | -.025 | + 3.3 | + 3.1 | -.011 | -.050 | 1.4 | 1.3 | |
| 9 a. m. | -.028* | - 1.7 | + 0.3 | -.017 | -.010 | 0.9 | 1.6 | |
| 10 a. m. | -.025 | - 6.4 | - 2.3 | -.025 | +.021 | 0.6 | 1.6 | |
| 11 a. m. | -.020 | - 8.7 | - 3.5 | -.030 | +.032 | 0.9 | 1.8 | |
| 12 a. m. | -.009 | -10.7 | - 5.3 | -.025 | +.053 | 1.0 | 2.3 | |
| 1 p. m. | +.004 | -11.3* | - 5.6 | -.027 | +.054 | 0.9 | 2.6 | |
| 2 p. m. | +.019 | -13.2 | - 6.8 | -.028 | +.065 | 1.1 | 2.8 | |
| 3 p. m. | +.025 | -12.1 | - 6.3 | -.025 | +.062 | 1.2 | 2.1 | |
| 4 p. m. | +.029 | -10.9 | - 5.8 | -.021 | +.059 | 1.2 | 2.3 | |
| 5 p. m. | +.029† | - 4.5 | - 2.8 | -.002 | +.037 | 1.1 | 2.3 | |
| 6 p. m. | +.026 | - 2.5 | - 1.9 | +.003 | +.030 | 1.2 | 2.2 | |
| 7 p. m. | +.019 | - 0.5 | - 1.0 | +.007 | +.021 | 1.2 | 2.0 | |
| 8 p. m. | +.011 | + 0.7 | - 0.8 | +.014 | +.014 | 1.1 | 1.7 | |
| 9 p. m. | +.003 | + 2.5 | + 0.3 | +.015 | +.010 | 1.2 | 1.5 | |
| 10 p. m. | -.003 | + 3.3 | + 1.3 | +.010 | -.008 | 0.9 | 1.4 | |
| 11 p. m. | -.006* | + 5.4 | + 2.3 | +.014 | -.019 | 0.9 | 0.8 | |
| 12 p. m. | -.006 | + 7.4 | + 3.5 | +.016 | -.036 | 1.1 | 0.8 | |
| 1 a. m. | -.003 | + 8.0 | + 3.9 | +.015 | -.043 | 1.2 | 0.6 | |
| 2 a. m. | -.002 | + 9.0 | + 4.5 | +.016 | -.052 | 1.5 | 0.3 | |
| 3 a. m. | +.002 | + 9.4 | + 4.5 | +.020 | -.049 | 1.5 | 0.5 | |
| 4 a. m. | -.001† | + 9.9 | + 4.4 | +.024 | -.043 | 1.3 | 0.5 | |
| 5 a. m. | -.005 | +10.2† | + 4.2 | +.029 | -.036 | 1.4 | 0.6 | |
| 6 a. m. | -.021 | + 9.3 | + 4.7 | +.016 | -.055 | 1.4 | 1.0 | |
| Grand means | 24.233 | 62.7 | 19.5 | .145 | .259 | 1.2 | 1.5 | |

* Maxima.

† Minima.

GENERAL REMARKS UPON METEOROLOGICAL PHENOMENA OBSERVED.

Rain, with thunder and lightning, at 9 p. m., September 26; same, 6.15, p. m., October 1; same, from 6 to 7 p. m., October 1; ceased at 12.30 p. m.; in all, ".5.

Metcors, numerous.

HOURLY OBSERVATIONS.

545

SUMMARY OF HOURLY OBSERVATIONS AT OGDEN, UTAH, FROM SEPTEMBER 26 TO OCTOBER 3, 1873.

Latitude, 41° 13'. Altitude above sea-level, 4,374 feet.

[Pl. 9, fig. 16; Pl. 13, fig. 39; Pl. 16, fig. 57; Pl. 19, fig. 77; Pl. 22, fig. 96.]

| Hour. | Barometer red. to level. | Temp. (Fah.). | Mean diff., wet and dry thermometers. | Force of vapor. | Relative humidity (per M.). | Winds, mean force (10 max.). | Clouds, amount (10 max.). | REMARKS. |
|-------|--------------------------|---------------|---------------------------------------|-----------------|-----------------------------|------------------------------|---------------------------|--|
| | | | | | | | | PROPORTION OF CLEAR AND CLOUDED SKY. |
| | | | | | | | | Per ct. |
| | | | | | | | | Clear |
| | | | | | | | | Nimbus |
| | | | | | | | | Cumulus |
| | | | | | | | | Cirrus |
| | | | | | | | | Stratus |
| | | | | | | | | Cirro-cumulus |
| | | | | | | | | Cirro-stratus |
| | | | | | | | | Cumulo-stratus |
| | | | | | | | | Total |
| | | | | | | | | WINDS. |
| | | | | | | | | Calms. N. S. E. W. |
| | | | | | | | | Per cent. ... |
| | | | | | | | | Force |
| | | | | | | | | N. E. N. W. S. E. S. W. |
| | | | | | | | | Per cent. ... |
| | | | | | | | | Force |
| | | | | | | | | BAROMETER. |
| | | | | | | | | Extreme range of abnormal waves: |
| | | | | | | | | From 25.788 inches on Sept. 29 (10 a. m.), 1873, |
| | | | | | | | | To 25.169 inches on Sept. 26 (7 p. m.), 1873. |
| | | | | | | | | THERMOMETER. |
| | | | | | | | | Extreme range of diurnal temperature: |
| | | | | | | | | From 31° 6, at 3 a. m., on Sept. 30, 1873, |
| | | | | | | | | To 79° 4, at 1 p. m., on Sept. 30, 1873. |
| | | | | | | | | GREATEST DIFFERENCE BETWEEN WET AND DRY BULB THERMOMETERS. |
| | | | | | | | | Date. Hour. Dry (Fah.). Wet (Fah.). Diff. (Fah.). F. vapor. Humidity (per M.). |
| | | | | | | | | 1873. Oct. 2 3 p. m. 85.3 59.7 25.6 .277 .227 |

* Maxima.

† Minima.

SUMMARY OF HOURLY OBSERVATIONS AT TRUXTON SPRINGS, ARIZONA, FROM OCTOBER 23 TO OCTOBER 25, 1871.

Latitude 35° 25'. Altitude above sea-level, 3,885 feet.

[Pl. 9, fig. 17.]

| Hour. | Barometer red. to level. | Temp. (Fah.). | Mean diff., wet and dry ther- mometers. | Force of vapor. | Relative humid- ity (per M.). | Winds, mean force (10 max.). | Clouds, amount (10 max.). | REMARKS. |
|--|-----------------------------|---------------|---|-----------------|----------------------------------|---------------------------------|------------------------------|--|
| PROPORTION OF CLEAR AND CLOUDED SKY. | | | | | | | | |
| | | | | | | | | Per ct. |
| Clear | | | | | | | | 98.1 |
| Nimbus | | | | | | | | 0.0 |
| Cumulus | | | | | | | | 1.3 |
| Cirrus | | | | | | | | 0.4 |
| Stratus | | | | | | | | 0.0 |
| Cirro-cumulus | | | | | | | | 0.2 |
| Cirro-stratus | | | | | | | | 0.0 |
| Cumulo-stratus | | | | | | | | 0.0 |
| Total | | | | | | | | 100.0 |
| WINDS. | | | | | | | | |
| | | | | | | | | Calms. N. S. E. W. |
| Per cent. | | | | | | | | 31.25 27.08 8.33 2.09 |
| Force | | | | | | | | 1.4 1.0 1.0 0.0 |
| | | | | | | | | N. E. N. W. S. E. S. W. |
| Per cent. | | | | | | | | 6.25 14.53 4.16 6.26 |
| Force | | | | | | | | 1.0 1.0 1.1 1.3 |
| BAROMETER. | | | | | | | | |
| Extreme of abnormal waves: | | | | | | | | |
| From 26.102 inches on Oct. 23 (10 p. m.), 1871, | | | | | | | | |
| To 25.986 inches on Oct. 24 (2 p. m.), 1871. | | | | | | | | |
| THERMOMETER. | | | | | | | | |
| Extreme range of diurnal temperature: | | | | | | | | |
| From 80° 9, at 12 m., on Oct. 24, 1871, | | | | | | | | |
| To 41° 5, at 6 a. m., on Oct. 24, 1871. | | | | | | | | |
| GREATEST DIFFERENCE BETWEEN WET AND DRY BULB THERMOMETERS. | | | | | | | | |
| | | | | | | | | Date. Hour. Dry (Fah.). Wet (Fah.). Diff. (Fah.). F. vapor. Humidity (per M.). |
| 1871. Oct. 24 12 m. 80.9 59.8 21.1 .305 .290 | | | | | | | | |
| Grand means | 26.059 | 58.9 | 6.1 | .341 | .703 | 0.8 | 0.2 | |

* Maxima.

† Minima.

HOURLY OBSERVATIONS.

547

SUMMARY OF HOURLY OBSERVATIONS AT FORT FRED. STEELE, WYOMING, FROM OCTOBER 30 TO NOVEMBER 27, 1872.

Latitude, 41° 47'. Altitude above sea-level, 6,840 feet.

[Pl. 9, fig. 18; Pl. 13, fig. 42; Pl. 16, fig. 60; Pl. 19, fig. 76; Pl. 22, fig. 94.]

| Hour. | Barometer red. to level. | Temp. (Fah.). | Mean diff. wet and dry thermometers. | Force of vapor. | Relative humidity (per M.). | Winds, mean force (10 max.). | Clouds, amount (10 max.). | REMARKS. | |
|-------|--------------------------|---------------|--------------------------------------|-----------------|-----------------------------|------------------------------|---------------------------|--|-----------------------|
| | | | | | | | | PROPORTION OF CLEAR AND CLOUDED SKY. | |
| | | | | | | | | Clear | Per ct. 51.4 |
| | | | | | | | | Nimbus | 4.0 |
| | | | | | | | | Cumulus | 16.4 |
| | | | | | | | | Cirrus | 1.3 |
| | | | | | | | | Stratus | 0.2 |
| | | | | | | | | Cirro-cumulus | 22.9 |
| | | | | | | | | Cirro-stratus | 1.6 |
| | | | | | | | | Cumulo-stratus | 2.2 |
| | | | | | | | | Total | 100.0 |
| | | | | | | | | WINDS. | |
| | | | | | | | | Calms. | N. S. E. W. |
| | | | | | | | | Per cent..... | 24.1 0.4 0.5 0.0 30.4 |
| | | | | | | | | Force | 1.5 1.0 0.0 1.8 |
| | | | | | | | | N. E. N. W. S. E. S. W. | |
| | | | | | | | | Per cent..... | 0.10 1.22 0.0 43.40 |
| | | | | | | | | Force | 0 2.7 0 1.8 |
| | | | | | | | | BAROMETER. | |
| | | | | | | | | Extreme range of abnormal waves: | |
| | | | | | | | | From 24.065 inches on Nov. 12 (9 a. m.), 1872, | |
| | | | | | | | | To 23.156 inches on Nov. 14 (7 a. m.), 1872. | |
| | | | | | | | | THERMOMETER. | |
| | | | | | | | | Extreme range of diurnal temperature: | |
| | | | | | | | | From -10° 0, at 5 a. m., on Nov. 16, 1872, | |
| | | | | | | | | To 26° 4, at 2 p. m., on Nov. 16, 1872. | |
| | | | | | | | | GREATEST DIFFERENCE BETWEEN WET AND DRY BULB THERMOMETERS. | |
| | | | | | | | | Date. | Hour. |
| | | | | | | | | Dry (Fah.). | Wet (Fah.). |
| | | | | | | | | Diff. (Fah.). | F. vapor. |
| | | | | | | | | Humidity (per M.). | |
| | | | | | | | | 1873. | |
| | | | | | | | | Nov. 8 | 8 p. m. |
| | | | | | | | | 42.8 | 31.0 |
| | | | | | | | | 11.8 | .093 |
| | | | | | | | | .388 | |

* Maxima.

† Minima.

SUMMARY OF HOURLY OBSERVATIONS AT PRESCOTT, ARIZONA, FROM NOVEMBER 1 TO NOVEMBER 8, 1871.

Latitude, 34° 33'. Altitude above sea-level, 5,318 feet.

[Pl. 10, fig. 19; Pl. 13, fig. 40; Pl. 16, fig. 58; Pl. 19, fig. 74; Pl. 22, fig. 95.]

| Hour. | Barometer red. to level. | Temp. (Fah.). | Mean diff. wet and dry ther- mometers. | Force of vapor. | Relative humid- ity (per M.). | Winds, mean force (10 max.). | Clouds, amount (10 max.). | REMARKS. | |
|-------|-----------------------------|---------------|--|-----------------|----------------------------------|---------------------------------|------------------------------|--|-----------------------|
| | | | | | | | | PROPORTION OF CLEAR AND CLOUDED SKY. | |
| | | | | | | | | Clear | Per ct. 82.4 |
| | | | | | | | | Nimbus | 5.9 |
| | | | | | | | | Comulus | 3.4 |
| | | | | | | | | Cirrus | 4.9 |
| | | | | | | | | Stratus | 0.1 |
| | | | | | | | | Cirro-cumulus | 3.3 |
| | | | | | | | | Cirro-stratus | 0.0 |
| | | | | | | | | Cumulo-stratus | 0.0 |
| | | | | | | | | Total | 100.0 |
| | | | | | | | | WINDS. | |
| | | | | | | | | Calms. | N. S. E. W. |
| | | | | | | | | Per cent.... | 23.4 4.4 4.9 1.6 14.2 |
| | | | | | | | | Force | 1.3 1.3 1.0 1.6 |
| | | | | | | | | N. E. N. W. S. E. S. W. | |
| | | | | | | | | Per cent.... | 13.7 3.8 6.0 23.0 |
| | | | | | | | | Force | 1.4 1.7 1.0 1.6 |
| | | | | | | | | BAROMETER. | |
| | | | | | | | | Extreme range of abnormal waves: | |
| | | | | | | | | From 24.854 inches on Nov. 7 (12 p. m.), 1871, | |
| | | | | | | | | To 24.476 inches on Nov. 5 (1 p. m.), 1871. | |
| | | | | | | | | THERMOMETER. | |
| | | | | | | | | Extreme range of diurnal temperature: | |
| | | | | | | | | From 81° 2, at 1 p. m., on Nov. 2, 1871, | |
| | | | | | | | | To 29° 0, at 2 a. m., on Nov. 3, 1871. | |
| | | | | | | | | GREATEST DIFFERENCE BETWEEN WET AND DRY BULB THERMOMETERS. | |
| | | | | | | | | Date. | Hour. |
| | | | | | | | | Dry (Fah.). | Wet (Fah.). |
| | | | | | | | | Diff. (Fah.). | F. vapor. |
| | | | | | | | | Humidity (per M.). | |
| | | | | | | | | 1871. | |
| | | | | | | | | Nov. 2 | 1 p. m. |
| | | | | | | | | 81.2 | 58.8 |
| | | | | | | | | 27.4 | .206 |
| | | | | | | | | .194 | |

* Maxima.

† Minima.

HOURLY OBSERVATIONS.

549

SUMMARY OF HOURLY OBSERVATIONS AT GUNNISON, UTAH, FROM NOVEMBER 1 TO DECEMBER 1, 1872.

Latitude, 39° 10'. Altitude above sea-level, 5,145 feet.

[Pl. 10, fig. 20.]

| Hour. | Barometer red. to level. | Temp. (Fah.). | Mean diff., wet and dry ther- mometers. | Force of vapor. | Relative humid- ity (per M.). | Winds, mean- force (10 max.). | Clouds, amount (10 max.). | REMARKS. | | | | | |
|-------|-----------------------------|---------------|---|-----------------|----------------------------------|----------------------------------|------------------------------|--|---------|-------------|-------------|---------------|-----------|
| | | | | | | | | PROPORTION OF CLEAR AND CLOUDED SKY. | | | | | |
| | | | | | | | | Clear | Per ct. | 58.6 | | | |
| | | | | | | | | Nimbus | | 6.2 | | | |
| | | | | | | | | Cumulus | | 2.1 | | | |
| | | | | | | | | Cirrus | | 15.1 | | | |
| | | | | | | | | Stratus | | 1.0 | | | |
| | | | | | | | | Cirro-cumulus | | 2.4 | | | |
| | | | | | | | | Cirro-stratus | | 11.4 | | | |
| | | | | | | | | Cumulo-stratus | | 3.2 | | | |
| | | | | | | | | Total | | 100.0 | | | |
| | | | | | | | | WINDS. | | | | | |
| | | | | | | | | | Calms. | N. | S. | E. | W. |
| | | | | | | | | Per cent.... | 23.7 | 9.1 | 1.5 | 0.3 | 0.9 |
| | | | | | | | | Force | 1.4 | 1.0 | 1.0 | 1.0 | 1.0 |
| | | | | | | | | | N. E. | N. W. | S. E. | S. W. | |
| | | | | | | | | Per cent.... | 3.9 | 54.6 | 2.2 | 4.8 | |
| | | | | | | | | Force | 1.0 | 1.2 | 1.3 | 1.9 | |
| | | | | | | | | BAROMETER. | | | | | |
| | | | | | | | | Extreme range of abnormal waves: | | | | | |
| | | | | | | | | From 25.470 inches on Nov. 17 (12 p. m.), 1872, | | | | | |
| | | | | | | | | To 24.475 inches on Nov. 8 (11 p. m.), 1872. | | | | | |
| | | | | | | | | THERMOMETER. | | | | | |
| | | | | | | | | Extreme range of diurnal temperature: | | | | | |
| | | | | | | | | From 62° 9, at 2 p. m., on Nov. 2, 1872, | | | | | |
| | | | | | | | | To 17° 6, at 4 a. m., on Nov. 2, 1872. | | | | | |
| | | | | | | | | GREATEST DIFFERENCE BETWEEN WET AND DRY BULB THERMOMETERS. | | | | | |
| | | | | | | | | Date. | Hour. | Dry (Fah.). | Wet (Fah.). | Diff. (Fah.). | F. vapor. |
| | | | | | | | | Humidity (per M.). | | | | | |
| | | | | | | | | 1872. | | | | | |
| | | | | | | | | Nov. 23 | 3 p. m. | 60.0 | 41.5 | 18.5 | .136 |
| | | | | | | | | | | | | | |

* Maxima.

† Minima.

GENERAL REMARKS UPON METEOROLOGICAL PHENOMENA OBSERVED.

Rain began at 6 a. m., November 3; ceased 6.30 a. m.; a few drops at 1 p. m., same day. Light rain with strong gusts of wind at 11.40 p. m., November 11. Rain and snow at 1.30 a. m., November 12.

Snow, 6 a. m. to 2.30 p. m., November 13; same, 1.30 to 4.50 a. m.; and 7.30 to 9.30 a. m., November 15; same, 8.45 p. m. to 12.40 a. m., November 23.

Mock sun in cirro-stratus clouds at 4.15 p. m., November 7, lasting 20 minutes.

Circle around moon at 12 p. m., November 9.

SUMMARY OF HOURLY OBSERVATIONS AT LARAMIE, WYOMING, FROM DECEMBER 6 TO DECEMBER 20, 1872.

Latitude, 41° 19'. Altitude above sea-level, 7,123 feet.

[Pl. 10, fig. 21.]

| Hour. | Barometer red. to level. | Temp. (Fah.). | Mean diff., wet and dry ther- mometers. | Force of vapor. | Relative humid- ity (per M.). | Winds, mean force (10 max.). | Clouds, amount (10 max.). | REMARKS. | |
|-------------|-----------------------------|---------------|---|-----------------|----------------------------------|---------------------------------|------------------------------|--|-----------------------|
| | | | | | | | | PROPORTION OF CLEAR AND CLOUDED SKY. | |
| | | | | | | | | Per ct. | |
| | | | | | | | | Clear | 58.5 |
| | | | | | | | | Nimbus | 5.7 |
| | | | | | | | | Cumulus | 8.7 |
| | | | | | | | | Cirrus | 3.6 |
| | | | | | | | | Stratus | 0.3 |
| | | | | | | | | Cirro-cumulus | 12.8 |
| | | | | | | | | Cirro-stratus | 8.0 |
| | | | | | | | | Cumulo-stratus | 2.4 |
| | | | | | | | | Total | 100.0 |
| | | | | | | | | WINDS. | |
| | | | | | | | | Calms. | N. S. E. W. |
| | | | | | | | | Per cent..... | 62.8 3.3 0.8 0.0 14.7 |
| | | | | | | | | Force | 1.9 1.7 1.0 1.9 |
| | | | | | | | | N. E. N. W. S. E. S. W. | |
| | | | | | | | | Per cent..... | 0.0 5.0 0.6 12.8 |
| | | | | | | | | Force | 1.7 1.0 1.7 |
| | | | | | | | | BAROMETER. | |
| | | | | | | | | * Extreme range of abnormal waves: | |
| | | | | | | | | From 23.300 inches on Dec. 11 (11 a. m.), 1872 | |
| | | | | | | | | To 22.718 inches on Dec. 20 (5 a. m.), 1872. | |
| | | | | | | | | THERMOMETER. | |
| | | | | | | | | * Extreme range of diurnal temperature: | |
| | | | | | | | | From 63° 0, at 1 p. m., on Dec. 8, 1872, | |
| | | | | | | | | To 9° 1, at 7 a. m., on Dec. 8, 1872. | |
| | | | | | | | | GREATEST DIFFERENCE BETWEEN WET AND DRY BULB THERMOMETERS. | |
| | | | | | | | | Date. | Hour. |
| | | | | | | | | Dry (Fah.). | Wet (Fah.). |
| | | | | | | | | Diff. (Fah.). | F. vapor. |
| | | | | | | | | Humidity (per M.). | |
| | | | | | | | | 1872. | |
| | | | | | | | | Dec. 13 | 3 p. m. |
| | | | | | | | | 58.0 | 36.0 |
| | | | | | | | | 22.0 | .090 |
| | | | | | | | | .187 | |
| Grand means | 23.026 | 17.3 | 3.2 | .046 | .469 | 0.7 | 4.1 | | |

* Maxima.

† Minima.

