DEPARTMENT OF COMMERCE AND LABOR

REPORT OF THE SUPERINTENDENT

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Annual Report of the Superintendent of the Coast Survey

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DEPARTMENT OF COMMERCE AND LABOR

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COAST AND GEODETIC SURVEY

LETTER OF TRANSMITTAL.

DEPARTMENT OF COMMERCE AND LABOR,
OFFICE OF THE SECRETARY,
Washington, September 1, 1906.

SIR: In compliance with the requirements of section 4690, Revised Statutes, I have the honor to transmit herewith, for the information of Congress, a report submitted to this Department by Mr. O. H. Tittmann, Superintendent of the Coast and Geodetic Survey, showing the progress made in that work during the fiscal year ended June 30, 1906. It is accompanied by maps illustrating the general advance in the operations of the Survey up to that date.

Respectfully,

V. H. METCALF,
Secretary

The SPEAKER OF THE HOUSE OF REPRESENTATIVES.

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LETTER OF SUBMITTAL.

DEPARTMENT OF COMMERCE AND LABOR,
COAST AND GEODETIC SURVEY,
Washington, September 1, 1906.

SIR: In conformity with law and with the regulations of the Department of Commerce and Labor, I have the honor to submit herewith, for transmission to Congress, the Annual Report of progress in the Coast and Geodetic Survey for the fiscal year ended June 30, 1906. It is accompanied by maps illustrating the general advance in the field work of the Survey up to that date.

Respectfully,

O. H. TITTMANN,
Superintendent

The SECRETARY OF COMMERCE AND LABOR.

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REPORT OF THE SUPERINTENDENT.

THE WORK OF THE YEAR.

The most notable feature of the work of the year is the determination of longitude in Alaska, along the coast and in the interior, by the telegraphic method. This was made possible by the completion of the military cable and telegraph lines in certain localities in the Territory. One of these determinations, at Eagle (Fort Egbert), is very important in connection with the marking of the international boundary along the one hundred and forty-first meridian. The transit micrometer was used for the first time by the Survey in making these determinations and its use resulted in a very considerable reduction in the cost of the work, as it eliminates the necessity of the observers exchanging stations for each determination.

Nickel-steel (also known as Invar) tapes for the measurement of base lines were used for the first time by the Survey. This metal has been used in Europe for some years in the construction of apparatus for the measurement of base lines, and it was considered very desirable to procure tapes for use in the United States. During the year for the first time it became possible to procure the metal in the desired form of tapes. This metal has a very small coefficient of expansion. It is softer than steel and requires a larger reel upon which to be wound to avoid danger of a permanent change in length. The nickel-steel tapes were thoroly standardized at the Bureau of Standards before being sent to the field and then tested in the field, on a comparator, under the conditions existing in the actual measurement of base lines. The length of the comparator used in this work was obtained from several measurements made with the iced-bar. Four 50-meter steel tapes were standardized and four 50-meter nickel-steel tapes were tested on the comparator by measurements made within a short period before or after an iced-bar measurement. Each base line was measured twice in the daytime, using three nickel-steel tapes, and twice at night, using three steel tapes. Each tape was used in measuring two-thirds of the length of each base line in order to provide for an intercomparison of the tapes. The results obtained when using the nickel-steel tapes in daylight were uniformly better than those given by the measures with steel tapes at night. When steel tapes are used it is necessary, tho inconvenient, to make all measurements at night on account of the difficulty of obtaining the temperature of the tape with sufficient accuracy in daylight. The use of nickel-steel in the measurement of base lines is a decided advance in the method of obtaining the results desired, as it gives these results at reduced cost without loss of accuracy and does away with the necessity of standardizing the tapes in the field with the iced-bar.

The field work undertaken by the United States in opening and renonumenting

the international boundary between the United States and Canada west of the Rocky Mountains was practically completed, under the direction of the Secretary of State, as authorized by the Director of the United States Geological Survey and myself as Commissioners on the part of the United States.

The examination of the international boundary between the States of Vermont, New Hampshire, and Maine and the Dominion of Canada was completed from a point 10 miles west of Richford, Vt., to St. Croix River, and a survey was made to relocate that portion of said boundary line lying between Beebe Plain and Derby Line, Vt. This work was requested by the Secretary of State for the benefit of the Secretary of the Treasury in enforcing the revenue laws.

The tracing and marking of the boundary line between Alaska and Canada, as laid down by the Alaska Boundary Tribunal, was continued by me as Commissioner on the part of the United States, acting under the direction of the Secretary of State. On the Unuk River the coast triangulation was extended to the boundary, and the geographic positions of five of the peaks on the boundary line were determined. Six permanent monuments were placed in position on the boundary. On the Chilkat River the coast triangulation was extended to the boundary, and the geographic positions of several peaks on the boundary were determined, and five permanent monuments were placed in position on the boundary. In the vicinity of Skagway the line was marked across the valley of the main Skagway River, and several of the peaks on the boundary were connected with the triangulation, and their geographic positions were determined. Six permanent monuments were placed in position, four of these being used to mark the line in the vicinity of White Pass. The work was in progress at the close of the year.

Geographic positions of aids to navigation not previously determined were obtained, and numerous dangers to navigation were located. These operations extended along the coasts of Maine, Massachusetts, Rhode Island, New York, Maryland, Virginia, North Carolina, and Florida.

Hydrographic surveys were made in the Hudson River, Chesapeake Bay, Potomac River, Ocracoke Inlet, off Key West, and along the coast of Louisiana.

The topographic resurvey of Chesapeake Bay and the Potomac River was continued and was in progress at the close of the year.

The triangulation along the ninety-eighth meridian was completed to the United States and Mexican boundary on the south and was connected with the Lake Survey triangulation at Duluth, Minn. The extension of this triangulation northward from the vicinity of Fergus Falls, Minn., was in progress at the close of the year. The triangulation along the Pacific coast was extended southward from Tacoma, Wash., and was nearly completed at the close of the year.

Base lines were measured in the vicinity of Point Isabel, Texas; in the Willamette Valley, Oregon; near Tacoma, Wash.; near Stephen, Minn., and in South Dakota, near Brown Valley.

Astronomic observations to determine latitude and azimuth were made in Florida, Georgia, Minnesota, Missouri, and Texas. The longitudes of Point Isabel, Texas; Mount Wilson, California; and of Sitka, Valdes, Seward, and Eagle (Fort Egbert), Alaska, were determined by telegraphic method by means of the military cables and telegraph lines connecting these places.

The standard levels were extended from Smithville to Galveston in Texas, thus furnishing a second connection of the level net of the United States with the Gulf of Mexico. The levels were also extended from Evansville, Minn., to Stephen Base Line; from San Diego to Barstow in California, and the concluding link of the large level-circuit, Sioux City–Kansas City–St. Louis–St. Paul–St. Cloud–Watertown–Sioux City, was completed.

The Magnetic Survey of the country was continued by making observations at 382 stations in 43 States and Territories and in 2 foreign countries. Magnetic observations were also made at 45 stations in the Atlantic and Pacific oceans and in the Gulf of Mexico. Continuous records were obtained during the year at the magnetic observatories maintained at Cheltenham, Md.; Baldwin, Kans.; Sitka, Alaska; Honolulu, Hawaii; and Vieques, P. R. At these observatories the international program of rapid registration on the 1st and 15th of each month was carried out, and special observations were made during the solar eclipse of August 30, 1905. Special observations were also made during the eclipse by the parties in the field. Numerous earthquake shocks were recorded on the seismographs in operation at the observatories, and many such shocks were also recorded by the magnetographs.

The trigonometric survey of the Government reservation at Fort Stanton, N. Mex., used as a sanatorium by the Public Health and Marine-Hospital Service, was completed, the 64 corners in the boundary were marked, and numerous range posts between these corners were placed in position.

Work at the latitude observatories at Gaithersburg, Md., and Ukiah, Cal., maintained by the International Geodetic Association under my direction, was continued.

At the request of the Navy Department several speed-trial courses along the coast were examined and put in order.

The Survey maintained an exhibit at the Lewis and Clark Centennial Exposition at Portland, Oreg., as a portion of the exhibit of the Department of Commerce and Labor, from July 1 to the close of the exposition.

An officer of the Survey continued on duty as a member of the Mississippi River Commission, as required by law, devoting as much of his time as necessary to the work of the Commission.

ALASKA.

In Alaska, surveys, including triangulation, topography, and hydrography, were made in Prince William Sound, Resurrection Bay, Kasaan Bay, McKenzie Inlet and approaches, Lyman Anchorage, and Lake Bay. The rapid economic development which is taking place in widely separated localities of the Alaskan coast has necessitated special efforts on the part of the Survey to meet the immediate demands made upon it for information. Thus a survey was urgently required for Resurrection Bay, the terminal of the Alaskan Central Railway and of the United States cable. As stated in my previous report, surveying vessels were dispatched to assist the War Department in selecting the best route for the cable. The necessary surveys were completed by the time the cable ship *Burnside* arrived in Prince William Sound. In addition to furnishing the data, an officer was assigned to the ship to guide her in laying the cable over the exact route shown to be most favorable by the hydrographic developments made by officers of the Survey. The officers of the Signal Corps of the Army, under whose direction the cable was laid, exprest their high appreciation of the services rendered.

The geographic positions of Lincoln Rock Light-house and several dangers to navigation in Lynn Canal were determined. Work was in progress at the close of the year in the approaches to Prince William Sound, Controller Bay, and Kasaan Bay.

The longitude and magnetic work in Alaska and the extension of the demarcation of the Alaska–Canada boundary have been referred to above.

PHILIPPINE ISLANDS.

In the Philippine Islands the following field work was done:

Luzon, Manila to Dagupan.—The triangulation connecting these two places was completed and a base line was measured on the shore of Lingayen Gulf. Surveys were made on the west coast in the vicinity of Santa Cruz, Iba, Subic, Balayan, and Lucena, and in Verde Island Passage, on the east coast in Maqueda Channel, as far north as the north end of Catanduanes Island, including a survey of Pandan Bay, and hydrographic work off the south end of Catanduanes Island.

Surveys were also made in *Mindoro*, on the north coast, in the vicinity of Calapan; in *Samar*, on the east coast, in the vicinity of Laoang and at Davao; in *Panay*, on the south, west, and north coasts, and in the vicinity of San Jose and Iloilo; in *Negros*, on the west coast, in the vicinity of Bacolod; in *Leyte*, on the west coast, from Villaba to Ormoc, and surveys were made of Palompon Harbor, Dupon Bay, and Mattang Bay; in *Mindanao*, on the south coast in the vicinity of Malabang.

Office work.—The results of the field work were revised and 18 new charts were prepared for publication at the suboffice in Manila and published at the Office in Washington. The sailing directions were kept up to date as nearly as practicable by issuing supplements covering several sections. New editions covering three sections were prepared. The new edition of Section I of the sailing directions and a catalog of charts were published.

Two vessels, the *Romblon* and the *Marinduque*, were transferred to the Coast and Geodetic Survey by the Philippine Commission, to be used in making surveys of the coasts and waters of the archipelago.

In connection with the survey of the Philippine Islands, I desire to call attention to the fact that the work has been done in the past at the joint expense of the General Government and the insular government, under an agreement approved by the Secretary of the Treasury and the Philippine Commission, in 1901, and that the expenses of the work have been divided since January 1, 1902, in accordance with this agreement. In 1905 the Philippine Commission recommended in their report that the whole expense of the survey of the archipelago should be borne by the National Government, and this recommendation was approved by the Secretary of War. As suggested by him, an estimate of the appropriation necessary for this purpose was prepared for transmission to Congress.

The necessity of having accurate charts of the waters of the Philippine Archipelago appeals directly to the nation, as the safety of the Navy and of all vessels engaged in commerce in these waters depends upon the possession of such charts.

PORTO RICO.

The hydrographic survey off the south coast of the island of Porto Rico was continued, the soundings being extended to the 2 000-fathom curve.

TIDE OBSERVATIONS.

Self-registering tide gages were maintained at Fort Hamilton, N. Y.; Philadelphia, Pa.; Baltimore, Md.; Fernandina, Fla.; Weeks, La.; Galveston, Tex.; San Diego, Cal.; Presidio, Cal.; Seattle, Wash.; Honolulu, Hawaii; and Manila and Iloilo, P. I.

The tide indicators at Fort Hamilton, N. Y.; Reedy Island, Delaware River, Delaware; and Alcatraz Island, San Francisco Bay, California, have been continued, and the electric tide indicators in the rooms of the Maritime Association of New York and in the Bourse Building in Philadelphia have given satisfaction.

OFFICE WORK.

In the Office the current work was kept up to date and satisfactory progress was made in the various branches of the work, including computation, reduction, plotting, and discussion of results of field work and the preparation of the data for publication by chart or otherwise.

The demand for data from the archives of the Survey continues to increase with the growth of the country. This is a most gratifying proof of the usefulness of the work. The results of field work are prepared for publication as rapidly as practicable for the purpose of distributing the data in the published form instead of furnishing information copied by hand.

The computation of the heights from the leveling observations made during the year was completed. Gratifying progress was made in the reduction of the triangulation in California north of Monterey Bay to the United States Standard Datum, and the preparation of this work for publication was almost completed. In this connection it should be stated that strong evidence has been presented by the California Earthquake Commission of a horizontal displacement of the earth's crust resulting from the earthquake. As such a displacement would seriously affect the coordinates of the triangulation, it has been deemed necessary to test at once the correctness of the positions assigned to the triangulation points by the computation, and orders have accordingly been issued for this purpose.

The introduction of telegraphic longitude into Alaska by the determination of the positions of Sitka, Valdez, Seward, and Eagle was made and the computation of the triangulation in Prince William Sound and vicinity was revised to adjust it to the new position of Valdez, which is three minutes of arc (or 1½ miles) west of the position hitherto tentatively assumed.

The computations connected with the investigations of the figure of the earth which were begun several years ago were practically completed, and it is believed that the result of this work is a definite advance in the method of dealing with this problem and that it has increased the accuracy with which the figure of the earth is determined.

The results of magnetic observations made on land and sea during the year have been revised and prepared for publication in my Annual Report. The discussion of the work of the magnetic observatories has progressed sufficiently to permit the completion of the reduction of most of the special observations made at the request of the German Government in cooperation with the German Antarctic Expedition of 1902–3, and the results have been forwarded to the State Department for transmission to the German Government. Copies of the magnetograms for certain specified days from October,

1902, to March, 1903, together with the necessary explanatory data, have been prepared and forwarded to Prof. Kr. Birkeland, of the University of Christiania, Norway, for use in connection with his study of the relation of terrestrial magnetism to northern lights and allied phenomena. Sufficient material is now on hand for the construction of a new set of magnetic charts for the United States and Alaska. A new discussion of the secular change of the magnetic declination and the reduction of all observations of declination to the same epoch, January 1, 1905, have been completed. The compilation of earthquakes recorded by the seismographs at the various magnetic observatories has been kept up to date and a special study was made of the San Francisco earthquake record to determine the existence of magnetic effects.

Tide Tables containing the predicted tides for numerous ports on the coasts of the United States and in foreign countries for the year 1907 were prepared for publication. Copies of the predicted tides for Astoria, Oreg., and Sitka, Alaska, were furnished in advance of publication to the Canadian government in response to a request from the authorities, and similar information relative to Wellington and Auckland, New Zealand, was furnished to the New Zealand authorities upon their request.

Nineteen drawings for new charts were completed and a large number of drawings were changed to show present conditions.

The work of engraving was principally confined to making necessary changes in existing plates to bring them up to date. The work of printing charts from copper plates was facilitated by installing individual motors for each press and the lithographing plant was extended so that all charts issued in this form are now printed by the Survey instead of by contract with private parties.

A process of etching copper plates from transfers of drawings to the plates is being tried and six charts have been etched in this way with success.

The Annual Report of the Survey to Congress for 1905 was prepared for printing and sent to the printer on September 1, 1905, and it was available for distribution on December 28, 1905.

Some of the results of observations made in the progress of the work during that year were published in three appendixes, covering the magnetic, leveling, and triangulation work of the Survey.

One appendix describes a long wire sweep devised and used to discover dangers to navigation in bays and other large bodies of water, and another describes the method used in making topographic surveys, with illustrations of the various signs employed in the work.

The amount appropriated for the Coast and Geodetic Survey for the fiscal year 1906 was $876 975 (exclusive of the appropriation for printing), of which $210 245 was for manning the vessels of the Survey, $54 600 for repairs and maintenance of vessels, and $50 000 for office expenses. The remainder of the appropriation was about equally divided between expenses of parties in the field and salaries of field and office forces.

In addition to the above sums the appropriations for marking the boundary between the United States and Canada west of the Rocky Mountains and for locating and marking the Alaska Boundary, made to be expended under the direction of the Secretary of State, are disbursed under my direction as Commissioner by the Disbursing Agent of the Coast and Geodetic Survey as special disbursing officer for the State Department.

OFFICE OF ASSISTANT IN CHARGE.

ANDREW BRAID, *Assistant in Charge.*

The Assistant in Charge has direct supervision of the work of the divisions of the Office as follows:

Computing Division.
Division of Terrestrial Magnetism.
Tidal Division.
Drawing and Engraving Division.
Chart Division.
Instrument Division.
Library and Archives Division.

He also has charge of the purchase of supplies and of all other expenditures for Office expenses, the care of the public property at the Office, the distribution of the publications of the Survey issued free, and of the sale of the Charts, Coast Pilots, and Tide Tables published by the Survey.

Details of the Office operations are given in Appendix 2.

OFFICE OF INSPECTOR OF HYDROGRAPHY AND TOPOGRAPHY.

H. G. OGDEN, *Inspector*, July 1 to February 25.*
J. J. GILBERT, *Inspector*, February 27 to June 30.

The work of the parties in the field was inspected whenever necessary, and numerous short trips were made by the Inspector in connection with the repair and maintenance of the surveying vessels.

THE VESSELS AND THEIR HYDROGRAPHIC WORK.

THE STEAMER BACHE.

At the beginning of the year this vessel was at Baltimore being repaired and fitting out for field work. On August 20 the ship sailed for New York and reached there the next day. Deep-sea soundings were made off the entrance to New York Bay to define the submarine valley of the Hudson River. An examination of a reported rock in Newport Harbor was made, and the remainder of the season was spent in making examinations of shoal spots with the harbor sweep in Frenchmans Bay, Salisbury Cove, Eastern Bay, and adjacent waters on the coast of Maine.

The *Bache* returned to Baltimore on November 11 to have repairs made. She sailed for Key West on January 16 and reached there on February 3. Hydrographic examinations of the channels in the vicinity of Key West were made with the harbor sweep until May 4, except during the period April 6 to 25, when the vessel went to Galveston, Tex., to make magnetic observations at sea in the Gulf of Mexico. The work in the vicinity of Key West closed on May 4, and on May 8 the ship sailed for Brunswick, Ga. A search was made for a reported shoal off St. Simons Sound. No such shoal exists at the place indicated.

* Died in the service February 25, 1906.

On May 19 the vessel proceeded to Cape Fear, North Carolina, and located the light vessel and buoy off Frying Pan Shoals. The *Bache* sailed for Baltimore on June 5 and reached there on the 9th. At the close of the year the vessel was being repaired.

THE STEAMER EXPLORER.

At the beginning of the year the *Explorer* was at Baltimore fitting out for field work. She sailed on the 26th, and reached Rockland, Me., on July 30.

The season was spent in examining shoals and reefs in Penobscot Bay and Eggemogin Reach with the harbor sweep and in searching for reported dangers to navigation. Work on the coast of Maine was closed on November 2, and the *Explorer* returned to Baltimore on the 6th. Repairs were made and the vessel sailed for Porto Rico on January 4. Magnetic observations were made en route and the ship reached Ponce on January 20.

Hydrographic work was done off the south coast of Porto Rico, and on May 28 the *Explorer* sailed from San Juan for Baltimore, and reached there on June 5. The ship was being repaired at the close of the year.

THE STEAMER ENDEAVOR.

At the beginning of the year the *Endeavor* was being used in hydrographic work in the lower Potomac River. This work was suspended on July 6 and the vessel proceeded to Norfolk. From July 15 to November 24 hydrographic work was done off Cape Henry, Virginia. From November 28 to December 6 the vessel was again at work in the Potomac River examining the Kettle Bottom Shoals.

The vessel went to Baltimore and remained there until December 27, when she went to Tangier Sound, Chesapeake Bay, and was used in hydrographic work in that vicinity until March 31, when the vessel returned to Baltimore for repairs, which were incomplete on June 30.

THE STEAMER HYDROGRAPHER.

At the beginning of the year repairs were being made to the ship at Baltimore. These were completed and the vessel sailed on August 17 for Portland, Me., and reached there on August 24. The season was spent in searching for reported dangers to navigation, examining shoals, locating buoys, etc., in Saco Bay, Provincetown Harbor, on Nantucket Shoals, and in Buzzard and Narragansett bays. The work closed on December 14, and the vessel returned to New York for repairs and remained there until February 6.

On the 7th she sailed for Hampton Roads, Virginia, and was used in hydrographic work at the entrance to Back River until April, when she went to Philadelphia for repairs, which were completed on May 23. The *Hydrographer* was taken to Curtis Bay on the 26th and laid up for the remainder of the year.

THE SCHOONER MATCHLESS.

The vessel was engaged on hydrographic work at the beginning of the year, and on July 28 went to Norfolk for repairs. She sailed for Ocracoke Inlet, North Carolina, on September 13 and arrived on the 22d. A survey was made of Ocracoke Bar and the channels leading to Pamlico Sound, and on December 11 the vessel returned to Norfolk. Repairs were made to launch *No. 22*, and from January 29 to May 15 the vessel was

engaged on hydrographic work on the west side of Chesapeake Bay from Wolf Trap Light-house to Windmill Point Light-house. On May 16 the *Matchless* returned to Norfolk for repairs, which were incomplete on June 30.

THE SCHOONER TRANSIT.

This vessel was repaired at Madisonville, La., and sailed for New Orleans on January 17 and to Timbalier Bay, Louisiana, on January 24, and arrived on January 30. Survey work was done in Terrebonne Bay and in Lake Pelto until June 9, when the *Transit* was taken to Morgan City, La., and laid up.

THE STEAMER GEDNEY.

The *Gedney* was at work in southeastern Alaska on July 1 and continued this work until September. She sailed from Sitka on September 21 and reached Seattle, Wash., on the 30th. The vessel remained at Seattle until May 25, when she sailed for Alaska and began work on June 11. During the remainder of the month work was done in Khaz Bay and Slocum Arm, southeast Alaska. The launches *Cosmos* and *No. 117* were used in this work. The vessel was out of commission the greater portion of the time while she was at Seattle, and repairs were made.

THE STEAMER M'ARTHUR.

The *McArthur* was at work in Prince William Sound, Alaska, on July 1, and continued at work in that vicinity until September, when she sailed for Seattle, and reached there on September 30. The vessel remained at Seattle until May 27, when she sailed for Controller Bay, Alaska, and made an examination off Point St. Elias and in the approaches to Kyack. The vessel then proceeded to Port Chatham, via Seward, and at the end of the year was engaged in making a reconnaissance along the south coast of Kenai Peninsula. The vessel was out of commission the greater portion of the time she remained at Seattle, and repairs were made.

THE STEAMER PATTERSON.

On July 1 the *Patterson* was engaged in making surveys between Prince William Sound and Resurrection Bay, Alaska. Several lines of soundings were made to enable the Chief Signal Officer, U. S. Army, to select the most suitable route for the military cable between Valdez and Seward. A survey of Martin Islands and their vicinity was made. Field work closed on October 25 and on November 7 the vessel reached Seattle. The *Patterson* remained at Seattle until June 13, when she sailed for Alaska, and was at work off the south end of Kodiak Island at the close of the year. The vessel was out of commission the greater portion of the time she remained at Seattle, and repairs were made.

THE STEAMER TAKU.

On July 1 the *Taku* was at work in Resurrection Bay, Alaska, and the survey of the bay was continued until September 21, when the vessel was taken to Odiak and put out of commission. On May 21 the vessel was put in commission and at the close of the year was at work making a survey of Latooche Passage Prince William Sound.

THE STEAMER YUKON.

This vessel was at Dutch Harbor, out of commission, during the year.

THE STEAMER FATHOMER.

On July 1 the *Fathomer* was at work making a survey of Maqueda Channel, east coast of Luzon, P. I., and the work was continued until November 22, when the vessel sailed for Manila and reached there on the 25th. The vessel left Manila on December 30 and reached Illana Bay, southwest coast of Mindanao Island, on January 7. This work was continued until April 2, when the vessel returned to Manila. In May she proceeded to the east coast of Luzon and began work between Lahuy Island and Daet, and this work was in progress at the close of the year.

THE STEAMER PATHFINDER.

On July 1 the *Pathfinder* was at work on the east coast of Samar, P. I., and this work was continued until September 25, when the vessel was driven on a reef by a typhoon and seriously injured. She was taken to Manila for repairs, which were not completed until February. On the 17th she left Manila and was at work on the survey of Davao Bay, Mindanao, until May 1, when the vessel returned to the east coast of Samar, and the work on that coast was in progress on June 30.

THE STEAMER MARINDUQUE.

This vessel was transferred to the Coast and Geodetic Survey by the Philippine Commission for use in charting the waters of the Archipelago on November 1, 1905. She left Manila on December 10 and was engaged in the survey of the west coast of Leyte from Illongas to Polompon until April. The vessel was at Manila from April 10 to 23, and during the remainder of the year was at work on the east coast of Luzon between Atimonan and Polillo islands.

THE STEAMER ROMBLON.

This vessel was transferred to the Coast and Geodetic Survey by the Philippine Commission for use in charting the waters of the Archipelago on November 1, 1905. She left Manila on December 14, and was at work on the west coast of Luzon, off Zambales Province, until April. From April 13 to May 1 the vessel was at Manila and during the remainder of the year was at work on the east coast of Luzon between Daet and Sogod.

THE STEAMER RESEARCH.

On July 1 this vessel was at work in Guimaras Strait and the work was continued until July 27. She was at Manila from July 29 to September 9, when she proceeded to Calapan, Mindoro, and made a survey of the Verde Island Passes. The vessel returned to Manila on April 4 and then proceeded to Guimaras Strait and was at work on the north coast of Negros Island during the remainder of the year.

The schooners *Quick* and *Spy* and launch *No. 515* were sold during the year.

COAST PILOT PARTY.

The work in the Office included the preparation of a Coast Pilot of Porto Rico; the compilation and proofreading of the third edition of U. S. Coast Pilot, Atlantic Coast, Part VII; the compilation of three supplements to Coast Pilot volumes; the collection of data concerning the depths in harbors on the Atlantic coast of the United States, as

requested by the secretary of state of North Carolina; the preparation of a list of depths in the harbors of the world as requested by the Panama Canal Commission; and the correction of Coast Pilot volumes to date of issue.

OFFICE OF INSPECTOR OF GEODETIC WORK.

J. F. HAYFORD, *Inspector.*

The duties of the Inspector of Geodetic Work were performed at the Office in Washington, except for the period August 16 to September 9. During this period an inspection was made of the work of parties in the field as follows: a triangulation party, a party making astronomic observations, and a leveling party, all at work in Minnesota.

In addition to the inspection in the field, an examination was made of the records as they were received at the Office from parties in the field, and an effective supervision was exercised over the field work in this way.

The following interesting statistics relate to a line of levels between Watertown, S. Dak., and Sioux City, Iowa, which was completed during the year:

Number of months of observation	2.5
Length of line.....kilometers..	382
Length of line.....miles..	237
Speed per month.....kilometers..	155
Speed per month.....miles..	96
Total field expenses	$1 797.00
Salary, percentage	12
Cost per kilometer	$4.70
Cost per mile	$7.60
Average distance between permanent bench marks.....kilometers..	2.3
Velocipede cars used	Yes.

This line was leveled in both directions, forward and backward, and it is the most economical work of this character that has been done by the Survey.

OFFICE OF INSPECTOR OF MAGNETIC WORK.

L. A. BAUER, *Inspector.*

The instructions for magnetic work were prepared and the information required by the various parties engaged in field work was furnished by the Inspector.

He inspected the field work in Montana and the observatory work at Cheltenham, Md., and examined the new forms of instruments, appliances, and methods devised for the determination of the magnetic elements at sea on board the yacht *Galilee*, chartered by the Carnegie Institution of Washington for the magnetic survey of the Pacific Ocean.

The activity of the Survey in magnetic work may be summarized as follows:

OBSERVATORY WORK.

The magnetic observatories at Cheltenham, Md.; Baldwin, Kans.; Honolulu, Hawaii; Sitka, Alaska; and Vieques, P. R., were kept in continuous operation and observations were obtained with a self-registering magnetograph and a seismograph at each observatory. At Cheltenham two magnetographs were in use and the extreme

sensitiveness maintained on the Eschenhagen magnetograph led to the detection of a slight magnetic disturbance directly traceable to an electric railway from 12 to 14 miles distant. Numerous instruments were standardized, including two magnetometers which were used by the United States Navy eclipse expedition to Spain.

A report on the San Francisco earthquake of April 18, 1906, was prepared from the records made by the seismographs and magnetographs at the Coast and Geodetic Survey observatories.

MAGNETIC WORK ON LAND.

The magnetic declination, dip, and intensity were determined at 382 stations distributed over 43 States and Territories as summarized in the following table:

States and Territories.	Localities.	Stations.	Old localities reoccupied.	Declinations observed.	Dips observed.	Intensities observed.
Alaska	9	14	2	14	4	4
Arkansas	20	20	2	20	20	20
California	9	9	7	10	10	10
Colorado	12	12	3	11	12	12
District of Columbia	1	2	1	3	4	3
Florida	14	14	5	16	15	16
Georgia	1	1	1	1	1	1
Hawaii	19	21	10	23	23	23
Idaho	9	9	0	9	9	9
Illinois	9	10	0	13	13	13
Indiana	13	15	2	15	17	15
Indian Territory	8	9	1	9	9	9
Iowa	1	1	1	1	1	1
Kansas	1	1	1	6	6	6
Kentucky	1	1	0	1	1	1
Maine	9	11	5	12	10	10
Maryland	2	4	2	13	9	12
Massachusetts	8	8	1	8	8	8
Michigan	15	16	2	16	16	16
Minnesota	11	11	1	11	11	11
Mississippi	1	1	0	1	1	1
Missouri	7	7	1	7	7	7
Montana	14	14	4	15	15	15
Nevada	3	3	0	3	3	3
New Hampshire	4	5	1	6	4	4
New Mexico	12	12	1	12	12	12
New York	16	17	2	18	17	18
North Dakota	14	14	2	15	15	15
Ohio	1	1	1	1	1	1
Oklahoma	1	1	0	1	1	1
Oregon	12	12	4	12	12	12
Pennsylvania	2	2	2	2	2	2
Philippine Islands*	5	5	0	5	1	1
Porto Rico	4	4	2	8	5	8
South Carolina	4	4	1	4	4	4
South Dakota	6	6	1	6	6	6
Tennessee	6	6	2	6	6	6
Texas	16	16	9	15	16	16
Utah	2	2	0	2	2	2
Vermont	7	8	1	8	7	7
Washington	29	29	9	34	35	34
Wisconsin	15	16	0	16	16	16
Wyoming	6	6	0	6	6	6
Foreign countries	2	2	2	2	2	2
Total	361	382	92	417	395	399

*Estimated.

Observations were made at a large number of stations formerly occupied in order to obtain additional data for a new discussion of the secular change of the magnetic elements. At the time of the solar eclipse of August 30, 1905, special observations were made at all of the observatories and by all, except one, of the magnetic observers engaged in field work.

SUMMARY OF RESULTS AT SEA.

The observations made on shipboard are summarized in the following table. A very valuable series of observations was made on the *Bache* on her trip from Key West to Galveston and return, furnishing means to extend the iso-magnetic lines well into the Gulf with almost as great accuracy as over the land.

Vessel.	Region.	Results from swings.			Observations on three headings.		
		Declination.	Dip.	Intensity.	Declination.	Dip.	Intensity.
Bache	Atlantic ...	29	31	31	1	0	0
Explorer .	Atlantic ...	13	14	14	7	7	7
Patterson.	Pacific	3	3	3	0	0	0
Total	.....	45	48	48	8	7	7

OFFICE OF DISBURSING AGENT.

SCOTT NESBIT, *Disbursing Agent.*

The disbursement of the funds of the Coast and Geodetic Survey is made not only by payments directly from the Disbursing Agent, but also largely thru the medium of the Assistants and other officers when acting as chiefs of parties. These officers, on approval of the Superintendent, receive advances of public funds from the Disbursing Agent in lump sums, under authority of an Executive order, dated March 26, 1886.

In conformity to this order there are now 71 officers of this Service bonded in the sum of $2 000 to $10 000 each. When acting as chiefs of parties, these officers receive from time to time such advances of public funds from the Disbursing Agent as are required to meet the necessary current expenses of the work in hand.

A ledger account is kept in the office of the Disbursing Agent with each chief of party receiving an advance, each one being charged with all advances made to him, and, on the other hand, receiving credit for all proper expenditures made by him when presented on regularly supported vouchers after such accounts have been audited in the office of the Disbursing Agent and found to be correct. All of these accounts, with their supporting vouchers, are then sent thru the Department of Commerce and Labor to the Auditor for the State and other Departments for examination and audit by him.

This system has met the needs of this Service, and results in the main in economy and good order in its expenditures.

In addition to the regular appropriations of the Coast and Geodetic Survey, the Disbursing Agent also disburses the appropriations for the survey and marking of the boundary between the United States and Canada and the boundary between Alaska and Canada. During the year additional appropriations were made under these items of $20 000 and $25 000, respectively.

An itemized statement of receipts and expenditures is submitted to Congress each year, in accordance with law, and is printed as a Congressional document.

OFFICE OF EDITOR OF PUBLICATIONS.

The Annual Report (pp. 1–347) covering the progress of the work of the Survey during the fiscal year 1905 was completed, made ready for printing, and sent to the Public Printer thru the Secretary of Commerce and Labor on September 29, and the last proof was read and returned to the printer on October 30. Copies of the Report were received for distribution on December 28.

The annual statement covering the work of the year was prepared and transmitted to the Secretary of Commerce and Labor. Numerous assignments to temporary duty were completed, and all possible aid was extended to officers engaged in the preparation of material to form part of the Annual Report.

The publications of the Coast and Geodetic Survey during the fiscal year are given in the following list:

Report of the Superintendent, showing the progress of the work, July 1, 1904, to June 30, 1905, 347 pages, with the following appendixes published as separates:

No. 3. Results of magnetic observations made by the Coast and Geodetic Survey between July 1, 1904, and June 30, 1905. 88 pages.

No. 4. Precise leveling from Red Desert, Wyoming, to Seattle, Wash. 50 pages.

No. 5. Triangulation along the ninety-eighth meridian, Lampasas to Seguin, Tex. 40 pages.

No. 6. Long wire sweep. 6 pages.

No. 7. A plane table manual. 53 pages.

Tide Tables for the year 1906. 516 pages.

Tide Tables Atlantic Coast (reprint), 1906. 172 pages.

Tide Tables Pacific Coast (reprint), 1906. 160 pages.

Notices to Mariners, Nos. 326–338.

Notices to Mariners and volumes of sailing directions were prepared and published in Manila, P. I., and issued from the suboffice at that place as follows, viz:

Philippine Island Notices to Mariners, Nos. 7–15 of 1905 and Nos. 1 to 5 of 1906.

Sailing Directions, Philippine Islands, Section I (3d edition). 101 pages.

Sailing Directions, Philippine Islands, Section V (2d edition). 72 pages.

Catalogue of Charts, 1906. 17 pages.

APPENDIX 1

REPORT 1906

DETAILS OF FIELD OPERATIONS

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DETAILS OF FIELD OPERATIONS.

EASTERN DIVISION.

EASTERN DIVISION—EAST OF THE MISSISSIPPI RIVER.

Alabama.	Maine.	Ohio.
Connecticut.	Maryland.	Pennsylvania.
Delaware.	Massachusetts.	Rhode Island.
District of Columbia.	Michigan.	South Carolina.
Florida.	Mississippi.	Tennessee.
Georgia.	New Hampshire.	Vermont.
Illinois.	New Jersey.	Virginia.
Indiana.	New York.	West Virginia.
Kentucky.	North Carolina.	Wisconsin.

TOPOGRAPHY. MARYLAND. W. Bowie.

TRIANGULATION VIRGINIA.

SUMMARY OF RESULTS.

Topography:
- 136 square miles area covered.
- 83 miles of shore line surveyed.
  (Rivers and general coast line.)
- 35 miles of shore line of creeks surveyed.
- 403 miles of roads surveyed.
- 4 topographic sheets completed.

Triangulation:
- 10 stations occupied.
- 26 geographic positions determined.

The continuation of topographic work in connection with the resurvey of Chesapeake Bay was assigned to Assistant Bowie, who relieved Assistant Latham of the charge of the party at work on the shores of Mobjack Bay on August 15. He continued this work from that date until October 26, when he went to the head of Chesapeake Bay and completed the unfinished portion of the interior topography along the west shore of Elk River from Bohemia River to Elkton, Md. The survey was extended to the road leading southward from Elkton thru Chesapeake City across the head of Bohemia River.

He finished this work on November 27 and resumed work in Mobjack Bay on December 12. The survey of the shores of Mobjack Bay was then continued without interruption until April 24, when the party was transferred to Assistant F. A. Young.

The shore line of the rivers emptying into Mobjack Bay was found practically unchanged, and only the shore line of the prominent points was surveyed. A survey was made of the shore line of the portions of Chesapeake Bay, Mobjack Bay, and York River covered by the work.

The work in Mobjack Bay was based on the triangulation work of Assistant Latham, and in the tributaries upon plane table triangulation extended from the work in the bay.

The triangulation was extended up York River from Tue Marshes Light-house to Yorktown and Gloucester Point.

A survey was made of the interior topography back to the road from Milford Haven around the heads of the East, North, Ware, and Severn rivers, to Gloucester Point on the York River.

MAGNETIC OBSERVATIONS — MAINE. MASSACHUSETTS. — J. E. Burbank.

Stations occupied.

MAINE.

Bangor.	Farmington.	Rangeley.

MASSACHUSETTS

Athol.	Lawrence.	Pittsfield.
Concord.	Mansfield.	Sheffield.
Huntington.	Newburyport.	

The work began at Bangor, Me., on October 1 and was finished at Mansfield, Mass., on November 9. Observations were made to determine the three elements of terrestrial magnetism at all the stations named above, and meridian lines were established at Rangeley, Me., and Pittsfield, Mass.

