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CHARLES D. WALCOTT, DIRECTOR

THE
NORTHWEST BOUNDARY OF TEXAS

BY

MARCUS BAKER



WASHINGTON
GOVERNMENT PRINTING OFFICE
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LETTER OF TRANSMITTAL

DEPARTMENT OF THE INTERIOR,
UNITED STATES GEOLOGICAL SURVEY,
Washington, D. C., January 16, 1902.

SIR: I have the honor to transmit herewith the manuscript of an account of the northwest boundary of Texas, and to suggest its publication as a bulletin of the United States Geological Survey.

Very respectfully,

MARCUS BAKER,
Cartographer.

Hon. CHARLES D. WALCOTT,
Director of United States Geological Survey.

THE NORTHWEST BOUNDARY OF TEXAS.

By MARCUS BAKER.

INTRODUCTION.

The particular part of the Texas boundary here considered begins on the eastern bank of the Rio Grande near El Paso and runs easterly on the thirty-second parallel to the one hundred and third meridian; thence north on that meridian to its intersection with the parallel of $36^{\circ} 30'$, the northwest corner of Texas; thence eastward on the parallel of $36^{\circ} 30'$ to the one hundredth meridian, and thence southward on that meridian to Red River. It is shown in the accompanying figure (fig. 1). This boundary, except the part on the one hundredth meridian, was created by Congress in an act approved September 9, 1850. On some recent Government maps this boundary is not shown as here described. It is shown as coincident with the parallels, but instead of coinciding with the meridians it is placed 1 or 2 miles west of them. This discrepancy has led to an inquiry as to the cause and an investigation of the law and the various surveys based thereon.

In 1835 Texas declared its independence of Mexico, and on December 29, 1845, was admitted to the Union. It then comprised parts of territory now included in New Mexico, Oklahoma, Kansas, Colorado, and Wyoming. In 1850 it sold to the United States for \$10,000,000 all its territory north of latitude $36^{\circ} 30'$ and west of the one hundred and third meridian as far south as latitude 32° . The purchase was accomplished by an act of Congress approved September 9, 1850.^a

In that act most of the line here considered was first defined. The language of the statute is as follows:

The State of Texas will agree that her boundary on the north shall commence at the point at which the meridian of one hundred degrees west from Greenwich is intersected by the parallel of thirty-six degrees thirty minutes north latitude,

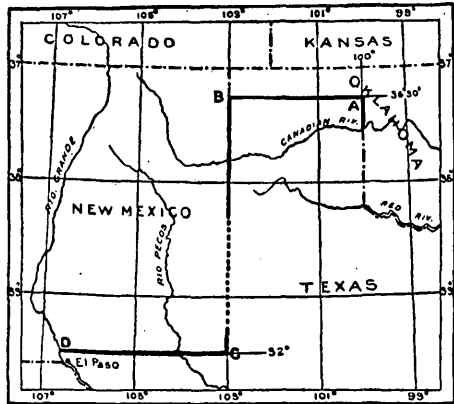


FIG. 1.—Diagram of Clark's survey (1850-60).

^a Statutes at Large, Vol. IX, p. 446.

and shall run from said point due west to the meridian of one hundred and three degrees west from Greenwich; thence her boundary shall run due south to the thirty-second degree of north latitude; thence on the said parallel of thirty-two degrees of north latitude to the Rio Bravo del Norte, and thence with the channel of said river to the Gulf of Mexico.

About eight years later provision was made for running and marking this boundary. Congress passed an act which was approved June 5, 1858, entitled—

An act to authorize the President of the United States, in conjunction with the State of Texas, to run and mark the boundary lines between the territories of the United States and the State of Texas.^a

This short act in three sections provided for the appointment of a "suitable person or persons" on the part of the United States to act with similar persons on the part of Texas in running and marking the line, and it appropriated \$80,000 therefor. The boundary which they were to run and mark is thus described in the act:

Beginning at the point where the one hundredth degree of longitude west from Greenwich crosses Red River, and running thence north to the point where said one hundredth degree of longitude intersects the parallel of thirty-six degrees thirty minutes north latitude, and thence west with the said parallel of thirty-six degrees and thirty minutes north latitude to the point where it intersects the one hundred and third degree of longitude west from Greenwich, and thence south with the said one hundred and third degree of longitude to the thirty-second parallel of north latitude, and thence west with the said thirty-second degree of north latitude to the Rio Grande.

The survey thus provided for was executed just prior to the civil war, in the years 1859 and 1860. Most of the boundary on the one hundredth meridian was surveyed and marked by the Indian contract surveyors Jones and Brown in 1859, and the remainder (except 130 miles on the one hundred and third meridian which have never been surveyed) was surveyed and marked by United States Commissioner John H. Clark in 1859-60.

An account of those surveys, and also of several others earlier and later which bear more or less directly on the present status of the boundary here considered, will be presented, the evidence afforded by these accounts will be discussed, and the conclusions reached will then be given.

HISTORY OF SURVEYS.

JONES AND BROWN'S SURVEY, 1859.

The one hundredth meridian, forming the eastern boundary of the panhandle of Texas, was surveyed and marked, under the direction of the Indian Office, by A. H. Jones and H. M. C. Brown, contract surveyors, in 1859. The manuscript record of the survey, with the

^aStatutes at Large, Vol. XI, p. 310.

correspondence, etc., is now on file in the Indian Office. The initial monument is on the north bank of the main Red River and 30 chains therefrom. It is said to be a pile of gypsum rock, and Prof. H. S. Pritchett, now president of the Massachusetts Institute of Technology, who in June, 1892, visited it and determined its latitude and longitude, thus describes it:

A pile of stones on a very prominent hill, the stones being piled up to a height, perhaps, of 2 feet in a circular form, 6 feet across, approximately, in the center of this heap being a stone some 2½ feet high, on which are cut the letters "100 W."*

This initial monument was established by Daniel G. Major, astronomer, early in 1859, its longitude having been determined by moon culminations. Major was appointed astronomer for the Indian boundary surveys on November 3, 1857. On April 2, 1859, he forwarded to the Indian Office the records of astronomical observations made by him for locating the one hundredth meridian at its intersection with Red River. There are five books of observations and computations, three small and two large ones, all now in the Indian Office, but these do not contain any summary of results, and I have found none anywhere. The only record found is that Jones and Brown started from the monument (above mentioned) "as established by the astronomer." From this point they surveyed northward 109 miles 56 chains 54 links, setting monuments at every mile. Their "terminating monument" is 19 miles north of the Canadian River.

The observations of moon culminations were made with a transit in an observatory at Camp Radziminski, on Otter Creek, near the one hundredth meridian, by Mr. Major, in January, February, and March, 1859.

As to what was known of the location of this meridian prior to Major's observations, we learn the following from a letter written by Surveyors Jones and Brown to the Commissioner of Indian Affairs on November 30, 1858, and now in the files of the Indian Office:

CAMP RADZIMINSKI,

Near the 100th meridian, west longitude, November 30, 1858.

SIR: * * * We are now encamped within sight of Major Van Dorn's command on Otter Creek, west of the Wichita Mountains, and about 2 miles east of the point on this creek that Captain Marcy reports to be the one hundredth meridian, west longitude, which he describes in the first page of his introductory remarks as having been ascertained by a pocket chronometer, and does not vouch for the correctness of the result. Since our arrival here the results of our observations are of such a character as to safely notify the Department that the one hundredth meridian, west longitude, is at least 40 miles farther westward than any line hitherto reported or delineated upon the topographical maps.

We have a good observatory, and our instruments are all in excellent order. We are likely to winter at this post, and it will take fully three months' constant observations before the accurate initial point of the one hundredth meridian can

*Record in the Greer County case, *United States v. Texas*, pp. 1199-1202. There is a copy of the Record in the library of the Bureau of American Ethnology, in the United States Supreme Court, and in the library of the Department of Justice.

be identified. It is an important boundary and requires great care. The delay incident upon ascertaining a true longitude originates from lunar observations, and it requires at least two full moons, and probably three, before the result can be known with sufficient accuracy.

A. H. JONES,
H. M. C. BROWN,

United States Surveyors, Indian Boundary Lines.

Hon. CHARLES E. MIX,

Commissioner Indian Affairs.

In connection with the famous Greer County case, *United States v. Texas*, Prof. H. S. Pritchett, now president of the Massachusetts Institute of Technology, was employed by Texas to determine as accurately as possible the longitude of this initial monument. His results, printed in the record of that case, are here reprinted (pp. 31-35).

CLARK'S SURVEY, 1859-60.

The original survey of the northwest boundary of Texas was made by the United States and Texas Boundary Commission. The United States commissioner and surveyor was John H. Clark, and as he did all the surveying I have called this the Clark survey. An account or report of the Clark survey, presented to Congress in response to a call therefor, was printed in 1882 as Senate Ex. Doc. No. 70, Forty-seventh Congress, first session, which may, for brevity, be cited as the Clark report. The story of the Clark survey is in brief as follows:

It was executed in 1859-60. All the surveying work was done by Clark, the Texan commissioner withdrawing from the work in May, 1859. The line was surveyed and marked by mounds from the vicinity of El Paso eastward on the thirty-second parallel to the one hundred and third meridian, and north on the one hundred and third meridian for about 20 miles, between January and May, 1859. The longitude of the monument at the intersection of the thirty-second parallel and the one hundred and third meridian rests upon the station Frontera of the Mexican boundary survey, carried eastward from the Rio Grande 211 miles by chaining and triangulation.

The northwest corner of Texas was established in September, 1859; in latitude, by zenith telescope observations, and in longitude by transfer from Johnston's survey (not Johnson's monument) of the southern boundary of Kansas. This same J. H. Clark was the astronomer in Johnston's party in 1857, and determined by moon culminations the longitude of the so-called Johnston's monument to be $103^{\circ} 2' 22.7''$ west from Greenwich. In September, 1859, Clark surveyed and monumented the one hundred and third meridian from the northwest corner of Texas southward for 156 miles, leaving a gap of 130 miles between this part, run from the north in September and that run from the south in the preceding May. The following year, 1860, he returned to the work and began on the one hundredth meridian where it crosses the Canadian River. He joined and accepted the

previous survey by Jones and Brown, contract surveyors, who had, in 1859, surveyed the one hundredth meridian from the main Red River northward to a point 19 miles north of the Canadian, prolonged that line northward to its intersection with the parallel of $36^{\circ} 30'$, the northeast corner of the Texas panhandle, and then surveyed and marked the northern boundary of the panhandle. This done, he returned to Washington and worked, during 1861, on his maps, observations, and computations. This was the opening year of the civil war. There was great impatience at what was deemed slowness in finishing up, and finally the work was abruptly ended in an unfinished condition in January, 1862. The maps were unfinished and the reductions incomplete. They remained in this condition till 1882, when the Senate, by resolution, called for the report. The result is Senate Ex. Doc. No. 70, Forty-seventh Congress, first session, from which most of the information here recorded has been gleaned. From that report it may be learned that, in January, 1882, "No part of said boundary has ever been officially agreed upon or accepted by the two governments as contemplated in the act of Congress authorizing the survey."

Since that date, however, part of the Clark survey has been adopted by the United States. In the sundry civil act approved March 3, 1891, it is enacted that "the boundary line between said public-land strip and Texas, and between Texas and New Mexico, established under the act of June fifth, eighteen hundred and fifty-eight, is hereby confirmed." By this act Clark's survey is confirmed as to the one hundred and third meridian. It is not confirmed as to the one hundredth meridian, except for the monument at the northeast corner of the panhandle. This story will now be told in somewhat greater detail.

Shortly after the passage of the act of June 5, 1858, providing for this survey, the matter was placed, on the part of the United States, in charge of the Secretary of the Interior, Hon. Jacob Thompson. He at once corresponded with the governor of Texas with a view to agreeing upon a plan of operations, and proposed that the survey should begin near El Paso, taking some point on the Mexican boundary as a starting point; should then proceed eastward on the thirty-second parallel to longitude 103° ; and thence northward on the one hundred and third meridian. The governor of Texas objected to this plan on the ground that the delimitation of the boundary north of Red River was of more immediate and pressing importance.

Early in July, 1858, Mr. John H. Clark was appointed commissioner, astronomer, and surveyor on the part of the United States, and Mr. William R. Scurry was appointed commissioner on the part of Texas. On July 9 Clark received his instructions from Hon. Jacob Thompson, then Secretary of the Interior, and left Washington for Texas, arriving in Austin late in August or early in September. Here he met the governor, Hon. H. R. Runnels, and accompanied him to San Antonio.