GENERAL REMARKS UPON METEOROLOGICAL PHENOMENA OBSERVED.

Rain, 9.30 to 11.15 p. m., December 5; same, 6.10 to 7.10 p. m., December 10; same, 6 to 6.10 a. m., December 15; same, 7 to 9 p. m., December 18; same, 7 a. m., December 20.

Horary corrections, for reducing barometric readings to daily means.

| Station. | Georgetown, Colo. | Green River, Wyo. | Los Angeles, Cal. | Santa Fe, N. Mex. | Colorado Springs, Colo. | Salt Lake City, Utah. | Hughes, Colo. | Camp Independence, Cal. | Beaver, Utah. | Labrum, Colo. | Cottonwood Springs, Nev. | Beaver, Utah. | Trinidad, Colo. |
|--------------------|-------------------|-------------------|-------------------|-------------------|-------------------------|-----------------------|---------------|-------------------------|---------------|---------------|--------------------------|---------------|-----------------|
| Latitude | 39° 42' | 41° 31' | 34° 03' | 35° 41' | 38° 49' | 40° 47' | 39° 59' | 36° 50' | 38° 16' | 38° 23' | 36° 03' | 38° 16' | 37° 10' |
| Altitude (feet) .. | 8,587 | 6,006 | 325 | 7,044 | 6,030 | 4,339 | 5,021 | 3,956 | 5,915 | 5,217 | 3,449 | 5,915 | 5,939 |
| Month | June. | June. | June. | June. | July, Aug. | July. | July. | July. | Aug. | Sept. | Sept. | Sept. | Sept. |
| 7 a. m. | -.037 | -.028 | -.032 | -.026 | -.030 | -.031 | -.029 | -.039 | -.038 | -.031 | -.027 | -.026 | -.031 |
| 8 a. m. | .029 | .032 | .044 | .027 | .028 | .036 | .035 | .044 | .048 | .031 | .033 | .028 | .027 |
| 9 a. m. | .014 | .029 | .036 | .029 | .028 | .032 | .034 | .040 | .040 | .029 | .030 | .034 | .021 |
| 10 a. m. | .016 | .018 | .033 | .025 | .021 | .029 | .024 | .036 | .035 | .023 | .024 | .033 | .009 |
| 11 a. m. | .008 | -.007 | .022 | .020 | .013 | .022 | .015 | .027 | .023 | -.012 | .022 | .021 | -.002 |
| 12 m. | -.069 | +.008 | -.012 | -.006 | -.001 | .014 | -.007 | -.018 | -.008 | +.001 | -.013 | -.006 | +.010 |
| 1 p. m. | +.013 | .016 | +.005 | +.004 | +.014 | -.003 | +.017 | +.004 | +.005 | .017 | +.006 | +.007 | .023 |
| 2 p. m. | .023 | .029 | .004 | .018 | .034 | +.010 | .034 | .019 | .018 | .033 | .021 | .022 | .036 |
| 3 p. m. | .035 | .034 | .013 | .028 | .043 | .015 | .041 | .037 | .038 | .032 | .036 | .033 | .041 |
| 4 p. m. | .043 | .040 | .026 | .027 | .045 | .029 | .047 | .053 | .047 | .034 | .045 | .037 | .039 |
| 5 p. m. | .050 | .042 | .033 | .044 | .047 | .040 | .045 | .069 | .054 | .030 | .045 | .042 | .038 |
| 6 p. m. | .036 | .041 | .033 | .037 | .042 | .043 | .045 | .052 | .051 | .026 | .034 | .042 | .029 |
| 7 p. m. | .029 | .036 | .028 | .033 | .022 | .037 | .027 | .042 | .037 | +.014 | .028 | .030 | +.008 |
| 8 p. m. | .018 | +.017 | .019 | .025 | +.005 | .029 | +.006 | .029 | .025 | -.002 | .016 | .013 | -.008 |
| 9 p. m. | +.005 | -.010 | .010 | +.004 | -.006 | +.014 | -.006 | +.006 | .012 | .009 | +.008 | .008 | .016 |
| 10 p. m. | -.009 | .015 | .006 | -.006 | .017 | .010 | .009 | -.007 | .005 | .011 | -.005 | +.002 | .016 |
| 11 p. m. | .013 | .019 | .007 | .012 | .017 | .005 | .007 | .008 | +.001 | .012 | .014 | -.002 | .016 |
| 12 p. m. | .017 | .017 | .009 | .010 | .017 | .005 | .001 | .012 | -.005 | .009 | .018 | .009 | .012 |
| 1 a. m. | .016 | .017 | .006 | .008 | .014 | +.000 | .001 | .008 | .009 | .007 | .015 | .010 | .006 |
| 2 a. m. | .010 | .016 | .007 | .004 | .013 | -.004 | .004 | .006 | .011 | .007 | .010 | .010 | .004 |
| 3 a. m. | .012 | .010 | +.006 | .002 | .011 | .007 | .008 | .003 | .011 | .016 | -.008 | .008 | .006 |
| 4 a. m. | .023 | .006 | +.004 | .007 | .011 | .013 | .010 | .014 | .018 | .019 | +.004 | .008 | .008 |
| 5 a. m. | .029 | .014 | .012 | .020 | .013 | .022 | .024 | .022 | .027 | .029 | +.009 | .018 | .017 |
| 6 a. m. | -.028 | -.019 | -.017 | -.023 | -.023 | -.023 | -.029 | -.042 | -.032 | -.034 | -.017 | -.022 | -.026 |

Horary corrections, for reducing barometric readings to daily means—Continued.

| Station. | Cheyenne, Wyo. | Pioche, Nev. | Ogden, Utah. | Truxton Springs, Ariz. | Fort Fred Steele, Wyo. | Prescott, Ariz. | Gunnison, Utah. | Laramie, Wyo. | Camp Mohave, Ariz. | Pagosa, Colo. | Bozeman, Mont. | Virginia City, Nev. | Winnemucca, Nev. |
|-------------------|----------------|--------------|--------------|------------------------|------------------------|-----------------|-----------------|---------------|--------------------|---------------|----------------|---------------------|------------------|
| Latitude..... | 41° 08' | 37° 55' | 41° 13' | 35° 25' | 41° 47' | 34° 33' | 39° 10' | 41° 19' | 35° 02' | 37° 16' | 45° 41' | 39° 18' | 40° 58' |
| Altitude (feet).. | 6, 041 | 5, 942 | 4, 374 | 3, 885 | 6, 840 | 5, 318 | 5, 145 | 7, 123 | 755 | 7, 057 | 4, 839 | 6, 339 | 4, 355 |
| Month..... | Oct. | Oct. | Sept., Oct. | Oct. | Nov. | Nov. | Nov. | Dec. | Aug., Sept. | Sept. | Sept. | Aug. | July. |
| 7 a. m..... | -.014 | -.022 | -.031 | -.029 | -.022 | -.021 | -.023 | -.026 | -.067 | -.039 | -.017 | -.029 | -.045 |
| 8 a. m..... | .022 | .025 | .036 | .037 | .024 | .028 | .037 | .023 | .068 | .044 | .026 | .029 | .051 |
| 9 a. m..... | .029 | .028 | .040 | .023 | .022 | .030 | .041 | .021 | .071 | .035 | .036 | .029 | .047 |
| 10 a. m..... | .026 | .025 | .042 | .019 | .020 | .023 | .035 | .017 | .063 | .030 | .031 | .027 | .035 |
| 11 a. m..... | .018 | .020 | .034 | -.013 | -.014 | .015 | .029 | .011 | .048 | -.025 | .022 | .017 | .019 |
| 12 m..... | +.002 | -.009 | .023 | +.012 | +.005 | +.020 | -.008 | +.006 | .027 | +.003 | .013 | +.009 | +.012 |
| 1 p. m..... | +.014 | +.004 | +.019 | .033 | .017 | .029 | +.010 | .020 | .003 | .017 | -.000 | +.004 | +.004 |
| 2 p. m..... | .025 | .019 | +.001 | .036 | .034 | .041 | .023 | .035 | +.028 | .032 | +.013 | .017 | .019 |
| 3 p. m..... | .034 | .025 | .018 | .030 | .036 | .041 | .033 | .043 | .041 | .041 | .024 | .027 | .033 |
| 4 p. m..... | .036 | .029 | .025 | .024 | .035 | .035 | .043 | .035 | .075 | .043 | .034 | .033 | .043 |
| 5 p. m..... | .030 | .029 | .031 | .028 | .026 | .019 | .040 | .028 | .086 | .039 | .030 | .038 | .050 |
| 6 p. m..... | .026 | .026 | .032 | .019 | .014 | .009 | .037 | .025 | .084 | .030 | .028 | .033 | .052 |
| 7 p. m..... | .012 | .019 | .031 | .020 | .008 | +.001 | .033 | .014 | .077 | .013 | .023 | .023 | .044 |
| 8 p. m..... | +.000 | .011 | .028 | +.010 | +.003 | -.005 | .021 | .009 | .062 | .010 | .009 | .009 | .035 |
| 9 p. m..... | -.008 | +.003 | .020 | -.002 | -.003 | .010 | +.004 | +.008 | +.038 | +.001 | +.005 | .005 | .020 |
| 10 p. m..... | .014 | -.003 | .015 | .010 | .003 | .013 | -.002 | -.002 | ..... | ..... | ..... | +.003 | +.008 |
| 11 p. m..... | .014 | .006 | .014 | .009 | .004 | .015 | -.000 | .011 | ..... | ..... | ..... | -.001 | +.001 |
| 12 p. m..... | .007 | .006 | .005 | .008 | .006 | -.008 | +.003 | .017 | ..... | ..... | ..... | .002 | .004 |
| 1 a. m..... | -.005 | .003 | .005 | .010 | .005 | +.003 | +.005 | .016 | ..... | ..... | ..... | .000 | .008 |
| 2 a. m..... | +.002 | -.002 | .003 | .006 | .006 | .008 | -.003 | .015 | ..... | ..... | ..... | .003 | .002 |
| 3 a. m..... | .003 | +.002 | .001 | .008 | .008 | +.007 | .011 | .016 | ..... | ..... | ..... | .004 | .007 |
| 4 a. m..... | +.005 | -.001 | .005 | .007 | .012 | .011 | .014 | .011 | ..... | ..... | ..... | .007 | .016 |
| 5 a. m..... | -.007 | .005 | +.001 | -.014 | -.014 | -.018 | -.017 | -.012 | | | | .012 | .031 |
| 6 a. m..... | .017 | -.021 | -.008 | +.027 | +.017 | +.022 | +.020 | +.019 | | | | -.020 | -.042 |

HORARY CORRECTIONS.

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Horary table, for reducing observed temperature to daily mean.

| Station. | Georgetown, Colo. | Green River, Wyo. | Los Angeles, Cal. | Santa Fe, N. Mex. | Colorado Springs, Colo. | Salt Lake City, Utah. | Hughes, Colo. | Camp Independence, Cal. | Beaver, Utah. | LaBran, Colo. | Cottonwood Springs, Nev. |
|--------------------------|-------------------|-------------------|-------------------|-------------------|-------------------------|-----------------------|---------------|-------------------------|---------------|---------------|--------------------------|
| Latitude..... | 33° 42' | 41° 31' | 34° 03' | 35° 41' | 38° 49' | 40° 47' | 39° 59' | 36° 50' | 38° 16' | 38° 23' | 36° 03' |
| Altitude (feet) | 8,587 | 6,096 | 325 | 7,044 | 6,030 | 4,339 | 5,021 | 3,956 | 5,915 | 5,217 | 3,449 |
| Month..... | June. | June. | June. | June. | July, Aug. | July. | July. | July. | Aug. | Sept. | Sept. |
| 7 a. m. | +11.7 | +2.6 | +2.4 | -6.0 | +0.6 | -0.3 | +7.9 | +5.3 | +5.7 | +2.0 | +3.9 |
| 8 a. m. | +2.0 | -1.4 | -1.5 | 9.0 | -5.7 | 4.1 | -1.2 | +1.3 | +1.1 | -4.4 | -2.3 |
| 9 a. m. | -4.4 | 7.4 | 5.2 | 12.4 | 8.5 | 6.3 | 8.7 | -3.7 | -4.6 | 9.9 | 4.9 |
| 10 a. m. | 10.9 | 14.0 | 8.9 | 13.4 | 12.9 | 10.3 | 15.5 | 7.7 | 8.1 | 15.5 | 7.9 |
| 11 a. m. | 13.8 | 16.3 | 10.4 | 13.6 | 13.3 | 11.4 | 17.6 | 10.7 | 10.7 | 20.4 | 11.9 |
| 12 m. | 14.3 | 17.1 | 11.9 | 13.9 | 13.3 | 14.4 | 20.0 | 12.2 | 12.3 | 21.0 | 12.3 |
| 1 p. m. | 14.3 | 16.8 | 11.1 | 14.1 | 13.4 | 15.1 | 22.2 | 13.7 | 13.3 | 19.3 | 13.3 |
| 2 p. m. | 15.5 | 16.0 | 7.9 | 14.2 | 9.9 | 15.7 | 22.1 | 14.5 | 14.2 | 17.5 | 13.2 |
| 3 p. m. | 14.3 | 15.0 | 7.1 | 14.3 | 8.6 | 15.2 | 20.1 | 14.0 | 14.4 | 14.3 | 13.2 |
| 4 p. m. | 12.7 | 12.9 | 6.4 | 10.8 | 7.0 | 15.7 | 15.1 | 13.1 | 13.2 | 10.6 | 11.4 |
| 5 p. m. | 11.1 | 11.8 | 5.4 | 8.8 | 5.4 | 12.6 | 10.8 | 10.3 | 10.8 | 6.9 | 10.0 |
| 6 p. m. | 3.8 | 9.9 | -3.6 | -4.2 | -2.2 | -7.1 | 8.4 | -4.7 | 8.3 | -0.9 | -3.5 |
| 7 p. m. | -0.3 | +5.6 | +1.5 | +2.1 | +1.6 | +0.4 | -1.8 | +0.9 | -2.1 | +4.8 | +0.8 |
| 8 p. m. | +3.3 | +2.0 | 5.1 | 5.2 | 3.5 | 6.0 | +6.4 | 3.2 | +2.5 | 6.0 | 2.9 |
| 9 p. m. | 4.8 | 5.6 | 0.7 | 7.6 | 4.8 | 8.0 | 8.7 | 5.0 | 4.3 | 9.3 | 3.9 |
| 10 p. m. | 7.9 | 8.7 | 6.6 | 9.9 | 5.7 | 8.8 | 11.1 | 6.4 | 5.7 | 11.1 | 5.9 |
| 11 p. m. | 8.0 | 10.9 | 7.4 | 10.4 | 8.2 | 11.3 | 11.6 | 7.0 | 6.4 | 11.3 | 7.3 |
| 12 p. m. | 9.3 | 12.9 | 7.6 | 11.6 | 10.1 | 13.0 | 13.7 | 8.3 | 7.5 | 12.2 | 9.3 |
| 1 a. m. | 10.1 | 15.2 | 7.7 | 13.3 | 10.8 | 13.3 | 15.1 | 9.7 | 10.2 | 13.1 | 9.6 |
| 2 a. m. | 11.5 | 17.5 | 7.7 | 15.0 | 10.9 | 13.3 | 16.6 | 10.7 | 12.2 | 14.1 | 10.7 |
| 3 a. m. | 12.1 | 18.8 | 7.9 | 16.1 | 11.9 | 15.1 | 17.6 | 11.7 | 13.4 | 14.8 | 11.5 |
| 4 a. m. | 13.2 | 21.0 | 8.0 | 17.2 | 12.5 | 17.2 | 19.0 | 12.9 | 15.4 | 15.3 | 12.3 |
| 5 a. m. | 14.0 | 20.1 | 7.6 | 17.4 | 12.7 | 17.9 | 21.3 | 13.2 | 13.8 | 16.5 | 14.4 |
| 6 a. m. | +13.2 | +9.7 | +5.4 | +5.2 | +9.1 | +7.2 | +16.8 | +9.0 | +12.1 | +11.2 | +11.0 |
| Range of temperature ... | 20.5 | 38.1 | 19.9 | 31.7 | 26.1 | 33.6 | 43.5 | 27.7 | 29.8 | 37.5 | 27.7 |

Horary table, for reducing observed temperature to daily mean—Continued.

| Station. | Beaver, Utah. | Trinidad, Colo. | Cheyenne, Wyo. | Pioche, Nev. | Ogden, Utah. | Truxton Springs, Ariz. | Fort Steele, Wyo. | Prescott, Ariz. | Gunnison, Utah. | Laramie, Wyo. |
|--------------------------|---------------|-----------------|----------------|--------------|--------------|------------------------|-------------------|-----------------|-----------------|---------------|
| Latitude..... | 38° 16' | 37° 10' | 41° 08' | 37° 55' | 41° 13' | 35° 25' | 41° 47' | 34° 33' | 39° 10' | 41° 19' |
| Altitude (feet) | 5,915 | 5,980 | 6,041 | 5,942 | 4,374 | 3,885 | 6,840 | 5,318 | 5,145 | 7,123 |
| Month..... | Sept. | Sept. | Oct. | Oct. | Sept., Oct. | Oct. | Nov. | Nov. | Nov. | Dec. |
| 7 a. m. | + 4.2 | + 5.1 | +12.3 | + 7.1 | +15.4 | + 2.5 | + 4.5 | + 4.4 | +12.9 | + 7.9 |
| 8 a. m. | - 0.4 | - 2.2 | - 0.1 | + 3.3 | + 1.7 | - 5.5 | + 2.3 | - 6.9 | + 6.4 | + 4.4 |
| 9 a. m. | 3.8 | 7.5 | 8.8 | - 1.7 | - 6.1 | 10.0 | - 0.9 | 11.0 | - 1.9 | - 2.6 |
| 10 a. m. | 7.2 | 12.8 | 13.4 | 6.4 | 11.8 | 16.6 | 4.7 | 12.7 | 8.2 | 9.7 |
| 11 a. m. | 8.3 | 14.7 | 15.7 | 8.7 | 16.1 | 17.1 | 6.0 | 14.4 | 12.7 | 15.6 |
| 12 m. | 10.1 | 16.6 | 17.8 | 10.7 | 19.0 | 17.7 | 6.3 | 16.1 | 16.3 | 16.6 |
| 1 p. m. | 10.6 | 16.5 | 19.2 | 11.3 | 20.9 | 18.7 | 6.6 | 22.8 | 18.4 | 18.3 |
| 2 p. m. | 11.0 | 14.5 | 19.8 | 13.2 | 21.0 | 19.1 | 7.3 | 20.9 | 19.9 | 19.0 |
| 3 p. m. | 10.8 | 12.1 | 19.4 | 12.1 | 21.2 | 15.7 | 7.1 | 15.7 | 16.2 | 15.3 |
| 4 p. m. | 10.6 | 11.2 | 17.4 | 10.9 | 20.6 | 4.6 | 5.0 | 10.1 | 12.5 | 11.5 |
| 5 p. m. | 8.6 | 6.9 | 11.5 | 4.5 | 15.0 | 1.6 | 2.6 | - 3.4 | 8.9 | - 3.2 |
| 6 p. m. | 5.2 | - 1.0 | - 2.9 | 2.5 | - 6.8 | - 0.6 | - 1.0 | + 0.3 | 2.5 | + 1.0 |
| 7 p. m. | - 0.7 | + 1.9 | + 2.0 | - 0.5 | + 4.2 | + 0.9 | + 0.3 | 2.7 | 0.2 | 2.5 |
| 8 p. m. | + 1.1 | 4.5 | 3.1 | + 0.7 | 7.1 | 2.0 | 0.6 | 5.4 | 2.0 | 4.0 |
| 9 p. m. | 3.4 | 0.6 | 7.9 | 2.5 | 8.7 | 7.0 | 1.3 | 6.8 | 3.7 | 4.8 |
| 10 p. m. | 5.2 | 7.5 | 9.3 | 3.3 | 10.1 | 9.4 | 2.1 | 7.9 | 5.5 | 7.5 |
| 11 p. m. | 6.5 | 8.1 | 11.6 | 5.4 | 9.7 | 10.8 | 2.8 | 9.6 | 7.4 | 8.6 |
| 12 p. m. | 7.8 | 9.0 | 13.0 | 7.4 | 11.0 | 12.1 | 2.8 | 11.3 | 8.3 | 9.4 |
| 1 a. m. | 8.6 | 9.9 | 13.8 | 8.0 | 11.9 | 13.7 | 3.4 | 11.4 | 10.0 | 9.6 |
| 2 a. m. | 9.3 | 11.4 | 14.5 | 9.0 | 13.1 | 13.5 | 3.9 | 13.0 | 11.5 | 9.2 |
| 3 a. m. | 10.5 | 12.9 | 15.3 | 9.4 | 14.4 | 13.5 | 4.4 | 14.1 | 13.1 | 10.0 |
| 4 a. m. | 10.9 | 14.0 | 15.1 | 9.9 | 16.2 | 14.3 | 5.5 | 15.2 | 13.9 | 10.8 |
| 5 a. m. | 11.6 | 15.7 | 15.3 | 10.2 | 16.8 | 14.4 | 5.8 | 16.3 | 14.7 | 11.9 |
| 6 a. m. | + 9.8 | +12.5 | +15.0 | + 9.3 | 17.2 | +14.5 | + 6.7 | +13.4 | +13.9 | +11.2 |
| Range of temperature.... | 22.6 | 32.3 | 35.1 | 23.4 | 38.4 | 33.6 | 14.0 | 39.1 | 34.6 | 30.9 |

NOTE.—Take the difference between maximum and minimum for daily mean and select corresponding tables. If maximum is not observed, select highest observed temperature during March in connection with minimum. Difference for several camps will give a range which, with the month, will decide the tables to be used for all observation in vicinity.

TABLE OF ALTITUDES DETERMINED FROM SIMULTANEOUS CISTERN-BAROMETER OBSERVATIONS AT TWO OR MORE STATIONS.

NOTE.—This table contains only the altitudes of important peaks or points of local notoriety in the section embraced. Less than one-third of the altitudes determined by the cistern-barometer are included.

