

UNITED STATES DEPARTMENT OF THE INTERIOR

J. A. Krug, Secretary

GEOLOGICAL SURVEY
W. E. Wrather, Director

DEPARTMENT OF GEOLOGY
OHIO STATE UNIVERSITY

Bulletin 957-C

GEOPHYSICAL ABSTRACTS 130

JULY-SEPTEMBER 1947

BY

V. L. SKITSKY



UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1947

CONTENTS

	Page
Foreword.....	117
1. Gravitational methods.....	118
2. Magnetic methods.....	123
3. Seismic methods.....	131
4. Electrical methods.....	142
5. Radioactive methods.....	147
6. Geothermal methods.....	149
7. Geochemical methods.....	150
8. Unclassified geophysical subjects.....	151
9. Related nongeophysical subjects.....	157
10. Patents.....	162
Index.....	175

NOTICE OF PUBLICATION

Publication of this quarterly serial by the the U. S. Geological Survey is resumed after a 4-year interval, during which it was issued by the U. S. Bureau of Mines.

Copies may be purchased singly or by annual subscription from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. For subscription, the Superintendent of Documents will accept a deposit of \$5 in payment for subsequent issues. When this fund is near depletion, the subscriber will be notified. The deposit may also be used to cover purchase of any other publication from the Superintendent of Documents.

GEOPHYSICAL ABSTRACTS 130, JULY-SEPTEMBER 1947

By V. L. SKITSKY

FOREWORD

Geophysical Abstracts are issued by the Section of Geophysics of the Geological Survey, United States Department of the Interior, as an aid to those engaged in geophysical research and exploration. The publication covers world literature on geophysics contained in periodicals, books, and patents. It deals with exploration by gravitational, magnetic, seismic, electrical, radioactive, geothermal, and geochemical methods and with underlying geophysical theory, research, and related subjects.

Inasmuch as geophysicists in the field may have little opportunity to consult libraries, the policy is to provide abstracts sufficiently informative in themselves to keep readers abreast of developments in the United States and abroad.

Distribution.—Geophysical Abstracts 1-86 were issued as Information Circulars by the U. S. Bureau of Mines; 87-111 were issued as Bulletins of the Geological Survey; and 112-127 were issued as Information Circulars by the Bureau of Mines. Beginning with 128, Geophysical Abstracts will again be published as Bulletins of the Geological Survey.

Within limits of availability, Geophysical Abstracts issued as Information Circulars may be obtained free of charge from Publications Section, Bureau of Mines. Geophysical Abstracts issued as Bulletins of the Geological Survey may be purchased as single copies or by subscription from the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

Author's reprints.—The Geological Survey will appreciate receiving reprints of publications and patent specifications from authors and inventors. These will be filed for reference after being abstracted. Foreign publications and patents with little circulation in the United States are especially desired. In reproducing authors' abstracts the Geological Survey reserves the right to make minor changes in accordance with its editorial policy.

All reprints and correspondence other than orders for copies of Geophysical Abstracts should be addressed to the Director, Geological Survey, United States Department of the Interior, Washington 25, D. C.

1. GRAVITATIONAL METHODS

9329. Alexanian, C. L., and Rothé, J. P. Prospection gravimétrique à la Grande-Mâcholles, près de Riom [Gravimetric prospecting at the Grande-Mâcholles, near Riom]: *Annales des Mines et des Carbur.*, ser. 14, vol. 4, pp. 162-166, Paris, 1944.

To check magnetic observations made over bituminous outcrops near Riom, France, a gravimetric survey was conducted in this area in 1942. Previous regional gravity observations and local drilling clarified the subsurface geology, and preliminary topographic measurements furnished corrective data. The gravity determinations were made with the Askania torsion balance at 15 stations, once during the day and once at night, by means of recordings on photographic plates read through a special graduated glass.

The values of the gradients obtained are tabulated and plotted on maps, and the formulas used for calculation are presented. The results show a marked localized anomaly coinciding with the previously detected magnetic anomaly and with the surface outcrops. It is concluded that the source of the disturbance is surficial and is likely to extend in a north-northwest direction.—V. S. (See also Geophys. abstract 9348.)

9330. Ballarin, S. Calcolo grafico della riduzione topografica delle misure di gravità nell'ipotesi della terra sferica [Graphic determination of the topographic reduction of gravity measurements based on the hypothesis of a spherical earth]: *Riv. Geominer.*, vol. 3, nos. 3-4, pp. 22-41, Milan, 1942.

Assuming that the earth is spherical, the author gives a graphical procedure whereby the calculation of the topographic correction of gravity measurements requires only the determination of a plane area easily measured with a planimeter. To facilitate the drawing of the necessary diagrams, numerical tables are appended.—*Author's abstract.*

9331. Bureau de Recherches Géologiques et Géophysiques. Prospection gravimétrique du Bas-Dauphiné [Bureau of Geological and Geophysical Research. Gravimetric prospecting of the Bas-Dauphiné, France]: *Pubs.*, no. 2, pp. 1-61, Paris (?), 1945.

An introduction outlines the principles of gravitational measurement, the procedures of calculation, the technique of measuring the altitude of stations, and related subjects. The results obtained for the 58 base stations surveyed are then listed in a series of tables. The data are presented in the form recommended by the International Union of Geodesy.—*Cent. Nat. Rech. Sci., Bull. Anal.*, vol. 7, no. 2, pt. 1, p. 218, Paris, 1946, translated by V. S. (See also Geophys. abstract 9414.)

9332. Deegan, C. J. Helicopter aids oil search: *Oil and Gas Jour.*, vol. 46, no. 5, pp. 61-63, Tulsa, Oklahoma, 1947.

A helicopter-borne gravimeter has been used by the Robert H. Ray Co. of Houston, Texas, to explore the marshlands near Houma, Louisiana. This venture, the first of its kind, has reduced the cost of operations to \$25 per station, as compared with \$65 to \$75 cost of work with

marsh buggies, ordinarily employed in this region. The helicopter is equipped with pontoons, which support it on water or swampy ground. The best rate of readings to date is 19 stations in 2.5 hours.

Position fixing is made by ground observers who record angular directions from three elevated platforms when the helicopter descends vertically for a reading; the maximum distance of these sights is about 6 to 7 miles. Refueling of the helicopter is arranged, whenever possible, from a boat on a nearby waterway. Allowing for weather limitations and construction of triangulation platforms, about 600 stations can be occupied per month.—*V. S.*

9333. Evans, Percy, and Crompton, Wilfred. Geological factors in gravity interpretation illustrated by evidence from India and Burma: *Geol. Soc. London Quart. Jour.*, vol. 102, no. 3, pp. 211-249, London, 1946.

In an extensive gravity survey of Burma and northeastern India involving more than 6,000 stations, an endeavor was made to resolve anomalies into local portions due to known geological causes and residual (regional) portions due to deep-seated variations in density. For this purpose, sections through representative gravity stations were drawn from geological maps, and the gravity effects attributable to geological structures were estimated graphically and subtracted from the observed anomalies.

The residual anomalies obtained show a close relation to the main tectonic lines. A pronounced gravity minimum follows the lines of maximum uplift in the hills separating Assam and Bengal from Burma, and a gravity maximum almost coincides with the nearly parallel volcanic line of Burma. A gravity minimum follows the general trend of the eastern Himalayas. Other findings are indicated. The broad regularity of the gravity features is interrupted by several local anomalies.—*Author's abstract, condensed by V. S.*

9334. Hasselmann, K. F. Torsion balance surveys of inundated areas: *World Oil*, vol. 126, no. 8, pp. 38-40, Houston, Texas, 1947.

Development of a technique for successful torsion-balance surveys in areas of shallow-water inundation opens up much potentially valuable territory. Some measurements of gravity have been made under water before, but their procedure is not applicable to relatively shallow bodies of water. After considerable experimentation the writer developed a new technique employing a tripod and floats, which has given very satisfactory results. Using the new method, geophysicists have made surveys in the Gulf coast areas which lead to the discovery of anomalous subsurface conditions and opened up new production.—*Author's abstract, edited by V. S. (See also Geophys. Abstracts 124, no. 8332.)*

9335. Heiskanen, W. Über die finnischen Arbeiten zum Problem der Isostasie [Concerning Finnish investigations of the problem of isostasy]: *Geol. Rundschau*, vol. 32, nos. 4-5, pp. 563-574, Stuttgart, Germany, 1941.

An outline is given of Finnish contributions to the study of isostasy. The investigations began in 1905, at the Finnish Geodetic Institute, and dealt with the topographic-isostatic reduction of gravity anomalies, deflection of the vertical, validity of isostatic theory, calculation of isostatic reduction tables, preparation of isostatic maps, determination of the density of the earth's crust in various mountainous regions and of

the postglacial elevation of the ground in Fennoskandia, derivation of gravity formulas, calculation of geoid undulations, and analysis of irreducible isostatic gravity anomalies. The work was carried out by Bonsdorff, Heiskanen, Ölander, Hirvonen, Salonen, Luoma, Erola, Niskanen, and others. A bibliography is appended.—*V. S.*

9336. Independent PAA Monthly. Gravimetric service firm provides reports by areas: Vol. 18, no. 2, pp. 62-63, Fulton, Missouri, June 1947.

Exploration Surveys, Inc., of Dallas, Texas, has copyrighted reports on gravity surveys of entire counties in the midcontinent area. The first report covers Cooke County, Texas. It contains an isogal map, a derived map for each quadrangle and each township, with explanatory text on gravity data and geological interpretation, a large gravity map of the entire county, and an index system. Surveying practice is patterned after the procedure of the United States Coast and Geodetic Survey for third and fourth order traverses. At present the company is conducting surveys in Bryan County, Oklahoma, and in Denton and Jones Counties, Texas. The agent for the sale of reports is the Continental Corporation of Tulsa, Oklahoma.—*V. S.*

Jeffreys, H. The genesis of deep foci earthquakes [summary]. See Geophys. abstract 9386.

9337. Kazinskii, V. A. Concerning an appraisal of the accuracy of the variometer method for measuring deviations of plumb lines in the gravitational field of the earth [in Russian]: Acad. Sci. U.R.S.S. Comptes Rendus (Doklady), new ser., vol. 54, no. 2, pp. 131-134, Moscow, 1946.

A system of linear equations was previously deduced by the writer for determining the component deflections of plumb lines by the use of surface curvature gradients at the level of the disturbing potential, T . Their mathematical derivation is now analyzed with respect to the effect of errors of geodetic and variometer measurements in order to ascertain the precision of the findings obtainable. The calculations are given, and the results are tabulated.

It is found that in the theoretical case considered the accumulation of errors is caused by inaccuracies primarily in astronomical determinations and secondarily in geodetic determinations. Variometer measurements cause relatively small cumulative errors but tend to shift the maximum of errors toward the center of the net. Other conclusions are given. The method employed for this analysis can also be used for choosing the optimal length and shape of closed variometer polygons.—*V. S.* (See also Geophys. Abstracts 126, no. 8652, and 127, no. 8814.)

9338. Lejay, Pierre. Mesures de pesanteur exécutées dans le sud de la France en 1940 [Measurements of gravity in the south of France in 1940], 98 pp., Comité National Français de Géodésie et Géophysique, Paris, 1942.

In 1940 a gravity survey was made in the region of Bagnères-Toulouse-Carcassonne-Montpellier in southern France. A network of 100 stations was occupied with Holweck-Lejay gravimeters calibrated at several reference stations by procedures that are described. The results, tabulated and plotted together with values obtained in the same region by R. Goudey, show that negative anomalies generally increase in the vicinity of mountains, whereas weak positive anomalies are found on the Mediterranean shore.

On the basis of the findings a theoretical study is made of the attraction of thin strata, with a tentative application to the interpretation of regional anomalies. The analysis of the anomalies caused by thin layers covers the particular cases of limited horizontal layers, inclined layers, symmetrical and asymmetrical anticlines and synclines, and anticlines adjacent to synclines. A special discussion is devoted to topographic corrections.—V. S.

9339. McCollum, E. V., and Brown, Andrew. Empleo del gravimetro para establecimiento de puntos fijos gravimetricos [Use of the gravity meter in establishment of gravity bench marks]: Direccion General del Instituto Geografico Militar, fol. 5, 26 pp., Buenos Aires, 1946. See Geophys. Abstracts 116, no. 7264, for the English text.

9340. Morelli, Carlo. Per un sistema di riferimento "internazionale" delle misure di gravita [On an international reference system of gravity measurements]: Geofis Pura e Appl., vol. 8, nos. 3-4, pp. 81-93, Milan, 1946.

It is shown that the "conventional" base value of gravity at Potsdam (981.274), considered until a few years ago as one of the most reliable determinations, probably involves a large error. This error is demonstrated by the new absolute determination at Washington and seems to be confirmed by the absolute determination at Leningrad, for which definite results are not yet available.

A new "international" reference system is therefore proposed, based on not one absolute value of gravity alone but on all known high-precision determinations. Certain differences between these determinations arise from a new compensation of the international net of reference stations worked out by the author. Suggestions on the solution of this problem are welcome.—*Author's abstract.*

9341. Offman, P. E. On the geological interpretation of geophysical maps of the Ishimbai pre-Urals [in Russian]: Neftianoe Khoziaistvo, vol. 24, nos. 9-10, pp. 30-36, Moscow, 1946.

The extensive geophysical work done in Bashkiria, U.S.S.R., in quest of oil showed the particular usefulness of gravimetric and electrical surveys in this region. The author discusses the interpretation of such data in the light of local geology.

The regional gravity map shows high values in the east, very variable low values in the central part, and uniform, moderately high values in the west. The successive outcropping of Artinskian, Samarian, Carboniferous, and Devonian strata and their relative densities are cited in explanation of these features, and seven types of gravitational anomalies are distinguished.

The regional electric map shows some areas characterized by shallow zones of high resistivity, in which the contours are smooth and widely spaced, and other areas characterized by abruptly changing resistivities, in which the contours are contorted and closely spaced. Comparison with a geologic map reveals a close correspondence of such areas to elevated and depressed sections of the Artinskian relief, which suggests an explanation in terms of the salt tectonics associated with this relief.—V.S.

9342. Ravignani, G. Osservazioni sulla nota G. Petrucci circa la possibilità di aumentare la sensibilità del gravimetro Ising [Observations on the note of G. Petrucci concerning the possibility of increasing the sensitivity of the Ising gravimeter]: Riv. Geominer., vol. 4, no. 1, pp. 24-26, Milan, 1943.

The author discusses the suggestions made by G. Petrucci for increasing at will the sensitivity of the Ising gravimeter and for employing an indirect zero method of measurement and gives practical reasons why their execution would meet with difficulties.—V. S. (See also Geophys. Abstracts 129, no. 9153.)

9343. Skeels, D. C., and Vajk, Raoul. Geophysical exploration and discovery of the Budafapuszta (Lispe) oil field in Hungary: Geophysics, vol. 12, no. 2, pp. 208-220, Tulsa, Okla., 1947.

Interest was first attracted to the Budafapuszta area by its geographical position on the eastward projection of a known surface anticline, which had produced small quantities of oil at Piklenicza and Szelnicza. A test was located in 1920 on a small surface feature and completed in 1923 as a dry hole. In 1934 a torsion-balance survey was made by Eurogasco, a subsidiary of the Standard Oil Co. (N. J.), which indicated a dome with its crest 1,500 meters north of the dry hole. A reflection survey verified the presence of the structure. The discovery well was located by the torsion-balance data and completed as a producer in 1937. A gravity-meter survey, made after the first two producers had been drilled, gave further information on the structure and assisted in the development of the field. This exploration history shows that a properly made torsion-balance survey may be very efficient and economical even in hilly country. A geological map of part of the Szelnicza-Piklenicza anticline, a topographical map, torsion balance, seismograph and gravity meter maps, a seismograph cross section and a subsurface contour map of the Budafapuszta structure are submitted.—*Authors' abstract.*

9344. Solaini, L. Sulla riduzione topografica delle misure di gravità [Concerning topographic reduction of gravity measurements]: Riv. Geominer., vol. 4, nos. 2-3, pp. 55-67, Milan, 1943.

The author suggests a new division of surveyed areas into zones and compartments for the computation of the topographic correction of gravity measurements. These divisions are obtained by thickening the nearest zones of the Hayford-Bowie system adopted internationally. They seem particularly convenient in applied geophysics where the influence of the topography immediately surrounding each station must be accurately estimated. Three zones are suggested, conforming to the degree of roughness of the terrain. A sector diagram also is offered for the computation of the topographic correction, derived from a similar diagram previously proposed by Ballarin. Finally, an estimate is made of the magnitude of the errors introduced by assuming a constant height within each compartment.—*Author's abstract.*

9345. Stoyko, N. L'attraction luni-colaire et la formule internationale de la pesanteur [The attraction exerted by the moon and the sun, and the international formula of gravity]: Annales Franç. Chronom., vol. 16, no. 1, pp. 5-29, Besançon, France, 1946.

In the derivation of the international formula of gravity no consideration has been given to the influence exerted upon the earth by the moon

and the sun. To take this influence into account, the author recalculates the formula. The method of computation is indicated, and the data are tabulated.—*Cent. Nat. Rech. Sci., Bull. Anal., vol. 8, nos. 1-2, pt. 1, p. 44, Parts, 1947, translated by V. S.*

9346. Vitalis, I. von. Die Messungen mit der Eötvös'schen Drehwaage und die Kohlenforschung [Measurements with the Eötvös torsion balance and exploration for coal]: Roy. Hungarian Palatine-Joseph Univ., Dept. Min. and Met. Pub., vol. 12, pp. 73-84, Sopron, Hungary, 1940.

In this paper on the Baron Eötvös torsion balance is demonstrated by examples from the vicinity of Nagybátony and Mátraverebély that in flat regions where there are no sufficient indications for the location of faults and for the determination of the relative position of faulted coal-seams torsion-balance surveys accompanied by seismic methods may be very useful in the preliminary survey for drill holes. The author hopes to obtain good results from this method in the subsurface coal fields of the Transdanubian region which have not yet been thoroughly examined.—*Author's abstract.*

9347. Woodward, S. W. Unique tripod speeds water gravimetric survey: Oil Weekly, vol. 125, no. 1, pp. 50-51, Houston, Tex., 1947.

Gravity surveying in the Bahamas is aided by the use of a metal tripod 17 feet high towed by boat from station to station and set in the water for each reading. The device, welded into a single-frame unit, supports a crew of 3 men and a gravimeter over the water surface. It has a 10.5-foot width at the base, possesses good stability on the firm Bahamas ocean floor, and can be handled from a small boat. In good weather most readings have been taken at 10-minute intervals where the stations were 2,600 to 3,000 feet apart, but under windy conditions the time intervals increased to nearly 20 minutes; with the wind exceeding 20 miles per hour, work had to be discontinued. Preliminary runs have been made also with a tripod 26 feet high having an 18-foot width at the base. A tripod 28 feet high is under construction.—*V. S.*

2. MAGNETIC METHODS

9348. Alexanian, C. L. Prospection magnétique à la Grande-Mâcholles [Magnetic prospecting at the Grande-Mâcholles]: Annales des Mines et des Carbur., ser. 14, vol. 4, pp. 171-173, Paris, 1944.

In 1941 a magnetic survey was made in the area of the Grande-Mâcholles Castle near Riom, France, to investigate numerous surface indications of bitumen. The Haalck universal variometer was used to measure the vertical component of the geomagnetic field at 165 stations disposed on 13 traverses over an area 160 by 400 meters. The results, represented by an isoanomaly map, show in the area of the surface outcrops two distinct anomalous zones that align with previous bituminous workings in the vicinity. In the light of local geology the small values of the anomalies, ranging between -50 and $+20$ gammas, are interpreted to indicate the possibility of near-surface bituminous veins.—*V. S. (See also Geophys. abstract 9329.)*

9349. Armstrong, L. D. The use of high permeability materials in magnetometers: Canadian Jour. Research, vol. 25, no. 3, pp. 124-133, Ottawa, Ontario, 1947.

Two types of magnetometers using high-permeability materials are described—first, those using a field leaving the material in an unsaturated condition and giving a second harmonic output, and second, those using the saturated core method resulting in a peak signal output. The application of the saturated core-type magnetometer to the particular problem of an automatic steering control is described in detail.—*Author's abstract.*

9350. Barta, G. On the changes of the horizontal intensity and inclination of the earth magnetism in Transylvania, 1943.0 [in Hungarian, with English summary]: Hungarian Inst. Meteorol. & Terr. Magn., Papers on Terr. Magn., no. 1, 26 pp., Budapest, 1947.