ASTRONOMIC OBSERVATIONS. FLORIDA.
MAGNETIC OBSERVATIONS. GEORGIA. — W. H. Burger.

SUMMARY OF RESULTS.

Latitude observations:
4 stations occupied in Florida.
Magnetic observations:
4 stations occupied in Florida.
2 stations occupied in Georgia.

The work of making astronomic and magnetic observations in various localities was assigned to Assistant Burger. The work began in Florida on February 24 and continued until May 30. During this period observations were made at or near the places named below.

FLORIDA.

Latitude observations at Jupiter Inlet, Sebastian, St. Augustine, and Titusville.
Magnetic observations at Daytona, Jupiter Inlet, Sebastian, and St. Augustine.

GEORGIA.

Magnetic observations at Darien and Crescent.

Longitude stations were selected in Florida at Clearwater, Jupiter Inlet, Miami, Sebastian, St. Augustine, and Titusville, and at Darien in Georgia. Triangulation stations were recovered and the positions of the astronomic stations and other objects were determined at Clearwater, Miami, Sebastian, St. Augustine, and Titusville in Florida, and at Darien in Georgia.

HYDROGRAPHY. MAINE. R. B. Derickson, Commanding,
TRIANGULATION. MASSACHUSETTS. Steamer *Hydrographer*.
RHODE ISLAND.
VIRGINIA.

SUMMARY OF RESULTS.

Hydrography:
6 square miles area covered.
311 miles lines sounded.
13 543 soundings made.
6 tide stations established.
10 hydrographic sheets completed.
Triangulation:
13 stations occupied.
5 geographic positions determined.

The work of making hydrographic examinations along the coasts of Maine, Massachusetts, and Rhode Island was assigned to Assistant Derickson, commanding the steamer *Hydrographer*. He sailed from Baltimore, Md., on August 17, and reached Portland on August 24.

The work mentioned below was done:

Broad Cove Rock, vicinity of Biddeford Pool, Maine.—Position and least depth of water determined.

Buoy off Cape Elizabeth, Maine.—Position determined.

Saco Bay, Maine.—Position of ledge of rock determined.

Boon Island, Maine.—Position of three ledges in vicinity determined.

Gloucester Harbor, Massachusetts.—A search was made for the 8-fathom ledge reported to be on Saturday Night Shoal. The shoal was thoroly developed by sounding and the least depth obtained was 13 fathoms. A search was also made for a rock reported to be north of Bakers Island. A large area was covered by soundings, and it was shown that no such rock is in existence in this vicinity.

Stellwagen Bank.—A search was made for the 6-fathom spot reported to be on the southwest point of the bank, but no such depth was found.

Bearse Shoal.—Position of dry spot on shoal determined.

Monomoy Point.—Position of buoy No. 6, south of this point, was determined, and soundings were made in the vicinity to determine the position of the reported 2-fathom spot.

Falmouth.—A rock off Gunning Point, vicinity of Falmouth, was located, and the depth of water on the Middle Ground south of Penikese Island was determined.

Carrs Point, Rhode Island.—Position of rocks south of this point determined.

Hydrographic work in the vicinity of Old Point Comfort was assigned to Assistant Derickson, commanding the Steamer *Hydrographer*. The work began on February 7 and continued until April 3. During this period a partial examination was made of the entrance to Back River and of the shoals off the entrance.

TIDE OBSERVATIONS. VIRGINIA. W. C. Dibrell.

The installation of a self-registering tide gage at Colonial Beach, Virginia, was assigned to Assistant Dibrell. He proceeded to Colonial Beach on June 21 and completed the work on the 28th.

The positions of the two tide staffs used at this place by Assistant Young could not be determined.

The self-registering gage was mounted on an extension built at one side of the freight pier. Two old bench marks were recovered and two new ones were established, and the tide staff was connected with the bench marks by a line of levels.

MAGNETIC OBSERVATIONS. FLORIDA. J. H. Egbert.

Stations occupied.

Fort Myers.	Miccos Bluff.	Sugar Loaf Beach.
Kissimmee.	Punta Gorda.	Turkey Hammock.
Labelle.	Puntarasa.	Warners Camp.

Magnetic work in Florida was assigned to Surg. J. H. Egbert. He began work at Kissimmee on January 17 and closed work at Punta Gorda on April 8. Observations were made to determine the value of the three elements of terrestrial magnetism at the stations named above. At Kissimmee and Punta Gorda old stations were recovered and occupied.

HYDROGRAPHY. MAINE. R. L. Faris, Commanding,
MAGNETIC OBSERVATIONS. Steamer *Explorer*.

The hydrographic examination of various areas along the coast of Maine was assigned to Assistant Faris, commanding the steamer *Explorer*.

The vessel arrived at Rockland on July 30, after swinging the ship at Lynnhaven Bay to make magnetic observations, en route from Baltimore.

The pipe drag was placed in position, and on August 3 and 4 a search was made for a rock which had been reported as off Munroes Island, but it was not found. The position of Pendletons Cove on the east shore of Long Island in Penobscot Bay was determined, and two uncharted ledges in the vicinity of Bay Ledge spindle off Isle au Haut were located. The vessel then proceeded to the north end of Eggemoggin Reach, and a number of hydrographic signals were erected and located with the plane table. The work mentioned above was done under the direction of Assistant L. H. Westdahl, temporarily in command of the *Explorer*.

On August 28 Assistant Faris assumed command of the ship, and on the 31st he began the work of examining with the channel drag various shoal spots in East Penobscot Bay, Eggemoggin Reach, Jericho Bay, and Blue Hill Bay. The work continued until October 16, when it was closed for the season. In making the examinations the channel drag was used wherever there was sufficient sea room in which to handle the ship. When the shoal spots were so close to the shore that the ship could not be used over them, the examination was made by running sounding lines close together, using a launch. While working with the drag, soundings were made as usual in hydrographic work. The shoal spots examined were distributed over a wide area, and considerable time was required for the location of the necessary hydrographic signals.

During the progress of this work the geographic positions of a number of aids to navigation were determined.

Magnetic observations were made on shore at Rockland, in Penobscot Bay, on Nantucket Shoals, in Chesapeake Bay, and on shore at Baltimore. The vessel reached Baltimore on November 6.

MAGNETIC OBSERVATIONS. J. A. Fleming.

ILLINOIS. NEW YORK.
INDIANA. OHIO.
KENTUCKY. PENNSYLVANIA.
MICHIGAN. SOUTH CAROLINA.
MISSISSIPPI. TENNESSEE.
NEW HAMPSHIRE. VERMONT.
WISCONSIN.

Stations occupied.

ILLINOIS.

Marion. Olney. Paxton.

INDIANA.

Albion. Columbus. Reynolds.
Anderson. Greencastle. San Pierre.
Bloomington. Jasper. Vincennes.
Brownstown. Lawrenceburg. Wabash.

KENTUCKY.

Scottsville.

MICHIGAN

Ann Arbor.
Bessemer.
Big Rapids.
Cadillac.
Flint.
Gaylord.
Gladwin.
Hastings.
Jackson.
Lansing.
Mackinac Island.
Roscommon.
St. Johns.
Stanton.

MISSISSIPPI.

Corinth.

NEW HAMPSHIRE.

Colebrook.
Hanover.
Newport.
Plymouth.

NEW YORK.

Albany.
Antwerp.
Beaver River.
Belmont.
Big Indian.
Delhi.
Elizabethtown.
Johnstown.
Lake George.
Little Valley.
Malone.
New York.
Plattsburg.
Saranac Lake.
Warsaw.

OHIO.

Dayton.

PENNSYLVANIA.

Doylestown.
Philadelphia.

SOUTH CAROLINA.

Camden.
Columbia.
Lancaster.
Yorkville.

TENNESSEE.

Brownsville.
Cookeville.
Huntingdon.
Memphis.
Nashville.

VERMONT.

Burlington.
Hyde Park.
Manchester.
Middlebury.
Rutland.
St. Albans.
St. Johnsbury.

WISCONSIN.

Ashland.
Chippewa Falls.
Florence.
Grand Rapids.
Grantsburg.
Marinette.
Mountain.
Neillsville.
Newberry.
Osceola.
Rhinelander.
Shawano.
Shell Lake.
Wausau.

The extension of the magnetic survey in various localities in the Eastern Division was assigned to Magnetic Observer Fleming. Observations were made to determine the value of the three elements of terrestrial magnetism at the stations mentioned above

by magnetic observers detailed to work under Mr. Fleming's direction. All the stations were permanently marked, usually by a stone monument suitably lettered.

Special observations were made at Colebrook, N. H., and Wausau, Wis., in connection with the solar eclipse of August 30, 1905.

TOPOGRAPHY. MARYLAND. S. Forney.

VIRGINIA.

SUMMARY OF RESULTS.

60 square miles area covered.
56 miles of shore line of creeks surveyed.
155 miles of road surveyed.
4 topographic sheets completed.

On July 1 topographic work along the lower Potomac River was in progress under the direction of Assistant Forney. He was at work continuously except during the period December 22 to February 27, when field work was suspended. The topographic survey of the country back of the shore line of the river was completed from Wicomico River to Point Lookout in Maryland and from the upper end of Nomini Cliffs to Lower Mochodoc Creek in Virginia. The work included the location of contours, roads, and the shore line of creeks, and this work was extended to the high land overlooking the river. The land within the limits of the work rises in some places to an elevation of 90 feet in Maryland and 190 feet in Virginia. The work was in progress on June 30.

TOPOGRAPHY. VIRGINIA. J. J. Gilbert.

The work of locating the position of the trolley line between Norfolk and Virginia Beach, via Cape Henry, was assigned to Assistant Gilbert. He began the work on August 8, and after considerable delay on account of bad weather it was completed on August 19.

TRIANGULATION. NORTH CAROLINA. J. S. Hill.

SUMMARY OF RESULTS.

75 square miles area covered.
7 stations occupied.
29 geographic positions determined.

The extension of the tertiary triangulation in the vicinity of Southport, N. C., and the determination of aids to navigation were assigned to Assistant Hill. He began work on November 25 and completed the duty assigned him on December 12.

Four old triangulation stations were recovered, and the geographic positions determined depend upon the lines between these stations. Cape Fear Light-house and several beacons were among the objects whose positions were determined.

MAGNETIC OBSERVATIONS. ILLINOIS. W. B. Keeling.

INDIANA.

WISCONSIN.

Stations occupied.

ILLINOIS.

Effingham.	Knoxville.	Shabbona.
Freeport.	Paxton.	Tuscola.
Highland.	Princeton.	Woodstock.
Joliet.		

INDIANA.

Kentland.

WISCONSIN.

Elkhorn.	Madison.	Montello.
Fond du Lac.	Mauston.	Richland Center.

The extension of the magnetic survey in various localities in the Eastern Division was assigned to Magnetic Observer Keeling, and an observer was assigned to him to make the desired observations in the field.

Observations to determine the three elements of terrestrial magnetism were made at the stations mentioned above.

TOPOGRAPHY. VIRGINIA. E. B. Latham.

SUMMARY OF RESULTS.

15 square miles area covered.
37 miles of coast line surveyed.
19 miles of roads surveyed.

On July 1 the topographic resurvey of the shore of Chesapeake Bay between Old Point Comfort and the mouth of the Potomac River was in progress, under the direction of Assistant Latham. The work was continued until August 15, and on that date the party was transferred to Assistant Wm. Bowie.

HYDROGRAPHY. NEW YORK. J. B. Miller.

TRIANGULATION.

SUMMARY OF RESULTS.

Hydrography:
27 square miles area covered.
448 miles lines sounded.
15 043 soundings made.
5 tide stations established.
5 hydrographic sheets completed.
Triangulation:
8 square miles area covered.
41 stations occupied.
55 geographic positions determined.

The hydrographic examination of the Hudson River above Fort Montgomery was assigned to Assistant Boutelle, and he began work at Cold Spring, N. Y., on July 11. General preparations were made, and on the 18th the charge of the work was transferred to Aid J. B. Miller. A thoro survey was not attempted, but all shoals indicated on the charts were examined by making soundings close together over their entire area. The shore line was corrected to show its present position as far north as Crum Elbow.

Between Milton Landing and Esopus Light very few of the old triangulation stations were recovered. Forty-one new stations were established and their geographic positions determined.

A self-registering tide gage was used at Poughkeepsie during fifty-six days, and tide staffs were erected at four other stations.

The elevations of bench marks along the river had already been determined, and these gages were connected with each other by leveling from each gage to the nearest bench mark.

LEVELING. OHIO. E. H. Pagenhart.

SUMMARY OF RESULTS.

37 kilometers of double line completed.
88 kilometers of single line completed.

The work of releveling the line between Chicago Junction and Deshler, Ohio, was assigned to Aid Pagenhart.

The work began at Chicago Junction on October 31, and was extended along the Baltimore and Ohio Railroad to Deshler, where the season closed on November 25.

The check levels verified the elevations determined when the line was originally leveled.

TIDAL INDICATOR. MAINE. H. P. Ritter.
SPEED TRIAL COURSES. MASSACHUSETTS.
DETERMINATION OF. NEW YORK.
AIDS TO NAVIGATION.

The tide indicator at Fort Hamilton, N. Y., was changed so that its operation will be continuous even when the surface water is frozen. An iron float tube was erected of the proper diameter and of such length as to permit its being filled with enough coal oil to cover the extreme range of the tide without danger of loss thru the opening which establishes communication between the water outside and inside the tube. The lower end of the tube was closed and it was sunk 7 feet into the ground. A small pipe enters the side of the tube about 1½ feet above the bottom of the water outside the tube and passes downward to a point a few inches above the lower end of the tube so that the column of coal oil can sink below the bottom of the water outside without allowing any of it to escape. This solution of the problem was suggested by Mr. E. G. Fischer.

The indicator was also remodeled, the work being done in the carpenter shop at the Office, and one of the carpenters was sent from the Office to erect the new indicator.

In response to a request from the Light-House Board the position selected for a new range light for Ambrose Channel, New York Bay, was located by anchoring a spar buoy near the point selected. The position of this buoy was then determined by angles from three adjacent triangulation stations which gave the data required to place the buoy in the desired position. The buoy was moved and the information was furnished to the Light-House Board.

Some work was done in connection with the improvement of the speed trial courses at Rockland, Me., and Provincetown, Mass., as requested by the Navy Department.

In May the position of Emerald Rock off New Rochelle, N. Y., was determined and a number of soundings were made in its vicinity.

By the courtesy of the Light-House Board the tender *Rodgers* was used in doing this work and a leadsman and boat's crew were furnished by Captain Hawkins.

HYDROGRAPHY. VIRGINIA. E. C. Sasnett, Commanding, Steamer *Endeavor*.

SUMMARY OF RESULTS.

56 square miles area covered.
797 miles lines sounded.
42 582 soundings made.
4 tide stations occupied.

Hydrographic work in Tangier and Pocomoke Sounds, Virginia, was assigned to Assistant Sasnett, commanding the steamer *Endeavor*. The field work began on January 1 and was continued until March 31, when the work closed for the season.

The hydrographic survey covered the lower portion of Tangier Sound, from the upper end of Great Fox Island to a point 3 miles south of Watts Island Light, and was practically completed over this area, as only a small portion remained undeveloped at the close of the season.

Tide staffs were erected at James Island Light-house, Great Fox Island, and Cod Harbor, and observations were made to establish a plane of reference for the hydrographic work.

GRAVITY OBSERVATIONS. DISTRICT OF COLUMBIA. E. Smith.

Gravity observations having been made by Assistant Smith at Eagle (Fort Egbert), Alaska, and at Madison, Wis., as referred to under the proper headings, he was directed to complete the set of observations by swinging the pendulum at the base station in Washington. The necessary observations were made at the Office April 16 to 18.

TIDE OBSERVATIONS.

FLORIDA.
MARYLAND.
NEW YORK.
PENNSYLVANIA.

Self-registering tide gages were kept in operation thruout the year at the places mentioned below:

Fernandina, Fla.
Baltimore, Md.
Fort Hamilton, N. Y.
Philadelphia, Pa.

HYDROGRAPHY.
TOPOGRAPHY.

NORTH CAROLINA.
VIRGINIA.

W. I. Vinal, Commanding,
Schooner *Matchless*.

SUMMARY OF RESULTS.

Hydrography:
117 square miles area covered
1 217 miles lines sounded.
50 680 soundings made.
3 tide stations occupied.
2 hydrographic sheets completed.
Topography:
2 square miles area covered.
16 miles of coast line surveyed.
1 mile of shore line of creeks surveyed.
5 miles of roads surveyed.
1 topographic sheet completed.

The party on the Schooner *Matchless* was engaged on hydrographic work in the lower portion of the Potomac River in the vicinity of Munday and Cole points on July 1, and the work was continued until July 24.

The vessel then proceeded to Norfolk for repairs and arrived at Ocracoke Inlet, North Carolina, on September 22. A hydrographic survey was made of this locality and the inlet, the bar, and the channels leading from it into Pamlico Sound were thoroly developed.

In addition to the hydrographic work a topographic survey was made of a small area in the vicinity of Portsmouth and Ocracoke to show recent changes in the shore line. This work was completed and the vessel returned to Norfolk on December 21.

On January 29 the vessel proceeded to Cricket Hill, Virginia, and a hydrographic survey was made of the west side of Chesapeake Bay from Wolf Trap Light-house, including the entrances to Piankatank and Rappahannock rivers.

This work was suspended on May 15 in order to have repairs made to the vessel.

TRIANGULATION. MAINE. D. B. Wainwright.

In response to a request from the Navy Department for the determination of the length of the speed-trial course off Monroe Island, Maine, Assistant Wainwright was instructed to make the determination. He measured a short base line from which he extended a triangulation to include the beacons marking the speed-trial course and two points in the old triangulation in this vicinity, Owls Head Light-house and Shag Rock Beacon. The distance between these two points was used as a check on the work and it agreed with the distance computed from the measured base.

MAGNETIC OBSERVATIONS. MARYLAND. Wm. F. Wallis.

The work at the Magnetic Observatory at Cheltenham, Md., was continued during the year under the direction of Magnetic Observer Wallis.

Two sets of self-recording magnetographs were in successful use and an almost continuous record of the relative changes in the magnetic declination, horizontal and vertical intensity was obtained. Observations were made once a week to determine the absolute value of the elements of terrestrial magnetism and special observations were made on the 1st and 15th of each month in accordance with an international program.

A satisfactory record was made by the seismograph. From December 1, 1904, to December 31, 1905, thirty-one earthquakes were recorded. Some of these were records of mere tremors, but some showed the far-reaching effects of great shocks in other portions of the globe, such as the disastrous earthquakes that occurred in India in April, 1905, and in southern Italy in September of the same year. None of the earthquakes recorded were felt by persons in the vicinity of Cheltenham, but nine of them affected the record with Eschenhagen magnetograph.

From January 1 to June 30 eighteen earthquakes were recorded. Two of these, one on January 31 and one on April 18 (San Francisco earthquake), produced the greatest disturbances recorded since the instruments were installed. Five of the earthquakes produced a distinct disturbance of the magnetograph magnets.

Observations were made to standardize various instruments, among them the magnetometers used by the United States Navy eclipse expedition.

HYDROGRAPHY. FLORIDA. P. A. Welker, Commanding,
MAGNETIC OBSERVATIONS. GEORGIA. Steamer *Bache*.
MAINE.
NEW YORK.
NORTH CAROLINA.
RHODE ISLAND.

SUMMARY OF RESULTS.

Hydrography:
- 315 square miles area covered.
- 1 158 miles lines sounded.
- 612 miles lines sounded (deep-sea work).
- 35 923 soundings made.
- 125 soundings made (deep-sea work).
- 6 tide stations occupied.
- 9 hydrographic sheets completed.

Magnetic observations:
- 9 stations occupied on land.
- 31 stations occupied at sea.

Hydrographic examinations on the coast of Maine and magnetic observations on land and at sea were assigned to Assistant Welker, commanding the steamer *Bache*. Magnetic observations were made on shore at Baltimore and the vessel sailed for Bar Harbor, Me., on August 20. Magnetic observations were again made in Hampton Roads and deep-sea soundings were made off the entrance to New York Bay, beginning at a point 130 miles to the southeast and continuing for a distance of 220 miles, where the work was suspended on account of stormy weather. While in Newport Harbor, Rhode Island, storm bound, a reported rock was located. The deep-sea sounding was resumed on September 8 and completed next day. The vessel reached the coast of Maine on September 16 and the hydrographic work mentioned below was completed before the close of the season on October 28. This work consisted of special hydrographic examinations in certain localities, searching for reported uncharted rocks with the channel sweep in position, resurveys of bars, and the development of localities where uncharted rocks were suspected.

A survey was made in the vicinity of the 4-fathom spot in Salisbury Cove, Eastern Bay, and a number of uncharted rocks were located. The northern part of Eastern Bay in the vicinity of Googin's ledge was examined. Sunken Ledge, near black buoy No. 9, at the entrance to Eastern Bay, was examined and a least depth of 4 feet was found over the rock. Surveys were made of Calf Island Bar and of Jordans Bar, which showed changes in Calf Island Bar and located numerous uncharted rocks in the vicinity of Jordans Bar. Certain portions of Frenchmans Bay were examined with the channel sweep in position.

Magnetic observations were made at an old station on Bear Island and on board ship in the vicinity.

Early in October the vessel proceeded to Southwest Harbor. The approaches to the harbor, from East Bunkers Ledge to Bear Island Light-house, were thoroly examined with the channel sweep. The region in the vicinity of Old Tom and the approaches to Southwest Harbor, between Sutton Island and Cranberry Island, was also examined with the channel sweep, and a number of uncharted rocks were discovered and located. A survey was made of the passage between Bear Island and Mount Desert Island and of the entrance to Cranberry Island Passage, in the vicinity of buoys Nos. 2 and 3. Shoal water having been reported between Little Gott Island and Black Island, this passage was carefully examined with the channel sweep, but no such shoal was found. Magnetic observations were made on shore near the old station in Southwest Harbor,

on board the vessel in the harbor, at one station at sea en route to Baltimore, and on shore after reaching Baltimore on November 11.

Hydrographic work along the Atlantic coast and at Key West, Fla., and magnetic observations in the Gulf of Mexico were assigned to Assistant Welker, commanding the steamer *Bache*. Early in January magnetic observations were again made at Baltimore and the vessel sailed for Key West on January 16.

Magnetic observations were made in Hampton Roads and at sea over a prescribed route leading from Diamond Shoals Light-vessel across the Gulf Stream to the eastern end of Great Abaco Island, thence along the eastern end of the island, thru the Northwest Providence Channel, across the Gulf Stream, and along the Florida Reefs thru the main ship channel to Key West, where observations were made in the harbor and on shore.

On February 10 the work of examining the southeast and western channels in the approaches to Key West began and was continued until April 2, when this work was temporarily suspended.

Magnetic observations were made on board ship and the vessel made a trip to Galveston, Tex. Seven sets of magnetic observations were made en route to Galveston and seven sets on the return voyage, also one set near the entrance to Galveston Harbor, one set on shore at Galveston, one set in the lower harbor, one set in the harbor at Key West, and the series ended with one set on shore at Key West. On May 9 the vessel sailed for Brunswick, Ga., and made one set of magnetic observations en route.

A search was made for a shoal reported as existing 40 miles to the eastward of St. Simons Sound. One hundred and sixty miles of lines were run with a submarine sentry set at a depth of 8 fathoms, with soundings made every thirty minutes covering the location of the supposed shoal, but the reported shoal was not found. The vessel reached Southport, N. C., on May 28, and the positions of Frying Pan Shoals Light-ship, of the whistling buoy 9 miles to the eastward, and of the outer limits of the shoal were determined. On June 6 the vessel sailed for Baltimore and reached there on June 9.

TRIANGULATION. FLORIDA. Isaac Winston.

The recovery of old triangulation stations south of St. Augustine, Fla., and the determination of the geographic positions of certain aids to navigation on the east coast of Florida were assigned to Assistant Winston.

The work began at St. Augustine on November 18, 1905, and was continued until May 7, 1906. The work for the season included a search for all of the triangulation stations between St. Augustine and Sebastian, along the Matanzas, Halifax, Hillsborough, Indian, and Banana rivers and Mosquito Lagoon, a distance along the axis of the triangulation of 320 kilometers (200 miles) and along the coast of 245 kilometers (150 miles). One hundred and fifty stations were searched for, 70 were recovered and re-marked, 61 were determined as lost, and 19 were not found.

The geographic positions of the light-houses at Mosquito Inlet and Cape Canaveral and of numerous prominent objects along the coast and inland waters were determined, the total number being 88.

The canal in process of construction to connect the Matanzas and Halifax rivers was located, the permanent aids to navigation were fixt in position by triangulation, and the necessary observations were made to determine the position of the more important wharves and the Haulover Canal connecting Mosquito Lagoon and Indian River.

Town plans of Daytona, Seabreeze, New Smyrna, and Cocoa were secured, with notes to show the built-up portions of these places, and five drawbridges on the Halifax and Hillsborough rivers were located.

Numerous other notes were made for use in bringing the charts up to date.

All the stations recovered were marked in a substantial manner by using sewer pipe and cement, and supplementary descriptions of these and all other stations were prepared to show their present condition.

HYDROGRAPHY. VIRGINIA. F. A. Young, Commanding,
TRIANGULATION. Steamer *Endeavor*.

SUMMARY OF RESULTS.

219 miles lines sounded.
7 237 soundings made.
3 tide stations occupied.

On July 1 the *Endeavor* was at work at the mouth of the Potomac River.

Tide observations were made at Holland Island Bar Light-house and at Point Lookout. The geographic position of the new light-house at Point No Point was determined and the hydrographic work at the mouth of the Potomac River was completed on July 7.

On July 14 a hydrographic examination of the ocean off Cape Henry was begun and continued whenever the weather and other conditions permitted until November 24. Lines of soundings 3 miles apart were run over the area to be examined, the positions of the ship being determined from time to time by sextant angles taken on the ship on objects on shore or by observations on the ship made with theodolites from stations on shore. Two signals were anchored 8 miles offshore on account of the difficulty of seeing the signals on shore, and these were used until they were carried away by heavy seas in October. After they were destroyed two observers with theodolites were sent on shore and the position of the ship was determined at certain times, as stated above.

The ship was at Norfolk having repairs made to the boiler during the greater part of October.

Tide observations were made at Old Point Comfort and in Lynn-haven Inlet.

On November 28 the *Endeavor* proceeded to Colonial Beach, and an examination with the channel sweep was made in the vicinity of a proposed channel on the north side of the Kettle Bottom Shoals.

This work was completed, and the vessel sailed for Baltimore on December 10.

TOPOGRAPHY. VIRGINIA. F. A. Young.

SUMMARY OF RESULTS.

22 square miles area covered.
40 miles of shore line, rivers, and creeks surveyed.
38 miles of roads surveyed.
2 topographic sheets in progress.

The extension of the topographic work along the shores of the lower Chesapeake Bay and tributaries was assigned to Assistant Young. He relieved Assistant Bowie of the charge of the work on April 24 and continued it during the remainder of the fiscal year. From April 24 to May 28 a double party was at work, one along the shore and one in the interior. The work covered the shores of Paquosin River and its tributaries and the country back of it, and a survey was made along the shores of all navigable inlets and creeks.

MIDDLE DIVISION.

MIDDLE DIVISION—BETWEEN THE MISSISSIPPI RIVER AND THE ROCKY MOUNTAINS.

Arkansas.	Louisiana.	North Dakota.
Indian Territory.	Minnesota.	Oklahoma.
Iowa.	Missouri.	South Dakota.
Kansas.	Nebraska.	Texas.

TRIANGULATION. MINNESOTA. Wm. Bowie.

The extension of the triangulation along the ninety-eighth meridian northward from the vicinity of Fergus Falls was assigned to Assistant Bowie. He arranged to have a signal-building party organized, and this party began work on May 18. Seven observing towers, with an average height of 14 meters, were built by the 8th of June, and on this date the work was suspended to take up the work of preparing for base measurement.

Assistant Bowie organized an observing party and began work on May 31. Observations were made at four triangulation stations, and on June 15 this work was also suspended and the party reported to Assistant French to aid in the measurement of Stephen Base Line.

ASTRONOMIC OBSERVATIONS. MINNESOTA. W. H. Burger.
MAGNETIC OBSERVATIONS. MISSOURI.
TRIANGULATION. TEXAS.

SUMMARY OF RESULTS.

Azimuth observations:
- 1 station occupied in Minnesota.
- 1 station occupied in Missouri.
- 5 stations occupied in Texas.

Latitude observations:
- 6 stations occupied in Minnesota.
- 1 station occupied in Missouri.
- 8 stations occupied in Texas.

Magnetic observations:
- 6 stations occupied in Minnesota.
- 2 stations occupied in Missouri.
- 10 stations occupied in Texas.

The work of making astronomic and magnetic observations in various localities was assigned to Assistant Burger. He began work in Minnesota on August 19, and continued at work in the Middle Division until February 17, when the work in this Division was suspended until June 4. During this period similar work was done in the Eastern Division. The work was resumed on June 4 and continued until June 30. Observations were made at or near the places named below:

MINNESOTA.

Azimuth observations at Stephen.
Latitude observations at Douglas, Loerch, Osakis, Royalton, Stephen, and Tilden.
Magnetic observations at Brainerd, Douglas, Osakis, Royalton, Stephen, and Tilden.

MISSOURI.

Azimuth observations at Knob Noster.
Latitude observations near New Haven.
Magnetic observations at Hermann and Warrensburg.

TEXAS.

Azimuth observations at Austin, Hamilton, Isabel, Lampasas, and New Braunfels.
Latitude observations at Alice, Clareville, Corpus Christi, Hamilton, Karnes City, Lampasas, New Braunfels, and at a triangulation station on Laguna Madre.
Magnetic observations at Austin, Beeville, Corpus Christi, Hamilton, Isabel, Karnes City, Lampasas, New Braunfels, San Diego, and at a triangulation station on Laguna Madre. The instruments were mounted on wooden stands at these stations.

Longitude stations were selected at Knob Noster, New Haven, and Warrensburg, in Missouri.

The work was in progress on June 30 in Minnesota.

MAGNETIC OBSERVATIONS. MINNESOTA. P. H. Dike.

NORTH DAKOTA.

Stations occupied.

MINNESOTA.

Deer River.	Northome.	Two Harbors.
Fosston.	Tower.	

NORTH DAKOTA.

Carrington.	Hope.	Lakota.

Magnetic work in Minnesota and North Dakota was assigned to Magnetic Observer Dike. He began work in October and made observations to determine the value of the three elements of terrestrial magnetism at the stations mentioned above. The work was completed on October 25.

TRIANGULATION. TEXAS. W. B. Fairfield.

SUMMARY OF RESULTS.

18 stations occupied.
54 geographic positions determined.

Triangulation work on the coast of Texas was assigned to Assistant Fairfield. He went to Matagorda on January 28 to determine the geographic position of the light-house at that place. Six old triangulation stations were recovered and the triangulation was carried along the whole length of the bay, thru seven quadrilaterals to Matagorda Light-house. The shore line of the bay has changed materially since the survey was made, fifty years ago, and most of the old stations have been destroyed. In 1903 the Fish Commission did some triangulation work in the bay in connection with a survey of the oyster beds, and many of the signals used were found standing. These were connected with the new work, and all of them were marked in the same way as the stations of the regular work. A small oyster sloop was used for quarters and as the means of transportation, and heavy winds (northers) seriously delayed the work in February and March. During April and May fresh winds from the southeast and fog also delayed the work. The work was completed on May 14, and Mr. Fairfield went to Sabine Pass to determine the geographic position of Sabine Bank Light-house. This light is 18½ miles southeast of Sabine Pass Light-house and farther than this from any available triangulation stations along the coast. Two old triangulation stations were recovered south of Sabine Pass. An observing tower 50 feet high was erected at one of these stations and a high pole at the other, but it was so difficult to observe on the light that the attempt was finally abandoned. Another high pole was then erected over the tower, and observations were made from the Sabine Bank Light-house and Sabine Pass Light-house, and the desired position was determined in that way. Dense smoke and various other causes delayed the work, and it was in progress on June 30.

MAGNETIC OBSERVATIONS. ARKANSAS. J. A. Fleming.
IOWA.
MISSOURI.
NORTH DAKOTA.
SOUTH DAKOTA.

Stations occupied.

ARKANSAS.

Clarendon.
Clarksville.
Clinton.
Danville.
De Queen.
Forrest City.
Hardy.
Harrison.
Heber.
Huntsville.
Jasper.
Marshall.
Mena.
Mountain Home.
Mount Ida.
Perryville.
Salem.
Searcy.
Waldron.
Yellville.

IOWA.

Sioux City.

MISSOURI.

Cassville. West Plains.

NORTH DAKOTA.

Battinea.	Grand Forks.	Pembina.
Cando.	Langdon.	Rolla.
Ellendale.	Minot.	Washburn.
Fargo.	Mohall.	

SOUTH DAKOTA.

Bellefourche.	Eureka.	Rapid City.
Chamberlain.	Hot Springs.	Yankton.

The extension of the magnetic survey in various localities in the Middle Division was assigned to Magnetic Observer Fleming. Observations were made to determine the value of the three elements of terrestrial magnetism at the stations mentioned above by magnetic observers detailed to work under Mr. Fleming's direction.

All the stations were permanently marked, usually by a stone monument suitably lettered.

Special observations were made at Pembina, N. Dak., in connection with the solar eclipse of August 30, 1905.

BASE MEASUREMENT. MINNESOTA. O. B. French.
TRIANGULATION. SOUTH DAKOTA.
TEXAS.

SUMMARY OF RESULTS.

Base measurement:
3 base lines measured.
Triangulation:
50 square miles area covered.
6 stations occupied.
6 geographic positions determined.

The work of measuring one base line in Texas, one in Minnesota, and one in South Dakota was assigned to Assistant French. The base line at Point Isabel, Tex., was prepared and the measurement began on March 25. A comparator 50 meters long was established and four double measures of it with the iced-bar were made during the time required to standardize the steel tapes. Four 50-meter steel tapes were standardized and four 50-meter nickel-steel tapes were tested on the comparator by measurements made within a short period before or after an iced-bar measure. In this way the steel tapes were standardized under practically the same conditions involved in their use in the field.

The base line was measured twice in the daytime, using three nickel-steel tapes, and twice at night, using three steel tapes, and these measurements were all made in

light wind, as windy weather prevails in this region. Observations were made at six triangulations stations to connect the base line with the triangulation. Some of this work was done while waiting for suitable weather to complete the base measurement. The connection was completed on April 11.

The observations at the triangulation stations were made at night, as the conditions for observing in the daytime were very unfavorable.

The nickel-steel (Invar) tapes, recently acquired by the Survey, were used for the first time in measuring this base line. They have about the same cross section as the steel tapes (6 millimeters wide and 0.5 millimeter thick), and they were used in daylight in the same way as the steel tapes were used at night.

After completing the work in Texas, base measurement was suspended in the Middle Division until June 13, and during this interval two base lines were measured in the Western Division. The work was resumed at Stephen, Minn., on June 13, where the base line had been prepared in advance. The measurement was made between June 16 and 22, and next day the party started to the Brown Valley base in South Dakota. The measurement of this base line was begun on June 25 and was completed on June 30.

Both these bases were measured twice in the daytime with nickel-steel tapes (using three tapes) and twice at night with steel tapes (using three tapes). Each tape was used in measuring two-thirds of the length of each base, in order to provide for an intercomparison of the tapes. The results obtained when using the nickel-steel tapes in daylight were uniformly better than those given by the measures with steel tapes at night, and the use of nickel-steel or invar (having a very small coefficient of expansion) for base measurement is a decided advance in the method of obtaining the results desired, as it will furnish the results at a reduced cost without loss of accuracy. The method of preparing and measuring these base lines with tapes is fully described in Appendix 3, Report for 1901.

MAGNETIC OBSERVATIONS. TEXAS. W. M. Hill.

STATIONS OCCUPIED.

Alpine. Fort Stockton. Marathon.
Boquillas. Jasper.

Magnetic work in Texas was assigned to Magnetic Observer Hill, and he made observations to determine the value of the three elements of terrestrial magnetism at the stations mentioned above.

MAGNETIC OBSERVATIONS. INDIAN TERRITORY. W. B. Keeling.

IOWA.

KANSAS.

MISSOURI.

OKLAHOMA.

Stations occupied.

INDIAN TERRITORY.

Antlers.	Pauls Valley.	Talihina.
Ardmore.	Poteau.	Wewoka.
Atoka.	South McAlester.	

IOWA.

Keokuk.

KANSAS.

Baldwin.

MISSOURI.

Lamar.	Steelville.	Waynesville.

OKLAHOMA.

Tecumseh.

The work at the magnetic observatory at Baldwin, Kans., was continued without interruption during the year. The registration of the relative force of the three elements of terrestrial magnetism was practically continuous.

On the 1st and 15th of each month the international program of rapid registration was carried out, and observations were made once each week to determine the absolute value of the horizontal and vertical intensity. Special declination observations were made in connection with the solar eclipse of August 30, 1905. Meteorological observations were made every day.

In addition to his work at the observatory, Mr. Keeling did field work and directed the work of other observers in the field, and observations to determine the value of the three elements of terrestrial magnetism were made at the stations named above.

TRIANGULATION. MINNESOTA. H. D. King.

TEXAS.

SUMMARY OF RESULTS.

2 152 square miles area covered.
35 stations occupied.
101 geographic positions determined.

The triangulation work was in progress in Minnesota at the close of the previous fiscal year. Observations were made at 22 primary and at 2 tertiary stations before October 10, thus extending the triangulation from the line Bethlehem–French to Lake Superior at Duluth and completing the connection of triangulation along the ninety-eighth meridian with the triangulation of the Great Lakes.

Continued heavy rains and the absence of crossroads in a wide tamarack swamp crost by the triangulation materially delayed the progress of the work. The elevation

of Carlton triangulation stations was determined by leveling to the station from a bench mark previously established in the town of the same name. The observing towers at the triangulation stations were built by separate party in advance of the date on which they could be occupied for observations.

This portion of the work was completed on August 26, and the signalman was sent to Texas to erect observing towers on the extension of the triangulation to the Laguna Madre Base line, near Corpus Christi. On October 10 Mr. King closed work in Minnesota and proceeded to Texas, accompanied by his recorder. He reached Alice on the 14th and found that the observing towers, mentioned above, had been completed. Observations were begun on October 21 and completed on November 30. During this period eleven stations were occupied, extending the triangulation from the line Nolan–Elliff near Banquete to the Gulf coast at Corpus Christi Pass. This work includes the connection of the Laguna Madre Base line.