With the aneroid determinations the list of computed barometric altitudes will exceed eleven thousand in number. To render this data useful otherwise than in the delineation of the topography of the country on the atlas map of the survey, it is contemplated, as already set forth, to publish at intervals "Tables of positions, distances, and altitudes." These tables, with descriptive notes, it is hoped will prove of considerable practical advantage to the departments of the government operating in the more remote Western regions, to actual settlers, and to those who may hereafter occupy some portion of this territory.

Table of altitudes determined from simultaneous cistern-barometer observations at two or more stations.

| No. | Locality. | State or Territory. | Atlas-sheet. | Altitude above the sea (feet). |
|-----|--|---------------------|--------------|--------------------------------|
| 1 | Abiquiu | New Mexico | 69d | 5,930.1 |
| 2 | Abiquiu Peak | do. | 69d | 11,240.7 |
| 3 | Acoma | do. | 77d | 6,422.8 |
| 4 | Adobe Station | California | 73a | 282.2 |
| 5 | Agency Knob | Colorado | 61b | 12,273.5 |
| 6 | Agua Azul (northeast on Mesa) | New Mexico | 77d | 7,928.0 |
| 7 | Agua Azul, or Blue Water | do. | 77d | 6,682.8 |
| 8 | Agua Caliente | California | 80b | 3,618.6 |
| 9 | Agua Fria | New Mexico | 77a | 6,486.2 |
| 10 | Agua Negra | do. | 70e | 8,193.9 |
| 11 | Aguajes de Los Guajolotes | do. | 78a | 6,202.4 |
| 12 | Albuquerque | do. | 77b | 4,918.7 |
| 13 | Algodones | do. | 77b | 5,104.3 |
| 14 | Altar Peak | Colorado | 61c | 13,254.0 |
| 15 | Animas City, Old | do. | 61c | 6,662.3 |
| 16 | Antelope Ranch | California | 72b | 355.7 |
| 17 | Antelope Spring | Arizona | 75 | 8,065.1 |
| 18 | do. | Utah | 50 | 6,701.7 |
| 19 | Antelope Spring, Upper | do. | 50 | 7,143.7 |
| 20 | Antelope Spring | New Mexico | 77b | 6,290.7 |
| 21 | Anton Chico | do. | 78d | 5,381.5 |
| 22 | Antoro Peak | Colorado | 61c | 13,496.8 |
| 23 | Anvil Rock | Arizona | 75 | 5,354.1 |
| 24 | Apache Camp | do. | 83 | 5,000.9 |
| 25 | Arab Spring | California | 65 | 5,697.3 |
| 26 | Argentine Pass | Colorado | 52d | 13,286.1 |
| 27 | Arkansas Pass | do. | 52d | 11,445.3 |
| 28 | Austin | Nevada | 48d | 6,593.9 |
| 29 | Bacon Springs, main divide, northeast of | New Mexico | 77 | 8,814.9 |
| 30 | Bacon Springs | do. | 77d | 7,189.0 |
| 31 | Badito | Colorado | 62c | 6,386.5 |
| 32 | Bah-li-vah Spring | California | 65b | 6,284.1 |
| 33 | Bakersfield | do. | 73a | 465.3 |
| 34 | Baldy Peak (east of Fort Cameron) | Utah | 59 | 11,730.2 |
| 35 | Baldy (Elizabeth) Peak | New Mexico | 70a | 12,491.3 |
| 36 | Baldy (Santa Fé) Peak | do. | 69d | 12,661.2 |
| 37 | Banded Peak | do. | 69b | 12,824.4 |
| 38 | Bare Mountain | California | 65c | 6,038.9 |
| 39 | Bayard, Fort | New Mexico | 84 | 6,318.5 |
| 40 | Beaver | Utah | 59 | 5,915.7 |
| 41 | Bear Peak | New Mexico | 83 | 8,081.1 |
| 42 | Bear Creek Pass | Colorado | 61c | 11,605.7 |
| 43 | Belmont | Nevada | 57 | 8,091.9 |
| 44 | Belknap Peak | Utah | 59 | 11,894.3 |
| 45 | Bellevue Peak | Colorado | 61d | 12,673.1 |
| 46 | Bernalillo | New Mexico | 77b | 5,083.7 |
| 47 | Berry's Springs | Utah | 67 | 2,809.6 |
| 48 | Bernal Hill | New Mexico | 78d | 7,029.0 |
| 49 | Big Lake (San Luis Valley) | Colorado | 61d | 7,477.6 |
| 50 | Blanco and Largo Cañons, junction of | New Mexico | 69a | 5,738.2 |
| 51 | Blue Spring | Arizona | 76 | 7,795.8 |
| 52 | Blue Water Spring | New Mexico | 77 | 6,774.1 |
| 53 | Bold's Ranch | California | 80d | 141.2 |
| 54 | Boston Peak | do. | 73a | 6,519.3 |
| 55 | Boulder Peak | Colorado | 61d | 12,416.9 |
| 56 | Bower's Ranch | Arizona | 75 | 4,411.8 |
| 57 | Bowie, Camp | do. | 89 | 4,871.6 |
| 58 | Bozeman's Ranch | California | 73d | 3,157.2 |
| 59 | Bozeman | Montana | 23b | 4,838.6 |
| 60 | Breckenridge Mountain | California | 73a | 7,417.6 |
| 61 | Breckenridge Pass | Colorado | 52d | 11,503.3 |
| 62 | Brown's Peak | California | 65d | 5,392.3 |
| 63 | Buckhorn Ranch (or Warren's Station) | do. | 73c | 693.1 |

ALTITUDES.

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Table of altitudes—Continued.

| No. | Locality. | State or Territory. | Atlas-sheet. | Altitude above the sea (feet). |
|-----|--|---------------------|--------------|--------------------------------|
| 64 | Bueno Caballo | New Mexico | 77 | 6,947.6 |
| 65 | Buffalo Peak | Colorado | 52d | 3,328.6 |
| 66 | Bullion City | Nevada | 49 | 16,386.4 |
| 67 | Bull Run Mountain | do. | 40 | 9,040.7 |
| 68 | *Bennett's Wells, Death Valley | California | 65d | — 5.8 |
| 69 | Burguin, Camp | New Mexico | 69d | 7,277.4 |
| 70 | Butte Valley post-office | Colorado | 62c | 5,894.2 |
| 71 | Butte near Cubero | New Mexico | 77d | 6,820.2 |
| 72 | Cady, Camp | California | 73d | 1,893.8 |
| 73 | Cajon Pass Divide | do. | 73d | 4,195.4 |
| 74 | Caliente | do. | 73d | 1,314.1 |
| 75 | Caliente Springs | do. | 73a | 3,687.7 |
| 76 | Callville | Nevada | 66 | 944.6 |
| 77 | Camulos Ranch | California | 73c | 799.0 |
| 78 | Canby Peak | Colorado | 61c | 13,356.0 |
| 79 | Cañoncito | New Mexico | 77b | 7,023.0 |
| 80 | Cañon City | Colorado | 62a | 5,395.5 |
| 81 | Cañon Springs | Arizona | 83 | 5,497.7 |
| 82 | Cañon Spring | California | 81d | 1,238.5 |
| 83 | Cañon Station | do. | 65d | 2,650.0 |
| 84 | Carrizo Spring | New Mexico | 76 | 7,477.0 |
| 85 | Carrizo Peak | do. | 68b | 9,390.4 |
| 86 | Carlin | Nevada | 40 | 4,849.4 |
| 87 | Carr's Cabin, Antelope Park | Colorado | 61c | 9,988.7 |
| 88 | Carthage, on Owen's Lake | California | 65c | 3,589.0 |
| 89 | Cave Spring | Arizona | 76 | 6,031.2 |
| 90 | Cibola | New Mexico | 77a | 6,410.7 |
| 91 | Cement and Eureka Creeks, divide between | Colorado | 61c | 12,786.5 |
| 92 | Cerro Blanco | New Mexico | 62c | 14,269.0 |
| 93 | Cerro Gordo Landing, Colorado River | California | 65d | 3,656.1 |
| 94 | Cerro Gordo Pass | do. | 65b | 8,873.5 |
| 95 | Chamisal | New Mexico | 69d | 7,527.6 |
| 96 | Cheyenne | Wyoming | 44c | 6,041.0 |
| 97 | Chicoso | Colorado | 70a | 6,076.3 |
| 98 | Chloride | Arizona | 74b | 4,201.4 |
| 99 | Chuckawalla | California | 81d | 2,095.2 |
| 100 | Cienega de San Simon | Arizona | 89 | 3,854.8 |
| 101 | Cimmaron | New Mexico | 70a | 6,384.5 |
| 102 | Circleville | Utah | 59 | 5,624.8 |
| 103 | Ciruela | New Mexico | 70c | 6,743.9 |
| 104 | Clear Creek and Platte Divide | Colorado | 52d | 11,416.1 |
| 105 | Coal-mines near Cañon City | do. | 62a | 5,440.9 |
| 106 | Cochetopa, or Los Pinos Agency | do. | 61b | 9,088.0 |
| 107 | Cochetopa Pass | do. | 61b | 10,032.3 |
| 108 | Cochetopa and Saguache Divide, near head | do. | 61d | 11,234.3 |
| 109 | Colfax | do. | 62c | 8,599.4 |
| 110 | Colonas Ferry, Rio Grande | New Mexico | 69b | 7,442.7 |
| 111 | Colorado Creek and Rio Grande Junction | do. | 69b | 6,386.4 |
| 112 | Colorado Springs | Colorado | 62a | 6,009.7 |
| 113 | Conejos | do. | 69b | 7,434.9 |
| 114 | Conejos Peak | California | 73c | 2,564.9 |
| 115 | Conejos and San Juan, divide between | Colorado | 61d | 12,302.1 |
| 116 | Cooley's Ranch | Arizona | 83 | 5,366.8 |
| 117 | Coombs Station | California | 73d | 2,885.5 |
| 118 | Corinne (C. P. R. track by level) | Utah | 41 | 4,233.0 |
| 119 | Corrales | New Mexico | 77b | 5,090.9 |
| 120 | Costilla | Colorado | 69b | 7,750.7 |
| 121 | Costilla Peak | New Mexico | 70a | 12,615.3 |
| 122 | Cottage, Camp | Nevada | 40 | 6,437.2 |
| 123 | Cottonwood Spring | do. | 66 | 3,449.5 |
| 124 | Cottonwood Station | California | 73d | 2,487.8 |
| 125 | Cow Spring | do. | 65 | 3,875.5 |

* Below the level of the sea.

Table of altitudes—Continued.

| No. | Locality. | State or Territory. | Atlas-sheet. | Altitude above the sea (feet). |
|-----|---|---------------------|--------------|--------------------------------|
| 126 | Cow Spring | New Mexico | 84 | 4,954.1 |
| 127 | Coyote Spring | Nevada | 58 | 3,674.4 |
| 128 | do | New Mexico | 76 | 7,201.8 |
| 129 | Coyote Water-holes | do | 84 | 6,774.8 |
| 130 | Craig, Fort | do | 84 | 4,619.0 |
| 131 | Cross Spring | do | 77d | 6,264.6 |
| 132 | Crossman's Spring | Nevada | 74a | 4,390.7 |
| 133 | Crystal Spring | do | 66 | 5,782.0 |
| 134 | Cubero | New Mexico | 77a | 6,121.9 |
| 135 | Cucamonga | California | 73d | 1,327.8 |
| 136 | Cucamonga Peak | do | 73d | 8,529.4 |
| 137 | Cucharas Pass | Colorado | 70d | 9,994.2 |
| 138 | Cucharas and Trinchera, divide between | do | 62c | 10,955.2 |
| 139 | Cuchillo | New Mexico | 77b | 5,195.4 |
| 140 | Cuddy's Ranch | California | 73c | 5,277.9 |
| 141 | Cuerno Verde Peak | Colorado | 62c | 12,340.6 |
| 142 | Culebra Church | do | 69b | 8,009.7 |
| 143 | Culebra Peak | New Mexico | 70a | 14,049.3 |
| 144 | Cummings, Fort | do | 84 | 4,777.7 |
| 145 | Current Creek Pass | Colorado | 61b | 9,653.6 |
| 146 | Dawe's Ranch | California | 73a | 451.1 |
| 147 | Darwin Cañon | do | 65d | 3,143.1 |
| 148 | Dayton | Colorado | 52d | 9,333.3 |
| 149 | Death Valley, barometer-station I | California | 65d | *— 69.2 |
| 150 | Death Valley, barometer-station II | do | 65d | + 57.1 |
| 151 | Death Valley, barometer-station III | do | 65d | + 7.3 |
| 152 | Death Valley, barometer-station IV | do | 65d | — 45.3 |
| 153 | Death Valley, barometer-station V | do | 65d | — 62.4 |
| 154 | Death Valley, barometer-station VI | do | 65d | —110.0 |
| 155 | Death Valley, barometer-station VII | do | 65d | — 63.9 |
| 156 | Del Norte | Colorado | 61d | 7,742.7 |
| 157 | Deep Spring | California | 65a | 4,957.1 |
| 158 | Deer Spring | Arizona | 76 | 5,981.9 |
| 159 | Defiance, Fort | New Mexico | 68 | 7,041.7 |
| 160 | Del Norte Knob | Colorado | 61d | 8,218.3 |
| 161 | Del Norte Peak | do | 61d | 13,084.1 |
| 162 | Denver (K. P. R. R. track by level) | do | 53c | 5,196.6 |
| 163 | Deseret City | Utah | 50 | 4,642.2 |
| 164 | Desert Spring | do | 58 | 5,886.8 |
| 165 | Desert Tanks | Arizona | 76 | 5,192.1 |
| 166 | Desert Wells | do | 82 | 2,135.2 |
| 167 | Desert Springs | California | 73a | 1,989.0 |
| 168 | Desert Wells | Nevada | 57 | 4,696.3 |
| 169 | Diamond City | Utah | 50 | 6,369.9 |
| 170 | Disappointment Spring | Nevada | 66 | 4,834.8 |
| 171 | Dos Palmas | California | 81d | 102.8 |
| 172 | Dotson's Ranch | Colorado | 62c | 6,379.1 |
| 173 | Douglas Camp (astronomical monument by level) | Utah | 41 | 4,905.0 |
| 174 | Dunn's Peak | Colorado | 61c | 13,502.4 |
| 175 | Dutch Henry's Ranch | California | 73c | 1,195.1 |
| 176 | Edgar's Spring | do | 65 | 4,060.8 |
| 177 | Ehrenberg, camp opposite | do | 81b | 408.0 |
| 178 | Eighteen-Mile Mountain | Colorado | 61c | 12,277.8 |
| 179 | Eldorado Mill | California | 66d | 863.0 |
| 180 | Elizabethtown | New Mexico | 70a | 8,464.7 |
| 181 | Elizabeth Lake | California | 73c | 3,317.5 |
| 182 | El Monte | do | 73c | 328.5 |
| 183 | El Paso Mines (tunnel) | do | 73b | 4,112.6 |
| 184 | El Puerto de la Laguna | New Mexico | 69b | 7,187.1 |
| 185 | El Rito | do | 69d | 6,792.0 |

* The altitudes in Death Valley marked with a minus-sign (—) indicate that that station in the valley is so many feet below the level of the sea.

ALTITUDES.

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Table of altitudes—Continued.

| No. | Locality. | State or Territory. | Atlas-sheet. | Altitude above the sea (feet). |
|-----|--|---------------------|--------------|--------------------------------|
| 186 | El Rito | New Mexico | 77d | 5,649.7 |
| 187 | El Vado de los Padres (Colorado River) | Utah | 67 | 3,193.9 |
| 188 | Engineer Peak | Colorado | 61c | 13,076.4 |
| 189 | Ephraim City | Utah | 50 | 5,633.4 |
| 190 | Escudilla Mountain | Arizona | 83 | 10,691.3 |
| 191 | Embudo | New Mexico | 69d | 5,891.0 |
| 192 | Eureka | Nevada | 49 | 5,905.6 |
| 193 | Eureka Springs | New Mexico | 83 | 4,239.2 |
| 194 | Evans Mountain (timber-line) | Colorado | 52d | 11,722.6 |
| 195 | Evans Mountain | do | 52d | 14,321.0 |
| 196 | Fairplay | do | 52d | 10,075.9 |
| 197 | Faust's Station | Utah | 50 | 5,296.1 |
| 198 | Fear's Station | California | 73d | 3,393.0 |
| 199 | Fillmore | Utah | 59 | 6,025.7 |
| 200 | Fish Lake | Nevada | 57 | 4,745.0 |
| 201 | do | Utah | 59 | 8,763.2 |
| 202 | do | Nevada | 58 | 6,866.0 |
| 203 | Floyd Camp (now Fairfield) | Utah | 50 | 4,866.5 |
| 204 | Forks of road, Sunset crossing to (Apache) | Arizona | 76 | 7,839.6 |
| 205 | Fountain Green | Utah | 50 | 5,873.8 |
| 206 | France's Springs | California | 74d | 4,219.8 |
| 207 | French Pass | Colorado | 52 | 12,043.5 |
| 208 | Furnace Creek | California | 65d | 405.1 |
| 209 | Furnace Spring | do | 65d | 336.9 |
| 210 | Galena | Nevada | 48 | 5,649.8 |
| 211 | Galisteo | New Mexico | 77b | 6,116.6 |
| 212 | Gallinas Park | do | 69d | 9,798.3 |
| 213 | Gardner's post-office | Colorado | 62c | 6,956.2 |
| 214 | Garland, Fort | do | 62c | 7,849.4 |
| 215 | Georgetown (astronomical station) | do | 52d | 8,587.2 |
| 216 | Georgia Pass | do | 52d | 11,770.2 |
| 217 | Gila Cañon (Hot Springs) | New Mexico | 84 | 5,905.4 |
| 218 | Gila Cañon, mouth of | do | 83 | 4,917.8 |
| 219 | Gila River Junction, Big and Little | do | 84 | 5,743.4 |
| 220 | Glacier Peak | Colorado | 61c | 14,243.0 |
| 221 | Glenville | California | 65c | 3,094.3 |
| 222 | Glencove | Utah | 59 | 5,220.9 |
| 223 | Goodwin, Old Camp, post-office | Arizona | 83 | 2,816.3 |
| 224 | Gordon's Ranch | California | 73c | 736.8 |
| 225 | Gorman's Ranch | do | 73c | 3,838.1 |
| 226 | Goshen | Utah | 50 | 4,482.5 |
| 227 | Gould's Ranch | do | 67 | 4,052.5 |
| 228 | Graham Mountain | Arizona | 83 | 10,516.2 |
| 229 | Granite Wells | California | 73b | 2,080.1 |
| 230 | Granite Springs | do | 73b | 4,115.2 |
| 231 | Grant, post-office | Colorado | 52d | 8,497.3 |
| 232 | Grant, Old Camp | Arizona | 83 | 2,118.5 |
| 233 | Grant, New Camp, post-office | do | 83 | 4,833.1 |
| 234 | Grape Vine Peak | California | 65c | 8,527.9 |
| 235 | Grape Vine Spring | do | 65c | 2,431.8 |
| 236 | Grape Vine Ranch | do | 73d | 2,246.8 |
| 237 | Gray's Peak, north | Colorado | 52d | 14,380.3 |
| 238 | Gray's Peak, south | do | 52d | 14,410.7 |
| 239 | Gray's Peak, north and south, divide between | do | 52d | 13,929.3 |
| 240 | Green River (astronomical station) | Wyoming | 42 | 6,096.9 |
| 241 | Griffith Peak | Colorado | 52d | 11,588.8 |
| 242 | Grizzly Peak | California | 73d | 11,723.4 |
| 243 | Guadalupe | New Mexico | 70c | 7,676.9 |
| 244 | Gunnison | Utah | 50 | 5,144.6 |
| 245 | Guy Fawkes | New Mexico | 84 | 6,700.0 |
| 246 | Half-Moon Creek, A. and P. divide, head of | Colorado | 52d | 12,968.6 |
| 247 | Half-Moon Creek, timber-line, head of | do | 52d | 11,668.5 |
| 248 | Half-Moon Creek Peak, south of | do | 52d | 13,552.3 |

Table of altitudes—Continued.