In 1943 the Hungarian Institute for Meteorology and Terrestrial Magnetism conducted a magnetic survey in Transylvania. The horizontal intensity was measured at 31 stations with a QHM instrument and the inclination at 27 stations with an earth inductor. Several readings were made at each point, with an accuracy of ± 2 gammas for H and ± 1 minute for I . The results for the horizontal intensity have revealed a magnetic valley in the area from Borgó-Pass to Diós and a magnetic ridge to the north and to the west. The values of inclination had the same trend, but the signs were reversed. The findings are discussed, and observations are made on the secular change of magnetic elements in Hungary.—*V. S.*

9351. Beers, R. F., and Larsen, H. R. A new station-type magnetometer: Am. Geophys. Union Trans., vol. 28, no. 4, pp. 545-548, Washington, D C., 1947.

This paper describes a new station-type magnetometer built with a magnetic detector based upon a saturated core-type transformer principle. The instrument is built in its most universal form, with the detector unit mounted on a somewhat special engineer's transit, and permits measurements of magnetic declination, dip, total field intensity, and horizontal and vertical components. Sensitivity is adjusted to about 10 gammas per division.—*Authors' abstract.*

9352. Besairie, Henri. Le nouveau réseau magnétique de Madagascar—Campagne magnétique de 1938 [The new magnetic network of Madagascar—Magnetic survey of 1938]: Annales Géol. du Serv. des Mines, no. 10, pp. 7-50, Tananarive, 1939.

In 1938 the magnetic survey of Madagascar was extended to the east coast of the island. The work included 156 measurements of declination and 180 measurements of the horizontal component made with the theodolite of Chasselon, and 258 measurements of the vertical component made with the Schmidt balance. The results are listed, and the nature of the subsoil at the stations is indicated. It is found that the numerous anomalies discovered over the crystalline masses in the east and those detected over sediments in the west a year earlier are due chiefly to deeply buried eruptive rocks. This explanation appears particularly applicable to the results of stations located on the upper Senonian strata

where these overlie volcanic rocks.—V. S. (For previous work see Geophys. Abstracts 90, no. 3820.)

9353. Burns, W. W. Airborne magnetometer surveys of Bahamas soon to start: Oil and Gas Jour., vol. 45, no. 51, pp. 92-93, Tulsa, Oklahoma, 1947.

The Gulf airborne magnetometer will be used by the Aero Service Corp. for surveying the entire Bahaman region. The work is financed by American, British, and Dutch interests and is expected to cover an area of 50,000 to 80,000 square miles, at a cost of \$650,000. Aero Service proposes to employ a total of 50 people for the plane crew, the ground crew, and the three boat crews. Plans call for flight traverses at 2-mile intervals covering 10,000 square miles of territory per month and for the use of a shore station and three boats anchored at strategic points during each flight as bases in shoran position determination. The aerial survey will be checked by gravimeter work, which already is in progress.—V. S.

9354. Delagugue, Arthur. Essai d'une théorie sur l'origine du champ magnétique terrestre [A tentative theory of the origin of the geomagnetic field]: Annales de Géophys., vol. 1, no. 2, pp. 121-143, Paris, 1944.

The geomagnetic field is explained tentatively by the action of gravity on the free ions at the center of the earth. This action produces electrified zones which, by their rotation about the terrestrial axis, form currents and may thereby generate a magnetic field. Two main requirements, conditioned on certain assumptions, must be satisfied to account for the characteristics of the main geomagnetic field: (1) The ionized strata must be spherical, in conformity with the distribution of the field on the surface of the globe, and (2) the ratio of the mass of free positive ions to their valency must be of the order of 3.14×10^{-8} cgs, the total charge of fixed ions per cubic centimeter being 3.72×10^{-4} esu. These theoretical deductions presuppose the existence of a positively charged core with a negatively charged halo in the interior of the earth. Details of the hypothesis are discussed.—V. S.

9355. Gassmann, Fritz. Bericht über Versuche mit der Wünschelrute [Report on experiments with the divining rod]: Naturf. Gesell. Zürich, Vierteljahressch., vol. 91, no. 2, pp. 114-122, Zurich, 1946.

Experiments have been made by the Institute of Geophysics, an affiliate of the Federal Institute of Technology in Zurich, to find suitable localities for a physical test of the divining rod reaction. In the investigation 16 dousers were assigned to the task of independently surveying 7 test fields and determining the locations where the rod reacted with a deflection. The spots, lines, and areas reported by the dousers are marked on maps of the test fields.

The experiments so far have not yielded the desired result, but further investigations will be made as soon as means are available to ascertain in what measure the findings of the diviners are reproducible.—*Author's abstract.*

9356. Haas, W. J. de, and Westerdijk, J. B. Strong magnetic fields: Nature, vol. 158, no. 4008, pp. 271-272, London, 1946.

The practical limitations of generating strong magnetic fields by electromagnets and solenoids have prompted Kapitsa to experiment with solenoid-shortcircuited batteries and generators. His method has been

perfected by the authors, who report producing magnetic fields up to 250,000 gauss. They used a small copper coil immersed in a bath of liquid hydrogen and connected for 0.1 second with the terminals of a very strong battery. Similar experiments have been carried out in baths of liquid helium. The possibilities of these methods are considered promising.—V. S.

9357. Hughés, D. S., and Pondrom, W. L. Computation of vertical magnetic anomalies from total magnetic field measurements: *Am. Geophys. Union Trans.*, vol. 28, no. 2, pp. 193-197, Washington, D. C., 1947.

Magnetic measurements for geophysical work have been largely confined to measurement of the vertical field. Recently an instrument that measures only the total magnetic field has been invented and used with considerable success. Its operation is simpler and faster than the vertical magnetometer, and its accuracy is as good as the best of the available vertical instruments. Since the instrument responds only to the total field, its readings are completely independent of orientation or leveling. It is shown that the readings of this instrument give the component of the magnetic anomalies along the direction of dip of the earth's field. Since this "slant" anomaly is not directly comparable with ordinary measurements of the vertical and horizontal anomalies, or easily interpretable, a method of computing the equivalent vertical and horizontal anomalies has been devised. It is shown that the horizontal and vertical anomalies can be expressed as surface integrals over the surface of measurement of the "slant" anomaly. Means of evaluating these integrals are discussed.—*Authors' abstract.*

9358. Jones, W. M. Effects of surface relief on anomalies of vertical magnetic intensity: *New Zealand Jour. Sci. Technology*, vol. 28, no. 2, pp. 117-126, Wellington, New Zealand, 1947.

Using an average value of inclination for New Zealand, the central portions of the vertical magnetic fields from a sphere, magnetized by induction in the earth's field, have been worked out for 14 different levels, ranging from 1.0 to 3.4 times the radius of the sphere above its center. The results are presented in a table and in diagrams of iso-anomalies. When the surface rocks above the magnetized sphere can be taken as negligibly magnetic, the results can be applied to show the effects of surface relief on the magnetic mapping, and illustrations are given of such effects in the cases of a plane surface sloping in different directions and of a surface of irregular relief. Some possibilities of approximating to the field from an actual rock body by a combination of two or more spheres are discussed and illustrated.—*Author's abstract.*

9359. Kalinin, In. D. The potential of age-long geomagnetic variations on the territory of the U.S.S.R. [in Russian]: *Acad. Sci. U.S.S.R. Comptes Rendus (Doklady)*, vol. 53, no. 1, pp. 29-32, Moscow, 1946.

It is possible to apply spherical harmonic analysis to the calculation of age-long geomagnetic variations in the U.S.S.R. because the whole territory lies almost entirely within a single regional part of the field of the variations. The author has made such an analysis for the data of 1905-40 collected by V. P. Orlov and has calculated the potential of the variations. The method of least squares developed by J. Bartels

was used for successive periods of 10 and 5 years; mathematical derivation is presented.

The equations obtained show that the part of the magnetic field of the 1905-40 variations depending on the earth's interior can be explained by an electric current in the earth which is equivalent to a dipole having, as its characteristics, an average magnetic moment $M = -2.04 \times 10^{23}$ cgs., a constant depth of 0.56 of the earth's radius, and certain listed coordinates for the periods considered.—V. S.

9360. Kuehn, H. E., and Dent, G. E. Comparative study of magnetic surveys of Worcester County, Maryland, made on the ground and from airplane observations: U. S. Bur. Minés, Rept. Inv. 4070, 23 pp., Washington, D. C., May 1947.

For making a comparison of magnetic surveys measured from the ground and from the air, Worcester County, Maryland, was chosen as a proving ground. Vertical magnetic intensities were observed on the ground, and total magnetic intensities were observed from the air. A comparison of the two magnetic maps reveals similar large magnetic features, but these are displaced in some instances by distances greater than a mile. Magnetic terrain in the two charts is of the same type but often differs greatly in respective characteristic features.

Consideration of the sacrifices in accuracy that may be expected from the use of different systems of diurnal magnetic corrections on ground observations constitutes a part of this report.—*Authors' abstract.*

9361. Logachev, A. A. Aeromagnetic survey in the Karelian-Finnish S.S.R. [in Russian]: Razvedka Nedr., vol. 12, no. 1, pp. 37-40, Moscow, 1946.

In 1945 an aeromagnetic survey was made over an area of 40,000 square kilometers in the south of the Karelian-Finnish S.S.R. in search for iron deposits. The most suitable type of craft proved to be the S-2 having a flight radius of 200 kilometers and a velocity of 100 kilometers per hour. For general reconnaissance, isolated magnetometer readings were taken at intervals of 2 kilometers from a height of 400 meters over parallel traverses. For detailed mapping, such readings were made at intervals of 0.5 to 1.0 kilometer from a height of 300 meters, or from several heights. Magnetometers of a special type designed by the author served for measurements. The night hours were found most favorable for the work. The results so far have shown more than 10 large anomalies, which are discussed. They correspond to ground readings of the order of 30,000 to 40,000 gammas.—V. S.

9362. Morelli, C. Distribuzione normale delle componenti orizzontale del campo magnetico terrestre in Italia [Normal distribution of the horizontal component of the geomagnetic field in Italy]: Istit. Veneto di Sci., Let., ed Arti Atti, vol. 103, pt. 2, pp. 183-195, Venice, 1944.

During the past decade the Italian Military Geographic Institute has made first-order magnetic observations in Italy. The data are used by the author to determine the normal horizontal component of the magnetic field for Italy. The results give a surface of the second order, which is found to be a satisfactory approximation to the actual field. The formulas used for calculations are indicated, and the findings obtained on the gradients of the horizontal component over latitude and

longitude variation and on the general characteristics of the normal field are discussed. The isodynamic map of the normal field shows that the magnetude of the horizontal component for 1935.0 over the entire surface of Italy is between 21,000 and 26,000 gammas.—V. S.

9363. Nikolsky, A. P. Dual laws of the course of magnetic disturbances and the nature of mean regular variations: *Terres. Magn. and Atmos. Electr.*, vol. 52, no. 2, pp. 147-172, Baltimore, Maryland, 1947.

The investigation of magnetic storms through the use of data obtained by observatories located in high latitudes has revealed at a number of stations the presence of two maxima in the diurnal variation of magnetic disturbance. Study of a vast amount of material, in particular the magnetic observations made at Tikhaya Bay for 9 years, has shown that the changes in magnetic disturbance in the morning and the night hours depend on different laws. This, in turn, suggests that the magnetic disturbances in the morning and the night are of a different nature. The above conclusion has proved to be of great importance for the further investigation of the diurnal variations of the disturbed magnetic field in high latitudes. Other studies have been made, and the findings are given.

The result of the present investigation permits the suggestion that during magnetic storms there are only accidental discrete and short-period disturbed magnetic fields caused directly by the corpuscular streams coming from the sun. The mean, regular variations S_a and D_{st} in the disturbed magnetic field do not correspond to any real, prolonged phenomena in the field of magnetic storms but are merely statistical results.—*Author's abstract, condensed by V. S.*

9364. Oil News. Flying eye survey may revolutionize geological labors: Vol. 22, no. 6, p. 3, Albuquerque, New Mexico, 1946.

The airborne magnetometer of the Gulf Research and Development Co. promises a new era in oil exploration. The company began working on this instrument in 1940, and during the war the apparatus was used by the United States Navy as a submarine detector. Present adaptation for geophysical exploration turns this "flying eye" into a potent tool for oil search. The instrument provides the fastest and probably the cheapest means of prospecting, furnishes a continuous magnetic chart over the territory surveyed, and renders water-covered areas, jungles, and mountains accessible. The discovery of the still undetected petroleum deposits should be greatly accelerated by this approach.—V. S.

9365. Olsen J. Persistent solar rotation period of 26.875 days and solar-diurnal variation in terrestrial magnetism: *Nature*, vol. 157, p. 621, London, May 11, 1946.

Measurements made at Godhavn, Greenland, over a period of 15 years have established the fact that the amplitude of daily variation of terrestrial magnetism varies (through a range of 1:4) with a period of 26.875 days. The variation persisted through the quiet summers of 1932-36. It practically vanishes in winter and was not observed at Lovoe, Sweden, or Huancayo, Peru. The latter observation shows that not only a sunlit atmosphere but also charged particles from the sun are necessary factors. The indication is that the corpuscles giving

rise to the c_1 -variation are controlled from an inner layer in the sun with a fixed speed of rotation.—*Physics Abstracts*, vol. 49, no. 583, p. 215, London, 1946.

9366. Roberts, E. B. Magnetic work of the United States Coast and Geodetic Survey from April 1, 1945, to June 30, 1946: *Am. Geophys. Union Trans.*, vol. 28, no. 2, pp. 291–294, Washington, D. C., 1947.

The magnetic work of the United States Coast and Geodetic Survey during the period from April 1, 1945, to June 30, 1946, comprised magnetic repeat observations in South America, the furnishing of magnetic data to Government agencies and scientific institutions, publication of isogonic charts and serial papers, operation of five magnetic observatories, establishment of an automatic declination recording station at Gatlinburg, Tenn., and instrumental work.—V. S.

9367. Sagui, C. L. Les variations du champ magnétique terrestre [Variations of the geomagnetic field]: *Inst. de Fisiograf. y Geol. Pub.*, no. 29, 17 pp., Rosario, Argentina, 1946.

The causes of diurnal and secular geomagnetic variations and of the displacement of the geomagnetic pole relative to the geographic pole are discussed in the light of electromagnetic quantum theories. Consideration is given to convection currents formed by the electrons of the terrestrial mass, to convection currents produced by the velocity of terrestrial revolution and rotation, and to related phenomena, as elucidated by the work of Rowland, Musschenbroock, Duchemin, J. C. Ross, Dufay, and others.

It is found that the magnetic phenomena under consideration can be explained in electromagnetic terms when they are viewed in their relation to retrograde secular rotation of the magnetic meridian, the difference between the theoretical and observed secular variation, considerations of two magnetic poles, the interaction between the moving magnetic field and the gravitational field, and the effects of the gravitational field of the sun. These factors are discussed.—V. S.

9368. Scott, W. E. Mean K -indices from thirty magnetic observatories and preliminary international character-figures, C , for 1945: *Terres. Magn. and Atmos. Electr.*, vol. 52, no. 1, pp. 25–31, Baltimore, Md., 1947.

Geomagnetic activity—the frequency and intensity of magnetic disturbance—is supposed to indicate the influence of solar corpuscular radiation on the earth. Magnetic disturbance also has associations with other terrestrial phenomena similarly correlated with solar changes, and notably with aurorae, earth currents, and disturbance of the ionosphere such as measured by radio methods. Two schemes for magnetic characterization, adopted by international agreement are (1) three-hourly range index K and (2) daily character-figure C , as follows:

K-index.—Three-hourly range indices, K , characterize the variation in the degree of *irregular* magnetic activity throughout each Greenwich day, for the intervals 0–3, 3–6, . . . 21–24 hours GMT (see Bartels, Heck, and Johnston, *Terres. Magn. and Atmos. Electr.*, vol. 44, no. 4, pp. 411–454, Baltimore, Md., 1939). Each observatory has definite, fixed standards or scales for K , measured in units of force (γ). The indices range from 0, very quiet, to 9, extremely disturbed. Mean indices,

K_M , are derived for each three-hourly interval from the individual indices K assigned at each observatory.

Character-figure C.—The C -figures classify Greenwich days on a scale of 0-1-2 (the character "0" applies to quiet, "1" to moderately disturbed, and "2" to greatly disturbed day). They are thus useful in describing and comparing the degree of magnetic activity day by day. For each day the mean of the figures supplied by all the cooperating observatories is taken, to one decimal place, and the result is called the international magnetic character-figure, C .—*Author's abstract.*

9369. Skillings' Mining Review. Helicopter prospecting to get underway this year: Vol. 35, no. 43, p. 6, Duluth, Minn., 1947.

A brief account is given of the progress in helicopter prospecting as reported by H. Lundberg at the January meeting of the Canadian Institute of Mining Engineers. A specially modified helicopter supplied with automatically stabilized and continuously recording equipment has been developed for magnetic exploration on the basis of experiments conducted last summer in northern Ontario and Quebec. These experiments showed that helicopter surveys for ores can closely duplicate surveys made on the ground. Over bare and open areas the flights were made at heights of 25 and 50 feet above ground and in forested areas at heights of 100 and 150 feet. As a result, even comparatively small magnetic features recorded from the air were identical with those obtained by ground surveys. The helicopter may also offer possibilities of determining the depth to the magnetic body by readings taken from two different altitudes.—*V. S.*

9370. Solaini, L. Determinazioni variometriche delle componenti orizzontale e verticale del campo magnetico terrestre, eseguite in Abruzzo nel 1943 [Variometric determinations of the horizontal and vertical components of the geomagnetic field made in Abruzzi in 1943]: Riv. Geominer., vol. 5, nos. 1-4, pp. 3-11, Milan, 1944.

In August 1943 a brief magnetic survey was made in Abruzzi by the Geomineral Prospecting Center for the Military Geographical Institute. The author makes a report on this survey, during which the relative values of the horizontal and the vertical components of the earth's magnetic field were measured at 41 stations with Schmidt-Askania variometers. The mean error of each determination was less than ± 5 gammas. On the basis of the results of these measurements, contour-line maps have been drawn of the horizontal and vertical field, as well as of the anomalies computed with respect to the normal field recently calculated for Italy.—*Author's abstract.*

9371. Tromp, S. W. First report on experiments concerning the influence of variations in the strength of magnetic fields, in particular the magnetic field of the earth, on muscular contraction [in Dutch, with English summary]: Dutch Jour. Parapsychology, no. 1, pp. 29-56, Amsterdam (?), January 1947; mimeographed Appendix, April 15, 1947.

Divining-rod practices were studied experimentally in physical and physiological laboratories at Leiden and Delft, Netherlands, to determine the influence of magnetic fields on muscular contraction. The instruments consisted of a tangent galvanometer for creating artificial magnetic fields, a string galvanometer for registering induction poten-

tials, an ordinary steel divining-rod, and a camera. The various experiments carried out over inorganic sources of magnetic disturbance, over human beings, and in artificial magnetic fields are described and illustrated by plates. It is found that the turning of the divining rod is caused by the contraction of the arm muscles resulting from a stimulation of muscular nerves by the local or regional variations in the magnetic field of the earth. Other observations are given.—V. S.

9372. Vestine, E. H. Description of the earth's main magnetic field and its secular change, 1905–1945: Carnegie Inst. Washington, Pub. 578, 532 pp., Washington, D. C., 1947.

This volume presents a unified picture of the earth's main magnetic field and of its secular change, obtained by fitting the numerous published observations into a consistent whole. New comprehensive world-charts of secular change, drawn for the first time complete in all magnetic elements, are given. They form the first set of isopores standing in reasonable agreement with all available measurements and show the phenomenon in its continuity for almost half a century, being plotted at four epochs a decade apart. The use of most of the old and new measurements made possible by the charts has increased the number of observation points available for drawing isomagnetic lines and has afforded a more detailed description of the earth's main field than was obtainable hitherto.—V. S.

9373. Vsekhsviatskii, S. K. Concerning the question of the nature of geomagnetic disturbances [in Russian]: Nauchno-Issledovatel'skii Institut Zemnogo Magnetizma, Zemnoi Magnetizm i Electrichestvo, pp. 47–77, Moscow, 1946.

The data of the Slutsk Catalogue of magnetic storms were studied in relation to solar observations. The main purpose was to find a new basis for classifying different kinds of storms connected with solar eruptions and to estimate their relative frequency. The paper discusses the cases in which the data show a correspondence between the storms and the eruptions, and analyzes the recurrence of storms listed in the Slutsk Catalogue. The comparison between magnetic and solar observations is made on the basis of the maps of d'Azambuja.—V. S.

Weiss, Oscar. Geophysical prospecting for water in the dolomite. See Geophys. abstract 9424.