Apparently a conference was had in San Antonio early in September between Governor Runnels and the two commissioners, Clark and Scurry. As to the outcome, Clark reported to Secretary Thompson from San Antonio, under date of September 8, "They have concluded to adopt our plan of operations throughout."^a

On November 12, 1858, everything was in readiness, and the two commissioners, with their outfit, left San Antonio for "the initial point,"^b where they arrived on January 2, 1859, and began the survey on the following day. "The plan of survey adopted was to determine the line in latitude with a zenith telescope as often as it might be necessary to secure accuracy, and in longitude by triangulation and direct measurement from the initial point, the longitude of this point being found by transfer from Frontera, a well-established station of the Mexican boundary survey."^c

As to the division of the work between the commissioners Mr. Clark writes: "The performance of the astronomical work, upon which the boundary line is based, I undertook exclusively, the Texan commissioner taking a part in the tracing and demarcation of the line by furnishing half of the surveying force."^d

Most of the month of January, 1859, was spent in connecting the initial point with the astronomical station Frontera, of the Mexican boundary survey. A base line 4,750 feet long was cleared and "carefully and repeatedly measured with standard rods taken out for the purpose."^e Frontera was then connected with the initial point by a triangulation resting on this base. This work completed, the party on January 26 started eastward along the thirty-second parallel. The sandy and desert character of the country made progress slow and difficult, and much labor and travel were necessary to keep the party supplied with water. From the initial monument on the Rio Grande eastward to the one hundred and third meridian is, according to Clark, 211^e miles, and to survey this line he was compelled to travel 1,248 miles. The party, which had started eastward from the Rio Grande late in January (1859), reached the one hundred and third meridian in May, and on the 22d of that month erected the boundary monument at the intersection of the thirty-second parallel and the one hundred and third meridian. "This is a mound of very sandy soil; it has a bottle buried in it which contains the latitude and longitude of the point, a list of the names of the members of the Commission, and the date of its erection."^f An astronomical station was established near this corner, and observations were made on 27 pairs of stars on the nights of May 17, 18, 20, and 21, the resulting latitude

^a Senate Ex. Doc. No. 70, 47th Cong., 1st sess., p. 269.

^b Same, p. 296.

^c This initial point is at the intersection of the thirty-second parallel and the Rio Grande, about 18 miles northwest of El Paso.

^d Senate Ex. Doc. 70, 47th Cong., 1st sess., p. 296.

^e Same, p. 298. On p. 56 of same report this distance is given as 211.4246, which I take to mean 211 miles and 4,246 feet.

^f Senate Ex. Doc. 70, 47th Cong., 1st sess., p. 302.

being $31^{\circ} 58' 42.4''$, or about $1\frac{1}{3}$ miles south of the parallel. It does not appear that any observations were made for longitude, but that the determination of the position of the one hundred and third meridian at this point rests upon Frontera, and rough measurements made over a distance of about 225 miles, measurements made in small part by triangulation and in large part by chaining. On the thirty-second parallel 32 monuments were erected, for the most part mounds of earth or stone.

On completing the thirty-second parallel the party started northward along the one hundred and third meridian with a pack-mule train, the heavy sand preventing the use of wagons. Starting in the middle of the afternoon of May 24, the party traveled $14\frac{1}{2}$ miles (according to the field notes) and camped. At this camp time and latitude observations were made with a sextant, the resulting latitude being $32^{\circ} 7' 52''$, and the monument was erected on the meridian. The next day the party continued northward, traveling (according to field notes) $20\frac{1}{2}$ miles. They then camped again, and with sextant determined time and latitude. The latitude was found to be $32^{\circ} 20' 45''$, indicating the northing made as about 14 miles. Here they erected a monument. The country traversed to this point was level, sandy, and desert; not a drop of water was to be had except that carried with them. Country of the same character was seen to the northward, and accordingly the further continuance of the line was abandoned and the party turned westward and proceeded toward the Pecos River, which they reached on the afternoon of May 29.

Mr. Clark, writing in September, 1861, says that on or about February 18, 1859, when the party was preparing to leave El Paso for the line, Mr. Scurry, the Texan commissioner, notified him that he had resigned. Nevertheless, it appears that Mr. Scurry continued with the party some time longer, for early in May John E. Weyss, topographer in Clark's party, and Anson Mills, Mr. Scurry's principal assistant, quarreled, whereupon Mr. Scurry wrote Clark a letter declaring that "the Texas commission will not proceed with the survey from this point."

From the best information Clark then had as to the course of the upper Pecos, he thought it not far from the one hundred and third meridian. His plan, therefore, was to run a meridian line near the Pecos, from which he could draw his water supply, and then measure offsets eastward to the one hundred and third meridian. Finding the distance much greater than he had expected, he abandoned this plan and started for the northwest corner of Texas, proceeding up the Pecos and surveying as he went.

Near the northwestern corner of Texas is Rabbit Ear Creek or North Fork of the Canadian River. Reporting to the Department on October 27, 1859, Clark writes: "I arrived at Rabbit Ear Creek from Fort Union the 3d of August, and proceeded at once to establish the northwest corner of the boundary, which was done by transfer from

the Kansas line as to longitude, the result of independent observations being used for the latitude. A lunation was also observed, with the view of serving as a check on the accuracy of the transfer."^a This transfer was made by means of triangulation over a distance of about 35 miles.^b As to this transfer Clark also says, writing on September 30, 1861: "Again the surveying party was sent over to the Kansas boundary, and, taking up the one hundred and third meridian *as then established*, transferred it to its intersection with the parallel for the longitude."^c At a camp on Rabbit Ear Creek, near the northwest corner of Texas, transits of stars and moon for determining the longitude were observed on the evenings of August 7, 9, 11, 12, 13, 14, and 15. Of these observations Clark made no use. Writing to the Secretary of the Interior July 24, 1861, he says: "As the results of the longitudinal determinations are not essential to the accuracy of the maps except as checks, I do not propose to prosecute this branch of the work further, and it may therefore be closed. They can be computed hereafter if desirable."^d I have not discovered that any use was ever made of these observations. Observations for latitude with zenith telescope were made at Rabbit Ear Creek on August 4, 5, 21, and 22, the resulting latitude being $36^{\circ} 34' 16''$.^e

While at Rabbit Ear Creek "a second Texas commission" joined the party. Having determined the place and erected a monument at the intersection of the parallel of $36^{\circ} 30'$ with the meridian of 103° , the party, on August 23, started south along the one hundred and third meridian. The astronomical station on Rabbit Ear Creek was about 8 miles northwesterly from the northwest corner of Texas. More exactly, the Clark monument set to mark the intersection of the one hundred and third meridian by the parallel of $36^{\circ} 30'$ bears E. $37^{\circ} 53'$ S., distant 7 miles and 5,252 feet from the astronomical station on Rabbit Ear Creek.^f

The survey and marking of the northern part of the boundary on the one hundred and third meridian from the parallel of $36^{\circ} 30'$ southward took about a month. It was begun by Clark on August 23 and finished on September 20, 1859.

The meridian was traced with a large theodolite, the distances measured and checked by latitude observations. Latitude observations with sextant were made at five stations, with the following results:

	Latitude.		
	"	"	"
September 14, 1859	35	09	07.8
September 15, 1859	35	00	09.0
September 17, 1859	34	46	59.0
September 19, 1859	34	27	27.8
September 20, 1859	34	21	40.5

^a Sen. Ex. Doc. No. 70, 47th Cong., 1st sess., p. 278.

^b Same, p. 279.

^c Same, p. 279. Italics not in original.

^d Same, p. 293.

^e Same, p. 208.

^f Same, pp. 86-88.

The line was continued about 8 miles beyond this last station to some low sand hills, where the last monument was erected on September 21, in about latitude $34^{\circ} 14'$.

This closed the season's work of 1859. The party then proceeded to Fort Smith for winter quarters. The length of the one hundred and third meridian from latitude 32° to $36^{\circ} 30'$ is 310 miles. Of this line Clark surveyed and marked:

	Miles.
From the south end, setting 3 monuments.....	24
From the north end, setting 23 monuments.....	156
Total.....	180
Leaving an unsurveyed part between $32^{\circ} 21'$ and $34^{\circ} 14'$ of.....	130
Total.....	310

The number of monuments erected by Clark on this one hundred and third meridian is 26. They are chiefly earth or stone mounds, sometimes erected around a stake. They are described in detail in Clark's report, dated September 30, 1861.^a The present condition of these monuments, erected more than forty years ago, is not known. I was told at the Land Office that, though they had been searched for by land surveyors, only three of them had ever been found. These three are on or near the banks of the Canadian River. (See Taylor and Fuss's survey, 1883, p. 29, and Preston's survey, 1900, p. 36.)

Having wintered at Fort Smith, Ark., Clark set out on April 28, 1860, to complete the boundary survey, going by way of Forts Cobb and Arbuckle to the one hundredth meridian at the point where it intersects the Canadian River. He arrived at this point June 8, 1860. The one hundredth meridian had been surveyed and marked from the Canadian River northward for 19 miles by Jones and Brown in 1859, under the direction of the Indian Office. Clark was instructed by the Secretary of the Interior, Hon. Jacob Thompson, to adopt this line^b so far as it had been laid down and to prolong it northward to latitude $36^{\circ} 30'$. This he did between June 8 and 20. The adopted longitude was checked by prolonging the line northward about 35 miles to the Kansas boundary, in latitude 37° . The result is thus stated by Clark:

The one hundredth meridian, determined and run as the eastern boundary of Texas, falls within 1,700 feet of the one fixed by me on the Kansas boundary in 1857.

Elsewhere we learn^c that the one hundredth meridian, as fixed on the southern Kansas boundary, is to the west (1,700 feet) of the one hundredth meridian adopted for the eastern boundary of Texas. The northeast corner of Texas was fixed as to its longitude by Clark's extension northward of the one hundredth meridian, as determined by Jones and Brown and checked by Clark, by connecting with his own determination of the one hundredth meridian on the south bound-

^a Sen. Ex. Doc. No. 70, 47th Cong., 1st sess., pp. 302-303.

^b Same, p. 300.

^c Same, pp. 123, 200-201.

ary of Kansas. It was fixed in latitude by observations with zenith telescope on June 15, 17, and 19, 1860, the astronomical station being in latitude $36^{\circ} 32' 49.2''$, i. e., a little more than $2\frac{1}{2}$ miles north of the parallel. It was about the same distance east of the one hundredth meridian.

After establishing the northeast corner Clark ran west on the parallel of $36^{\circ} 30'$, surveying and erecting monuments. This was done under great difficulty from lack of water. Finally the party abandoned the line to seek water on the North Fork of the Canadian. Clark then went to the west end, the northwest corner of Texas, and traced the parallel eastward to the point where he had abandoned it, thus completing the field work of the boundary survey, except 130 miles on the one hundred and third meridian previously mentioned. This completed, he set out July 12 for the one hundredth meridian, where he traced a part of the Jones and Brown line along the one hundredth meridian southward from Commission Creek. On this part mounds had been erected at every mile. He says that he found that some of these falling in hollows had been washed away,^a while others had been destroyed by buffaloes. He then returned to Washington, and was engaged in office work till his work was terminated by the Interior Department on January 16, 1862.

The published correspondence indicates friction between Clark and the Commissioner of the General Land Office, under whom the work had been placed. The office work was left incomplete and the maps were unfinished, some of them being unlettered.

On January 6, 1882, the Senate, by resolution, called upon the Secretary of the Interior for the report "of the survey of the United States and Texas Boundary Commission, made under the provision of the act of Congress approved June 5, 1858." The reply to that call is Senate Ex. Doc. No. 70, Forty-seventh Congress, first session, an octavo volume of 309 pages, containing 15 maps. Most of the statements here made are taken from or based upon that report, supplemented by conferences with various employees in the General Land Office.

The maps in that report are 15 in number, of which 14 show the line in detail, with adjacent topography, trails, stations, monuments, etc., from El Paso eastward along the thirty-second parallel, northward along the one hundred and third meridian, and so on. I have sought in the General Land Office for the originals of these maps, yet unsuccessfully with a single exception. That exception relates to No. 3 (erroneously No. 4 in the printed report). The manuscript which may have been the original of map 3 of the printed report is drawn all in black, shows topography, monuments, trails, etc., is backed on cloth, bound in blue braid, is 24.5 by 47 inches in size, and is entitled:

Texas Boundary Line | surveyed under the direction | of the Department of
the Interior | Scale: 100 000 | No. 3.

^a Sen. Ex. Doc. No. 70, 47th Cong., 1st sess., p. 204.

It bears on its back the erroneous indorsement, "Map showing boundary between U. S. and Mexico," instead of the correct indorsement, "Map showing part of the boundary between the U. S. and Texas."

In the printed Clark report are 15 maps, of which 1-14 are photolithographs, showing the line in sections. The scale is about 1:160 000. From the one supposed original I infer that these 14 sectional maps were all drawn on a scale of 1:100 000.

A general map of the whole line, No. 16, was also prepared, but was not printed with the others. Now, these two maps, 3 and 16, have a curious history. The Commissioner of the General Land Office, N. C. McFarland, wrote on January 11, 1882:

Of the 16 maps returned by the commissioner (J. H. Clark) Nos. 3 and 16 are missing, the latter being a general map of the whole survey, noted on the records as "missing" as early as May 7, 1862; the former, No. 3, being a map of that part of the thirty-second parallel from Crow Spring to the Pecos River.^a

Now, the curious part of this history is that these two missing maps are both on file in the General Land Office, and so far as my search has gone all the others are missing.