| No. | Locality. | State or Territory. | Atlas-sheet. | Altitude above the sea (feet). |
|-----|--|---------------------|--------------------------|--------------------------------|
| 249 | Halloran Springs..... | California..... | 74a | 3,271.7 |
| 250 | Hall's Gulch Summit..... | Colorado..... | 52d | 12,670.8 |
| 251 | Hall's Ranch..... | do..... | 61b | 7,839.8 |
| 252 | Hall's Works..... | do..... | 52d | 9,916.5 |
| 253 | Hamilton's Ranch..... | do..... | 62c | 7,226.7 |
| 254 | Handie's Peak..... | do..... | 61c | 14,149.0 |
| 255 | Hancock Pass..... | do..... | 52d | 12,263.0 |
| 256 | Hartsell's Ranch (new)..... | do..... | 61b | 8,828.0 |
| 257 | Harvard, Mount..... | do..... | 61b | 14,151.6 |
| 258 | Hayden Creek Pass..... | do..... | 61b | 10,780.4 |
| 259 | Hebron..... | Utah..... | 58 | 5,474.8 |
| 260 | Hedionda Lake..... | New Mexico..... | 69b | 7,149.0 |
| 261 | Hell Cañon, western entrance of..... | do..... | 77b | 5,991.5 |
| 262 | Henson Creek and Animas River, divide between..... | Colorado..... | 61c | 12,876.7 |
| 263 | Henson and Cebolla Creeks, divide between..... | do..... | 61c | 13,002.9 |
| 264 | Hoosier Pass..... | do..... | 52d | 11,627.1 |
| 265 | Horse Springs..... | New Mexico..... | 84 | 7,044.7 |
| 266 | Hot Springs, Diamond Creek..... | do..... | 84 | 5,544.7 |
| 267 | Hot Springs..... | Nevada..... | 48 | 4,730.8 |
| 268 | Hot Springs and Thunder Creek, divide between..... | Colorado..... | 61c | 11,643.8 |
| 269 | Howardsville..... | do..... | 61c | 9,545.2 |
| 270 | Hualapais..... | Arizona..... | 75 | 5,321.9 |
| 271 | Huerfano..... | Colorado..... | 62c | 4,714.5 |
| 272 | Hughes (astronomical station)..... | do..... | 53 | 5,021.0 |
| 273 | Humphreys Peak..... | Arizona..... | 75 | 12,561.8 |
| 274 | Hunchback Peak (Oso)..... | Colorado..... | 61c | 13,755.5 |
| 275 | Hunter's Ranch..... | California..... | 65c | 6,274.7 |
| 276 | Huntington, Mohave River..... | do..... | 73d | 2,898.6 |
| 277 | Hunt's Peak..... | Colorado..... | 61b | 14,054.6 |
| 278 | Hurricane Peak..... | do..... | 61c | 13,565.2 |
| 279 | Idaho Springs..... | do..... | 53c | 7,284.0 |
| 280 | Independence Camp..... | California..... | 65a | 3,956.5 |
| 281 | Indian Spring..... | Utah..... | 50 | 5,283.5 |
| 282 | Indian Wells..... | California..... | 73a 73b 65d 65c | 2,607.6 |
| 283 | Ivanpah..... | do..... | 74d | 4,238.1 |
| 284 | Jaycock's Ranch..... | Arizona..... | 75 | 6,814.1 |
| 285 | Jefferson..... | Colorado..... | 52d | 9,862.5 |
| 286 | Jemez Mountain (Δ station XX)..... | New Mexico..... | 69d | 9,533.7 |
| 287 | Jemez Peak..... | do..... | 77b | 8,568.9 |
| 288 | Joe's Peak..... | California..... | 65c | 9,712.2 |
| 289 | Johnson's Ranch..... | do..... | 65a | 3,459.5 |
| 290 | do..... | do..... | 65d | 5,015.3 |
| 291 | Kerber and Poncho Creeks, divide between..... | Colorado..... | 61b | 11,129.7 |
| 292 | Kernville..... | California..... | 65c | 2,550.7 |
| 293 | Kincaid's Ranch..... | do..... | 73d | 1,771.0 |
| 294 | King's Springs, Death Valley..... | do..... | 65 | — 225.1 |
| 295 | Kneeling Jesus Bluff..... | New Mexico..... | 84 | 7,902.8 |
| 296 | Kozlowski's Ranch..... | do..... | 77b | 6,905.3 |
| 297 | La Bajada..... | do..... | 77 | 5,514.5 |
| 298 | La Bayonne..... | California..... | 80a | 15.7 |
| 299 | Labran..... | Colorado..... | 62a | 5,217.8 |
| 300 | Lachusca..... | New Mexico..... | 68 | 6,702.8 |
| 301 | La Glorieta..... | do..... | 77b | 7,047.7 |
| 302 | Laguna Los Griegos..... | do..... | 78a | 6,655.5 |
| 303 | Laguna..... | do..... | 77a | 6,266.0 |
| 304 | La Junta..... | Colorado..... | 52d | 6,612.0 |
| 305 | Lake City..... | do..... | 61c | 8,753.4 |
| 306 | Lake Creek, at fall..... | do..... | 52d | 9,384.2 |
| 307 | Lake Creek Pass..... | do..... | 61b | 12,226.3 |
| 308 | Lake City, Antelope Park, divide between..... | do..... | 61c | 11,777.7 |

Table of altitudes—Continued.

| No. | Locality. | State or Territory. | Atlas-sheet. | Altitude above the sea (feet). |
|-----|--|---------------------|--------------|--------------------------------|
| 309 | Lake Peak..... | New Mexico..... | 69d | 12,405.3 |
| 310 | La Laguna Ranch..... | California..... | 73c | 129.2 |
| 311 | La Monica Springs..... | New Mexico..... | 84 | 7,735.3 |
| 312 | Lane's Crossing, Mojave River..... | California..... | 73d | 2,819.1 |
| 313 | Lane's Ranch..... | Colorado..... | 61b | 6,380.1 |
| 314 | La Placita or Placitas..... | New Mexico..... | 77b | 5,129.3 |
| 315 | La Plata Peak..... | Colorado..... | 61c | 13,316.0 |
| 316 | La Veta..... | New Mexico..... | 77a | 6,266.0 |
| 317 | Laramie..... | Wyoming..... | 43d | 7,123.0 |
| 318 | Las Animas, west..... | Colorado..... | 62b | 3,885.7 |
| 319 | Las Tapiacitas..... | New Mexico..... | 69a | 8,810.0 |
| 320 | Las Vegas..... | Nevada..... | 66 | 2,074.0 |
| 321 | Las Lunitas..... | New Mexico..... | 77 | 4,805.5 |
| 322 | Laughlin's Peak..... | do..... | 70d | 8,949.9 |
| 323 | La Veta Peak..... | Colorado..... | 62c | 11,653.9 |
| 324 | Leaches Point..... | California..... | 73b | 3,613.7 |
| 325 | Lee's Springs in Fremont Pass..... | Utah..... | 59 | 6,883.1 |
| 326 | Lehigh..... | do..... | 50 | 4,596.1 |
| 327 | Leonard's Ranch, Arkansas River..... | Colorado..... | 61b | 8,335.4 |
| 328 | Liedendorf's Wells..... | New Mexico..... | 89 | 4,601.3 |
| 329 | Leine and Cascade Creeks, divide between..... | Colorado..... | 61c | 10,703.4 |
| 330 | Leine or White Earth Creek Pass..... | do..... | 61c | 11,313.7 |
| 331 | Lincoln, Mount..... | do..... | 52d | 14,375.3 |
| 332 | Little Cottonwood..... | Utah..... | 50 | 4,359.0 |
| 333 | Little Yosemite..... | California..... | 65c | 6,442.1 |
| 334 | Liverpool Landing, Colorado River..... | do..... | 74d | 606.3 |
| 335 | Lone Pine..... | do..... | 65b | 3,810.1 |
| 336 | Lookout Hill..... | do..... | 65d | 4,214.2 |
| 337 | Lopez Ranch..... | do..... | 73c | 3,248.3 |
| 338 | Los Angeles..... | do..... | 73c | 325.6 |
| 339 | Los Brazos (river bottom)..... | New Mexico..... | 69b | 7,321.2 |
| 340 | Los Cerros del Aguila..... | do..... | 69b | 7,942.6 |
| 341 | Los Chavez..... | do..... | 77d | 4,775.0 |
| 342 | Los Encinos Ranch..... | California..... | 73c | 774.1 |
| 343 | Los Lunas..... | New Mexico..... | 77d | 4,805.5 |
| 344 | Los Machos..... | do..... | 69d | 7,289.8 |
| 345 | Los Ojos, Chama River..... | do..... | 69b | 7,272.7 |
| 346 | Los Pinos and Piedra Rivers, divide between..... | Colorado..... | 61c | 10,177.7 |
| 347 | Los Pinos and Rio Grande, divide between..... | do..... | 61c | 10,736.9 |
| 348 | Los Quelites..... | New Mexico..... | 77 | 5,133.6 |
| 349 | Los Toros..... | California..... | 81a | 202.7 |
| 350 | Los Tusos..... | New Mexico..... | 77 | 7,537.3 |
| 351 | Luceros..... | do..... | 69b | 7,941.2 |
| 352 | Luna Springs..... | do..... | 84 | 7,649.6 |
| 353 | Lyons Ranch..... | California..... | 73c | 1,396.6 |
| 354 | Macomb's Peak..... | Colorado..... | 61c | 13,154.2 |
| 355 | Malaga Peak..... | California..... | 73c | 2,319.6 |
| 356 | Malaga Ranch..... | do..... | 73c | 4.5 |
| 357 | Mammoth Mills..... | Utah..... | 58 | 6,947.3 |
| 358 | Mangos Spring..... | New Mexico..... | 83 | 4,798.6 |
| 359 | Marshall Pass..... | Colorado..... | 61b | 10,851.7 |
| 360 | Martinez Mesa..... | New Mexico..... | 78d | 6,820.1 |
| 361 | Martin's Ranch..... | California..... | 73d | 2,055.1 |
| 362 | McCarthy's Ranch..... | New Mexico..... | 77a | 6,099.4 |
| 363 | McClellan's Peak..... | Colorado..... | 52d | 13,841.8 |
| 364 | McClure's Ranch..... | do..... | 62d | 5,318.4 |
| 365 | McLaughlin's Ranch..... | do..... | 52d | 9,671.5 |
| 366 | Meadow Mountain..... | California..... | 65c | 11,734.2 |
| 367 | Mears Peak..... | Colorado..... | 61c | 13,007.9 |
| 368 | Meigs Peak..... | do..... | 61d | 13,393.5 |
| 369 | Mill Station..... | Utah..... | 59 | 6,504.2 |
| 370 | Mimbres Mountains (Δ station XXXIX, 1873)..... | New Mexico..... | 84 | 10,061.1 |
| 371 | Mineral City..... | Colorado..... | 61c | 11,473.7 |

Table of altitudes—Continued.

| No. | Locality. | State or Territory. | Atlas-sheet. | Altitude above the sea (feet). |
|-----|---|---------------------|--------------|--------------------------------|
| 372 | Mineral Spring..... | Arizona..... | 76 | 6,670.3 |
| 373 | Mogollon Mesa..... | do..... | 76 | 7,535.3 |
| 374 | Mojave, Camp..... | do..... | 74b | 755.0 |
| 375 | Morey..... | Nevada..... | 58 | 7,383.6 |
| 376 | Morton or Silver Heels Mountain..... | Colorado..... | 52d | 10,107.1 |
| 377 | Mosca Pass..... | do..... | 62c | 9,849.1 |
| 378 | Mesquite..... | do..... | 52d | 10,445.6 |
| 379 | Mesquite Pass..... | do..... | 52d | 13,308.4 |
| 380 | Mesquite Spring..... | California..... | 73b | 2,009.8 |
| 381 | Mount Pleasant..... | Utah..... | 50 | 5,875.0 |
| 382 | Mountain Meadows..... | do..... | 59 | 5,741.8 |
| 383 | Mountain Spring..... | Nevada..... | 66 | 5,500.8 |
| 384 | Mule Spring..... | New Mexico..... | 84 | 5,281.8 |
| 385 | Murderer's Mesa, California Plateau..... | Colorado..... | 61c | 12,309.7 |
| 386 | Nacimiento Peak..... | New Mexico..... | 69d | 10,044.8 |
| 387 | Nacimiento..... | do..... | 69c | 7,300.0 |
| 388 | Nambe Pueblo..... | do..... | 69d | 6,045.1 |
| 389 | Navajo Spring..... | Arizona..... | 67 | 4,101.2 |
| 390 | Nebo Peak..... | Utah..... | 50 | 11,992.0 |
| 391 | Nelson's Tank..... | Arizona..... | 75 | 6,216.5 |
| 392 | Newberry Peak..... | California..... | 74c | 3,375.4 |
| 393 | Nichols Point..... | do..... | 73a | 6,262.7 |
| 394 | Nolman's Spring..... | do..... | 74d | 3,734.7 |
| 395 | Nordhoff..... | do..... | 73c | 818.8 |
| 396 | Nutria..... | New Mexico..... | 76 | 6,901.4 |
| 397 | Nutria Spring..... | do..... | 76 | 6,934.0 |
| 398 | Nutritas Plaza..... | do..... | 69b | 7,454.9 |
| 399 | Oak Spring..... | do..... | 76 | 7,946.4 |
| 400 | Ocate Crater..... | do..... | 70c | 8,902.8 |
| 401 | Ogden (astronomical observatory)..... | Utah..... | 41 | 4,374.0 |
| 402 | Ogden Junction Railroad (by level)..... | do..... | 41 | 4,299.6 |
| 403 | Ojitos-de-las Cuevas, or Two-Cave Spring..... | New Mexico..... | 77a | 5,901.8 |
| 404 | Ojo Amarillo..... | do..... | 69c | 6,384.1 |
| 405 | Ojo Caliente..... | do..... | 76 | 6,291.6 |
| 406 | Ojos Calientes..... | do..... | 68a | 5,594.2 |
| 407 | Ojo Datil..... | do..... | 77 | 7,419.2 |
| 408 | Ojo del Indio..... | do..... | 77a | 9,239.3 |
| 409 | Ojo de los Cazos..... | do..... | 77b | 7,615.1 |
| 410 | Ojo del Oso..... | do..... | 76 | 5,902.1 |
| 411 | Ojo de los Valles..... | do..... | 77b | 6,978.9 |
| 412 | Ojo de Nuestra Señora..... | do..... | 69c | 6,605.8 |
| 413 | Ojo de Vaca..... | do..... | 77b | 6,863.6 |
| 414 | Ojo Gallo..... | do..... | 77a | 7,942.7 |
| 415 | Olancha Peak..... | California..... | 65c | 12,250.8 |
| 416 | Old Bony Mountain..... | do..... | 73c | 1,892.4 |
| 417 | O'Neil's Ranch..... | Nevada..... | 49 | 5,581.2 |
| 418 | Ord Peak..... | New Mexico..... | 76 | 10,093.5 |
| 419 | Oro City..... | Colorado..... | 52 | 10,088.1 |
| 420 | Owen's River Bridge..... | California..... | 65a | 3,618.0 |
| 421 | Owyhee..... | Nevada..... | 40 | 5,392.3 |
| 422 | Pagosa Hot Springs..... | Colorado..... | 69a | 7,057.3 |
| 423 | Pagosa Peak..... | do..... | 61c | 12,675.8 |
| 424 | Pah-ghun-pah-ghun Spring..... | Nevada..... | 66 | 2,281.9 |
| 425 | Pah-Ute Mines..... | California..... | 73a | 6,607.6 |
| 426 | Pah-Ute Peak..... | do..... | 73a | 8,342.0 |
| 427 | Pah-Ute Spring..... | do..... | 74 | 2,849.3 |
| 428 | Painted Cañon, entrance..... | Arizona..... | 74 | 745.8 |
| 429 | Palca Peak..... | California..... | 72b | 4,507.5 |
| 430 | Panamint..... | do..... | 65d | 6,604.9 |
| 431 | Panamint Station..... | do..... | 73a | 3,548.6 |
| 432 | Panquitch..... | Utah..... | 59 | 6,273.3 |
| 433 | Paragoonah..... | do..... | 59 | 6,222.7 |
| 434 | Paria..... | do..... | 67 | 4,562.1 |

ALTITUDES.

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Table of altitudes—Continued.

| No. | Locality. | State or Territory. | Atlas-sheet. | Altitude above the sea (feet). |
|-----|---|---------------------|--------------|--------------------------------|
| 435 | Paria Cañon, mouth..... | Arizona..... | 67 | 3,077.6 |
| 436 | Paria River and Birch Creek, divide between..... | Utah..... | 59 | 7,591.3 |
| 437 | Pass Peak..... | Colorado..... | 61c | 13,091.8 |
| 438 | Peach Orchard Spring..... | Arizona..... | 68c | 6,272.7 |
| 439 | Pelado..... | New Mexico..... | 69d | 11,260.4 |
| 440 | Peñasco..... | do..... | 69d | 7,452.0 |
| 441 | Penroyer Springs..... | Nevada..... | 58 | 6,651.7 |
| 442 | Pescado Spring..... | New Mexico..... | 76 | 6,546.2 |
| 443 | Picacho Station..... | Arizona..... | 82 | 1,750.2 |
| 444 | Picket Post..... | do..... | 82 | 2,669.6 |
| 445 | Pilot Knob..... | California..... | 73b | 5,525.1 |
| 446 | Pioche..... | Nevada..... | 58 | 5,942.3 |
| 447 | Pipe Springs..... | Arizona..... | 67 | 5,397.2 |
| 448 | Placer Mountain..... | New Mexico..... | 77b | 8,826.5 |
| 449 | Plaza del Alcalde..... | do..... | 69 | 5,601.2 |
| 450 | Pleasant Valley..... | Utah..... | 50 | 7,539.0 |
| 451 | Point of Rocks..... | California..... | 73d | 2,541.6 |
| 452 | Pole Creek, A. and P. divide between Pole Creek and Maggie Gulch..... | Colorado..... | 61c | 12,296.3 |
| 453 | Puncho Pass..... | do..... | 61b | 8,945.5 |
| 454 | Prescott..... | Arizona..... | 75 | 5,316.0 |
| 455 | Prospect Peak..... | Colorado..... | 69b | 9,908.9 |
| 456 | Provo..... | Utah..... | 50 | 4,544.0 |
| 457 | Provo Peak..... | do..... | 50 | 11,066.2 |
| 458 | Pueblo Colorado..... | New Mexico..... | 68c | 6,367.6 |
| 459 | Pueblo. R. R. levels; track at Depot..... | Colorado..... | 62a | 4,669.0 |
| 460 | Pueblo Jemez..... | New Mexico..... | 77b | 5,479.0 |
| 461 | Pueblo Pintado..... | do..... | 69c | 6,505.7 |
| 462 | Pueblo Springs..... | do..... | 77 | 6,362.7 |
| 463 | Pueblo Viejo, or Safford post-office..... | do..... | 83 | 2,711.5 |
| 464 | Puertocito Spring..... | do..... | 84 | 6,499.3 |
| 465 | Purgatoire and Vermejo divide (Vermejo or Francisco Pass)..... | do..... | 70a | 9,173.1 |
| 466 | Quinn Cañon..... | Nevada..... | 58 | 6,255.7 |
| 467 | Ralston..... | New Mexico..... | 89 | 4,487.7 |
| 468 | Raton Pass..... | Colorado..... | 70a | 7,893.2 |
| 469 | Real Dolores..... | New Mexico..... | 77 | 6,801.9 |
| 470 | Red Cloud Peak..... | Colorado..... | 61c | 14,092.6 |
| 471 | Red Mountain..... | do..... | 61b | 13,332.7 |
| 472 | Red Mountain (timber-line)..... | do..... | 61b | 11,745.7 |
| 473 | Red Rock Station..... | California..... | 73a | 2,394.1 |
| 474 | Reily's Station..... | do..... | 73c | 1,477.5 |
| 475 | Rio Grande and Culebra Junction..... | Colorado..... | 69b | 7,086.7 |
| 476 | Rio Grande, Crossing at Embudo Creek..... | New Mexico..... | 69d | 5,829.6 |
| 477 | Rio Grande, Crossing at La Joya..... | do..... | 69d | 5,651.0 |
| 478 | Rio Grande, Crossing at Honda Creek..... | do..... | 69b | 6,357.9 |
| 479 | Rio Grande, at Peña Blanca..... | do..... | 77b | 5,255.8 |
| 480 | Rito Embargo Creek..... | Colorado..... | 61d | 8,099.5 |
| 481 | Ritger's Ranch..... | California..... | 65a | 4,345.3 |
| 482 | Rock Cliff, post-office..... | Colorado..... | 61d | 8,270.7 |
| 483 | Rock Spring..... | Arizona..... | 76 | 6,849.3 |
| 484 | Rosalie Peak..... | Colorado..... | 52d | 14,236.1 |
| 485 | Rose Springs..... | California..... | 65c | 3,544.9 |
| 486 | Rosita (sun-dial)..... | Colorado..... | 62c | 8,932.0 |
| 487 | Round Peak..... | do..... | 61c | 12,946.1 |
| 488 | Sabinal..... | New Mexico..... | 77d | 5,087.3 |
| 489 | Saguache..... | Colorado..... | 61d | 7,620.4 |
| 490 | Saguache Creek, (camp 16, 1875)..... | do..... | 61d | 9,450.3 |
| 491 | Salt Lake City (Temple pier by level)..... | Utah..... | 41 | 4,330.4 |
| 492 | Santa Ana..... | New Mexico..... | 77b | 5,345.7 |
| 493 | San Antonio..... | Nevada..... | 57 | 5,280.5 |
| 494 | San Antonio Valley..... | New Mexico..... | 69b | 8,366.9 |
| 495 | San Antonio Peak..... | California..... | 73d | 10,191.0 |

Table of altitudes—Continued.