3. SEISMIC METHODS

9374. Angenheister, G. Bestimmung einer Grenzfläche durch Laufzeiten oder Richtungswinkel reflektierter Wellen [Determination of a boundary surface by means of the travel times or emergence angles of reflected waves]: Zeitschr. Geophys., vol. 17, pp. 309–316, Braunschweig, 1942.

The position of a plane reflecting boundary is determined by means of the transmission times or the emergence angles of reflected seismic waves observed at three points chosen at equal distance from the shot-point and in directions perpendicular to one another. The velocity is assumed to be constant above the reflecting boundary and to be known. The image method is used. Formulas are developed for the

controlling factors, and it is shown how graphic construction may be used. A photograph of a three-dimensional model and an anaglyph figure illustrate the procedure clearly.—*Lehmann, Zentralb. Geophys., Meteorol. u. Geod., vol. 11, no. 4, p. 194, Berlin, 1943.*

9375. Bader, G. E. Geophysical history of the Anahuac oil field, Chambers County, Texas: *Geophysics*, vol. 12, no. 2, pp. 191-199, Tulsa, Okla., 1947.

Early geophysical exploration in the Anahuac area from 1925 to 1929 included refraction fan shooting and a torsion balance survey. A reflection dip survey in 1933 indicated a large structural closure on which the discovery well was drilled in 1935. No detailed geophysical work has been done on the structure since the discovery of the field.—*Author's abstract.*

9376. Berson, I. S. On a solution of the direct problem of the method of refracted waves in continuous media with surfaces of separation [in Russian]: *Acad. Sci. U.S.S.R. Bull. (Izvestiia), Sér. Géog. et Géophys.*, vol. 10, no. 1, pp. 71-90, Moscow, 1946.

The author considers the problem of a two-dimensional interpretation of seismic refraction hodographs for the case where the velocity of propagation is a continuous function of the coordinates with discontinuities of the first order at curvilinear boundaries. A solution is first achieved for a single layer by an application of the principle of Fermat defining the trajectory of a seismic ray as a line over which the wave travels during a minimum time. The analysis shows that in certain cases with given positions of the seismic source and of the refracting boundary there is no trajectory at all to satisfy the requirement of a minimum time of propagation of refracted waves. In other cases there are one or several such trajectories. As a consequence, observations at the surface will yield either no hodograph corresponding to the given refracting boundary or one or several hodographs referred to this boundary. The solution is further generalized to cover the case of a multilayered medium with surfaces of separation.—*V. S.*

9377. Dobrin, M. B., and others. Seismic-refraction survey of Bikini Atoll [abstract]: *Geol. Soc. America Bull.*, vol. 57, no. 12, pt. 2, p. 1189, Baltimore, Md., 1946.

In connection with the atomic bomb tests of 1946 the Bureau of Ordnance Instrumentation Section and the Oceanographic Section under Joint Task Force One conducted a reconnaissance seismic-refraction survey of Bikini Atoll to determine the subsurface structure. Depth charges were exploded on the bottom along four profiles across the lagoon. The resulting seismic waves were received by hydrophones on the bottom at the ends of the profiles. Distances from shot to hydrophone were determined from the travel time of the sound wave through water.

The time-distance plots indicate two sharp interfaces between three distinct zones having respective wave velocities of 7,000, 11,000 and 17,000 ft./sec. The first zone is approximately 2,000 feet thick and most likely is composed of calcareous sediments similar to those being deposited at present. The second zone varies in thickness from 3,500 to 11,000 feet and may be pyroclastic material or a limestone of different

type from that of the first zone. The third zone (thickness undetermined) is probably the igneous basement.

The geophysical evidence appears to support the view that considerable relative subsidence has occurred during the formation of at least some coral atolls.

9378. Galanopoulos, A. Les deux violents séismes de Larissa de 1892 et de 1941, Grèce [The two violent earthquakes of Larissa, Greece, in 1892 and in 1941]: Acad. Sci. Comptes Rendus, vol. 223, pp. 821-822, Paris, Nov. 13, 1946.

From the standpoint of effects, the earthquake of 1892 belongs to destructive shocks and its focus must be placed in the second class. The earthquake of 1941, having occurred after intense bombardments by the enemy, has acted rather as a coup de grâce. These earthquakes, it must be recognized, are to be attributed to disturbances incidental to the sudden overcoming of local obstacles in the course of a general sinking.—*Cent. Nat. Rech. Sci., Bull. Anal., vol. 8, nos. 3-4, pt. 1, p. 543, Paris, 1947, translated by V. S.*

9379. Gamburtsev, G. A. On the theory of the seismic mixer [in Russian]: Acad. Sci. U.S.S.R. Bull. (Izvestiia), Sér. Géog. et Géophys., vol. 9, no. 4, pp. 368-381, Moscow, 1945.

The equipment for prospecting by seismic reflection sometimes includes a mixer device which reduces the effects of accidental interference upon the tracing of seismograms. This instrument consists of a system of galvanometer connections which establishes a controlled interdependence between the seismic channels. The mathematical theory of the action of the mixer is presented and is used to deduce the equation of the "coefficient of mixing" as a function of the parameters of the equipment, and also the equations of the direction of the mixer, the values of equalizing resistances, and other factors.

The formulas obtained make it possible further to consider the upper limit of the "coefficient of mixing" practicable in prospecting. This value is determined by calculating the extent of seismic phase shifts produced by the mixer with the increase of the coefficient, and by analyzing these shifts in conjunction with related characteristics of seismograms.—*V. S.*

9380. Grenet, Gaston. Sur l'utilisation de la masse des séismographes et la possibilité d'améliorer les caractéristiques de certains appareils à amplification mécanique [On the utilization of the mass of seismographs and the possibility of improving the characteristics of certain apparatus having mechanical amplification]: Acad. Sci. Comptes. Rendus, vol. 214, pp. 916-917, Paris, June 1942.

It is demonstrated mathematically that the coefficient of utilization of the mass of a seismograph can be expressed as the ratio between the amplification of the rapid movements of the ground and the amplification of the movements of the center of gravity. The first amplification, termed static, can be determined in the customary manner, whereas the second amplification is equal to the total amplification by the levers.

The coefficient of mass utilization is close to 0.8 for small seismographs, but in seismographs of a short period and a large mass it can

be considerably decreased by the effects of the inertia of the levers and of the parts involved in the augmentation of the period. For example, the coefficient of utilization of the 19-ton pendulum studied by C. Bois apparently was reduced by the astatising device to 0.25 for the vertical component. It is concluded that, for large seismographs with a mechanical amplification depending on the weight of the mass, an increase in the coefficient of mass utilization is very important.—V. S.

9381. Gutenberg, B. Microseisms and weather forecasting: Jour. Meteorology, vol. 4, no. 1, pp. 21-28, Lancaster, Pennsylvania, 1947.

Microseisms are more or less regular elastic surface waves recorded continuously by sensitive seismographs. They may be propagated to great distances except where the energy is dissipated at geological discontinuities. Microseismic waves arriving at a seismographic station can be used to locate the direction of the source. The accuracy of such azimuth determination from differences in arrival times at three stations on a triangle with sides 1 or 2 miles long is investigated. Certain types of microseisms are correlated with atmospheric disturbances and can be used in weather forecasting and especially in locating tropical disturbances. Publications referring to this method are mentioned. The method's routine application by the United States Navy Department in locating hurricanes in the Caribbean area is discussed, as well as the precautions which must be taken in drawing conclusions from the amplitudes of microseisms.—*Author's abstract.*

9382. Hamil, A. B. Portable equipment expedites inland marine seismic surveys: Oil and Gas Jour., vol. 46, no. 4, pp. 146-156, Tulsa, Oklahoma, 1947.

"Inland marine surveying," as distinguished from offshore marine surveying, is made over tidewater marshlands, inland bays, fresh-water lakes, inundated river bottoms, and other inland water-covered terrain. The Marine Exploration Co. of Houston, Texas, employs for such work portable seismic-reflection equipment which can be transported in 11 packaged units by man power. The recording set comprises a recording unit, a developing unit, a power-supply unit, a cable unit, and a geophones unit; the total weight is 250 lb. The shooting set consists of two units containing a day's supply of explosives, a blaster, cable, loading poles, and a shot hole detector. The drilling set includes fuel, tools, and bits, packed in four units and sufficing for 50 holes. The items making up the packages are listed, and the use of the portable equipment for reflection surveys is described.—V. S.

9383. Hawley, P. F. Geophysical contributions to vibration measurements and micro-chemistry: Geophysics, vol. 12, no. 2, pp. 229-237, Tulsa, Oklahoma, 1947.

This paper gives a brief account of the development, during the war emergency, of equipment made especially for the measurement of vibration and strain in airplane structures in flight. Experience in the design and manufacture of seismograph equipment made rapid development possible. A mass spectrometer is also described. This instrument, built originally for analysis of gas samples in connection with the geochemical prospecting, was later adapted for rapid analysis of complex

hydrocarbon mixtures and has found application particularly in control of refinery processes.—*Author's abstract.*

9384. Hodgson, J. H. Analysis of travel times from rock bursts at Kirkland Lake, Ontario: *Seismol. Soc. America Bull.*, vol. 37, no. 1, pp. 5-17, Berkeley, California, 1947.

The present paper is an extension of E. A. Hodgson's preliminary report on rock burst in the Lake Shore mines at Kirkland Lake, Ontario, published in 1942. The travel times of the observed seismic phases are listed, and time-distance curves and crustal structure are deduced from the data. The material includes the records of three additional bursts that suggest the existence of a previously unsuspected medium below the Mohorovicic discontinuity. The total evidence appears to indicate a considerable thickening of the intermediate layer under the Canadian shield.—*V. S.*

9385. Imle, J. F. Accident prevention in geophysical exploration: *Oil Weekly*, vol. 125, no. 6, pp. 53-57, Houston, Texas, 1947.

Geophysical exploration is inherently hazardous and has one of the highest accident rates in the petroleum industry. In the United States as many as 75 percent of the nearly 500 yearly crews, aggregating 8,000 to 10,000 men, use explosives for seismic work. Yet, the safety departments of the companies and consulting agencies so far have been unable effectively to regulate field operations, which often are kept secret. As a result, the geophysical industry has grown to its present stature without developing safety controls.

In seismic prospecting, the measures essential for the prevention of accidents from explosives include a judicious selection of personnel; education in safety; proper storage facilities; checks on the condition of explosives; competent handling, transporting, and loading; and enforcement of regulations. In the present report the practices established along these lines by the Petty Geophysical Engineering Co. are discussed in the light of field experience, with attention to practical details, and suggestions are made for further progress.—*V. S.*

9386. Jeffreys, H. The genesis of deep foci earthquakes [summary]: *Union Géod. Géophys. Internat., Assoc. de Séismol. Comptes Rendus*, 7-me Conf. 1939, p. 62-64, Toulouse, France, 1940.

The study of deep-focus earthquakes has clarified some problems of seismic transmission time that could not be solved from normal earthquakes. The evidence, combined with Stoneley's results from surface waves, gives 15 ± 3 and 18 ± 4 kilometers for the thickness of the upper and the intermediate layer of the earth's crust, respectively.

Deep-focus earthquakes also shed light on the strength of the earth's materials. At a depth of about 700 kilometers, down to which these earthquakes are now known to occur, the earth appears to be as strong as the surface rock. If it is, the notion that the lower layer is a passive medium yielding to disturbances of pressure imposed by loading on the top must be abandoned, and a new explanation of isotasy is necessary. For many purposes it becomes essential to consider that the sources of disturbance originate in the lower layer and affect the upper layers.—*V. S.*

9387. Kirilov, F. A. Concerning the dependence of the period of ground oscillation upon the distance to the explosion [in Russian]: *Seismol. Inst. Trudy*, no. 117, pp. 65-73, Moscow, 1945.

Measurements were made of the periods of ground oscillations generated by explosions set off at different distances from the observation point. The data showed that the periods of waves forming the main phase increase perceptibly with an increase of the distance. The results obtained confirmed the empirical formula of Sadovskii expressing the relationship between the period T of ground oscillation and the distance R from the shotpoint: $T = k \log R$. This formula was found valid for a computation of periods within distances of 6 to 7 kilometers. The empirical evidence also made it possible to determine with added precision the coefficient k for alluvial deposits.

The findings are considered to aid preliminary computations of the seismic effects of explosions and to increase the reliability of the present methods of determining the limits of dangerous zones in carrying out large-scale explosions.—V. S.

9388. Krumbach, Gerhard. Grundlagen und Aufbau eines Ortsbebenseismometers mit mechanischer Registrierung [Principles and construction of a local-vibration seismometer with mechanical registration]: *Zeitschr. Geophys.* vol. 17, pp. 281-290, Braunschweig, 1942.

The author discusses the question of what the requirements of seismometers used for the registration of local vibrations should be, and how well they are satisfied by the existing instruments. He then describes his own two-component apparatus, which has a height of 90 cm., a weight of 100 kg., a short and rigid intermediate lever, a 50-fold to 100-fold magnification, a pneumatic damping, and a separate arrangement for a recording speed of 15 to 30 mm./min. Construction is illustrated by drawings.—V. S. (An abstract appeared in *Zentralb. Geophys., Meteorol. u. Geod.*, vol. 11, no. 4, p. 193, Berlin, 1943.)

9389. Le Conte, Joseph. Geophysical history of the North Coles Levee oil field, Kern County, California: *Geophysics*, vol. 12, no. 3, pp. 406-413, Tulsa, Oklahoma, 1947.

The North Coles Levee oil field was discovered in November 1938. The location for the discovery well was based on data obtained from a reflection seismograph survey run early in the same year. A contour map, based on these reflection data, was prepared after several months of geophysical field work and interpretation. This map outlined the structure with reasonable accuracy as shown by comparing it with the present subsurface contour map constructed from electric-log correlations in over one hundred wells which have been drilled in the field as of December 1946.—*Author's abstract.*

9390. Macelwane, J. B. Study of large-scale vibrations at a pumping station: *Seismol. Soc. America Bull.*, vol. 37, no. 1, pp. 1-3, Berkeley, California, 1947.

Large-scale ground and building vibrations have developed in the course of years at the Biggers pumping station, Arkansas. They vary widely in intensity and, at their worst, affect the entire area, so that buildings, telephone poles, trees, grass, and grain fields sway visibly. Several sets of measurements were made with different in-

struments variously disposed with relation to the axis of the engines, but usable records of the larger waves were obtained only with a Taylor-Macelwane mechanical-optical vertical-component seismograph and a Schweydar-Macelwane horizontal-component seismograph. These instruments showed a maximum amplitude of 1/1,000 inch at an apparent frequency of 1.8 cycles per second in both the vertical and the horizontal direction.—V. S.

9391. Mantle, Edward. Amateur seismology in the making: Roy. Astron. Soc. Canada Jour., vol. 36, no. 2, pp. 40-48, Toronto, Ontario, 1942.

The author has succeeded in constructing an efficient seismograph from materials which are cheap and easily obtained. Although his only available location for the instrument is in the basement of a small house, quite close to a furnace and within a block of a city main street with passing trams, he succeeds in obtaining most satisfactory records of distant as well as relatively local shocks. His experience extends over several years. The article gives a detailed description of his seismograph as operating in 1942.—*Dominion Observatory, Bibliography, Seismology, no. 20, p. 344, 1946, Ottawa, [1947.]*

9392. Mercanton, P. L. Les sondages sismométriques de la Commission Helvétique des Glaciers à l'Unteraar, Suisse [Seismometric sounding by the Helvetic Glaciological Commission at Unteraar, Switzerland]: Bur. Centr. Séismol. Internat. Pub., Sér. A, Trav. Sci., no. 16, pp. 52-53, Strasbourg, 1946.

A brief report is given on the seismic investigation of the Unteraar Glacier, Switzerland, conducted by the Helvetic Glaciological Commission to determine the thickness of the ice and the configuration of its bed. The work is conducted with a special Kreis three-component seismograph having an oscillation period proper of 0.1 second and a 30,000-fold amplification. The instrument is employed in combination with two oscillographs registering both the time of explosion and the arrival of waves at one or two points on the glacier.

The reported surveys of 1936-38 revealed that the thickness of the glacier varies from 50 meters on the frontal cliff to more than 300 meters at the Dollfus pavilion. For distances of more than 300 meters between the shotpoint and the seismograph, the velocity of longitudinal waves reached 3.8 km./sec. near the frontal part of the glacier, but nearer the head measured 3.6 km./sec., without apparent reason. The work is being continued.—V. S.

9393. Morelli, Carlo. Nuovi fondamenti di assicurazione sismica [New foundations of seismic safety]: Istit. Geofis. Trieste Pubbl., no. 177, 15 pp., 1 map, Trieste, 1946.

Consideration is given to the importance which the coefficient of stable seismicity may assume in problems of safety from earthquakes, and to the adoption of new criteria for this coefficient in each region. In view of such importance, new and quantitatively rigorous premises are offered for the wider use of this basic form of earthquake prediction. A map of coefficients of seismicity for Albania prepared by the author in 1942 is appended.—*Author's abstract, translated by V. S.*

9394. Murphy, L. M. Geological effects on microseisms in the Caribbean: *Am. Geophys. Union Trans.* vol. 28, no. 4, pp. 528-533, Washington, D. C., 1947.

Investigation of geological influence on the transmission of microseisms in the Caribbean region is extended to new areas. Estimated effective ranges for tracking hurricanes by three types of seismographs are suggested.—*Author's abstract.*

9395. Neumann, Frank. The accuracy of seismogram analysis as revealed by shaking-table tests: *Bur. Centr. Séismol. Internat. Pub., Sér. A, Trav. Sci.*, no. 16, pp. 56-66, Strasbourg, 1946.

The accuracy of seismogram analysis is examined in the light of the results of shaking-table tests. Possibilities of error are found to exist in the analysis by inspection of the point of arrival of new trains of waves, in the averaging of travel-time curves and the study of too few wave groups, in ignoring the directional characteristics of ground motion and the complete actual displacement, in the insufficient reduction of seismograms, and in other factors.

To aid accurate analysis, two former shaking-table projects of the United States Coast and Geodetic Survey are discussed. In the first project, motions of teleseismic magnitude were investigated to determine the magnification curves of certain seismographs and to estimate the accuracy of the computation of shaking-table motion from seismograph records. In the second project, destructive effects within the central region of an earthquake were studied by recording the displacements of a shaking table subjected to strong irregular motion and by computing the same motion from the record of an accelerograph mounted on the table.—*V. S.*

9396. O'Connell, D. J. K. The calculation of the ground movement for the initial impulses of Galitzin seismographs: *Roy. Soc. New South Wales Jour. and Proc.*, vol. 79, pt. 4, pp. 172-175, Sydney, Australia, 1945.

Galitzin derived a method of computing the ground movement for initial impulses of his seismographs. The tables he gives were designed for seismograph periods of 24 seconds. For Galitzin seismographs with shorter periods, as generally used nowadays, Galitzin's tables are inadequate. Extended tables have been computed and are given here.—*Author's abstract.*

9397. Pinar, Nuriye. Géologie et météorologie sismiques du bassin de la mer de Marmara [Seismic geology and meteorology of the basin of the Sea of Marmara]: *Univ. d'Istanbul, Fac. des Sci. Rev., ser. A*, vol. 7, nos. 3-4, 64 pp., Istanbul, 1943.

Seismic activity in the Marmara Basin, long known for its strong earthquakes, is localized principally in the Gulf of Ismid, the Island of Marmara, and the Gazikoy-Mürefté coast. Its geologic and meteorologic causes have been investigated by the author on the basis of the records of the observatory at Kandilli, Istanbul, and other data. The primary causes are traced to local tectonics typified by persistent orogenic movements, by depressed shelves and elevated terraces, and by pronounced longitudinal faults constituting the loci of epicenters of strong earthquakes, of sources of thermal energy, and of volcanoes and dikes. The secondary causes are tentatively attributed to local barometric de-

pressions, which can have a trigger effect on tectonic disturbances when the resultant vertical forces of both phenomena act in the same sense.—
V. S.

9398. Poulter, T. C. Seismic measurements on the Ross shelf ice: *Am. Geophys. Union Trans.*, vol. 28, no. 2, pp. 162-170, no. 3, pp. 367-384, Washington, D. C., 1947.

Because of the possibility of using seismic instruments for locating the coastal outlines beneath the surface of the Antarctic ice and for studying the little understood Ross shelf ice, a specially designed seismograph was included in the scientific equipment of the Byrd Antarctic Expedition II, 1933-35. One hundred and twenty-two stations were occupied with this instrument in the general area of the Bay of Whales. On the basis of the data obtained, it has been possible to determine the thickness of the ice, to judge whether it was floating or resting on the bottom, and to estimate the depth of the water and the stratification of the bottom in cases of floating ice. The findings are presented. The seismograph was found very effective for studying the Ross shelf ice.—*Author's abstract, condensed by V. S.*

9399. Richter, C. F. Recording with Benioff instruments at Pasadena [California]: *Bur. Centr. Séismol. Internat. Pub.*, Sér. A, *Trav. Sci.*, no. 16, pp. 72-82, Strasbourg, 1946.