The original manuscript of the general map, No. 16, made by John E. Weyss, is beautifully drawn, and is slightly damaged by water in the upper left-hand corner, presumably as a result of the Patent Office fire in 1877. It shows the country between the parallels $31\frac{1}{2}^{\circ}$ and $37\frac{1}{2}^{\circ}$ and the longitude between the meridians $96\frac{1}{2}^{\circ}$ and 107° . The map is 26.5 by 40 inches, is drawn wholly in black, and contains a list of positions. It is entitled:

Map of the | United States | and | Texas boundary line | and | adjacent territory | determined & surveyed | in 1857-8-9-60 | by | J. H. Clark, U. S. Commissioner, &ca. &ca. | under the direction of the | Department of the Interior | Astronomical determinations by J. H. Clark and H. Campbell | Triangulation & topography by J. E. Weyss, assisted by W. P. Clark | Drawn by J. E. Weyss | Scale | 1 Million, or 15 Miles 4133 ft. to 1 inch.

It bears two indorsements, viz:

First:

Original map of U. S. & Texas Boundary. Rec'd back from Office of U. S. Engineers, Nov. 14. 1885.

Second:

By 35. United States and Texas Boundary Line &c., &c., 1860. J. H. Clark & others.

1 original
1 tracing
2 photoliths made Nov. 5, 1885.

4

There is now no tracing with it and only 1 photolithograph. A few copies of this photolithograph still exist at the office of the Chief of Engineers.

JOHNSTON'S SURVEY, 1857.

The southern boundary of Kansas was first surveyed by a party under the command of Lieut. Col. Joseph E. Johnston, U. S. Army, in 1857. The astronomer of the party was John H. Clark; the assistant astronomer, Hugh Campbell, and the topographer, John E. Weyss.

The party took as the initial point of survey the intersection of the thirty-seventh parallel with the western boundary of Missouri. The longitude of this western boundary was taken from "the map" to be $94^{\circ} 38' 03.6''$ west of Greenwich. From this meridian to the one hundred and third meridian is $8^{\circ} 21' 56.4''$, equal in latitude 37° to 462.71 statute miles. Having made this calculation, the party measured west on this parallel 462.71 miles and set a monument, called the terminal monument, on the spot which the chaining indicated to be the one hundred and third meridian. This monument is known in the late records as the Johnston (erroneously Johnson) monument. As a check, however, on this long chaining across the plains, an astronomical station was established in its vicinity, and the longitude was determined by moon culminations. This astronomical station appears to have been 5,760 feet ($1' 11''$) east of the terminal station and about a mile south of the thirty-seventh parallel. The lunar observations were made with transit on August 29, 31, September 1, 6, 7, 8, 9, 1857. On completing them Clark and Campbell were sent back to the initial point on the Missouri line to make similar observations, which they did on October 27, 28, 31, November 2, 3, 4, 5, 1857. To compute the best results for the longitude of the terminal station, corresponding observations were obtained from Greenwich. The resulting longitude of the Johnston monument was $103^{\circ} 2' 22.7''$ west of Greenwich, i. e., $2' 22.7''$ west of the one hundred and third meridian. In latitude 37° this distance, $2' 22.7''$, is equal to 11,575 feet, or, according to Clark's calculation, 11,582 feet. Accordingly, they adopted as the intersection of the thirty-seventh parallel and one hundred and third meridian a point 11,582 feet east of the Johnston monument.

The records of this survey are in the office of the Chief of Engineers in the War Department. The observations, computations, maps, and Campbell's Journal are there. Nine maps, numbered I to IX, from the initial monument westward, drawn by John E. Weyss, show the line, adjacent topography, camps, stations, etc. All are on a scale of 1:100 000 except the last one, No. IX, which shows on the larger scale of 1:25 000, the region about the terminal monument. Of the nine maps in the series the General Land Office has copies of numbers I to VII only.

Map No. IX is entitled as follows:

Map No. IX. Southern boundary of Kansas, showing the country in the vicinity of the terminal point, on an enlarged scale; also the difference between the survey and astronomical observations. Determined and surveyed under the direction of Lt. Col. J. E. Johnston, 1st Cavalry, U. S. A., by J. H. Clark, astronomer, assisted by Hugh Campbell and J. E. Weyss, C. E. Scale, 1:25,000.

Upon this map is neatly lettered in the draughtsman's hand the following note:

NOTE.—The reason of the difference between the survey and astronomical determination of the terminal point is as follows: The west point of Missouri, or initial point of survey, according to the map, was taken to be $94^{\circ} 38' 03.6''$ west of Greenwich. From this point 462.7 miles were run west, which places the one hundred and third meridian where this terminal point was erected, as shown on the map. After a careful comparison, however, made at Washington, of moon culminations observed near this point, with corresponding observations at Greenwich, the one hundred and third or true meridian was found to be 11,582 feet to the east of the terminal point of survey, and consequently gives the west boundary of Missouri $94^{\circ} 40' 26''$.

Washington, September, 1858.

J. E. WEYSS, *Surveyor*.

The final results for longitude of the astronomical station near the terminal monument are summed up in the manuscript book of computations in the office of the Chief of Engineers, as follows:

Computation for longitude, southern boundary of Kansas.

[Results deduced final.]

	h.	m.	s.
August 31, 1857	6	51	54.470
September 1, 1857			59.720
September 6, 1857			76.270
September 7, 1857			66.770
September 8, 1857			64.826
September 9, 1857			60.761
August 29, 1857			70.646
Mean	6	52	04.781 = $103^{\circ} 01' 11.70''$

It will be remembered that the adopted longitude of the initial monument was $94^{\circ} 40' 26.3''$, and that this also was checked by similar lunar observations by Clark and Campbell the same season. The discrepancy between this assumed value and that resulting from Clark's observations of moon culminations is very marked. In the same book of computations already cited we find the following:

Results for longitude at western boundary of Missouri.

	h.	m.	s.
October 27, 1857	6	18	02.69
28, 1857			07.46
31, 1857			09.31
November 2, 1857			02.22
3, 1857			05.68
4, 1857			03.47
5, 1857			04.68
Mean	6	18	05.07

Results for longitude at western boundary of Missouri—Continued.

	h.	m.	s.	s.
Longitude of astronomical station.....	6	18	05.072	± 0.605
Missouri line 158.5 feet east of astronomical station = 1.95"				
= 0°.13			00.13	
	6	18	04.942	
			[°]	[']
In arc this equals			94	31 14.1
Whereas the adopted value was.....			94	40 26.3
Difference.....			9	12.2

A good map, showing the results of this survey, was prepared by the topographer of the party, John E. Weyss, and published by Congress in 1858 in a document entitled:

House of Representatives, Ex. Doc. No. 103, Thirty-fifth Congress, first session. Southern Boundary Line of Kansas—Letter from the Secretary of War (John B. Floyd) transmitting the report of Colonel Johnston's survey of the Southern Boundary of Kansas. April 16, 1858. Ordered to be printed. 8°, 3 pages, 1 map.

The map, which is sometimes found separated from the report, is entitled:

Sketch of the Country | near the Southern Boundary | of | Kansas. | Astronomical and Barometric determinations by J. H. Clark & H. Campbell. | Survey by J. E. Weyss. | (Signed) J. E. Johnston, Lt. Col. 1st Cavalry. | Lith. of J. Bien, 60 Fulton street, N. Y. |

Scale, 1:1 000 000, or 15 miles 4,133 feet to the inch. Size, 22 by 48½ inches. Shows topography, trails, stations, etc., from west line of Missouri westward to longitude 106°.

MACOMB'S SURVEY, 1859.

Capt. J. N. Macomb, United States topographical engineer, in the summer of 1859 conducted an exploring expedition from Santa Fe, N. Mex., to the junction of the Grand and Green rivers. On completing this work he returned to Washington, stopping en route at the southwest corner of Kansas, and, as instructed, he erected a monument (since called the Macomb monument) east of the monument erected by Lieutenant Colonel Johnston in 1857 (since called the Johnston monument) to mark the southwest corner of Kansas.

As to this, Macomb says:^a

I was directed on my return * * * to stop at the southwest corner of the Territory of Kansas to set up a new monument at a point some 2½ miles to the east of the one originally placed there. I accordingly * * * went up the Cimarron to the point indicated, and retraced that part of the thirty-seventh parallel from the old monument to the meridian of 103°, as laid down upon the map accompanying my instructions, and at the intersection of these two geographical lines I erected a rough stone monument. The original monument above alluded to is of earth and sods. This duty was finished about the middle of November, 1859.

^a Report of Exploring Expedition in 1859 under Capt. J. N. Macomb, with geology by J. S. Newberry, 4°, Washington, 1876, pp. 7-8.

DARLING'S SURVEY, 1868.

On May 22, 1868, Mr. Ehud N. Darling entered into a contract with the United States to survey and mark the thirty-seventh parallel of north latitude so far as it constitutes the northern boundary of New Mexico, commencing at the one hundred and third and ending at the one hundred and ninth meridian of west longitude. This survey was begun at the Macomb monument July 19, 1868, and ended at the one hundred and ninth meridian on November 18, 1868.

As to his starting point, the Macomb monument, Darling says:

The cobblestone monument established by Captain Macomb, United States Army, is 8 feet at base, conical shape, 5 feet high and $2\frac{1}{2}$ feet top. In order to better perpetuate the initial point I set a stone $30 \times 10 \times 8$ imbedded 20 inches in monument, with 10 inches projecting above same, engraved on the southeast Ind. T.; on the southwest N. M.; on the the northwest Col. T., and on the northeast 1868 and 103° W. L.

Measuring west Darling found, at the distance of 1 mile 68 chains 20 links, a monument which he identified as the Johnston monument of 1857. He says he found an "earthen mound situated on a high level plateau, established for the one hundred and third meridian of west longitude from Greenwich, on the thirty-seventh parallel of north latitude, in the survey of the southern boundary of Kansas in 1857. Mound was found partially destroyed and apparently had been 8 feet in diameter and 5 feet high. Found near mound a stone marked with a brush, in black—N M-COL-IND TER-37 N L—on the four sides, respectively."

This account is drawn up from the manuscript field notes of Darling and his map, both now on file in the General Land Office.

CHAFFEE AND MAJOR'S SURVEYS, 1869 AND 1872.

In 1869 Mr. O. N. Chaffee determined the longitude of the western boundary of Kansas. This he did by chaining from Julesburg 16 miles 10 chains 47 links east. The longitude of Julesburg had been telegraphically determined by the Coast Survey. The longitude resulting from Chaffee's measures is $24^\circ 59' 49.35''$ west of Washington (old Naval Observatory dome).

In 1872 Mr. J. J. Major again determined the longitude of this line. He first determined telegraphically the longitude of Fort Wallace by exchange of signals with Fort Leavenworth on the nights of October 1, 2, 3, 7, 8, 9, 1872, and thence by chaining from Fort Wallace about 25 miles westward (in latitude $38^\circ 58'$). The resulting longitude was $25^\circ 00' 07.35''$ west of Washington (old Naval Observatory dome).

The mean of these two values is $24^\circ 59' 58.3''$ west of Washington, or $102^\circ 03' 04''$ west of Greenwich.

The law names the twenty-fifth meridian west from Washington as the western boundary of Kansas.

Major surveyed the Kansas-Colorado boundary line in 1872. Beginning at the north end he chained southward 207 miles 26 chains to its south end, or the thirty-seventh parallel, where he set a terminal monument to mark the corner of Kansas-Colorado-Indian Territory. Of this terminal monument he says:

Made excavation and deposited can, bottle, bones, and stakes, and broken flag-poles. Planted a white pine, seasoned, sawed pine post 8 feet long, 8 inches square, deeply and legibly marked on the north 25 L; on the south 207 M., 26 Chs on the east K; on the west C. Built mound with four pits to cardinal points.

This account is drawn up from manuscript records now on file in the General Land Office.

MAJOR'S SURVEY, 1874.

In 1874 Mr. John J. Major, United States astronomer and surveyor, surveyed and marked at every mile the thirty-seventh parallel from the Kansas-Colorado-Indian Territory monument, set by himself in 1872, westward to the Johnston monument, and thence southward in the meridian of that monument to the parallel of $36^{\circ} 30'$. The longitude of the Kansas-Colorado-Indian Territory corner, from which he started, is $102^{\circ} 03' 04''$ west of Greenwich. (See Chaffee and Major's surveys, 1869 and 1872.) At a distance of 55 miles $22\frac{1}{2}$ chains from his starting point he found the Macomb monument, of which the longitude resulting from this chaining would be:

Longitude of starting point	102	03	04
55 miles $22\frac{1}{2}$ chains = 55.281 miles (in latitude 37°)	0	59	58
Longitude of Macomb monument	103	03	02

At a distance of 57 miles $4\frac{1}{2}$ chains from the starting point Major found the Johnston monument, the longitude of which resulting from this chaining would be:

Longitude of starting point	102	03	04
57 miles $4\frac{1}{2}$ chains = 57.056 miles (in latitude 37°)	1	01	54
Longitude of Johnston monument	103	04	58

Its longitude resulting from moon culminations, observed by Clark in 1857, is $103^{\circ} 02' 22.7''$.