In November Signalman J. S. Bilby was sent to Point Isabel, Texas, to select a base line and to arrange for its connection with the triangulation. He selected a base line and a station for longitude and azimuth determinations. He recovered and remarked five old triangulation stations and selected one new one. This work was completed during the period November 12–24.

HYDROGRAPHY. LOUISIANA J. B. Miller, Commanding,
TOPOGRAPHY. Schooner *Transit.*
TRIANGULATION.

SUMMARY OF RESULTS.

Hydrography:
- 123 square miles area covered.
- 402 miles of lines sounded.
- 8 625 soundings made.
- 3 tide stations occupied.
- 3 hydrographic sheets completed.

Topography:
- 241 square miles area covered.
- 385 miles of coast line surveyed.
- 90 miles of shore line of creeks surveyed.
- 98 miles of shore line of ponds surveyed.
- 2 topographic sheets completed.

Triangulation:
- 241 square miles area covered.
- 22 stations occupied.
- 33 geographic positions determined.

The survey of the coast of Louisiana from Timbalier Bay to Lake Pelto was assigned to Aid Miller, in command of the schooner *Transit.* He reached Seabreeze, Timbalier Bay, on January 30, and began work immediately. It was found that nearly all the triangulation stations in this vicinity had been destroyed, but two were found after considerable delay in searching for stations, and the triangulation was extended from them across Timbalier Bay, Lake Barré, Terrebonne Bay, and Lake Pelto, to another

old triangulation station, which was recovered at the western limit of the season's work. The geographic position of Timbalier beacon was determined as a portion of this work.

A topographic survey was made of the marsh in the vicinity of Lake Pelto and Terrebonne Bay.

Timbalier Bay was covered by lines of soundings, and these lines were extended over certain portions of Lake Barré, Terrebonne Bay, and Lake Pelto. In Lake Pelto the hydrographic work extends from Caillon Boca to the center of the lake, and covers the inside passage from Raccoon Point to Grand Pass Timbalier. In Terrebonne Bay the work covers the passes into Bayou Terrebonne and Lake Barré from the bay. All these passes were found to be quite shallow.

The work closed on June 9 and the party proceeded to Oyster Bayou, and an effort was made to recover some of the old triangulation stations in this vicinity, but none were found.

The work closed at Oyster Bayou on June 13.

LEVELING. MINNESOTA. E. H. Pagenhart.

TEXAS.

SUMMARY OF RESULTS.

570 kilometers of lines completed.
184 bench marks established.

The work of extending the standard levels in Minnesota and Texas was assigned to Aid Pagenhart.

On July 1 he was at work in the vicinity of Dalton, Minn., and after that date the work was continued northward along the Great Northern Railway to Stephen, where the line ended at Stephen West Base on September 16.

This line of levels follows the triangulation laid out along the ninety-eighth meridian, and branch lines were leveled from the main line to determine the elevation of seven points selected as triangulation stations. The main line determines the elevation of the base line near Stephen. Velocipede cars were not used on this work.

On December 9 Mr. Pagenhart began leveling work at Smithville, Tex., and extended the levels along the Missouri, Kansas and Texas Railroad to Galveston, completing the work on February 10.

This line furnishes an additional connection between the levels in the interior of the country and mean sea level on the Gulf of Mexico.

Velocipede cars were used on this work as the means of transportation.

ASTRONOMIC OBSERVATIONS. TEXAS. E. Smith.

GRAVITY OBSERVATIONS. WISCONSIN. J. E. McGrath.

The work of making observations to determine the relative force of gravity at Madison, Wis., was assigned to Assistant Smith, and the determination of the telegraphic longitude of Alice and Point Isabel, Texas, was assigned to Assistants Smith and McGrath in charge of cooperating parties.

Mr. Smith reached Madison on January 20, and Prof. C. E. Mendenhall placed at his disposal the room and piers in Science Hall, of the University of Wisconsin, where previous observations with pendulums had been made. Professor Comstock, of the Washburn Observatory, furnished the corrections to the sidereal clock used for time comparisons and the gravity observations were completed January 25 to 29.

Austin, Tex., was used as the base for the longitude work in Texas. Mr. McGrath reached there on January 31 and recovered the astronomic station in the Capitol Grounds, which had been preserved thru the intelligent interest of the superintendent of the grounds. The station was ready for use on February 3.

Mr. Smith reached Alice on February 2, but a "norther" delayed his work and the station was not ready until the 10th. Unfavorable weather delayed the observations, and the determination of the difference of longitude, Austin–Alice, was not completed until the 24th. Mr. Smith then proceeded to Point Isabel and Mr. McGrath moved from Austin to Alice. The difference of longitude, Alice–Point Isabel, was determined March 14 to 20, and Mr. Smith went to Austin while Mr. McGrath occupied the station at Point Isabel. The difference of longitude, Austin–Point Isabel, was determined March 29 to 31, closing the triangle, Austin–Alice–Point Isabel, and completing the work in Texas.

TIDE OBSERVATIONS.

LOUISIANA.

TEXAS.

Self-registering tide gages were kept in operation thruout the year at the places mentioned below:

Weeks, La.
Galveston, Tex.

WESTERN DIVISION.

WESTERN DIVISION—WEST OF THE ROCKY MOUNTAINS.

Arizona.	Montana.	Utah.
California.	Nevada.	Washington.
Colorado.	New Mexico.	Wyoming.
Idaho.	Oregon.	

TIDE OBSERVATIONS. CALIFORNIA. B. A. Baird.

The installation of a self-registering tide gage at San Diego, Cal., was assigned to Assistant Baird. He arrived at San Diego on December 19 and selected the United States quarantine wharf as the best location for the gage. The work was completed and the gage was in operation on February 4.

MAGNETIC OBSERVATIONS. MONTANA. J. A. Fleming.
WYOMING.

Stations occupied.

MONTANA.

Crow Agency.	Harlem.	Malta.
Glasgow.		

WYOMING.

Casper.	Gilette.	Sheridan.
Douglas.	Newcastle.	Wheatland.

The extension of the magnetic survey in various localities in the Western Division was assigned to Magnetic Observer Fleming. Observations to determine the value of the three elements of terrestrial magnetism were made at the stations mentioned above by magnetic observers detailed to work under Mr. Fleming's direction. All the stations were permanently marked, usually with a stone post suitably lettered

ASTRONOMIC OBSERVATIONS. OREGON. O. B. French.
BASE MEASUREMENT. WASHINGTON.
RECONNAISSANCE.
TRIANGULATION.

SUMMARY OF RESULTS.

Astronomic observations:
1 azimuth determined.
Reconnaissance:
2 300 square miles area covered.
16 triangulation stations selected.
Triangulation:
2 300 square miles area covered.
22 stations occupied.
40 geographic positions determined.

On July 1 the primary triangulation along the Pacific coast was in progress in Washington. Several men were kept at work in charge of a foreman, opening trails and lines and preparing stations for the observing party, until October, when this work was suspended for the season.

Observations were made at all the stations in the vicinity of Tacoma, completing the connection of the base line with the triangulation, and at six stations south of the city extending the triangulation to the vicinity of Mount St. Helens. Work closed on September 29 as the result of a heavy snow storm which made it impracticable to remain in the mountains. After reaching Portland, observations were made at four stations in the vicinity of the Columbia River, and work for the season closed on October 8.

The weather was very unfavorable during the season and serious delay was caused by the heavy cutting necessary in opening lines and by forest fires during a portion of the season.

In the latter part of September, Assistant Hill was sent to make a reconnaissance for triangulation to connect the primary work in the interior with the tertiary work on the shores of Coos Bay, Oregon. The country was examined and a satisfactory scheme was developed by the selection of fourteen stations. The work was completed in fifteen days.

The measurement of a base line in Oregon and another in Washington was assigned to Assistant French. After suspending work in the Middle Division he began work on the Willamette base line at Eugene, Oreg., on April 22 and the line was prepared and all measures were completed on May 13, as favorable weather prevailed nearly all the time the work was in progress. The party then moved to Tacoma, Wash., and began work on the base line in that vicinity on May 19. The work at this base line and in this Division was completed on June 8.

These base lines were measured twice in the daytime with nickel-steel tapes (using three tapes) and twice at night with steel tapes (using three tapes). Each tape was used in measuring two-thirds of the length of each base line in order to provide for an intercomparison of the tapes. The results obtained when using the nickel-steel tapes in daylight were uniformly better than those given by measures with steel tapes at night. The method of preparing and measuring these base lines with tapes is fully described in Appendix 3, Report for 1901.

TRIANGULATION. WASHINGTON. J. S. Hill.

The extension of the primary triangulation in Oregon and Washington was assigned to Assistant Hill. He began work in the vicinity of the Columbia River on June 9 and made observations at three primary and three secondary stations before June 30, on which date the work was in progress.

MAGNETIC OBSERVATIONS. CALIFORNIA. W. M. Hill.
NEVADA.
NEW MEXICO.
OREGON.

Stations occupied.

CALIFORNIA.

Barstow.	Kelso.	San Jose.
Goat Island.	Red Bluff.	

OREGON.

Detroit.	Eugene.	McMinnville.
Estacada.	Jacksonville.	Yaquina.

NEVADA.

Caliente.	Las Vegas.	Rox.

NEW MEXICO.

Alamogordo.	Nara Visa.	Silver City.
Cloudcroft.	Orange.	Torrance.
Engle.	Prathers Ranch.	Tucumcari.
Jarilla.	Santa Rosa.	

Magnetic work in the Western Division was assigned to Magnetic Observer Hill, and observations were made to determine the value of the three elements of terrestrial magnetism at the stations mentioned above.

MAGNETIC OBSERVATIONS. COLORADO. W. B. Keeling.
IDAHO.
MONTANA.
OREGON.
WASHINGTON.

Stations occupied.

COLORADO.

Castle Rock.	Denver.	Glenwood Springs.
Cheyenne Wells.	Durango.	Grand Junction.
Deer Trail.	Fort Morgan.	Hugo.
Del Norte.	Georgetown.	Montrose.

IDAHO.

Baker.	Hailey.	Sumpter.
Boise City.	Mountain House.	Union.
Council.	Murray.	Weiser.
Elgin.	Pendleton.	

MONTANA.

Anaconda.	Iron Mountain.	Missoula.
Dillon.	Lewiston.	Stevensville.

OREGON.

Elgin.	Sumpter.	Union.
Pendleton.		

UTAH.

Blake.		Price.

WASHINGTON.

Colfax.		Walla Walla.

The extension of the magnetic survey in various localities in the Western Division was assigned to Magnetic Observer Keeling, and an observer was detailed to make the observations under his direction.

Observations to determine the value of the three elements of terrestrial magnetism were made at the stations mentioned above.

LEVELING. CALIFORNIA. E. H. Pagenhart.

IDAHO.

SUMMARY OF RESULTS.

403 kilometers of line completed.
132 bench marks established.

The extension of the leveling work in California and Idaho was assigned to Aid Pagenhart.

The work began at sea level on San Diego Bay, California, on March 5, and the line was completed to Barstow on June 7. The route followed the Atchison, Topeka and Santa Fe Railroad via Santa Ana and San Bernardino. After closing work at Barstow, Mr. Pagenhart proceeded to Idaho and began work at Pocatello on June 26, and extended the work northward over the Oregon Short Line Railway to the vicinity of Blackfoot, where it was in progress on June 30.

The lines mentioned were leveled in both directions and temporary bench marks were established at short intervals to furnish the means of comparing the elevations determined by the two lines.

ASTRONOMIC OBSERVATIONS. NEW MEXICO. E. D. Preston.*
BASE MEASUREMENT. C. W. Fitzgerald.
TRIANGULATION.

The trigonometric survey of the United States Public Health and Marine-Hospital Service Reservation at Fort Stanton, N. Mex., was completed. The positions of the sixty-four "corners" or points where the irregular boundary line changes its direction were determined and permanently marked. Numerous range posts were placed in position between these corners.

A base of verification was measured and check astronomic observations were made and four triangulation stations were occupied.

CHARGE OF SUBOFFICE. CALIFORNIA. A. F. Rodgers.
HYDROGRAPHY.
TOPOGRAPHY.
TRIANGULATION.

The suboffice of the Survey in San Francisco was continued in charge of Assistant Rodgers, who attended to numerous duties, many of them matters of routine, as the representative of the superintendent on the Pacific coast.

A number of officers were temporarily attached to the suboffice at different times during the year, engaged in completing the records of their work in the field. Mr. Rodgers made a hydrographic examination of Ellis Creek, San Francisco Bay, California, and reported its present condition.

In accordance with a request from the Commissioner-General of Immigration, a survey was made of the reservation on Angel Island, San Francisco Bay, for an immigration station, and of the water front off the reservation. The hydrographic work included submarine borings to determine the character of the ocean bottom beneath its surface.

The survey on land included topography and triangulation, and the latter was connected with the triangulation around San Francisco Bay.

The topographic work was done on a large scale and contours were determined at intervals of 5 feet.

ASTRONOMIC OBSERVATIONS. CALIFORNIA. E. Smith.
J. E. McGrath.

The determination of the longitude of Mount Wilson, California, was assigned to Assistants Smith and McGrath, in charge of cooperating parties. Mr. Smith went to Mount Wilson and made observations to determine the latitude December 24 to 29. Mr. McGrath prepared the station at Los Angeles and the observations to determine the longitude of Mount Wilson were made December 31 to January 8. Magnetic

*Died in the service May 2, 1906.

observations were made on Mount Wilson and the astronomic station was connected by triangulation with "Wilson Peak" triangulation station.

Mr. Smith left Mount Wilson on January 10 and made magnetic observations at Los Angeles on January 16, which closed his work in California.

Mr. McGrath connected the astronomic station of 1906, in Los Angeles, with the point previously used for astronomic observations and closed work in California on January 27.

SPEED-TRIAL COURSE. CALIFORNIA.

In response to a request from the Navy Department for the establishment of a speed-trial course off the coast of southern California an officer was instructed to accompany the naval officer representing the Department to the locality proposed and to do the work necessary to comply with the requirements of the case. He reached Goleta on May 9. Old triangulation stations were recovered and others were established. The positions of the range beacons were determined and they were erected. The work was in progress on June 30.

MAGNETIC OBSERVATIONS. WASHINGTON. W. M. Steirnagle.

Stations occupied.

Ellensburg.	North Yakima.	Tacoma.
Hot Springs.	Olympia.	Wilson Creek.
Leavenworth.	Port Orchard.	

Magnetic work in Washington was assigned to Aid Steirnagle. The work began on February 6 and was completed on April 6.

Observations were made to determine the value of the three elements of terrestrial magnetism at the stations mentioned above.

TIDE OBSERVATIONS. CALIFORNIA.
WASHINGTON.

Self-registering tide gages were kept in operation thruout the year, except as stated, at the places mentioned below:

Presidio, Cal.
Redondo, Cal., July 1 to September 27.
San Diego, Cal., January 20 to June 30.
Seattle, Wash.

DIVISION OF ALASKA.

MAGNETIC OBSERVATIONS. ALASKA. B. A. Baird.

Advantage was taken of Assistant Baird's presence at St. Michael, Alaska, to secure a determination of the magnetic declination at that place and the desired observations were made in accordance with his instructions.

HYDROGRAPHY. ALASKA. H. C. Denson, Commanding,
TRIANGULATION. Steamer *McArthur*.

The party on the steamer *McArthur*, with Assistant H. C. Denson in command, was at work in Prince William Sound, Alaska, on July 1. The triangulation was extended from the entrance of Resurrection Bay to Point Basil on Montague Island, an approximate distance of 50 miles, and a hydrographic survey was made of the adjacent waters.

Tide staffs were erected at Smith Island, Discovery Bay, and Hanning Bay to furnish tidal data for the reduction of soundings.

The work in Prince William Sound was completed, as stated above, on August 14, and the vessel sailed at once for Dixon Harbor and reached there on the 21st, having been detained two and one-half days in Yakutat Bay by bad weather. Work began at once, and the survey was continued until September 7, when the *McArthur* proceeded to Chilkat Island, Lynn Canal, via Juneau for coal. Four triangulation stations were recovered and the positions of several dangers to navigation were determined. Three triangulation stations were recovered in the vicinity of Point Sherman Light-house, and preparations were made to determine the position of this light-house and also that of Eldred Rock Light-House, but observations were prevented by stormy weather until it was necessary for the vessel to sail for Seattle in obedience to instructions to arrive there on or before September 30, and the *McArthur* reached Seattle on that day.

HYDROGRAPHY. ALASKA. R. B. Derickson, Commanding,
TRIANGULATION. Steamer *Taku*.

SUMMARY OF RESULTS.

Hydrography:
15 square miles area covered.
79 miles lines sounded.
6 528 soundings made.
3 tide stations occupied.

Triangulation:
30 square miles area covered.
11 stations occupied.
13 geographic positions determined.

Hydrographic work in Alaska was assigned to Assistant Derickson. He began work at Orca on May 29. A sunken rock at the south end of Channel Island, in Orca Bay, was located. The survey of Latouche Passage, at the west end of Prince William Sound, began June 8.

Several old triangulation points were recovered and additional ones were determined.

The hydrographic, topographic, and triangulation work were all in progress on June 30.

HYDROGRAPHY. ALASKA. E. F. Dickins, Commanding,
TOPOGRAPHY. Steamer *Gedney*.
TRIANGULATION.

SUMMARY OF RESULTS.

Hydrography:
28 square miles area covered.
382 miles lines sounded.
10 860 soundings made.
8 tide stations established.
3 hydrographic sheets completed.
Topography:
8 square miles area covered.
70 miles of shore line surveyed.
3 miles of railroad surveyed.
Triangulation:
38 square miles area covered.
12 stations occupied.
5 geographic positions determined.

On July 1 the party on the steamer *Gedney*, with Assistant Dickins in command, was at work in Kassa Inlet on the east side of Cordova Bay. The hydrographic survey of the bay was completed on July 6 and the vessel proceeded to Sitka to obtain the launches *Cosmos* and *No. 117*. The necessary repairs to the launches were completed and the vessel and launches sailed on the 20th for McKenzie Inlet via Wrangell for signal lumber and supplies. The hydrographic survey of this inlet was begun on July 26 and completed on August 1.

The vessel sailed the same day for Hollis Anchorage, and a hydrographic survey of the anchorage was completed on August 2. This work included the determination of the position of a rock which had been found in Twelve Mile Arm. After completing this work the party proceeded to Lyman Anchorage, and a hydrographic survey of the anchorage was completed on August 8. The next day a rock which had been reported as on the south side of Patterson Island at the entrance to Kasaan Bay was located. On August 11 an unsuccessful search was made for a rock reported as being in Behm Canal off the entrance to Traitors Cove. A reef which had been reported as lying off South

Vallenar Point in Clarence Strait was located, and a hydrographic survey of Lake Bay was begun and the work was completed on September 9. In connection with this work, the position of Lincoln Rock Light-house was determined.

In addition to the work mentioned above, the positions of the cannery in Sitkoh and of a reef in the entrance to Rodman Bay were determined, and the vessel sailed for Sitka on September 13, en route to Seattle, where the vessel arrived on September 30.

Stormy weather was encountered on the voyage, and on the 22d the vessel went on a reef in Wrangell Narrows in a fog, and was pulled off apparently uninjured by the steamer *Excelsior*, which appeared soon after the accident.

The *Gedney*, with Assistant Dickins in command, sailed from Seattle on May 25 to resume work in Alaska. The vessel reached Seal Bay, Nichols Passage, on June 4, and the hydrographic survey of the bay was begun the next day and completed on June 8. On June 10 the vessel proceeded to Gibson Anchorage, Kasaan Bay, and made a survey of the anchorage, including hydrography, topography, and triangulation. This work was completed on June 24, and the next day a base line was measured on Pennock Island, to be used in the survey in the vicinity of Ketchikan.

The vessel went to Juneau for coal, and on June 30 was at Killisnoo, where repairs were made to the furnaces.

MAGNETIC OBSERVATIONS. ALASKA. H. M. W. Edmonds.

The work at the Sitka magnetic observatory was continued during the year.

A record of the variations in the relative value of the three elements of terrestrial magnetism was obtained with self-registering instruments and the international program of running the magnetograph at high speed for a specified time on the 1st and 15th of each month was carried out.

Observations were made at least once every week to determine the absolute value of the declination, dip, and horizontal intensity.

Observations for time were not necessary, as time signals were received over the cable.

The seismograph was kept in operation during the year.

The prevailing dampness caused dry rot in the sawdust packing of the observatory building, and extensive repairs were necessary.

An auxiliary building was constructed and observations were made in this building during the time repairs were made to the main building. These repairs were not quite completed at the close of the year.

ASTRONOMIC OBSERVATIONS. ALASKA. W. C. Hodgkins, Commanding,
HYDROGRAPHY. Steamer *Patterson*.
TOPOGRAPHY.
TRIANGULATION.

On July 1 the *Patterson* was at work in the vicinity of Prince William Sound, Alaska. During the season the work mentioned below was done:

Soundings were made from Resurrection Bay to Montague Strait. A search was made for a shoal reported as existing in the fairway of Prince William Sound between Bligh and Glacier islands, but no indication of it could be found.

A topographic reconnaissance was made around the Naked Island group and between Prince William Sound and Resurrection Bay, and some hydrographic work was done in this locality.

Information obtained from the work of the *Patterson*, *Gedney*, and *McArthur* was furnished to the officer of the Signal Corps, U. S. Army, in command of the army cable ship *Burnside*, and an officer (Assistant H. W. Rhodes) was detailed to the *Burnside* to assist in piloting her over the ground surveyed and to determine her position from time to time by observations on signals on shore.

Observations to determine latitude were made at Seward, and time signals were exchanged with Valdez, using the cable to determine the longitude of Seward by the telegraphic method.

The triangulation was extended through Montague Strait and a survey was made of Hanning Bay. During the latter part of September the triangulation of Montague Strait was completed and comparative tide observations were made simultaneously at several stations in the strait.

On October 4 magnetic observations were made on shore at Seward and the ship was swung for magnetic work on October 4 and 5 off Seward.

The *Patterson* reached Controller Bay on October 14, and completed the topographic and hydrographic work assigned to the party on the 24th. She sailed next day for Seattle and reached there on November 7.

The *Patterson* sailed from Seattle on June 13 for Kodiak Island under instructions to make surveys in that region.

HYDROGRAPHY.
MAGNETIC OBSERVATIONS.
TOPOGRAPHY.
TRIANGULATION.

ALASKA.

H. W. Rhodes, Commanding,
Steamer *McArthur*.

SUMMARY OF RESULTS.

Hydrography:
- 33 square miles area covered.
- 139 miles of line sounded.
- 7 573 soundings made.
- 1 tide station occupied.
- 1 hydrographic sheet completed.

Magnetic observations:
- 1 station on land occupied.
- 1 station at sea occupied.

Topography:
- 10 miles of coast line surveyed.
- 1 topographic sheet completed.

Triangulation:
- 11 square miles area covered.
- 5 stations occupied.
- 17 geographic positions determined.

Surveys in Alaska were assigned to Assistant Rhodes, commanding the steamer *McArthur*.

He sailed from Seattle on May 22, and began work in the vicinity of Controller Bay on June 6. Lines of soundings were run around Cape St. Elias to develop the reef extending southward from Pinacle Rock.

A hydrographic reconnaissance was made of the approach to Kayak village and of the waters between Wingham and Kayak islands. Triangulation was extended over the region examined. A topographic survey was made of the adjacent shores. At the close of the year the vessel was at work in Port Chatham.

HYDROGRAPHY. ALASKA. E. C. Sasnett, Commanding,
TOPOGRAPHY. Steamer *Taku*.
TRIANGULATION.

SUMMARY OF RESULTS.

Hydrography:
10 square miles area covered.
341 miles lines sounded.
2 738 soundings made.
Topography:
50 square miles area covered.
114 miles of coast line surveyed.
5 miles shore line of creeks surveyed.
5 miles of roads surveyed.
2 topographic sheets completed.
Triangulation:
143 square miles area covered.
20 stations occupied.

On July 1 the survey of Resurrection Bay was in progress under the direction of Aid E. C. Sasnett, in command of the steamer *Taku*. Triangulation was extended over the bay, and the positions and heights of a number of adjacent mountains were determined.

A hydrographic survey of the whole bay was completed. Particular attention was given to the development of the passages at the eastern entrance to the bay, and all places where safe anchorage in storms could be obtained were examined and surveyed. All shoals were developed and an examination was made of all places where indications of shoals were found.

Surface and bottom temperatures of the water were observed in sounding along the line of the proposed army cable to Seward, the terminus of the Alaska Central Railroad.

The topographic work included the delineation of the shore line and adjacent topography and all rocks lying offshore. In the upper portion of the bay topographic details of the surrounding hills were sketched.

The work in Resurrection Bay closed on September 21, 1905.

ASTRONOMIC OBSERVATIONS. ALASKA. E. Smith.
GRAVITY OBSERVATIONS. J. E. McGrath.
MAGNETIC OBSERVATIONS.

The determination of the longitude of certain places in Alaska was assigned to Assistants Smith and McGrath, in charge of cooperating parties. This work was in progress on July 1 and it was continued until December 2. During this period the observers made observations at Sitka, Valdez, and Eagle (Fort Egbert), and time signals were exchanged with an observer at Seward, who made observations at that place under Assistant Hodgkins's direction.

These observations resulted in determining the telegraphic longitude of the three places mentioned, thus adding important data to the existing geographical knowledge of the region. The station at Eagle (Fort Egbert) is quite near the international boundary line, and will be used in the final determination of the position of that line.

It was necessary to occupy Eagle during the summer months, and the difference of longitude Valdez–Eagle was determined during the period July 18–August 26. From August 20 to 28 time signals were exchanged between Valdez and Seward, and after August 25 between Valdez and Copper Center, the latter work being done at the request of the United States deputy land surveyor in order to determine the longitude of a certain corner in his survey. During this work Mr. Smith was at Eagle and Mr. McGrath at Valdez.

The work at Eagle included observations with pendulums to determine the force of gravity, observations to determine latitude, and magnetic observations. A short base line was measured and the positions of several objects were determined by triangulation and connected with the astronomic station, one of these being Eagle Peak. The azimuth of a meridian mark placed on Eagle Peak was deduced from the time observations made to determine the longitude.

In his report Assistant Smith expresses his appreciation of the courtesy with which he was received by the officers of the military post at Fort Egbert, and states that Maj. E. H. Plummer, the commanding officer, rendered valuable assistance in the work by assigning quarters to the observer, by giving permission to use the cellar under the quarters for the gravity observations, by sending a party to erect the azimuth mark, and by personal assistance at the transit.

Mr. Smith left Eagle on August 28 and reached Sitka on September 7. Unfavorable weather caused serious delay, and the necessary observations to determine the difference of longitude between Sitka and Valdez were not completed until November 25, and the work closed on December 1. During this interval observations were made at Valdez to determine the latitude and the elements of terrestrial magnetism, and the astronomic station was connected with the triangulation. The work closed on December 2.

OUTLYING TERRITORY.

MAGNETIC OBSERVATIONS. HAWAII. S. A. Deel.

Stations occupied.

ISLAND OF HAWAII.

Hilo.	Kilauea.	Napoopoo.
Ka Lae.	Laupahoehoe.	Waimea.
Kapoho.		

ISLAND OF KAUAI.

Hanalei.	Nawiliwili Bay.	Waimea.

ISLAND OF MAUI.

Hana.	Kihei.	Lahaina.
Kahului.		

ISLAND OF OAHU.

Honolulu.	Kahuku.	Waikane.
Kaena.		

The work at the Honolulu Magnetic Observatory was continued during the year. A record of the variations in the relative value of the three elements of terrestrial magnetism was obtained with self-registering instruments and the international program of running the magnetograph at high speed for a specified time on the 1st and 15th of each month was carried out.

Special declination observations were made every minute for six hours during the solar eclipse of August 30, 1905.

The seismograph was kept in operation and a practically continuous record was obtained.

Observations to determine the absolute value of the declination, dip, and horizontal intensity were made on Monday of each week, and the local mean time was determined at intervals of about ten days.

In addition to the regular observatory work, observations were made to determine the value of the three elements of terrestrial magnetism at the stations mentioned above.

Magnetic Observer Nyswander assisted in the observatory work during the year and had charge of the observatory in Mr. Deel's absence.

TIDE OBSERVATIONS. HAWAII.

A self-registering tide gage was in operation at Honolulu thruout the year.

COMBINED OPERATIONS. PHILIPPINE ISLANDS. G. R. Putnam.

The work of surveying the coasts of the Philippine Islands was continued under the direction of Assistant Putnam, who represented the Superintendent in all matters requiring immediate decisions.

In performing this duty he adopted plans for field operations, issued instructions for field work, compiled all data, secured and prepared drawings for charts of the water surveyed. Notices to Mariners were prepared and published. He was aided in this work by such advice and instructions, issued from Washington, as became necessary.

FIELD WORK.

The following is a brief summary of the field work done during the fiscal year:

Guimaras Strait and coast of Negros.—Hydrography and topography, steamer *Research*, July, 1905, W. C. Dibrell, commanding. The work in progress at the beginning of the fiscal year was extended to include the vicinity of Bacolod, the capital of Occidental Negros. The *Research* returned to Manila July 29, after an absence of nearly fourteen months.

Manila Bay to Lingayen Gulf, triangulation thru the central valley of Luzon.—Shore party, July and August, 1905, W. B. Fairfield, chief of party. This work, in progress during the preceding fiscal year, was completed, furnishing a connection between the surveys on the west coast of Luzon and the positions of many intermediate points.

Northeast coast of Samar, vicinity of Laoang.—General survey, hydrography, triangulation, and topography, shore party with chartered launch *Comillas*, July to October, 1905, O. W. Ferguson, chief of party. This work was commenced in the preceding fiscal year and was completed in October. It furnishes the data for a new chart of Laoang Bay, Port Palapag, and vicinity.

East coast of Samar.—General survey, hydrography, topography, and triangulation, steamer *Pathfinder*, July to September, 1905, Ferdinand Westdahl, commanding. This work, commenced in the preceding year, was continued until September 25, when a severe typhoon damaged the vessel so that it had to be towed to Manila. The *Pathfinder* was very close to the track of the storm's center. The barometer on the vessel showed a minimum of 27.16 inches, the lowest ever observed in the Philippines. The work had been completed between the north entrance to Port Libas and about 5 miles north of Apiton Island.

East coast of Luzon, Maqueda Channel, etc.—General survey, hydrography, topography, and triangulation, steamer *Fathomer*, July, 1905, C. C. Yates, commanding; August to November, 1905, W. C. Dibrell, commanding. This work, commenced in the preceding fiscal year, was continued as long as the monsoon season permitted. Maqueda Channel, the area between Lahuy and Catanduanes Islands, the dangers northwest of Catanduanes Island, and a portion of Tagun Bay were completed, some additional hydrography was done south of Catanduanes Island, and a reconnaissance was made of a part of the east coast of Catanduanes.

Verde Island Passage and Tayabas Bay.—General survey, hydrography, topography, and triangulation, steamer *Research*, October, 1905, to April, 1906, D. R. Jewell,

commanding. This work comprised a survey of the anchorage and vicinity of Calapan, Mindoro, of Pagbilao Bay, Port Laguimanoc, Lucena Anchorage, and the coast from Lucena to Batangas Bay, including the eastern part of Verde Island Passage.

West coast of Luzon.—Topography north of Capones Island and triangulation to connect with Subic and Manila Bay triangulation, shore party, November, 1905, to January, 1906, E. B. Latham, chief of party. This work was for the purpose of completing the topography of the Zambales coast as far south as Capones Islands and joining the triangulation along the Zambales coast with that north from Manila Bay and with the longitude station at Subic.

West coast of Leyte, from Villaba to Hilongos.—General survey, hydrography, topography, and triangulation, steamer *Marinduque*, December, 1905, to April, 1906, H. C. Denson, commanding. Besides general survey of the coast, detailed surveys were made of Palompon Harbor, Dupon Bay, Siapon Bay, and the anchorages at Baybay, Inopacan, and Hindang. The offshore hydrography was not completed.

West coast of Luzon, ports Masinloc and Matalvi, Santa Cruz Harbor, and Dasol Bay.—Hydrography, shore party with chartered launch, December, 1905 to May, 1906, C. G. Quillian, chief of party. A detailed hydrography survey was made of Ports Masinloc and Matalvi, additional work was done at Santa Cruz, and a survey of Dasol Bay was completed.

Southwest coast of Mindanao, vicinity of Malabang.—General survey, hydrography, topography, and triangulation, steamer *Fathomer*, December, 1905, to April, 1906, D. B. Wainwright, commanding. This survey extended from Lapitan Point to Tapian Point, and included the development of the reef on which the *Buford* struck, as well as other dangers reported south of Malabang. A survey was made of the north entrance of the Mindanao River as far as Cotabato; a line of deep soundings was run between Flecha Point and Malabang, along the route of the cable. A reconnaissance was made of the coast between Tapian Point and Quidapil Point.

West coast of Luzon, coast of Zambales Province.—Hydrography, steamer *Romblon*, December, 1905, to April, 1906, L. H. Westdahl, commanding. Some additional hydrography was done to complete Palauig Reefs, and the hydrography was completed as far north as the entrance to Santa Cruz, excepting ports Masinloc and Matalvi, which were done by another party. The hydrography was also completed between the Capones Islands and Port Silanguin, and also the topography and triangulation extended along this stretch. Soundings were also made southwest of Los Frailes, proving the nonexistence of reef reported as extending from them.

Southwest coast of Luzon.—Triangulation from Manila Bay entrance thru Verde Island Passage, January to June, 1906, launch *Erica*, O. W. Ferguson, chief of party. This work was carried on with a small chartered launch, and is an extension of the main triangulation, which it is proposed to carry as far south as Mindanao thru the channels between the islands. Many points, islands, mountains, and light-houses are included in the triangulation, the determination of which will greatly aid in the charting of the coast as well as in other surveys. A station was established on the summit of Mount Calavite, on the northwest extremity of Mindoro; the ascent of this mountain was difficult, and its elevation is higher than has been shown.

South and west coasts of Panay Island, from Tigbauan westward to San Jose de Buenavista.—Triangulation and topography, shore party, January to February, 1906,

C. M. Sparrow, chief of party; February to May, 1906, E. B. Latham, chief of party. This work joins on to the former surveys near Iloilo and extends to the southwest extremity of Panay, and thence north along the west coast.

East coast of Luzon, Atimonan to Polillo Island.—General survey, hydrography, topography, and triangulation, steamer *Marinduque*, April to June, 1906, H. C. Denson, commanding. At the end of the fiscal year a survey of Port Lampon had been completed and survey of a harbor on the east coast of Polillo Island was in progress.

Guimaras Strait and north coast of Negros.—General survey, hydrography, topography, and triangulation, steamer *Research*, April to June, 1906, J. B. Boutelle, commanding. At the end of the fiscal year surveys had been completed to Tomonton Point, and the work was in progress.

East coast of Luzon, Daet to Sogod Bay.—General survey, hydrography, topography, and triangulation, steamer *Romblon*, May to June, 1906, L. H. Westdahl, commanding. This work was in progress at the end of the year.

East coast of Luzon, Lahuy Island to Daet.—General survey, hydrography, topography, and triangulation, steamer *Fathomer*, May to June, 1906, D. B. Wainwright, commanding. This work was in progress at the end of the year.

East coast of Samar, Gumay Bay to Bacan Island, and coast south of Port Libas.—General survey, hydrography, topography, and triangulation, steamer *Pathfinder*, May to June, 1906, F. Westdahl, commanding. This work was in progress at the end of the year.

North coast of Samar, Laoang Bay to Cabaun Island.—General survey, hydrography, topography, and triangulation, shore party with chartered launch, June, 1906, C. G. Quillian, chief of party. This work is to fill in the unsurveyed portion of the north coast of Samar, and was commenced at the close of the fiscal year.

North coast of Mindanao, vicinity of Oroquieta, and west shore of Iligan Bay.—General survey, hydrography, topography, and triangulation, shore party, June, 1906, E. B. Latham, chief of party.

West coast of Luzon, entrance to Manila Bay.—Observation of currents, with chartered launch, June, 1906, H. L. Ford, chief of party. A few days' current observations were made in the two channels at the entrance to Manila Bay.

Tidal and magnetic observations.—In addition to the field work above outlined, observations of tides and currents and of the magnetic declination have been made in connection with the other work, and in addition automatic self-registering tide gages have been maintained thruout the year at Manila and at Iloilo.

Survey steamers.—The steamer *Pathfinder* has been at work during the year except the time necessary for repairs necessitated by the damage received in the September typhoon. The vessel was driven ashore on September 25, and towed to Manila, arriving there October 8, 1905. The stern frame had to be removed and sent to Hongkong for rewelding, and a number of plates had to be taken off and straightened or renewed. Owing to unexpected delays in the repairs, the *Pathfinder* was not able to leave Manila for another season's work until February 17.

The steamer *Research* was at Manila from July 29 to September 9, undergoing a thoro overhauling, including calking the hull and a new sheathing of copper. This steamer was again at Manila from April 5 to 28 for docking and minor repairs and outfitting for another season. During the balance of the year the *Research* was continuously on the working ground.

The steamer *Fathomer* was at Manila from November 24 to December 30, 1905, for docking and minor repairs, and outfitting for another season and turning in survey results, and again from April 6 to May 4, 1906, for the same purpose. During the balance of the year the *Fathomer* was continuously on the working ground.

The steamer *Marinduque* was transferred on November 1, 1905, to the Coast and Geodetic Survey, for use in survey work in the Philippines, in pursuance of a resolution of the Philippine Commission of June 23, 1905. The vessel sailed from Manila on December 10, 1905, after being completely outfitted for survey work. Some alterations were made to adapt the steamer for change of service, and necessary repairs were effected. The *Marinduque* was again at Manila from April 10 to 23, 1906, docking, turning in survey results, and outfitting for another season. During the remainder of the year the steamer has been on the working ground.

The steamer *Romblon* was transferred at the same time and under the same arrangement as the *Marinduque*, and after outfitting, alterations and repairs, sailed from Manila December 14, 1905. The *Romblon* was at Manila from April 13 to May 13, 1906, during which time the vessel was docked, repairs and some additional alterations effected, and survey results turned in, and the steamer outfitted for another season. During the rest of the season the steamer has been on the working ground, with the exception of a few days' repairs effected when coming to port for coal.

OFFICE WORK.