In view of the increasing number of installations employing electromagnetic pendulum seismographs of the Benioff type, a summary is given of the experience accumulated with these instruments at Pasadena, California, and of the methods found useful for interpreting their seismograms. The instruments considered have a short-period pendulum and respond to long period by virtue of coupling with a long-period galvanometer which may possess a period of as much as 100 seconds.

Various problems of routine work with local earthquakes and teleseisms are discussed, such as speed of recording paper, magnification, shock magnitude, large local shocks, large local *G* waves with the appearance of *S*, compression and dilation in initial teleseismic records, reading of the times of various types of waves, and related subjects. It is found that the short-period vertical instruments are the best for all the data required in dealing with teleseisms, whereas horizontal instruments are desirable for recording surface waves and are indispensable for reading such important phases as *S*, *ScS*, and *SKP*.—V. S.

9400. Ríznichenko, Iu V. Problem of the spatial interpretation of hodographs of reflected waves [in Russian]: *Acad. Sci. U.R.S.S. Bull. (Izvestiia)*, Sér. Géog. et Géophys., vol. 10, no. 1, pp. 45-62, Moscow, 1946.

The coordinates of a point on a reflecting boundary can be determined by analyzing any arbitrarily selected segment of a seismic hodograph of reflected waves. Three cases of different media overlying the boundary are considered: A homogeneous, isotropic medium with a constant seismic velocity; a horizontally stratified medium with the velocity a function of depth alone, which can be an anisotropic medium of a certain type; and a stratified medium, with each layer homogeneous and isotropic, and arbitrary spatial boundaries. The solutions offered for these cases can be applied to intersecting profiles and can be used to interpret isochrone maps of reflected waves.—V. S.

9401. Rutten, L., and Van Raadshooven, B. On earthquake epicenters and earthquake shocks between 1913 and 1938 in the region between 0° and 30° N. and 56° and 120° W.: *Nederl. Akad. Wet. Verh.*, sec. 2, vol. 39, no. 4, pp. 1-44, Amsterdam, 1940.

A map has been prepared of the computed epicenters of the earthquakes that occurred during 1913-39 in the zone between 0° and 30° N. and 56° and 120° W. The regions represented thereon—West Indies, Venezuela, Colombia, Panama, and Costa Rica—are discussed with respect to their seismic features. It is found that the area from Costa Rica to southwestern Mexico is the most active in the entire mapped zone; most of its epicenters are situated on the continent near the coast and in the Pacific Ocean near the continent. Existence of reaction shocks in the zone cannot be proved. The recorded shocks are mostly of nonvolcanic origin and it appears that eruptions should be regarded as a result rather than a cause of the shocks. Other findings are examined, and the reliability of the map is discussed.—V. S.

9402. Sadvovskii, M. A. Experimental investigations of the mechanical effect of an impact wave from explosion [in Russian]: *Seismol. Inst. Trudy*, no. 116, 44 pp., Moscow, 1945.

The mechanical effect of an impact wave caused by explosion was investigated by a determination of the resulting pressure. A piezoelectrical manometer, equipped with a device for registration, served for measuring the maximum pressure and impulse against obstacles as functions of the distance from the explosion and of the weight of the explosive. In an accessory study preliminary observations were made of the time during which the wave preserves its impact force and of the velocity with which it propagates. The apparatus and procedures of the investigation are described, and the results are given.—V. S.

9403. Sieberg, August. Investigation of structures with a view to protection against earthquake damage, conducted at the Reichsanstalt für Erdbebenforschung, Series C [in Hungarian], 15 pp., Budapest, K. J. Könyvnyomdaja, 1942.

An account is given of the investigations of shockproof structures conducted at the Reichsanstalt für Erdbebenforschung, Jena. The method has consisted in studying the destruction of models subjected to quakelike disturbances on shaking tables and photographed by moving-picture cameras. The work was limited to the effects of horizontal pushes characteristic of actual disturbances.

The results of several years of experiments show that earthquake damage to structures is caused not by vibrations but by the impact action of shocks. Destruction depends primarily on the relation between the structure's height and the dimensions of its foundation, and also on the presence of nearby structures, the technical specifications of construction, and the nature of the subsurface.—V. S. (An abstract appeared in *Zentralb. Geophys., Meteorol., u. Geod.*, vol. 11, no. 4, p. 195, Berlin, 1943.)

- Skels, D. C., and Vajk, Raoul. Geophysical exploration and discovery of the Budafapuszta (Lispe) oil field in Hungary. See *Geophys. abstract* 9343.

9404. Swan, B. G., and Boyd, W. B. Geophysical history of the Guthrie field, Logan County, Oklahoma: Geophysics, vol. 12, no. 2, pp. 159-168, Tulsa, Okla., 1947.

The geophysical history of the Guthrie oil field, as presented in this paper, consists of a reflection seismograph survey in early 1938; a re-interpretation of these data in 1941; and a detailed reflection seismograph survey in 1941, after the discovery of oil, to outline dimensions of the structure more definitely. Early concern over the fact that Viola reflection times failed to show east closure on the structure was later dispelled when drilling developments showed that closure actually was not present on horizons above the Second Wilcox sand.—*Authors' abstract.*

9405. Valle, P. E. Assorbimento e smorzamento di alcuni tipi di onde sismiche [Absorption and damping of some types of seismic waves]: *Ricerca Sci.*, vol. 14, pp. 177-182, Rome, April 1943.

A mathematical study is made of the propagation of seismic waves in a partly elastic and selectively absorptive medium. It is found that the waves undergo continuous deformations in space and in time and that the maximum of a wave moves with an unconstant velocity, depending upon the initial form of the wave.—*Cent. Nat. Rech. Sci., Bull. Anal.*, vol. 7, nos. 11-12, pt. 1, p. 2095, Paris, 1946, translated by V. S.

9406. Veldkamp, J. Seismic records at De Bilt, no. 30: Kon. Nederland. Meteorolog. Inst., no. 108, 33 pp., De Bilt, Netherlands, 1942.

The De Bilt seismic station in the Netherlands operates continuously with the instruments of Galitzin, Wiechert, and Bosch, which stand 3 meters above mean sea level. The geographic coordinates of the station are 52°6' N., 5°11' E.; the subsoil is sand. A report is given on the calibration of the instruments, the methods of measuring the Galitzin and Wiechert records, and the observations obtained on the character of microseismic movement.—V. S.

9407. Vening Meinesz, F. A. Deep-focus and intermediate earthquakes in the East Indies: Kon. Nederland. Akad. Wetensch. Proc., vol. 49, no. 8, pp. 855-865, Amsterdam, 1946.

The explanation of deep-focus and intermediate earthquakes by subcrustal currents so far has left undetermined the nature of these currents and their relation to deformations of the crust at the surface. The author discusses these and related questions as applied to the East Indian Archipelago, a strongly seismic region which has been investigated seismologically, gravitationally, and geologically. Various data, reviewed in turn for the Banda Sea area, Celebes, and Java, appear to support the hypothesis that there exists in the subcrustal plastic layers convection-currents which give rise to a system of stresses. When a sudden deformation in the crust generates another quickly increasing system of stresses superimposed on the first system, a break occurs in areas of excessive total stress. Certain qualifying considerations are examined, and the fields of stress caused by the convection current in the Banda Sea area are analyzed mathematically.—V. S.

9408. Vercelli, Francesco. *Analisi periodale dei diagrammi* [Periodicity analyses of diagrams]: Istit. Geofis. Trieste Pubbl., no. 221, 12 pp., Trieste, 1946.

After discussing the fundamental concepts of the mathematical analysis of unknown periodicity elements, eventually presented in diagrams, the author illustrates by examples the use of an arithmetical method which permits selection of the elements themselves in their actual form and position. There follows a description of an apparatus constructed to perform the analysis by means of purely mechanical operations.—*Author's abstract, translated by V. S.*

9409. Waterman, J. C. Geophysical history of the Ten Section oil field, Kern County, California: *Geophysics*, vol. 12, no. 3, pp. 402-405, Tulsa; Oklahoma, 1947.

The Ten Section oil field, generally regarded as the first geophysical oil field discovery in the San Joaquin Valley of California, was found by Shell Oil Co., Inc., by means of a reflection seismograph survey made in 1934-35. The discovery well, Shell Oil Co.'s K.C.L.-Stevens A-1, was completed in June 1936. A map presenting results of reflection shooting before discovery and one from well data with contours on the top of the productive upper Miocene "Stevens" sand are shown.—*Author's abstract.*

4. ELECTRICAL METHODS

9410. Aquilina, C. *Sull' interpretazione dei risultati nella prospezione del sottosuolo con metodi induttivi a maglia orizzontale* [On the interpretation of the results of subsoil exploration by the inductive method with a horizontal net]: *Riv. Geominer.*, 1945-1946, pp. 19-22, Milan, 1947 (?).

The effects of electrically conductive geologic formations on the electromagnetic fields of suitably disposed circular conductors are discussed with a view to determining the possibility of expressing them by simple circuits and of using a generalization of the method of Bieler. It is shown that, even in the complex case under consideration, the characteristic elliptical polarization, discoverable by customary methods, can be ascertained.—*Author's abstract, translated by V. S.*

9411. Archie, G. E. Electrical resistivity an aid in core-analysis interpretation: *Am. Assoc. Petroleum Geologists Bull.*, vol. 31, no. 2, pp. 350-366, Tulsa, Oklahoma, 1947.

A correlation of permeable rock characteristics is important to understand rock structure and detect oil reservoirs exposed in a borehole. The present study shows that electrical resistivity, useful in outlining different formations exposed in a borehole, is closely related to total porosity. The type of rock structure, provided it is well consolidated, has remarkably little effect on porosity, notwithstanding the heterogeneity and marked variation between different types, which is fortunate because the resistivity log can be used in a more quantitative way. Comparisons of connate water in place, determined by resistivity curves and residual fluid in contaminated or flushed cores, have indicated the existence of an empirical relation between resistivity and fluids, which is described.—*Author's abstract condensed by V. S.*

9412. Doll, H. G., Legrand, J. C., and Stratton, E. F. True resistivity determination from the electric log and its application to log analysis [digest]: *Oil and Gas Jour.*, vol. 46, no. 2, p. 58, Tulsa, Oklahoma, 1947.

A distinction is established between the observed resistivity, or apparent resistivity, and the resistivity of the undisturbed formation, or true resistivity. The general relation between the two is discussed. A method is described for determining the true resistivity of geologic formations traversed by a borehole through the application of resistivity-departure curves to the apparent resistivity measured on the electric log.

Effects of electrode spacing, hole diameter, mud resistivity, and invasion of the formation by mud filtrate are discussed in detail, with examples of their influence on the apparent resistivity.

In developing the application of resistivity-departure curves to the analysis of the electric log, the importance of the true resistivity for the determination of quantitative data in producing horizons is indicated. A short discussion is given outlining the electrode devices used in electrical logging of the borehole.

9413. Fock, V. The field of a plane wave near the surface of a conducting body: *Jour. Physics*, vol. 10, no. 5, pp. 399-409, Moscow, 1946.

For the field induced by an incident plane wave on and near the surface of a convex body of finite conductivity approximate formulas are derived. Since these formulas give also the current distribution in the skin-layer on the surface, they may be used for calculating by means of definite integrals the field at arbitrary distances from the body, yielding thus an approximate solution of the general diffraction problem.—*Author's abstract.*

9414. Friedel, E., and Goguel, J. La prospection géophysique du Bas-Dauphiné [Geophysical prospecting of the Bas-Dauphiné]: *Annales des Mines et des Carbur.*, no. 6, pp. 417-432, Paris, 1944.

Methods of gravimetric prospecting and electrical sounding are outlined. It is found that a study of the electrical resistivity of geologic strata makes possible the determination of their nature and approximate age. This approach has led to the discovery of a heretofore unsuspected series of thick Oligocene beds located between two faults in the region between the Côte St.-André and Drôme, France.—*Cent. Nat. Rech. Sci., Bul. Anal.*, vol. 7, no. 3, p. 429, Paris, 1946, translated by V. S. (See also Geophys. abstract 9331.)

9415. McGarva Bruckshaw, J. Geophysical prospecting and petroleum discovery: *Petroleum*, vol. 10, no. 5, pp. 98-101, London, 1947.

The nature of geophysical exploration is briefly outlined, and attention is centered on electrical-resistivity prospecting for oil. The method is based on the fact that water-saturated rocks are better conductors than oil-bearing rocks. To determine the relative resistivity of formations, an electrical current is passed between two electrodes on the surface, and measurements are made by means of two other electrodes set between the first two. If I amperes is the current passed through the ground and V volts is the drop in measured voltage across the inner electrodes, the apparent resistivity can be calculated from the

formula $\rho = 2\pi aV/I$. The use of various types of electrode arrangements to locate structures is described. The limitations of resistivity prospecting arise principally from the obscuring effects of changes in resistivity near the surface and from the complexity of the distribution of current in continuous bodies.—V. S.

9416. Miller, M. C. Galvanic couples and cathodic protection: Petroleum Engineer, vol. 17, pp. 55-58, Dallas, Texas, May 1946.

The author presents charts obtained from a series of tests made on buried pipes of different metals and arranged to permit the correlation of galvanic currents, of pipe-to-soil potentials over anodic and cathodic areas, and of effects of increments of cathodic protection currents upon galvanic currents and upon pipe-to-soil potentials. The tests indicate that to stop galvanic currents, and thus to stop corrosion, it is necessary to change the measured potentials of the structure [a pipe line] to remote earth, or of the electrode near the anodes, so that they are equal to, or greater than, the open-circuit potentials of the anodes.—*Corrosion, vol. 3, no. 7, Abstracts, p. 22, Pittsburgh, Pennsylvania, 1946, condensed by V. S.*

9417. Morelli, Carlo. Sulla corrente elettrica verticale in Italia [Concerning vertical electric currents in Italy]: Istit. Veneto di Sci., Let., ed Arti Atti, vol. 103, no. 2, pp. 197-209, Venice, 1944.

The average intensity of the vertical electric currents in the soil of Italy is determined by calculating the work performed by a single long magnetic pole tracing closed circuits on the earth's surface in opposition to the horizontal component of terrestrial magnetism. The value obtained varies from -854×10^{-6} to $+978 \times 10^{-6}$ amp./km.²; it is negative (toward the base) in northern Italy and positive in southern Italy. The total residual current is -44×10^{-6} amp./km.² These results agree with the average values of Bauer for the entire spherical zone of the earth located within Italy's latitudes.—*Author's abstract, translated by V. S.*

Offman, P. E. On the geological interpretation of geophysical maps of the Ishimbai pre-Urals [in Russian]. See Geophys. abstract 9341.

9418. Petropavlovskii, S. A. Practical techniques of detailed geophysical exploration of pyrite deposits in the Urals [in Russian]: Razvedka Nedr, vol. 12, no. 4, pp. 29-32, Moscow, 1946.

The electrical anomaly previously detected north of the Sibavsk pyrite deposit in the southern Urals has been explored by several electrical methods. Isoline mapping delineated a conducting zone of 250 to 300 meters but did not indicate the nature of its geology. Measurements of natural potential revealed an anomaly of the order of -70 millivolts and increased the chance of its being a sulfide deposit, but did not exclude the possibility of the presence of carbon-graphite schists. Finally, resistivity profiling and sounding confirmed the existence of a conducting medium and located it at a depth of 15 to 20 meters, thus rendering the schists improbable as a source. The results are discussed and illustrated by maps and profiles. Test drilling on the anomaly revealed copper pyrite at a depth of 17 meters.—V. S.

9419. Ramachandra Rao, M. B. Geophysical survey report on the Sowannahalli copper ore block, Nanjangud Taluk, Mysore District: Mysore Geol. Dept. Records, vol. 43, 1944, pp. 31-46, Bangalore, India [1946].

In 1943 electrical resistivity and self-potential surveys were made near Sowannahalli, Mysore, to test the extension in depth of small copper-ore bodies that had been worked near the surface. The ore occurs in an altered dolerite dike in a region covered by thick black clay. The combined measurements were made along 4 preliminary traverses laid out partly over the area of the workings and partly outside of it. The more detailed resistivity measurements were taken along 11 traverses over a wider area and included an expanding electrode test between two old shafts by means of the Wenner and the Lee partitioning configurations.

The self-potential readings registered no marked anomalies, even over the ore bodies visible in the old workings. The preliminary resistivity results indicated characteristic anomalies over the contact between the dolerite dike and the granulitic schists and gneisses. However, the more detailed resistivity data failed to show clearly circumscribed anomalous zones. It is concluded that there is little prospect of large copper deposits in the area.—V. S.

9420. Schlumberger, Marcel, and Kunetz, Géra. Variations rapides simultanées du champ tellurique en France et à Madagascar [Rapid simultaneous variations of the telluric field in France and Madagascar]: Acad. Sci. Comptes Rendus, vol. 223, no. 15, pp. 551-553, Paris, 1946.

A notable correlation has been found to exist between measurements of the telluric field made simultaneously in France and Madagascar on October 11, 1945. Differences of potential measured between the extremities of two mutually perpendicular lines and plotted in curves showed similar variations, particularly along the northeast-southwest direction in Madagascar and the north-south direction in France. For these directions the abscissas of the successive minima of the curves had a correlation coefficient of +0.84. The study of all the observed variations of the telluric field revealed that a north vector in France corresponds to a south-southwest vector in Madagascar, and that a rotation of the direction of the vector in France corresponds to an opposite rotation in Madagascar.—V. S.

9421. Stick, J. C., Baker, J. S., and Norelius, R. G. New electrical logging techniques in California: Oil and Gas Jour., vol. 46, no. 2, pp. 82-89, Tulsa, Oklahoma, 1947.

Several improved techniques of electrical logging recently developed in California are described. Differentiation between oil sands and fresh-water sands is effected by impregnating the critical zones with a drilling fluid having a resistivity lower than that of the water in the formation. If shallow lateral resistivity curves tend to group toward high values, the invaded zone is likely to be an oil sand.

Oil-base logs are improved by a reduction in the magnitude and intermittency of the electrical contact, by the use of measuring circuits establishing an essentially constant formation current over a wide range of resistance variations, and by the smoothing of the remaining effects of contact variation.

A shallow lateral resistivity curve of the closely spaced, double pick-up type combining the merits of detailed and averaging curves is introduced to record highly interbedded oil sands, shales, and other formations ranging in thickness from 6 inches to several feet.—V. S.

9422. Tikhonov, A. N. Concerning electrical sounding over an inclined layer [in Russian]: *Inst. Teor. Geofis. Trudy*, vol. 1, pp. 116-136, Moscow, 1946.

A solution is offered for one of the main problems of electrical prospecting by direct current—the determination of the field of an electrical point source placed on the earth's surface over an inclined layer. The method consists in resolving an integral equation by means of successive approximations, and yields a summation of two components. In the important case of layers differing considerably in resistivity, one of the components is found to be so small that it can be ignored, whereby the calculation of the potential is reduced to a relatively simple approximate formula. Further derivation gives equations for the approximate asymptotic value of the potential and for the determination of apparent resistivity. The accuracy of the approximate asymptotic equation is appraised by comparison with calculations made in terms of precise asymptotic values.—V. S.

9423. Turkisher, R. I. Calculation of the field of a point-source placed over an inclined layer [in Russian]: *Inst. Teor. Geofis. Trudy*, vol. 1, pp. 137-142, Moscow, 1946.

In calculating the field of an electrical point source placed over an inclined layer, A. N. Tikhonov has employed double integrals to determine the apparent resistivity for surface points satisfying certain conditions (*see* Geophys. abstract 9422). The present author shows by mathematical analysis that the inner integral in Tikhonov's equations can be reduced to full elliptic integrals, making it possible to effect the second integration by using the approximate trapezoidal formula.—V. S.

9424. Weiss, Oscar. Geophysical prospecting for water in the dolomite: *Chem. Met., Min. Soc. South Africa Jour.*, vol. 47, no. 4, pp. 155-163, Johannesburg, 1946.

Electrical-resistivity and magnetic surveys were made on the east side of the Wonderfontein Dyke, western Witwatersrand, to find water supplies. The dike is a syenite intrusion of Bushveld age bordering on dolomite. In the area explored it is decomposed and covered with thick soil.

The magnetometer measurements located the dike, which produces a strong negative vertical anomaly. The resistivity survey tested the zone along the dolomite contact by the application of the Wenner electrode configuration at nine sites disposed in pairs about 500 feet apart. Water-bearing zones in dolomite were expected to register resistivities of less than 20,000 ohm-centimeters.