Major identified the monuments of Macomb and Johnston. He makes no reference to any monument set by Johnston in 1857 except the terminal one, called the Johnston monument.

At 42 miles and 42 chains from the starting point and 10 chains south of the parallel, as he was running it, Major found a monument set by Darling in 1868 as the initial point of his survey. This is 12 miles 60 chains east of the Macomb monument. Major concluded that Darling at first mistook something for the Macomb monument, and after erecting this initial monument of his survey and measuring west about 13 miles found the true Macomb monument, recognized

it as such, and there began anew, without returning to destroy the monuments already set. Major found several of these monuments erected by Darling; he also identified both the Macomb and Johnston monuments and describes them. From his starting point to the Macomb monument is, by his chaining, 55 miles $22\frac{1}{2}$ chains; from the starting point to Johnston monument, 57 miles $4\frac{1}{2}$ chains; distance from Macomb monument to Johnston monument, according to Major, 1 mile 62 chains.

Major describes the Macomb monument thus:

A large stone monument 10 feet in diameter at base, 8 feet high, and capstone marked C., N. M., I. T., 1868. Removed the monument for further information, but found none. Mr. Darling had built over Macomb's original monument. Rebuilt the monument so that it stands as Darling left it.

As to the Johnston monument, 1 mile 62 chains west of this, he says:

It is a large earth mound 12 feet at base and 3 feet high, sodded, with several stones about it. * * * Dimensions of capstone, $18 \times 13 \times 15$, marked K, 103 L. N. M., with black paint, nearly obliterated; 18 more recently cut into the stone; situated on a high table-land; new subscription N. M., 103 L., on opposite sides, and 37 L., 1874, on opposite sides.

From this "Johnson monument" erroneously taken by Major to mark the one hundred and third meridian, he ran south, setting marked monuments at every mile. At 34 miles and 40 chains he set a monument to mark the "northwest corner of the State of Texas." As to this monument, called in the field notes "terminal monument," Major says; "Made excavation, deposited bones and glass, erected pine 7 feet \times 7 inches, deeply marked TEXAS, N. M., 103 W. L."

As to Clark's previous determination of this same corner, Major says:

Having reached the $36^{\circ} 30'$ parallel, according to the chain measurements, I commenced a close search for the monument erected in 1859 by the Texas boundary commissions. After a very thorough examination by all my party, together with portion of the escort, of a belt of country 2 miles wide and $2\frac{1}{2}$ miles east and one-half mile west of line, I failed to find either the initial or other monuments of said line. The topography of the country is such as to designate very closely where this monument had been, but the evidence was wanting, except in finding a few scattered rocks, which were doubtless a portion of said monument, as they had been conveyed to this place from the Rabbit Ear Range, some 7 miles distant. I therefore reestablished this corner as described in field notes. We were enabled to trace the old trail from this vicinity to Colonel Johnson's or Clark's astronomical camp, some 6 miles northwest, on the creek, where there was a stone designating the grave of "Jane Quin, died 1859;" on the other side, "103 W. L., $36^{\circ} 30'$ L.," showing that this stone was probably intended to be used in marking the Texas corner.

This account is drawn up from the original manuscript records, field notes, etc., in the General Land Office. Among these records is a manuscript map which shows both the Macomb and Johnston monu-

ments and a line running due south from the Johnston monument from latitude 37° to latitude $36^{\circ} 30'$. Major was instructed to join the Macomb and Clark monuments by a straight line. Instead of this he ran south from the erroneous Johnston monument and did not find Clark's monument. The manuscript map showing his results, drawn wholly in black, is $25\frac{1}{2}$ by 38 inches in size and entitled:

Map of that portion of the | Southern Boundary of Colorado | between the 25th Mer. west from Washington, & the 103rd Mer. west from Greenwich | also of | that portion of the | Eastern Boundary of New Mexico | between the $36^{\circ} 30'$ & $37^{\circ} 00'$ Par. of North Latitude, | Surveyed by order of the Hon. Sec. of the Interior | by | John J. Major | U. S. Astronomer & Surveyor | 1874. | Scale: 2 Miles to an Inch.

CHANEY'S SURVEY, 1881.

Richard O. Chaney and William W. Smith, United States deputy surveyors, between October 19 and November 16, 1881, surveyed the Cimarron meridian, being the one hundred and third meridian of west longitude from Greenwich, between the parallels of 37° and $36^{\circ} 30'$.

This survey began with a telegraphic determination of longitude near Old Las Animas, Colo., in approximately latitude $38^{\circ} 03'$, longitude $103^{\circ} 09'$. Telegraphic signals were exchanged with Ormond Stone at Cincinnati, Ohio, on the nights of October 6 and 7, 1881. The station was a stone pier erected by the Government engineers "about 100 yards south of the railroad depot." Resulting longitude, $103^{\circ} 08' 41''$ west of Greenwich. The conditions were unfavorable and the resulting longitude determination was correspondingly weak.

The computed distance of the one hundred and third meridian from this station was 7 miles 71 chains 20 links east. This distance was chained three times and the one hundred and third meridian was thus determined. From it Chaney chained south 73 miles 9 chains 42 links to the thirty-seventh parallel, where he erected a gray sandstone, $6\frac{1}{2}$ feet long, 12 inches square, set $3\frac{1}{2}$ feet in the ground, marked on the north face, "Colorado;" on the south face, " $103^{\circ} W L$;" on the east face, " $37^{\circ} N L$," and on the west face, "1881."

At this point begins the Cimarron meridian of the Land Office. From this, the north end of the Cimarron meridian, Chaney chained south 34 miles 26 chains 44 links to the vicinity of the parallel of $36^{\circ} 30'$. Here he observed the latitude to be $36^{\circ} 30' 11.9''$, whereupon he chained 16 chains 24 links farther south and set a monument, in latitude $36^{\circ} 30'$, to mark the south end of the Cimarron meridian. This monument, located in latitude $36^{\circ} 30'$ and longitude 103° west of Greenwich, according to Chaney's observations, is a gray sandstone 6 feet long, 12 inches square, set 3 feet in the ground, surrounded by a mound of earth 5 feet in diameter, 2 feet high, with pits $24 \times 24 \times 12$ inches north, south, east, and west of the stone, which is 6 feet distant, marked on the north face "C M;" on the south face, " $103^{\circ} W L$;" on the east face, " $36^{\circ} 30' N L$," and on the west face, "N M."

It will be remembered that in 1859 Clark determined the intersection of the one hundred and third meridian with the parallel of $36^{\circ} 30'$, and erected there a monument to mark the northwest corner of Texas. Chaney in this survey sets a new monument at the same intersection as determined by his (Chaney's) observations. He then searched west for Government survey stakes or marks, but makes no mention of Clark's monument. According to Chaney's chaining, the Macomb monument is 2 miles 34 chains 28 links west of the north end of the Cimarron meridian. Chaney searched for three days south of Macomb's monument for the line closing on that monument without finding it.

From the south end of the Cimarron meridian, Chaney made search for the "east boundary of the Government surveys governed by the New Mexico meridian." His field notes set forth the details and conclude with the statement that the nearest corner found was a quarter post 2 miles 35 chains west of the Cimarron meridian. Ten miles farther north he renewed the search in company with a local ranchman, but no marks were found. Chaney's search was made over the ground where the monuments were set by Clark in 1859 and by Major in 1874 to mark the northwest corner of Texas. Yet he makes no reference to either of them.

This account is drawn up from the manuscript field notes of Chaney's survey, now on file in the General Land Office.

MABRY'S SURVEY, 1882-1885.

W. S. Mabry, county surveyor of Dallam, Hartley, and Oldham counties, Tex., retraced the Clark line from the Canadian River northward in 1882 to 1885, and built the XIT pasture fence. The record of his surveys is at Austin, Tex. Some information touching it will be found here under Preston's survey, 1900.

TAYLOR AND FUSS'S SURVEY, 1883.

On March 5 and 6, 1883, the contract surveyors, Taylor and Fuss, subdivided the fractional townships—Towns 13 and 14 N., range 37 E., New Mexico meridian. These surveys join and close on two monuments, being 15 and 16 of Clark, set in 1859 on opposite banks of the Canadian River to mark the one hundred and third meridian.

Map 8 of Clark's report^a shows the crossing of the one hundred and third meridian and Canadian River. The location of the monuments is shown on the map, and the monuments are described in the text, where they are numbered 15 and 16. The accompanying fig. 2, made from Clark's map 8, shows the situation of these monuments as given by Clark in 1859. Fig. 3 shows the same as given by Taylor and Fuss on their manuscript plats submitted to the General Land Office in 1883. Taylor and Fuss also show on their plats the locations of the monuments and the course of the Canadian.

^a Sen. Ex. Doc. No. 70, 47th Cong., 1st sess.

Clark describes his monument 15, erected in 1859, as follows: "A mound of earth near the edge of a red sandstone bluff which forms the southern bank of the Canadian."

Taylor and Fuss describe the same monument as found by them in 1883 thus: "Monument, mound of earth and trench."

Clark describes his monument 16 thus: "This is of stone; in sight from No. 15, and on north bank of the river. The angle at which the line crosses the river is shown by these two monuments."

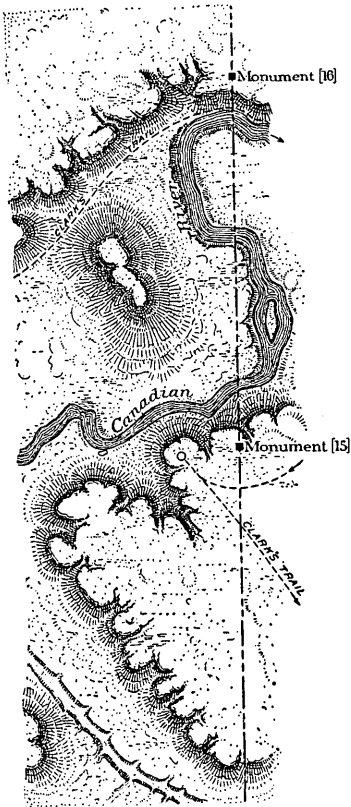


FIG. 2.—Clark's monuments 15 and 16 on the one hundred and third meridian (1859), from Clark's report, map 8.

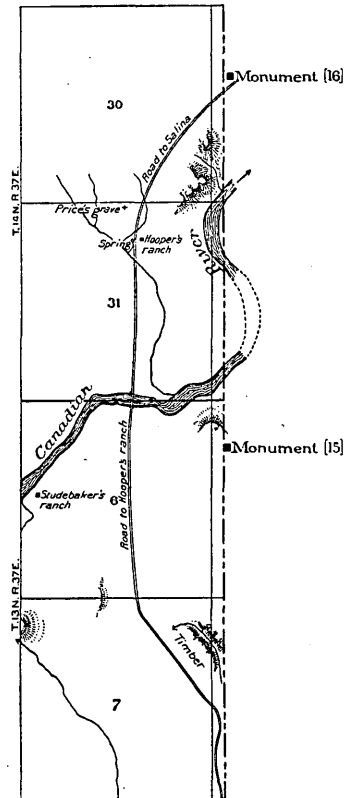


FIG. 3.—Clark's monuments 15 and 16, as given by Taylor and Fuss (1883), from original plats in General Land Office.

Taylor and Fuss describe the same monument as they found it in March, 1883, thus: "It consists of a trench about a foot in depth and width, dug in a circle of about 15 feet in diameter, with a mound of earth in center and several large sandstones, marks on which were indistinct."^a

So far as the Land Office records show, these were the only monuments set by Clark on the one hundred and third meridian which have since been reported by United States surveyors or connected with the public land surveys, down to 1900. For later information see Preston's survey, 1900.

^a MS. field notes, New Mexico, vol. 51, p. 42; in General Land Office.

PRITCHETT'S SURVEY, 1892.

In 1892 Prof. H. S. Pritchett, then professor of astronomy and director of the observatory of Washington University of St. Louis, Mo., was employed by Texas to determine "with the utmost accuracy the location of the one hundredth meridian in its intersection with the Red River." This determination was desired by Texas for use in the famous lawsuit known as the Greer County case. Professor Pritchett made the desired determination and prepared a written report thereon. This report was printed in full in the record of the case.^a As this record is a scarce document, only a few copies having been printed, Pritchett's report is here reprinted in full.

REPORT OF THE FIXATION OF THE ONE HUNDREDTH MERIDIAN.

The part of the one hundredth meridian forming the boundary between Texas and the Indian Territory was determined in 1857 by a United States surveying party. The last station fixed by that expedition is just north of the South fork of the Red river. The station was marked by a mound of stones, in the centre of which was placed a larger stone, marked "100 W.," and is known in that region as the "initial monument."

The nearest telegraph station to the monument is Childress, distant about eleven miles west and nine miles south.

It was necessary to determine the geographic co-ordinates of this point and then proceed to the fixation of the position of the meridian at the intersection of the Red river. The method of triangulation seemed best suited for this purpose. The longitude of Childress was determined on three nights by an exchange of clock signals with the observatory at St. Louis, the time observation at that point being made by my assistant, Mr. A. Ramel.