Under the existing plan the preliminary office work is completed at Manila, for the reason that much of it can be done to better advantage in the regions concerned than it could be so far away as Washington. The work is done in the following Divisions: Computing, Nautical, Chart Construction, and Correspondence and Property. The Director, in addition to general supervision of these Divisions, prepares specifications for field work and for charts, and examines chart drawings and nautical information prepared for publication.

Computing Division.—The work of this Division comprises the receipt and register of all survey records (not drawings), and the completion of all computations necessary to put the field records in shape for chart construction or other purpose. Where computations are made in the field they are verified. The principal classes of computations are the reduction of tidal observations and planes of reference, reduction of astronomic observations for latitude, longitude, and azimuth, reduction of all soundings to mean ower low water, computation of distances, positions and elevations from triangulation, and computation of magnetic declination.

Data were prepared for the use of field parties in extending surveys, and for the use of the office in plotting hydrographic sheets and preparing charts.

Nautical Division.—The following publications have been prepared and verified:

Notices to Mariners, Nos. 8 to 15 of 1905.

Notices to Mariners, Nos. 1 to 6 of 1906.

Sailing Directions, Section I, North and West Coast of Luzon and adjacent islands, 1906 (third edition).

Sailing Directions, Section II, Southwest and South Coasts of Luzon and adjacent island-from Manila to San Bernandino Strait, 1906 (third edition).

Sailing Directions, Sections VI and VII, Mindoro Strait, Palawan and Sulu Sea and Archis pelago, 1906 (second edition). The two sections will be published together.

Catalog of Charts, Sailing Directions, and Tide Tables of the Philippine Islands, 1906.

The above have been printed and issued with the exception of Sections II and VI and VII, which are in press..

This Division now also has charge of the correction and issue of charts and nautical publications and of furnishing information in response to inquiries regarding charts and sailing directions. Files of charts and other publications concerning the Philippine Islands and adjacent waters are kept as works of reference for those interested.

The Manila office has this year undertaken to examine files of Coast and Geodetic Survey charts sent in from ships, and to make necessary corrections, or to mark charts which are canceled. During the year 23 sets of Philippine charts have been so examined. With the facilities at the office this can readily be done. In almost every set of charts sent in for examination a number were found in use which were obsolete, having been superseded by later charts or editions.

This Division has assisted in the inspection of survey steamers, the preparation of specifications for repairs, the examination of requisitions for supplies for vessels, and the filing of papers and drawings regarding the vessels.

A table of distances between Philippine ports has been prepared, and measurements have been made of the shore line of each island and of the water area of the Islands.

A systematic collection and arrangement of records and information regarding currents has been undertaken.

Distribution of publications.—The following is a summary of the distribution of publications from the Manila office during the past fiscal year. The numbers stated are exclusive of the publications sent to Washington for distribution:

	1906.
Charts:	
Sold	1 774
Official use	5 841
Total	7 615
Tide tables	133
Sailing Directions, Philippine Islands	1 200
Notices to Mariners, Philippine Islands	9 500
Chart Catalogs, Philippine Islands	400

Chart Construction Division.—The work of this Division includes the preparation of drawings for new charts and new editions of charts, the completion of unfinished field sheets, as the inking of topographic sheets and the plotting of hydrographic sheets, the preparation of projections for field parties, and of various miscellaneous drawings required, the examination and verification of hydrographic sheets, the examination and registry of all survey sheets, and the verification of chart drawings.

The following drawings for charts or for extensive corrections have been completed in Manila during the fiscal year and forwarded to Washington for printing, comprising 12 new charts, 5 complete new drawings for new editions, 7 extensive additions for new editions; total, 24 charts or new editions:

No. 4266. Ports Masinloc and Matalvi.
No. 4255. Manila Bay (additions for new edition).
No. 4254. Harbors of Burias Island (additions for new edition).
No. 4243. Manila and Cavite Anchorages (new edition).
No. 4233. Pasig River, upper part.
No. 4459. Capiz to Calibo.
No. 4418. Southeast Masbate.

No. 4208. Solvec Cove to San Fernando.
No. 4246. San Fernando Harbor (new edition).
No. 4613. Iligan Bay (additions for new edition).
No. 4711. Northern Luzon (new edition).
No. 4342. Halsey Harbor (new addition).
No. 4714. Mindoro, etc. (additions for new edition).
No. 4259. Rapurapu Strait (new edition).
No. 4309. Balabac Strait.
No. 4512. Samales Islands.
No. 4544. Siasi and Lapac islands.
No. 4220. San Bernandino Strait.
No. 4647. Agusan River entrance.
No. 4715. Southeastern Luzon (new edition).
No. 4713. East coast of Luzon (new edition).
No. 4460. Iloilo Strait.
No. 4712. West coast of Luzon (new edition).
No. 4543. Isabela Channel.

Drawings were prepared for a base map of the Philippine Islands and a chart index map, both of which have been published.

Joint arrangement.—During the year the work has been done under the same general plan of division of expense as previously and in accordance with the additional arrangement made as to the operation of the two steamers, transferred by the resolution of the Philippine Commission of June 23, 1905, and as authorized by the national authorities. The United States has paid the salaries and subsistence of its technical corps detailed for this duty, including several experts in the office, has furnished instrumental equipment, has paid the expenses of one large surveying steamer, supplies for two other surveying steamers, chart publication, traveling expenses to and from the Philippine Islands, and hire of launches. The Philippine government has paid the operating expenses of two surveying steamers and the crew and repairs of two other surveying steamers (not including officers), the contingent expenses of several shore parties, the office force locally employed, office supplies obtained in Manila, and has furnished office accommodations and printing.

Valuable information has been received from many sources, including the Commander in Chief of the United States Asiatic Fleet, Bureau of Port Works, Bureau of Navigation, Chief Engineer of the Philippine Division, Military Information Division, Bureau of Public Works, City Engineer of Manila, officers of merchant vessels, and others. In response to request and inquiries, special information has been supplied to many offices and persons.

HYDROGRAPHY.
RECONNAISSANCE.
TOPOGRAPHY.
TRIANGULATION.

PHILIPPINE ISLANDS. J. B. Boutelle, Commanding, Steamer *Research*.

SUMMARY OF RESULTS.

Hydrography:
149 square miles area covered.
607 miles lines sounded.
15 198 soundings made.
1 tide station occupied.
3 hydrographic sheets completed.

Reconnaissance:
280 square miles area covered.
5 triangulation stations selected.
Topography:
21 square miles area covered.
48 miles of coast line surveyed.
2 miles of shore line of rivers surveyed.
5 miles of shore line of creeks surveyed.
12 miles of roads surveyed.
2 topographic sheets completed.
Triangulation:
280 square miles area covered.
5 stations occupied.
16 geographic positions determined.

The extension of the survey of Guimaras Strait northward from the vicinity of Iloilo was assigned to Assistant Boutelle, and he sailed from Manila for Iloilo on April 28. The work began on May 1 and was in progress on June 30.

The triangulation was extended to Calabazas Light-house, 25 miles north of its former limit. The topography covered the adjacent shores of Negros and Panay, and the hydrography was completed to a line running north from Tomonton Point and east from Banate.

BASE MEASUREMENT. PHILIPPINE ISLANDS. H. C. Denson, Commanding,
HYDROGRAPHY. Steamer *Marinduque*.
TOPOGRAPHY.
TRIANGULATION.

SUMMARY OF RESULTS.

Base measurement:
3 base lines measured.
Hydrography:
784 miles lines sounded.
29 180 soundings made.
3 tide stations occupied.
Topography:
104 miles of shore line surveyed.
Triangulation:
32 stations occupied.

The survey of a portion of the west coast of Leyte was assigned to Assistant Denson, commanding the steamer *Marinduque*. The work began in the vicinity of Ormoc on December 17, 1905, and was continued until April 7, 1906. The survey, including triangulation, topography, and hydrography, covers the west coast of Leyte from Villaba to Ormoc and Hilongos, where it joins the work previously done by the party on the *Pathfinder* and completes the survey of the west coast of Leyte, south of Villaba. Surveys in detail were made of Palompon Harbor, Dupon Bay, and Mattang Bay, and the anchorages off Baybay, Inocapan, and Hindang. Base lines were measured and connected with the triangulation at Palompon and Dupon.

The geographic positions determined were based upon the astronomic station at Ormoc.

The hydrographic work was all inshore, extending only half a mile from the shore line. Tide staffs were erected at Dupon Bay and Baybay and were used in connection with a self-registering gage at Palompon.

The *Marinduque* sailed from Manila on April 23 and reached Atimonan, east coast of Luzon, on the 28th. Field operations were immediately begun and were in progress off the east coast of Polillo Island on June 30.

HYDROGRAPHY. PHILIPPINE ISLANDS. W. C. Dibrell, Commanding,
MAGNETIC OBSERVATIONS. Steamer *Research*.
TOPOGRAPHY.

SUMMARY OF RESULTS.

Hydrography:
17 square miles area covered.
194 miles lines sounded.
4 670 soundings made.
1 tide station established.
1 hydrographic sheet completed.
Magnetic observations:
1 station occupied for declination.
Topography:
28 square miles area covered.
10 miles of general coast line surveyed.
5 miles of creeks surveyed.
10 miles of roads surveyed.
1 topographic sheet completed.

The survey of Guimaras Strait was in progress on July 1 under the direction of Assistant W. C. Dibrell, commanding the steamer *Research*, and work was continued until July 25, when field work was suspended and the vessel started to Manila via Iloilo.

Repairs were made to the vessel between July 1 and 15, and field work was resumed on the 16th, but rain prevented work from the 17th to 20th. During the following four days the topography and hydrography were extended from Bacolod, Negros, to a point about 3 miles to the north, the hydrography extending to the middle of the strait, and some magnetic observations were made at one station to determine the declination.

HYDROGRAPHY. PHILIPPINE ISLANDS. W. C. Dibrell, Commanding,
MAGNETIC OBSERVATIONS. Steamer *Fathomer*.
TOPOGRAPHY.
TRIANGULATION.

SUMMARY OF RESULTS.

Hydrography:
767 square miles area covered.
2 594 miles of lines sounded.
35 009 soundings made.
3 tide stations established.
7 hydrographic sheets completed.

Magnetic observations:
1 station occupied on land.
1 station occupied at sea.
Topography:
54 square miles area covered.
62 miles of coast line surveyed.
2 miles of shore line of rivers surveyed
4 topographic sheets completed.
Triangulation:
16 square miles area covered.
6 stations occupied.
5 geographic positions determined.

On July 1 the survey of the southeastern coast of Luzon in the vicinity of Maqueda Channel was in progress under the direction of Assistant C. C. Yates, commanding the steamer *Fathomer*.

On August 9 the triangulation had been extended from the triangulation of Lagonoy Gulf along Maqueda Channel as far north as Palumbanes Islands and as far west as Masnou and Lunguipao islands.

The topographic survey of the west coast of Catanduanes Island had been finished as far as Pandan Point, and on the coast of Luzon from Rungus Point to a point 3 miles west of Caramuan Point.

Assistant Dibrell relieved Assistant Yates of the command of the *Fathomer* on August 9, and continued the work in accordance with the original plan.

A self-registering tide gage was kept in operation in Gituma River until the middle of September, when it was moved to Tabgon Bay, a sheltered locality on the coast of Luzon west of Lunguipao Island, and kept in operation in that place during the remainder of the season.

The hydrographic survey of Maqueda Channel was completed north of Rungus Point, and was extended to cover the waters west of Catanduanes Island to a line north and south thru Lahuy Island and to a point 10 miles north of Catanduanes Island. Some hydrographic work was also done in the vicinity of Virac Point, on the south end of Catanduanes Island, including a portion of Virac Bank.

A topographic survey was made of the shores of Pandan Bay and of the coast of Luzon in the vicinity of Tabgon.

The topographic survey of the islands to the eastward of Quinabugan was completed, with the exception of the west coast of Lahuy Island. Unfavorable weather caused a suspension of the field work on November 17, on which date the vessel sailed from Tabgon Bay for Manila via Legaspi. Legaspi was used as the base of supplies during the season, and one return trip to the working ground was made by way of the east coast of Catanduanes Island and a running reconnaissance was made of that coast.

ASTRONOMIC OBSERVATIONS. PHILIPPINE ISLANDS. W. B. Fairfield.

BASE MEASUREMENT.

TRIANGULATION.

On July 1 the work of extending the primary triangulation along the central valley of Luzon from Manila to Lingayen Gulf was in progress under the direction of Assistant Fairfield.

The triangulation was completed, and a base line was measured on the south shore of Lingayen Gulf in the vicinity of Lingayen. Azimuth observations were made at the eastern end of the base line. Heavy rains and the flooded condition of the country materially delayed the progress of the work, but all the work was completed by August 28, and the party returned to Manila.

ASTRONOMIC OBSERVATIONS. PHILIPPINE ISLANDS. O. W. Ferguson.
HYDROGRAPHY.
TOPOGRAPHY.
TRIANGULATION.

SUMMARY OF RESULTS.

Astronomic observations:
1 azimuth determined.
Hydrography:
39 square miles area covered.
782 miles lines sounded.
28 443 soundings made.
1 tide station occupied.
4 hydrographic sheets completed.
Topography:
45 square miles area covered.
15 miles of general coast line surveyed.
15 miles of shore line of rivers surveyed.
15 miles of shore line of creeks surveyed.
7 miles of roads surveyed.
5 topographic sheets completed.
Triangulation:
4 040 square miles area covered.
68 stations occupied.
209 geographic positions determined.

On July 1 field work was in progress on the coast of Samar in the vicinity of Laoang, under the direction of Assistant Ferguson. The work continued until October 24, when the survey was completed and the party returned to Manila.

The triangulation was extended from Cajogan Island to Bacan Island and the hydrography from a point 4 miles west of Laoang Island to Bacan Island. The hydrographic work covers the shoals and all the entrances to Laoang Bay. The topographic work covers 40 miles of general coast line, including a portion of the northern coast of Samar and the adjacent islands of Batag, Laoang, Cahayagan, Dernasan, Boring, Cuyon, Calacan, and Pallajan.

The party was at Calomutan, on September 25, during the great typhoon which demolished every house in the town about 9.30 in the evening, leaving the inhabitants exposed to the fury of the storm until morning.

The commanding officer of the United States army post at Laoang extended many courtesies to the party and rendered material assistance in facilitating the progress of the work.

In January several old triangulation stations were recovered in the vicinity of the entrance to Manila Bay and a connected scheme of triangulation was extended to include the Verde Island Passage. All the old stations that could be recovered were connected with the scheme and the positions of several mountain peaks were determined. This work covers several detached surveys previously made in this locality, including the surveys at Calapan and in Tayabas Gulf, and was extended to a point 47 miles beyond Verde Island. The geographic positions of the following light-houses were determined, viz: Corregidor, Caballo, Cabra, Santiago, Escasceo, Calapan, and Malabrigo.

Observations were made to determine objects in Subang, Balayan, Taal, Bauan, Rosario, San Jose, Calapan, and Baac. Provision was made for the extension of the triangulation at various points.

The work was in progress on June 30.

ASTRONOMIC OBSERVATIONS. PHILIPPINE ISLANDS. D. R. Jewell.

BASE MEASUREMENT.

HYDROGRAPHY.

TOPOGRAPHY.

TRIANGULATION.

SUMMARY OF RESULTS.

Astronomic observations:
1 azimuth determined.
Base measurement:
4 base lines measured.
Hydrography:
315 square miles area covered.
2 100 miles of lines sounded.
34 032 soundings made.
4 tide stations occupied.
5 hydrographic sheets completed.
Topography:
406 square miles area covered.
156 miles of coast line surveyed.
31 miles of roads surveyed.
6 topographic sheets completed.
Triangulation:
750 square miles area covered.
74 stations occupied.
120 geographic positions determined.

Surveys of the coast in the vicinity of Calapan, Mindoro, and Lucena, Luzon, were assigned to Assistant Jewell, commanding the steamer *Research*.

He began work at Calapan on September 19, and on October 19 had completed a general survey of the harbor and approaches and the extension of the work to a junction with the survey, already completed, of Port Galera.

The vessel then proceeded to Lucena, Luzon, and began work at Point Pinacapalauan.

A general survey was made along the coast to the westward to a junction with the work already completed in Batangas Bay.

This work was completed on April 4, and the vessel returned to Manila.

TOPOGRAPHY. PHILIPPINE ISLANDS. E. B. Latham.
TRIANGULATION.

SUMMARY OF RESULTS.

Topography:
232 square miles area covered.
110 miles of general coast line surveyed.
22 miles of shore line of rivers surveyed.
118 miles of roads surveyed.
7 topographic sheets completed.
Triangulation:
1 075 square miles area covered.
55 stations occupied.
136 geographic positions determined.

The extension of the triangulation and topography in the vicinity of San Felipe, Luzon, was assigned to Assistant Latham, and he reached that place on November 11. Two of the old stations were recovered and the triangulation was extended along the coast to the Capones Islands and across the peninsula to Subic Bay, and thence to a connection with the triangulation in the interior. The work included a connection with the astronomic station at Subic.

The topography was extended from the limit of the work previously completed in the vicinity of Cabangan, along the immediate shore line to the Capones Islands. The topography includes the survey of the Capones Islands. This work was completed on January 18.

On February 8 Assistant Latham reached Guimbal, Panay, and took charge of the work in that vicinity. The triangulation and topography was extended along the coast to San Jose, and a connection was made with the astronomic station at that place. Field work closed on May 31 at San Jose.

HYDROGRAPHY. PHILIPPINE ISLANDS. C. G. Quillian.

SUMMARY OF RESULTS.

1 020 miles lines sounded.
55 010 soundings made.

Hydrographic work in ports Masinloc and Mataloc and in Dasol Bay on the west coast of Luzon was assigned to Assistant Quillian. He reached Iba on December 15, and the work continued until February 14, when the survey was completed. The work was based upon triangulation previously completed and some additional signals which were determined by intersections from the old stations.

The party reached Santa Cruz on February 19. A tide gage was erected and a number of old triangulation stations were recovered.

The hydrographic work was completed during the period March 12 to May 12. The portion of Santa Cruz Harbor not previously surveyed was completed, and lines 300 meters apart were sounded over the remaining portion of the bay.

The weather conditions were very favorable during the morning hours, but in the afternoon the work was often delayed and made difficult by a strong wind from the northwest.

TIDE OBSERVATIONS. PHILIPPINE ISLANDS.

Self-registering tide gages were in operation at Manila and Iloilo thruout the year.

ASTRONOMIC OBSERVATIONS. PHILIPPINE ISLANDS. D. B. Wainwright, Commanding Steamer *Fathomer*.
BASE MEASUREMENT.
HYDROGRAPHY.
MAGNETIC OBSERVATIONS.
TOPOGRAPHY.
TRIANGULATION.

SUMMARY OF RESULTS.

Astronomic observations:
1 azimuth determined.
Base measurement:
1 base line measured.
Hydrography:
70 square miles area covered.
598 miles lines sounded.
39 miles lines sounded (deep sea).
13 355 soundings made.
6 soundings made (deep sea).
1 tide station occupied.
6 hydrographic sheets completed.
Magnetic observations:
1 station occupied.
Topography:
47 square miles area covered.
59 miles of coast line surveyed.
12 miles of shore line of rivers surveyed.
2 miles of roads surveyed.
5 topographic sheets completed.
Triangulation:
130 square miles area covered.
17 stations occupied.
32 geographic positions determined.

The survey of the western coast of Mindanao Island between Tapian and Lapitan points was assigned to Assistant Wainwright, commanding the *Fathomer*.

He reached Parang on January 7. The astronomic station was recovered and a base line was measured on the east shore of Polloc Bay. The triangulation was extended from the astronomic station and the base line to the entrance of the bay and thence across to Bongo Island and up and down the coast.

Observations to determine an azimuth were made at the north end of the base. A self-registering tide gage was established on a wharf at Polloc and a record was obtained covering a period of nearly three months. A topographic survey was made within the following general limits: Lapitan Point to Tugupangan Point, Bongo Island; Timako Hill to Manangula Point; and along the northern branch of the Rio Grande of Mindanao.

The hydrographic work was done within the general limits named below:

Lapitan Point to Tugupangan Point; Lapitan Point to Bongo Island, vicinity of Tapian Point and Bongo Island; and Tapian Point to Manangula Point.

All this work was in Illana Bay.

The determination of Parang and Malabang showed that they were located on the published charts considerably out of their true position. Work was discontinued on April 2 and the vessel returned to Manila.

On May 4 the *Fathomer* sailed from Manila for the east coast of Luzon, and during the remainder of the fiscal year was at work along the coast from Lahuy Island to San Miguel Bay, extending the hydrography, topography, and triangulation.

ASTRONOMIC OBSERVATIONS. PHILIPPINE ISLANDS. F. Westdahl, Commanding,
BASE MEASUREMENTS. Steamer *Pathfinder*.
HYDROGRAPHY.
MAGNETIC OBSERVATIONS.
TOPOGRAPHY.
TRIANGULATION.

SUMMARY OF RESULTS.

Astronomic observations:
- 2 azimuths determined.
- 2 latitudes determined.
- 2 longitudes determined (chronometric).

Base measurement:
- 2 base lines measured.

Hydrography:
- 199 square miles area covered.
- 1 583 miles lines sounded.
- 50 729 soundings made.
- 7 tide stations occupied.
- 8 hydrographic sheets completed.

Magnetic observations:
- 1 station occupied.

Topography:
97 square miles area covered.
183 miles of general coast line surveyed.
12 miles of shore line of rivers surveyed.
7 miles of shore line of creeks surveyed.
9 miles of roads surveyed.
7 topographic sheets completed.
Triangulation:
205 square miles area covered.
37 stations occupied.
91 geographic positions determined.

On July 1 the *Pathfinder* was at work at Hilaban Island, east coast of Samar, and the work was continued whenever the weather and other conditions permitted until September 25. On this date the vessel was driven ashore by a typhoon and severely injured, which required a return to Manila for repairs as soon as possible.

Considerable delay during the season resulted from the necessity of having a military escort for the parties on shore and from the long distance to be traveled in going to Cebu for coal and supplies. While on the way to and from Cebu additional reconnaissance work was done on the east coast of Samar. While the ship was in Cebu Harbor early in July a close examination was made of two shoal spots not shown by the former survey, and on the return voyage to the working ground a running reconnaissance was made along the north coast of Samar.

The topographic work was along shore from Cabra Point to Cannomanda Point and from Bunga Point to a point 3 miles to the north. The hydrographic work was done within the limits stated below:

Dolores to Canaoid and Pasig Island, Pasig Island to Sulat Harbor, Apiton Island to Alugon Bay, and Port Libas to San Ramon.

The *Pathfinder* reached Davao, Mindanao, on February 21, and the work of surveying the Gulf of Davao began immediately.

An astronomic station was selected and observations to determine time, latitude, and azimuth were made. The longitude was determined from Zamboanga by the chronometric method. A base line was measured and progress was made in the topographic, hydrographic, and triangulation work whenever the weather permitted until April 2, when the survey of the upper portion of the Gulf of Davao was completed. On April 3 the vessel proceeded to Casilaran Bay and landed a party to begin work while the vessel went to Zamboanga for coal. A running reconnaissance was made of the coast going to and returning from Zamboanga. The vessel reached Casilaran Bay on April 12, and on the 18th the survey of the bay and approaches was completed. Observations to determine time, latitude, and azimuth were made at Malalog.

The vessel returned to Davao, making a reconnaissance of the coast on the way and taking soundings at intervals of 2 miles until the limit of the survey off Davao was reached.

Work in this vicinity was resumed, and the survey of the most important portion of Pakiputan Strait was completed by April 30, and the ship sailed at once for Zamboanga, making a reconnaissance of the coast on the way.

The vessel reached Hilaban Island, east coast of Samar, on May 9, and the survey of this region was resumed and continued during the remainder of the fiscal year. Surveys were made along the coast from Alugan Bay to Helm Bay, and the triangulation was extended a little beyond these limits. On June 30 the vessel was at work on the survey of Gumay Bay.

HYDROGRAPHY. PHILIPPINE ISLANDS. L. H. Westdahl, Commanding,
TOPOGRAPHY. Steamer *Romblon*.
TRIANGULATION.

SUMMARY OF RESULTS.

(West coast of Luzon.)

Hydrography:
94 square miles area covered.
1 195 miles lines sounded.
Topography:
12 square miles area covered.
18 miles of shore line surveyed.
Triangulation:
53 square miles area covered.
7 stations occupied.

Hydrographic work on the west coast of Luzon was assigned to Assistant Westdahl, commanding the steamer *Romblon*. He sailed from Manila Bay on December 15 and proceeded to Port Masinloc. A self-registering tide gage was established and signals were erected along the coast from Luan Island to Iba Point. Sounding work began on December 23 and was continued without interruption until January 24, when the development of the reefs off Iba and Palauig Point was completed. Work was then suspended to land coal for the use of a party working on shore and to obtain an additional supply from Manila. The vessel resumed work on February 6 and the hydrographic work from Palauig Bay to the Hermanos Islands, including the approaches to the islands, was completed. The triangulation, hydrographic, and topographic work was extended along the coast from Port Silanguin to Capones Island and this work was completed on April 12, on which date work was suspended in order to take up work on the east coast of Luzon between Daet and Dagdap Point, including the off-lying islands and the passage inside Canimo Island to San Miguel Bay. This work began on May 21 and was in progress on June 30. A tide staff was erected at Port Mercedes at the entrance of Daet River and half-hourly observations were made, day and night, during June. On June 30 the topographic and hydrographic work had been completed to Quinamanuea Island and the triangulation had been extended to cover the Calaguas group of islands and Maculabo Island.

HYDROGRAPHY. PORTO RICO. R. L. Faris.
MAGNETIC OBSERVATIONS.

SUMMARY OF RESULTS.

1 927 miles lines sounded.
23 317 soundings made.
1 tide station occupied.
6 hydrographic sheets completed.

Hydrographic work off the south coast of Porto Rico was assigned to Assistant Faris, commanding the steamer *Explorer*, and the vessel sailed from Baltimore on January 4.

Magnetic observations were made on shore at Baltimore before starting, and observations were also made in the bay off Baltimore and off Norfolk and at sea on two days while en route to Porto Rico. At Fajardo Roads observations were made at sea and on shore, and also off the south coast of Porto Rico near Muertos Island.

During the season observations were made on shore in Rincon Bay and at Port Real, Vieques Island, with the ship's dip circle and with the theodolite magnetometer. Observations were made on shore at Fajardo at the close of the season and en route to Baltimore, whenever the weather permitted, on a course about 100 miles to the eastward of the usual track, in latitude 30° N.

The vessel reached Ponce on January 20, and on the 22d a self-registering tide gage was installed at Ponce and hydrographic signals were erected. The hydrographic work began in the vicinity of St. Isabel Landing on January 22 and was continued until May 23. The work extended along the south coast of Porto Rico from Cape Rojo to Port Ferro, Vieques Island, and included inshore and offshore (deep sea) work. From the shore to the 100-fathom curve the unsurveyed waters between previous surveys were covered, and numerous shoals discovered in the progress of the work were developed by soundings. The 100-fathom curve was defined along the entire distance covered.

The deep-sea work covers the coasts of the islands of Porto Rico and Vieques and extends offshore to an average depth of 1 800 fathoms.

The work was delayed by the inferior quality of the coal obtained at San Juan and by the unusually strong trade winds that prevailed in February and May.

MAGNETIC OBSERVATIONS. PORTO RICO. J. W. Green.

The work at the magnetic observatory at Vieques, P. R., was continued during the year without interruption. The registration of the relative force of the three elements of terrestrial magnetism was continuous except for brief periods during which it was necessary to adjust the instruments. On the 1st and 15th of each month the international program of rapid registration was carried out and, with one exception, observations were made twice each week to determine the absolute value of the declination and the horizontal and vertical intensity.

The seismograph was kept in continuous operation, meteorological observations were made every day, and time observations were made once every week.

Special observations were made to determine the value of the declination in connection with the solar eclipse on August 30, 1905.

SPECIAL DUTY.

VERMONT–NEW HAMPSHIRE–MAINE AND CANADA BOUNDARY. J. B. Baylor.

The joint examination of the northeastern boundary of the United States was in progress on July 1, under the direction of Mr. O. H. Tittmann, Superintendent Coast and Geodetic Survey, and Mr. W. F. King, Chief Astronomer, Dominion of Canada. Assistant J. B. Baylor and Mr. G. C. Rainboth, D. L. S., had charge of the work in the field as representatives of the United States and Canada, respectively, and made the examination in person.

Work was being done in the vicinity of Philipsburg, Canada, on July 1, and the examination was continued until August 22 to a point 10 miles west of Richford, Vt. From August 23 to September 1 Mr. Baylor was engaged in locating the boundary (on the ground) between Beebe Plain and Derby Line, Vt., for the purpose of determining the national location of the buildings on or near the line between these places. In the case of factory buildings situated on the boundary line, the location of the boundary was marked by bands of red paint on the east and west sides of such buildings. This work was done for the Treasury Department, at the request of the Secretary of State, to aid in enforcing the revenue laws of the United States.

The examination of the boundary was resumed on September 1 and continued until October 22, when the field work closed for the season. During this time the line was examined along the boundary of New Hampshire and Maine, including the line along St. John River and thence to St. Croix River.

While engaged in this work Assistant Baylor was accompanied by Mr. G. C. Rainboth, D. L. S., a representative of the Canadian government, and the examination was made conjointly by these representatives of the governments concerned.

LEWIS AND CLARK CENTENNIAL EXPOSITION. Wm. Eimbeck.

The Coast and Geodetic Survey maintained an exhibit, with Assistant Eimbeck in charge, at the Lewis and Clark Centennial Exposition at Portland, Oreg., from July 1 to October 15, as a part of the exhibit of the Department of Commerce and Labor.

TRIANGULATION. NEW YORK. A. T. Mosman.

The trigonometric survey of Greater New York was continued by the city authorities under the direction of Assistant Mosman. During the year an area of 400 square miles was covered by the extension of the reconnaissance, and in this area 150 triangulation stations were selected. The area covered by triangulation was extended

to include an additional area of 323 square miles. Eighty-five triangulation stations were occupied, and 115 geographic positions were determined. The field work in the Borough of Brooklyn was completed. The approximate area of this borough is 64 square miles, and within this area are included 47 determined points and 1 measured base line.

At the close of the fiscal year a considerable portion of the area of the Borough of Richmond had been covered and the work was in progress.

MISSISSIPPI RIVER COMMISSION. H. P. Ritter.

Assistant Ritter continued on duty as a member of the Mississippi River Commission during the year.

Between November 16 and 28 he attended a meeting of the Commission in St. Louis, Mo., and went on a low-water inspection trip to New Orleans. April 1 to 16 he performed similar duty on the high-water inspection trip, and he attended the annual business meeting of the Commission at St. Louis, June 16 to 22. During the remainder of the year he performed all the duties required of a member of the Commission.

SPEED TRIAL COURSE. DELAWARE.

DELAWARE BREAKWATER

In response to a request from The William Cramp & Sons Ship and Engine Building Company, an officer was sent to examine and put in order the Delaware Breakwater Speed Trial Course, off Lewes, Del. This work was done, at the expense of the company, to meet the requirements of the Navy Department.

ALASKA BOUNDARY. O. H. Tittmann.

The work of tracing and marking the boundary line between Alaska and Canada, as laid down by the Alaska Boundary Tribunal, was continued by O. H. Tittmann and W. F. King, Commissioners of the United States and Great Britain, respectively.

The following work was done, as directed by the Secretary of State, under the immediate supervision of the United States Commissioner:

During the season of 1905 three parties were at work—one on the Unuk River, in charge of Fremont Morse; one on the Chilkat River, under J. A. Flemer; and one at the head of Lynn Canal, under O. M. Leland.

On the Unuk River a base line and azimuth were measured and the triangulation was extended from Burroughs Bay to the boundary line.

The positions of nine mountain peaks were determined, five on the north and four on the south side of the river.

The positions of five boundary peaks were determined by triangulation: 7700, 6650, and 6450 south of the river and 6200 and 6500 north of the river.

Six permanent monuments were placed in position on the boundary—one on Peak 6200, one on the slope of this peak, one on the north bank and one on the south bank

of the Unuk River, one on the crest of the first ridge south of the river, and one on the crest of a ridge 1½ kilometers south of the river. An area of 400 square miles was covered by phototopographic reconnaissance.

Acknowledgment is made of the valuable assistance rendered by the officers of the Unuk River Mining, Smelting and Transportation Company, which made it possible to complete the triangulation from Burroughs Bay to the boundary line during the season.

The triangulation on the Chilkat River was extended to the boundary where it crosses the headwaters of the river and the positions of several of the boundary peaks were determined. The boundary between Peaks Nos. 48 and 49 (6850 and 6700) was indicated by stakes, and a vista was opened across the valley of the Tahini (west branch of the upper Chilkat) for a distance of 2½ miles. Five boundary monuments were placed in position on this section, one on the east bank of the Tahini River, one on the west bank of this river, and three others at irregular intervals west of the river, the last one being a little more than halfway between Peaks Nos. 48 and 49.

One hundred and seventy square miles in the vicinity of the Chilkat River was covered with phototopographic reconnaissance.

In the vicinity of Skagway the line was marked across the valley of the main Skagway River between Peaks 6750 and 6600. An avenue was cut thru the timber in this valley for a distance of 1 mile, and this vista was cleared of logs and brush. Several of the boundary peaks were connected by triangulation with the triangulation already completed on Lynn Canal, and two of these peaks, 5550 and 6750, were occupied as triangulation stations. This triangulation extends up the Taiya River to Taiya Pass. A phototopographic reconnaissance was made of the vicinity of the boundary between Peaks 5550 and 6600.

Monuments were placed in position as follows: One on the north bank of the main Skagway River, one on a high bluff across the river to the southward, one on top of Peak 6750, and one on Peak 5550. The line across White Pass was marked by four monuments. The actual distance along the boundary covered by the work is about 20 miles. The completed line extends from Peak 5550, adjacent to Chilkoot Pass, across White Pass to Peak 6750.

At the close of the year three parties were at work on the boundary—one in the vicinity of the Chilkat River, one in the vicinity of White Pass, and one in the vicinity of Yakutat Bay.

NORTHWEST BOUNDARY. O. H. Tittmann.

On July 1 the work of re-marking the boundary line between the United States and Canada was in progress, under the direction of the Department of State, with Messrs. O. H. Tittmann, Superintendent Coast and Geodetic Survey, and C. D. Walcott, Director of the United States Geological Survey, as Commissioners representing the United States. Mr. W. F. King, Chief Astronomer of the Canadian Department of Interior, took part in this work as the Commissioner of Great Britain. Messrs. C. H. Sinclair and E. C. Barnard were assigned to the immediate charge of the work in the field, representing the United States Commissioners, and the following statement covers the work done by the parties under them during the season of 1905:

A triangulation party was organized at Gateway, Mont., about the middle of May, and after determining trigonometrically 7 boundary monuments in that section, and setting 4 monuments to complete the gap between Frozen Lake and the West Fork of the Yaak River, it was transferred to the Rocky Mountains, where it completed the observations in the most easterly quadrilateral that carried the triangulation to the terminus of the boundary work. It then moved to the west of the Yaak River and determined 20 monument locations between that river and Porthill. These determinations were made by developing subordinate schemes from the main scheme of triangulation.

Another triangulation party was organized at Loomis, Wash., June 1 and extended the work to the westward of the Skagit River, reoccupying the necessary stations of the preceding season and locating a number of boundary monuments.

A monumenting party was organized at Belton, Mont., early in June, from which place it moved 50 miles north to the boundary and set 15 monuments between the summit of the Rocky Mountains and Frozen Lake, a distance of 26.5 miles. The party then went west of the Yaak River and set 22 monuments that completed the marking from the summit of the Rocky Mountains to Porthill, a distance of 110 miles. A monument was also set a Laurier, Wash., to mark the railroad crossing.

A double monumenting party was organized at Loomis, Wash., in June and set 38 monuments between the Similkameen and the Skagit rivers, a distance of 61 miles.

The work of 1905 completed the marking of 200 miles of boundary, undertaken by the United States, by 130 aluminum-bronze monuments, set in concrete. Of the 409.5 miles of boundary between Point Roberts and the summit of the Rocky Mountains there are 11 miles of water across Simiamoo Bay.

A topographic party was organized at Loomis in October and completed a belt 12 miles long and 2 miles in width on the United States side of the boundary between the Similkameen River and Lake Osoyoos.

In June a magnetic observer undertook to determine the magnetic elements along the boundary from Point Roberts to the summit of the Rocky Mountains, 409.5 miles, but on account of snowstorms he omitted the last three eastern stations. He occupied 24 stations, covering 366 miles of boundary, at an average distance apart of 15.3 miles.

During the month of May a leveling party was organized at Meyers Falls, Washington, and carried a line of levels to the boundary at Waneta and checked back to Meyers Falls, a distance of 90 miles. Fifteen permanent and 40 temporary bench marks were located.

In September a line of levels was run from the boundary at the Pasayten River to Barron, a distance of 27.5 miles, to check the work of 1904.

SUMMARY OF RESULTS.

Sites for monuments permanently fixt	18
Aluminum bronze monuments set	80
Monuments located by triangulation	35
Miles of boundary monumented	127
Stations occupied for triangulation	66
Miles of triangulation executed, linear	71
Miles of levels run	117.5
Bench marks located, permanent	16
Topography executed, square miles	25
Magnetic stations occupied	24

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APPENDIX 2

REPORT 1906

DETAILS OF OFFICE OPERATIONS

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DETAILS OF OFFICE OPERATIONS.

OFFICE OF THE ASSISTANT IN CHARGE.

ANDREW BRAID, *Assistant in Charge.*

The Assistant in Charge of the Office has direct supervision of the work of the different divisions of the Office.

The Miscellaneous Section is a part of the immediate Office of the Assistant in Charge.

COMPUTING DIVISION.

The work of supplying data and other information to the parties in the field and to persons outside the Government service was heavier than ever before, the quantities and percentages of increase being as follows: 2 096 pages of correspondence, an increase of 18 per cent; 3 878 geographic positions furnished, an increase of 31 per cent; and 3 123 descriptions of stations and bench marks prepared, an increase of 66 per cent.

The average effective force of the Division, not including the Chief, was 13.

The manuscript of two appendixes to the Annual Report for 1905 was completed and the proof was read. The computation of the observations made in the astronomic, gravity, and precise-leveling work was kept nearly up to date. Considerable progress was made in reducing the triangulation in California north of Monterey Bay to the United States Standard Datum. The computations in connection with the investigation of the figure of the earth were practically completed. It is believed that the result of these computations is a definite advance in the method of dealing with this problem.