One site showed values of about 10,000 ohm-centimeters and was investigated by the Lee five-electrode method, with traverses drawn in eight directions across the promising area. The resistivity data obtained in the five directions disposed either parallel or toward the dike had consistently low values. It was concluded that water is present between this site and the dike. Subsequent drilling on the site inter-

sected water-bearing fissures at depths of 220, 265, and 343 feet, yielding a large water supply.—V. S.

5. RADIOACTIVE METHODS

9425. Barschall, H. H., and Bethe, H. A. Energy sensitivity in fast neutron counters: *Rev. Sci. Instruments*, vol. 18, no. 3, pp. 147-149, Lancaster, Pennsylvania, 1947.

The energy sensitivity of counters using recoils from a radiator or recoils produced in a gas is discussed. The sensitivity of a hydrogen-filled counter, calculated as a function of neutron energy, is found to rise sharply above the bias and to remain almost constant over a wide range of neutron energies. The sensitivity of a detector using a thin radiator is the same as that of a gas-filled chamber, provided the neutrons are incident within a reasonably small angle with respect to the normal to the radiator.

The sensitivity of a detector using a thick radiator, when calculated for an isotropic scattering in the center of the mass system, is found to increase rapidly with neutron energy, which shows that a thick radiator is useful primarily for investigating the properties of the most energetic neutrons in a given distribution. This radiator can be employed as a bias-sensitive detector only if the bias is not much smaller than the highest neutron energy present, and if an appreciable fraction of the neutrons have energies close to the bias energy.—V. S.

9426. Cork, J. M. Radioactivity and nuclear physics, 175 pp., Ann Arbor, Michigan, Edwards Bros., 1946.

This book gives an account of present-day knowledge of radioactivity and nuclear physics viewed in its historical perspective. The subjects treated include the origin of natural radioactivity; methods of its detection employing fluorescence, photography, ionization chambers, vacuum-tube electrometers, point counters, tube counters, and other instruments; apparatus for induced radioactivity; alpha rays, beta rays, and gamma radiations; neutrons, protons, and other types of particles; cosmic radiation; nuclear fission; and applications of radioactivity. The text is designed for the use of students and research workers. Tables of isotopes and a bibliography are appended.—V. S.

9427. Cfiér, Pierre. Prospection de l'uranium par ses particules alpha [Prospecting for uranium by the use of its alpha particles]: *Annales de Géophys.*, vol. 2, no. 2, pp. 147-159, Paris, 1946.

We have attempted to perfect some of the simple methods of detecting and measuring alpha rays in order to utilize them in prospecting for uranium. By constructing sensitive and solid electrometers equipped with mobile disks, by adapting the technique of the photographic plate, and by experimenting with a new activating device, we succeeded in separating the uranium and thorium effects in the radioactivity measurements of deposits. The prospecting method thus developed was tested in the region of the Monts du Forez and Bois Noirs, where the number of known radioactive veins is relatively large. The results have revealed certain areas of strong radioactive concentration and brought to light the close relationship existing between physical measurements and geologic data.—*Author's abstract, translated by V. S.*

9428. Doll, H. G., and Schwede, H. F. Radioactive markers in oil field practice [digest]: Oil Weekly, vol. 125, no. 3, p. 50, Houston, Texas, 1947.

In an oil well the subsurface points revealed as promising by electrical logs can be rendered identifiable after the casing is set by placing radioactive markers nearby. A marker consists of a charge of radium salt set in a brass pellet and placed inside a steel projectile. It is fired at the proper depth by a gun and is later located through the casing by means of a detector of the gamma rays emanating from the charge.—V. S.

9429. Elliott, G. A., and Lee, R. H. The construction of Geiger-Müller tubes of high sensitivity to β -radiations: Rev. Sci. Instruments, vol. 18, no. 6, pp. 450-451, Lancaster, Pennsylvania, 1947.

A report is given on the construction of a Geiger-Müller counter tube highly sensitive to the weak beta rays of potassium salts. To satisfy the requirement of a large window area, the electrodes of this model are completely enclosed in a Pyrex glass envelope, and a thin film serves as the cathode, being deposited on the inner wall of the glass either by silver plating or by the evaporation technique of Du Toit and de Vois. Almost the entire area of this cathode must be further reduced in thickness by chemical attack from the outside to obtain the desired sensitivity. Three possible thinning processes are described, and data on the characteristics of the counters are presented.—V. S.

9430. Federal Science Progress. Geiger counter: Vol. 1, no. 3, p. 3, U. S. Dept. Commerce, Washington, D. C., 1947.

A brief explanation is given of the Geiger counter invented 40 years ago for detecting radiation. High energy radiation from radium, X-rays, and cosmic rays has the property of charging electrically neutral gas molecules by knocking out their electrons. The electrons so separated carry a negative charge, and the molecules from which they are separated become positively charged ions. This ionization property is used in the Geiger counter to detect radiation and measure its intensity.

The counter consists of a vacuum tube in the form of a negatively charged metal cylinder, through which a positively charged wire is stretched. Radiation enters the tube through a window and ionizes the small amount of gas left in the tube, causing the positive ions to move toward the negative metal wall and the freed electrons to move toward the positive wire. This motion produces a pulse of electricity large enough to be measured. When the ions reach the walls they are neutralized, and the pulse dies away, leaving the counter ready for the next pulse.—V. S.

9431. Holmes, Arthur. A revised estimate of the age of the earth: Nature, vol. 159, pp. 127-130, London, January 25, 1947.

The preliminary estimate of the age of the earth based on Nier's isotopic analyses of samples of lead is revised on the basis of a greatly increased number of solutions and a use of Glaisher's exponential tables. The data and calculations employed are discussed, corrections are introduced, and the new mean and modal solutions are tabulated, together with the results of a verification by a method of least squares. It is concluded, on the evidence available at present, that the most probable age of the earth is about 3,350 million years.—V. S. (See also Geophys. Abstracts 125, no. 8557.)

9432. Instrument Development Laboratories, Chicago. Radioactivity probe: Rev. Sci. Instruments, vol. 18, no. 2, p. 140, Lancaster, Pennsylvania, 1947.

Announcement is made of a portable beta-gamma-count rate meter for general radioactivity surveys. One model has three ranges—0.2, 2.0, and 20.0 milliroentgens per hour full scale—and is equipped with a detachable probe on a 4-foot cable connecting it with the Geiger-Müller tube. For separating beta rays and gamma rays the window of the probe has an adjustable shield that can be set to prevent beta particles from affecting the tube. The instrument is suited to surveys of radioactive ores. It weighs 10 pounds and measures 8 by 11 by 4 inches.—V. S.

9433. Walker, J. M., and McGaha, S. W. Some practical considerations of radioactivity well logging: Oil Weekly, vol. 124, no. 6, pp. 33-34, Houston, Texas, 1947.

In the literature on radioactivity well logging little attention has been given to the preparations necessary in advance of logging, to the requirements imposed by limitations of equipment and by physical conditions in wells, and to the correlation of logging results with other data. The authors discuss these subjects in their bearing on the requisite surface equipment, the knowledge of casing program, the planning of logging operations, and the uses of the finished log. The need of close cooperation between the management of the well and the logging company is emphasized.—V. S.

6. GEOHERMAL METHODS

9434. Benfield, A. E. A heat flow value for a well in California: Am. Jour. Sci., vol. 245, no. 1, pp. 1-18, New Haven, Connecticut, 1947.

A value of $(1.29 \pm 0.011) \times 10^{-6}$ cal./cm.² × sec. has been found for the heat flow in a well in California, and the methods used for deriving this value are described in some detail. This new heat-flow value is close to those found in Great Britain and in South Africa, where similar work has been done. The possibility of using heat-flow methods for detecting the existence of convection cells, as suggested by Griggs, is briefly discussed.—*Author's abstract.*

9435. Guyod, Hubert. Temperature well logging—Wells not in thermal equilibrium, parts 1-2: Oil Weekly, vol. 124, no. 2, pp. 36-40, no. 3, pp. 38-40, Houston, Tex. 1946.

In cable-tool wells there is an almost continuous influx of fluids into the borehole from the penetrated beds. If gas sands are traversed, an appreciable quantity of gas is released thereby. Similarly, when an oil reservoir is tapped, part of the dissolved gas comes out of solution and escapes into the well. The expansion of this gas produces a considerable cooling in wells only partly filled with mud and may be used to detect petroleum reservoirs by means of temperature logging. Examples of such reservoir location in wells that do not contain drilling fluid are discussed and illustrated by temperature curves from west Texas and West Virginia.

Another case of temperature logging in wells not in thermal equilibrium is the location of the exact position of the cement behind a freshly cemented pipe by a determination of the increase of temperature resulting from the setting of the cement. The magnitude of the anomaly

produced, the quantity of cement, the influence of time, and other factors are discussed. It is preferable to make the temperature measurements from 5 to 24 hours after cementation if the cement sets fast and somewhat later if it sets slowly. No circulation should occur in the hole between the operations of cementing and of temperature logging.—V. S.

7. GEOCHEMICAL METHODS

9436. Hawkes, H. E., Jr. Research on geochemical prospecting by the Geological Survey [abstract]: *Econ. Geology*, vol. 42, no. 4, p. 414, Lancaster, Pa., 1947.

The United States Geological Survey has undertaken a program of research on new methods of prospecting for mineral deposits, based on studies of the geochemical dispersal in surface material of minor elements derived by the leaching of buried mineral deposits. Particular emphasis is being placed on the content of zinc, copper, and lead in soil, vegetation, and natural water and its relation to known or suspected bodies of ore.

Several geochemical field studies are currently in progress, and preliminary results are believed to be sufficiently encouraging to warrant further and more intensive study. The ultimate goal of the Geological Survey's program is the development of a routine method by which a relatively untrained field party will be able to prospect for hidden mineral deposits by tracing the distribution of minor elements in surface materials.—*Condensed by V. S.*

Hawley, P. F. Geophysical contributions to vibration measurements and micro-chemistry. (*See Geophys. abstract 9383.*)

9437. Tabasaranskii, Z. M. Geochemical surveys of deposits in the Fergana Valley [in Russian]: *Neftianoe Khoziaistvo*, vol. 24, no. 12, pp. 16-20, Moscow, 1946.

In 1935-43 a number of geochemical surveys were made in Fergana, U.S.S.R., in quest of oil. The author reviews several surveys, compares their findings with the results of drilling, discusses the local geology and promising structures, and draws conclusion on the value of geochemical prospecting. Particular attention is given to the surveys of anticlines in Andizhan, southern Alamyshik, and northern Alamyshik, which led to an important oil discovery.

It is found that in Central Asia positive geochemical indications of oil have proved largely correct and negative indications invariably correct, so that the efficacy of the geochemical method is demonstrated conclusively. Particularly in Fergana, it is possible to determine the existence of a petroleum deposit in the subsurface and tentatively to delineate its contours. A regular distribution of hydrocarbon concentration over a structure is more significant than the absolute hydrocarbon content in the subsurface air. The center of an anomaly usually is displaced toward the more gently sloping side rather than the steep side of a structure. A gas dome is not necessarily indicated by a circular heavy-hydrocarbon anomaly or by a linear methane anomaly. Sometimes a hydrocarbon anomaly may be due to subsurface water saturated by a nearby hydrocarbon concentration. Other observations are given.—V. S.

9438. Vecchia, O. La prospezione geochemica del petrolio [Geochemical prospecting for petroleum]: Riv. Geominer., 1945-1946, pp. 31-34, Milan, 1947(?).

The need for further progress in petroleum exploration is stressed, and the development of geochemical techniques for that purpose in the United States is outlined in the light of the writings of Pirson, McDermott, Rosaire, Tripp, and Kriegel. The principles, advantages, and limitations of the method are discussed briefly.—V. S.

9439. Zobell, C. E. Action of microorganisms on hydrocarbons: Bact. Rev., vol. 10, nos. 1-2, pp. 1-49, Baltimore, Md., 1946.

In discussing the action of microorganisms on hydrocarbons and their role in the formation of petroleum, the author dwells briefly on the hydrocarbon-oxidizing bacteria used in geomicrobiological prospecting. In the method of R. T. Sanderson, receptacles containing mineral media inoculated with bacteria which utilize volatile hydrocarbons are placed in holes at a depth where hydrocarbonogenic bacteria are not active. (See Geophys. Abstracts 111, no. 6781.) In the method of L. W. Blau, certain chemical agents produce characteristic changes of color in the soil where hydrocarbon-consuming bacteria have been active. (See Geophys. Abstracts 109, no. 6560.) Other effects of bacterial action on the hydrocarbon content of soil are indicated.—V. S.

8. UNCLASSIFIED GEOPHYSICAL SUBJECTS

9440. Allison, A. P., and Claypool, C. B. Developments in upper Gulf coast of Texas in 1946: Am. Assoc. Petroleum Geologists Bull., vol. 31, no. 6, pp. 1071-1077, Tulsa, Oklahoma, 1947.

In the upper Gulf coast of Texas 320 exploratory wells were drilled for oil during 1946. Of these, 121 were new-field wildcats, with 30.5 percent located by seismic reflection work, 32.2 percent by seismic and subsurface work, and 37.3 percent by subsurface, gravity, geochemical, and core-drilling work. One out of every nine new-field wildcats proved productive. In comparison with 1945, seismic-reflection operations in 1946 showed a decline of 5 percent in the number of crew weeks and gravity operations a decline of 32 percent in the number of crew weeks.—V. S.

9441. Bogdanov, A. I. The role of geophysical methods of exploration in the oil industry of the United States [in Russian]: Razvedka Nedr, vol. 12, no. 1, pp. 28-36, Moscow, 1946.

In 1945 the author, traveling in the United States to study geophysical prospecting for oil, visited instrumental laboratories, consulting offices, and parties in the field. His report presents statistical data characterizing the condition of the oil industry and its reserves, the progress of drilling and logging operations, and the scope of surface exploration by various geophysical methods.—V. S.

9442. Carnegie Institution of Washington. Year Book No. 45, July 1, 1945-June 30, 1946, 235 pp., Washington, D. C., 1946.

This yearbook comprises two reports on geophysical work.

Geophysical Laboratory, by L. H. Adams. The research in fundamental science interrupted by the war was resumed. The laboratory pro-

poses a reorganization of investigation which is outlined. The aim is to narrow and refocus activities on a coordinated and relatively limited group of problems in experimental geology.

Department of Terrestrial Magnetism, by J. A. Fleming. Extracts from a reorganization program are included under the items of the review of the year's work. The review covers geomagnetic investigations, terrestrial electricity, ionosphere, nuclear physics, observatory studies, and field work. A summary of war activities is included, and magnetic surveying from the air is outlined.—V. S.

9443. Danckwortt, P. W. *Lumineszenz-Analyse im filtrierten ultravioletten Licht* [Luminescence analysis in filtered ultraviolet light], 4th ed., 241 pp., Leipzig, Akad. Verlagsges., 1940, and Ann Arbor, Michigan, Edwards Bros., 1944.

The luminescence analysis of substances under a filtered ultraviolet light has been developing in several fields of science during the past 25 years. The author assembles the accumulated knowledge, supplements it with his own findings, and organizes the information into a coordinated system. The material covers theory, apparatus, methods, and applications, and deals with the subjects of filters, sources of ultraviolet light, techniques of qualitative and quantitative observation, factors affecting results, and utilizations in the fields of science and industry. A systematic bibliography containing 1,583 entries is appended.—V. S.

9444. De Ment, Jack, and Dake, H. C. *Handbook of uranium minerals*, 80 pp., Portland, Oregon, Mineralogist Pub. Co., 1947.

This handbook furnishes for the lay reader information on world deposits of uranium minerals, the methods of prospecting for them, the mineralogy of carnotite and pitchblende, and the constituents of the uranium and thorium families. The chapter on prospecting describes the methods employing photography, radioscope, spintariscope, electroscope, Geiger counter, fluorescence, the bead test, and the zinc test. Generally, these methods are based on the various effects of radioactivity on matter. Photographic emulsion registers radioactive radiations, luminescent substances are rendered luminous, and electrically nonconductive gases become temporarily ionized and conduct electricity. The usually spotty and irregular distribution and the small size of uranium deposits make it advisable to use several methods in prospecting.—V. S.

9445. Donabedov, A. T., and Feofilova, A. P. *Geophysical methods in the search and exploration of coal deposits and basins in the U.S.S.R.* [abstract, in Russian]: Acad. Nauk S.S.S.R., Otd. Geol.-Geog. Nauk, Referaty za 1944 god, p. 45, Moscow, 1945.

Experience gained in the exploration of the principal coal basins of the U.S.S.R. shows that geophysical methods are suited for the overall spatial delineation of a coal-bearing structure, for the geologic differentiation of the productive mass and clarification of its tectonics, and for the determination and delineation of separate coal layers. The last-named determination is possible, however, only in cases where there is a considerable difference between the physical properties of the coals and those of the enclosing rocks, and also a sufficient depth and thickness of the coal layers, as has been demonstrated in the Cheliabinsk, Kuznetsk, and Karaganda coal basins. The choice of geophysical method must be

based on such factors as the regularity of change in the physical properties of the coals and the rocks viewed in relation to other local geologic characteristics.—V. S.

9446. Grant, P. A. and Doshier, A. W. Developments in Texas Panhandle: Am. Assoc. Petroleum Geologists Bull., vol. 31, no. 6, pp. 1015-1017, Tulsa, Oklahoma, 1947:

In the Panhandle district of Texas 317 new oil wells were drilled in 1946, as compared with 567 wells in 1945. Exploration was largely geophysical. At the beginning of the year there were 3 seismograph parties, 9 gravimeter parties, and 4 magnetometer parties in the field, whereas at the close of the year there were 7 seismograph parties, 2 gravimeter parties, and no magnetometer parties. The work of 1946 centered in the Anadarko basin, but there was also some activity in the southern parts of Parmer, Castro, and Swisher Counties, in the western parts of Oldham and Deaf Smith Counties, and in Armstrong County.—V. S.

9447. Kelly, S. F. What geophysics is and is not: Northern Miner, vol. 32, no. 43, pp. 34-35, Toronto, Ontario, 1947.

The similarities and differences between geological and geophysical exploration are discussed. Both approaches make use of physical properties of the earth's crust, but geophysics begins where geology leaves off and substitutes physical instruments for the unaided eye. These instruments enable geophysicists to investigate distant rock and mineral bodies that they can neither touch nor see. Still, geophysical exploration only serves to reveal geological conditions favorable to mineral deposits but not to detect the deposits themselves. It is not a means of locating ore and petroleum directly. The fundamentals of the principal geophysical methods—gravitational, magnetic, seismic, and electrical—are outlined and the principal applications are indicated.—V. S.

9448. Lahee, F. H. Exploratory drilling in 1946: Am. Assoc. Petroleum Geologists Bull., vol. 31, no. 6, pp. 917-930, Tulsa, Oklahoma, 1947.

During 1946 a total of 5,752 exploratory holes were drilled in the United States in quest of oil. Statistics of the relative success of the different methods used to locate exploratory holes show that 21.3 percent of the holes drilled on technical (geological and/or geophysical) advice were producers, in contrast to 4.6 percent successful in the case of the holes located without technical advice. Thus, locations based on technical recommendations were 4.6 times as successful as those drilled without them.

In the case of new-field wildcats only, 12 percent of the holes drilled on technical advice were successful, and only 2.7 percent of the holes drilled without technical advice were successful. The figures refer to totals for the 17 States that include 98 percent of the proved oil reserves of the United States.—V. S.

9449. Nettleton, L. L., editor. Early geophysical papers of the Society of Exploration Geophysicists, 844 pp., Soc. Explor. Geophys., Tulsa, Oklahoma, 1947.

Prior to the establishment of the quarterly journal "Geophysics" in January 1936 the papers presented at the meetings of the Society of Exploration Geophysicists were published in various periodicals and

in a publication entitled *Journal of the Society of Petroleum Geophysicists*. These early papers contain much of the history and technical fundamentals of the present geophysical exploration industry. To preserve them and make them conveniently available to geophysicists throughout the world, the Society of Exploration Geophysicists Executive Committee has arranged for reproduction of these papers in one bound volume.—*Oil and Gas Jour.*, vol. 46, no. 12, p. 263, Tulsa, Okla., 1947, condensed by V. S.