The transit instrument used at Childress was Wurdemann No. 20, the property of the United States Geological Survey, and kindly loaned by the director of the survey for this work. The instrument used at St. Louis was the Fauth transit of the observatory.

The observing station at Childress was placed in the northeast corner of lot 12, block 43, as shown on the town plat of Childress, the observing pier being 5.50 feet west and 2.33 feet south of that corner. The following determinations of the longitude refer to this pier:

Apparent differences of longitude from exchange of arbitrary signals.

Date.	Mean difference, clock faces.	Correction, St. Louis clock.	Correction, Childress chronometer.	Childress, west of St. Louis.
1892.	m. s.	s.	s.	m. s.
June 14.....	+36 37.544	+1.060	-200.652	39 59.256
15.....	+36 40.293	+1.323	-197.499	59.115
20.....	+36 50.264	+2.368	-186.590	59.222

Observing pier at Childress west of St. Louis transit pier = $0^{\text{h}} 39^{\text{m}} 59.198^{\text{s}}$.

Difference longitude St. Louis-Childress = $0^{\text{h}} 39^{\text{m}} 59.198^{\text{s}} \pm .029$.

^a Record, Supreme Court of the United States, October term, 1894. No. 4, original. The United States, complainant, v. The State of Texas. In equity, Vol. II, pp. 1194-1199.

The correction for personal equation between Mr. Ramel and myself was determined from a large number of observations made before and after the longitude exchange. The results before and after exchange were very accordant. The amount of this difference of personality was found to be $+0.2066s. \pm 0.0078s.$ taken in the sense P.—R.—that is to say, Pritchett observes the transit of a star later than Ramel by this amount. The correction is therefore to be subtracted from the observed longitude, giving as the final longitude of Childress with respect to St. Louis.

	<i>h.</i>	<i>m.</i>	<i>s.</i>
Longitude, Childress-St. Louis	0	39	58.991
Longitude, St. Louis-Greenwich	6	00	49.168
Longitude, Childress-Greenwich	6	40	48.159
	100°	12'	2.38"

LATITUDE OF CHILDRESS.

The latitude of Childress was determined by Talcott's method from observations of pairs of stars. The declinations of stars were taken from the Berlin Jahrbuch or from Safford's catalogue of mean declinations of 2,018 stars.

The resulting latitude of the observing pier is $34^{\circ} 25' 16.1'' \pm 0.46''$.

The triangulation system commenced at a point in the meridian of the transit instrument and 18.96 feet north of it, and this point is designated as Childress in the triangulation scheme. We have, therefore, for the co-ordinates of the initial point of the triangulation the following values:

Co-ordinates of the station Childress.

	<i>o.</i>	<i>'</i>	<i>"</i>
Longitude	100	12	2.38
Latitude	34	25	16.3

MEASUREMENT AND LENGTH OF BASE LINE.

As the basis of triangulation a base line was selected in the best available ground, starting at the station Childress and extending for about 0.8 miles east. The base was measured twice with a 300-foot steel tape, kindly loaned by Professor Johnson, of Washington university. The tape had been carefully compared with the standard of the Mississippi river commission and found to be for a stress of 16 pounds $300.349 \text{ feet} + 300 \times 0.000007 (t - 62^{\circ})$.

This determination was made with the tape resting on a level surface, and the 100-foot divisions of the tape were also examined. In the measurement of the base the tape was allowed to rest on the ground, which was very smooth and at a nearly constant grade. A constant pull of 16 pounds was maintained by means of a spring balance. Marks were made with a pencil to mark the end upon stakes driven close down to the ground and having a surface some 3 inches in width. Two measurements of the base were made, the first on June 17th, during a very cloudy day, and the other on June 23rd, just after sunset. The temperature was read by a thermometer placed in contact with the tape. For correcting the measurement for error of grade a line of levels was run from the station Childress to the east end of the base and the inclination of each tape length determined. The altitude of the base was assumed from the railroad surveys to be 1,880 feet above sea level.

The following results were obtained for the length of the base:

June 17.—Measured length of base=13 tapes+101.0 feet. $t=72.5^{\circ}$.

June 23.—Measured length of base=13 tapes+100.675 feet. $t=84.5$.

Using the length of tape given above, there results:

June 17: Length of base	4,005.841 feet.
June 23: Length of base	4,005.844 "
Adopted length of base	4,005.842 "
Correction for grade	-0.167 "
Correction to reduce to sea level	-0.360 "
Reduced sea level length of base	4,005.315 "
	= 1,220.809 meters.

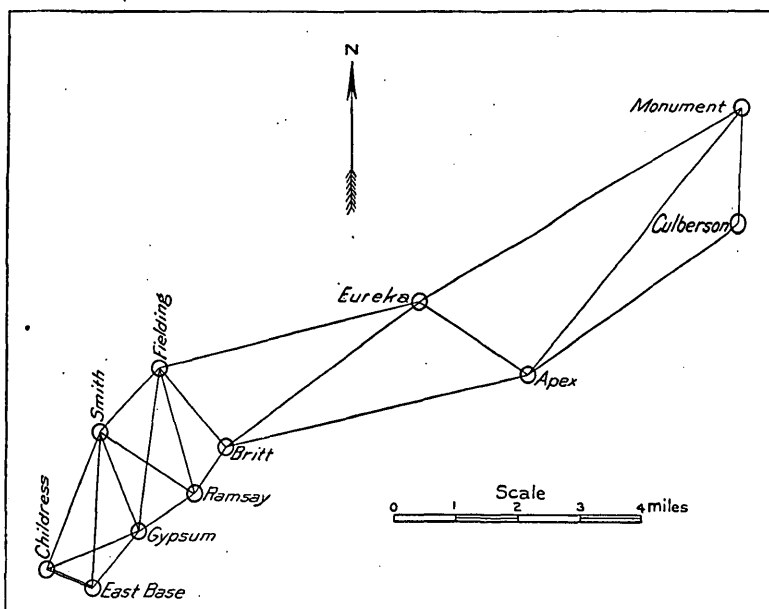


FIG. 4.—Diagram of Pritchett's triangulation near Red River (1892), from Record in the Greer County case, p. 1196.

The triangulation which connects Childress with the initial monument is shown in the accompanying sketch. It will be noted that the long sides of the triangles on the eastern end lie mostly north and south, so that errors in the sides would make but little difference in the longitudes of the stations. The stations Eureka and Apex are on the range of hills between Childress and the Red river, and the station Britt had to be so chosen that these could be seen through ravines in the intervening hills.

The angles of the triangles were measured with an engineer's transit having a six-inch circle divided to fifteen minutes and read by two verniers to twenty seconds of arc. The repeating method was used. The error of closure was quite satisfactory, the average error being 9".

The two quadrilaterals at the beginning of the triangulation were not adjusted as quadrilaterals. Each triangle was adjusted for errors of closure only, and the mean of the independent results taken. The values of the measured angles are shown in the following table:

Triangle.	Measured angle.	Spher. Ex.	Adjusted angle.	Log. sines.	Log. sides in meters.
	° ' "		° ' "		
Smith	19 33 57.0	-----	19 34 00.7	9.524924	3.086648
Childress	88 13 39.5	-----	88 13 43.2	9.999792	3.561516
East base	72 12 12.5	-----	72 12 16.1	9.978707	3.540431
Childress	42 2 00.0	-----	42 1 55.6	9.825781	3.242318
East base	110 4 26.5	-----	110 4 22.1	9.972785	3.389322
Gypsum	27 53 46.7	-----	27 53 42.3	9.670110	3.086648
Smith	44 54 49.5	-----	44 55 5.4	9.848864	3.389322
Childress	46 11 39.5	-----	46 11 55.4	9.858384	3.398842
Gypsum	88 52 43.3	-----	88 52 59.2	9.999918	3.540376
Smith	25 20 52.5	-----	25 21 00.4	9.691594	3.242373
Gypsum	116 46 30.0	-----	116 46 37.8	9.950738	3.561516
East base	37 52 14.0	-----	37 52 21.8	9.788104	3.398883
Fielding	37 49 50.5	-----	37 49 41.4	9.787670	3.398863
Smith	111 47 21.0	-----	111 47 11.8	9.967816	3.579009
Gypsum	30 23 16.0	-----	30 23 6.8	9.703959	3.315181
Ramsay	41 59 53.0	-----	41 59 52.1	9.825492	3.398863
Smith	34 30 38.3	-----	34 30 37.4	9.753243	3.320613
Gypsum	103 29 31.5	-----	103 29 30.5	9.787846	3.561217
Fielding	70 23 35.9	-----	70 23 35.5	9.974059	3.561217
Smith	77 16 42.7	-----	77 16 42.3	9.989206	3.576363
Ramsay	32 19 42.5	-----	32 19 42.2	9.728168	3.315335
Fielding	32 34 5.0	-----	32 34 6.3	9.731030	3.326494
Ramsay	74 19 35.5	-----	74 19 36.8	9.983545	3.579009
Gypsum	73 6 15.5	-----	73 6 16.9	9.980838	3.576362
Britt	97 25 44.5	-----	97 25 43.5	9.996339	3.576333
Ramsay	49 06 9.2	-----	49 06 8.2	9.878453	3.458446
Fielding	33 28 9.2	-----	33 28 8.3	9.741534	3.321527
Britt	95 35 15.0	-----	95 35 16.3	9.997931	3.902710
Fielding	63 26 43.0	-----	63 26 44.3	9.951586	3.856364
Eureka	20 57 58.0	-----	20 57 59.4	9.553567	3.458446
Britt	22 40 44.6	-----	22 40 47.0	9.586114	3.605649
Eureka	113 56 32.5	-----	113 56 35.0	9.960922	3.980457
Apex	43 22 35.5	-----	43 22 38.0	9.836829	3.856364
Eureka	61 27 44.7	-----	61 27 44.7	9.943744	4.010350
Monument	20 14 28.4	-----	20 14 28.4	9.539043	3.605649
Apex	98 17 46.9	-----	98 17 46.9	9.995435	4.062041
Monument	38 59 3.0	-----	38 59 1.9	9.798721	3.898182
Apex	15 33 21.0	0.1	15 33 19.8	9.428413	3.527874
Culberson	125 27 39.5	-----	125 27 38.3	9.910889	4.010350

THE AZIMUTH OF THE LINE CHILDRESS-GYPSUM.

The azimuth of the line Childress-Gypsum depends on the azimuth of a meridian mark set up about three-fourths of a mile north of the observing pier. This mark was bisected by the mid wire of the transit instrument each night before commencing time observations; also special observations for it were made on June 22nd. The resulting observations showed the mark to be west of north $11.22'$. A number of measures of the angle Meridian-Childress-Gypsum gave as the final azimuth of the line Childress-Gypsum $248^{\circ} 21' 27.8''$.

With this initial azimuth the following geodetic positions of the stations in the triangulation were obtained:

Geodetic positions and azimuths in triangulation.

Stations.	Latitudes.			Longitudes.			Azimuths.			Stations.	Reverse azimuth.		
	°	'	"	°	'	"	°	'	"		°	'	"
Childress	34	25	16.3	100	12	2.38	248	21	28	Gypsum	68	22	18
							290	23	23	East base	110	23	49
							202	09	32	Smith	22	10	1
Gypsum	34	25	45.6	100	10	33.16	157	15	17	Smith	337	14	40
							260	44	41	Ramsay	80	45	27
Smith	34	27	0.6	100	11	11.09	225	27	41	Fielding	45	28	13
Ramsay	34	25	56.7	100	09	11.16	204	11	28	Britt	24	11	47
Fielding	34	27	47.7	100	10	13.38	301	36	37	Britt	121	37	31
Britt	34	26	58.8	100	08	37.51	239	53	34	Apex	59	53	53
Eureka	34	30	4.5	100	05	47.20	221	50	4	Monument	41	52	55
Apex	34	29	34.4	100	03	13.36	201	37	3	Monument	21	38	27
							217	10	23	Culberson	37	12	9
Monument	34	34	43.4	100	00	45.33	312	39	25	Culberson	162	39	47
Culberson	34	32	58.9	100	00	5.90							

The station "monument" was 6.8 feet east and 1.2 feet south of the initial monument.

We have, therefore, the following final positions for the initial monument and the station Culberson:

Longitude, initial monument	100	00	45.41
Latitude, initial monument	34	34	43.4
Longitude, Culberson	100	00	5.90
Latitude, Culberson	34	32	58.9

The initial monument is, therefore, shown to be 45.41" west of the one hundredth meridian, equivalent at this parallel of latitude and at the assumed altitude to 3,797.3 feet.

Similarly the station Culberson is 5.90" west of the one hundredth meridian, equivalent to 493.5 feet, and the final monument to mark the one hundredth meridian should, therefore, be placed 493.5 feet east of station Culberson.

PROBABLE ERROR OF THE RESULT.

The probable error of the final determination involves the probable errors of the longitudes Greenwich-St. Louis, St. Louis-Childress, and Childress-Culberson. The last-named, which depends on the triangulation, may be assumed as insignificant in comparison with the other two. The probable error of the difference St. Louis-Childress as found above is $\pm 0.029s.$, and that of the difference St. Louis-Greenwich is estimated as $\pm 0.05s.$, the uncertainty lying almost wholly in the transatlantic determination. The probable error of the final result is, therefore,

$$\pm \sqrt{(0.05)^2 + (0.029)^2} = \pm 0.058s. = \pm 0.87'' = \pm 73 \text{ feet.}$$

This probable error can not be appreciably reduced without a redetermination of transatlantic longitudes.