The computation of the triangulation in Prince William Sound, Alaska, was very nearly completed.

DIVISION OF TERRESTRIAL MAGNETISM.

The revision of the computation of the magnetic observations made by the parties in the field was kept nearly up to date. The results of observations made during the previous fiscal year were prepared for publication in the Annual Report of the Survey, Appendix 3, and the proof was read.

The discussion of the observations made at the observatories was continued. The base lines of the declination and horizontal intensity records were tabulated for the observatory at Cheltenham, Md., for 1902–5; at Honolulu, Hawaii, for 1902–5; and at Sitka, Alaska, for 1902–4. Values were adopted for the conversion of the relative observations into absolute measures which made it possible to furnish the results of the special observations on the 1st and 15th of each month made at the request of the

German Government in cooperation with the German Antarctic Expedition of 1902–3. The values of the declination and horizontal intensity were furnished for every twenty seconds of the specified hour during which the magnetographs were run at a rapid rate, and the values for each hour of the corresponding Greenwich mean day were also furnished.

Copies of the magnetograms from the Cheltenham, Baldwin, Honolulu, and Sitka observatories for certain specified periods between October, 1902, and March, 1903, and the data necessary to interpret the curves were sent, through the Department of State, to Prof. Kr. Birkeland, of the University of Christiania, Norway, for his use in connection with his investigations of the relation of terrestrial magnetism with northern lights and allied phenomena.

In this connection acknowledgment is made to the Department of Terrestrial Magnetism of the Carnegie Institution for the assistance rendered by Mr. E. H. Bowen, who was detailed to aid in the preparation of this material.

The reversal of the secular motion of the declination over the greater part of the continental portion of the United States, exclusive of Alaska, during the past ten years makes it very important that a new isogonic chart should be prepared, and the accumulation of data since the last publication of isoclinic and isodynamic charts makes it desirable to prepare a revised edition of these charts. A tabulation of the latest values of the declination, dip, and horizontal intensity at all the stations of the Coast and Geodetic Survey within the area mentioned has been made, and a new discussion of the secular variation is in progress.

The tabulation of the data for the earthquakes recorded by the seismographs at the magnetic observatories was brought up to the end of 1905, except in the case of the Sitka Observatory.

A map was prepared for the Wellman polar expedition, which shows the distribution of the magnetic forces of declination and horizontal intensity in the north polar regions.

TIDAL DIVISION.

Harmonic analyses of tide observations were completed for 5 stations with aggregate length of 1 year and 7 months. Nonharmonic reductions were made for 218 stations with an aggregate length of 42 years and 10 months. Tide notes were prepared for 407 stations on 109 charts and 80 original hydrographic sheets. Tidal information was furnished to the field parties and to individuals not connected with the Survey in response to 332 requests, involving the preparation of 393 descriptions of bench marks, tidal data for 187 stations, and current data for 34 stations. Tabulations of high and low water and of hourly heights of the sea were made for 14 years and 9 months of self-registering tide-gage records from 27 stations, and mean sea level was obtained from hourly heights of the sea for about 47 years at 15 stations. There were received, examined, and registered in this Division an aggregate of 15½ years of record from self-registering tide gages at 25 stations, together with 4 years and 8 months of record from staff gages. Tidal records and data were received from outside sources as follows:

Brazil: Tracings of marigrams at 4 stations for 1 month at each station.

Franz Josef Land (Ziegler Polar Expedition): Hourly heights and high and low waters at 2 stations with aggregate length of 5 months.

Germany: Harmonic constants for 3 stations; Duala, Africa; Matupi, Bismark Archipelago, and Fenschafen, New Guinea.

Great Britain: Harmonic constants for Auckland, New Zealand.

India: Copies of marigrams for 15 days at 4 stations.

Mexico: Tabulated tides for 12 stations, with an aggregate length of 9 years and 4 months.

Netherlands: High and low waters for 68 stations, with an aggregate length of about 50 years.

In addition to the records mentioned above, tide records were received as follows:

For 2 stations on Lake Superior and 1 station on the Hudson River, with an aggregate length of 3 years and 9 months, from the Corps of Engineers, U. S. Army; for station at Mare Island, Cal., 1 year of high and low waters, from the Navy Department; for Yes Bay, Alaska, at 1 station for 39 days, from the Bureau of Fisheries; and for Fort McKinley, Pasig River, Luzon, Philippine Islands, hourly heights of the tide for 8 months, from the Bureau of Engineers.

The tide predictions for Astoria, Oreg., for the year 1907 were furnished to the Canadian government by request.

The tide predictions for Wellington and Auckland, New Zealand, for the year 1907 were furnished in response to a request from the Secretary of the Marine Department.

Nearly all the proof of the Tide Tables for 1906 was read, and the manuscript for the Tide Tables for 1907 was prepared for printing.

DRAWING AND ENGRAVING DIVISION.

The Division is divided into five sections—the Drawing, the Engraving, the Printing, the Photographing, and the Electrotyping sections. Each section executes the work indicated by its title, and the combined result is shown on the charts published and issued by the Survey.

The number of requests for information received in the Division was greater than during the previous year, and information was furnished in response to 468 requests, involving the measurement of areas, shore line, and distances between various points, the preparation of tracings from original sheets and copies of old and canceled charts, and the construction of special maps.

Drawing section.

During the year the following drawings were completed for photolithographing or etching:

Chart No.	Title.	Scale.
282	New Hamburg to Germantown	1–40 000
560	Mattawoman Creek to Washington	1–40 000
918	Yabucoa Harbor, Porto Rico	1–10 000
950	Colon Harbor, Panama	1–15 000
4109	Honolulu Harbor, Hawaiian Islands	1–5 000
4202	Guam Island	1–80 000
5971	Coquille River Entrance	1–10 000
5984	Coos Bay, Oregon	1–20 000
8076	Harbors in Clarence Strait	Varying.
8077	Harbors in Prince of Wales Island	Varying.
8150	Dixon Entrance to Chatham Strait	1–200 000
8242	Harbors in Chatham Strait	1–20 000
8246	Whitewater Bay and Chaik Bay	1–20 000
8305	Dixon Harbor, Alaska	1–15 000
8513	Controller Bay, Alaska	1–100 000
8519	Prince William Sound	1–80 000
8538	Resurrection Bay	1–50 000
8572	St. Paul Harbor and approaches	1–60 000
9170	Kiska Harbor, Alaska	1–15 000

Two Filipino students were under instruction in this section during the year and made good progress in learning cartography.

The increase in the number of new drawings for charts, completed during the year, is gratifying.

In addition to the work mentioned above, 649 charts were revised, corrected, and verified for new editions or new prints; 9 projections for topographic sheets and 31 for hydrographic sheets were constructed for the use of field parties or the Office; 448 topographic and hydrographic sheets were inked, plotted, revised, or made ready for the approval of the Office. The drawings for charts in the Philippine Islands were prepared at the suboffice in Manila. These drawings were carefully examined and completed for publication by adding titles, notes, compasses, etc. In republishing charts of the Philippine Islands, extensive corrections were required to most of the drawings.

Engraving section.

The following original plates were completed:

Chart No.	Title.	Scale.
193	Lakes Pontchartrain and Maurepas	1–30 000
4259	Rapurapu Strait	1–30 000
4342	Halsey Harbor	1–15 000
5531	San Francisco Bay, southern part	1–50 000
5651	Fort Ross Cove, California	1–5 000
8305	Dixon Harbor, Alaska	1–15 000
9381	Port Safety, Alaska	1–10 000

The following plates were corrected for new editions of charts:

Chart No.	Title.	Scale.
T	General Chart of Alaska	1-3 600 000
109	Boston Bay and approaches	1-80 000
116	Stratford Shoal to New York	1-80 000
120	New York Bay and Harbor	1-80 000
121	Sandy Hook to Barnegat Inlet	1-80 000
122	Barnegat Inlet to Absecon Inlet	1-80 000
123	Absecon Inlet to Cape May	1-80 000
137	Cape Henry to Currituck Beach	1-80 000
158	St. Marys Entrance to Latitude 30° N	1-80 000
169	Newfound Harbor Key to Boca Grande Key	1-80 000
194	Mississippi River—Passes to Grand Prairie	1-80 000
343	Nantucket Harbor	1-10 000
359	New London Harbor and approaches	1-20 000
369	New York Bay and Harbor	1-40 000
369[4]	Hudson and East Rivers	1-10 000
381	Philadelphia Water Front, Schuylkill River	1-9 600
385	Annapolis Harbor	1-10 000
431	Charleston Harbor	1-30 000
446	Doboy and Altamaha Sounds	1-40 000
469	Key West Harbor	1-50 000
520	Galveston Entrance	1-40 000
920	Porto Rico	Mercator.
1000	Cape Sable to Cape Hatteras	Mercator.
5525	Mare Island Strait	1-10 000
7000	Cape Flattery to Dixon Entrance	1-1 200 000

The following new bassos were completed:

Chart No.	Title.	Scale.
102	Little River to Petit Manan	1-80 000
149	Old Topsail Inlet to Cape Fear	1-80 000

RECAPITULATION.

	Number.
New plates completed	7
New plates unfinished	15
New editions commenced	21
New editions completed	25
New editions unfinished	11
New bassos commenced	16
New bassos completed	2
New bassos unfinished	15
Plates corrected	860

A great deal of work was done toward completing new bassos of worn-out plates and many of those commenced are nearly completed.

Printing Section.

	Number.
Impressions for Chart Section, from plates	73 263
Impressions for proofs, from plates	3 402
Impressions for standards, from plates	164
Impressions for transfers (lithograph), from plates	183
Impressions on bond, from plates	484
Number of impressions from plates	77 496
Impressions for Chart Section, from stones	71 288
Impressions for proofs, from stones	4 191
Impressions for transfers (Drawing Section), from stones	198
Impressions on bond, from stones	1 090
Number of impressions from stones	76 767
Total number of impressions	154 263

Of the charts printed from plates for the Chart Section, 1 479, namely, Nos. 369, 380, and 381, required two impressions, and 344 District of Columbia Charts required four impressions, leaving 70 752 charts delivered to the Chart Section. Four bond copies from the files were also sent to the Chart Section, making a total of 70 756 charts.

Of the lithograph charts 34 015 impressions were pulled from stones for charts which had two or more colors, requiring two or more impressions per chart, leaving 37 273 charts which were delivered to the Chart Section.

The charts which were published by lithography and sent to the Chart Section for distribution are as follows:

NEW CHARTS.

Chart No.	Title.	Scale.
196	Barataria Bay and approaches	1–80 000
560	Mattawoman Creek to Washington	1–40 000
918	Yabucoa Harbor, Porto Rica	1–10 000
950	Colon Harbor, Panama	1–15 000
4109	Honolulu Harbor, Hawaiian Islands	1–5 000
4207	Laoag to Vigan	1–100 000
4208	Solvec Cove to San Fernando	1–100 000
4209	Lingayen Gulf	1–100 000
4232	Manila Harbor, etc	1–10 000
4233	Pasig River	1–10 000
4266	Ports Masinloc and Matalvi and Palanig Bay	1–25 000
4316	Northwest Coast of Luzon	1–100 000
4346	Harbors of Paragua Island	Varying.
4347	Harbors of Balabac Island	Varying.
4418	Southern Masbate	1–100 000
4459	Capiz to Calibo	1–50 000
4514	Sulu Archipelago	1–100 000
4618	Dumanquilas Bay, etc	1–100 000
4723	Western Mindanao	Mercator.
4724	Southeastern Mindanao	Mercator.
5533	San Pablo Bay	1–40 000
6446	Lake Washington	1–80 000
8076	Harbors in Clarence Strait	Varying.
8077	Harbors in Prince of Wales Island	Varying.
8160	Zarembo Island and approaches	1–80 000
8242	Harbors in Chatham Strait	1–20 000
8246	Whitewater Bay and Chaik Bay	1–20 000
8305	Dixon Harbor, Alaska	1–15 000
8519	Fidalgo Bay and Valdez Arm	1–80 000
8572	St. Paul Harbor and approaches	1–80 000
9170	Kiska Harbor	1–15 000

NEW EDITIONS.

Chart No.	Title.	Scale.
79	Chesapeake Bay	1–200 000
248	Boston Inner Harbor	1–10 000
293	New London Harbor and Naval Station	1–10 000
329	Portsmouth Harbor	1–20 000
468	St. Johns River	1–80 000
517	Sabine Pass and Lake	1–40 000
901	West Coast of Porto Rico	Mercator.
920	Porto Rico	Mercator.
1002	Straits of Florida and approaches	Mercator.
4202	Guam Island	1–80 000
4243	Manila and Cavite Anchorages	1–30 000
4246	San Fernando Harbor	1–15 000
4255	Manila Bay	1–150 000
4342	Halsey Harbor	1–20 000
4447	Cebu Harbor and approaches	1–30 000
4454	Harbors of Burias and Ticao Islands	Varying.
4541	Anchorages on Coast of Jolo Island	Varying.
4613	Iligan Bay	1–100 000
4711	Northern part of Luzon	Mercator.
4714	Mindoro and adjacent Coasts	Mercator.
5533	San Pablo Bay	1–40 000
5534	Suisun Bay	1–40 000
5832	Humboldt Bay	1–30 000
5971	Coquille River Entrance	1–10 000
5984	Coos Bay, Oregon	1–20 000
7000	Cape Flattery to Dixon Entrance	1–1 200 000
8000	Dixon Entrance to Cape St. Elias	1–1 200 000
8050	Dixon Entrance to head of Lynn Canal	1 600 000
8413	Controller Bay, Alaska	1 100 000
9100	Aleutian Islands	1–1 200 000

NEW PRINTS.

Chart No.	Title.	Scale.
T.	General Chart of Alaska	1–3 600 000
79	Chesapeake Bay	1–200 000
136	Sandy Point to Head of Bay	1–80 000
244	Salem Harbor	1–20 000
251	Head of Buzzards Bay	1–20 000
274	Harlem River	1–10 000
369[8]	Hudson River, etc	1–10 000
560	Mattawoman Creek to Washington	1–40 000
950	Colon Harbor, Panama	1–15 000
1000	Cape Sable to Cape Hatteras	Mercator.
1001	Chesapeake Bay to Jupiter Inlet	Mercator.
1007	Gulf of Mexico	Mercator.
4100	Hawaiian Islands	1–600 000
5052	San Francisco to Cape Flattery	Mercator.
5532	San Francisco Entrance	1–40 000
5832	Humboldt Bay	1–30 000
6400	Seacoast and Interior Waters of Washington	1–300 000
8304	Icy Strait and Cross Sound	1–80 000
8520	Prince William Sound, eastern part	1–80 000
8651	Kachemak Bay, Cook Inlet	1–150 000

CHARTS REISSUED.

Chart No.	Title.	Scale.
249	Buzzards Bay and approaches	1–40 000
258	Clinton Harbor and approaches	1–10 000
259	Madison to Guilford	1–10 000
356	Block Island	1–10 000
376	Delaware and Chesapeake Bays	1–400 000
565	Passaic River—Newark Bay to Belleville Bridge	1–10 000
4721	Jolo Sea	Mercator.
5705	Caspar Anchorages and approaches	1–10 000
8216	Woedwadski and Eliza Harbors	1–40 000
8500	Icy Cape to Semidi Islands	1–1 200 000
8833	Port Moller and Herendin Bay	1–80 000
9006	Unalaska Bay, etc	1–40 000
9375	St. Michael Bay, Alaska	1–20 000

SUMMARY.

New charts printed	31
New editions printed	30
New prints printed	21
Reissues printed	13
Miscellaneous	7
Total number of lithographs	102

No charts were printed by contract during the year. The number of impressions printed from copper were 77 496, against 69 121 last year, and from stone 76 767, against 35 531 last year. Last year 89 charts were printed from stone—37 by contract and 52 in the Printing Section. This year 102 charts were printed from stone in the Printing Section.

Photographic Section.

Glass negatives made	996
Paper negatives made	28
Velox prints made	6 212
Bromide prints made	334
Vandyke prints made	121
Solio prints made	66
Blueprints made	669
Lantern slides made	29
Negatives developed	734
Prints mounted	414
Copper plates etched	7

The following plates were etched in this section:

Chart No.	Title.	Scale.
918	Yabucoa Harbor, Porto Rico	1–10 000
4259	Rapurapu Strait	1–30 000
4342	Halsey Harbor	1–20 000
4454	Harbors on Burias and Ticao Islands (6 plates)	Varying.
8076	Harbors in Clarence Strait	Varying.
8305	Dixon Harbor, Alaska	1–15 000

The output of the Photographic Section has been larger than that of any preceding year. During the year experiments in etching charts on copper were conducted. Satisfactory progress was made and 7 charts were etched. These all required more or less recutting in the Engraving Section. The seal, compasses, and scales were engraved.

Electrotyping Section.

Kilograms of copper deposited	1 024
Square decimeters on which deposited	7 826
Alto plates made	37
Basso plates made	32

This section has turned out more work during the year than ever before and has supplied the increasing demand for altos and bassos. There was an increased output of 8 altos and 11 bassos over that of the preceding year.

CHART DIVISION.

Chart Section.

In this section all letters relating to the sale of charts, tide tables, and coast pilots were prepared; the accounts with sales agents were kept; the buoys were colored, and other routine work was done. Progress was made in the preparation of a new edition of the chart catalog. Copies of 34 new charts, all printed from stone, were received for distribution. Fifty-six new editions of charts, 28 printed from plates and 28 from stone, were also received for distribution. Charts were received as follows from the Drawing and Engraving Division:

	Number.
Prints from plates	70 756
Prints from stone	37 273

No charts were printed by contract during the year.

Charts were issued as follows:

	Number.
Sales agents	42 460
Sales at the office	2 196
Congressional account	2 733
Hydrographic Office, U. S. Navy	24 832
Light-House Board	3 896
Coast and Geodetic Survey Office	6 237
Coast and Geodetic Survey suboffice, Manila, P. I.	8 559
Executive Departments	6 947
Foreign governments	602
Miscellaneous	1 782
Total	100 244

A comparison of the total issue of charts for the fiscal year with the issue in previous years shows the total to be 46 per cent larger than the average and 5 per cent larger than the previous fiscal year. The charts issued from the suboffice at Manila, P. I., are not included in the statement made above.

The number of letters prepared in the section shows an increase of 11 per cent during the year.

Hydrographic Section.

The necessary corrections to charts were indicated and the monthly Notices to Mariners were prepared in this section. The following work was also done:

16 charts reviewed for publication.
217 charts, corrections on Office Standards verified.
68 charts, corrections on proofs verified.
43 hydrographic sheets verified and examined.

INSTRUMENT DIVISION.

In this Division an account was kept of all instruments and general property owned by the Survey or purchased during the year except the articles on the inventory of the Office at Washington. All necessary repairs were made to the instruments used by the Survey. Minor repairs were made to the Office buildings and furniture and progress was made in constructing a new tide-predicting machine. The tide indicator at Fort Hamilton, N. Y., was remodeled at the Office, and a plan of the changes necessary to make the operation of the indicator continuous even when the surface water freezes was devised. For details of this plan see the report of the work done by Assistant Ritter.

One of the dip circles was fitted with a telescope in such a manner that it can be used as an alt-azimuth instrument in determining azimuths. This change was suggested by the Inspector of Magnetic Work for the purpose of increasing the usefulness of the instrument.

To meet the requirements of the Coast Survey work in the Philippine Islands, in determination of longitudes by the telegraphic method where there are no telegraph lines or cables, a wireless telegraph outfit was purchased and an experimental receiver, based upon the principle devised by Schuhmacher, was made, which combines simplicity with sufficient sensitiveness to reach distances up to 50 miles. This receiver has proved to be quite satisfactory as far as comparative tests can show.

Four duplicates of the spirit level devised and adopted by the Coast and Geodetic Survey, made for the Survey of India Department, Dehra Dun, India, by private parties subject to inspection and approval by the Superintendent, were carefully examined and recommended for approval.

Nickel-steel or "Invar," in the form of tape suitable for base measurement, was purchased and made into 50-meter tapes. These tapes have a very small coefficient of expansion, and are softer than steel tapes. They require a larger reel, when wound, than the steel tapes, to avoid the danger of a permanent change in length, and a light crowbar was made to be used with the tapes to replace the stretching apparatus formerly in use.

Two of the transits used for longitude work were improved by adding attachments, as suggested by Assistant Edwin Smith, for the purpose of increasing the rigidity of their bases. This attachment can be clamped after adjusting the instrument without any change in azimuth or in level as the result of manipulating this device.

LIBRARY AND ARCHIVES.

The current routine work of the Division was kept up to date. The records of observations made in the field were indexed as they were received. Considerable use was made of the library by other Government bureaus and all calls for books met a prompt response. A full author and subject catalog is being prepared, and progress was made whenever the current work of the Division permitted.

The following tables show the accessions during the year:

Accessions.

	Purchased.	Donated.	Exchanged.	Total.
Books	209	29	528	766
Pamphlets	11	105	259	375
Serials	17	1	73	101
Maps and charts	13	15	2 508	2 536

Issued for temporary use.

	Number.
Books and pamphlets	1 458
Serials	602
Records	6 054
Original sheets	3 313
Maps and charts	1 497

The following list shows the original records received:

Subject.	Volumes.	Cahiers.	Sheets or rolls.
Astronomy	25	72	78 rolls.
Geodesy	196	247	2 sheets.
Hydrography	497	.....	74 sheets.
Hypsometry	88	23	
Magnetism	1	614	
Tides	301	12	377 sheets. 181 rolls.
Topography	.....	89	56 sheets.
Total	1 108	1 057	768

Photographic prints	382
Photographic negatives	776

MISCELLANEOUS SECTION.

The publications received were issued without delay and all current work was kept up to date. All purchases under the appropriation made for Office expenses were made thru this section, and this involved a great deal of correspondence.

The following publications were received from the Public Printer:

	Number.
Report of the Superintendent of the Coast and Geodetic Survey for the year 1905	2 000
Appendixes to Report for 1905, published as separates	3 059
Catalog of Charts, 1905	2 588
Tide Tables, 1906, complete	1 100
Tide Tables, 1906, Atlantic Coast	1 250
Tide Tables, 1906, Pacific Coast	9 155
Supplements to Coast Pilots	2 550
Notices to Mariners	54 600
The work of the Coast and Geodetic Survey	5 058

The following publications were received from the Manila suboffice:

Catalog of Charts, Philippine Islands, 1906	52
Sailing Directions, Philippine Islands, sections 1–7	403
Supplements to Sailing Directions	399
Notices to Mariners, Philippine Islands	1 044

The following publications were issued by the Office:

Annual Reports covering the years 1851 to 1904	2 675
Appendixes to Annual Reports	2 444
Bulletins Nos. 1 to 40	310
Catalog of Charts, 1905	1 953
Catalog of Charts, Philippine Islands, 1906	35
Atlantic Coast Pilots, parts 1 to 8	2 088
Pacific Coast Pilots, part 1	114
Pacific Coast Pilot, California, Oregon, and Washington	355
Supplements to Coast Pilots	1 975
Louisiana Purchase Exposition Leaflets	13
Pan-American Exposition Leaflets, Spanish edition	13
U. S. Magnetic Declination Tables, 1902	259
Sailing Directions for Philippine Island, sections 1–7	558
Supplement to Sailing Directions, Philippine Islands	253
Special Publications:	
No. 1	3
No. 3	54
No. 4	45
No. 5	54
No. 6	12
No. 7	24
Tide Tables, complete	1 016
Tide Tables, Atlantic Coast	1 078
Tide Tables, Pacific Coast	8 882
Administration and Work of the Coast and Geodetic Survey	6
Coast Pilot Notes on Warren Channel	7
Deep Sea Sounding and Dredging	15
List and Catalog of Publications	179
Treatise on Projections	24
Work of the Coast and Geodetic Survey	7 100
Notices to Mariners	53 622
Notices to Mariners, Philippine Islands	447

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APPENDIX 3

REPORT 1906

RESULTS OF MAGNETIC OBSERVATIONS MADE BY THE COAST AND GEODETIC SURVEY BETWEEN JULY 1, 1905, AND JUNE 30, 1906

By L. A. BAUER

Inspector of Magnetic Work and Chief of Division of Terrestrial Magnetism
Assistant, Coast and Geodetic Survey

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RESULTS OF MAGNETIC OBSERVATIONS MADE BY THE COAST AND GEODETIC SURVEY BETWEEN JULY 1, 1905, AND JUNE 30, 1906.

By L. A. BAUER,

Inspector of Magnetic Work and Chief of Division of Terrestrial Magnetism, Assistant, Coast and Geodetic Survey.

INTRODUCTION.

The present publication contains the results of the magnetic observations made on land and at sea by members of the Coast and Geodetic Survey in the prosecution of the magnetic survey of the United States and outlying territories during the period July 1, 1905, to June 30, 1906.*

Five magnetic observatories† have been in continuous operation thruout the year: At Cheltenham, Md.; Baldwin, Kans.; Sitka, Alaska; near Honolulu, Hawaii, and on Vieques Island, Porto Rico.

* For previous results see United States Magnetic Declination Tables and Isogonic Charts for 1902, and Principal Facts Relating to the Earth's Magnetism, by L. A. Bauer. Washington, Government Printing Office, 1902. A second edition of this special publication of the Coast and Geodetic Survey was issued in 1903.

Magnetic Dip and Intensity Observations, January, 1897, to June 30, 1902, by D. L. Hazard, with preface by L. A. Bauer. Appendix 6, Report for 1902. Washington, Government Printing Office, 1903.

Results of Magnetic Observations made by the Coast and Geodetic Survey between July 1, 1902, and June 30, 1903. Appendix 5, Report for 1903. Washington, Government Printing Office, 1904.

Results of Magnetic Observations made by the Coast and Geodetic Survey between July 1, 1903, and June 30, 1904. Appendix 3, Report for 1904. Washington, Government Printing Office, 1904.

Results of Magnetic Observations made by the Coast and Geodetic Survey between July 1, 1904, and June 30, 1905. Appendix 3, Report for 1905. Washington, Government Printing Office, 1905.

† For description of observatories see Appendix 5, Report for 1902.

OBSERVATIONS ON LAND AND THEIR DISTRIBUTION.

The distribution of the stations on land is shown in the following table, from which it will be seen that the work of the year, while principally in the region where magnetic data are most needed, viz, in the States west of the Mississippi River and in the Hawaiian Islands, was distributed over 43 States and Territories:

Summary of results on land.

State	Number of localities	Number of stations	Old localities reoccupied	Declinations observed	Dips observed	Intensities observed
Alaska	9	14	2	14	4	4
Arkansas	20	20	2	20	20	20
California	9	9	7	10	10	10
Colorado	12	12	3	11	12	12
District of Columbia	1	2	1	3	4	3
Florida	14	14	5	16	15	16
Georgia	1	1	1	1	1	1
Hawaii	19	22	10	24	25	24
Idaho	9	9	0	9	9	9
Illinois	9	10	0	13	13	13
Indiana	13	15	2	15	17	15
Indian Territory	8	9	1	9	9	9
Iowa	1	1	1	1	1	1
Kansas	1	1	1	6	6	6
Kentucky	1	1	0	1	1	1
Maine	9	9	5	10	10	10
Maryland	2	4	2	13	9	13
Massachusetts	8	8	1	8	8	8
Michigan	15	16	2	16	17	16
Minnesota	11	11	1	11	11	11
Mississippi	1	1	0	1	1	1
Missouri	7	7	1	7	7	7
Montana	14	14	4	15	15	15
Nevada	3	3	0	3	3	3
New Hampshire	4	5	1	6	4	4
New Mexico	13	13	2	13	13	13
New York	16	17	2	18	17	18
North Dakota	14	14	2	15	15	15
Ohio	1	1	1	1	1	1
Oklahoma	1	1	0	1	1	1
Oregon	12	12	4	12	12	12
Pennsylvania	2	2	2	2	2	2
Porto Rico	4	4	2	8	5	8
South Carolina	4	4	1	4	4	4
South Dakota	6	6	1	6	6	6
Tennessee	6	6	2	6	6	6
Texas	16	16	9	15	16	16
Utah	2	2	0	2	2	2
Vermont	7	8	1	8	7	7
Washington	29	29	9	34	35	34
Wisconsin	15	16	0	16	16	16
Wyoming	6	6	0	6	6	6
Foreign countries	3	4	3	4	4	4
Total	358	379	94	414	400	403

The table shows that the three magnetic elements were determined at 379 stations in 358 different localities, in about one-fourth of which accurate determinations had been made, chiefly by the Survey, at some previous time. It has now become possible to

give a complete account, for the entire United States, of the secular change, and to map out the extent of the reversals noted in last year's Report (p. 111). A set of tables giving the secular change in the magnetic declination will be found in Appendix 4 of the current volume, where is also given a new chart of the Lines of Equal Magnetic Declination in the United States, for January 1, 1905, with accompanying text.*

OBSERVATIONS AT SEA AND THEIR DISTRIBUTION.

The policy of making magnetic observations at sea as often as the regular surveying duties of the ships of the Bureau would permit has been continued. Observations were made by the *Bache* during her cruise from Norfolk, Va., to Maine and return, and from Norfolk to Key West, Fla., and Galveston, Tex. (thus securing a valuable series of observations in the Gulf of Mexico), and return; by the *Explorer* on her cruises between Norfolk and Maine and return, and to Porto Rico and return; by the *Patterson* on the way from Seattle, Wash., to Alaska and return. The Carnegie Institution of Washington thru its Department of Terrestrial Magnetism, as is known, has undertaken a systematic survey of the oceanic areas.

The *Bache*, *Patterson*, and *Explorer* are each provided with a Lloyd–Creak dip circle and accompanying gimbal stand, by means of which dip and relative intensity can be determined on board ship. Observations for declination (or "magnetic variation") are made with the usual standard liquid compass and an azimuth circle of the Ritchie or Negus pattern. Each value of declination, dip, or intensity usually depends upon the mean of observations made on 8 or 16 equidistant headings while steaming in a circle, once with port and once with starboard helm. In some cases, however, observations were made on three headings, namely, on the course, one or two points to the starboard of the course, then a like amount to port and back again on course.

The three magnetic elements were determined at sea at 47 different points in the Atlantic Ocean, Gulf of Mexico, and Pacific Ocean.

Summary of results at sea.

Vessel	General region	Observations from swings			Observations on and near course		
		Declination	Dip	Intensity	Declination	Dip	Intensity
Bache	Atlantic Ocean	29	31	31	1	0	0
Explorer	Atlantic Ocean	13	14	14	6	7	7
Patterson	Pacific Ocean	6	4	4	0	0	0
Total		48	49	49	7	7	7

*Distribution of the Magnetic Declination in the United States for the period January 1, 1905, with Isogonic Chart and Secular Change Tables. Appendix 4, Annual Report Superintendent, Coast and Geodetic Survey for 1906. Washington, Government Printing Office, 1906.

GENERAL METHODS OF OBSERVING.

Land Work.

The methods of observing have been the same as those described in the previous publications. Observers engaged exclusively in magnetic work are supplied with a complete magnetic outfit, consisting of theodolite-magnetometer, dip circle, half-second pocket chronometer, an observing tent, and small accessories, while those who are expected to get magnetic results incidental to other work are supplied with more or less complete outfits, according to circumstances. Where only declination results can be secured under the conditions involved, a compass declinometer is supplied; but to those who can attempt more, a dip circle with compass attachment is furnished, with which compact outfit, knowing the azimuth of some reference mark from triangulation or other source, the declination, dip, and total intensity (Lloyd's method) can be obtained, as repeated experience has shown, with a very fair degree of accuracy.

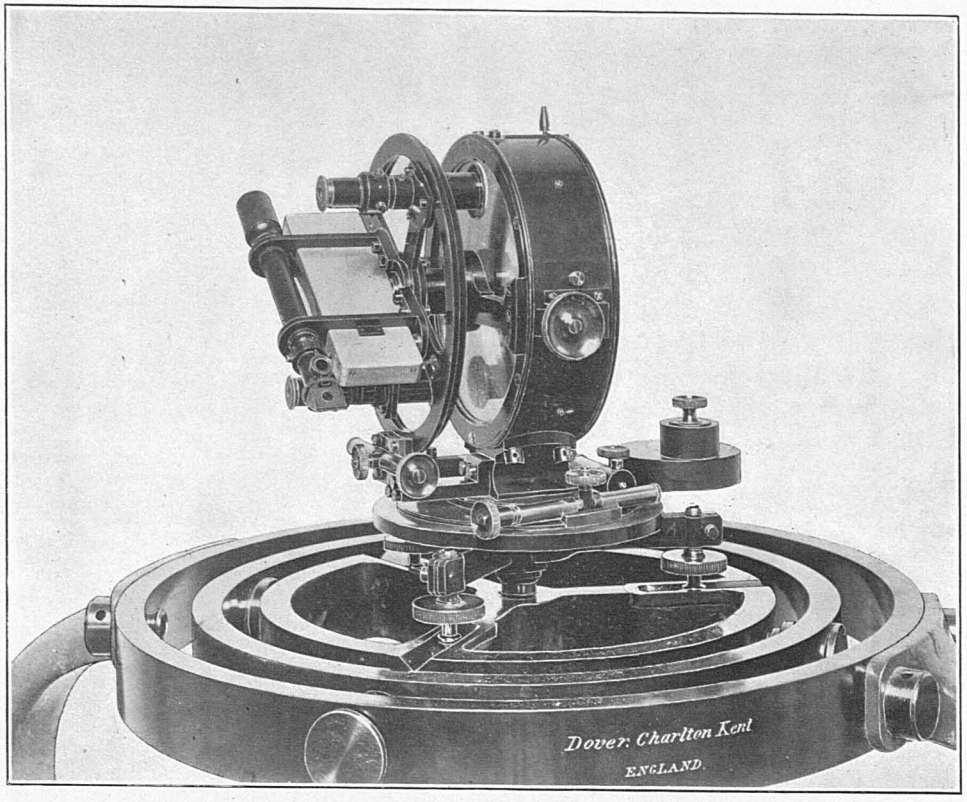
Sea Work.

The same methods as in the two previous years have been used. It was related in last year's Report (p. 115) that the use of the Lloyd-Creak dip circle, as at present constructed, had been found by two of the Survey vessels to fail for determining the total intensity when a certain magnetic latitude was reached. The Carnegie Institution magnetic survey yacht, the *Galilee*, had a similar experience on her 1905 cruise from San Diego to Honolulu. When a dip of about 40° was reached, deflections for the existing distance between the deflected and deflecting needles became impossible, as the earth's total magnetic force was entirely overcome by the magnetic force of the deflecting needle, rendering the attainment of a position of equilibrium between the operating forces impossible.

Accordingly one of the Lloyd-Creak dip circles (No. 35) was modified in the instrument shop of the Survey, so that the original deflecting distance was increased from 7.3 to 7.9 centimeters, permitting the making of deflection observations, with the increased distance, in all parts of the globe likely to be traversed by the Survey vessels. At the same time a second deflecting distance (9.4 centimeters) was furnished for use if necessary, and also for more effectively controlling the instrumental constants than possible with but one distance.

Furthermore, the loaded needle, when in use as a deflector, is now mounted in a special nonmagnetic metallic case, avoiding unnecessary handling of the needle. Change from one deflecting distance to the other is accomplished by mere reversal, within its bearings, of the case containing the deflecting needle.

It was proven by investigations in Washington that the discrepancies noted between the dip results obtained directly and as deduced from the deflection observations were largely due to the lateral play of the deflected or suspended needle (No. 3) in the jewels, namely, the maker does not always succeed in getting the pivots precisely of the same length for all the needles belonging to the same circle, so that it becomes necessary, in order not to have some of the needles bind, that for others more play may result than desirable. It is especially important that there be no more play than absolutely essential (so as not to have needle stick) for the suspended needle used in



LLOYD-CREAK DIP CIRCLE NO. 35, AS MODIFIED BY THE COAST AND GEODETIC SURVEY IN JANUARY, 1906.

the deflection observations; for, otherwise, with the motion of the ship or due to the rubbing of the brass point with the ivory scraper, the suspended needle moves back and forth in the jewels by an amount sufficient to cause appreciable changes in the deflecting distance and, hence, in the intensity constant as determined by the shore observations. This defect has been remedied by adjusting the jewels for the deflected needle (No. 3) and replacing those of the needles which stuck for this adjusted position by new ones.

For certain shore work, in determining geographic position of station, or for getting the azimuth for declinations with the compass attachment where no other instrument is available, an astronomical telescope has been added to the Lloyd-Creak dip circle No. 35, thus making it a complete magnetic instrument—theodolite, dip circle, and magnetometer combined—for use with expeditions whose outfit, for one reason or another, must be limited.

The above modifications are shown in the accompanying illustration.

ACCURACY OF RESULTS.

The endeavor in general is to secure, on land, declination and dip observations whose absolute error (including everything involved—error of observation and reduction) shall not exceed 2′, and to determine the horizontal intensity within 1 part in 1 000. As stated in previous reports, the experience of the Coast and Geodetic Survey has been that, under all of the conditions involved in a campaign of field work covering a large area, including the standardization of instruments and the determination of reduction errors, this accuracy can not be much increased. In observatory work with special instruments, or when special investigations are made under the best conditions by special observers, there is no difficulty in reducing these limits of error; but in a large organization, where results must be secured from all kinds of observers, under all conditions, and at times under great physical difficulties, and when all sources of error are considered, the degree of accuracy stated must be regarded as satisfactory and sufficient. It happens, of course, that these limits, for one reason or another, are occasionally exceeded, and there may be a few isolated cases in which the errors are two or three times the amounts given.

COMPARISON OF INSTRUMENTS.

Comparisons of field instruments with the standard instruments of the Cheltenham Magnetic Observatory have been made when conditions demanded it or opportunity offered. The magnetometer and dip circle which had been loaned to the second Zeigler Polar Expedition, and used for their observations at Teplitz Bay, were standardized at Cheltenham. The Lloyd-Creak dip circles in use on the steamers *Bache* and *Explorer* were standardized there in November, and again in June, and each of these vessels was provided with a magnetometer, so that the stability of the intensity constant could be further controlled by shore observations in the progress of the season's work. Individual comparisons were also secured at various places in the progress of the field work, where the same station was occupied by different observers with different instruments. These comparisons show that few changes are required in the instrumental corrections

used last year. The various dip circles used and the corrections which have been applied to the results by each are given in the following table. The figures after the decimal point in the fourth column indicate, as in the past, the particular needles to which the correction applies:

Corrections to Dip Circles.