| No. | Locality. | State or Territory. | Atlas-sheet. | Altitude above the sea (feet). |
|-----|---|---------------------|--------------|--------------------------------|
| 496 | San Antonio Mountain..... | New Mexico..... | 69b | 10,912.0 |
| 497 | San Antonio..... | do..... | 84 | 4,958.2 |
| 498 | San Antonio and El Brazos, divide between..... | co..... | 69b | 9,887.4 |
| 499 | Santa Buena Ventura..... | California..... | 60d | 145.8 |
| 500 | San Carlos Agency..... | Arizona..... | 83 | 2,456.0 |
| 501 | Sanchez Ranch..... | New Mexico..... | 77a | 7,298.0 |
| 502 | San Christobal crossing, Rio Grande, water edge..... | do..... | 69b | 6,422.9 |
| 503 | San Christobal crossing, high bank west side of river..... | do..... | 69b | 7,192.5 |
| 504 | San Daño..... | do..... | 69d | 8,366.2 |
| 505 | Sardia Mountains..... | do..... | 77b | 10,608.8 |
| 506 | San Emigdio Store..... | California..... | 73a | 788.3 |
| 507 | San Felipe..... | New Mexico..... | 77b | 5,007.4 |
| 508 | San Fernando..... | California..... | 73c | 1,034.0 |
| 509 | San Fernando Peak..... | do..... | 73c | 3,792.8 |
| 510 | San Gabriel..... | do..... | 73c | 418.9 |
| 511 | San Gabriel Church..... | do..... | 73c | 480.7 |
| 512 | San Gabriel Peak..... | do..... | 73c | 6,293.2 |
| 513 | San Gorgonio Pass..... | do..... | 80b | 2,745.7 |
| 514 | Sangre del Cristo Pass..... | Colorado..... | 62c | 9,577.9 |
| 515 | San Francisco Spring..... | Utah..... | 59 | 6,527.1 |
| 516 | San Francisquito Cañon..... | California..... | 73c | 2,381.6 |
| 517 | San Francisco Mountain (edge of crater)..... | Arizona..... | 75 | 10,121.8 |
| 518 | San Francisco Mountain (timber-line)..... | do..... | 75 | 11,467.6 |
| 519 | San Ildefonso..... | New Mexico..... | 69d | 5,457.8 |
| 520 | San Ignacio..... | do..... | 77a | 5,515.0 |
| 521 | San Isidro..... | do..... | 77b | 5,459.9 |
| 522 | San Juan City..... | Colorado..... | 61c | 8,900.8 |
| 523 | San Juan River, junction with Navajo Creek..... | New Mexico..... | 69a | 6,268.2 |
| 524 | San Juan, or Hamilton Pass, head of Rio Grande..... | Colorado..... | 61c | 12,413.0 |
| 525 | San Juan River, mouth of Rio Mancos..... | New Mexico..... | 68b | 4,692.1 |
| 526 | San Juan and Old Animas City, pass between..... | Colorado..... | 61c | 11,595.9 |
| 527 | San Juan River and South Fork Rio Grande, A. and P. divide, on trail from Del Norte to Pagosa Spring..... | do..... | 61d | 10,853.6 |
| 528 | San Juan, fork of Upper..... | do..... | 61c | 7,776.9 |
| 529 | San Luis Lake..... | do..... | 61d | 7,535.0 |
| 530 | San Luis de Culebra..... | do..... | 70a | 7,593.3 |
| 531 | San Lorenzo..... | New Mexico..... | 69d | 6,107.0 |
| 532 | San Mateo..... | do..... | 77a | 7,323.0 |
| 533 | San Mateo Peak..... | do..... | 84 | 10,336.5 |
| 534 | Santo Nino del Rincon..... | do..... | 70c | 7,418.3 |
| 535 | San Rafael..... | do..... | 77 | 6,509.1 |
| 536 | Santa Cruz..... | do..... | 69d | 5,590.0 |
| 537 | Santa Monica..... | California..... | 73c | 81.7 |
| 538 | Santa Fé..... | New Mexico..... | 69d | 7,044.2 |
| 539 | Santa Paula..... | California..... | 73c | 384.0 |
| 540 | Sapello..... | New Mexico..... | 70 | 6,876.0 |
| 541 | Saratoga Springs..... | Nevada..... | 66 | 263.6 |
| 542 | Sayer's Ranch..... | New Mexico..... | 70a | 6,693.5 |
| 543 | Say-qui-to Spring..... | California..... | 65 | 5,553.2 |
| 544 | Sevier Pass (west side)..... | Utah..... | 50 | 4,767.5 |
| 545 | Sevier Lake Desert..... | do..... | 50 | 4,873.8 |
| 546 | Sevier River Bridge..... | do..... | 59 | 5,282.6 |
| 547 | Shconesburg..... | do..... | 67 | 3,920.5 |
| 548 | Shungo-pah-we..... | Arizona..... | 68 | 6,031.9 |
| 549 | Signal Peak, Carrizo Mountains..... | do..... | 69c | 9,330.2 |
| 550 | Silla..... | New Mexico..... | 77b | 6,676.8 |
| 551 | Silver City..... | do..... | 83 | 5,946.0 |
| 552 | Silver Peak Mines..... | Nevada..... | 57 | 4,256.6 |
| 553 | Silver Spring..... | California..... | 65 | 4,000.2 |
| 554 | do..... | Arizona..... | 76 | 6,169.1 |
| 555 | Simpson's..... | Colorado..... | 61c | 14,055.9 |
| 556 | S'kumpah..... | Utah..... | 67 | 5,999.6 |
| 557 | Slate Ranch..... | Colorado..... | 52d | 9,257.2 |
| 558 | Smith's Ranch, Arkansas River..... | do..... | 62d | 4,797.5 |

Table of altitudes—Continued.

| No. | Locality. | State or Territory. | Atlas-sheet. | Altitude above the sea (feet). |
|-----|--|---------------------|--------------|--------------------------------|
| 559 | Snake River, mouth of Chihuahua Gulch | Colorado | 52d | 11,757.9 |
| 560 | Snyder's Ranch | do. | 61a | 8,127.1 |
| 561 | Soda Lake | California | 74a | 1,127.9 |
| 562 | Soledad City | do. | 73c | 2,513.0 |
| 563 | Spadra | do. | 73d | 802.4 |
| 564 | Spanish Peak, west | Colorado | 70a | 13,717.9 |
| 565 | Spear's Ranch | Arizona | 74b | 680.6 |
| 566 | Spring Valley Spring | Nevada | 49 | 7,768.1 |
| 567 | Saint Clair's Ranch | California | 80b | 1,961.2 |
| 568 | Steele, Fort | Wyoming | 43 | 6,850.0 |
| 569 | Stern's Store | Colorado | 62c | 9,067.7 |
| 570 | Stewart's Peak | do. | 61c | 14,032.1 |
| 571 | Stinking Springs | New Mexico | 76 | 6,690.4 |
| 572 | do. | do. | 77b | 6,248.8 |
| 573 | Stone Cabin | Nevada | 57 | 6,390.3 |
| 574 | Stone's Ferry | do. | 66b | 1,107.9 |
| 575 | Saint Mary's (post-office) | Colorado | 62c | 6,167.1 |
| 576 | Stump's Ranch | Nevada | 49 | 4,748.9 |
| 577 | Summit Springs | Arizona | 76 | 7,867.2 |
| 578 | Summit Mines, general level | Colorado | 61d | 11,089.2 |
| 579 | Sunday Peak | California | 65c | 8,334.8 |
| 580 | do. | New Mexico | 84 | 6,030.3 |
| 581 | Sunset Crossing | Arizona | 76 | 4,891.0 |
| 582 | Sunset Gap | do. | 76 | 5,754.8 |
| 583 | Sunset Tanks | do. | 76 | 5,797.2 |
| 584 | Surveyors Wells | California | 73b | 3,567.1 |
| 585 | Tanks between Camp Apache and Camp Grant | Arizona | 83 | 5,717.0 |
| 586 | Taos Peak | New Mexico | 70a | 13,145.0 |
| 587 | Taos Plaza | do. | 69d | 6,949.4 |
| 588 | Taos Pueblos | do. | 69d | 7,014.6 |
| 589 | Taylor, Mount | do. | 77a | 11,391.2 |
| 590 | Taylor's Ranch | do. | 78a | 5,830.9 |
| 591 | Tegua (Moqui) | Arizona | 68c | 6,298.8 |
| 592 | Tehachapai | California | 73a | 3,830.6 |
| 593 | Tehachapai Pass | do. | 73a | 3,831.9 |
| 594 | Tehachapai Peak | do. | 73a | 8,263.1 |
| 595 | Tejon, Old Fort | do. | 73a | 3,245.7 |
| 596 | Ten Mile and Eagle Tail, divide between | Colorado | 52d | 10,756.1 |
| 597 | Tennessee Pass | do. | 52d | 10,701.9 |
| 598 | Tetilla Peak | New Mexico | 77b | 7,060.0 |
| 599 | Thomas Ranch | California | 73c | 3,771.6 |
| 600 | Thunder Peak | do. | 65 | 9,121.7 |
| 601 | Tierra Amarilla | New Mexico | 69b | 7,499.8 |
| 602 | Tijeras | do. | 77b | 6,213.7 |
| 603 | Tin-pa-ute, or Maguinta Spring | Nevada | 58 | 6,891.7 |
| 604 | Tinnah-kah Springs | do. | 66 | 4,079.9 |
| 605 | Tipton Peak | Arizona | 74a | 7,364.4 |
| 606 | Toas Kete | New Mexico | 68 | 6,505.8 |
| 607 | Too-lee-cha Peak | California | 65 | 7,021.8 |
| 608 | Tres Hermanos | New Mexico | 77 | 7,151.1 |
| 609 | Trinchera Peak | Colorado | 70a | 13,680.7 |
| 610 | Trinidad (astronomical monument) | do. | 70a | 6,043.1 |
| 611 | Triplets | New Mexico | 83 | 4,346.6 |
| 612 | Trout Creek Pass | Colorado | 61b | 9,612.7 |
| 613 | Trout Lake | do. | 61c | 9,700.2 |
| 614 | Truxton Springs | Arizona | 75 | 3,885.5 |
| 615 | Tucson | do. | 89 | 2,537.7 |
| 616 | Tule Spring | do. | 76 | 5,924.7 |
| 617 | Tulerosa, Old Fort | New Mexico | 83 | 6,740.4 |
| 618 | Tunicha Mesa | do. | 68d | 5,510.0 |
| 619 | Twin Creek Pass | Colorado | 62d | 8,568.1 |
| 620 | Uncompahgre Creek and Animas, divide between | do. | 61c | 11,928.0 |
| 621 | Uncompahgre Peak | do. | 61c | 14,408.4 |

Table of altitudes—Continued.

| No. | Locality. | State or Territory. | Atlas-sheet. | Altitude above the sea (feet). |
|-----|---|---------------------|--------------|--------------------------------|
| 622 | Union, Fort | New Mexico | 70c | 6,744.1 |
| 623 | Union Park | Colorado | 61b | 9,654.8 |
| 624 | Union Pass | Arizona | 74b | 3,600.0 |
| 625 | United States Mountain | New Mexico | 69d | 10,734.3 |
| 626 | Ute Peak | do | 69b | 10,152.3 |
| 627 | Venable's Ranch | Colorado | 61d | 7,628.1 |
| 628 | Venado Spring | New Mexico | 76 | 5,981.9 |
| 629 | Verde, Camp | Arizona | 75 | 3,159.7 |
| 630 | Vergenes Ranch | California | 73c | 940.0 |
| 631 | Volunteer Spring | New Mexico | 75 | 7,106.4 |
| 632 | Wah Wah, or Ha-wa-wab Spring | Utah | 59 | 5,545.9 |
| 633 | Waucoba Peak | California | 65a | 11,261.1 |
| 634 | Warm Spring | Utah | 67 | 3,806.9 |
| 635 | Washington | do | 67 | 2,906.0 |
| 636 | Washington, Mount. | California | 73d | 10,801.9 |
| 637 | Washington Pass | Arizona | 68d | 8,825.5 |
| 638 | Welden | California | 65c | 2,716.9 |
| 639 | Weston's Pass | Colorado | 52d | 12,108.8 |
| 640 | West's Ranch | California | 74a | 595.6 |
| 641 | White Bluff Spring | Nevada | 66 | 5,019.8 |
| 642 | White Granite Mountain | California | 73c | 7,045.0 |
| 643 | White River Junction, North and South Forks | Utah | 51 | 7,088.0 |
| 644 | White Rock Spring | Arizona | 68c | 6,301.2 |
| 645 | White's Ranch, Huerfano Valley | Colorado | 62c | 7,469.0 |
| 646 | Whitney's Meadows | California | 65c | 9,371.4 |
| 647 | Whitney's Peak (called also Fisherman's Peak) | do | 65a | 14,448.4 |
| 648 | Whitlock's Cienega | Arizona | 83 | 3,579.5 |
| 649 | Wilcox Ranch, Antelope Park | Colorado | 61c | 9,600.1 |
| 650 | Wild Rose Spring | California | 65d | 4,683.4 |
| 651 | Willow Spring | Arizona | 76 | 7,294.8 |
| 652 | do | California | 73a | 2,530.8 |
| 653 | do | do | 81b | 420.0 |
| 654 | do | New Mexico | 77a | 6,676.6 |
| 655 | do | Utah | 50 | 4,421.6 |
| 656 | Willow Tree Spring | California | 73b | 2,500.0 |
| 657 | Wingate, Old Fort | New Mexico | 77a | 6,507.3 |
| 658 | Wingate, Fort | do | 76 | 7,037.7 |
| 659 | Winnemucca | Nevada | 39d | 4,365.6 |
| 660 | Workman's Ranch | California | 73c | 361.6 |
| 661 | Yellow Peak | Colorado | 61c | 13,618.0 |
| 662 | Young's Ranch | Utah | 49 | 5,642.2 |
| 663 | Yucca, Camp | New Mexico | 89 | 4,373.9 |
| 664 | Zuni, near | do | 76 | 6,391.8 |

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GEOGRAPHICAL POSITIONS.

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| Bozeman | 489 | Monte Christo Mill | 490 |
| Carlin | 489 | North Platte | 489 |
| Cheyenne | 489 | Ogden | 489 |
| Cimarron | 489 | Peko | 490 |
| Colorado Springs | 489 | Pioche | 489 |
| Deep Creek | 490 | Pipe Springs | 490 |
| Douglas, Camp | 491 | Provo | 490 |
| Elko | 490 | Richfield | 490 |
| Ellis, Fort | 491 | Ruby, Camp | 490 |
| Fillmore (near) | 490 | Saint George | 489 |
| Fred Steele, Fort | 488, 491 | Salt Lake City | 489 |
| Garland, Fort | 491 | Sanders, Fort | 491 |
| Georgetown | 488 | Santa Fé | 489 |
| Green River | 488 | Sidney Barracks | 489 |
| Gunnison | 488 | South Pueblo | 489 |
| Halleck, Camp | 490 | Toquerville | 490 |
| Hamilton (near) | 490 | Trinidad | 489 |
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| Georgetown..... | 530 | Prescott | 548 |
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| Gunnison | 549 | Santa Fé..... | 533 |
| Hughes | 536 | Trinidad..... | 542 |
| Independence, Camp..... | 537 | Truxton Springs | 546 |

PLATE VII.

Showing diurnal barometric oscillation.

- FIG. 1. *Georgetown, Colo.* Lat. $39^{\circ} 42'$. Altitude above sea 8587.8 feet; range of diurnal temperature $29^{\circ}.5$. Results from hourly observations taken from June 16 to July 5, 1873.
- FIG. 2. *Green River Station, Wyo.* Lat. $41^{\circ} 31'$. Altitude 6096.9 feet; range of diurnal temperature $38^{\circ}.1$. Results from hourly observations taken from June 5 to June 29, 1873.
- FIG. 3. *Salt Lake City, Utah.* Lat. $40^{\circ} 47'$. Altitude 4330.4 feet; range of diurnal temperature $33^{\circ}.6$. Results from hourly observations taken from July 13 to August 1, 1872.
- FIG. 4. *Colorado Springs, Colo.* Lat. $38^{\circ} 49'$. Altitude 6030.4 feet; range of diurnal temperature $26^{\circ}.1$. Results from hourly observations taken from July 24 to August 10, 1873.
- FIG. 5. *Los Angeles, Cal.* Lat. $34^{\circ} 03'$. Altitude 325 feet; range of diurnal temperature $19^{\circ}.9$. Results from hourly observations taken from June 11 to June 28, 1875.
- FIG. 6. *Santa Fé, N. Mex.* Lat. $35^{\circ} 41'$. Altitude 7044.2 feet; range of diurnal temperature $31^{\circ}.7$. Results from hourly observations taken from June 11 to June 20, 1873.

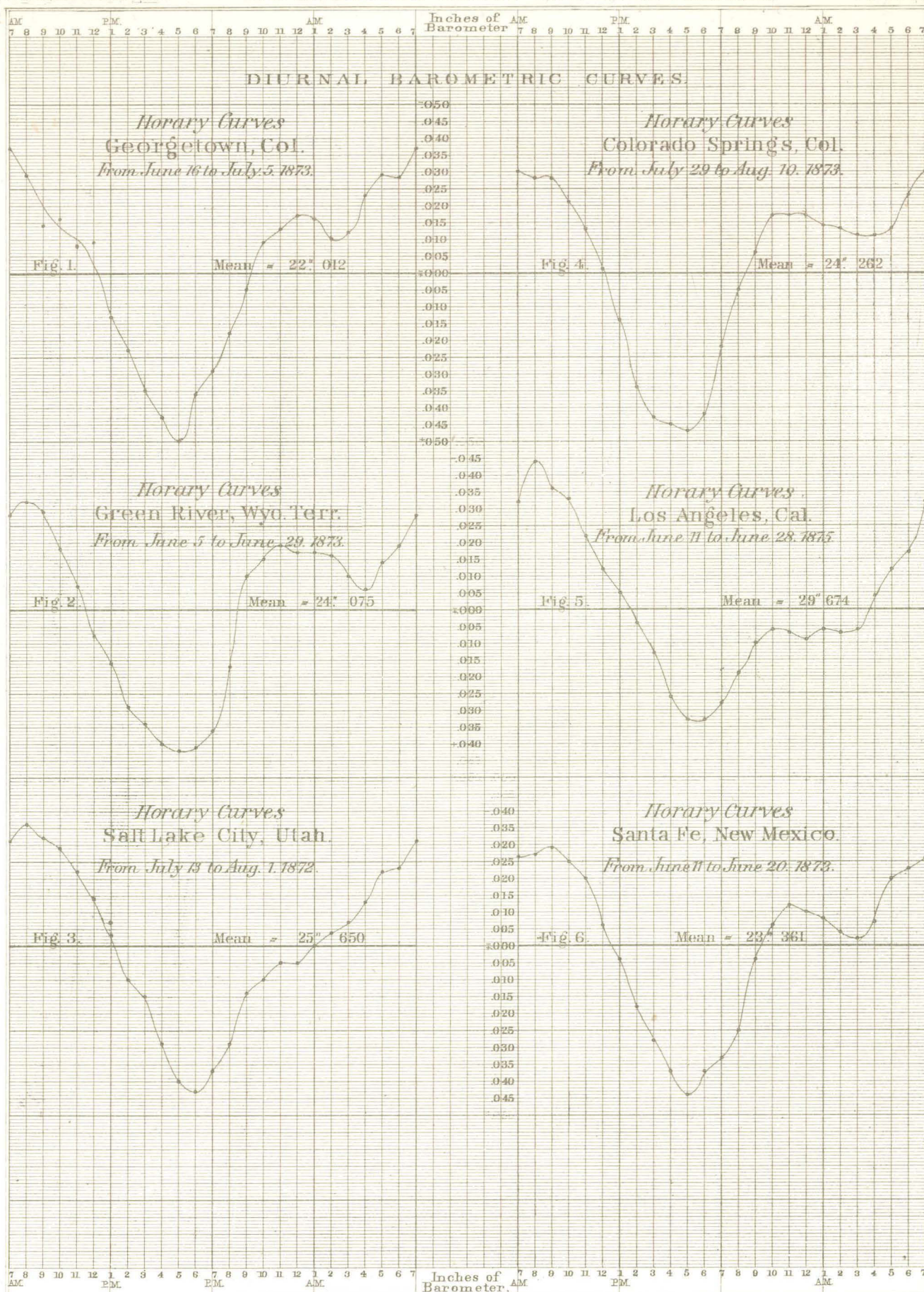


PLATE VIII.

Showing diurnal barometric oscillation.

- FIG. 7. *Hughes, Colo.* Lat. $39^{\circ} 59'$. Altitude 5021.6 feet; range of diurnal temperature $43^{\circ}.5$. Results from hourly observations taken from July 12 to July 23, 1873.
- FIG. 8. *Camp Independence, Cal.* Lat. $36^{\circ} 50'$. Altitude 3956.5 feet; range of diurnal temperature $27^{\circ}.7$. Results from hourly observations taken from July 19 to August 9, 1871.
- FIG. 9. *Beaver, Utah.* Lat. $38^{\circ} 16'$. Altitude 5915.6 feet; range of diurnal temperature $29^{\circ}.8$. Results from hourly observations taken from August 8 to August 25, 1872.
- FIG. 10. *Labran, Colo.* Lat. $38^{\circ} 23'$. Altitude 5217.8 feet; range of diurnal temperature $37^{\circ}.5$. Results from hourly observations taken from August 12 to August 27, 1873.
- FIG. 11. *Cottonwood Springs, Nev.* Lat. $36^{\circ} 03'$. Altitude 3449 feet; range of diurnal temperature $27^{\circ}.7$. Results from hourly observations taken from August 31 to September 14, 1871.
- FIG. 12. *Beaver, Utah.* Lat. $38^{\circ} 16'$. Altitude 5915.6 feet; range of diurnal temperature $22^{\circ}.6$. Results from hourly observations taken from August 30 to September 7, 1872.

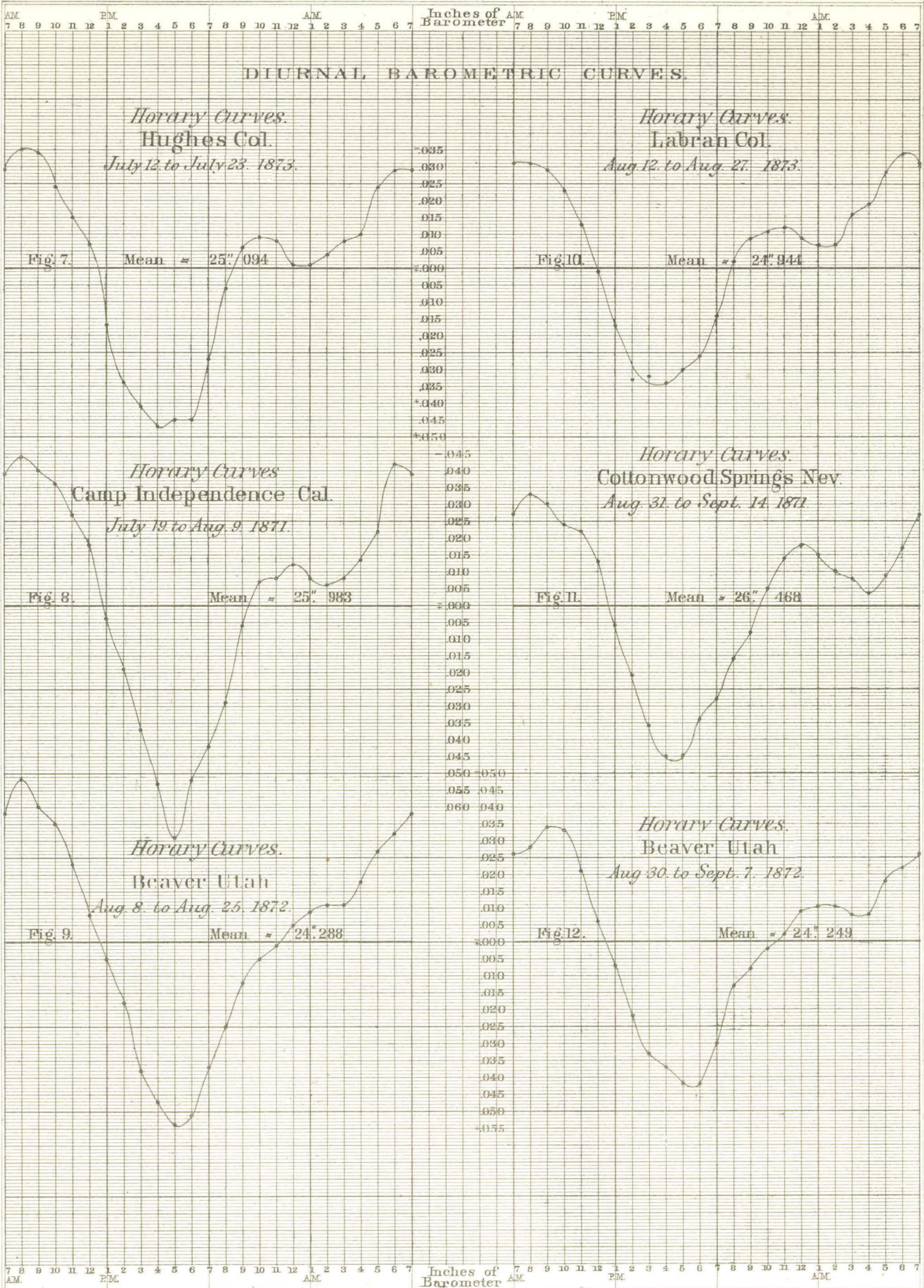


PLATE IX.