H. S. PRITCHETT.

PRESTON'S SURVEY, 1900.

On October 25, 1899, Mr. Levi S. Preston, United States deputy surveyor, entered into a contract (No. 336) with the General Land Office to execute certain land surveys in New Mexico near the north and west boundaries of Texas. Among other things, Preston was to carefully redetermine or retrace Clark's line along the northern part of the one hundred and third meridian and connect his surveys therewith. This work he did (between July 11 and 18, 1900) with such zeal, intelligence, and faithfulness and reported his results (on May 7, 1901) with such clearness that much of the doubt and uncertainty which had long existed has been cleared up. So far as Preston's work relates to the west boundary of Texas, it may be briefly summarized as follows:

Starting with a Gurley transit at Clark's monument 15 on the south bank of the Canadian, he surveyed northward 76 miles, retracing Clark's line to the northwest corner of Texas. He also prolonged this line $34\frac{1}{2}$ miles farther north to its intersection with the south boundary of Colorado, and from that point of intersection measured westward to the Johnston and Macomb monuments and eastward to the Cimarron meridian; also from the northwest corner of Texas, as now locally recognized and adopted, he measured eastward to the Cimarron meridian (south end) and westward to the supposed locality of the Major monument of 1874, which, however, he did not find. Clark's monuments on the one hundred and third meridian, from the one on the south bank of the Canadian northward to the corner, are numbered (in Clark's report) 15 to 26, inclusive. Of these, Preston identified 15, 16, and 17 certainly, 20 doubtfully, and 26, the corner one, not at all as a monument, but satisfied himself that the present fence corner of the pasture of the XIT or Capital Land and Cattle Company is at or very near Clark's corner monument. He also reports that there is no trace of monument 24.

The story of Preston's survey we shall now tell somewhat more at length and mostly in his own words. The records from which this story is derived are chiefly his Special Instructions, consisting of 24 typewritten foolscap pages, typewritten transcript of his field notes, and the accompanying plat, all now on file in the General Land Office.

At page 9, of the Special Instructions, Preston is directed thus:

"In the event that you can identify and locate the northwest corner of the State of Texas as established by the United States and Texas commission, which should be done by proving such corner by running west on the north boundary and north on the west boundary of Texas," you will do one thing, "but in the event that you can not identify and locate the said corner and boundary," you will do something else.

At page 9½ the Instructions continue:

In 1874 Mr. Major, who established a portion of the east boundary of New Mexico, between 36° 30' and 37° North Latitude, ran south from the old Johnson monument, on the north boundary of New Mexico, for a total distance of 34½ miles, where he established a monument for the northwest corner of Texas. As Major, in 1874, could find no trace of the old Clark monument and northwest corner of Texas, there seems little probability of identifying this point at the present time. Therefore in order to locate such northwest corner of Texas, and the southern boundary of the strip lying west of the Cimmarron Meridian, a line should be run due west from the initial point of said meridian to a point due south of the Johnson monument and on this line the surveys may be closed from the north, and Major's monument should not be used if found.

The distance between the Johnson monument and the intersection of the Colorado-New Mexico boundary line with the Cimmarron Meridian should be ascertained by remeasurement and this distance, allowing for divergence of meridians, may be adopted in setting off the southern boundary of this strip to be run west of the initial point of said Cimmarron Meridian. This will avoid the necessity of running due south from the Johnson monument to fix the position of the line of the southern boundary of the strip, as there appears to be no other feasible method of identifying the west boundary of Texas as surveyed by Clark, and confirmed by Congress, without retracing an indefinite and at present unknown, part of the boundary, involving much time and expense.

And finally, on page 17 of the same Special Instructions, Preston is told that—

It is more than likely that some of the exterior lines of townships heretofore established and of the grant line on which one of your surveys will close, and of the eastern boundary of New Mexico and Cimmarron Meridian and the western boundary of Texas are in a very bad condition or the corners obliterated on the ground, and it is very necessary for you to retrace and reestablish some or all of said lines in order to properly execute your surveys and in order to prove your surveys correct, and said lines should be so far retraced and reestablished (if you conclude the same to be absolutely necessary) as will show conclusively where the errors, if any, exist.

Under these instructions and provided with a Gurley transit, reading to minutes, Preston began his work. In May, 1900, he retraced the range line between ranges 36 and 37, from the vicinity of the northwest corner of Texas northward to the Colorado line, about 35 miles, and between July 11 and 18, 1900, retraced Clark's line from the Canadian northward to the northwest corner of Texas, about 76 miles.

In his field notes, received by the General Land Office May 7, 1901, he says:

I retraced Range line between ranges 36-37 E., running north through townships 26 to 32 North (i. e., from latitude 36½° to 37°, near the one hundred and third meridian) and intersected the Colorado and New Mexico boundary line in May, 1900, at a point 48.83 chains east of the monument erected by Captain Macomb in 1859 for the northeast corner of New Mexico.

From the Macomb monument I ran west and at 1 mile 68.15 chains found the Johnson monument established in 1857.

The Johnson monument I found to consist of a circular trench 24 feet in diameter, 6 inches deep, and 2 feet wide, with the remains of an old mound in the center about 15 feet in diameter and 1 foot high, the whole grass grown. Lying on the ground I found a stone marked, "Major 1874," "N. M. 103° L., 37° L.," evidently the stone set by Mr. Major in 1874, as mentioned in letter "E" of July 16, 1887, from the Commissioner of the General Land Office supplied me by the Surveyor General.

Also from the Macomb monument I ran east and intersected the Cimarron Meridian at 2 miles 40.53 chains, making the total distance between Cimarron Meridian and the Johnson monument 4 miles 28.68 chains. This distance was carefully chained twice over and is correct within a few links at most.

* * * * *

I ran west from the southwest corner of Oklahoma, as established by Chaney and Smith in 1881 a distance of 4 miles 28.68 chains, * * * searching as I went, but failed to find any old corners as established by either Clark in 1859 or by Major in 1874. But at 2 miles 14.65 chains west of Cimarron Meridian and 5.47 chains south I found the northwest corner of XIT pasture fence, accepted by the State of Texas and by Dallam County, Tex., as the northwest corner of the State.

From this fence corner the State of Texas has initiated surveys running east and south and dividing the XIT lands into leagues, and have set stones for some distance at each one-fourth league, or 53 chains, marked with paint XIT on south and east faces as the case may be.

According to my traverse this fence corner is 2 miles 14 chains east of the Johnson monument.

In 1859 Captain Macomb was instructed to establish a new monument for the one hundred and third meridian at 11,582 feet, or 2 miles 15.50 chains, east of the Johnson monument. * * * While John H. Clark ran south from the Johnson monument in 1859, several months prior to the establishment of the Macomb monument, it is very probable that he was supplied with the information from Washington that the Johnson monument had been determined to be 11,582 feet too far west.

Clark was at Fort Union after supplies at this time and in direct communication with Washington, and it would be strange if he were not supplied with the information.

Preston's conclusions here are valid, although when writing he was evidently not aware that it was Clark himself who made the lunar observations and the computations from which it was concluded that the Johnston monument was placed 11,582 feet too far west. Clark, therefore, was, without communicating with Washington, in possession of the data for setting his Texas corner post on the one hundred and third meridian in 1859, in accordance with the results of his own astronomical work in 1857.

Preston continues:

If this were the case then Clark did what Captain Macomb failed to do, as the fence corner is within $1\frac{1}{4}$ chains of a point 11,582 feet east of the Johnson monument, while the Macomb monument is still 26.35 chains west of where Captain Macomb was instructed to establish it.

From this fence corner I ran east 17 miles [and] south 11 miles as per the plat and notes furnished me by the Surveyor General, but failed to find any old monuments, as both Johnson and Captain Macomb had failed to establish their monuments correctly.

Professor Darling, Major, Chaney, and Smith and Brown had all failed to recover or reestablish the west boundary and northwest corner of Texas, and Surveyor General Vance, at Santa Fe, had exhausted his resources in supplying me with information in regard to this boundary, but urged the necessity of recovering the west boundary and northwest corner of Texas, so as to settle for all time the closings of the public land surveys of New Mexico on the Texas and Oklahoma boundaries, which closings had been in a state of uncertainty and dispute for forty years past. Hence I set to work to solve the problem regardless of time or expense. I rode 200 miles on horseback, interviewing "old timers" who had assisted in building the XIT fence. I went by rail to Channing, Tex., to interview the manager of the XIT, or Capital Land and Cattle Company, and there got track of Mr. W. S. Mabry, who retraced the western boundary of Texas and built the XIT fence in 1882 to 1885. Mabry was at San Antonio, Tex., but I wired him to meet me, which he did on June 10 [1900]. From him I received a copy of the retracement of the old Clark survey in 1882 to 1885, which gave one connection with the public surveys of New Mexico, and received much information in regard to the history of Clark's survey and of the old monuments on the western boundary of Texas. I learned that no monuments were to be found north of the north bank of the Canadian River in T. 14 N., R. 37 E., and possibly none north of the bluffs of the Llano Estacado, in Ts. 8 or 9 N., R. 37 E., of New Mexico Principal Meridian.

It seems that prior to 1880 the XIT, or Capital Land and Cattle Company, had had their lands subdivided into leagues, and on Mabry's retracement of the Clark survey, in 1882 to 1885, he found these "Capital leagues" extending over into New Mexico. The extent of this conflict Mabry ascertained, and the State of Texas granted the Capital Land and Cattle Company other lands in Texas, equal to the amount of this conflict.

All this is matter of record and history at Austin, Tex.

Supplied with this information, and having completed all the surveys in this part of New Mexico under my contract No. 336, except the closings onto Texas boundary, I left Kenton, Okla., on July 5th, 1900, intending to go south as far as the Llano Estacado, if necessary, and reached the Canadian on July 10th, where I found three of the monuments of the Clark survey [Nos. 15, 16, and 17], as described by Mabry.

Preston continues:

[On July 11, 1900] with the assistance of Mr. Ritter, of Red River Springs, who has lived on the Canadian near the Texas line since 1880, I found two old monuments on the mesa north of the Canadian and one on the mesa south. I set a flag pole in center of the extreme north monument [Clark's 17] and at the monument south of the Canadian [Clark's 15], which I found to be a circular depression in the ground 16 feet in diameter, with slightly higher ground in center of same, partly overgrown with grass and amole plants and agreeing in description and position with Mr. Mabry's description, as it was in 1885, and with the copy of Clark's plat of 1859.

* * * * *

I set up over stone in center of old monument on mesa south of Canadian river [Clark's 15]. Sight on signal one and one-half miles northerly [Clark's 17] and run north on course of old monuments on resurvey of old line.

From Clark's monument 15 to Clark's monument 16 Preston finds the distance by chaining to be 1 mile 36.25 chains, and Clark's 16 bears from Clark's 15 N. $0^{\circ} 09' W.$, true, from observation on Polaris at E. elongation. From Clark's monument 15 to Clark's monument 17 is 1 mile 63.70 chains, and the bearing N. $0^{\circ} 09' W.$, true.

Clark's monument 16 is thus described:

An old monument on state line, a circular trench 20 feet in diameter, 1 foot deep, 3 feet wide, with mound of gravel in center, 14 feet in diameter and 3 feet high, with bunches of grass and amole plants growing on same, evidently one of Clark's old monuments, and agrees with copy of Clark's old map of 1859 and Mabry's description.

Clark's monument 17 is thus described:

An old mound on state line, a circular trench 20 feet in diameter, 6 inches deep and 2 feet wide, with mound of gravel in center, 15 feet in diameter and $1\frac{1}{2}$ feet high, with bunches of grass and amole plants, evidently one of Clark's old monuments, and agrees in position with copy of Clark's old map of 1859 and Mabry's description.

At a point 39 miles 60 chains N. $0^{\circ} 09'$ W., true, from Clark's monument 15, Preston finds:

A sandstone $6 \times 8 \times 6$ inches above ground, marked "XIT" on east, "NM" on west, and "1885" on top, bearing east 86 links distant, situate on fence line.

Mabry describes finding traces of one of Clark's monuments in 1885 at about this point, which is some 60 chains south of the Tramperos arroyo, or Major Longs Creek, and which monument he had United States Deputy Surveyor Unruh tie in to the Range line. Unruh gives tie as 39 chains south, 56.45 chains east of the corner to sections 12-13, on line Rs. 36-37 E. in T. 20 N. Mabry does not mention setting this stone, but either he or Unruh evidently set it here in the old mound to preserve the position of same. All trace of the old Clark monument is obliterated. * * *

He continues:

I am now satisfied with the identity of this stone on state line as being the position of one of Clark's old monuments as described by Mabry.

This monument [Clark's 20] is 36 miles 76.30 chains north of the last old monument [Clark's 17] on north bank of the Canadian, and the falling is 86 links west or 1 minute in course. Hence, true course from Canadian monument to Tramperos monument [Clark's 20] is N. $0^{\circ} 08'$ W.