9450. Oil and Gas Journal. Radar, new exploration tool: Vol. 45, no. 43, p. 109, Tulsa, Oklahoma, 1947.

Shoran radar promises to speed work in several types of geophysical exploration. In essence, it makes use of waves traveling with the velocity of light to measure distances in a system of triangulation. Magnetic surveys from the air are accelerated thereby, because position determination by ground methods is the main time-consuming factor. Over water or jungle or featureless terrain, radar offers practically the only possible solution for position fixing at present. The use of radar should also aid airborne gravimeter exploration, now in the experimental stage. The benefits of radar have been demonstrated in the surveys of continental shelves in the Gulf of Mexico and in the Bahamas.—V. S.

9451. Pospelov, P. A. The 5-year plan of geophysical work for the oil industry and its equipment problems [in Russian]: *Razvedka Nedr*, vol. 12, no. 3, pp. 39-44, Moscow, 1946.

In the U.S.S.R. geophysical exploration on behalf of the oil industry is carried out by the State Geophysical Trust (G.S.G.T.), which operates more than 150 field crews and maintains its own research institute. The work of this organization is reviewed briefly, and its 5-year plan for 1946-50 is outlined.

To date it is estimated that the use of geophysical methods in the Emba region has made it possible to conduct the search for salt domes in one-fifteenth the time and at one-thirtieth the cost of that required by other prospecting techniques. Examples of the success of the seismic, electrical, and gravitational surveys are given.

The projected 5-year plan calls for a considerable increase in the number of field crews. The seismic method is to take the lead by a fourfold expansion of its crews, the electrical method is to occupy second place by a doubling of crews, and the gravitational method is to come next. In all, 280 crews are expected to operate for the oil industry in 1950. A second factory for the manufacture of geophysical instruments is to be established by the G.S.G.T.—V. S.

9452. Rinehart Oil News Co. Rinehart's Yearbook 1947, Tulsa, Oklahoma, 1947.

Statistics are assembled on oil exploration and new-field discoveries made in 1946 in the following 21 oil-producing States: Texas, Oklahoma, Louisiana, Arkansas, Mississippi, Florida, Alabama, Georgia, Tennessee, Kansas, New Mexico, Colorado, Wyoming, Montana, Utah-Idaho-Arizona, Dakotas-Nebraska, Missouri-Iowa. The information is arranged in sections covering one or more States. The material on Mississippi, Florida, and Tennessee contains a few data on geophysical exploration. In the southeastern States the number of geophysical crews in 1946 decreased to almost half the number of such crews in 1945;

the number of gravimeter crews showed the largest drop. In contrast, in Florida there was considerable geophysical exploration, with gravity and magnetic surveys predominating. In western Tennessee, geophysical activity was largely confined to gravity and magnetic work.—V. S.

9453. Ritzmann, O. F. Patents [a classification]: Geophysics, vol. 12, no. 2, pp. 256-264, Tulsa, Oklahoma, 1947.

A system of subject headings carrying identification numbers has been developed by the author for the classification of patents abstracted in the journal "Geophysics." The system is presented in detail. The numbers are not consecutive, the intervening numbers being left to permit insertion of new classes. In addition to serving as a classification for current patents, the system will be used in the patent-index section of the Cumulative Index to be published by "Geophysics" this year.—V. S.

9454. Sergeev, E. A. A new field luminoscope [in Russian]: Razvedka Nedr, vol. 12, no. 5, pp. 41-42, Moscow, 1946.

The Institute of Exploration Geophysics (V.I.G.R.), Moscow, has developed a field luminoscope for the detection of rare metals by their luminescence under ultraviolet light. The instrument consists of a cylindrical box placed with its open end down on cleared ground and equipped at its upper end with a quartz-mercury lamp and an optical observation device. The prospector can study through the eye piece a spot 40 millimeters in diameter illuminated by the ultraviolet lamp and magnified 4 to 25 times. Two types of lamps, suited for different groups of minerals, are used with the luminoscope.—V.S.

9455. Smith, N. J., and Gulmon, G. W. Geophysical history, Lake St. John field, Concordia and Tensas Parishes, Louisiana: Geophysics, vol. 12, no. 3, pp. 369-383, Tulsa, Oklahoma, 1947.

This paper discusses chronologically the geophysical methods used in discovering the Lake St. John field in Concordia and Tensas Parishes, Louisiana, and compares the results of these with the structure revealed by subsequent drilling. The discovery well was drilled in 1942, and the field has produced approximately 6,310,000 barrels to date.—*Author's abstract.*

9456. Solaini, L. L'Istituto di Geofisica Applicata del Politecnico di Milano [Institute of Applied Geophysics at the Polytechnic of Milan]: Riv. Geominer., 1945-1946, pp. 5-7, Milan, 1947(?)

An announcement is made of the founding of the "Istituto di Geofisica Applicata" at the Polytechnic of Milan. The new institution is made possible by the grant of C. M. Lericci, who donated to the polytechnic the equipment formerly possessed by the "Centro di Prospezioni Geominerarie C. M. Lericci." The proposed activities and problems of the institute are outlined.—*Author's abstract.*

9457. Voronca, A. La prospección pendant la guerre et ses perspectives d'avenir [Prospecting during the war and its future outlook]: Mon. Petrol. Român, nos. 7-9, pp. 232-234, Bucharest, 1946.

A summary is given of world-wide geophysical exploration for oil during 1941-45 and of the prospects for continued activity. The in-

formation is based largely on reports published in the United States in 1946.—*Am. Assoc. Petroleum Geologists Bull.*, vol. 31, no. 1, p. 183, Tulsa, Oklahoma, 1947.

9458. Williams, J. R. Developments in Arkansas and north Louisiana in 1946: *Am. Assoc. Petroleum Geologists Bull.*, vol. 31, no. 6, pp. 1084-1105, Tulsa, Oklahoma, 1947.

Among the 1,000 wells drilled during 1946 in the area under consideration there were 55 wildcats in Arkansas and 117 wildcats in northern Louisiana, a total increase of 50 percent over 1945. Subsurface work accounted for most of the discoveries. Geophysical exploration consisted of seismic, gravitational, and magnetic surveys aided by core drilling. In Arkansas the total of 470 geophysical crew weeks was made up of 333 seismograph, 52 magnetometer, 37 gravimeter, and 48 core drill crew weeks. In northern Louisiana the total of 1,779 geophysical crew weeks included 913 seismograph, 859 gravimeter, and 7 core drill crew weeks.—*V. S.*

9459. World Petroleum. Marine exploration develops new techniques: Vol. 18, no. 3, pp. 57-59, New York, 1947.

A brief review is given of the techniques recently developed for the exploration of submarine oil deposits. In the Bahamas, gravity surveys were aided by the use of diving chambers, radar position fixing, and platforms on tripods; seismic surveys benefitted by specially designed boats; and magnetic exploration is to be conducted with air-borne equipment. Underwater drilling has a longer record, covering wells sunk in Galveston Bay, the Caspian Sea, Lake Maracaibo, and other places; some details are given. During World War II, R. D. Shrewsbury developed plans for drilling at ocean depth.—*V. S.*

9460. Wrather, W. E. Oil and mineral possibilities on the continental shelves of the United States and Alaska: Hearings before a Special Committee Investigating Petroleum Resources, U. S. Senate, 79th Cong., 1st sess., pursuant to S. Res. 36, June 19-25, 1945, pp. 1-21, Washington, D. C., 1946.

In testifying before the Senate Special Committee Investigating Petroleum Resources, the Director of the United States Geological Survey dealt with the occurrence of oil on the Gulf coast, oil occurrence beneath the Gulf Continental Shelf, geophysical exploration on the Continental Shelf, and the drilling and exploitation of submarine fields. The evidence submitted pointed to the existence of salt plugs as far out on the Continental Shelf off the Texas, Louisiana, and Mississippi coast as submarine drilling could be expected to reach in the predictable future. In the light of the available experience, illustrated by examples, it was considered possible to detect such plugs by a combination of pendulum surveys from submarines and reflection seismic surveys from surface boats.

Information was also presented on the petroleum potential of the Continental Shelf off the Atlantic coast, Puerto Rico, and Alaska, as well as on possibilities of submarine deposits other than petroleum.—*V. S.*

9. RELATED NONGEOPHYSICAL SUBJECTS

9461. Aeronautical Chart Service. Reconnaissance mapping with trimetrogon photography, 133 pp. 33 illus., Washington, D. C., U. S. Army Air Forces, 1943.

This manual has been written with the idea of presenting in detail the theory and method of compilation now used in the Photogrammetry Section of the Aeronautical Chart Service, United States Army. Two general methods that have proved to be most useful in the mass production of aeronautical charts drawn on a scale of 1:1,000,000 are described. By one method compilation is made of single isolated strips of trimetrogon photographs; by the other several adjacent strips are compiled at one time. Since this is primarily a training manual for the novice, a large number of detailed explanations of elementary photogrammetric theory and procedure are included.—*Preface, condensed by V. S.*

9462. Bennett, H. Concise chemical and technical dictionary, 1055 pp., Brooklyn, New York, Chemical Publishing Co., 1947.

This dictionary comprises about 50,000 definitions from every field of scientific development. It gives terms used in chemistry, physics, mineralogy, biology, mathematics, metallurgy, medicine, bacteriology, pharmaceuticals, and electrical and mechanical engineering, as well as in industry, manufacturing, plastics, and textiles. It also includes international chemical and technical terms. The volume is designed for use by both the professional man and the layman.—*Econ. Géology, vol. 42, no. 3, p. 307, Lancaster, Pennsylvania, 1947, condensed by V. S.*

9463. Blanchard, Jacques. L'hypothèse du déplacement des pôles et la chronologie du Quaternaire [The hypothesis of pole displacement and Quaternary chronology], 168 pp., Le Mans, France, Imprim. Ch. Monnoyer, 1942.

The relationship observed between the stratigraphy of the Somme Valley and the periodicity of glacial phenomena is explained by a hypothesis of pole displacement, and on the basis of geological data a trajectory is traced of the displacements of the north pole. As a complementary approach, the astronomical facts bearing on pole displacements are examined and employed for plotting the same trajectory. A comparison of the two curves shows their similarity and, together with other evidence, confirms the displacement hypothesis. The astronomical and geological conclusions, supported by additional considerations, are used as an aid in outlining the absolute chronology of the Quaternary.—*V. S.*

9464. Cameron, E. N. Applications of the concept of zonal structure in pegmatites to prospecting for feldspar [abstract]: *Econ. Geology*, vol. 42, no. 4, p. 420, Lancaster, Pennsylvania, 1947.

Studies of pegmatites during the intensive wartime search for strategic mica, tantalum, beryl, and other pegmatite minerals have shown that these materials are obtained largely from zoned pegmatites composed of successive concentric shells having contrasting mineralogy or texture. Once the sequence of zones has been established for a group of pegmatites, systematic prospecting within it is greatly facilitated.

Applications of the concept of zonal structure to the problem of feldspar prospecting are discussed and illustrated by examples from the Bryson City district of western North Carolina.—*Condensed by V. S.*

9465. Goloubinow, R. Existence, exploitabilité, et prospection des roches aurifères [Existence, exploitability, and exploration of auriferous rocks]: Bur. d'Études Géol. et Min. Coloniales Pub., no. 16, 39 pp. Paris, 1941.

Considerable new gold resources can be discovered if it is realized that small but commercially profitable deposits are not infrequently found in common igneous and metamorphic rocks. Toward that end, the practicability of the exploitation of auriferous rocks is examined, and 54 examples are given of localities known to contain diffuse segregations and impregnations of gold. These considerations point to the need of broadening the customary procedures of gold prospecting to include a mapping of surface auriferous mineralizations and the laboratory testing of samples from promising localities. The details of such operations are discussed.—*V. S.*

9466. Hodell, C. M. Aerial surveys expedite exploration in Venezuela: *Petroleo Interamericano*, vol. 5, no. 5, pp. 78-80, 107, Tulsa, Okla., 1947.

An aerial photographic survey covering a total of about 27,000 square miles was recently completed in western Venezuela for the preparation of geologic and topographic maps, the planning of gravity and seismic exploration, and the construction of roads and pipe lines. Several oil companies financed the work, which extended over the Maracaibo, Falcon, Barinas, and Paraguaná regions. The aerial photography was done on a scale of 1:40,000 from a normal flight altitude of 18,000 feet, with the use of three AT-11 planes, and was completed in one and a half dry seasons. The local geographic features, the damp tropical climate, and the lack of topographic maps combined to create difficult surveying conditions and required the adoption of special flying and photographic techniques.—*V. S.*

9467. Jeffreys, Harold, and Jeffreys, B. S. *Methods of mathematical physics*, 679 pp., Cambridge University Press, England, 1946.

This volume gives an account of the branches of mathematics most frequently used in physics. Generally, a mathematical method is discussed if it has application in at least two fields of physics. Accordingly, the contents cover the theory of the real variable, scalars and vectors, tensors, matrices, multiple integrals, potential theory, operational methods, numerical methods, calculus of variations, functions of a complex variable, contour integration, conformal representation, Fourier's theorem, asymptotic expansions, Bessel functions, elliptic functions, and allied subjects. Numerous applications to special problems illustrate the exposition.—*V. S.*

9468. Jillson, W. R. Thrust-shatter theory of oil accumulation: *World Oil*, vol. 126, no. 10, pp. 40-42, Houston, Texas, 1947.

The "thrust-shatter" theory to account for the accumulation of oil in formations such as those characteristic of the Fenster area of southwest Virginia and as exemplified by the Rose Hill field in Lee County is described. The outlook for that area and the similarly formed ones else-

where is discussed in the light of present production, and the history of production of the field is drawn upon to support the theory advanced.—*Author's abstract, edited by V. S.*

9469. Lees, G. M. Oil in the Middle East: Royal Central Asian Jour., vol. 33, no. 1, pp. 47-57, London, 1946.

The exceptional richness of the Middle East oil province appears to be due to a number of favorable factors, such as protracted marine sedimentation, large quantities of entombed organic matter, folding movements producing long anticlines and synclines, well-developed porous reservoirs, and effective sealing by impervious cap rocks. The Iraq and Persian oil fields, known for their giant dimensions, yield from a thousand-foot-thick limestone intersected by numerous small fissures. The Arabian side of the oil-field belt is characterized by broad and flat anticlines. Various types of anticlines exist in Syria, north and south of Mosul, and in other areas. The oil-bearing possibilities of the various regions are appraised, and the oil concessions now held in the Middle East are described.—*V. S.*

9470. Oil Weekly. 1947 World Oil Atlas, 375 pp., Houston, Texas, June 30, 1947.

The World Oil Atlas is an annual publication of the "Oil Weekly" presenting up-to-date maps and statistics on the oil industry in various countries. The issue for 1947 is organized on the same plan as the first issue published in 1946, with modifications in accordance with readers' suggestions.—*V. S.* (For the 1946 issue see *Geophys. Abstracts* 126, no. 8768.)

9471. Pratt, W. E. Petroleum on continental shelves: Am. Assoc. Petroleum Geologists Bull., vol. 31, no. 4, pp. 657-672, Tulsa, Oklahoma, 1947.

Geologic knowledge of the continental shelves is reviewed in the light of past experience in the search for petroleum. The various conditions essential to the generation and accumulation of petroleum are found satisfied to the fullest extent by the shelves. There must be about 70 to 80 million cubic miles of sediments in or adjacent to the shelves, possibly reduced by metamorphism to 50 to 60 million. From the 2.5 to 3 million cubic miles explored in the United States during the last 75 years 53 billion barrels of oil have been obtained to date, with more expected. On the basis of the returns obtained so far, the continental shelves of the earth should contain at least 1,000 billion barrels of oil, or approximately 500 times the world's present annual consumption.—*V. S.*

9472. Price, P. H. Evolution of geologic thought in prospecting for oil and natural gas: Am. Assoc. Petroleum Geologists Bull., vol. 31, no. 4, pp. 673-697, Tulsa, Oklahoma, 1947.

Following a brief review of the historical development of oil and gas in the United States to the time of the drilling of the Drake well, the more important opinions expressed concerning the geology of oil and natural gas in relation to prospecting are presented, and the progress of geologic thinking is traced through the main stages of its development. It is concluded from this evidence that in the future a discovery of new areas of production will require the application of existing

geologic knowledge and techniques plus new geologic data and methods, and especially their increased coordination.—*Author's abstract, condensed by V. S.*

9473. Razvedka Nedr. Problems of the Ministry of Geology of the U.S.S.R. [editorial, in Russian]: Vol. 12, no. 4, pp. 1-4, Moscow, 1946.

By decree of the Praesidium of the Supreme Soviet of the U.S.S.R., of June 13, 1946, the Committee of Geology has been reorganized into the Ministry of Geology of the U.S.S.R. The work of mineral exploration assigned to the new ministry in the 5-year plan for 1946-50 includes assuring mineral supplies to the national economy, controlling the work of all geological organizations in the country, evaluating known natural resources, generalizing the results of specific surveys, and preparing geologic maps.

To that effect, the numerous geological organizations now operating are to be merged with the Ministry of Geology. The need of consolidation is illustrated by the existence in Moscow alone of 5 geological bureaus in the various Ministries, 14 geological trusts and offices, and 6 geological research institutes, aside from the Ministry of Geology. The personnel of the Ministry of Geology and of the geological bureaus of the other Ministries numbers 4,283 geologists, of which 939 work in the central offices. The provinces also have independent geological organizations; for example, there are 6 in Sverdlovsk, 6 in Tashkent, 4 in Alma-Ata, and 4 in Tbilisi. In addition to administrative consolidation, the fulfillment of assignments is considered to require increased efficiency and up-to-date equipment.—*V. S.*

9474. Rove, O. N. Some physical characteristics of certain favorable and unfavorable ore horizons: *Econ. Geology*, vol. 42, no. 1, pp. 57-77, no. 2, pp. 161-193, Lancaster, Pennsylvania, 1947.

Laboratory tests were conducted on selected specimens of favorable and unfavorable limestone and dolomite ore horizons from a number of mining districts to determine the permeability, crushing strength, toughness, and relative grindability of the rocks. While these initial tests did not result in usable guides, it is believed that the results warrant the continuation of study along the lines indicated.—*Author's abstract.*

9475. Silverman, D., Eisler, J. D., and Evans, J. F. Vehicle borne instrument for continuously indicating road elevations: *Geophysics*, vol. 12, no. 3, pp. 432-442, Tulsa, Oklahoma, 1947.

An electromechanical device mounted in a moving vehicle capable of indicating differences in elevation between successive points along a traverse is described. Principle of operation, constructional details, and operating techniques are treated at length. Examples of elevation survey data obtained with the instrument under actual field conditions are presented.—*Authors' abstract.*

9476. Smith, P. S. Alaska's potential oil resources [abstract]: *Tulsa Geol. Soc. Digest*, vol. 13, 1944-45, pp. 66-68, Tulsa, Oklahoma, 1945(?)

Investigations in Alaska by the United States Geological Survey have detected indications of oil in three regions: The Gulf of Alaska area, the Alaskan Peninsula, and northern Alaska. Oil traces and local geology in these regions are described briefly. Additional information

will have to be gathered before it is possible to estimate the local oil potential in quantitative terms, but already it seems evident that an oil industry in Alaska is likely to succeed, though the expenses and risks may be considerable.—V. S.

9477. Technical News Bulletin. High-speed electronic digital computers: Vol. 31, no. 2, pp. 13-14, Washington, D. C., 1947.

The National Bureau of Standards is planning to construct a high-speed electronic computing machine of the automatically sequenced digital type. The apparatus will be capable of handling huge compilation problems and of solving the most complicated differential equations in physics and engineering. It will perform predetermined sequences of calculations running into the hundreds of operations without the intervention of human control. Electronic rather than electromechanical or relay-type components are to assure a speed of elementary arithmetical operations measured in millionths of a second.—V. S.

9478. Thom, E. M. Bibliography of North American geology, 1944 and 1945: U. S. Geol. Survey Bull. 952, 496 pp., Washington, D. C., 1947.

The bibliography of North American geology, including paleontology, petrology, and mineralogy, for the years 1944 and 1945, lists publications on the geology of the continent of North America and adjacent islands, Panama, the Hawaiian Islands, and Guam. In addition to specific papers, it includes textbooks and general papers by American authors and those by foreign authors published in America.—*Author's abstract, condensed by V. S.*

9479. U. S. Office of Scientific Research and Development. Radar—A report on science at war, 53 pp., Washington, D. C., 1945.

Radar means radio direction finding and ranging. The apparatus consists of a transmitter and a receiver located at the same place. (1) For the measurement of range, the transmitter sends out energy in intense bursts of small duration, called pulses. During the intervals between pulses, the receiver records the echoes reflected from objects at various distances. The time elapsed between the transmission of the pulse and the reception of its echo indicates the distance to the particular object. (2) For the determination of direction, the radar set is equipped with an antenna which sends out the pulses in a narrow revolving beam similar to a search light. The direction to the reflecting object is read on the dial of the antenna when the echo is received.