Dip circle	Pattern	Needles	Designation	Correction
				′
1	Wild-Eschenhagen	Earth inductor	1EI	0.0
15	Kew-Casella	1 and 3	15.13	0.0
15	do.	2 and 4	15.24	0.0
20	do.	1 and 2	20.12	0.0
21	do.	1 and 2	21.12	+6.0
21	do.	1, 2, 3, and 4	21IV	+4.3
22	Wild-Edelmann	Earth inductor	22EI	−0.2
23	Kew-Casella	2C and 2D	23.22	−2.3
23	do.	3 (deflected)	23.3	+0.2
23	do.	2C, 2D, and 3	23III	−1.5
24	French Magnetic Survey	1 and 2	24.12	+6.6
25	Tesdorpf	IV and VIII	25.48	−3.6
28	L. C.-Casella	1 and 2	28.12	−4.0
30	Kew-Dover	1 and 2	30.12	+1.0
31	do.	1 and 2	31.12	−1.8
31	do.	3 and 4	31.34	+0.4
32	L. C.-Dover	2	32.2	+0.5
33	do.	1 and 2	33.12	−4.2
34	do.	1 and 2	34.12	−1.9
35	do.	1, 2, and 3	35III	+0.8
36	Kew-Dover	1 and 2	36.12	+0.6
36	do.	3 (deflected)	36.3	−0.4
37	do.	1 and 2	37.12	−0.6
4655	Kew-Casella	1 and 2	55.12	+0.6
56	do.	1 and 3	56.13	−1.0
169*	L. C.-Dover	1 and 2	69.12	−2.0
172*	Kew-Dover	1 and 2	72.12	0.0
5676	Kew-Casella	3 and 4	76.34	−4.8

* Property of Department of Terrestrial Magnetism of the Carnegie Institution of Washington.

The corrections to reduce the horizontal intensity results to standard are the same as last year, except that the results of observations made with magnetometer No. 10, after it was overhauled and the long magnet supplied with a new lens, in May, 1906, require to be increased.

The following corrections have been applied:

Magnetometer	Correction to horizontal intensity
No. 10 (in June)	+.004 H
No. 20	+.002 H
No. 21	+.006 H
No. 36	+.002 H
No. 37	+.003 H

Index corrections have been applied to declination results obtained with compass declinometer or compass needle. In addition, the results with several magnetometers have been corrected by small amounts, as the result of careful comparisons with standard instruments. In December, 1905, a careful examination was made of magnetometer No. 19, and the source of error was traced to the brass collar thru which the thermometer was inserted into the magnet house. A new one was supplied and no correction was required after that date.

Magnetometer	Correction to west declination
	′
No. 10 (in June)	+2.5
No. 19 (up to Dec., 1905)	−1.5
No. 29	−1.5
No. 1 (Carnegie Institution)	+2.3

REDUCTION OF THE OBSERVATIONS.

A first computation is made by the observer in the field, and he is instructed to carry it far enough before he leaves a station to assure himself that the desired degree of accuracy has been attained. This computation is carefully revised in the Office, in the Division of Terrestrial Magnetism, and the necessary corrections are applied to reduce the results to the standard instruments, as indicated in the foregoing section.

Each value of the magnetic declination is then corrected to reduce it to the mean of the particular month in which the observation was made, with the aid of the continuous observations at the nearest magnetic observatory, allowance being made for the change in diurnal variation, with change in magnetic latitude. No attempt has been made to correct the dip and horizontal intensity for diurnal variation.

ARRANGEMENT OF THE TABLES.

Land Observations.

The values of declination, dip, and horizontal intensity presented in Table I are arranged by States alphabetically, the results for each State being given in the order of increasing latitudes. The latitudes and longitudes are in most cases the result of solar observations made with the small theodolite which forms a part of the magnetometer. In default of observations the geographic coordinates were scaled from the best available map, either the United States Geological Survey topographic sheets, a Post Route map, or a Rand & McNally State map. In such cases only the nearest whole minute of latitude and longitude is given. The horizontal intensity is exprest, as heretofore, in terms of the one hundred thousandth part of a C. G. S. unit of intensity of magnetic force, termed a *gamma*, and designated by the letter γ.

In order to include the desired amount of information in the available space the following abbreviations were adopted. Only the month and day of the date are given, since the observations were all made between July 1, 1905, and June 30, 1906, except when otherwise stated in footnote. The names of the month have been abbreviated, as follows:

January	Ja	May	My	September	Se
February	Fe	June	Je	October	Oc
March	Mh	July	Jy	November	No
April	Ap	August	Au	December	De

In the column headed "Instruments" M stands for "magnetometer" and D. C. for "dip circle." Italicized numbers in the magnetometer column indicate that the declination was determined with a compass declinometer of the number given. When the declination was determined with the compass attachment of the dip circle, the letter C is placed in the magnetometer column. The dip circles have been given the designations indicated on page 114, the figures after the decimal point denoting the needles used. Values of horizontal intensity printed in italics were obtained by combining the observed dip with the total intensity determined by Lloyd's method.

The observer is indicated by the initials of his name. The names of the observers are as follows:

H. M. Armstrong.
L. A. Bauer.
B. A. Baird.
H. L. Beck.
W. H. Burger.
J. E. Burbank.
C. C. Craft.
S. A. Deel.
W. C. Dibrell.
P. H. Dike.
H. C. Denson.
H. M. W. Edmonds.
A. J. Ela.
J. H. Egbert.
R. L. Faris.
J. A. Fleming.
H. W. Fisk.
A. L. Giacomini.
J. W. Green.
D. L. Hazard.
C. J. Houston.
N. H. Heck.
W. M. Hill.
W. B. Keeling.
J. E. McGrath.
E. Mueller.
G. B. Pegram.
W. J. Peters.
E. Smith.
W. M. Steirnagle.
J. H. Simpson.
D. C. Sowers.
W. F. Wallis.
L. H. Westdahl.

Sea Observations.

The results obtained at sea are presented in Table II. The general arrangement is indicated by the headings. Unless otherwise indicated, the ship was swung with both port and starboard helms. In the columns headed "Sea" sm means smooth; sw, swell; hvy, heavy; mod, moderate. The names of the ships taking part in the work and their commanding officers are as follows:

Bache	P. A. Welker.
Explorer	R. L. Faris and L. H. Westdahl.
Patterson	W. C. Hodgkins.

TABLE I.—*Magnetic observations on land, July 1, 1905, to June 30, 1906.*

ALASKA.

Station	Latitude	Longitude	Date	Declination	Dip	Horizontal intensity	Instruments		Observer
							M.	D. C.	
	° ′	° ′		East ° ′	° ′	γ			
McKenzie Inlet	55 21.0	132 20.6	Au 1	29 56	.. ....	.....	*744*	.....	H. L. B.
Gibson Anchorage	55 35	132 30	Je 21	27 45.0	.. ....	.....	*744*	.....	B. A. B.
Lake Bay	56 02.8	132 51.7	Se 6	29 42	.. ....	.....	*744*	.....	H. L. B.
Sitka Observatory	57 02.9	135 20.2	De–Ja	30 01.5	74 42.4	15494	25	25.48	H.M.W.E.
Dixon Harbor	58 22.0	136 53	Se 5, 6	30 14.2	.. ....	.....	*737*	.....	H.C.D.
Seward	60 06.5	149 26.3	Oc 5, 6	27 01.5	74 08.1	15658	20	32.2	A. J. E.
Valdez	61 06.8	146 16.6	Oc 6, 7	29 12.2	75 25.2	14547	7	20.12	J. E. M.
St. Michael									
I	63 28.8	162 01.4	Jy–Au	22 11.7	.. ....	.....	*15*	.....	B. A. B.
II	63 28.8	162 01.4	Jy–Au	22 02.2	.. ....	.....	*15*	.....	B. A. B.
III A	63 28.8	162 01.4	Jy–Au	21 31.6	.. ....	.....	*15*	.....	B. A. B.
North	63 28.8	162 01.4	Au 15, 26	22 23.7	.. ....	.....	*15*	.....	B. A. B.
Mesa	63 29.1	162 01.4	Jy–Au	21 48.8	.. ....	.....	*15*	.....	B. A. B.
Hill Top	63 29.2	162 00.8	Jy–Au	21 24.7	.. ....	.....	*15*	....	B. A. B.
Fort Egbert	64 47.3	141 12.5	Jy 25–29	35 50.9	78 27.8	*11794**	C	28.12	E. S.

ARKANSAS.

	° ′	° ′		East ° ′	° ′	γ			
De Queen	34 03.5	94 18.1	De 7	7 30.8	63 47.2	25410	17	37.12	D. C. S.
Mount Ida	34 34.7	93 37.2	De 4	7 04.2	64 27.5	25081	17	37.12	Do.
Mena	34 36.4	94 14.5	De 2	7 31.2	64 23.2	25127	17	37.12	Do.
Clarendon	34 42.5	91 18.9	No 22	6 39.3	65 00.5	24628	17	37.12	Do.
Waldron	34 55.8	94 05.7	No 30	7 36.6	64 58.6	24746	17	37.12	Do.
Perryville	35 01.4	92 50.2	No 24	6 37.6	65 09.4	24662	17	37.12	Do.
Forrest City	35 02.0	90 48.4	No 20	5 36.0	65 46.9	23935	17	37.12	Do.
Danville	35 05.1	93 24.7	No 25	7 12.6	65 19.1	24480	17	37.12	Do.
Searcy	35 15.8	91 44.9	No 18	6 03.7	65 49.3	24091	17	37.12	Do.
Clarksville	35 28.8	93 31.5	No 28	7 00.0	65 41.3	24363	17	37.12	Do.
Heber	35 31.4	92 00.7	No 16	6 31.8	66 02.0	23811	17	37.12	Do.
Clinton	35 36.6	92 26.2	No 13, 14	6 49.8	66 09.2	23780	17	37.12	Do.
Marshall	35 56.0	92 38.0	No 11	6 43.6	66 32.8	23314	17	37.12	Do.
Jasper	36 00.5	93 11.7	No 6	6 46.9	66 04.0	23831	17	37.12	Do.
Huntsville	36 05.4	93 43.4	No 8	7 32.5	66 15.5	23655	17	37.12	Do.
Yellville	36 14.4	92 41.5	No 1	7 49.4	66 46.8	23280	17	37.12	Do.
Harrison	36 15.2	93 07.4	No 3	7 05.8	66 43.5	23328	17	37.12	Do.
Hardy	36 20.1	91 28.4	Oc 27	6 27.6	66 48.6	23133	17	37.12	Do.
Mountain Home	36 21.3	92 21.0	Oc 30	6 41.4	66 46.5	23280	17	37.12	Do.
Salem	36 23.6	91 51.3	Oc 28	5 58.6	66 50.2	23255	17	37.12	Do.

*For the value in italics the total intensity determined by Lloyd's method was combined with the observed dip.

TABLE I.—*Magnetic observations on land, July 1, 1905, to June 30, 1906*—Continued.

CALIFORNIA.

Station	Latitude	Longitude	Date	Declination	Dip	Horizontal intensity	Instruments		Observer
							M.	D. C.	
	° ′	° ′		East ° ′	° ′	γ			
Los Angeles	34 04.3	118 15.1	Ja 16	15 14.2	59 30.9	*26902**	C.	28.12	E. S.
Mt. Wilson	34 13.4	118 03.7	Ja 6	15 06.3	59 39.0	*26839**	C.	28.12	E. S.
Barstow	34 53.9	117 01.8	My 10, 11	15 29.0	60 30.9	26404	11	23. III	W. M. H.
Kelso	35 00.2	115 39.9	My 14	14 47.8	60 45.9	26432	11	23. III	W. M. H.
Fresno	36 44.5	119 48.0	Au 16, 17	16 23.9	61 44.2	*25519**	C	35. III	L. A. B.
San Jose	37 18.0	121 52.0	My 31–Je 2	18 16.6	61 28.0	26243	11	23. III	W. M. H.
Presidio Hill	37 47.5	122 27.9	Jy 17	17 00.5	62 43.0	24898	C	69.12	L. A. B.
Presidio Hill	37 47.5	122 27.9	No 19, 20	17 02.5	62 48.8	24814	21	24.12	C. J. H.
Goat Island	37 48.8	122 21.7	My 28, 29	17 43.6	62 05.3	25309	11	23. III	W. M. H.
Red Bluff	40 11.5	122 16.3	Je 4, 5	19 04.2	64 42.6	23862	11	23. III	W. M. H.

COLORADO.

	° ′	° ′		East ° ′	° ′	γ			
Durango	37 16.7	107 52.9	Oc 6, 7	14 03.9	64 46.7	24361	11	23. III	W. M. H.
Del Norte	37 40.7	106 20.4	Oc 11, 12	14 20.3	65 20.0	24032	11	23. III	W. M. H.
Montrose	38 29.2	107 53.0	Oc 2	14 16.6	65 59.9	23654	11	23. III	W. M. H.
Cheyenne Wells	38 49.2	102 20.4	Je 24	12 26.1	67 15.9	22804	19	56.13	W. B. K.
Grand Junction	39 04.8	108 33.2	Se 25, 26	15 07.8	66 24.3	23245	11	23. III	W. M. H.
Hugo	39 08.5	103 28.8	Je 25, 26	13 03.8	67 34.6	22743	19	56.13	W. B. K.
Castle Rock	39 23.0	104 51.1	Je 28, 29	14 39.7	67 32.0	22775	19	56.13	W. B. K.
Glenwood Springs	39 32.0	107 20.2	Se 28	15 54.4	66 42.9	23506	11	23. III	W. M. H.
Deer Trail	39 36.5	104 03.1	Je 26, 27	13 30.3	67 52.4	22348	19	56.13	W. B. K.
Georgetown	39 43.7	105 43.8	Oc 21	15 32.4	67 25.1	22496	11	23. III	W. M. H.
Denver	39 46	104 54	Oc 14, 16	.. ....	67 38.9	*22471*	..	23. III	W. M. H.
Fort Morgan	40 17.4	103 47.9	Je 30	14 15.1	68 29.6	22016	19	56.13	W. B. K.

DISTRICT OF COLUMBIA.

	° ′	° ′		West ° ′	° ′	γ			
Washington, Office	38 53.2	77 00.5	Oc 30	5 19.3	69 57.6	*20284**	C	35. III	D. L. H.
Near Zoo Park	38 55.2	77 02.5	Jy 10–13	4 29.1	70 28.3	20086	29	56.13	J. A. F.
Do.	38 55.2	77 02.5	Oc 11	.....	70 28.1	.....	..	37.12	D. C. S.
Do.	38 55.2	77 02.5	Ja 22	4 33.6	70 28.2	20022	21	24.12	J. A. F.

* For the value in italics the total intensity determined by Lloyd's method was combined with the observed dip.

TABLE I.—*Magnetic observations on land, July 1, 1905, to June 30, 1906*—Continued.

FLORIDA.

Station	Latitude	Longitude	Date	Declination	Dip	Horizontal intensity	Instruments		Observer
							M.	D. C.	
	° ′	° ′		East ° ′	° ′	γ			
Key West	24 33.5	81 47.6	Fe 9, 12	2 30.6	55 03.2	29404	19	33.12	A. L. G.
Key West	24 33.5	81 47.6	Ap 30	2 30.0	54 57.8	29357	19	33.12	W. C. D.
Punta Rassa	26 29.2	82 00.4	Ap 3, 4	1 58.9	57 24.0	28439	29	31.12	J. H. E.
Fort Myers	26 37.9	81 50.8	Mh 26	2 07.9	57 22.9	28523	29	31.12	J. H. E.
Sugar Loaf Beach	26 45.9	80 55.7	Mh 15, 16	1 17.3	58 00.5	27965	29	31.12	J. H. E.
La Belle	26 45.9	81 26.3	Mh 19	1 54.7	57 57.2	28252	29	31.12	J. H. E.
Jupiter	26 56.3	80 02.9	Mh 12	1 41.7	58 03.6	27957	10	30.12	W. H. B.
Punta Gorda	26 57.1	82 02.6	Ap 7, 8	2 15.5	57 56.4	28104	29	31.12	J. H. E.
Warners Camp	27 12.1	80 49.4	Mh 5, 6	1 26.4	57 48.4	28260	29	31.12	J. H. E.
Miccos Bluff	27 26.4	81 06.9	Fe 26, 27	2 15.8	58 08.7	28291	29	31.12	J. H. E.
Turkey Hammock	27 47.7	81 12.2	Fe 19, 20	2 15.7	59 13.8	27156	29	31.12	J. H. E.
Sebastian	27 49.0	80 28.1	Mh 17	1 16.5	59 27.1	27483	10	30.12	W. H. B.
Kissimmee	28 18.1	81 23.9	Ja 18–20	1 43.3	59 14.6	27625	29	31.12	J. H. E.
Daytona	29 12.6	81 00.8	My 4	1 14.4	60 41.9	26711	29	30.12	W. H. B.
St. Augustine	29 54.0	81 18.7	Ap28–My1	1 19.0	61 23.3	26348	10	30.12	W. H. B.
St. Augustine	29 54.0	81 18.7	Ap30, My1	1 20.0	.....	26377	29	.....	W. H. B.

GEORGIA.

	° ′	° ′		East ° ′	° ′	γ			
Cedar Point	31 29.8	81 20.8	My 30	0 48.9	62 54.0	25540	29	30.12	W. H. B.

HAWAII TERRITORY.

	° ′	° ′		East ° ′	° ′	γ			
Hawaii									
Ka Lae	18 53.9	155 41	Ap 27	9 58.6	37 36.5	30376	17	37.12	S. A. D.
Kilauea	19 26.0	155 15.7	Ap 20	9 48.8	36 58.7	30830	17	37.12	S. A. D.
Napoopoo	19 28.3	155 55	Ap–My	9 46.9	37 49.4	30130	17	37.12	S. A. D.
Napoopoo B	19 28.3	155 55	Ap 30	.....	37 14.4	.....		37.12	S. A. D.
Kapoho	19 29.8	154 48	Ap 16, 18	9 31.1	38 24.7	31416	17	37.12	S. A. D.
Hilo, Mooheau Park	19 43.5	155 05.0	Ap 13, 14	8 46.8	37 31.2	30272	17	37.12	S. A. D.
Hilo, Cocoanut Island	19 44.0	155 04.0	Ap 12	8 49.4	38 19.8	29970	17	37.12	S. A. D.
Laupahoehoe	20 00.0	155 14.6	Ap 9, 10	9 39.2	38 00.3	29097	17	37.12	S. A. D.
Waimea	20 01.4	155 37.9	Ap 5, 6	9 11.8	37 39.4	29589	17	37.12	S. A. D.
Maui									
Hana B	20 45.6	155 59	My 15	8 25.8	39 09.2	29465	17	37.12	S. A. D.
Hana A	20 46.5	155 59	My 14	9 07.6	39 50.6	28908	17	37.12	S. A. D.
Kihei	20 46.9	156 28	My 9	9 28.8	39 15.5	28269	17	37.12	S. A. D.
Lahaina	20 52.4	156 40.9	My 7	9 28.7	38 33.1	29803	17	37.12	S. A. D.
Kahului	20 54.0	156 27.9	My 11	9 04.8	38 37.2	29846	17	37.12	S. A. D.

TABLE I.—*Magnetic observations on land, July 1, 1905, to June 30, 1906*—Continued.

HAWAII TERRITORY—Continued.

Station	Latitude	Longitude	Date	Declination	Dip	Horizontal intensity	Instruments		Observer
							M.	D. C.	
				East					
Oahu	° ′	° ′		° ′	° ′	γ			
Honolulu	21 18.0	157 51.5	Fe 19	10 35.1	39 19.9	29566	17	37.12	S. A. D.
Honolulu Magnetic Obs'y	21 19.2	158 03.8	De–Ja	9 21.0	40 03.1	29173	22	22 EI	S. A. D.
Do.	21 19.2	158 03.8	Fe 16, 17	9 22.9	40 01.3	29182	17	37.12	S. A. D.
Do.	21 19.2	158 03.8	Je 8, 9	9 22.6	40 00.9	29168	17	37.12	S. A. D.
Waikane	21 29.7	157 52.1	Fe 21, 22	13 03.4	37 06.9	30798	17	37.12	S. A. D.
Kaena Point	21 34.6	158 17.2	Fe 26, 27	9 39.5	38 46.1	29502	17	37.12	S. A. D.
Kahuku Ranch	21 42.3	158 00.5	Fe 23, 24	10 36.3	40 31.3	29140	17	37.12	S. A. D.
Kauai									
Waimea	21 57.0	159 42.0	My 28	10 10.9	39 29.0	29114	17	37.12	S. A. D.
Nawiliwili Bay	21 57.5	159 20	My 24, 25	10 17.8	40 20.5	29303	17	37.12	S. A. D.
Hanalei A	22 12.9	159 30	My 31	10 34.8	39 20.6	30098	17	37.12	S. A. D.
Hanalei B	22 13.0	159 30	Je 1	9 23.4	41 18.9	28699	17	37.12	S. A. D.

IDAHO.

				East					
	° ′	° ′		° ′	° ′	γ			
Mountain Home	43 07.8	115 42.3	Jy 7, 8	18 58.6	68 18.3	21600	11	23.III	W. M. H.
Hailey	43 31.2	114 18.7	Jy 3, 5	19 17.3	69 01.8	21126	11	23.III	Do.
Boise	43 37.2	116 11.6	Jy 11	19 10.0	68 58.7	20966	11	23.III	Do.
Weiser	44 15.7	116 57.9	Jy 14, 15	20 41.6	69 04.5	21139	11	23.III	Do.
Council	44 43.5	116 25.6	Jy 18	19 55.0	69 54.3	20532	11	23.III	Do.
Murray	47 37.6	115 50.8	Au 18, 19	22 25.0	72 06.2	18584	11	23.III	Do.
Porthill	49 00.0	116 30	Se 21, 23	23 30.1	73 03.6	17557	21	24.12	C. J. H.
Summit Lake	49 00.0	116 56	Se 25, 26	23 40.0	73 01.2	17625	21	24.12	Do.
Moyie River	49 00.0	116 11.1	Oc 4, 6	23 43.4	73 07.1	17549	21	24.12	Do.

ILLINOIS.

				East					
	° ′	° ′		° ′	° ′	γ			
Marion	37 44.9	88 55.4	No 9	4 44.6	68 05.5	22498	37	36.12	J. A. F.
Olney	38 43.7	88 05.2	No 8	3 30.4	69 41.2	20951	37	36.12	Do.
Highland	38 44.2	89 40.8	Jy 29, 31	4 39.9	69 41.5	21201	10	30.12	W. B. K.
Effingham	39 08.7	88 32.8	Jy 28	4 24.1	70 01.6	20717	10	30.12	Do.
Tuscola	39 47.6	88 16.1	Jy 25, 26	3 56.1	70 33.2	20329	10	30.12	Do.
Paxton A	40 27.0	88 04.8	Jy 20–24	3 33.5	71 04.6	19960	10	30.12	Do.
Do. B	40 27.0	88 04.8	Jy 21–24	3 33.4	71 05.8	19982	10	30.12	Do.
Do. A	40 27.0	88 04.8	Jy 21–24	3 32.8	71 02.7	20021	29	56.13	C. C. C.
Do. B	40 27.0	88 04.8	Jy 20–24	3 33.0	71 02.6	19984	29	56.13	Do.
Joliet	41 28.7	88 11.2	Jy 15	2 52.3	72 13.0	18857	10	30.12	W. B. K.
Shabbona	41 46.6	88 53.9	Jy 13, 14	3 54.3	72 02.8	19076	10	30.12	Do.
Woodstock	42 19.3	88 25.2	Jy 11, 12	2 54.3	72 54.7	18232	10	30.12	Do.
Do.	42 19.3	88 25.2	Oc 25	2 46.9	72 56.3	18264	19	31.12	P. H. D.

TABLE I.—*Magnetic observations on land, July 1, 1905, to June 30, 1906*—Continued.

INDIANA.

Station	Latitude	Longitude	Date	Declination	Dip	Horizontal intensity	Instruments		Observer
							M.	D. C.	
	° ′	° ′		*East* ° ′	° ′	γ			
Jasper	38 23.9	86 56.3	No 11	3 01.0	69 41.8	20928	37	36.12	J. A. F.
Vincennes	38 40.2	87 31.3	No 10	3 08.8	69 41.6	20982	37	36.12	Do.
Do. S. M.	38 40.6	87 31.6	No 10	3 10.2	69 33.0	*20940*	C	36.3	Do.
Brownstown	38 52.4	86 02.5	No 13	1 29.0	70 09.6	20544	37	36.12	Do.
Lawrenceburg A	39 06.5	84 51.8	No 14–16	1 05.4	70 09.7	20637	37	36.12	Do.
Do. B	39 06.5	84 51.8	No 16	1 04.3	70 12.0	*20614*	C	36.12	Do.
Do. B	39 06.5	84 51.8	No 16	.....	70 12.4	.....	..	31.12	H. M. A.
Do. A	39 06.5	84 51.8	No 16	.....	70 11.6	.....	..	31.12	Do.
Columbus	39 09.4	85 57.9	No 12	1 26.8	70 26.6	*20160*	C	36.12	J. A. F.
Bloomington	39 10.2	86 32.0	No 6	2 15.9	70 11.9	20603	37	36.12	Do.
Greencastle	39 37.6	86 50.7	No 4	2 45.2	70 40.6	20182	37	36.12	Do.
Anderson	40 07.0	85 41.5	Oc 27	1 52.0	71 02.6	19844	37	36.12	Do.
Reynolds	40 45.2	86 52.9	No 3	1 52.5	71 47.8	19232	37	36.12	Do.
Kentland	40 45.3	87 27.0	Jy 18, 19	2 49.6	71 27.1	19629	10	30.12	W. B. K.
Wabash	40 48.3	85 49.4	Oc 29, 30	0 45.8	71 52.7	19125	37	36.12	J. A. F.
San Pierre	41 11.8	86 53.3	No 2	1 43.4	71 58.5	19127	37	36.12	Do.
Albion	41 24.1	85 26.0	Oc 31	1 21.4	72 10.4	18828	37	36.12	Do.

INDIAN TERRITORY.

	° ′	° ′		*East* ° ′	° ′	γ			
Ardmore	34 10.4	97 09.0	No 13, 14	9 08.8	63 37.0	25588	19	23. III	W. M. H.
Antlers	34 14.7	95 38.4	No 28, 29	8 01.5	63 58.9	25371	19	23. III	Do.
Atoka, new	34 22.8	96 08.6	No 17, 18	8 28.2	64 01.2	25406	19	23. III	Do.
Atoka, old	34 24.1	96 08.6	No 15–17	8 24.1	64 04.2	25352	19	23. III	Do.
Pauls Valley	34 44.8	97 14.3	No 10, 11	9 14.8	64 15.1	25278	19	23. III	Do.
Talihiva	34 45.9	95 03.1	No 26	8 17.7	64 33.2	25069	19	23. III	Do.
South McAlester	34 58.2	95 48.8	No 20, 21	8 35.2	64 49.3	24859	19	23. III	Do.
Poteau	35 03.2	94 38.0	No 23	8 01.9	65 01.8	24684	19	23. III	Do.
Wewoka	35 08.4	96 31.2	No 6, 7	8 49.7	64 51.6	24779	19	23. III	Do.

IOWA.

	° ′	° ′		*East* ° ′	° ′	γ			
Sioux City	42 29.4	96 28.4	Jy 19, 20	9 42.4	72 21.4	18756	19	31.12	H. W. F.

*For the values in italics the total intensity determined by Lloyd's method was combined with the observed dip.

TABLE I.—*Magnetic observations on land, July 1, 1905, to June 30, 1906*—Continued.

KANSAS.

Station	Latitude	Longitude	Date	Declination	Dip	Horizontal intensity	Instruments M.	Instruments D. C.	Observer
				East					
	° ′	° ′		° ′	° ′	γ			
Baldwin Magnetic	38 47.0	95 10.0	De–Ja	8 29.2	68 44.4	21824	30	55.12	W. B. K.
Obs'y	38 47.0	95 10.0	Au 10–12	8 28.3	68 42.4	21794	10	30.12	W. B. K.
Do.	38 47.0	95 10.0	Oc 16–18	8 29.5	68 43.3	21787	17	37.12	D. C. S.
Do.	38 47.0	95 10.0	Oc 25–27	8 27.3	68 43.5	21837	11	23. III	W. M. H.
Do.	38 47.0	95 10.0	De 12, 13	8 28.9	68 45.4	21782	17	37.12	D. C. S.
Do.	38 47.0	95 10.0	Je 19–22	8 29.1	68 42.2	21834	19	56.13	W. B. K.

KENTUCKY.

				East					
	° ′	° ′		° ′	° ′	γ			
Scottsville	36 45.0	86 13.0	No 28, 29	5 14.1	68 01.9	22869	29	31.12	H. M. A.

MAINE.

				West					
	° ′	° ′		° ′	° ′	γ			
Bailey Island	43 43.4	70 00.5	Se 5	15 06.8	74 10.9	*16382**	C	35. III	L. A. B.
Harpswell Neck	43 44.0	70 01.5	Se 5	16 33.9	73 55.7	*16714**	C	35. III	L. A. B.
Kimball Island	44 04.8	68 38.2	Au 14	15 49.7	74 20.7	*16216**	C	34.12	N. H. H.
Rockland	44 07.0	69 05.0	Au 5, 28	16 29.8	74 18.7	*16261**	C	34.12	N. H. H.
Rockland	44 07.0	69 05.0	Oc 30	16 31.2	74 13.9	*16365**	C	34.12	N. H. H.
Southwest Harbor	44 15.0	68 17.7	Oc 23, 24	16 20.6	74 47.2	*15813**	C	33.12	J. H. S.
Beans Island	44 28.5	68 12.6	Se 21	16 53.2	74 29.9	*15973**	C	33.12	Do.
Farmington	44 40.1	70 11.2	Oc 5, 6	15 55.8	74 50.5	15864	8	72.12	J. E. B.
Bangor	44 48.2	68 48.2	Oc 2–4	17 27.7	74 49.6	15715	8	72.12	Do.
Rangeley	44 58.3	70 38.2	Oc 17	16 17.8	74 52.4	15866	8	72.12	Do.

MARYLAND.

				West					
	° ′	° ′		° ′	° ′	γ			
Cheltenham Magnetic Obs'y	38 44.0	76 50.5	De–Ja	5 20.2	70 26.6	20059	26	26 EI	W. F. W.
Do.	38 44.0	76 50.5	Se 19–28	5 18.9	70 26.1	20060	IIII	76.34	W. J. P.
Do.	38 44.0	76 50.5	Oc 3–31	5 18.7	70 26.8	20068	IIII	76.34	W. F. W.
Do.	38 44.0	76 50.5	No–De	5 19.3	.....	20043	151	.....	W. F. W.
Do.	38 44.0	76 50.5	Ja–Fe	5 18.9	.....	20043	147	.....	W. F. W.
Do.	38 44.0	76 50.5	Mh 1	5 20.8	.....	20028	11	.....	W. M. H.
Do.	38 44.0	76 50.5	Je 7, 9	5 20.9	.....	20053	10	.....	W. F. W.
Baltimore									
Patterson Pk II	39 17.3	76 35.4	Au 10	5 54.4	70 44.4	*19553**	C	33.12	E. M.
I	39 17.5	76 34.8	Au 8	5 55.2	70 42.3	*19560**	C	33.12	E. M.
I	39 17.5	76 34.8	De 28	5 53.4	70 43.2	*19702**	C	34.12	N. H. H.
I	39 17.5	76 34.8	Ja 10, 11	5 54.1	70 47.9	19605	19	33.12	A. L. G.
III	39 18.0	76 34.5	No 7	5 54.1	70 48.7	*19563**	C	34.12	N. H. H.
III	39 18.0	76 34.5	No 16	5 56.2	70 50.3	*19539**	C	33.12	J. H. S.

* For the values in italics the total intensity determined by Lloyd's method was combined with the observed dip.

TABLE I.—*Magnetic observations on land, July 1, 1905, to June 30, 1906*—Continued.

MASSACHUSETTS.

Station	Latitude	Longitude	Date	Declination	Dip	Horizontal intensity	Instruments		Observer
							M.	D. C.	
	° ′	° ′		*West* ° ′	° ′	γ			
Mansfield	42 01.4	71 12.6	No 6, 7	12 27.5	72 56.2	17624	8	72.12	J. E. B.
Sheffield	42 06.3	73 21.6	No 2	11 11.8	73 10.8	17534	8	72.12	Do.
Huntington	42 13.7	72 53.8	No 4	12 10.9	73 15.0	17338	8	72.12	Do.
Pittsfield	42 26.6	73 17.2	Oc 31	11 17.2	73 24.7	17222	8	72.12	Do.
Concord	42 27.7	71 23.3	Oc 27	13 01.7	73 20.3	17223	8	72.12	Do.
Athol	42 37.0	72 17.4	Oc 28, 29	12 13.0	73 24.3	17180	8	72.12	Do.
Lawrence	42 42.5	71 12.1	Oc 25	12 35.3	73 31.6	17028	8	72.12	Do.
Newburyport	42 48.1	70 48.8	Oc 23	13 22.0	73 35.7	16968	8	72.12	Do.

MICHIGAN.

	° ′	° ′		*West* ° ′	° ′	γ			
Jackson	42 15.3	84 23.0	No 6–9	0 19.3	73 04.4	18021	29	31.12	H. M. A.
Ann Arbor	42 17.2	83 43.3	No 12–14	2 01.3	72 51.2	18248	29	31.12	Do.
				East					
Hastings	42 39.1	85 18.2	No 2, 3	0 20.3	73 24.6	17762	29	56.13	Do.
Hastings	42 39.1	85 18.2	No 1, 2	.....	73 22.3	.....	..	31.12	Do.
				West					
Lansing	42 44.4	84 31.7	Oc 23, 24	0 15.9	73 28.4	17632	29	56.13	Do.
St. Johns	42 59.6	84 31.9	Oc 26, 27	0 18.7	73 39.4	17558	29	56.13	Do.
Flint	43 00.3	83 38.7	Oc 29, 30	1 35.1	73 53.8	17210	29	56.13	Do.
Stanton	43 18.2	85 04.9	Oc 19, 20	0 13.7	74 08.3	17126	29	56.13	Do.
				East					
Big Rapids	43 40.8	85 30.8	Oc 14, 15	0 25.7	74 10.5	16948	29	56.13	Do.
				West					
Gladwin	43 58.3	84 23.3	Oc 6, 7	1 04.1	74 37.6	16686	29	56.13	Do.
Cadillac	44 13.6	85 19.9	Oc 9–12	0 38.3	74 44.7	16587	29	56.13	Do.
Roscommon	44 29.8	84 34.2	Oc 3, 4	0 54.5	75 16.8	16078	29	56.13	Do.
Gaylord	45 02.8	84 39.5	Se 28–30	0 41.9	75 32.7	15676	29	56.12	Do.
Mackinac I. Fort East	45 51.5	84 37.0	Se 25	1 49.2	76 05.7	15192	29	56.13	C. C. C.
Mackinac I. Fort West	45 51.5	84 37.2	Se 26, 27	1 53.4	76 06.4	15187	29	56.13	H. M. A.
Newberry	46 20.3	85 30.8	Se 22, 23	0 37.3	76 20.7	14879	29	56.13	C. C. C.
				East					
Bessemer	46 28.1	90 04.2	Au 20, 21	3 21.1	75 32.3	16160	29	56.13	C. C. C.

TABLE I.—*Magnetic observations on land, July 1, 1905, to June 30, 1906*—Continued.

MINNESOTA.

Station	Latitude	Longitude	Date	Declination	Dip	Horizontal intensity	Instruments		Observer
							M.	D. C.	
	° ′	° ′		East ° ′	° ′	γ			
Royalton S. Base	45 44.2	94 12.1	Au 28, 31	8 44.4	75 06.6	16091	10	30.12	W. H. B.
Osakis	45 49.5	95 07.9	Je 20	9 53.3	75 27.9	16027	29	30.12	Do.
Brainerd	46 21.0	94 11.8	Se 8–27	7 51.8	75 24.8	15849	10	30.12	Do.
Douglas	46 36.8	93 09.2	Se 21	7 34.3	76 06.8	15201	10	30.12	Do.
Two Harbors	47 03.0	91 38.2	Oc 21–23	4 15.5	76 53.3	14477	19	31.12	P. H. D.
Deer River	47 21.7	93 44.2	Oc 16	8 38.1	76 31.4	14808	19	31.12	Do.
Fosston	47 35	95 43.6	Oc 11	8 52.4	76 21.4	15133	19	31.12	Do.
Tilden	47 42.3	96 19.8	Oc 23–26	11 12.3	76 35.9	14782	10	30.12	W. H. B.
Tower	47 50.2	92 12.0	Oc 19	18 28.4	73 04.7	19686	19	31.12	P. H. D.
Northome	47 53.0	94 16.8	Oc 13	7 58.9	76 58.9	14267	19	31.12	Do.
Stephen W. Base	48 27.4	96 51.2	Oc 10–14	11 44.1	76 53.9	14439	10	30.12	W. H. B.

MISSISSIPPI.

	° ′	° ′		East ° ′	° ′	γ			
Corinth	34 55.3	88 30.8	De 5, 6	5 41.1	65 57.2	23751	29	31.12	H. M. A.

MISSOURI.

	° ′	° ′		East ° ′	° ′	γ			
Cassville	36 42.1	93 51.0	Oc 21	7 12.1	67 06.8	23066	17	37.12	D. C. S.
West Plains	36 43.5	91 50.0	Oc 23	6 18.3	67 04.0	23172	17	37.12	Do.
Lamar	37 29.5	94 16.3	Au 5	8 19.5	68 20.6	22190	10	30.12	W. B. K.
Waynesville	37 50.0	92 13.0	Au 3, 4	6 38.8	68 11.7	22357	10	30.12	Do.
Steelville	37 58.5	91 21.8	Au 1, 2	6 08.8	68 07.4	22437	10	30.12	Do.
Hermann	38 42.3	91 26.5	Je 6, 7	6 30.4	69 19.6	21300	29	30.12	W. H. B.
Normal	38 45.5	93 44.3	Je 16	7 40.1	68 18.7	22400	29	30.12	W. H. B.

MONTANA.