Showing diurnal barometric oscillation.

- FIG. 13. *Trinidad, Colo.* Lat. $37^{\circ} 10'$. Altitude 5989.9 feet; range of diurnal temperature $32^{\circ}3$. Results from hourly observations taken from September 4 to September 19, 1873.
- FIG. 14. *Cheyenne, Wyo.* Lat. $41^{\circ} 08'$. Altitude 6041 feet; range of diurnal temperature $35^{\circ}1$. Results from hourly observations taken from September 15 to October 21, 1872.
- FIG. 15. *Pioche, Nev.* Lat. $37^{\circ} 55'$. Altitude 5942.3 feet; range of diurnal temperature $23^{\circ}4$. Results from hourly observations taken from September 27 to October 14, 1872.
- FIG. 16. *Ogden, Utah.* Lat. $41^{\circ} 13'$. Altitude 4374.0 feet; range of diurnal temperature $38^{\circ}4$. Results from hourly observations taken from September 26 to October 3, 1873.
- FIG. 17. *Truxton Springs, Ariz.* Lat. $35^{\circ} 25'$. Altitude 3885.5 feet; range of diurnal temperature $33^{\circ}6$. Results from hourly observations taken from October 23 to October 25, 1871.
- FIG. 18. *Fort Fred. Steele, Wyo.* Lat. $41^{\circ} 47'$. Altitude 6840 feet; range of diurnal temperature 14° . Results from hourly observations taken from October 30 to November 27, 1872.

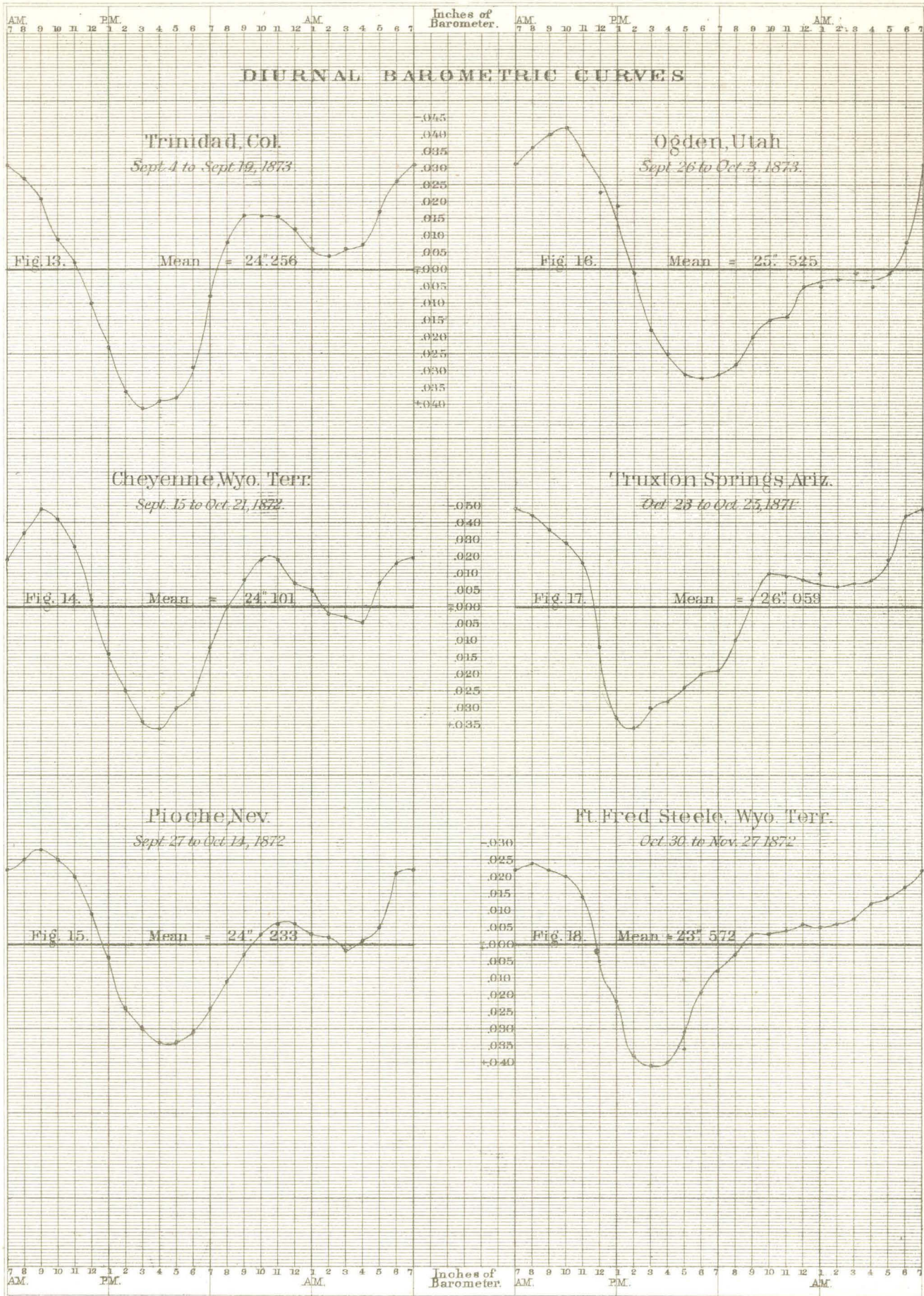


PLATE XI.

Showing diurnal temperature oscillation.

- FIG. 25. *Georgetown, Colo.* Results from observations taken hourly from June 16 to July 5, 1873.
FIG. 26. *Green River Station, Wyo.* Results from observations taken hourly from June 5 to June 29, 1873.
FIG. 27. *Los Angeles, Cal.* Results from observations taken hourly from June 11 to June 28, 1875.
FIG. 28. *Salt Lake City, Utah.* Results from observations taken hourly from July 13 to August 1, 1872.
FIG. 29. *Santa Fé, N. Mex.* Results from observations taken hourly from June 11 to June 20, 1873.
FIG. 30. *Colorado Springs, Colo.* Results from observations taken hourly from July 29 to August 10, 1873.

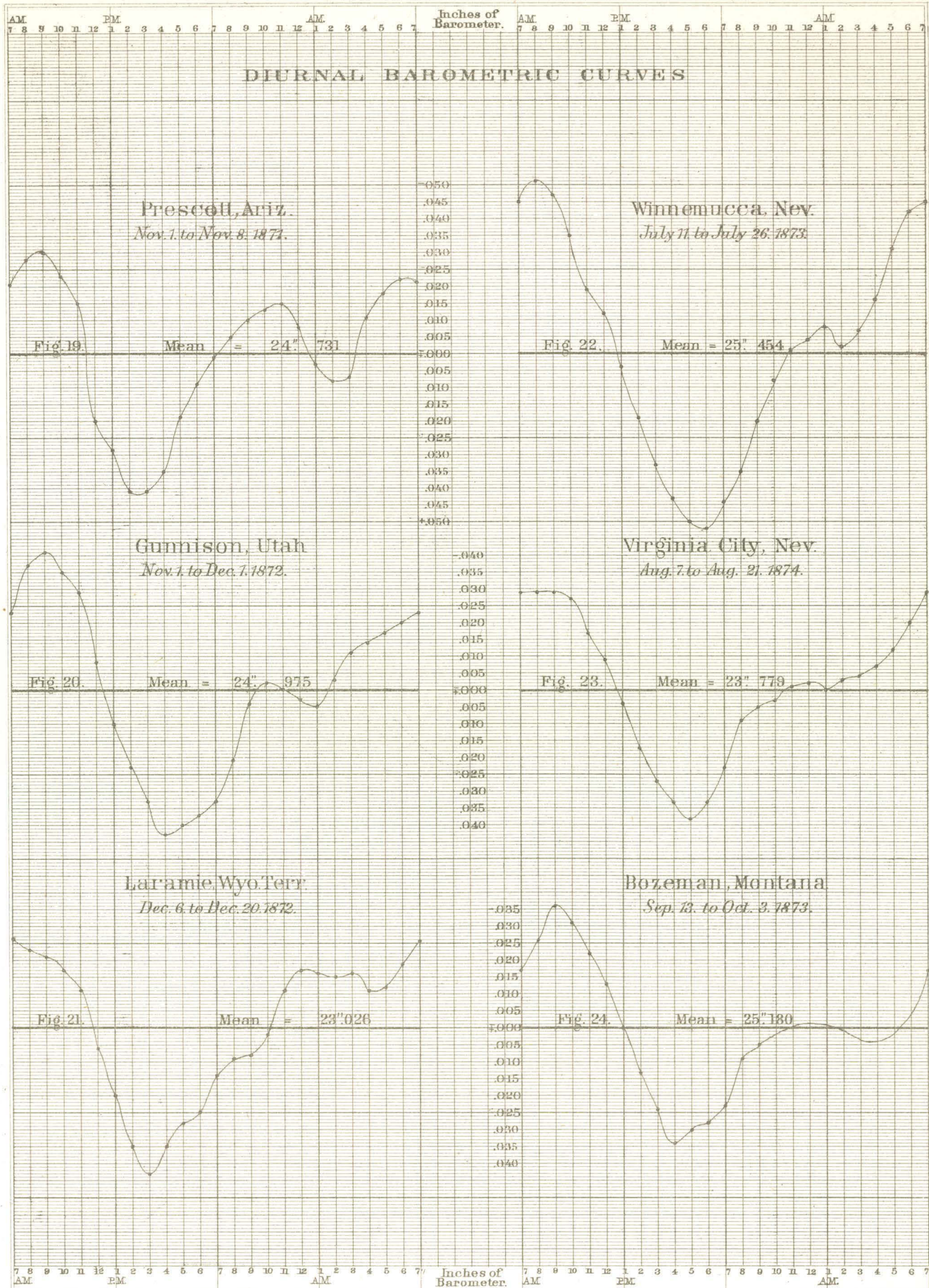


PLATE X.

Showing diurnal barometric oscillation.

- FIG. 19. *Port Prescott, Ariz.* Lat. $34^{\circ} 33'$. Altitude 5318 feet; range of diurnal temperature 38° . Results from hourly observations taken from November 1 to November 8, 1871.
- FIG. 20. *Gunnison, Utah.* Lat. $39^{\circ} 10'$. Altitude 5144.6 feet; range of diurnal temperature $34^{\circ}.6$. Results from hourly observations taken from November 1 to December 1, 1872.
- FIG. 21. *Laramie, Wyo.* Lat. $41^{\circ} 19'$. Altitude 7123 feet; range of diurnal temperature $30^{\circ}.9$. Results from hourly observations taken from December 6 to December 30, 1872.
- FIG. 22. *Winnemucca, Nev.* Lat. $40^{\circ} 58'$. Altitude 4355 feet; range of diurnal temperature $35^{\circ}.5$. Results from hourly observations taken from July 23 to July 28, 1873.
- FIG. 23. *Virginia City, Nev.* Lat. $39^{\circ} 17'$. Altitude 6339 feet; range of diurnal temperature $17^{\circ}.4$. Results from hourly observations taken from August 5 to August 31, 1873.
- FIG. 24. *Bozeman, Mont.* Lat. $45^{\circ} 41'$. Altitude 4838.6 feet; range of diurnal temperature $16^{\circ}.1$. Results from hourly observations taken from September 11 to September 31, 1873.

DIURNAL TEMPERATURE

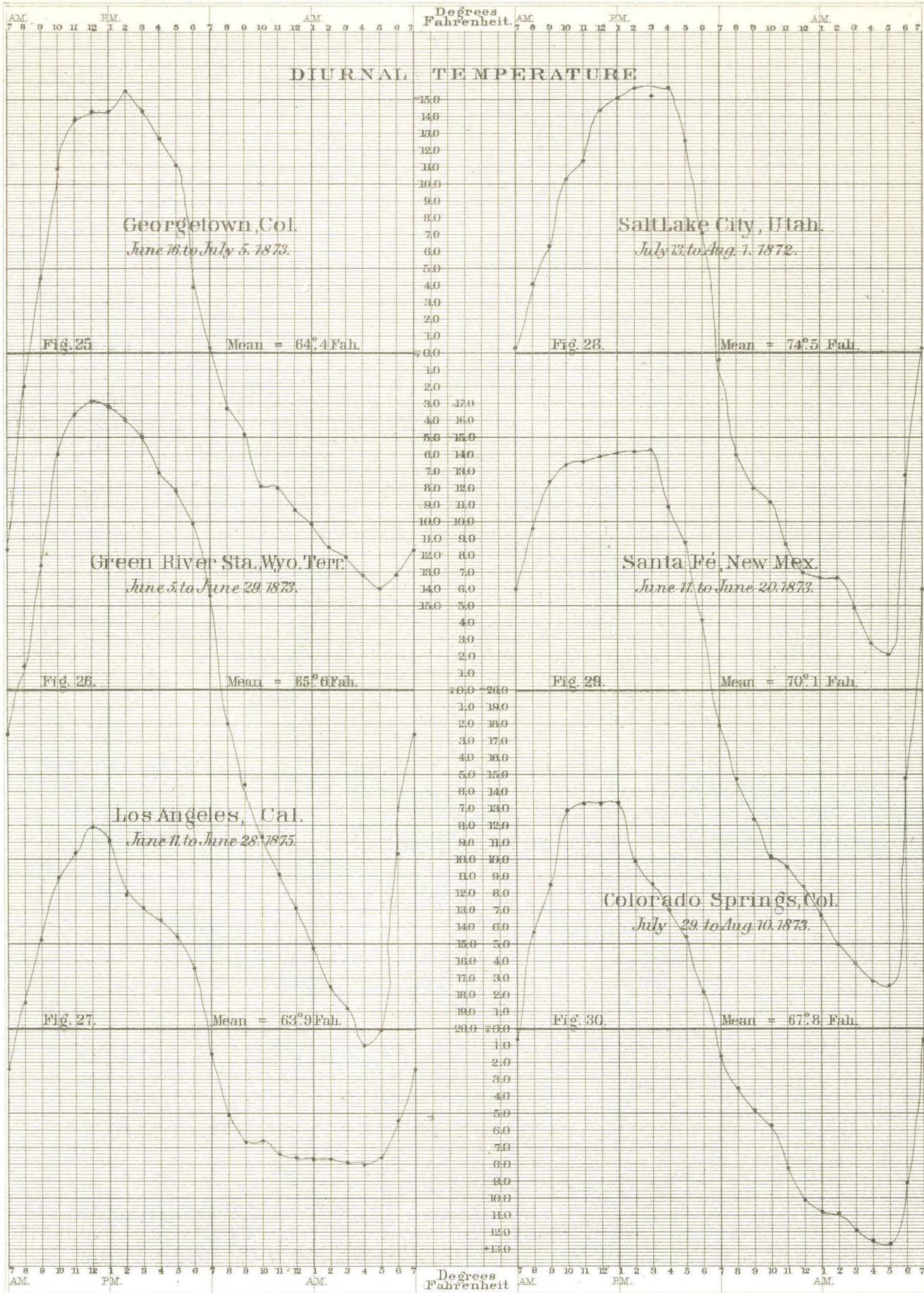


PLATE XI.

Showing diurnal temperature oscillation.

- FIG. 25. *Georgetown, Colo.* Results from observations taken hourly from June 16 to July 5, 1873.
FIG. 26. *Green River Station, Wyo.* Results from observations taken hourly from June 5 to June 29, 1873.
FIG. 27. *Los Angeles, Cal.* Results from observations taken hourly from June 11 to June 28, 1875.
FIG. 28. *Salt Lake City, Utah.* Results from observations taken hourly from July 13 to August 1, 1872.
FIG. 29. *Santa Fé, N. Mex.* Results from observations taken hourly from June 11 to June 20, 1873.
FIG. 30. *Colorado Springs, Colo.* Results from observations taken hourly from July 29 to August 10, 1873.

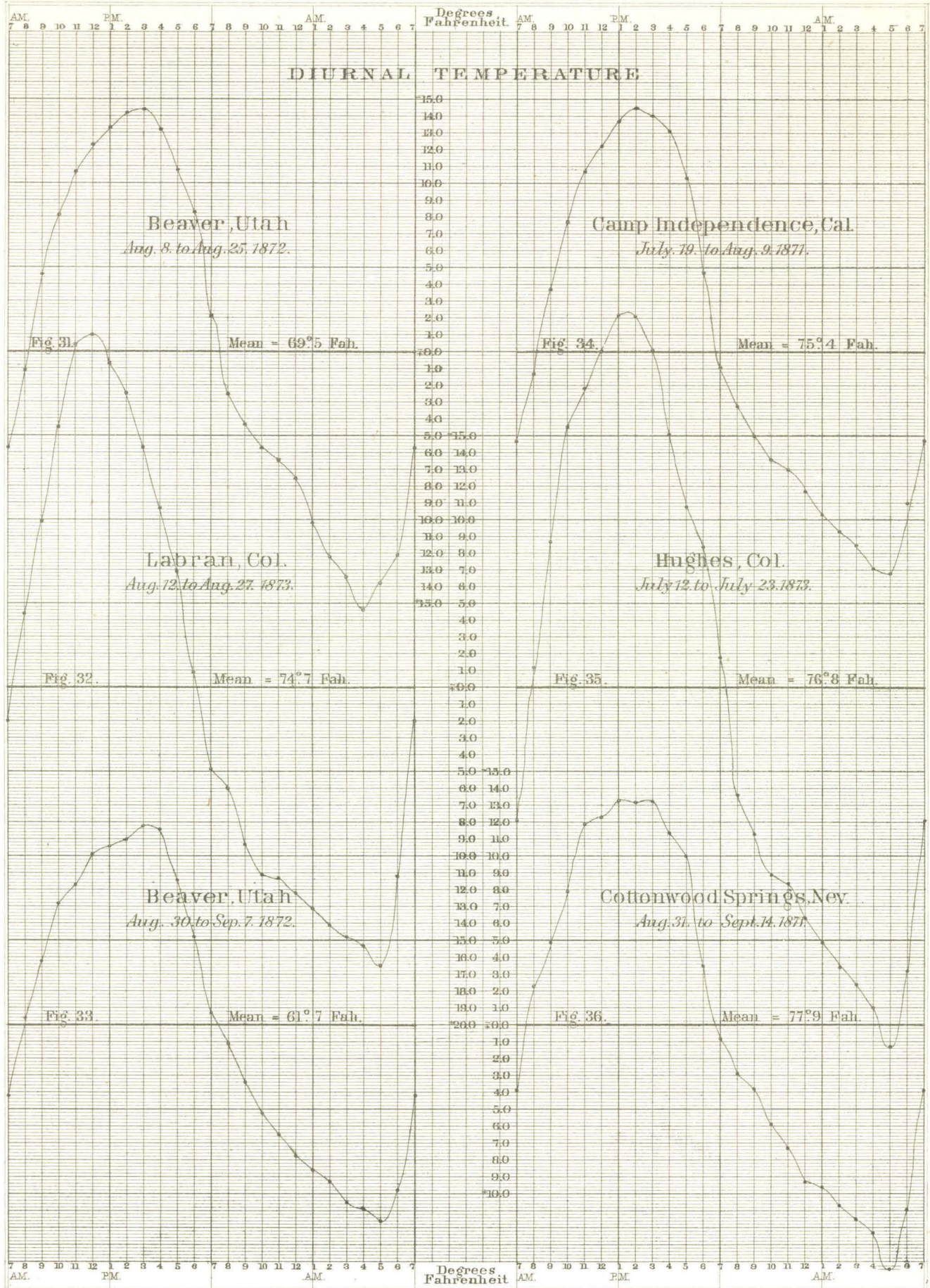


PLATE XII.

Showing diurnal temperature oscillation.

- FIG. 31. *Beaver, Utah.* Results from observations taken hourly from August 8 to August 25, 1872.
FIG. 32. *Labran, Colo.* Results from observations taken hourly from August 12 to August 27, 1873.
FIG. 33. *Beaver, Utah.* Results from observations taken hourly from August 30 to September 7, 1872.
FIG. 34. *Camp Independence, Cal.* Results from observations taken hourly from July 19 to August 9, 1871.
FIG. 35. *Hughes, Colo.* Results from observations taken hourly from July 12 to July 23, 1873.
FIG. 36. *Cottonwood Springs, Nev.* Results from observations taken hourly from August 31 to September 14, 1871.