The report outlines briefly the operation of radar, its history and war uses, electronic navigation, peacetime applications, and personnel training. A technical description of radar systems is given in an appendix.—V. S.

9480. Van Tuyl, F. M., and Parker, B. H. Oil—its origin and accumulation: World Oil, vol. 126, no. 7, pp. 39-44, 46, no. 8, pp. 48-52, Houston, Texas, 1947.

The principal conclusions regarding the origin and accumulation of petroleum, derived by the authors from an investigation sponsored by the American Association of Petroleum Geologists, are given in condensed form. They concern source beds, discontinuous reservoirs, multiple horizons, pyrobituminous shales, generation of hydrocarbons, ac-

accumulation in enclosed reservoirs, time relationships between cementation, folding, and accumulation, oil residues along unconformities, fault relationships, fractured strata, lateral versus vertical migration, barren and productive structures, salt-core structures, bituminous and crystalline rocks, asphalt seals, and related subjects. The recent evidence supplied by the work of J. Claude Jones, J. D. Haseman, J. McConnell Sanders, and others is reviewed, and new hypotheses are advanced.—V. S.

9481. World Petroleum. Bacteria help to produce oil: Vol. 18, no. 3, pp. 76-77, New York, 1947.

Research Project 43A of the American Petroleum Institute at the Scripps Institution of Oceanography has revealed that bacteria can produce hydrocarbons by stripping buried organic matter of oxygen, nitrogen, sulfur, and phosphorus. Bacteria were also found to transform the albuminous materials and fatty acids of sea ooze into natural gas and oil-like products. Certain bacteria survive underground temperatures as high as 196° F., underground pressures as high as 30,000 pounds per square inch, and brine concentrations of as much as 30 percent. The sulfate-reducing bacteria assimilate carbon from heavy hydrocarbons and lower their density. The various information assembled has been used as a basis for a process of recovering oil from subterranean deposits.—V. S. (*See also* Geophys. abstract 9511.)

10. PATENTS

[The figure in parentheses indicates the classification of the entry; see table of contents]

9482. (1) Werkwijze en toestel voor relatieve zwaartekrachtmeting [Method and apparatus for the relative measurement of gravity]. G. A. Ising, Djursholm, Sweden: Dutch patent 51,580, issued Dec. 15, 1941.

An electroscopie supplied with an electric charge is used as an apparatus for relative measurements of gravity, being taken in a continuously charged condition to the localities compared as to the value of gravity or deviation. The electroscopie has a mobile mass, the weight of which can be compensated by the electric field of one or several well-insulated and charged conductors. This mass is shaped in the form of an indicator rotating on a horizontal axis and set on it off center. When the electroscopie is charged the indicator mass adjusts itself in a horizontal or almost horizontal position. Claims allowed, 2.

9483. (2) Magnetic field responsive device. L. F. Beach, Merrick, N. Y., assignor to The Purves Corporation, Springfield, Massachusetts, a corporation of Massachusetts: U. S. patent 2,410,039, issued Oct. 29, 1946.

In a device sensitive to an external, unidirectional magnetic field and used for supplying a signal voltage output dependent in magnitude upon the direction of said field relative thereto, a core of permeable magnetic material, means including a source of periodically varying electrical energy for producing periodically varying fluxes in a zone of said core and in opposed bucking relationship, a pickup coil associated with said core in said zone thereof and positioned in symmetrical relation to said bucking fluxes, interaction between said device and said external field producing a periodically varying voltage in said pick-up coil, and means

for rectifying the output of said coil, said rectifying means being connected to and controlled by said energy source whereby to render the polarity sense of the rectified coil output dependent upon the phase relationship of the coil output with respect to said energy source. Claims allowed, 13.

9484. (2) Magnetic compass compensating field device. C. B. Dinsmore, Flint, Michigan: U. S. patent 2,417,864, issued March 25, 1947.

In a compass, the combination with the card, of a magnet for creating a compensating field and a mechanism for adjusting said magnet, including a member carrying said magnet mounted for rotary and axial movement respectively about the axis of said card and towards or from the plane of said card, said member being provided with intersecting axially and circumferentially extending teeth, a gear wheel on one side of said member in mesh with said circumferentially extending teeth, a worm on the opposite side of said member in mesh with said axially extending teeth, parallel shanks for said gear and worm independently revoluble to respectively alter the strength of the magnetic field and change the direction of magnetic lines of force with reference to said card, and locking means for said shanks to prevent accidental rotation thereof. Claims allowed, 6.

9485. (2) Flux measuring system. E. M. Irwin, San Marino, California: U. S. patent 2,418,553, issued April 8, 1947.

In a device for detecting magnetic fields, the combination of a core having a pair of similar extensions from opposite sides at one end forming a cross-bar providing a path for flux induced by an external field, a primary winding on the core, means for supplying alternating current to the primary winding to induce alternating flux in the core, such flux flowing in opposite directions through the extensions and being insufficient when added to the externally induced flux to saturate the path, secondary windings mounted on the extensions to be affected by the algebraic sums of the externally induced and alternating flux in the respective extensions, a pick-up arm mounted on each extension and projecting outwardly from the free end of its extension in alignment therewith, said arm being formed of a single thickness of thin sheet metal of high permeability, and means connecting the secondary windings in opposition, whereby the voltage across the remote terminals of the secondary windings is the unbalanced voltage only. Claims allowed, 3.

9486. Magnetometer. L. L. Antes, Houston, Tex., assignor to Standard Oil Development Company, a corporation of Delaware: U. S. patent 2,420,580, issued May 13, 1947.

A remote reading magnetometer comprising a coil having its plane normally in a vertical position, a rod passing through the transverse axis of said coil and rigidly connected thereto, means for supplying alternating current to said coil, whereby said coil is caused to oscillate by the vertical component of the earth's magnetic field, means remote from said assembly for indicating the torque in said rod as a result of the oscillations of said coil and means operably associated with said rod for communicating said torque to said indicating means. Claims allowed, 7.

9487. (2) Elimination of vibration errors in magnetic compasses and the like. G. M. Giannini, West Los Angeles, Calif., assignor to Autoflight Corporation, Burbank, Calif., a corporation of Delaware: U. S. patent 2,422,960, issued June 24, 1947.

In instruments of the type of a magnetic compass and which embody a frame, a normally vertical shaft mounted in bearings fixed in the frame to rotate about a normally vertical axis, and a magnet unit surrounding the shaft axis; mounting means for the magnet unit on the shaft, said mounting means including a gimbal joint of three normally concentric and annularly spaced elements, means mounting the inner one of said elements on the shaft for rotation therewith and vertical freedom with reference thereto, resilient means constraining said vertical freedom, pivotal connections joining the intermediate element to the inner and outer elements, respectively, on axes mutually at right angles, said pivotal connections allowing translational movements of the respectively connected elements along the pivotal axes, and resilient means associated with the said elements and pivotal connections constraining their relative translational movements. Claims allowed 2.

9488. (2) Magnetic testing apparatus. J. E. Clarke, Chicago, Illinois, assignor to Magnaflux Corporation, Chicago, Illinois, a corporation of Delaware: U. S. patent 2,423,552, issued July 8, 1947.

In combination, a contact prod, an auxiliary switch on said prod, an abutment of conducting material engageable by said prod, a source of alternating current, rectifier means, a first circuit means connecting said rectifier means with said prod and said abutment of conducting material to pass current therethrough through said prod, a second circuit means connecting said rectifier means with said source for energization thereby, a main switch in circuit connection with said second circuit means, motor means connected to operate said main switch, a third circuit means connecting said auxiliary switch with said motor means for the energization of said motor means, an impedance, and timing means operably connected with said third circuit to automatically insert said impedance in said second circuit means. Claims allowed, 7.

9489. (3) Apparatus for echo distance measurement. E. E. Turner, Jr., West Roxbury, Mass., assignor, by mesne assignments, to Submarine Signal Company, Boston, Massachusetts, a corporation of Delaware: U. S. patent 2,408,458 issued Oct. 1, 1946.

In an echo distance measuring system of the type in which the time interval is measured between direct and reflected signal impulses, the reflected impulse having an intensity which decreases as the length of the time interval being measured increases, the combination of an exhibitor for exhibiting the moment of receipt of the reflected impulse, said exhibitor having an exhibiting element requiring at least a minimum potential for operation, means for applying directly to the exhibiting element a potential substantially constantly proportional to the intensity of the reflected impulse, and means for applying directly to the exhibiting element in aid of the reflected impulse potential a potential which increases with the length of the time interval being measured. Claims allowed, 6.

9490. (3) Electrical circuits. B. M. Harrison, Newton, Massachusetts, assignor, by mesne assignments, to Submarine Signal Company, Boston, Massachusetts; a corporation of Delaware: U. S. patent 2,410,065, issued Oct. 29, 1946.

In a system for the transmission and reception of compressional waves, a series circuit including a coil of substantially negligible resistance adapted to have a high frequency current impressed upon the coil, a compressional wave transmitting and receiving device and separate capacities and inductances having substantially negligible resistance, forming a series circuit, the capacities and coil being balanced for the high frequency current impressed upon the coil, and an amplifying unit shunted across such inductances, the impedance of such inductances being substantially less than the impedance of the transmitting and receiving device. Claims allowed, 6.

9491. (3) Oscillator. B. J. Lazan, Greenwich, Connecticut: U. S. patent 2,410,170, issued Oct. 29, 1946.

An oscillator comprising, in combination, inner and outer concentric shafts, means for rotatably supporting the same, eccentric weights mounted on said shafts, grooves formed in each of the respective shafts in angular relation to each other, a device having two keys angularly offset with respect to each other so as to respectively fit in said grooves, and means for moving said device so that said keys move lengthwise of said grooves thereby to cause relative angular adjustment between said shafts and the eccentric weights thereon. Claims allowed, 9.

9492. (3) Vibration detector. Robert Black, Jr., South Orange, New Jersey, assignor to Bell Telephone Laboratories, Inc., New York, New York, a corporation of New York: U. S. patent 2,410,805, issued Nov. 12, 1946.

A vibration detector comprising an inertia-type electromechanical transducer including a case of relatively inflexible material, a body of relatively flexible material completely surrounding said case and intimately secured thereto, said body having a cylindrical outer contour, a thin metallic sleeve attached to and surrounding said body, a relatively rigid cup-shaped member at each end of said body secured to the latter and fitting within the ends of said sleeve, a terminal member within each of said rigid members, and conductors embedded in said body and connecting said transducer with said terminals. Claims allowed, 3.

9493. (3) Record reproduction circuit. W. R. Koch, Haddonfield, New Jersey, assignor to Radio Corporation of America, a corporation of Delaware: U. S. patent 2,410,982, issued Nov. 12, 1946.

In combination, a tube provided with an oscillator section and a positive output electrode, means connected to said oscillator section to provide angular velocity-modulated oscillations which have a predetermined mean frequency, electron coupling between said oscillator section and said output electrode developing said angular velocity-modulated oscillations in the output electrode circuit, a resonant circuit connected to said output electrode, said resonant circuit being tuned to a frequency sufficiently different from said mean frequency to permit the resonant circuit to function as a discriminator circuit, an electron discharge device having an input electrode coupled to said oscillator section, said

device having an output electrode coupled to said discriminator circuit. Claims allowed, 12.

9494. (3) Transducer system. C. M. Sinnett, Westmont, New Jersey, assignor to Radio Corporation of America, a corporation of Delaware: U. S. patent 2,411,008, issued Nov. 12, 1946.

In combination, an oscillator having a resonant tank circuit tuned to a desired frequency, a reactance device having a displaceable element responsive to a physical force for varying the reactance of said device, and the improvement which comprises an electron discharge tube having at least a cathode, control grid and plate, a second resonant circuit connected between the cathode and plate tuned substantially to said desired frequency, means electrically connecting the grid to cathode capacity of said tube across said tank circuit, means connecting the reactance device across said second resonant circuit for providing frequency variations of the latter in response to displacements of said element thereby to cause corresponding variations of said grid to cathode capacity, and means for deriving from oscillations variable in frequency, due to said capacity variations, a voltage representative of said physical force. Claims allowed, 7.

9495. (3) Method and means for testing for imperfections in vibratable objects. F. W. Williams and James Clark, Dayton, Ohio: U. S. patent 2,412,240, issued Dec. 10, 1946.

The method of testing for imperfections in vibratable objects which consists in subjecting the object to rapid blows of a predetermined or fundamental frequency by means of an electrically operated vibrator whose natural resonance is of the same frequency as the electric current which actuates the vibrator; picking up the sound of the blows through a microphone; amplifying the current output from the microphone in two parallel circuits; filtering the current by a low-pass filter in one circuit and by a high-pass filter in the other circuit; and conducting the filtered currents to a distortion meter having two circuits, to compare the harmonics with the fundamental. Claims allowed, 10.

9496. (3) Seismometer. Herbert Hoover, Jr., Sierra Madre, California, assignor, by mesne assignments, to United Geophysical Company, Inc., Pasadena, California, a corporation of California: U. S. patent 2,417,077, issued March 11, 1947.

A portable seismometer comprising a case having a flat base and a substantially uninterrupted domed top, vibration-detecting means sealed within the case and adapted to detect movement thereof transverse to the base, said means including a light-weight movably suspended coil with a natural frequency of about 15-20 cycles. Claims allowed, 4.

9497. (3) Gain-controlling system for seismographs. E. J. Shimek, Dallas, Texas, and G. M. Groenendyke, Norman, Oklahoma, assignors, by mesne assignments, to Socony-Vacuum Oil Company, Inc., New York, New York, a corporation of New York: U. S. patent 2,420,571, issued May 13, 1947.

In a seismograph system having a detector of seismic waves transmitted through the earth, an electrical recorder of said waves and a thermionic amplifier interconnecting said detector and said recorder,

said amplifier having means responsive to a negative bias for controlling the contraction and expansion of the amplification thereof, the combination of a resistor, a source of potential for producing a potential difference across said resistor, means for applying this potential difference to said amplifier as said negative bias, capacitors, a charging circuit for said capacitors including said source of potential and a part of said resistor, means for applying to said resistor and to said capacitors a potential difference of polarity opposite to that of said source to produce a forced decay of said negative bias to zero and thence to a positive value, means for producing said decay at different selected time rates between a low limit of high negative bias and a high limit of zero bias without changing the time interval between said low limit and said high limit, and means for changing the initial high negative value of said bias without changing the time at which said bias is reduced to zero. Claims allowed, 10.

9498. (3) Geophysical prospecting. Raymond Maillet, Paris 16E, France; vested in the Attorney General of the United States: U. S. patent 2,420,672, issued May 20, 1947.

An underground prospecting apparatus which comprises, in combination, means for detonating a charge of explosive, seismographs for detecting elastic waves in the ground, amplifiers coupled with said seismographs, one stage of said amplifiers including a thermionic tube with a variable grid polarization, and means connected to be placed into operation by said detonating means, for automatically varying said polarization in a gradual manner as a function of time, in such manner as to vary both the range of frequencies adapted to pass through said amplifiers and the sensitiveness of the apparatus. Claims allowed, 9.

9499. (4) Photoelectric detecting apparatus. McDowell, E. B., Scotia, and E. M. Gardiner, Schenectady, New York, assignors to General Electric Company, a corporation of New York: U. S. patent 2,419,459, issued April 22, 1947.

Apparatus for giving an indication of the presence of an object within an area, comprising the combination of radiation-emitting means supported in linearly extended position to project a curtain of radiation across said area, a rotating pyramidal mirror which is operative to scan substantially uninterruptedly successive portions of said curtain and to reflect the light received as an axial beam, a radiation-responsive device positioned in light-receiving relation to said scanning mirror, and an electrical mechanism operatively connected to be put into operation upon the occurrence of a shadow in said curtain of radiation. Claims allowed, 5.

9500. (4) Magnetic vane type ratiometer. Warshaw, H. D., Drexel Hill, Pennsylvania: U. S. patent 2,419,612, issued April 29, 1947.

In an indicating ratiometer of the type described, a coil form of non-metallic material having a circular bore therethrough secured, coils fixedly mounted on said coil form and arranged in predetermined angular relation with respect to one another, a shaft extending through the bore of the coil form and journaled for rotation coaxially of the bore in said coil form, a vane member of magnetic material having high permeability fixed on said shaft within the bore of said coil form, said vane being operable to align itself with the directionally resultant

field of the fixed magnetic fields produced by electric currents passing through said coils and thereby rotate said shaft, a pointer member actuatable by said shaft, a face plate having an indicating scale thereon disposed with respect to the pointer so that the latter is positioned with respect to said scale according to the position of the resultant field of the two directionally fixed magnetic fields of said coils, and a member of highly permeable magnetic material secured in surrounding relation with respect to said coil form to electrically shield the same. Claims allowed, 6.

9501. (4) Method and apparatus for taking physical measurements in boreholes. Shelley Krasnow, Arlington County, Virginia, assignor to Geophysical Development Corporation, Washington, D. C., a corporation of Delaware: U. S. patent 2,421,423, issued June 3, 1947.

In an apparatus for investigation of electrical properties within a deep narrow borehole, a holder of narrow lateral dimensions adapted to be lowered into the said borehole, a system for generating oscillations mounted within said holder, electrodes mounted upon the exterior of the said holder, so as to be in conducting relationship to material within the borehole; means to impress an electro-motive force upon some of the said electrodes, means to sense the resulting electro-motive force in an electrode other than the first named electrodes, the said sensing means being connected to the said other electrode and being adapted to modify the frequency generated by the said oscillator, means to transmit the said modified oscillations to the surface of the earth, and means at the surface of the earth to receive and detect the said oscillations. Claims allowed, 8.

9502. (4) Werkwijze en inrichting voor het onderzoek van aardlagen, die door een boorput worden doorsneden, met behulp van periodieke electromagnetische velden [Method of studying the earth strata traversed by a borehole by means of periodic electromagnetic fields]. Société de Prospection Électrique, Procédés Schlumberger, Paris: Dutch patent 50,919, issued Sept. 15, 1941.

A periodic electromagnetic field is produced at various levels in a borehole by means of one or more parts of a transmitting apparatus lowered therein. The amplitude variations and/or phase displacements of the vibrations are studied when received in one or more parts of a separate receiving apparatus disposed at a short distance from the parts of the transmitting apparatus and subject to the same vibrations. The receiving apparatus has two sections in the form of induction coils the effects of which cancel in the presence of air at a given level. Each induction coil is set between two oppositely connected transmitting coils; or two oppositely connected induction coils have a transmitting coil between them. The whole instrument can be raised and lowered in the borehole. Claims allowed, 3.

9503. (5) Apparatus and method for recording borehole radioactivity. Shelley Krasnow, New York, New York, assignor to Geophysical Development Corporation, Washington, D. C., a corporation of Delaware: U. S. patent 2,416,702, issued March 4, 1947.

In an apparatus for the measurement of radioactivity within a deep narrow borehole, an assemblage containing an element sensitive to radio-

activity, and an auxiliary amplifying tube operated thereby, the said tube and said element requiring a multiplicity of diverse voltages for operation, the said assemblage having narrow lateral dimensions and lowerable below the surface of the ground, a cable having conductors serving to connect the assemblage to apparatus at the surface of the earth, and energizing means at the surface of the earth, the said means providing through the intermediacy of the cable all of the multiplicity of diverse voltages and all of the electrical energy required for operation of the assemblage below ground, the output of the said amplifying tube being transmitted through the same cable, at least one of the conductors thereof serving a plural power conveying and signaling function. Claims allowed, 11.

9504. (6) Heat responsive device. W. A. Tolson, Princeton, New Jersey, assignor to Radio Corporation of America, a corporation of Delaware: U. S. patent 2,410,317, issued Oct. 29, 1946.

A heat responsive device including means for establishing an image of a scene including heat radiating objects, means for scanning said image whereby said image is subdivided into elements, a heat detector for converting said applied image elements into electric currents, and an indicator including elements responsive to scanning voltages and elements responsive to applied currents, said current responsive elements being connected to said heat detector for indicating said electric currents and said elements responsive to scanning voltages being energized in synchronism with the operation of said scanning means thereby to form a visible image of said scene. Claims allowed, 9.

9505. (7) Means for collecting gas analysis samples. W. J. Fene and G. L. Freas, Pittsburgh, Pennsylvania, assignors to the Government of the United States, as represented by the Secretary of the Interior: U. S. patent 2,411,157, issued Nov. 19, 1946.