I set over stone in monument in longitude $103^{\circ} 02'$ W. and latitude $35^{\circ} 57'$ N. and correct course to N. $0^{\circ} 08'$ W., and continue on state line over sand hills in Tramperos bottom or valley.

* * * * *

In 1882 W. S. Mabry, then county surveyor for Dallam, Hartley, and Oldham counties, Tex., proceeded to re-trace the north and west boundary of the State of Texas, and began said survey from the northwest corner of the State, and tied in to the Smith and Chaney monument at southwest corner of Oklahoma, as per following copy of his field notes:

"March 31st, 1882, begin at northwest corner of Texas, which is a large mound of earth with circular trench and a cedar post 12 inches square 6 feet high, marked 'T L $36^{\circ} 30'$ a 1859' on one side, and on the opposite side marked 'N. M. L. 103° a 1859.'^a Same being the northwest corner of the Panhandle of Texas."

Thence east, crossing a drain at 3,443 varas, to mound and three pits, the northeast corner of league No. 1. Thence north $79^{\circ} 30'$ E., 703 varas, to large stone monument marked "C. M. $103^{\circ}-36^{\circ} 30'$ & 1881."

^a Evidently this means T[exas] L[atitude] $36^{\circ} 30'$ a[nn]o 1859 and N[ew] M[exico] L[ongitude] a[nn]o 1859.

As the vara used in Texas is taken to be $33\frac{1}{4}$ inches long, or 4.21 links, this tie gives a distance of 2 miles 14.05 chains east and 5.39 chains north as the distance between northwest corner of XIT fence and the southwest corner of Oklahoma.

I made total distance 2 miles 14.65 chains east and 5.47 chains north, as previously described in these notes.

I made search for evidence of old corners, but there were none, other than at the XIT fence corner, where the ground is bare and hard over a circular area of some 20 feet in diameter, but whether from an old mound of earth or simply from cattle tramping around the fence inside and out of the pasture I was unable to determine. However, this fence corner is but one-half minute of course west of a line running N. 0° $08'$ W. from the Canadian through the Tramparas [sic] monument; that is, course from Tramparas monument to fence corner is N. 0° $08'$ $30''$ W., a distance of 37 miles 42.35 chains.

At this northwest corner of the XIT pasture fence I remove wire fencing, dig up the corner post, which I find set 18 inches in the ground, and set on top of the rotted stump of an old cedar post. Excavating carefully around this old stub, I find the bottom of it at 26 inches below surface of ground, and remove a segment of the old post 8 inches in diameter and 8 inches long, greatly decayed and reduced almost to a dry pulpy ash. The dark mould and pieces of decayed cedar indicated that the original post was about 10×12 inches in diameter at bottom.

This old cedar post could easily have been in the ground more than the eighteen years since 1882, and very likely for ten years longer.

This point being almost on true alinement with the old Clark monuments found 37 miles and 75 miles south, agreeing very closely with Mr. Mabry's tie of 1882, and within 150 links of the proper position east of the Johnson monument, as determined in 1858 and 1859, therefore

I set a sandstone $60 \times 12 \times 10$ inches 36 inches in the ground for the northwest corner of the State of Texas, marked "N. W. Cor.
Texas," on east; "N. M.," on west; "1859," on south, and "1900," on north faces.

I dig two pits $36 \times 36 \times 12$ inches south and east of corner, 12 feet distant, so as not to deface the surface of the possible old circular trench and mound, and raise mound of earth and stone 5 feet base $2\frac{1}{4}$ feet high southeast of corner.

From this corner the south and highest peak of the Rabbit Ears bears N. 78° $53'$ W.

* * * * *

In the retracement of a portion of the boundary line and the establishment of the northwest corner of Texas I have endeavored to carry out my "Special Instructions" to establish said northwest corner "by running west on the north boundary and north on the west boundary of Texas."

As I was unable to obtain an original copy of John H. Clark's report of his survey of 1858-1859, I obtained what information I could from private sources and then succeeded in verifying such information by actual explorations and surveys on the ground.

However, there are three sources of information on record in the Department in Washington or at Austin, Tex., which should verify my retracement of the Texas boundary, but these records I had neither the time nor the expense allowance necessary to obtain, viz:

First.—The report of United States Commissioner John H. Clark on his survey of the Texas boundary in 1858-59, and probably entitled "History of the one hundred and third meridian."

Second.—Field notes of the survey of Exterior or of the subdivision lines of T. 20 N. of R. 36 E., by Unrah (or Unrah and Davis), 1885.

Third.—Plat and estimates of conflict of "Capital leagues" with the Texas State line, by W. S. Mabry, 1885, filed at Austin, Tex.

LEVI S. PRESTON,
United States Deputy Surveyor.

Such is the story of the northwest boundary of Texas as told by Preston. The field notes of the survey by Unruh in 1880 (not 1885, as Preston writes) I have examined, but find therein nothing bearing on the Texas boundary. The records at Austin, Tex.. I have not seen.

DISCUSSION.

BOUNDARY ON THE ONE HUNDREDTH MERIDIAN.

THE LAW.

The east boundary of the panhandle of Texas is established by law to be that part of the one hundredth meridian, of west longitude from Greenwich, included between Red River and the parallel of $36^{\circ} 30'$. The earliest reference to any part of the one hundredth meridian as a boundary was made in 1821. In the treaty between Spain and the United States of February 19 of that year, the boundary between the United States and the Spanish possessions was defined, in part, as beginning at the mouth of the Sabine River and continuing along the western bank of that river to the thirty-second parallel; "thence by a line due north to the degree of latitude where it strikes the Rio Roxo of Natchitoches, or Red River; then following the course of the Rio Roxo westward to the degree of longitude 100° west from London and 23° from Washington; then crossing the said Red River and running thence by a line due north to the River Arkansas," etc.

In 1850 Texas agreed that the northeast corner of the panhandle should be at the intersection of the parallel of $36^{\circ} 30'$ and the one hundredth meridian west of Greenwich.^a

In 1858 provision was made for running and marking the boundaries between the United States and Texas. That act defined the east boundary of the panhandle as "beginning at the point where the one hundredth degree of longitude west from Greenwich crosses Red River and running thence north to the point where said one hundredth degree of longitude intersects the parallel of $36^{\circ} 30'$ north latitude," etc.

Such is the line on paper. In 1859 the line was surveyed and marked on the ground. How well the surveying was done and how nearly these marks conform to the language of the law we shall now consider.

ORIGINAL SURVEYS.

Messrs. A. H. Jones and H. M. C. Brown were contract surveyors employed by the Indian Office just prior to the civil war to survey the boundaries of certain Indian lands. They entered into a contract

^a Statutes at Large, Vol. IX, p. 446.

with the Indian Office for this purpose late in 1857. On November 3, 1857, Daniel G. Major was appointed astronomer for the Indian boundary surveys. In the spring of 1859 Jones and Brown started from a monument, which still exists on the north bank of Red River and which, according to moon culmination observations made by Major in January, February, and March, 1859, is on the one hundredth meridian of west longitude from Greenwich. From this point they surveyed northward, setting monuments at every mile. The whole distance from Red River to the northeast corner of the panhandle is 133 miles. Of this distance, starting at the south end, Jones and Brown surveyed and marked about 110 miles. Their line ended at 109 miles, 56 chains, 54 links from the starting point on Red River. Their "terminating monument" was set about 19 miles north of the Canadian River. The remaining 23 miles was surveyed by Clark in June the following year. Clark arrived June 8, 1860, at the point where Jones and Brown's line crosses the Canadian River. He first followed their line northward 19 miles to its end and then prolonged it 23 miles further, to its intersection with the parallel of $36^{\circ} 30'$, i. e., to the northeast corner of the panhandle. In this stretch he erected four monuments. This count includes the one at the end, marking the northeast corner of the panhandle. In going over that part of the Jones and Brown line north of the Canadian, 19 miles, Clark found that many of the mounds set the previous year had been destroyed. Rains had washed away some of those located in hollows and buffaloes had destroyed others.

As a check on the longitude of the northeast corner Clark prolonged his extension of the Jones and Brown line about 35 miles farther north, to the south boundary of Kansas. He intersected that line about 1,700 feet east of the one hundredth meridian as determined by himself when employed in the Johnston party of 1857.

SUBSEQUENT SURVEYS.

Since the original surveys of this line all the lands adjoining it on the east have been surveyed and subdivided. In 1873 Mr. C. L. Du Bois, now of the General Land Office, surveyed six townships adjoining this boundary at its south end. In the stretch of 36 miles covered by Du Bois's survey the one hundredth meridian, as laid down by Jones and Brown, is found to bear generally about half a degree east of north. This fact rests on solar compass observations. Subsequent surveys farther north show continuance of the same thing for some 70 or 80 miles, after which this deflection largely disappears and the line runs north. The Land Office meridians agree as to this. These meridians were laid down independently of the Jones and Brown line, and they converge toward it much more than the true convergence.

Prof. H. S. Pritchett, now president of the Massachusetts Institute of Technology, determined, telegraphically, the longitude of the south end of this line on June 14, 15, and 20, 1892. In the famous Greer

County case, *United States versus Texas*, Pritchett was employed by Texas to determine as accurately as possible the longitude of the monument on the north bank of Red River, set in 1859 to mark the one hundredth meridian. This he did, and found its longitude to be $100^{\circ} 00' 45'' .71$ west of Greenwich or 3,797.3 feet west of the one hundredth meridian.

FUTURE SURVEYS.

At its last session, Congress passed an act, approved January 16, 1901, directing the Secretary of the Interior "to cause to be established and fixed the intersection of the true one hundredth meridian with Red River * * * by the most accurate and scientific methods, and at said intersection cause a suitable monument to be erected on the ground." ^a

CONCLUSION.

1. The northeast corner of the panhandle of Texas is fixed by law at the intersection of the parallel of $36^{\circ} 30'$ and the one hundredth meridian west of Greenwich.

2. This point was located by Clark, in June, 1860, and a monument was erected to mark it.

3. Congress confirmed a part of Clark's survey in 1891, such confirmation including his monument at the northeast corner of Texas.

4. Subsequent surveys, though inconclusive, make it probable that the said Clark monument was established a little to the west—say 1,000 feet more or less—of the one hundredth meridian.

5. The monument on the north bank of Red River, set by Major in 1859, to mark the eastern boundary of Texas at that point, is 3,797 feet west of the one hundredth meridian.

6. By subsequent public land surveys, approved by the General Land Office, said monument on Red River has been accepted as marking the Texas boundary line at that point.

7. Those boundary monuments, which are northward from this one and which were set by Jones and Brown in 1859, have been accepted in the public land surveys as boundary monuments of Texas.

8. Said monuments were, by order of the Secretary of the Interior, accepted by Clark in 1860 as marking the east boundary of the panhandle.

9. Said monuments are accepted by local residents as the boundary monuments between Texas and Oklahoma.

10. So far as I know, Texas has never accepted or disputed these monuments.

11. To conform to these conclusions the boundary should, until better information is available, be drawn on maps as follows:

The northeast corner of the panhandle should be located on the parallel of $36^{\circ} 30'$ and about 1,000 feet west of the one hundredth meridian; thence a line should be drawn directly south, parallel to

^a Statutes at Large, Vol. XXXI, p. 732.

the one hundredth meridian, to a point about 50 miles south of the starting point; thence a line (about 80 miles long) should be drawn southward to Red River, intersecting it at a point 3,800 feet west of the one hundredth meridian.

BOUNDARY ON THE ONE HUNDRED AND THIRD MERIDIAN.

THE LAW.

On September 9, 1850, an act of Congress was approved, by which the one hundred and third degree of west longitude from Greenwich was fixed as the western boundary of the panhandle of Texas. This is the original act creating the boundary.

Another act of Congress, approved June 8, 1858, provided for surveying and marking the line, which is 310 miles long. Pursuant to this act 180 miles, or about 58 per cent of the line, was surveyed and marked by monuments in 1859.

By the sundry civil act of March 3, 1891, said survey of the boundary on the one hundred and third meridian was confirmed by the United States. The act declares that "the boundary line between said public land strip and Texas, and between Texas and New Mexico, established under the act of June 5, 1858, is hereby confirmed.

It does not appear that Texas has ever confirmed or disputed the line thus established, surveyed, marked, and confirmed.

ORIGINAL SURVEY.

The original survey was made by John H. Clark, United States commissioner and surveyor, in 1859. The Texan commissioner, Mr. Scurry, accompanied him during a part of the work.

The longitude of the south end of the line, where it meets the thirty-second parallel, was determined as follows: The station Frontera, of the Mexican boundary survey, near El Paso, was accepted and its longitude was transferred by triangulation and chaining about 12 miles northward to a point on the thirty-second parallel. The party then chained eastward 211 miles along that parallel to its calculated intersection with the one hundred and third meridian. Here they set a monument, from which they ran northward for 24 miles, erecting three monuments, or mounds, on the one hundred and third meridian north of the corner.