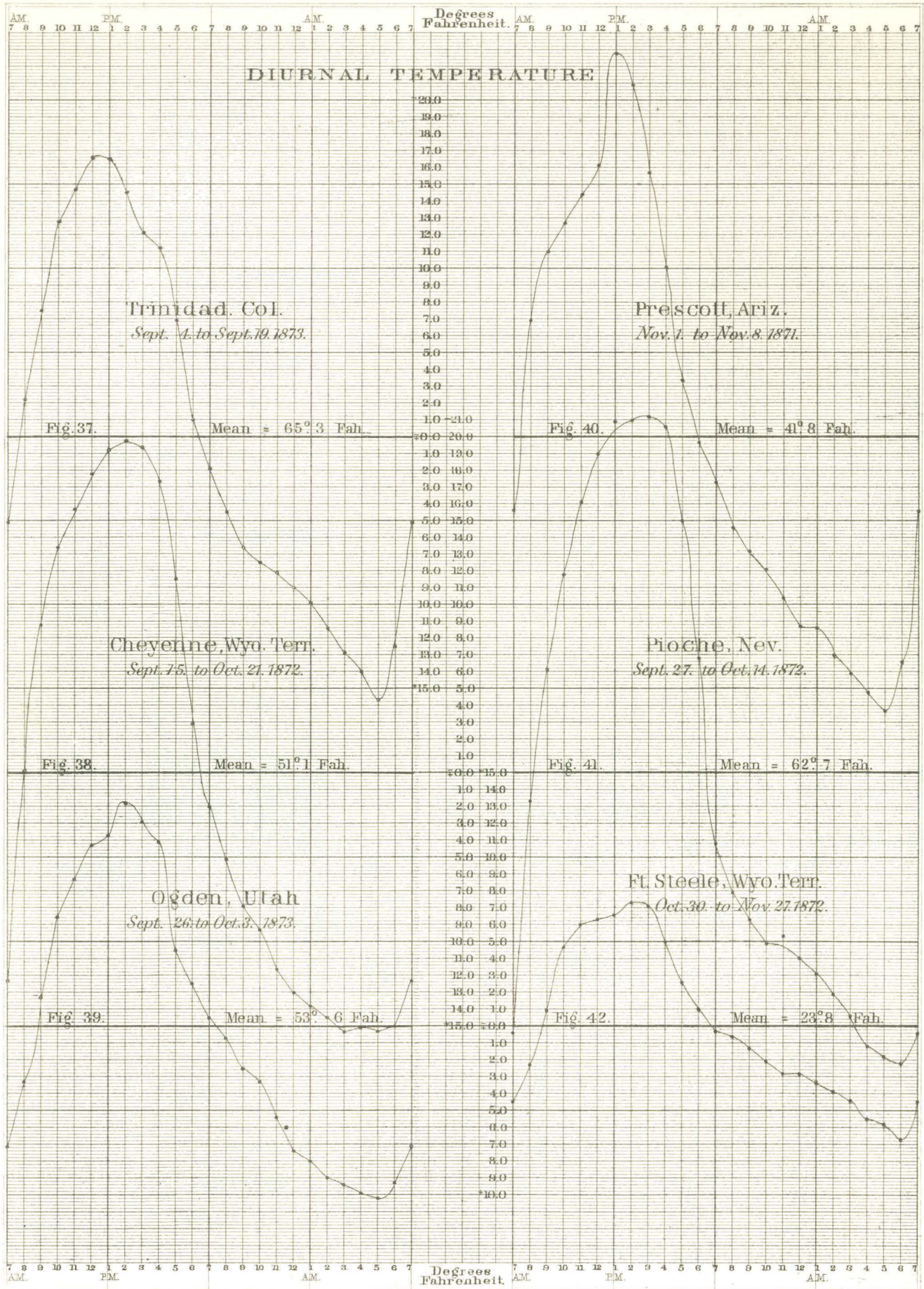


PLATE XIII.

Showing diurnal temperature oscillation.

- FIG. 37. *Trinidad, Colo.* Results from observations taken hourly from September 4 to September 19, 1873.
FIG. 38. *Cheyenne, Wyo.* Results from observations taken hourly from September 15 to October 31, 1872.
FIG. 39. *Ogden, Utah.* Results from observations taken hourly from September 26 to October 3, 1873.
FIG. 40. *Prescott, Ariz.* Results from observations taken hourly from November 1 to November 8, 1871.
FIG. 41. *Pioche, Nev.* Results from observations taken hourly from September 27 to October 14, 1872.
FIG. 42. *Fort Fred. Steele, Wyo.* Results from observations taken hourly from October 30 to November 27, 1872.

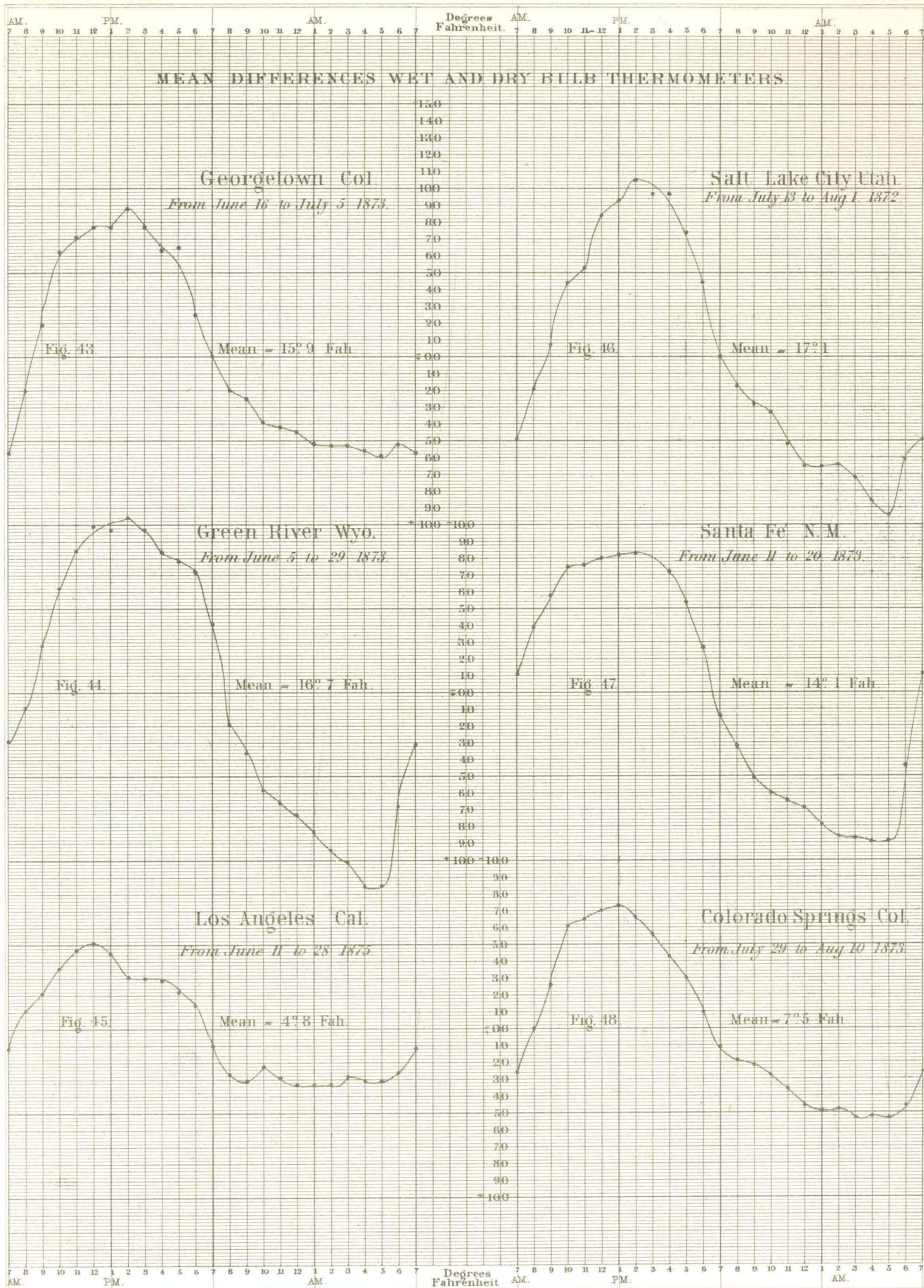


PLATE XIV.

Showing mean difference wet and dry thermometers.

- FIG. 43. *Georgetown, Colo.* Results from observations taken hourly from June 16 to July 5, 1873.
FIG. 44. *Green River Station, Wyo.* Results from observations taken hourly from June 5 to June 29, 1873.
FIG. 45. *Los Angeles, Cal.* Results from observations taken hourly from June 11 to June 28, 1875.
FIG. 46. *Salt Lake City, Utah.* Results from observations taken hourly from July 13 to August 1, 1872.
FIG. 47. *Santa Fé, N. Mex.* Results from observations taken hourly from June 11 to June 20, 1873.
FIG. 48. *Colorado Springs, Colo.* Results from observations taken hourly from July 29 to August 10, 1873.

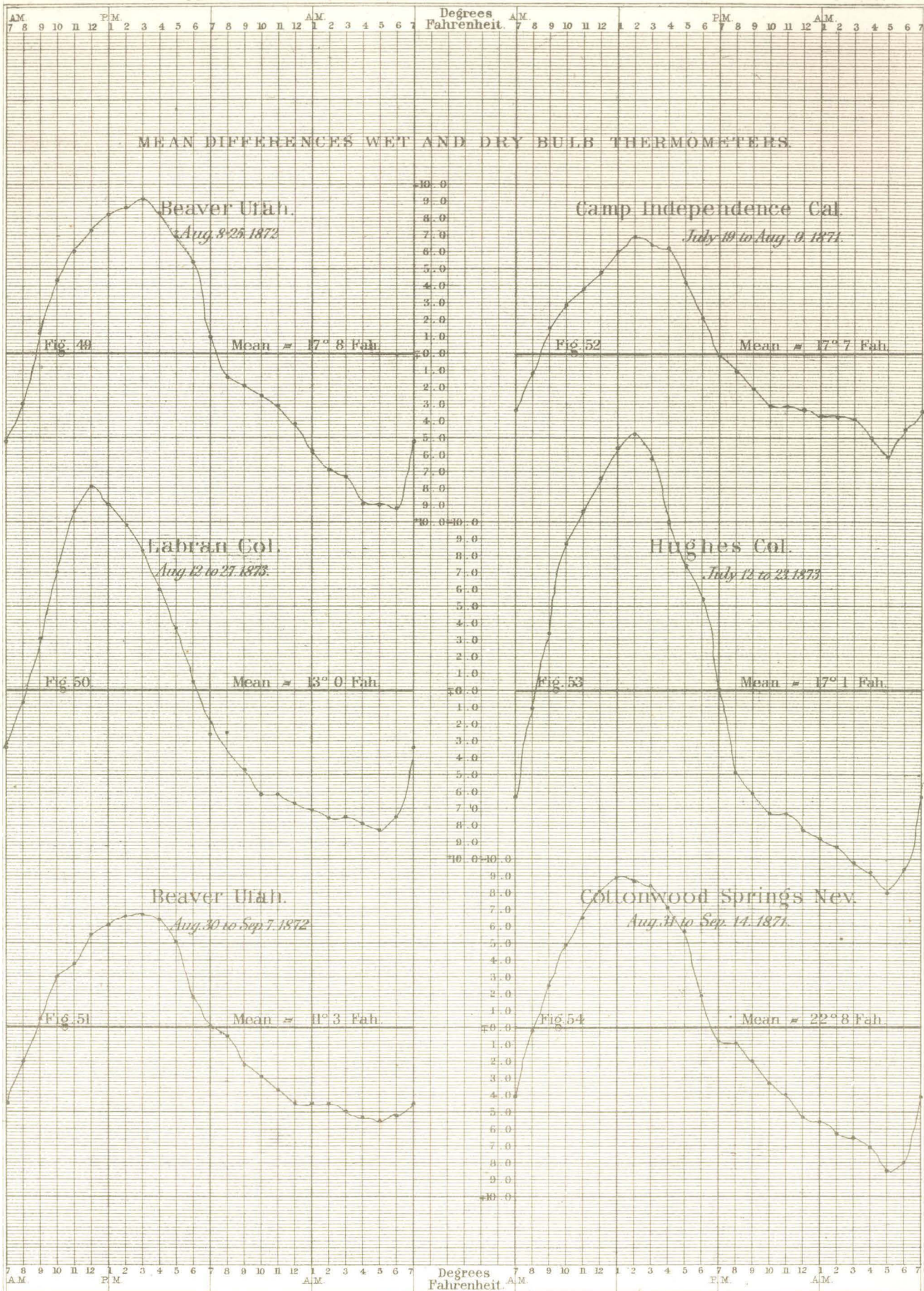


PLATE XV.

Showing mean difference-wet and dry thermometers.

- FIG. 49. *Beaver, Utah.* Results from observations taken hourly from August 8 to August 25, 1872.
FIG. 50. *Labran, Colo.* Results from observations taken hourly from August 12 to August 27, 1873.
FIG. 51. *Beaver, Utah.* Results from observations taken hourly from August 30 to September 7, 1872.
FIG. 52. *Camp Independence, Cal.* Results from observations taken hourly from July 13 to August 9, 1871.
FIG. 53. *Hughes, Colo.* Results from observations taken hourly from July 12 to July 23, 1873.
FIG. 54. *Cottonwood Springs, Nev.* Results from observations taken hourly from August 31 to September 14, 1871.

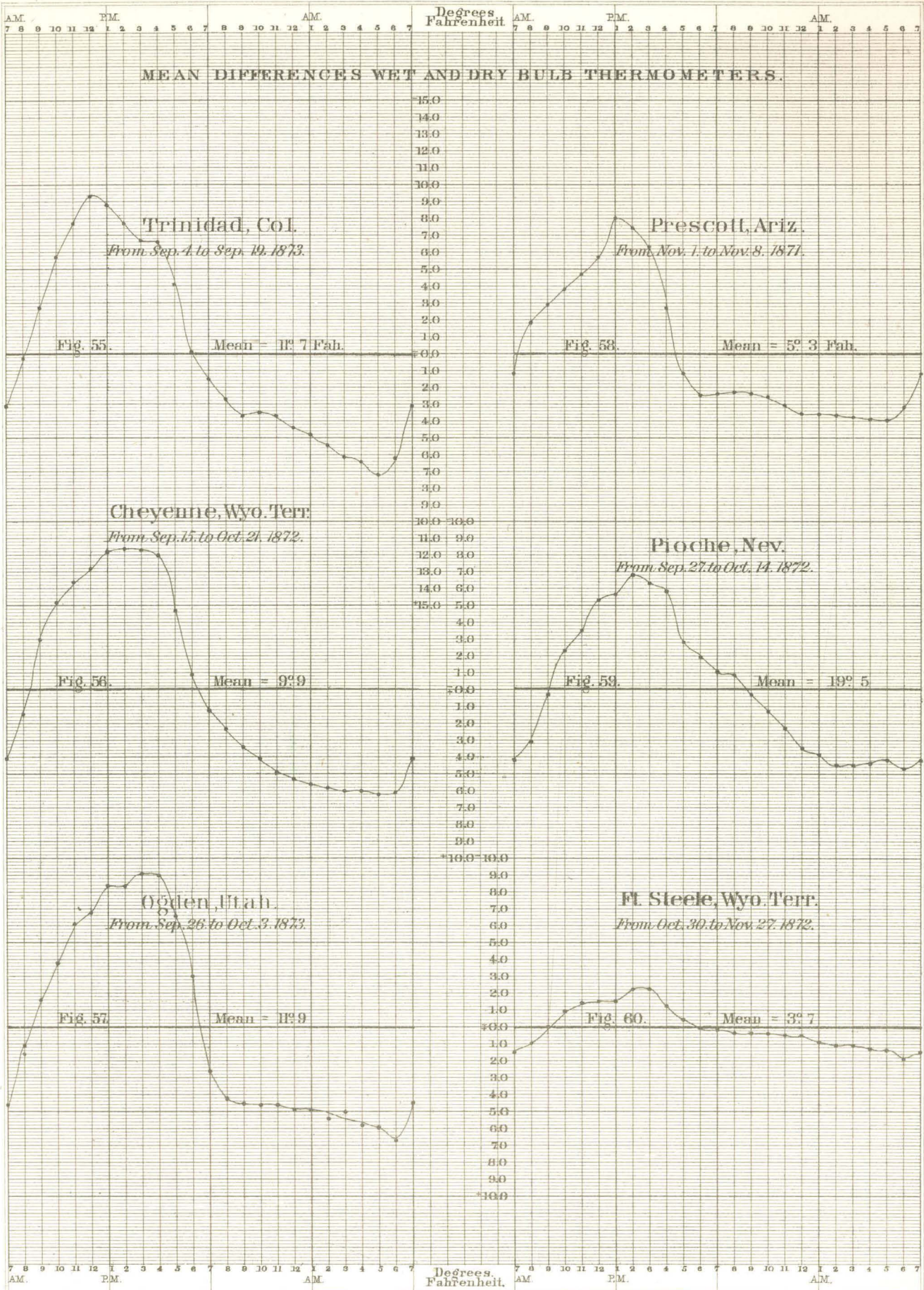


PLATE XVI.

Showing mean difference wet and dry thermometers.

- FIG. 55. *Trinidad, Colo.* Results from observations taken hourly from September 4 to September 19, 1873.
FIG. 56. *Cheyenne, Wyo.* Results from observations taken hourly from September 15 to October 21, 1872.
FIG. 57. *Ogden, Utah.* Results from observations taken hourly from September 26 to October 3, 1873.
FIG. 58. *Prescott, Ariz.* Results from observations taken hourly from November 1 to November 8, 1871.
FIG. 59. *Pioche, Nev.* Results from observations taken hourly from September 27 to October 14, 1872.
FIG. 60. *Fort Fred. Steele, Wyo.* Results from observations taken hourly from October 30 to November 27, 1872.

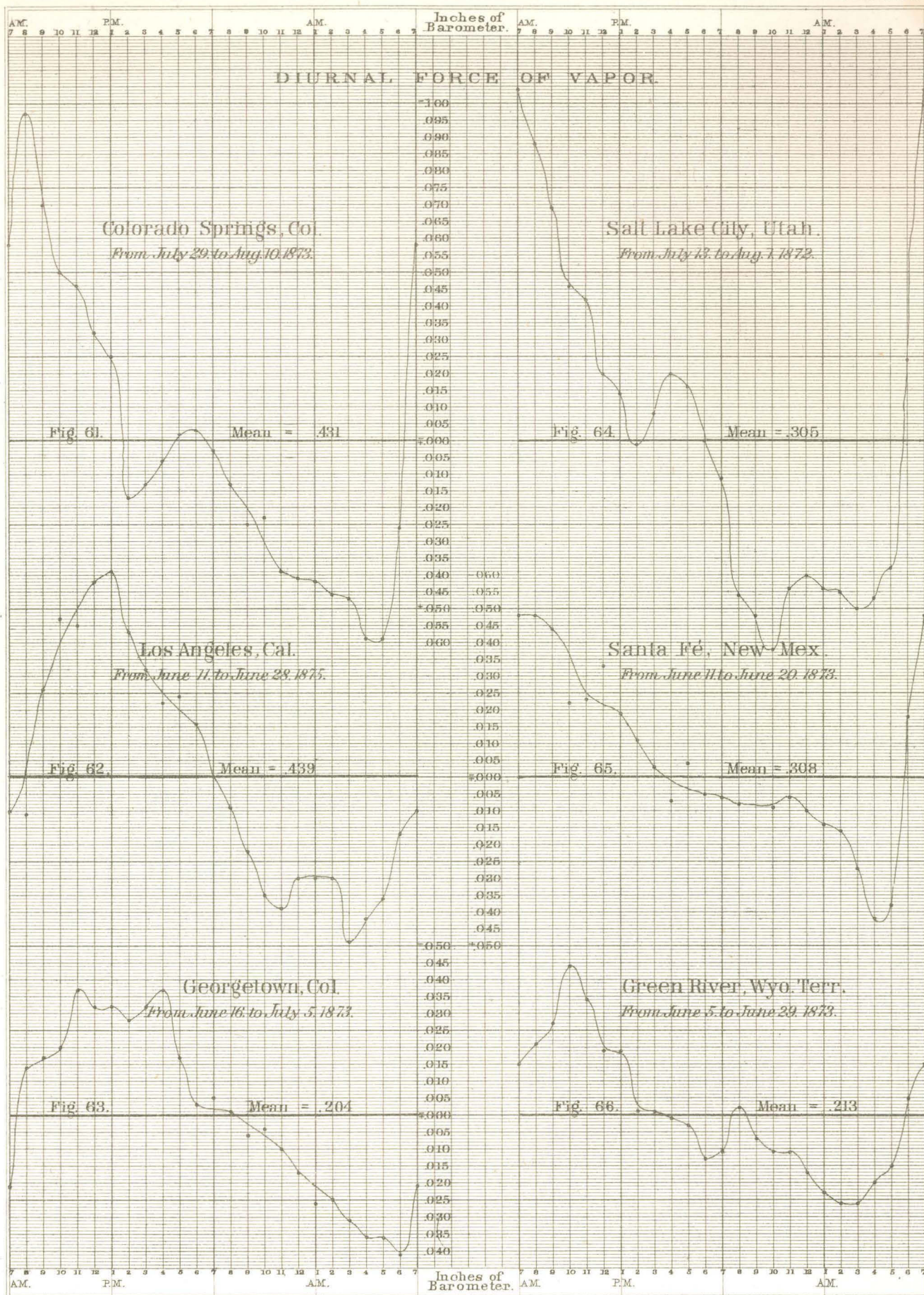


PLATE XVII.

Showing diurnal force of vapor.

- FIG. 61. *Colorado Springs, Colo.* Results from observations taken hourly from July 29 to August 10, 1873.
FIG. 62. *Los Angeles, Cal.* Results from observations taken hourly from June 11 to June 28, 1875.
FIG. 63. *Georgetown, Colo.* Results from observations taken hourly from June 16 to July 5, 1873.
FIG. 64. *Salt Lake City, Utah.* Results from observations taken hourly from July 13 to August 1, 1873.
FIG. 65. *Santa Fé, N. Mex.* Results from observations taken hourly from June 11 to June 20, 1873.
FIG. 66. *Green River, Wyo.* Results from observations taken hourly from June 5 to June 29, 1873.