	° ′	° ′		East ° ′	° ′	γ			
Dillon	45 12.9	112 39.2	Se 13, 14	20 14.8	71 11.6	19502	11	23. III	W. M. H.
Crow Agency	45 36.4	107 27.0	Au 21–23	18 13.5	72 21.1	18614	19	31.12	H. W. F.
Crow Agency	45 36.4	107 27.0	Au 23	18 14.4	72 20.0	*18546**	C	35. III	L. A. B.
Anaconda	46 08.5	112 58.8	Se 9, 11	21 03.1	71 36.6	19090	11	23. III	W. M. H.
Stevensville	46 30.4	114 04.8	Au 30, 31	20 49.9	71 43.1	18938	11	23. III	W. M. H.
Helena	46 37.0	112 02.2	Au 22	19 49.2	72 08.4	*18548**	C	35. III	L. A. B.
Missoula	46 52.1	113 58.9	Au 24, 25	21 17.4	72 00.5	18757	11	23. III	W. M. H.
Lewistown	47 04.4	109 26.5	Se 5, 6	19 53.2	73 09.7	17798	11	23. III	W. M. H.
Superior	47 11.9	114 53.6	Au 26, 28	21 51.8	71 56.3	18714	11	23. III	W. M. H.
Glasgow	48 12.2	106 38.2	Je 18, 25	19 25.0	74 50.0	16256	1C	36.12	C. C. C.
Malta	48 21.2	107 52.4	Je 27	20 12.7	74 36.4	16421	1C	36.12	C. C. C.
Harlem	48 31.6	108 47.2	Je 30	21 05.1	74 35.4	16451	1C	36.12	C. C. C.
Phillip's Ranch	49 00.0	115 03.4	Oc 16–18	24 01.0	73 20.7	17439	21	24.12	C. J. H.
Gateway	49 00.0	115 10.2	Oc 14, 15	23 56.2	73 19.8	17452	21	24.12	C. J. H.
Yaak River	49 00.0	115 38.8	Oc 11	23 36.4	73 16.4	17450	21	24.12	C. J. H.

*For the values in italics the total intensity determined by Lloyd's method was combined with the observed dip.

TABLE I.—*Magnetic observations on land, July 1, 1905, to June 30, 1906*—Continued.

NEVADA.

Station	Latitude	Longitude	Date	Declination	Dip	Horizontal intensity	Instruments		Observer
							M.	D. C.	
	° ′	° ′		*East* ° ′	° ′	γ			
Las Vegas	36 09.6	115 11.2	My 16	15 33.0	62 25.7	25469	II	23. 22	W. M. H.
Rox	36 52.4	114 42.1	My 18, 19	16 14.4	62 47.4	25389	II	23. III	W. M. H.
Caliente	37 36.3	114 30.7	My 21, 22	16 58.6	63 46.7	24700	II	23. III	W. M. H.

NEW HAMPSHIRE.

	° ′	° ′		*West* ° ′	° ′	γ			
Newport	43 22.2	72 09.7	Se 11, 13	13 23.4	74 00.8	16756	37	21. 12	G. B. P.
Hanover, old	43 42.3	72 17.3	Se 9	12 42.8	.. ....	.....	37	.. ..	Do.
Do.	43 42.3	72 17.3	Se 9	12 43.7	.. ....	.....	37	.. ..	Do.
Hanover, new	43 43.1	72 16.6	Se 8, 9	12 48.4	74 22.7	16387	37	21. 12	Do.
Plymouth	43 45.7	71 42.3	Se 7	13 32.0	74 16.5	16409	37	21. 12	Do.
Colebrook	44 53	71 30.9	Au 31	15 59.7	75 15.2	15634	37	21. 12	Do.

NEW MEXICO.

	° ′	° ′		*East* ° ′	° ′	γ			
Orange	32 01.5	105 20.6	Ap 6, 7	11 51.7	59 53.6	27486	II	23. III	W. M. H.
Deming*	32 15.3	107 46.0	Fe 8, 9	12 09.0	59 35.9	27530	II	23. III	Do.
Las Cruces	32 19.3	106 48.0	Ap30, My1	12 21.3	59 29.3	27646	II	23. III	Do.
Jarilla	32 23.3	106 05.7	Mh 26, 27	12 00.9	60 17.7	27173	II	23. III	Do.
Prathers Ranch	32 25.7	105 43.6	Ap 3	12 14.8	60 11.2	27236	II	23. III	Do.
Silver City	32 45.8	108 17.6	My 5, 6	12 45.6	59 50.8	27301	II	23. III	Do.
Alamogordo	32 54.2	105 58.4	Mh 28–30	12 14.0	60 16.1	27264	II	23. III	Do.
Cloudcroft	32 57.7	106 05.8	Ap 12, 13	12 28.2	60 43.0	27087	II	23. III	Do.
Engle	33 10.0	107 02.7	My 2, 3	12 46.4	60 45.6	26899	II	23. III	Do.
Torrance	34 21.2	105 32.1	Ap 17, 18	12 36.7	62 07.2	26208	II	23. III	Do.
Santa Rosa	34 55.8	104 40.6	Ap 20, 21	12 14.2	62 59.9	25705	II	23. III	Do.
Tucumcari	35 09.5	103 47.4	Ap 25	12 24.9	63 17.9	25669	II	23. 22	Do.
Nara Visa	35 36.1	103 08.9	Ap 26, 27	11 49.4	64 08.3	25096	II	23. 22	Do.

*Occupied on February 8 and 9, 1905.

TABLE I.—*Magnetic observations on land, July 1, 1905, to June 30, 1906*—Continued.

NEW YORK.

Station	Latitude	Longitude	Date	Declination	Dip	Horizontal intensity	Instruments		Observer
							M.	D.C.	
	° ′	° ′		*West* ° ′	° ′	γ			
New York	40 51.9	73 52.4	Se, Oc	9 08.1	72 02.0	18690	37	21.12	G. B. P.
Big Indian	42 05.5	74 26.5	Oc 15, 16	9 55.3	73 00.5	17695	37	21.IV	J. A. F.
Elmira	42 07.1	76 50.2	Jy 1, 2	7 52.3	73 22.9	17404	37	21.12	G. B. P.
Belmont	42 13	78 01.8	Jy 5, 6	6 02.8	73 22.0	17576	37	21.12	Do.
Delhi	42 15.0	74 56.0	Oc 17	9 39.4	73 20.4	17350	37	21.IV	J. A. F.
Little Valley	42 15.6	78 48.2	Jy 8–11	4 39.8	73 27.3	17600	37	21.IV	G. B. P.
Albany, old	42 39.8	73 45.1	Au 2, 3	11 08.2	73 49.5	16939	37	21.12	Do.
Do.	42 39.8	73 45.1	Se 15	11 08.0	.. ....	16931	37	.....	Do.
Albany, new	42 40.5	73 45.0	Au 3, 4	11 06.8	73 43.3	17013	37	21.12	Do.
Warsaw	42 45.0	78 07.6	Jy 12, 13	5 27.0	73 44.9	17256	37	21.12	Do.
Johnstown	43 00.1	74 23.7	Jy 29	11 22.9	73 43.7	17109	37	21.12	Do.
Lake George	43 24.7	73 41.6	Au 7, 8	11 56.3	74 13.7	16502	37	21.12	Do.
Beaver River	43 53.9	74 54.8	Jy 26, 27	10 40.4	74 51.9	16038	37	21.12	Do.
Antwerp	44 12.0	75 37.0	Jy 15, 17	10 27.4	75 17.4	15635	37	21.12	Do.
Elizabethtown	44 12.6	73 34.1	Au 9, 10	13 13.9	74 51.3	15804	37	21.12	Do.
Saranac Lake	44 19.6	74 08.8	Jy 21, 22	10 20.6	74 40.3	16291	37	21.12	Do.
Plattsburg	44 40.4	73 27.1	Au 11 13	11 48.0	74 04.6	16948	37	21.12	Do.
Malone	44 50.7	74 17.2	Jy 19, 20	15 11.6	74 26.3	16588	37	21.IV	Do.

NORTH DAKOTA.

	° ′	° ′		*East* ° ′	° ′	γ			
Ellendale	46 00.0	98 33.8	Jy 4, 5	12 04.9	74 22.8	16875	19	31.12	H. W. F.
Fargo	46 51.0	96 47.1	Se 22, 23	11 30.0	75 35.4	15731	19	31.12	H. W. F.
Fargo	46 51.0	96 47.1	Je 20	11 31.5	75 37.5	15728	10	31.34	H. W. F.
Washburn	47 17.7	101 02.1	Au 25, 26	15 34.5	75 10.3	16000	19	31.12	H. W. F.
Hope	47 20.3	97 42.9	Oc 6, 7	12 21.9	75 50.0	15459	19	31.12	P. H. D.
Carrington	47 27.4	99 07.4	Oc 3	13 37.1	75 38.4	15583	19	31.12	P. H. D.
Grand Forks	47 55.7	97 02.1	Se 25, 26	11 36.0	76 38.9	14686	19	31.12	P. H. D.
Lakota	48 03.2	98 19.0	Se 28	12 45.5	76 15.1	15089	19	31.12	P. H. D.
Minot	48 13.8	101 16.1	Se 6, 7	15 33.7	75 47.9	15396	19	31.12	H. W. F.
Cando	48 30	99 13.5	Je 25	13 45.5	76 20.8	14976	10	31.34	H. W. F.
Langdon	48 45.5	98 23.2	Se 1	13 16.4	76 53.0	14392	19	31.12	H. W. F.
Mohall	48 45.5	101 32.4	Je 29	16 56.6	76 26.9	14892	10	31.34	H. W. F.
Bottineau	48 49.8	100 27.6	Se 3, 4	15 58.9	76 34.6	14769	19	31.12	H. W. F.
Rolla	48 52.0	99 36.3	Je 26, 27	14 36.8	76 55.0	14479	10	31.34	H. W. F.
Pembina	48 58.0	97 15.2	Au 29	11 28.8	77 17.3	13952	19	31.12	H. W. F.

OHIO.

	° ′	° ′		*West* ° ′	° ′	γ			
Dayton	39 44.8	84 16.0	Oc 25, 26	0 02.9	70 59.8	19764	37	36.12	J. A. F.

TABLE I.—*Magnetic observations on land, July 1, 1905, to June 30, 1906*—Continued.

OKLAHOMA.

Station	Latitude	Longitude	Date	Declination	Dip	Horizontal intensity	Instruments M.	Instruments D.C.	Observer
				East					
	° ′	° ′		° ′	° ′	γ			
Tecumseh	35 16.2	96 57.3	No 3, 5	8 55.7	65 11.6	24532	19	23. III	W. M. H.

OREGON.

				East					
	° ′	° ′		° ′	° ′	γ			
Jacksonville	42 18.1	122 57.3	Je 7	19 59.6	65 59.5	22910	11	23. III	W. M. H.
Eugene	44 03	123 03.8	Je 9–13	22 13.5	67 37.8	21863	11	23. III	W. M. H.
Yaquina	44 36.4	124 00.9	Je 16–17	21 13.8	67 49.8	21557	11	23. III	W. M. H.
Detroit	44 42.9	122 08.3	Je 22, 23	21 14.6	68 12.8	21251	11	23. III	W. M. H.
Sumpter	44 44.6	118 12.6	Jy 24	20 46.6	69 11.8	20844	11	23. III	W. M. H.
Baker	44 48.1	117 50.0	Jy 20, 21	20 53.4	69 13.4	20808	11	23 III	W. M. H.
McMinnville	45 11.2	123 13.2	Je 19	21 45.4	68 24.8	21321	11	23. III	W. M. H.
Union	45 12.4	117 52.9	Jy 27	20 52.2	69 41.1	20568	11	23. III	W. M. H.
Estacada	45 16.4	122 23.1	Je 28, 29	21 52.6	68 42.1	21280	11	23. III	W. M. H.
Portland	45 31.4	122 42.2	Au 19	22 43.9	68 39.0	*21754**	C	35. III	L. A. B.
Elgin	45 33.2	117 55.5	Jy 31–Au 2	21 18.9	70 00.9	20281	11	23. III	W. M. H.
Pendleton	45 39.9	118 47.4	Au 7, 8	21 48.8	69 18.4	20798	11	23. III	W. M. H.

PENNSYLVANIA.

				West					
	° ′	° ′		° ′	° ′	γ			
Philadelphia	39 57.3	75 12.4	Oc 20	7 45.0	71 03.7	19361	37	21. IV	J. A. F.
Doylestown	40 17.4	75 10.5	Oc 19	7 19.5	71 33.4	19065	37	21. IV	Do.

PORTO RICO.

				West					
	° ′	° ′		° ′	° ′	γ			
Salinas	17 56.2	66 18.1	Fe 5	1 17.0	48 30.5	*29791**	C	34. 12	N. H. H.
Salinas	17 56.2	66 18.1	Fe 13	1 16.4	.. ....	29755	IIII	.....	N. H. H.
Water Key	18 05.6	65 28.4	My 9	1 43.0	49 14.0	*29442**	C	34. 12	N. H. H.
Water Key	18 05.6	65 28.4	My 11	1 42.6	.. ....	29508	IIII	.....	N. H. H.
Porto Rico Magnetic Obs'y	18 08.9	65 26.4	De–Ja	1 29.4	49 44.7	28964	31	1 EI	J. W. G.
Obispo Cayo	18 20.6	65 37.2	Ja 18	1 57.5	49 26.0	*29431**	C	34. 12	N. H. H.
Obispo Cayo	18 20.6	65 37.2	Ja 18, 19	2 00.8	.. ....	29478	IIII	.....	R. L. F.
Obispo Cayo	18 20.6	65 37.2	My 12	1 57.4	49 26.8	*29429**	C	34. 12	N. H. H.

* For the values in italics the total intensity determined by Lloyd's method was combined with the observed dip.

TABLE I.—*Magnetic observations on land, July 1, 1905, to June 30, 1906*—Continued.

SOUTH CAROLINA.

Station	Latitude	Longitude	Date	Declination	Dip	Horizontal intensity	Instruments		Observer
							M.	D.C.	
	° ′	° ′		*East* ° ′	° ′	γ			
Columbia	33 56.0	81 02.0	De 8, 9	0 00.2	65 35.0	23791	29	31.12	H. M. A.
				West					
Camden	34 13.3	80 36.6	De 10, 11	0 44.9	65 25.0	23693	29	31.12	Do.
Lancaster	34 41.6	80 47.9	De 12	0 57.0	66 19.7	23195	29	31.12	Do.
				East					
Yorkville	35 00.3	81 16.6	De 13	0 27.3	66 37.8	22892	29	31.12	Do.

SOUTH DAKOTA.

	° ′	° ′		*East* ° ′	° ′	γ			
Yankton	42 52.0	97 23.8	Jy 14, 15	11 17.2	72 53.7	18192	19	31.12	H. W. F.
Hot Springs	43 25.8	103 28.6	Au 2, 3	15 07.0	71 26.2	19500	19	31.12	Do.
Chamberlain	43 49.1	99 19.0	Jy 11	12 33.6	72 29.3	18680	19	31.12	Do.
Rapid City	44 04.8	103 12.1	Au 5–7	15 16.3	71 56.8	19041	19	31.12	Do.
Belle Fourche	44 40.7	103 51.5	Au 9	15 46.2	72 22.2	18712	19	31.12	Do.
Eureka	45 45.9	99 31.1	Jy 6–8	13 31.1	74 11.4	17061	19	31.12	Do.

TENNESSEE.

	° ′	° ′		*East* ° ′	° ′	γ			
Memphis	35 07.8	90 04.3	De 3, 4	5 29.5	65 46.5	24080	29	31.12	H. M. A.
Brownsville	35 35.3	89 17.8	No 30, De 1	4 44.2	66 22.0	23443	29	31.12	Do.
Huntingdon	35 59.8	88 23.1	No 24	4 19.7	66 59.0	23028	29	31.12	Do.
Nashville	36 08.5	86 46.0	No 19, 20	3 48.0	67 00.9	22938	29	31.12	Do.
Cookeville	36 09.6	85 28.7	No 21, 22	2 51.2	67 03.7	23293	29	31.12	Do.
Charlotte	36 11.5	87 18.5	No 23	3 29.5	67 19.8	22782	29	31.12	Do.

TEXAS.

	° ′	° ′		*East* ° ′	° ′	γ			
Fronton	26 04.6	97 12.4	De 13	8 04.2	54 28.4	30156	10	30.12	W. H. B.
Topo	26 45.4	97 28.4	De 19, 21	8 14.3	55 13.4	29859	10	30.12	W. H. B.
San Diego	27 45.1	98 14.0	No 20	8 39.0	56 12.7	29458	10	30.12	W. H. B.
Corpus Christi	27 47.3	97 24.5	De 26	8 24.1	56 33.7	29323	10	30.12	W. H. B.
Beeville	28 23.3	97 46.0	Ja 3	8 58.3	57 16.9	28814	10	30.12	W. H. B.
Karnes	28 54.7	97 53.6	Ja 9, 11	8 38.4	57 32.0	28845	10	30.12	W. H. B.
Boquillas	29 14.9	103 01.8	Mh 21	10 12.6	57 01.3	28975	11	23. III	W. M. H.
Galveston	29 17.0	94 48.2	Ap 14, 16	7 28.2	58 36.6	28404	19	33.12	A. L. G.
Mission	29 42.9	98 09.9	Ja 16–19	8 46.2	58 28.5	28572	10	30.12	W. H. B.
Marathon	30 12.6	103 14.3	Mh 17	10 20.7	58 22.9	28196	11	23.22	W. M. H.
Austin	30 16.0	97 46.3	Ja 27	8 19.8	59 21.3	27968	10	30.12	W. H. B.
Alpine	30 21.8	103 40	Mh 12	.....	58 50.6	*28217**	..	23.3	W. M. H.
Fort Stockton	30 53.7	102 50	Mh 14	10 57.4	59 00.2	28062	11	23. III	W. M. H.
Jasper	30 55.0	93 59	Mh 8, 9	7 21.9	60 42.2	27198	11	23. III	W. M. H.
Lampasas	31 01.0	98 10.3	Fe 8	8 38.4	60 22.0	27292	10	30.12	W. H. B.
Chamliss	31 39.4	98 07.5	Fe 13–16	8 56.6	60 36.3	27352	10	30.12	W. H. B.

* For the value in italics the total intensity determined by Lloyd's method was combined with the observed dip.

TABLE I.—*Magnetic observations on land, July 1, 1905, to June 30, 1906*—Continued.

UTAH.

Station	Latitude	Longitude	Date	Declination	Dip	Horizontal intensity	Instruments		Observer
							M.	D.C.	
				East					
	° ′	° ′		° ′	° ′	γ			
Green River	38 59.3	110 09.9	Se 21, 22	15 39.5	66 08.0	23476	11	23. III	W. M. H.
Price	39 36.3	110 49.8	Se 16, 18	16 34.2	66 11.6	23414	11	23. III	W. M. H.

VERMONT.

				West					
	° ′	° ′		° ′	° ′	γ			
Manchester	43 09.8	73 04.7	Au 15, 17	12 08.8	73 56.6	16804	37	21. 12	G. B. P.
Rutland	43 37.2	72 58.1	Au 18, 19	12 28.0	74 08.5	16642	37	21. 12	G. B. P.
Middlebury	44 01	73 11.3	Au 19, 21	12 18.0	74 30.8	16281	37	21. 12	G. B. P.
St. Johnsbury	44 24.5	72 00.6	Au 28, Se 1	13 44.6	74 50.0	15946	37	21. 12	G. B. P.
Burlington	44 28.7	73 11.8	Au 22–24	12 48.0	74 29.8	16341	37	21. 12	G. B. P.
Hyde Park	44 35	72 36.6	Se 5	14 19.8	74 50.3	15978	37	21. 12	G. B. P.
St. Albans	44 49.3	73 02.9	Au 25, 26	15 01.4	75 14.6	15624	37	21. 12	G. B. P.
St. Albans B	.....	.....	Au 26	15 11.6	.....	.....	37	.....	G. B. P.

WASHINGTON.

				East					
	° ′	° ′		° ′	° ′	γ			
Walla Walla	46 03.3	118 22.1	Au 10	21 37.4	70 29.2	19808	11	23. III	W. M. H.
North Yakima	46 34.4	120 32.2	Fe 27, 28	22 35.8	70 12.2	19953	20	15. 13	W. M. S.
Colfax	46 52.5	117 21.5	Au 12, 14	22 36.1	71 16.2	19376	11	23. III	W. M. H.
Ellensburg	46 59.9	120 31.6	Mh 14	22 52.2	70 32.6	19652	20	15. 13	W. M. S.
Olympia	47 03.3	122 53.4	Fe 19, 20	23 20.5	70 22.4	19869	20	15. 13	W. M. S.
Hot Springs	47 12.5	121 32.8	Mh 18, 19	22 17.9	70 23.1	19711	20	15. 13	W. M. S.
Tacoma	47 15.7	122 26.9	Fe 13, 15	23 06.6	70 37.9	19576	20	15. 13	W. M. S.
Wilson Creek	47 25.7	119 00.0	Ap 2, 3	22 42.2	72 01.0	18748	20	15. 13	W. M. S.
Port Orchard	47 32.1	122 38.2	Fe 8, 10	22 39.0	70 57.4	19425	20	15. 13	W. M. S.
Do.	47 32.1	122 38.2	My 29	22 41.4	70 57.5	19431	20	32.2	W. M. S.
Do.	47 32.1	122 38.2	My 28, Je 1	22 42.2	70 52.7	19443	8	15. 13	W. M. S.
Leavenworth	47 36.2	120 33.3	Mh 29, 31	22 32.0	71 02.8	19297	20	15. 13	W. M. S.
Seattle	47 39.6	122 18.4	Jy 13–17	23 16.7	70 48.6	19351	21	24. 12	C. J. H.
Do.	47 39.6	122 18.4	No 11–14	23 19.2	70 53.1	19321	21	24. 12	C. J. H.
Do.	47 39.6	122 18.4	De 7	23 17.0	70 46.6	*19328**	C	28. 12	E. S.
Do.	47 39.6	122 18.4	De 14	.. ....	70 47.1	.....	..	20. 12	J. E. M.
Do.	47 39.6	122 18.4	De, Ja	23 16.8	70 51.6	19341	20	32.2	W. M. S.
Point Roberts	49 00.0	123 03.9	Jy 22, 23	24 32.9	71 36.1	18765	21	24. 12	C. J. H.
Blaine	49 00.0	122 44.0	Jy 18–20	24 21.6	71 58.6	18752	21	24. 12	C. J. H.
Sumas	49 00.0	122 16.1	Jy 28, 29	23 46.8	71 38.1	18924	21	24. 12	C. J. H.
Lemolo	49 00.0	122 06.6	Au 1, 2	23 09.0	71 47.5	18609	21	24. 12	C. J. H.
Silicia Creek	49 00.0	121 35.5	Au 8–10	29 00.0	70 58.0	19651	21	24. 12	C. J. H.
Depot Creek	49 00.0	121 19.0	Au 22, 23	23 33.1	71 33.6	18820	21	24. 12	C. J. H.
Skagit River	49 00.0	121 06	Au 18, 19	22 46.7	72 39.3	18023	21	24. 12	C. J. H.
Pasayten River	49 00.0	120 33.2	Au 29, 30	24 49.0	71 40.9	18845	21	24. 12	C. J. H.
16 m. west of Similkameen R.	49 00.0	120 03.7	Se 2, 4	24 30.2	72 13.2	18289	21	24. 12	C. J. H.
Similkameen R.	49 00.0	119 40.7	Se 8, 10	24 38.3	72 08.7	18203	21	24. 12	C. J. H.
Osoyoos Lake	49 00.0	119 25.8	Se 13, 14	24 03.4	72 25.8	18073	21	24. 12	C. J. H.

* For the value in italics the total intensity determined by Lloyd's method was combined with the observed dip.

TABLE I.—*Magnetic observations on land, July 1, 1905, to June 30, 1906*—Continued.

WASHINGTON—Continued.

Station	Latitude	Longitude	Date	Declination.	Dip	Horizontal intensity	Instruments M.	Instruments D. C.	Observer
	° ′	° ′		East ° ′	° ′	γ			
Sawmill Creek	49 00.0	119 10.3	Se 15, 16	23 41.6	72 26.2	18017	21	24.12	C. J. H.
Midway	49 00.0	118 45.9	Se 19	23 31.4	72 29.5	18146	21	24.12	C. J. H.
Carson	49 00.0	118 30.4	No 7, 8	24 02.8	72 38.0	17854	21	24.12	C. J. H.
Laurier	49 00.0	118 13.9	No 5, 6	23 23.4	72 43.3	17941	21	24.12	C. J. H.
Sheep Creek	49 00.0	117 50.7	Oc31, No1	23 17.0	72 40.3	18006	21	24.12	C. J. H.
Waneta	49 00.0	117 37.8	Oc 23, 29	23 24.8	72 47.8	17874	21	24.12	C. J. H.
Pend Oreille R.	49 00.0	117 23	Oc 26, 27	23 43.0	72 52.2	17760	21	24.12	C. J. H.

WISCONSIN.

Station		Latitude	Longitude	Date	Declination.	Dip	Horizontal intensity	Instruments M.	Instruments D. C.	Observer
		° ′	° ′		East ° ′	° ′	γ			
Elkhorn		42 41.3	88 31.5	Jy 7, 8	1 42.5	73 11.4	18096	10	30.12	W. B. K.
Fond du Lac		43 46.7	88 28.1	Jy 1	3 25.9	73 49.7	17274	10	30.12	W. B. K.
Grand Rapids		44 24	89 47.1	Jy 26, 27	5 27.6	74 57.8	16178	29	56.13	C. C. C.
Neillsville		44 34.0	90 34.8	Jy 29, 30	5 26.7	74 27.3	16837	29	56.13	C. C. C.
Shawano		44 46.8	88 36.7	Se 6–8	3 33.2	74 55.2	16260	29	56.13	C. C. C.
Chippewa Falls		44 54.6	91 23.4	Au 1, 2	6 18.6	74 51.1	16523	29	56.13	C. C. C.
Wausau		44 57.2	89 37.6	Au 26, 28	5 59.3	75 21.5	16175	29	56.13	C. C. C.
Marinette		45 04.0	87 39.9	Se 14–16	2 32.8	75 11.2	16108	29	56.13	C. C. C.
Mountain		45 10.0	88 30.4	Se 9, 10	2 40.1	75 17.1	15982	29	56.13	C. C. C.
Osceola	A	45 19.3	92 41.2	Au 4, 5	6 08.1	74 46.3	16863	29	56.13	C. C. C.
Osceola	B	45 19.3	92 41.2	Se 4	6 14.1	74 42.9	16899	29	56.13	C. C. C.
Rhinelander		45 37.9	89 24.4	Au 24, 25	0 34.9	75 54.9	15690	29	56.13	C. C. C.
Grantsburg		45 45.6	92 40.4	Au 7–10	9 21.8	75 31.2	16053	29	56.13	C. C. C.
Shell Lake		45 45.7	91 53.5	Au 13–15	4 30.6	75 09.0	16106	29	56.13	C. C. C.
Florence		45 54.8	88 16.1	Se 17, 19	2 28.3	75 56.7	15248	29	56.13	C. C. C.
Ashland		46 34.7	90 54.8	Au 18, 19	5 39.0	76 21.2	15168	29	56.13	C. C. C.

WYOMING.

Station	Latitude	Longitude	Date	Declination.	Dip	Horizontal intensity	Instruments M.	Instruments D. C.	Observer
	° ′	° ′		East ° ′	° ′	γ			
Wheatland	42 03.1	104 56.7	Jy 24	15 09.4	69 50.1	20812	19	31.12	H. W. F.
Douglas	42 44.5	105 21.9	Jy 26	15 28.3	70 22.2	20298	19	31.12	H. W. F.
Casper	42 50.6	106 19.8	Jy 28, 29	15 54.9	70 24.2	20459	19	31.12	H. W. F.
Newcastle	43 50.9	104 12.1	Au 14, 15	15 21.0	71 36.3	19367	19	31.12	H. W. F.
Gillette	44 17.1	105 29.3	Au 16, 17	16 32.1	71 38.2	19346	19	31.12	H. W. F.
Sheridan	44 50.3	106 57.6	Au 18, 19	16 59.2	71 51.9	19030	19	31.12	H. W. F.

FOREIGN COUNTRIES.

Station	Latitude	Longitude	Date	Declination.	Dip	Horizontal intensity	Instruments M.	Instruments D. C.	Observer
	° ′	° ′		West ° ′	° ′	γ			
Montreal, Can.	45 30.5	73 31.4	Se 1	14 40.1	75 38.2	15122	C	35.III	L. A. B.
Quebec, Can.	46 48.4	71 13.0	Se 2	17 49.3	76 03.4	14745	C	35.III	L. A. B.
				East					
Union 1, B. C.	49 35.6	124 54.0	Je 16, 17	26 00.9	71 24.2	19012	8	32.2	W. M. S. & P.C.W.
Union 2, B. C.	49 35.8	124 54.0	Je 18	26 17.4	71 25.3	19096	8	32.2	W. M. S. & P.C.W.

TABLE II.—*Magnetic observations at sea, July 1, 1905, to June 30, 1906.*

ATLANTIC OCEAN.

Place	Latitude	Longitude	Date	Declination	Dip	Horizontal intensity	Ship	Number of headings	Sea
	° ′	° ′		° ′	° ′	γ			
At sea	17 56	66 30	Fe 12	1 31 W	48 21	29966	Explorer	16	Sm.
Fajardo Roads	18 21	65 36	Ja 18–20	. . .	49 06	29688	Do.	16	Mod. sw.
Do.	18 21	65 36	My 14	2 03 W	49 22	29594	Do.	16	Lt. sw.
At sea	21 03	66 15	Ja 13	4 41 W	52 05	29038	Do.	3	Hvy. sw.
Do.	22 12	67 07	My 29	. . .	53 16	28817	Do.	3	Mod. sw.
Do.	24 00	66 30	Ja 12	3 03 W	55 25	27743	Do.	16	Mod. sw.
Do.	24 04	67 54	My 30	2 22 W	56 02	27572	Do.	16	Mod. sw.
Key West Harbor	24 31	81 50	Fe 5	2 30 E	55 15	29356	Bache	16	Sm.
Do.	24 32	81 50	Ap 6	2 31 E	54 52	29402	Do.	16	Sm.
Do.	24 33	81 50	Ap 25	2 35 E	54 59	29341	Do.	16	Sm.
Gulf of Mexico	24 32	82 58	Ap 7	2 36 E	54 19	29899	Do.	8	Sm.
Do.	24 43	83 27	Ap 24	3 38 E	55 11	29357	Do.	8	Mod. sw.
Do.	24 44	85 20	Ap 8	4 10 E	54 36	29648	Do.	8	Hvy. sw.
At sea	24 46	80 34	My 9	2 22 E	55 33	28961	Do.	8	Lt. sw.
Do.	24 55	80 27	Fe 2	1 18 E	55 46	29157	Do.	8	Sm.
Do.	25 15	68 15	My 30	1 12 W	56 55	27457	Explorer	3	Mod. sw.
Gulf of Mexico	25 16	84 43	Ap 24	3 34 E	55 38	29308	Bache	8	Lt. sw.
At sea	25 48	77 17	Fe 1	0 23 W	57 23	28318	Do.	8	Sm.
Gulf of Mexico	26 18	88 52	Ap 9	5 00 E	56 02	29227	Do.	8	Mod. sw.
Do.	26 24	86 52	Ap 23	4 41 E	56 35	28978	Do.	8	Lt. sw.
Do.	26 43	90 16	Ap 9	5 32 E	56 30	28997	Do.	8	Mod. sw.
Do.	26 54	88 12	Ap 23	4 49 E	56 52	28911	Do.	8	Sm.
Do.	27 28	92 48	Ap 10	. . .	56 50	28842	Do.	8	Lt. sw.
Do.	27 29	90 15	Ap 22	5 42 E	57 27	28763	Do.	8	Lt. sw.
Do.	27 42	93 41	Ap 10	7 02 E	56 46	29192	Do.	8	Lt. sw.
Do.	27 56	91 22	Ap 22	6 12 E	57 53	28428	Do.	8	Hvy. sw.
Do.	28 47	93 25	Ap 21	6 43 E	58 20	28358	Do.	8	Hvy. sw.
Galveston	29 20	94 40	Ap 11	7 22 E	58 45	28213	Do.	16	Sm.
Do.	29 21	94 45	Ap 19, 20	7 33 E	58 47	28070	Do.	16	Lt. sw.
At sea	29 59	76 13	Ja 31	2 33 W	62 14	25772	Do.	8	Hvy. sw.
Do.	30 14	70 27	Je 1	3 48 W	62 12	25089	Explorer	3	Mod. sw.
Do.	31 26	71 19	Je 1	4 42 W	63 30	24479	Do.	16	Lt. sw.
Do.	32 34	75 36	Ja 30	3 59 W	64 37	24264	Bache	8	Lt. sw.
Do.	33 15	72 51	Je 2	5 10 W	65 11	23549	Explorer	3	Mod. sw.
Do.	33 25	75 21	Ja 30	. . .	65 27	23709	Bache	8	Mod. sw.
Do.	36 08	75 30	Je 7	4 44 W	67 57	21753	Do.	8	Lt. sw.
Hampton Roads	36 56	76 04	Jy 27	4 16 W	68 35	21423	Explorer	16	Sm.
Do.	36 57	76 07	Je 3	4 34 W	68 55	21147	Do.	16	Lt. sw.
Do.	36 57	76 21	Ja 17	4 47 W	68 43	21735	Bache	16	Sm.
Do.	36 58	76 21	Je 7	4 29 W	68 38	21352	Do.	16	Sm.
Do.	36 59	76 10	Ja 7	4 29 W	68 50	21256	Explorer	16	Sm.
Do.	36 59	76 20	Au 21	4 50 W	.. ..	.....	Bache	5	Lt. sw.
Do.	36 59	76 20	Au 22	4 27 W	68 33	21188	Do.	16	Sm.
Chesapeake Bay	37 38	76 09	No 5	5 18 W	69 22	20860	Explorer	16	Sm.
At sea	37 43	75 02	Jy 27	4 00 W	71 27	18433	Do.	3	Lt. sw.
Do.	38 08	75 00	No 10	5 58 W	69 52	20406	Bache	8	Mod. sw.
Do.	39 11	73 22	Jy 28	8 11 W	70 36	19790	Explorer	16	Mod. sw.
Do.	40 28	71 47	Jy 28	9 25 W	71 29	18867	Do.	3	Mod. sw.
Do	41 42	69 30	No 3	14 05 W	72 48	17621	Do.	16	Mod. sw.
Penobscot Bay	44 06	69 04	Au 2	16 07 W	74 08	16373	Do.	16	Sm.
Do.	44 08	69 02	Oc 30	16 31 W	74 24	16152	Do.	16	Lt. sw.
Southwest Harbor	44 16	68 17	Oc 30	16 46 W	74 34	16096	Bache	16	Sm.
Frenchmans Bay	44 25	68 12	Se 22	16 46 W	74 34	15829	Do.	16	Sm.

TABLE II.—*Magnetic observations at sea, July 1, 1905, to June 30, 1906*—Continued.

PACIFIC OCEAN.

Place	Latitude	Longitude	Date	Declination	Dip	Horizontal intensity	Ship	Number of headings	Sea
	° ′	° ′		East ° ′	° ′	γ			
Seattle, Wash.	47 37	122 24	Ja 15	23 00	70 54	19339	Patterson	16	Sm.
Port Townsend, Wash.	48 18	122 58	My 25*	23 11	.....	.....	Do	16	Sm.
Victoria, B. C.	48 22	123 24	My 21*	23 53	71 15	19062	Do	16	Sm.
Seward, Alaska	60 05	149 15	Oc 4	27 02	.....	.....	Do	16	Sm.
Do.	60 05	149 15	Oc 4	27 34	73 58	15796	Do	16	Sm.
Do.	60 08	149 13	Je 5*	26 45	74 12	15519	Do	16	Sm.

*Observations were made in 1905 for the date given.

DESCRIPTIONS OF STATIONS.

Magnetic observers are instructed to mark every station in as permanent a manner as possible, either with a stone or a post of some durable wood, so that it may be available for future occupation. They are also required to furnish a sufficiently detailed description to locate the station even if the marking should be destroyed, and to determine the bearing of two or three prominent objects in addition to the one used as reference mark in the azimuth and declination observations. The information is given in abridged form on the following pages for each of the stations occupied during the year. Further details can usually be obtained on application to the Superintendent of the Coast and Geodetic Survey. The usual method of marking a station is by a stone post about 3 feet long and 6 or 8 inches square, set so as to project an inch or two above ground, and lettered on top U. S. C. & G. S., with a drill hole in the center to mark the exact point. Whenever the local authorities desired and were willing to bear the expense a second stone was set to denote the true meridian.

The descriptions of stations are arranged alphabetically by States and by names of station.

ALASKA.

Dixon Harbor.—Magnetic observations were made at South West Base. The azimuth mark is triangulation station Second and bears 17° 05′.5 east of south.

Fort Egbert (Eagle).—The station is 57.1 feet north of the astronomic station at Fort Egbert and in the meridian of the transit No. 18. This point is called station A in the small triangulation which was made to connect with the meridian mark, Eagle Peak and other points. It is marked by a concrete pier 1 foot square, the top of which is level with the ground and the center defined by a 1-inch copper pipe. The following true bearings were determined:

	° ′
Eagle Peak	6 09.2 east of north
Schoolhouse flag pole	11 47.0 east of south

Lake Bay, Prince of Wales Island.—The magnetic observations were made at triangulation signal "Beck," which is located on a small wooded island in the entrance of the bay. The azimuth mark is triangulation signal "Coff" and bears 39° 22′.5 east of south.

Descriptions of stations—Continued.

ALASKA—Continued.

McKenzie Inlet.—The magnetic station is located at triangulation station "Isle" on an islet near the head of McKenzie Inlet. The azimuth mark is triangulation station "Change" and bears 13° 11′.2 west of north.

St. Michael.—Stations I, II, Mesa, and Hill Top, established in 1902, were reoccupied.

Station I is 68.5 feet south of the concrete astronomic pier. It is marked by a small stub driven flush with the ground, a nail determining the exact spot. The planing-mill smokestack bears 49° 04′.8 east of north.

Station II is 24 feet nearly due east from Station I and is marked by a 4 by 4 inch stake. The planing-mill smokestack bears 48° 40′.3 east of north.

Station III A: As the old Station III could not be located, a new station was established 117.2 feet east and 4 feet north of the astronomic pier. It is exactly on the east and west line of the north side of the Observatory. The station is marked by a 2 by 4 inch stub. The planing-mill smokestack bears 48° 25′.3 east of north. The Catholic church spire bears 22° 48′.8 east of north.

Mesa is in the tundra about a quarter of a mile north of the astronomical station. It is marked by a 2 by 4 inch stub, a stake of splintered board about 5 feet long being driven down on the north side of the stub to mark its location in the long grass.