Clark then left the line, from lack of water, and went to its northern end, the northwest corner of the panhandle. The longitude of this corner he determined by transfer from the Kansas boundary. The Kansas boundary here referred to, it will be remembered, is the thirty-seventh parallel of north latitude, being about $34\frac{1}{2}$ miles north of the corner he was to establish. Clark was the astronomer in Johnston's party, which two years before had set the so-called Johnston monument to mark the one hundred and third meridian. That monu-

ment had been erected at a point determined by chaining westward from the western boundary of Missouri 471 miles, the calculated distance of the one hundred and third meridian from the western boundary of Missouri along the thirty-seventh parallel. As a check on this long line measured by chaining, moon culmination observations were at once made by Clark near the one hundred and third meridian. These observations indicated that the Johnston monument was about $2\frac{1}{4}$ miles west of the one hundred and third meridian.

The results derived from the astronomical observations were accepted as being more accurate than those derived from chaining, and accordingly Captain Macomb was instructed to set a new monument on the thirty-seventh parallel, 11,582 feet east of the Johnston monument, to mark the southwest corner of Kansas at the intersection of the thirty-seventh parallel and the one hundred and third meridian. Pursuant to instructions, Captain Macomb did, in November, 1859, erect such monument on the thirty-seventh parallel to the eastward of the Johnston monument. Macomb's monument was set in November, 1859. The transfer of longitude from the thirty-seventh parallel of latitude south to $36^{\circ} 30'$ on the one hundred and third meridian was made by Clark's party in September, 1859. This was before the erection of the Macomb monument and after the erection of the Johnston monument, the longitude of which Clark had himself, by astronomical observations, determined to be $103^{\circ} 02' 22.7''$. It has been supposed, or rather assumed, that Clark set the northwest corner post of Texas due south of the Johnston monument, and thus in longitude $103^{\circ} 02' 22.7''$ instead of in longitude 103° . Such assumption appears to be purely gratuitous. In the absence of all evidence and all probability to the contrary, we are not warranted in assuming that he did not use his adopted astronomical result.

Clark did not transfer the longitude of the Johnston monument. What he says is that "the surveying party was sent over to the Kansas boundary, and taking up the one hundred and third meridian as *then established* transferred it," etc. He did not take up the Johnston monument as then established, but the one hundred and third meridian as then established and which he had himself nearly two years previously determined to be $2' 22.7''$ (equal, by his calculation, to 11,582 feet) east of the Johnston monument. This establishment of the one hundred and third meridian had been adopted by the United States engineers, and orders were issued to Macomb to set a new monument to mark it—a monument to take the place of the Johnston monument.

Clark did more. To test the accuracy of the transfer of longitude for this important corner, he established his camp on Rabbit Ear Creek, near the corner, and there, on seven nights in August, 1859, he observed transits of the moon and of stars. Thus the data was obtained for an independent check on the longitude. Of these obser-

vations, however, no use has been made. In the hurried closing of his work he reported that they were not essential for constructing the maps, and were therefore not worked up. He adds: "They can be computed hereafter if desirable."

I have examined these observations with a view to computing the longitude which Clark thought might "be computed hereafter if desirable." The original record has not been found, and the only material available is that printed in 1882 in the Clark report^a (pp. 252-261). The copy from which the printer set up these pages is said to have been Clark's original record, which, I am informed, was sent to the Public Printer and never returned. In the absence of that record, and in the absence of information as to the azimuth and collimation corrections, and also in view of the weakness of any determination by the moon culmination method, it was not deemed worth while to work up these observations.

The astronomical station where these observations were made lies to the northwest of the northwest corner of Texas, about 8 miles distant. The connection between these stations was made on August 8, 12, and 17, 1859, and the result was as follows:

Clark's monument at the northwest corner of Texas bears from his astronomical station on Rabbit Ear Creek east $37^{\circ} 53'$ south, distant 7 miles and 5,252 feet.^b

From the northwest corner of Texas the line was run south for 156 miles, the meridian being traced with a large theodolite, and the distances measured and checked by latitude observations. The longitude, however, depends wholly on the northwest corner.

SUBSEQUENT SURVEYS.

A part of the boundary surveyed and marked by Clark in 1859 along the one hundred and third meridian has been twice retraced. The part so retraced, about 76 miles long, lies between the Canadian River and the northwest corner. The first retracing was made by W. S. Mabry, county surveyor of Dallam, Hartley, and Oldham counties, Tex., in 1882-1885. The records of this survey, which I have not seen, are said to be in Austin, Tex. The second retracing was by Levi S. Preston, United States deputy surveyor, in 1900. This survey indicates an error of azimuth of about $8'$ in the original survey, by which its direction was made N. $0^{\circ} 8' W$. In these two surveys four of Clark's monuments were identified, three certainly, and one doubtfully. Those certainly identified are near the Canadian, being 15, 16, and 17 of Clark. The doubtful one is No. 24 of Clark.

Monuments 15 and 16 were also identified by Taylor and Fuss in 1883. None of the surveys by Mabry, or by Taylor and Fuss, or by Preston, add any information as to the longitude of this line. Mabry,

^a Sen. Ex. Doc. 70, Forty-seventh Cong., 1st sess.

^b Same, pp. 86-88.

in or about 1882, set a post to mark the northwest corner of Texas. Eighteen years later, in 1900, Preston dug up this post and found below it the rotted stump of an old cedar post, which he deemed older than Mabry's post.

In 1874, fifteen years after Clark's monument at the northwest corner was built, it was searched for by John J. Major, who, failing to find it, reestablished it, or rather set a new one. In such reestablishment Major made the mistake of setting it due south of the erroneous Johnston monument. Major, though aware of the erroneous location of the Johnston monument, quite overlooked this fact till after his work was completed and he had returned to Washington. Such is the statement that I have derived from conversations with present employees of the Land Office, a statement corroborated by Major's map. Both John J. Major and his brother Daniel G. Major died several years ago within a few days one of the other. Any information derivable from them is, therefore, not available. His boundary monument has disappeared; at least I so infer, as I find no mention of it in any subsequent record.

In 1881 Richard O. Chaney, by independent astronomical observations, determined the intersection of the one hundred and third meridian and parallel of $36^{\circ}30'$ and set a new monument to mark the south end of the Cimarron meridian and the point declared by the law to be the northwest corner of Texas. Having built the monument, he made search for the "east boundary of the Government surveys governed by the New Mexico meridian." His search was made over the region where Clark and Major had previously built monuments, yet he makes no mention of them and evidently did not find them.

Again, in 1900, Preston carefully went over the ground in the vicinity of the Clark and Chaney monuments. He found the corner now locally recognized as the northwest corner of Texas near or at the point where Clark's monument should be, and he also found Chaney's corner. They differ in longitude by more than 2 miles. The Clark corner is, according to Clark, in longitude 103° . The Chaney corner is, according to Chaney, in longitude 103° . One of them is surely wrong and probably both are, and yet Clark's monument, confirmed by Congress, is the de facto corner. Clark's determination was a fairly good one by a weak method; Chaney's a weak determination by a strong method, and the need of a new and strong longitude determination in this vicinity is obvious. The relations of the various monuments here discussed are shown in the accompanying diagram (fig. 5).

FUTURE SURVEYS.

In view of the foregoing it is obvious that our knowledge of the location of the west boundary of the panhandle is very imperfect and unsatisfactory, and that, in consequence, topographic surveys and maps

should be made of a strip of country several miles wide along the one hundred and third meridian between the parallels of 35° and 37° .

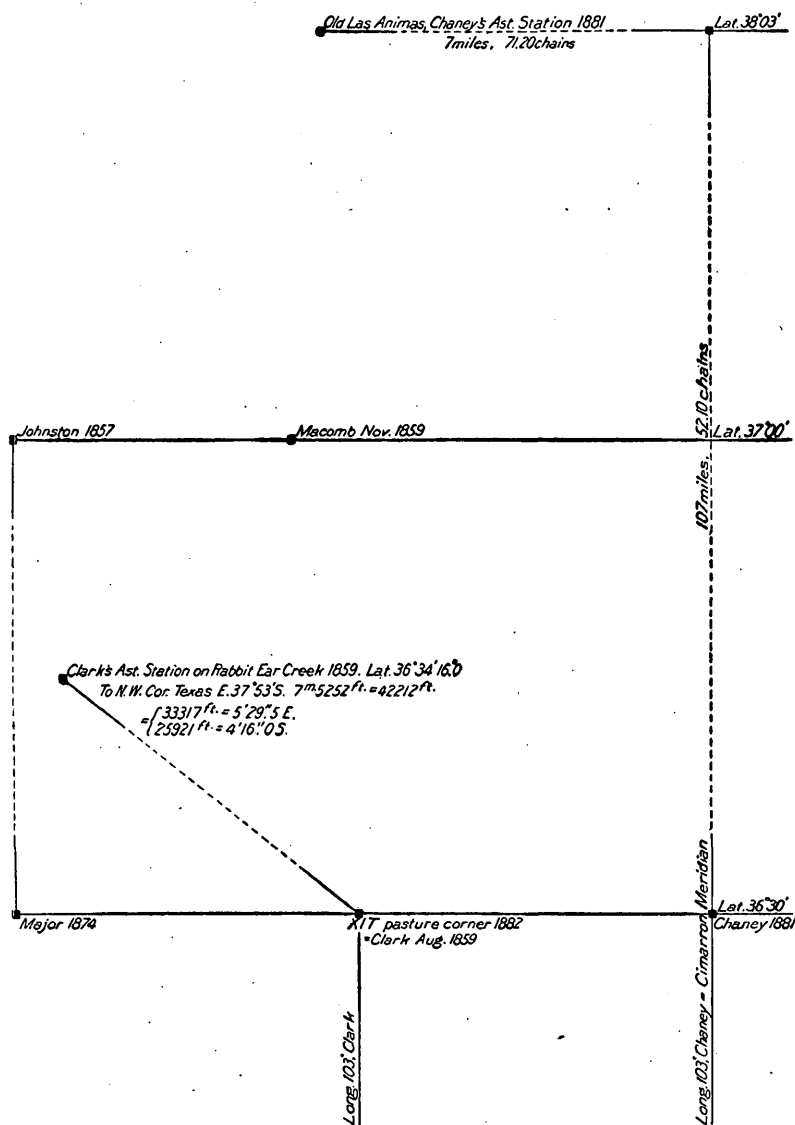


FIG. 5.—Diagram showing relations of the Johnston, Macomb, Major, Clark, and Chaney monuments.

		m.	ch.
Johnston to Macomb, teste Macomb, 1859,	11,582 feet=	2	15.39
Johnston to Macomb, teste Darling, 1868,	9,781 feet=	1	68.20
Johnston to Macomb, teste Major, 1874,	9,372 feet=	1	62
Johnston to Macomb, teste Preston, 1900,	9,778 feet=	1	68.15
Adopt.....		1	68.15
Macomb to Cimarron meridian, teste Chaney, 1881,	12,822 feet=	2	34.28
Macomb to Cimarron meridian, teste Preston, 1900,	16,458 feet=	3	09.36
Chaney to XIT pasture corner, teste Mabry, 1885,	11,487 feet=	2	14.05 and 5.39 S.
Chaney to XIT pasture corner, teste Preston, 1900,	11,527 feet=	2	14.65 and 5.47 S.

The Denver, Texas and Fort Worth Railroad passes near the northwest corner of Texas. The station Texline is near the corner. An astronomical station should be established here and an accurate determination made of its latitude and longitude. It would be well to set a line of iron posts along the one hundred and third meridian as reference marks for the topographic survey. In connection with such topographic survey care should be taken to discover, locate, and clearly show on the map all monuments and land corners. This done, we shall have the data for resurveying and remarking the boundary.

CONCLUSION.

1. The west boundary of the panhandle of Texas is fixed by law on the one hundred and third meridian.

2. Of the 310 miles composing the line 24 miles at the south end and 156 miles at the north end were surveyed and marked with monuments by Clark in 1859.

4. Clark's survey has been confirmed by the United States.

5. Clark's survey has not been confirmed or disputed by Texas.

6. Of Clark's monuments south of the Canadian we have no information. It seems probable that many or most of them are lost.

7. The boundary along the 130 miles not surveyed or marked by Clark is on the one hundred and third meridian as it shall hereafter be surveyed and confirmed.

8. As to the 24 miles at the south end we have no information to show that it is not on the true one hundred and third meridian.

9. As to that part of the Clark line running southward from the Canadian River, about 80 miles, we have no information as to its longitude except the monuments on the banks of the Canadian.

10. As to the longitude of that part of the Clark line north of the Canadian, we have no information except that depending upon Chaney's monument, according to which it is in about longitude $103^{\circ} 02' W$.

11. Both Clark's and Chaney's longitude determinations are weak.

12. Until a new and trustworthy determination of the longitude has been made the boundary should be shown on the one hundred and third meridian from the Canadian southward and on the meridian of $103^{\circ} 02'$ from the Canadian northward.

13. A new and accurate determination of longitude should be made at an early day at a station in or near Texline, and this station should be connected with Chaney's monument, with the XIT corner, and with Clark's monuments 15, 16, and 17.

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