In apparatus of the character and for the purpose described, the combination of an electric power source with an electrically-controlled gas-sampling device actuated thereby, a multiple-conductor electric cable connecting said source with said sampling device and supporting the latter, reeling means engaging said cable for varying the effective length thereof, and a switching device connected to said cable for selectively energizing pairs of conductors therein, said sampling device including a protective perforated housing supported by said cable, an evacuated container detachably secured in said housing longitudinally thereof, a frangible tip depending from said container for unsealing the same upon rupture, a solenoid containing a plunger adjacent said tip and at an angle to said tip axis in relation thereto such that the plunger moves in a path to engage said tip to rupture the same, and two electrical connections from said cable to said solenoid. Claims allowed, 2.

9506. (7) Werkwijze en inrichting voor het nemen van gasmonsters uit den boden [Method and apparatus for taking gas samples from the earth]. Bataafsche Petroleum Maatschappij, The Hague: Dutch patent 51,017, issued Sept. 15, 1941.

A vacuum is created in a zone of the ground from which the sample is extracted. Between this zone and the atmosphere there is established another zone of higher vacuum which prevents the outer air from pene-

trating into the lower zone. Both zones are located along the sides of a borehole. The apparatus used for sampling gas consists of a container open at one end which can be pressed into the ground by the rim, a cap partially enclosing the container and facing in the same direction, a tube attached to the inside of the container, and a second tube placed between the cap and the container. Two inflatable packings carried by a rod are arranged in the borehole at some distance apart in a way permitting to press them tight against the walls. One tube passes through both packings and terminates under the lower packing, whereas the second tube passes through the upper packing and terminates between the two packings. A pressure gauge above the ground is connected with the two chambers formed in the borehole, and gases are drawn off by a vacuum pump from the lower zone into a tank. The cap and container are used for sampling nearer to the surface. The apparatus can serve for detecting oil by means of an analysis of the gases. Claims allowed, 5.

9507. (8) Measuring instrument. O. S. Petty, San Antonio, Texas: U. S. patent 2,413,651, issued Dec. 31, 1946.

In a submersible measuring apparatus of the type subjected in use to high external pressures, the combination with a casing having a liquid filled compartment for housing a measuring instrument and having a passage affording communication between said compartment and the casing exterior, said passage including a cylindrical bore, of a tight fitting, solid piston closing said bore and displaceable axially thereof in response to variation in external pressure to which the casing is subjected, whereby said compartment is maintained substantially at the prevailing external pressure, said piston being formed to provide at least one annular peripheral groove to trap water or foreign material seeping between the piston and bore. Claims allowed, 1.

9508. (8) Translating circuit and apparatus for portable electrical devices. D. H. Mitchell, Chicago, Illinois, assignor to Galvin Manufacturing Corporation, Chicago, Illinois, a corporation of Illinois: U. S. patent 2,420,609, issued May 13, 1947.

A portable electrical device including a chargeable battery and a circuit arranged to charge said battery from a current source of any one of a plurality of predetermined voltages, a structure for supporting said device and for connecting said circuit to a current source of one of said predetermined voltages, and means comprising co-acting parts of said device and said structure for automatically conditioning said circuit for energization from the current source associated with said structure incident to the mounting of said device upon said structure. Claims allowed, 10.

9509. (9) Locating equipment. E. J. Wade, Pittsfield, Massachusetts, assignor to General Electric Company, a corporation of New York: U. S. patent 2,411,071, issued Nov. 12, 1946.

A pulse sharpening amplifier having a sharp cut-off stage and an automatic volume control having a time constant faster than the pulse width for controlling the gain of said stage to cut off the trailing ends of the pulses. Claims allowed, 6.

9510. (9) Disturbing influence detecting element. Gary Muffly, Penn Township, Allegheny County, Pennsylvania, assignor to Gulf Research & Development Company, Pittsburgh, Pennsylvania, a corporation of Delaware: U. S. patent 2,412,742, issued Dec. 17, 1946.

A device for signaling the proximity of a passing conveyance comprising an influence detector, a latchable device for giving a warning indication when a predetermined amount of influence is detected by said detector and a second latchable device for giving a final signal when the influence recedes a predetermined amount from a received maximum influence. Claims allowed, 7.

9511. (9) Bacteriological process for treatment of fluid-bearing earth formations. C. E. Zobell, La Jolla, California, assignor to American Petroleum Institute, New York, New York, a corporation of the District of Columbia: U. S. patent 2,413,278, issued Dec. 24, 1946.

The method of increasing or facilitating the recovery of oil from a subterranean oil-bearing formation, which comprises subjecting the formation to the action of *Desulfovibrio halohydrocarbonoclasticus*. Claims allowed, 4.

9512. (9) Method of determining permeability of earth formations penetrated by well bores. L. A. Courter, Seminole, Oklahoma, assignor to The Dow Chemical Company, Midland, Michigan, a corporation of Michigan: U. S. patent 2,413,435, issued Dec. 31, 1946.

In a method of determining the fluid permeability and elevation of earth formations penetrated by a well bore, the steps which comprise introducing into the well a first liquid in amount sufficient to fill the well to a point above the formations to be measured; introducing into the well a second liquid having a lower density than the first and immiscible therewith so as to form two liquid columns meeting at an interface in the well above the formations to be measured; continuing the introduction of the second liquid at a known rate so as to force the first liquid out of the well into the adjacent formations while ascertaining the rate of descent of the interface thereby causing the interface to descend, its rate of descent changing on traversing a fluid permeable portion of the well; and ascertaining the elevation of the interface as its rate of descent changes, the change in the rate of descent being a measure of the permeability of the formations at the elevation at which the rate of descent changes. Claims allowed, 5.

9513. (9) Frequency modulated altimeter or distance indicator. Royden C. Sanders, Jr., Haddonfield, New Jersey, assignor to Radio Corporation of America, a corporation of Delaware: U. S. patent 2,420,199, issued May 6, 1947.

A radio receiver comprising a pair of rectifiers connected in balanced relation, each rectifier having an anode and a cathode, means for so applying two carrier waves to said rectifiers that they have one phase relation with respect to each other at the anode of one rectifier and the opposite phase relation with respect to each other at the anode of the other rectifier, a frequency responsive device, an output impedance unit connected to supply signal to said frequency responsive device, means for taking the output signal of one rectifier off its anode and means for

taking the output signal of the other rectifier off its cathode, and means for supplying the signals from said anode and from said cathode to said output impedance unit whereby any amplitude modulation of said carrier waves may be balanced out while supplying said beat frequency signal to said frequency responsive device. Claims allowed, 9.

9514. (9) Method of and apparatus for determining absolute altitude. Lee de Forest, Los Angeles, California, assignor to A. B. DuMont Laboratories, Inc., a corporation of Delaware: U. S. patent 2,421,248, issued May 27, 1947.

A distance-indicating device, including: a spark-gap transmitter for transmitting toward an object, the distance of which is to be measured, an aperiodic damped electromagnetic impulse; means for receiving the reflection of said impulse from such object; means for producing a cathode-ray beam; means to initiate movement of said beam along a path in response to transmission of an impulse by said transmitter; means for terminating the movement of said beam along said path in response to receipt of the reflected impulse by said receiving means; a conductor of relatively high resistance extending along said path; means to form a circuit with said beam and said conductor in series whereby current flows in the circuit in accord with the distance along said path traversed by the beam; and indicating means responsive to the flow of current in said circuit. Claims allowed, 3.

9515. (9) Object locating system. G. B. Engelhardt, Hartsdale, New York, assignor to Bell Telephone Laboratories, Incorporated, New York, New York, a corporation of New York: U. S. patent 2,421,747, issued June 10, 1947.

In an object locating system of the type in which an exploratory sharply directive pulsed energy beam is turned to scan an area, reflections of said beam from objects within said area are received, and a pattern of indications is obtained on an indicator, in which pattern each object is represented by an indication at an angle from a center point corresponding to its azimuth angle with respect to the position of the exploratory means and at a distance from said center point which is proportional to the object's distance from said exploratory means, means for expanding a portion of said pattern which includes means for displacing the center point of said pattern from the center point of the indicator and means for expanding the radial sweep of said indicating means whereby a desired portion of said pattern is expanded to provide a more detailed view thereof. Claims allowed, 11.

9516. (9) Electric altimeter. J. L. Hathaway, Manhasset, New York, assignor to Radio Corporation of America, a corporation of Delaware: U. S. patent 2,421,785, issued June 10, 1947.

Altitude measuring apparatus comprising, in combination, a radio frequency timing-type altimeter, a reactive bridge-type altimeter and a common indicator responsive simultaneously to both said timing-type and said bridge-type altimeters. Claims allowed, 14.

9517. (9) Frequency modulated altimeter or distance indicator. W. L. Carlson and V. D. Landon, Princeton, New Jersey, assignors to Radio Corporation of America, a corporation of Delaware: U. S. Patent 2,422,079, issued June 10, 1947.

A distance-determining system comprising means for transmitting to a reflecting object a radio carrier wave which is cyclically frequency modulated, a detector, means for receiving the signal reflected from said object and for applying it to said detector, means for also applying to said detector a mixing signal that is obtained directly from said transmitting means and which has a frequency equal to one-half the frequency of the frequency modulated wave that is transmitted to said object, whereby the detector output includes a beat frequency signal which is a measure of the distance from said transmitting means to said object, and whereby any amplitude modulation that may be present is substantially balanced out. Claims allowed, 12.

9518. (9) Apparatus for testing altimetric devices. C. H. H. Rodanet, Neuilly-sur-Seine, France; vested in the Attorney General of the United States: U. S. patent 2,422,702, issued June 4, 1947.

Automatic apparatus for producing and maintaining a predetermined partial vacuum within a hollow container or enclosed member for testing altimetric devices, said apparatus including the hollow container for receiving such devices, a valve having a casing connected with the interior of said container and containing a movable valve member which in one position in said casing places said container in communication with a passageway adapted to be connected with a suction means and in another position places the container in communication with the atmosphere, a pressure-gauge communication with the atmosphere, a pressure gauge communicating with the interior of said container for measuring the pressure within the latter, an electric control circuit fed by a current source, electric shifting means in said circuit for moving said valve member upon closure of the circuit, a switch in said circuit operable by a movable portion of said pressure gauge for controlling the position of said shifting means, and including a manual adjusting switch member for predetermining the desired pressure in said container. Claims allowed, 5.



INDEX

[The figure in parentheses indicates the classification of the entry ; see table of contents]

	Class	Abstract		Class	Abstract
Aeronautical Chart Service_____	(9)	9461	Dobrin, M. B. _____	(3)	9377
Alexanian, C. L. _____	(1)	9329	Doll, H. G. _____	(4)	9412
_____	(2)	9348	Donabedov, A. T. _____	(5)	9428
Allison, A. P. _____	(8)	9440	Doshier, A. W. _____	(8)	9445
Angenheister, G. _____	(3)	9374	_____	(8)	9446
Antes, L. L. _____	(2)	9486	Eisler, J. D. _____	(9)	9475
Aquilina, C. _____	(4)	9410	Elliott, G. A. _____	(5)	9429
Archie, G. E. _____	(4)	9411	Engelhardt, G. B. _____	(9)	9515
Armstrong, L. D. _____	(2)	9349	Evans, J. F. _____	(9)	9475
_____			Evans, Percy _____	(1)	9333
Bader, G. E. _____	(3)	9375	_____		
Baker, J. S. _____	(4)	9421	Federal Science Prog-		
Ballarin, S. _____	(1)	9330	ress _____	(5)	9430
Barschall, H. H. _____	(5)	9425	Fene, W. J. _____	(7)	9505
Barta, G. _____	(2)	9350	Feoflova, A. P. _____	(8)	9445
Bataafsche Petroleum			Fock, V. _____	(4)	9413
Maatschappij _____	(7)	9506	Freas, G. L. _____	(7)	9505
Beach, L. F. _____	(2)	9483	Friedel, E. _____	(4)	9414
Beers, R. F. _____	(2)	9351	_____		
Benfield, A. E. _____	(6)	9434	Galanopoulos, A. _____	(3)	9378
Bennett, H. _____	(9)	9462	Gamburtsev, G. A. _____	(3)	9379
Berson, I. S. _____	(3)	9376	Gardiner, E. M. _____	(4)	9499
Besairie, Henri _____	(2)	9352	Gassmann, Fritz _____	(2)	9355
Bethe, H. A. _____	(5)	9425	Giannini, G. M. _____	(2)	9487
Black, Robert, Jr. _____	(3)	9492	Goguel, J. _____	(4)	9414
Blanchard, Jacques _____	(9)	9463	Goloubinow, R. _____	(9)	9465
Bogdanov, A. I. _____	(8)	9441	Grant, P. A. _____	(8)	9446
Boyd, W. B. _____	(3)	9404	Grenet, Gaston _____	(3)	9380
Brown, Andrew _____	(1)	9339	Groenendyke, G. M. _____	(3)	9497
Bureau de Recherches			Gulmon, G. W. _____	(8)	9455
Géologiques et Géo-			Gutenberg, B. _____	(3)	9381
physiques _____	(1)	9331	Guyod, Hubert _____	(6)	9435
Burns, W. W. _____	(2)	9353	_____		
_____			Haas, W. J., de _____	(2)	9356
Cameron, E. N. _____	(9)	9464	Hamil, A. B. _____	(3)	9382
Carlson, W. L. _____	(9)	9517	Harrison, B. M. _____	(3)	9490
Carnegie Institution of			Hasselmann, K. F. _____	(1)	9334
Washington _____	(8)	9442	Hathaway, J. L. _____	(9)	9516
Clark, James _____	(3)	9495	Hawkes, H. E., Jr. _____	(7)	9436
Clarke, J. E. _____	(2)	9488	Hawley, P. F. _____	(3, 7)	9383
Claypool, C. B. _____	(8)	9440	Heiskanen, W. _____	(1)	9335
Cork, J. M. _____	(5)	9426	Hodell, C. M. _____	(9)	9466
Courter, L. A. _____	(9)	9512	Hodgson, J. H. _____	(3)	9334
Crompton, Wilfred _____	(1)	9333	Holmes, Arthur _____	(5)	9431
Cüer, Pierre _____	(5)	9427	Hoover, Herbert, Jr. _____	(3)	9496
_____			Hughes, D. S. _____	(2)	9357
Dake, H. C. _____	(8)	9444	_____		
Danckwortt, P. W. _____	(8)	9443	Imle, J. F. _____	(3)	9385
Deegan, C. J. _____	(1)	9332	Independent PAA Month-		
de Forest, Lee _____	(9)	9514	ly _____	(1)	9336
Delaygue, Arthur _____	(2)	9354	Instrument Develop-		
De Ment, Jack _____	(8)	9444	ment Laboratories _____	(5)	9432
Dent, G. E. _____	(2)	9360	Irwin, E. M. _____	(2)	9485
Dinsmore, C. B. _____	(2)	9484	Ising, G. A. _____	(1)	9482

	Class	Abstract		Class	Abstract
Jeffreys, B. S.-----	(9)	9467	Pratt, W. E.-----	(9)	9471
Jeffreys, H.-----	(1, 3)	9386	Price, P. H.-----	(9)	9472
-----	(9)	9467			
Jillson, W. R.-----	(9)	9468	Ramachandra Rao, M. B.---	(4)	9419
Jones, W. M.-----	(2)	9358	Ravignani, G.-----	(1)	9342
			Razvedka Nedr.-----	(9)	9473
Kalinin, Iu. D.-----	(2)	9359	Richter, C. F.-----	(3)	9399
Kazinskii, V. A.-----	(1)	9337	Rinehart Oil News Com-		
Kelly, S. F.-----	(8)	9447	pany-----	(8)	9452
Kirilov, F. A.-----	(3)	9387	Ritzmann, O. F.-----	(8)	9453
Koch, W. R.-----	(3)	9493	Riznichenko, Iu. V.-----	(3)	9400
Krasnow, Shelley-----	(4)	9501	Roberts, E. B.-----	(2)	9366
-----	(5)	9503	Rodanet, C. H. H.-----	(9)	9518
Krumbach, Gerhard-----	(3)	9388	Rothé, J. P.-----	(1)	9329
Kuehn, H. E.-----	(2)	9360	Rove, O. N.-----	(9)	9474
Kunetz, Géra-----	(4)	9420	Rutten, L.-----	(3)	9401
Lahee, F. H.-----	(8)	9448	Sadovskii, M. A.-----	(3)	9402
Landon, V. D.-----	(9)	9517	Sagui, C. L.-----	(2)	9367
Larsen, H. R.-----	(2)	9351	Sanders, R. C., Jr.-----	(9)	9513
Lazan, B. J.-----	(3)	9491	Schlumberger, Marcel---	(4)	9420
Le Conte, Joseph-----	(3)	9389	Schwede, H. F.-----	(5)	9428
Lee, R. H.-----	(5)	9429	Scott, W. E.-----	(2)	9368
Lees, G. M.-----	(9)	9469	Sergeev, E. A.-----	(8)	9454
Legrand, J. C.-----	(4)	9412	Shimek, E. J.-----	(3)	9497
Lejay, Pierre-----	(1)	9338	Sieberg, August.-----	(3)	9403
Logachev, A. A.-----	(2)	9361	Silverman, D.-----	(9)	9475
			Sinnett, C. M.-----	(3)	9494
McCollum, E. V.-----	(1)	9339	Skeels, D. C.-----	(1, 3)	9343
McDowell, E. B.-----	(4)	9499	Skillings' Mining Re-		
Macelwane, J. B.-----	(3)	9390	view-----	(2)	9369
McGaha, S. W.-----	(5)	9433	Smith, N. J.-----	(8)	9455
McGarva Bruckshaw, J.---	(4)	9415	Smith, P. S.-----	(9)	9476
Maillet, Raymond-----	(3)	9498	Société de Prospection		
Mantle, Edward-----	(3)	9391	Electrique-----	(4)	9502
Mercanton, P. L.-----	(3)	9392	Solaini, L.-----	(1)	9344
Miller, M. C.-----	(4)	9416	-----	(2)	9370
Mitchell, D. H.-----	(8)	9508	-----	(8)	9456
Morelli, Carlo-----	(1)	9340	Stick, J. C.-----	(4)	9421
-----	(2)	9362	Stoyko, N.-----	(1)	9345
-----	(3)	9393	Stratton, E. F.-----	(4)	9412
-----	(4)	9417	Swan, B. G.-----	(3)	9404
Muffy, Gary-----	(9)	9510			
Murphy, L. M.-----	(3)	9394	Tabasaranskii, Z. M.---	(7)	9437
			Technical News Bulle-		
Nettleton, L. L., ed.---	(8)	9449	tin-----	(9)	9477
Neumann, Frank-----	(3)	9395	Thom, E. M.-----	(9)	9478
Nikolsky, A. P.-----	(2)	9363	Tikhonov, A. N.-----	(4)	9422
Norelius, R. G.-----	(4)	9421	Tiurkisher, R. I.-----	(4)	9423
			Tolson, W. A.-----	(6)	9504
O'Connell, D. J. K.-----	(3)	9396	Tromp, S. W.-----	(2)	9371
Offman, P. E.-----	(1, 4)	9341	Turner, E. E., Jr.-----	(3)	9489
Oil and Gas Journal---	(8)	9450			
Oil News-----	(2)	9364	United States Office of		
Oil Weekly-----	(9)	9470	Scientific Research		
Olsen, J.-----	(2)	9365	and Development-----	(9)	9479
Parker, B. H.-----	(9)	9480	Vajk, Raoul.-----	(1, 3)	9343
Petropavlovskii, S. A.---	(4)	9418	Valle, P. E.-----	(3)	9405
Petty, O. S.-----	(8)	9507	Van Raadshooven, B.---	(3)	9401
Pinar, Nuriye-----	(3)	9397	Van Tuyl, F. M.-----	(9)	9430
Pondrom, W. L.-----	(2)	9357	Vecchia, O.-----	(7)	9438
Pospelov, P. A.-----	(8)	9451	Veldkamp, J.-----	(3)	9406
Poulter, T. C.-----	(3)	9398	Vening Meinesz, F. A.---	(3)	9407
			Vercelli, Francesco-----	(3)	9408

	Class	Abstract		Class	Abstract
Vestine, E. H.-----	(2)	9372	Westerdijk, J. B.-----	(2)	9356
Vitalis, I. von.-----	(1)	9346	Williams, F. W.-----	(3)	9495
Voronca, A.-----	(8)	9457	Williams, J. R.-----	(8)	9458
Vsekhsvlatskii, S. K.---	(2)	9373	Woodard, S. W.-----	(1)	9347
			World Petroleum.-----	(8)	9459
Wade, E. J.-----	(9)	9509	-----	(9)	9481
Walker, J. M.-----	(5)	9433	Wrather, W. E.-----	(8)	9460
Warshaw, H. D.-----	(4)	9500			
Waterman, J. C.-----	(3)	9409	Zobell, C. E.-----	(7)	9439
Weiss, Oscar.-----	(4, 2)	9424	-----	(9)	9511