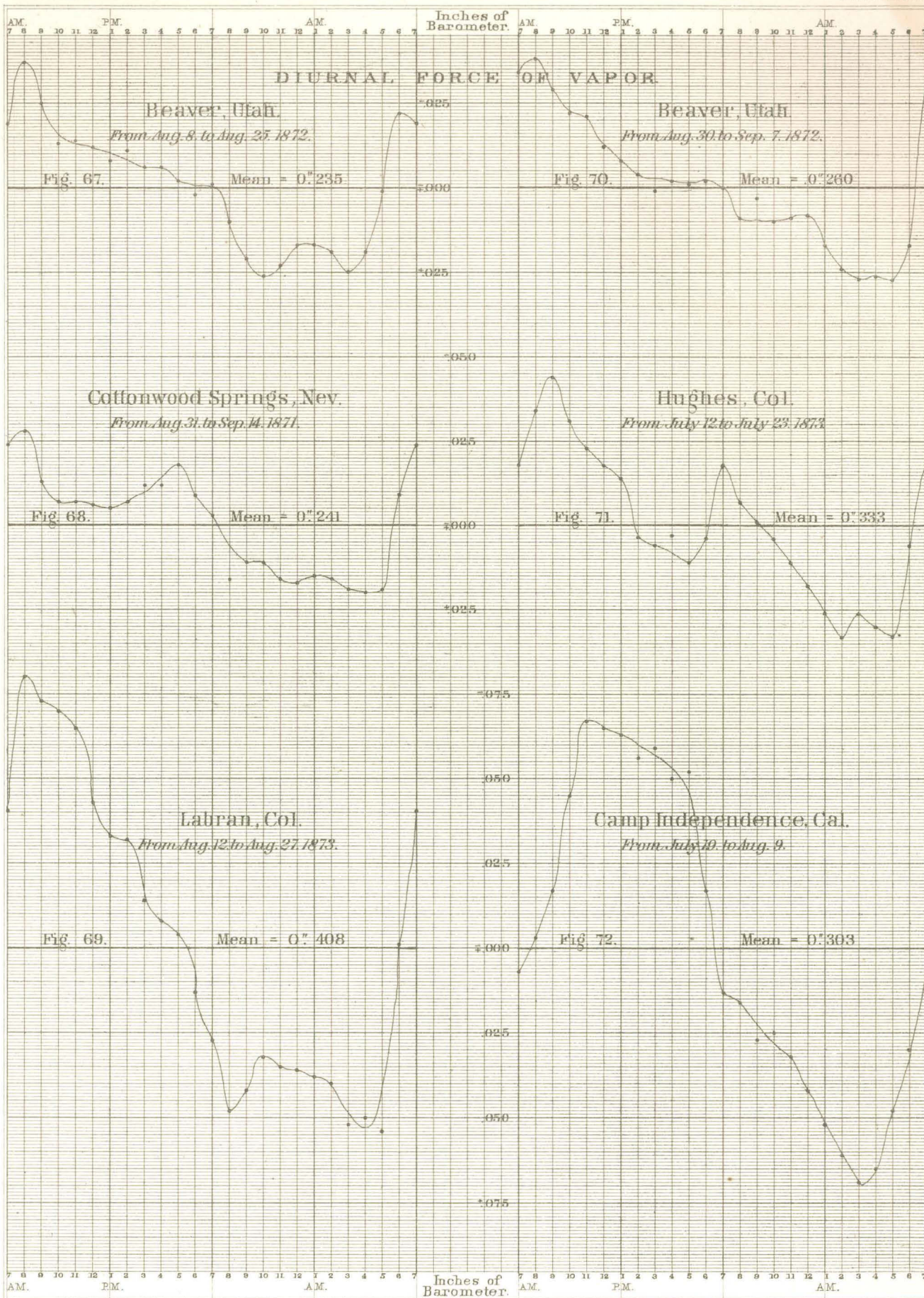


PLATE XVIII.

Showing diurnal force of vapor.

FIG. 67. *Beaver, Utah.* Results from observations taken hourly from August 8 to August 25, 1872.

FIG. 68. *Cottonwood Springs, Nev.* Results from observations taken hourly from August 31 to September 14, 1871.

FIG. 69. *Labran, Colo.* Results from observations taken hourly from August 12 to August 27, 1873.

FIG. 70. *Beaver, Utah.* Results from observations taken hourly from August 30 to September 7, 1872.

FIG. 71. *Hughes, Colo.* Results from observations taken hourly from July 12 to July 23, 1873.

FIG. 72. *Camp Independence, Cal.* Results from observations taken hourly from July 19 to August 9, 1871.

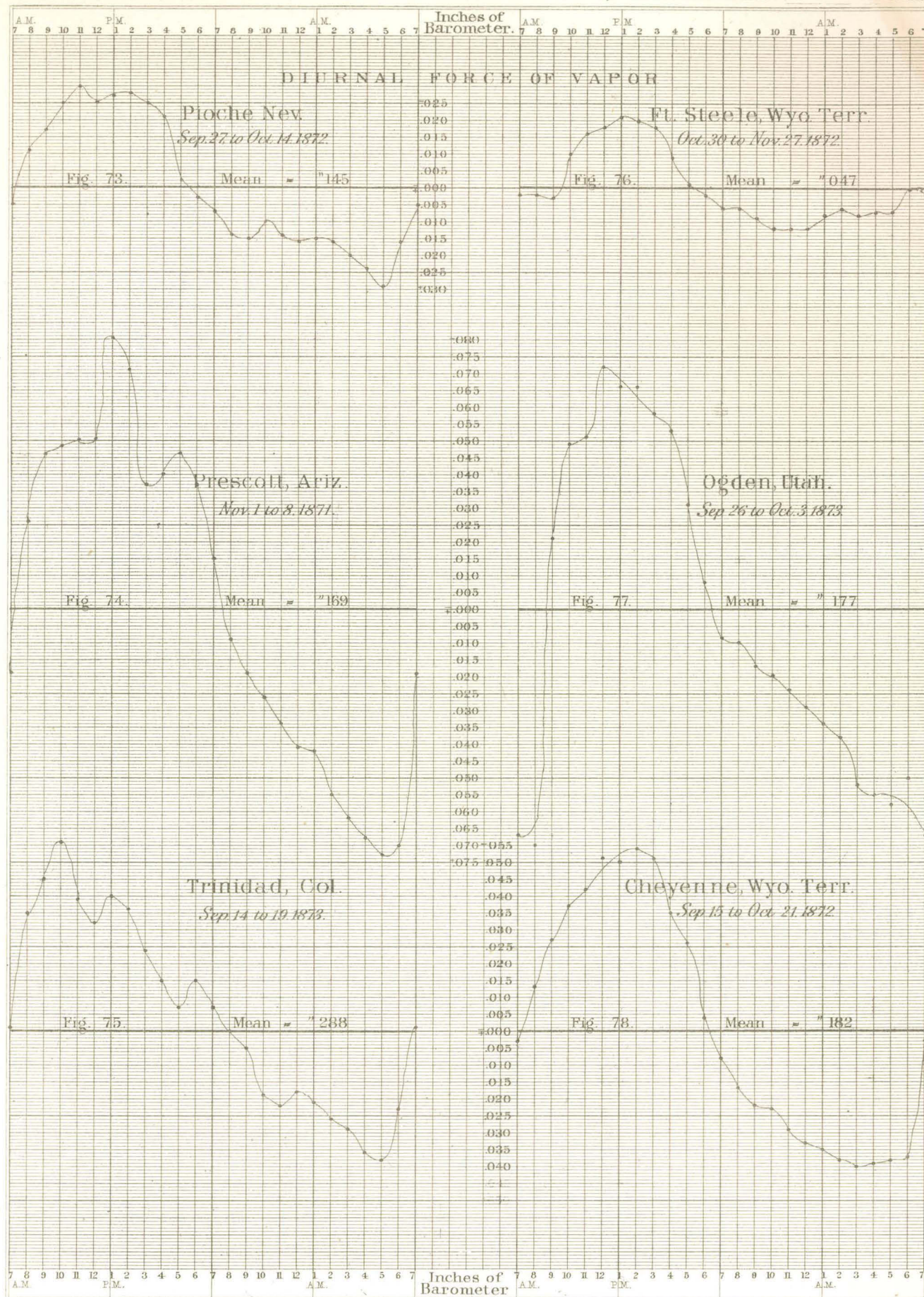


PLATE XIX.

Showing diurnal force of vapor.

- FIG. 73. *Pioche, Nev.* Results from observations taken hourly from September 27 to October 14, 1872.
FIG. 74. *Prescott, Ariz.* Results from observations taken hourly from November 1 to November 8, 1871.
FIG. 75. *Trinidad, Colo.* Results from observations taken hourly from September 14 to September 19, 1873.
FIG. 76. *Fort Fred. Steele, Wyo.* Results from observations taken hourly from October 30 to November 27, 1872.
FIG. 77. *Ogden, Utah.* Results from observations taken hourly from September 26 to October 3, 1873.
FIG. 78. *Cheyenne, Wyo.* Results from observations taken hourly from September 15 to October 21, 1872.

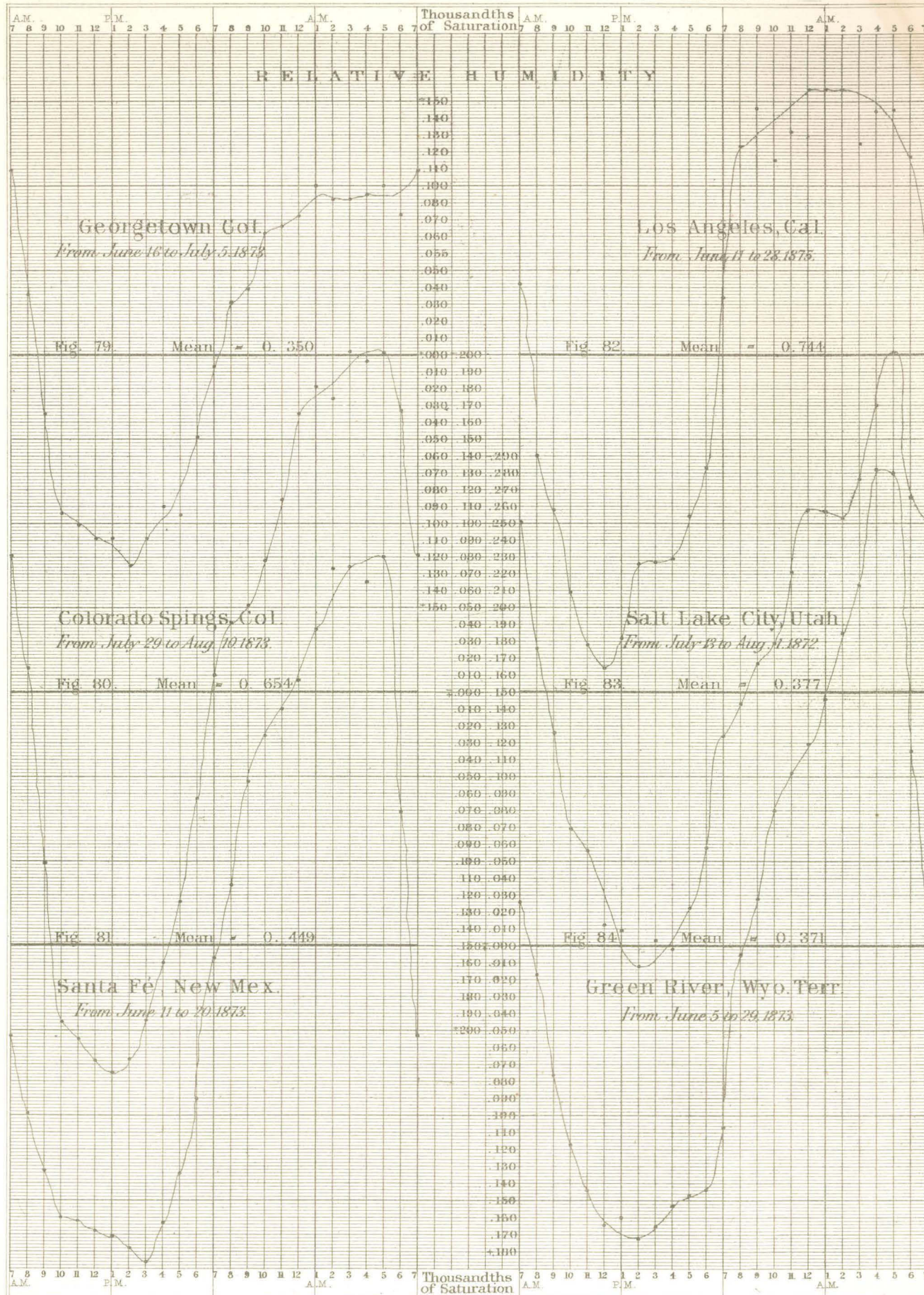


PLATE XX.

Showing relative humidity.

- FIG. 79. *Georgetown, Colo.* Results from observations taken hourly from June 16 to July 5, 1873.
FIG. 80. *Colorado Springs, Colo.* Results from observations taken hourly from July 29 to August 10, 1873.
FIG. 81. *Santa Fé, N. Mex.* Results from observations taken hourly from June 11 to June 20, 1873.
FIG. 82. *Los Angeles, Cal.* Results from observations taken hourly from June 11 to June 28, 1875.
FIG. 83. *Salt Lake City, Utah.* Results from observations taken hourly from July 13 to August 1, 1872.
FIG. 84. *Green River Station, Wyo.* Results from observations taken hourly from June 5 to June 29, 1873.

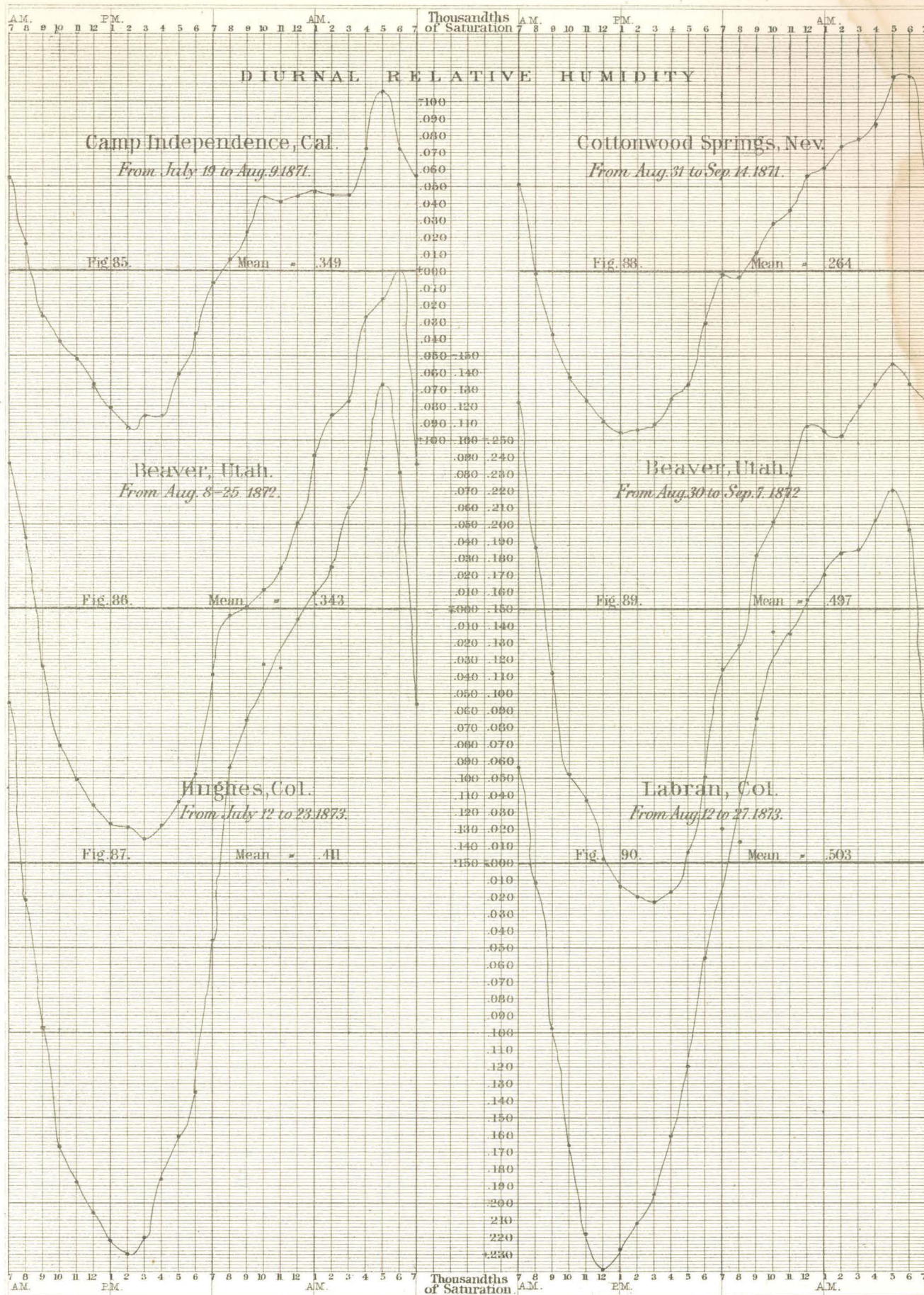


PLATE XXI.

Showing relative humidity.

FIG. 85. *Camp Independence, Cal.* Results from observations taken hourly from July 19 to August 9, 1871.

FIG. 86. *Beaver, Utah.* Results from observations taken hourly from August 8 to August 25, 1872.

FIG. 87. *Hughes, Colo.* Results from observations taken hourly from July 12 to July 23, 1873.

FIG. 88. *Cottonwood Springs, Nev.* Results from observations taken hourly from August 31 to September 14, 1871.

FIG. 89. *Beaver, Utah.* Results from observations taken hourly from August 30 to September 7, 1872.

FIG. 90. *Labran, Colo.* Results from observations taken hourly from August 12 to August 27, 1873.

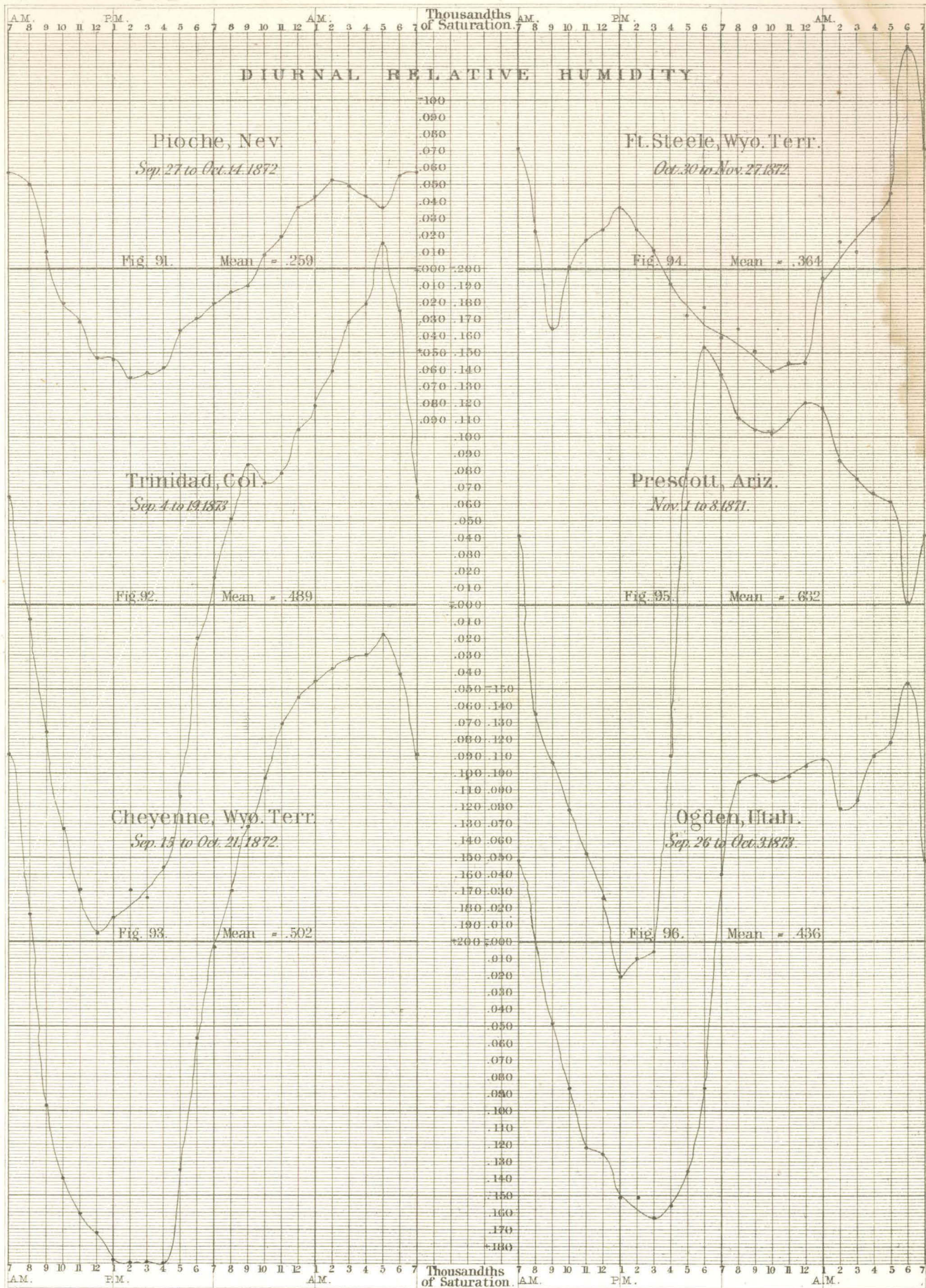


PLATE XXII.

Showing relative humidity.

- FIG. 91. *Pioche, Nev.* Results from observations taken hourly from September 27 to October 14, 1872.
FIG. 92. *Trinidad, Colo.* Results from observations taken hourly from September 4 to September 19, 1873.
FIG. 93. *Cheyenne, Wyo.* Results from observations taken hourly from September 15 to October 21, 1872.
FIG. 94. *Fort Fred. Steele, Wyo.* Results from observations taken hourly from October 30 to November 15, 1872.
FIG. 95. *Prescott, Ariz.* Results from observations taken hourly from November 1 to November 8, 1871.
FIG. 96. *Ogden, Utah.* Results from observations taken hourly from September 26 to October 3, 1873.