Hill Top: A signal pole and tripod were found standing over the station, which is 85 feet northwest of the store and 100 feet east of the schoolhouse. It is about 1 000 feet from Mesa. Observations were made at two points on the line from the station to the astronomic pier, one 5½ and the other 8 feet distant. The astronomic station bears 35° 00′.0 west of south.

North is 17.8 feet due north of the center of the astronomic pier, being 13.7 feet north of the north wall of the observatory. It is marked by a 1½ by 4 inch pine stub driven flush with the ground, the head of a nail showing the exact spot. The following true bearings were determined:

	° ′
Catholic Church spire	26 25.2 east of north
Left pole wireless station	33 11.0 east of north
Planing-Mill smokestack	51 03.0 east of north

Seward, Resurrection Bay.—The magnetic station is on a rounding point of land on the line of the Alaska Central Railway, nearly a mile north of the wharves. This point of land is the first to the east-southeast (mag.) from the first trestle of the railroad. The station is on the east side of the track and about 207 feet from it. It is about 394 feet north-northwest (mag.) from the "Powder House," 203 feet northwest (mag.) from a large sawed stump, 49 feet from the pebble beach, and 148 feet from the low-water line. The station is marked by a 4-inch stub driven flush with the ground, a copper nail marking the exact spot. Triangulation station "Point" bears 0° 32′.2 west of south.

Sitka Magnetic Observatory, Sitka.—In the absolute building. For description of the Observatory see Appendix 5, Report for 1902.

Valdez.—The magnetic station is in a lot belonging to Fred. Cameron, just adjoining the corral of the Valdez Transportation Company on the west. It is 26.2 feet due south of the longitude pier in the Observatory. The azimuth mark is the flagstaff at Fort Liscum, and bears 52° 57′.9 west of south. The station is marked by a 16 by 16 inch post, projecting 2 feet above ground. Under the post, at a depth of 2.5 feet, a large telegraph insulator was set for an underground mark.

ARKANSAS.

Clarendon, Monroe County.—The station is in the northwest corner of the court-house grounds, 16.2 feet from the walk running east and west, 54.5 feet from the west fence, and 42.8 feet from the north fence. The station is marked by a block of cement, 30 by 12 by 12 inches, projecting 1 inch above the ground, and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′
Colored Methodist Church spire (mark)	26 08.4 west of north
Northwest corner of court-house	87 26.6 east of south

Descriptions of stations—Continued.

ARKANSAS—Continued.

Clarksville, Johnson County.—The station is on College Hill, about one-half mile north of town and in front of the Cumberland Presbyterian College building. It is 116.6 feet and 145.8 feet from the southeast and southwest corners of the building, respectively, 49.2 feet from a cedar tree, and 57.3 feet from an oak tree to the northeast. The station is marked by a hard sandstone post, 30 by 12 by 10 inches, projecting 1 inch above the ground, and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′	
Schoolhouse spire (mark)	10 02.3	west of south
Court-house spire	16 52.8	east of south
Cumberland Presbyterian Church spire	30 26.2	east of south

Clinton, Van Buren County.—The station is in the school grounds, on a hill south of town. It is 120 feet southeast of the southeast corner of the school building and 20.5 feet from a picket fence on the east, near the road running west and diagonally northwest across the school grounds. It is also 15.2 feet from a hickory tree to the northeast, 22 feet and 40.4 feet from a pine and oak tree, respectively, to the northwest, and 20.9 feet from an oak tree to the southwest. The station is marked by a hard sandstone post, 24 by 6 by 6 inches, projecting 2 inches above the ground, and roughly lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′	
Center of cupola on court-house (mark)	1 06.5	west of north
Southeast corner of chimney on Leonard Hotel	8 04.5	west of north
Southwest corner of schoolhouse	37 20.3	west of north

Danville, Yell County.—The station is in the public school grounds, about three-fourths of a mile south of town. It is in the southwest corner of the grounds, on the girls' side, 18 feet from the west fence and 43 feet from the walk on the north. It is also 28 feet from the more northerly of three persimmon trees to the east and 57 feet from a small building to the southeast. The station is marked by a wooden post, 30 inches long and 8 inches in diameter, set flush with ground. The east gable on Mr. Gray's yellow house bears 71° 19′.6 west of true south.

De Queen, Sevier County.—The station is in the southwest corner of the court-house grounds, 20.5 feet from the west fence and 37.7 feet from the south fence. It is 26.6 feet from a medium-sized tree to the northeast and 38.8 feet from a large white oak tree to the southeast. The station is marked by a Eureka limestone post, 30 by 7 by 7 inches, projecting 1 inch above the ground, and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′	
Methodist Church spire (mark)	28 28.2	west of north
Schoolhouse spire	5 28.2	east of north
Presbyterian Church spire	26 48.0	east of south

Forrest City, St. Francis County.—The station is on the school grounds about one-half mile east of the center of the town. It is north of the school building, 125 feet and 124.7 feet from the northwest and northeast corners, respectively, and 18.4 feet from the north fence. The station is marked by a limestone post, 18 by 8 by 6 inches, projecting 1 inch above the ground, and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′	
Tip of railroad water tank (mark)	3 59.1	west of south
Northwest corner of schoolhouse	6 01.0	east of south
North gable of house	37 16.8	east of south

Hardy, Sharp County.—The station of 1903 was reoccupied. It is near the north edge of the street, running east and west, south of the public school grounds, on the hill north of Hardy. It is 152.4 feet from the southwest corner of the school building, 31.4 feet from a white oak tree to the northeast, and 52.6 feet from the northeast corner of a wire fence around a lot to the southwest. The station is marked by an irregular piece of limestone, about 24 by 6 by 6 inches, projecting about 5

Descriptions of stations—Continued.

ARKANSAS—Continued.

inches above the ground. One corner of the stone has been broken off so that it is slanting at the top. The following true bearings were determined:

	° ′
North edge of chimney on Mr. Hoover's house	86 34.9 east of south
Center of chimney on A. M. Jordan's house	14 36.4 west of south
Northeast corner of porch on Endicott's house	20 12.9 west of south

Harrison, Boone County.—The station is in the southeast corner of the public school grounds, about 3 blocks west of the public square and the old court-house. It is 14 feet from the south fence, 47 feet from the east fence, and 74 feet from a large oak tree to the west. The station is marked by a Eureka Springs limestone post, about 24 by 6 by 6 inches, projecting about 1 inch above the ground, and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′
Baptist Church spire (mark)	46 21.7 east of north
Methodist Church spire	50 26.5 east of north
Court-house flag pole	64 04.9 east of north

Heber, Cleburne County.—The station is in the court-house yard, 28.6 feet west of the southwest corner of the building. It is 53.3 feet from the west fence and 34.3 feet and 37.6 feet from trees to the northwest and southwest, respectively. The station is marked by a large sandstone rock, 24 by 12 by 6 inches, set flat in the ground, and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′
Methodist Church spire (mark)	21 19.0 west of north
West gable on H. Fix's house	50 53.4 east of north

Huntsville, Madison County.—The station is on the grounds surrounding the schoolhouse, on the hill, about three-fourths of a mile north of the town. It is southeast of the school building and near the fence south of the grounds. It is 34.4 feet from the northeast corner and 34 feet from the northwest corner of a barn south of the schoolhouse, and 68.3 feet from a large tree and 47.6 feet from a small tree to the southeast. The station is marked by a limestone post, about 24 by 6 by 6 inches, projecting 2 inches above the ground, and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′
Steeple on Methodist Church (mark)	17 37.7 west of south
North gable Cumberland Presbyterian Church	20 44.2 west of south
North gable on Mr. Low's house	29 23.3 east of south

Jasper, Newton County.—The station is in the court-house yard, just south of the building. It is 51.4 feet from the east corner of the court-house, 22 feet from the south corner, 23.5 feet from a tree to the southeast, and 27 feet from a tree to the south. The station is marked by a limestone post about 24 by 6 by 6 inches, projecting 1 inch above the ground and lettered U. S. C. & G. S., 1905. The Methodist Church spire bears 57° 46′.4 west of true south.

Marshall, Scarcy County.—The station is in the court-house grounds, just south of the court-house, 35 feet and 38.4 feet from the southeast and southwest corners, respectively, and 18.7 feet from the board fence on the south. It is marked by a Bedford limestone post 24 by 8 by 8 inches, set flush with the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′
Flagstaff on schoolhouse (mark)	58 12.0 east of south
Northeast corner of chimney on Doctor Redwine's house	42 18.8 east of south

Mena, Polk County.—The station is in the southeast part of the court-house grounds, 35.3 feet from the south fence, 89.3 feet from the southeast corner of the court-house, and 6.4 feet and 12.9

Descriptions of stations—Continued.

ARKANSAS—Continued.

feet from two pine trees to the east. The station is marked by a limestone post 30 by 6 by 6 inches, lettered U. S. C. & G. S., 1905, and projects about 3 inches above the ground. The following true bearings were determined:

	° ′	
Methodist Church spire (mark)	45 10.1	west of south
Flagstaff on college	45 38.2	east of north
Top of city water reservoir	22 09.4	west of north

Mountain Home, Baxter County.—The station is on the grounds of the Mountain Home Baptist College, to the north of the walk leading from the front gate to building. It is about 50 feet from the west fence and 35.5, 36.9, 48.5, and 36.7 feet, respectively, from neighboring trees to the southwest, west, northwest, and northeast. The station is marked by a sandstone post 30 by 12 by 12 inches, set flush with the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′	
Presbyterian Church spire (mark)	79 20.1	west of south
College spire	54 31.8	east of south

Mount Ida, Montgomery County.—The station is in the open space just east of the court-house. It is 84.8 and 78.6 feet, respectively, from the northeast and southeast corners of the building and 68.4 feet from the neighboring well. The station is marked by a sandstone post 30 by 12 by 12 inche projecting 1 inch above the ground and lettered U. S. C. & G. S., 1905. The following true bearing were determined:

	° ′	
Methodist Church spire (mark)	61 29.1	west of south
East edge of West Hotel chimney	30 11.2	west of south

Perryville, Perry County.—The station is in the southeast corner of the court-house yard, 25 feet from the fence on the east, 21.2 feet from the fence on the south, 18.4 feet from a large pine tree to the northwest, and 52.4 feet from the southeast corner of the court-house. The station is marked by a sandstone rock 30 by 12 by 6 inches, roughly dressed to about 6 inches square at the top, projecting about 2 inches above ground and roughly lettered U. S. 05. The following true bearings were determined:

	° ′	
Methodist Church spire (mark)	28 14.2	east of south
Tip of east gable on Mr. Bland's house	64 59.3	west of south

Salem, Fulton County.—The station is in the court-house yard, just northeast of the court-house. It is 44.6 feet northwest of the northwest corner of the building, 24.2 feet from the fence on the north, and 33 feet from the fence on the west. It is marked by a stone 6 by 8 by 18 inches, set flush with the surface and roughly lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′	
Schoolhouse spire (mark)	38 30.6	west of north
Methodist Church spire	82 45.1	west of north
Center of chimney on Davis's house	77 03.0	east of south

Searcy, White County.—The station of 1901 was reoccupied. It is on the grounds of the Spear Langford Military Academy, about 1 mile west of the town. It is 77 feet from the east fence and 76.8 feet from a tree to the southwest. The buildings have not been rebuilt. The station is marked by a post 42 by 7 by 7 inches, lettered U. S. C. & G. S. Some of the letters are missing, one corner of the stone having been broken off. The following true bearings were determined:

	° ′	
Church spire (mark)	83 33.6	east of south
West Searcy Methodist Church spire	53 31.7	east of south
Langford's house (tower tip)	67 03.4	east of south

escriptions of stations—Continued.

ARKANSAS—Continued.

Waldron, Scott County.—The station is on the school grounds about three-fourths of a mile southwest of town. It is west of the schoolhouse, 59.8 feet from the west fence, 88 feet from the south fence, and 62 feet from a small building to the southwest. The station is marked by a hard sandstone post 3 feet long and about 1 foot square at the top, projecting about 4 inches above the ground. Stone is not lettered. The following true bearings were determined:

	° ′	
Court-house spire (mark)	61 27.6	east of north
Hotel spire	67 31.2	east of north
Schoolhouse spire	85 45.0	east of south

Yellville, Marion County.—The station is in the schoolhouse grounds, northeast of the building, about 250 feet. It is about 50 feet west of the public road which runs north and south on the east side of the school grounds. It is 26.8 feet from a large stump to the northwest and 13.8 feet from a medium-sized oak tree on the west, 29.8 feet from an oak tree to the southwest, and 55.3 feet from an oak tree to the north. The station is marked by an oolitic limestone post 36 by 6 by 6 inches, lettered U. S. C. & G. S., 1905, and projecting about 4 inches above the ground. The following true bearings were determined:

	° ′	
Court-house spire (mark)	49 27.8	east of south
Methodist Church spire	28 20.5	east of south
Southeast corner of schoolhouse	55 33.6	west of south

CALIFORNIA.

Barstow, San Bernardino County.—The station is about 200 feet north of the probable location of the station of 1897. It is about 1 000 feet north of the Harvey Hotel and between a line of fence posts just north of the town and a fence on the southern boundary of a field immediately south of the Mojave River. It is 142 feet south of this fence, in line with the north gable of the Harvey Hotel and the top of the hill south of the hotel. The station is marked by a rough piece of red tufa rock 5½ by 6½ by 30 inches, showing about 6 inches above ground with the highest point at the top to mark the exact spot. The following true bearings were determined:

	° ′	
North gable of Harvey Hotel (mark)	12 30.8	west of south
Point of Rock on east edge of short range to the north	1 13.7	west of north
Top of large iron oil tank	40 39.2	east of south

Fresno, Fresno County.—As the station of 1897 could not be reoccupied on account of changed surroundings, observations were taken at a point 72 feet due north of the monument, a large cemented brick pier surmounted by a sandstone capstone lettered on its top "Long. & Lat. Mark. U. S. Geographical Survey West of the 100 Meridian. War Dept." This pier is four blocks south of the Southern Pacific Railroad tracks, in the square bounded by D and C, Kern, and Ingo streets.

Goat Island, San Francisco County.—The station of 1904 was reoccupied. It is near the center of the plateau just west of the hill at the extreme eastern end of the island. It is nearly in line with the top of the hill and the smokestack at the naval training station and about 50 feet north of the line of the two flag poles, one on the highest part of the island and the other on the southern part of the lawn in front of the officers' quarters. The station is on the ground belonging to the Army. It is marked by a rough stone 12 by 6 by 6 inches with a flat top in which there is a small hole. This stone projects about an inch above ground and has a cairn of loose stones piled over it. The following true bearings were determined:

	° ′	
Base of flagstaff on lawn	42 47.3	west of south
Flagstaff on highest part of island	44 59.5	west of south

Descriptions of stations—Continued.

CALIFORNIA—Continued.

Kelso, San Bernardino County.—The station is about 489 feet, a little east of south, of a small frame house just across the track from the railroad station and in line with the northeastern point at the top of roof of this house and the rod at the top of the railroad water tank. The station is marked by a long pine stake 1½ inches square and showing about 1½ feet above ground. The following true bearings were determined:

	° ′	
Base of rod on water tank (mark)	21 44.4	west of north
West gable of S. P. L. A. railroad station	27 59.4	west of north
South gable of general store	16 31.8	west of north

Los Angeles, Los Angeles County.—The station of 1892 was reoccupied. It is in Elysian Park, north of the city. It is on top of the ridge north of the reservoir road, and nearly in line with the west side of Douglas street extended. A small cottage is near the station, the southeast side being about 20 feet away. The station is marked by a drill hole in the center of the southern corner stone of the park, a stone 7 inches square and broken off a few inches above the ground. The following true bearings were determined:

	° ′	
Flag pole on Normal School	6 54.3	west of south
Cross on Sisters' Hospital	8 05.7	east of south

Mount Wilson, Los Angeles County.—The station is on the spur of the mountain known as Echo Rock, 746 feet from the telescope pier of the solar observatory. It is marked by a cement block. The following true bearings were determined by angular measurements connecting with the transit instrument:

	° ′	
Small spruce tree (mark)	75 47.0	east of north
Solar observatory, telescope pier	62 58.0	west of south

Red Bluff, Tehama County.—The station of 1897 was reoccupied. Azimuth observations were made over a hewn granite post 4 feet long, projecting 1½ feet above the ground, 6½ by 7 inches on top, with a cross marking the center. This north meridian stone is lettered on its north vertical face 1897, on its east face Mag. Sta., and on its west face U. S. C. & G. S. It was located about 1¼ miles northwestward from the county court-house, and is on the line forming the northeastern boundary of Johnson street, and is about 648 feet from the northwestern line of Breckenridge street. A similar post to this north meridian stone was located 970 feet true south of it, on the southern edge of the county road. This south meridian stone is lettered on its west vertical face Mer. Mark, on its south face 1897, and on its north face U. S. C. & G. S. The magnetometer station is on the line joining the center of the north meridian stone with the flag pole on the belfry of the Red Bluff public school when this line is extended 15 feet from the center of the stone. The dip station is on the same line 50 feet from the center of the stone in the direction of the schoolhouse. The following true bearings from the north meridian stone were determined in 1897:

	° ′	
Flag pole on belfry of schoolhouse	40 27.0	east of south
Presbyterian Church spire	67 19.7	east of south
Town Hall belfry	66 08.3	east of south

San Francisco, San Francisco County.—Observations were made at the Presidio Hill triangulation station, as in 1904. This station is in a northwesterly direction from the gate on the south side of the Presidio grounds, at the edge of the woods, and is marked by a stone post 6 inches square on top, which projects about 6 inches, and is lettered U. S. C. & G. Survey, 1881. The following true bearings were determined in 1904:

	° ′	
Cross on Lone Mountain	34 06.2	east of south
Center of top of Drake Cross	27 03.7	west of south

Descriptions of stations—Continued.

CALIFORNIA—Continued.

San Jose, Santa Clara County.—The station of 1904 was reoccupied. It is just west of the reservoir on the hill in the extreme southwestern part of Oak Hill Cemetery and is 102 feet from a fence corner to the south, 71 feet from the middle one of three posts to the southwest, and 86 feet from the nearest part of the outer face of the cement coping about the reservoir. It is marked by a piece of granite 10 inches square on top and 6 inches thick, lettered U. S. C. & G. S., with a drill hole in the center. The following true bearings were determined in 1904:

	° ′	
The court-house flagstaff	27 37.9	west of north
The Normal School flagstaff	20 38.9	west of north

COLORADO.

Castle Rock, Douglas County.—The station is on the hill west of the Colorado and Southern depot. It is almost in line with the middle of the street south of the depot, and 415.9 feet west of the west rail of the railroad track, measured with the surface. The station is marked with a cement block 7 by 7 by 30 inches, sunk even with the surface and lettered on the top U. S. C. & G. S., 1906. The following true bearings were determined:

	° ′	
Tip of dome on court-house (mark)	85 07.8	east of north
Rod on tower of school building	85 12.6	east of north
Iron gas pipe on Castle Rock	51 54.4	east of north

Cheyenne Wells, Cheyenne County.—The station of 1900 was reoccupied as nearly as could be determined from changed surroundings. It is about 350 yards northwest of the court-house, 142.0 feet from the corner of the water-tank support, 185.3 feet from the Methodist Episcopal Church, and 198.4 feet from the corner of a small stable. The station was marked by a cement block 8 by 8 by 36 inches, set 1 inch below the surface, and lettered U. S. C. & G. S., 1906. The following true bearings were determined:

	° ′	
Lightning rod on the north gable of house (mark)	16 47.9	west of south
Methodist Episcopal Church spire	14 51.1	east of south
East edge of flue on county jail	6 40.6	east of south

Deer Trail, Arapahoe County.—The station is in the open ground nearly due south of the Union Pacific Railway station. It is 376.0 feet from the west rail of the main track, measured at right angles from a point on the track 660.8 feet south of the semaphore post. The station is marked by a concrete post 10 by 10 by 34 inches, the top of which is lettered U. S. C. & G. S., 1906, and set 1 inch below the surface. The following true bearings were determined:

	° ′	
Tip of roof on Union Pacific water-storage tank (mark)	2 52.7	east of north
Tip of roof on softener tank	3 38.8	east of north
Tip of cupola on schoolhouse	86 49.4	east of south

Del Norte, Rio Grande County.—The station is on city ground, on the continuation in a southerly direction of the street just east of Main street. It is west of the public school, and about 380 feet south of the southwest corner of the fence surrounding the house of Mr. W. H. Cochran, and near the southwest corner of the block just south of Mr. Cochran's house. It is east of a steep hill upon which is an abandoned observatory. The location is known to Mr. W. H. Cochran and at the office of the county surveyor. The station is marked by a hickory stake 3 by 4 by 30 inches, showing 4 inches above the ground. The following true bearings were determined:

	° ′	
Cross on Catholic Church steeple (mark)	27 47.0	west of north
Flagstaff on court-house cupola	38 24.0	east of north
Western point of roof of land office	10 34.9	west of north
Flagstaff on public school	76 57.8	east of north

Descriptions of stations—Continued.

COLORADO—Continued.

Denver, Denver County.—The station is about 500 feet southeast of the station of 1899. On account of disturbances from trolley lines observations were made with dip circle only.

Durango, La Plata County—The station is on the mesa about one-half mile northeast of the town and on land leased by the town near reservoir No. 1. It is 71.3 feet west of the southwest corner of the wooden fence surrounding reservoir No. 1 and 117.8 feet south of the southwest corner of a small wooden tower upon which is a water gage. The station is marked by a 4-inch glazed pipe partly filled with cement. The cement is lettered U. S. The following true bearings were determined:

	° ′
East point of roof of shed at abandoned oil shaft	87 54.3 west of south
Point at top of eastern clock on court-house	49 49.4 west of south
Methodist Episcopal Church spire	50 23.1 west of south
First Presbyterian Church steeple	58 24.2 west of south
Flagstaff on City Hall cupola	53 49.7 west of south

Fort Morgan, Morgan County—The station is about 1½ miles north of town, across the South Platte River and the Union Pacific Railway, on a ranch owned by Mr. L. F. More. It is 52 paces west of a tenant's house and 120 paces north of the irrigation ditch. The station is on the corner of secs. 29, 30, 31, and 32, T. 4 N, R. 57 W, according to the original land survey. Since the stone marking the corner was small and insecure it was replaced by a cement block 10 by 10 by 34 inches, sunk even with the service and lettered on top U. S. C. & G. S., 1906, Original Section Corner. The following true bearings were determined:

	° ′
Middle of city standpipe (mark)	14 41.1 west of south
Tip of roof on Union Pacific water tank	73 39.7 west of south

Georgetown, Clear Creek County.—The station is on the property owned by the Keely Tunnel Company, about one-half mile north of the town. It is about 110 feet a little east of south from the house containing the office of the company, which is the residence of Mr. Jerome Smith. It is about 500 feet south of the power house of the Keely tunnel and 42.2 feet southwest of a cross cut in a large rock about 13 feet long and 10 feet wide. It is also 68.1 feet a little south of east of a cross cut in a large bowlder about 5 feet high and 11 feet in diameter. The station is marked by a limestone post 6 by 6 by 18 inches, set flush with the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′
Cross on Catholic Church steeple (mark)	34 09.7 east of south
Western small cupola on public school	5 32.3 east of south
Small cone shaped cupola	1 44.0 east of south

Glenwood Springs, Garfield County.—The station is in the eastern part of the Glenwood Fair Grounds, about 1 mile south of the town. It is in the southeast corner of a fenced field, near the northeast corner of the Polo Grounds and east of the grand stand and race track. It is 81.5 feet west of the east fence of the Fair Grounds and 116 feet north of the north fence of the Polo Grounds. The station is marked by a sandstone post 8 by 8 by 35 inches, projecting about 5 inches above the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′
East edge at base of standpipe (mark)	28 09.9 west of north
South point at top of red cupola	2 17.6 west of north
East point of roof of exhibition building	83 56.0 west of north
East edge of flag pole at Polo Club house	37 53.7 west of south

Grand Junction, Mesa County.—The station is in the northeast corner of the Grand Junction Fair Grounds, northeast of the race track and grand stand, and about 1½ miles northeast of the town. It

Descriptions of stations—Continued.

COLORADO—Continued.

is 102.7 feet south of the north fence of the fair grounds, 215.7 feet west of the fence on the east, and 225.5 feet north of the outside fence on the north side of the race track. The station is marked by a sandstone post 6 by 6 by 30 inches, projecting about 3 inches above the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	°	′	
Flagstaff on exhibition building	40	24.7	west of south
West edge of town standpipe	60	30.1	west of south
Top of small tower 2 or 3 miles to the south	14	28.8	west of south
East point of roof of small house in northwest corner of Fair Grounds	86	55.0	west of north

Hugo, Lincoln County.—The station is on the high ground overlooking the town from the northwest. It is 215 paces west of the court-house, 166 paces north of the jail, and 35 paces southeast from a stake marking the northwest corner of the town site. The station is marked by a cement block 8 by 8 by 30 inches, set 1 inch below the surface and lettered on top U. S. C. & G. S., 1906. The following true bearings were determined:

	°	′	
Flagstaff on court-house (mark)	52	14.6	east of south
Tip of cupola on schoolhouse	16	20.7	west of south

Montrose, Montrose County.—The station is in the southern part of the grounds of the Montrose Fair and Driving Association, in the southeast part of the oval within the race track, and about 1 mile a little north of east of town. It is a little west of north of the exhibition building and southeast of the grand stand. It is 130 feet from the fence bordering the outside of the race track to the south and 125 feet from this same fence to the east. The station is marked by a sandstone post, 6 by 6 by 30 inches, projecting about 6 inches above the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	°	′	
Methodist Episcopal Church spire (mark)	40	31.6	west of south
Ornamental point at west of roof, 601 North First street	37	32.8	west of south
Ball on pyramidal roof, 823 North Second street	2	23.8	west of south

DISTRICT OF COLUMBIA.

Washington.—The station of 1904 near the Zoological Park was reoccupied. It is about 50 feet south of the wire fence of the Zoological Park, about 18 feet southwest of a tree, and about 32 feet northeast of an oak tree 20 inches in diameter. It is marked by an oak stub. The following true bearings were determined:

	°	′	
Southeast corner of small brick house on Cincinnati street (mark)	18	58.2	west of south
Dome of The Ontario	61	02.8	east of south

FLORIDA.

Daytona, Volusia County.—The triangulation station is located on the sand ridge on the north end of the small island in Halifax River opposite the city of Daytona. The toll bridge crosses the south end of the island. It is a marsh island surrounded by a low sand ridge and is owned by the city. A library is being built on the south end of the island just north of the toll bridge. The station is marked by the tile and concrete station mark and is 23 feet from the shore line. Reference marks are:

Palmetto tree (blazed)	9.4 feet to eastward
Palmetto tree (blazed)	32.7 feet to eastward

The magnetic station is 80.7 feet from triangulation station on a sand ridge just northeast of three palmetto trees. The station is marked with a pine stub 1 by 2 by 16 inches. It is in direct line

Descriptions of stations—Continued.

FLORIDA—Continued.

between the triangulation station and cupola of Lawrence Thompson's house, and is 6 paces from high-water line. The following true bearings were determined:

	° ′	
Cupola on L. Thompson's house	69 58.4	east of north
Cupola on Gamble's house	75 50.3	east of north
Spire on dome of City Hotel	23 26.6	west of south
South gable of steam laundry	28 17.6	west of north
Goodall's water tower (mark)	26 51.3	east of north

Fort Myers, Lee County.—The station is in the southern portion of the town on the savanna south of the railroad. It is on the property of Mr. R. Jeffcott, at the extension of Lee street. It is about 200 yards south of the A. C. L. railroad, about south-southeast of the railroad water tank, and 52 yards north of the northeast corner of Mr. Jeffcott's orange grove. It is 9 yards southeast of what was the "home base" of an old base ball diamond. The station is marked by a cypress post placed 2½ feet in the ground and projecting 3 inches. It is 3 by 4 inches on top and is lettered U. S. on the north face. The following true bearings were determined:

	° ′	
Colored Methodist Church cupola (mark)	39 38.6	east of north
Royal Palms Hotel cupola	19 42.0	west of north

Jupiter, Dade County.—The station occupied in 1903 was washed away during a high storm, and a new station was established on the high ridge about 75 yards north of the original station. It is 20 feet back from the edge of the sea bluff and is surrounded with scrub palmettos 4 to 6 feet high. Cabbage palmettos are to the west of it but on lower elevation. Space 10 by 10 feet was cleared for observing tent. The underground mark consists of a wine bottle mouth up and 28 inches below surface of ground. Over this was placed 4 inches of sand. The surface mark is a 5 by 5 inch wooden painted post projecting about 14 inches above ground. Copper nail in top marks the station. One side of the post near the top has carved on it the letters U. S. The following true bearings were determined:

	° ′	
Chimney on house of C. R. Carlin (mark)	67 33.4	west of south
Spire on light-house	71 02.6	west of north
West gable of boathouse at old Life-Saving Station	6 41.9	east of south
East gable of house of Harry Dubois	50 16.8	west of south

Key West, Monroe County.—The station of 1905 was reoccupied. It is on the grounds of the United States barracks, north of the hospital building. It is 79.0 feet and 98.5 feet, respectively, from the brick posts on the northeast and northwest corners of the porch of the hospital; it is also 66.3 feet from the north fence of the barracks. It is marked by a brass plug lettered U. S. C. & G. S. set in the coral rock about 6 inches below the surface of the ground. The following true bearings were determined in 1903:

	° ′	
Northwest tower of armory	1 27.3	east of south
Southeast tower of armory	3 26.4	east of south

Kissimmee, Osceola County.—The station of 1903 was reoccupied. It is in Dakin avenue, near its intersection with Mitchell street, and about four blocks northwest of the depot. It is 24.3 feet from the fence on the southwest and 12.7 feet from the south line of Mitchell street. The station is marked by a marble post 30 by 6 by 6 inches, lettered on top U. S. C. & G. S., 1903, and sunk 4 inches below the ground. The following true bearings were determined in 1906:

	° ′	
Court-house spire (mark)	42 45.8	west of south
Kissimmee Hotel water tower	41 42.2	east of south
Methodist Church spire	59 21.2	east of north

Descriptions of stations—Continued.

FLORIDA—Continued.

La Belle, Lee County (?).—The station is on the south side of Caloosahatchee River at the town of La Belle. It is within a few feet of the county line dividing Lee and De Soto counties, presumably in Lee County. The station is on the river bank, east of the steamboat landing, on the property of Mr. Goodnough. It is 38 yards northeast of the northeast corner of Edgar Carlton's warehouse and 40 yards northeast from the northeast corner of Mr. Carlton's store. It is 10 yards from the river. The station is marked by a pine stake 5 inches in diameter set 3 feet in the ground and projecting 2 inches. The letters U. S. are carved on the upper surface. The following true bearing was determined:

	° ′	
North peak of the roof of W. Hall's house	6 23.5	west of south

Miccos Bluff, Osceola County.—The station is at Miccos Bluff, on the east bank of the Kissimmee River, about 100 miles by river course from the town of Kissimmee. There is no "bluff," just a bank or landing a few feet above the water. The station is on land of Mr. Hiram Moody, just back from the landing. It is 18 yards from the front gate (facing marsh), directly in front of the house, and almost due south of it. It is 11 yards eastward of the old well—that is, toward the stable from the well. The station is marked by a maple post, with top about 5 inches in diameter, set in the ground 3 feet and projecting about 2 inches above the ground. The top is sawed off smoothly and has the letters U. S. carved on it. The following true bearings were determined:

	° ′	
Southern peak of roof on stable (mark)	74 52.0	east of north
Cabbage palm about a mile distant	15 29.6	west of south

Punta Gorda, De Soto County.—The station of 1903 was reoccupied. It is in the park extending along Charlotte Harbor and at the foot of Gill street. It is 94.1 feet from the northeast corner of Doctor Burland's yard, 103.1 feet from the northwest corner of Mr. J. H. Farrington's yard, and 52.5 feet from a palmetto north of east. The station is marked by a marble post 30 by 6 by 6 inches, sunk 5 inches below the ground and lettered on top U. S. C. & G. S., 1903. The following true bearings were determined:

	° ′	
East gable Phosphate Company's warehouse	85 01.2	west of north
Flagstaff Punta Gorda Hotel	56 02.1	east of north
Schoolhouse steeple	81 49.7	east of south

Punta Rassa, Lee County.—The station is on land belonging to the Western Union Telegraph Company, and is as near the triangulation station of 1857–58 as could be determined, being approximately 100 paces south of the site of the old Government storehouse and 18 paces back of ordinary high water. The longitude station of 1874 was unavailable for magnetic work, being not only too close to the building and outhouses, but also between the large iron cable tank and a large iron smokestack. The magnetic station is marked with a hard pine post set 2½ feet in the ground and projecting one-half foot. The top is 7 inches in diameter, and has a small hole near center to mark the exact spot. The following true bearings were determined:

	° ′	
Sannibel light-house tower (mark)	1 59.3	west of south
Northeast gable of the store near the wharf at St. James City across San Carlos Bay	84 38.8	west of north

St. Augustine, St. Johns County.—Being unable to locate the station of 1900, a new station was selected to the eastward about 100 yards. The new station is north of the intersection of two concrete walks just northwest of Fort Marion. The station is 66.0 feet from the west edge of the east concrete walk and 51.9 feet from the eastern edge of the west concrete walk. It is marked by a 6 by 24 inch sewer tile set in and filled with concrete of pure cement and coquina. A copper nail, head down, in

Descriptions of stations—Continued.

FLORIDA—Continued.

top of pipe marks the station. The top of the pipe is flush with the surface of ground. The following true bearings were determined:

	° ′	
West spire Ponce-de-Leon Hotel (mark)	17 22.2	west of south
Center of water tower	4 15.7	east of south
Cross on Catholic Cathedral	1 34.3	east of south
Chimney on Ponce-de-Leon Hotel	21 48.6	west of south
Spire Presbyterian Church	34 06.0	west of south
Small spire northeast buttress of Fort Marion	60 48.0	east of south
Marble post set on west slope of rampart of Fort Marion	22 28.6	east of south

Sebastian, St. Lucie County.—The triangulation station established in 1906 is on land owned by the Florida East Coast Railway, 165.0 feet northeast of the northeast corner of northeast brick column supporting the northeast corner of the main portion of the railway station, 112.1 feet southeast of the southeast corner of Kitching's store, and 13½ paces south of center of shell road leading from north of railway depot to fish wharf. Marked by sewer tile and concrete.

The magnetic station is in direct line between Sebastian and Brig triangulation stations and distant from Sebastian station 402.0 feet. It is in the northeast corner of plot of ground formerly used as orchard and owned by Capt. R. A. Hardee, of Sebastian. The station is 72.9 feet east of west fence and 78.3 feet north of south fence. The underground mark is copper nail in cement in mouth of quart wine bottle 18 inches below ground. Surface mark is tile in concrete with copper nail, head down, in center of top of pipe. The pipe projects about 5 inches and is surrounded with concrete formed dome-shape and lettered U. S. C. & G. S. M. S. 1906. The following true bearings were determined:

	° ′	
Sebastian triangulation station (mark)	6 23.5	west of south
North end ridge Kitching store	31 16.1	west of south
Spire on belfry of schoolhouse	42 09.0	west of south
Spire on Methodist Church	55 07.5	west of south

Sugarloaf Beach, De Soto County.—The station is on the southwest shore of Lake Okeechobee, at the beach forming the eastern end of the cove out of which runs the 9-mile canal to Lake Hicpochee. It is about 5 miles south of Observation Island. It is on high ground (sand beach), about 5 feet above the level of the lake, on the eastern portion of a clearing occupied during the winter 1905-6 by a man named Currie. There are two palmetto shacks in the clearing. The station is 18 feet back (south) from the water of the lake, and between it and the lake is a large cypress tree, which stands by the small shack. The station is marked by an 8-inch rubber-tree post set 3½ feet in the ground and projecting about 8 inches, with the letters U. S. carved on the upper face. The following true bearing was determined:

	° ′	
Lone cypress at northwest end of Observation Island	17 27.8	west of north

Turkey Hammock, Osceola County.—The station is on the prairie near "Turkey Hammock," on the east side of Kissimmee River, about 2 miles south of Lake Kissimmee. It is at a clump of four cabbage palms about 500 yards south (and along river) from the grove known as Simmon Hammock. Two old oaks and two other cabbage palms are close by. The station is from 50 to 100 yards (according to height of water) east of a marsh adjoining the river. It is 18 yards north of the middle cabbage palm in the row of three and 12 yards west of a single cabbage palm standing west of the old oaks alongside a clump of palmettoes. The station is marked by an oak post with oval upper face, greatest width about 5 inches, set in the ground about 3½ feet and projecting 4 inches above the ground. Seven stakes were driven in a circle around this post and about 1 foot from it. The following true bearings were determined:

	° ′	
Straight trunk of cabbage palm on Simmon Hammock	24 37.2	west of north
Lower crotch of lone tree in pasture	52 36.5	east of south

Descriptions of stations—Continued.

FLORIDA—Continued.

Warners Camp, Dade County.—The station is on the north shore of Lake Okeechobee, about midway between Eagle Bay and Taylor Creek. The site is known as Warners Camp, from a man by that name having built a shack there. The station is 12 yards in front—along the beach—about west-southwest of the shack or shed, and at high water is 5 yards from the edge of the lake. It is in an open clearing, except for small bushes and sprouts, about 25 yards square. It is marked by a rough cypress post with sawed upper face, 7 inches in diameter, lettered U. S. 1906. The following true bearing was determined:

	° ′	
Knot hole in cypress tree standing in the lake about 75 yards from the station	36 24.4	west of south

GEORGIA.

Cedar Point, McIntosh County.—The station of 1902 was recovered and re-marked by a 4-inch sewer tile filled with cement and projecting 3 inches above ground. Observations were made at a point 82.4 feet west of the station, on ground recently purchased by C. C. Perrin, 19.5 feet east of the fence line, 30.3 feet north of the fence line, and about 500 feet north of Capt. W. H. Atwood's house. From the point where observations were made the following true bearings were determined:

	° ′	
Tall pole (mark)	85 33.1	east of south
Northeast edge of Captain Atwood's house	24 14.9	east of south
East end of gable of small house	9 21.4	west of south
Magnetic station of 1902	60 49.0	east of north

HAWAII.

Hana, Station A, Maui Island.—The station is in the yard of the old Catholic Church, a short distance north of the steamer landing. The station is southeast of the church, 59.3 feet from the southeast corner and 20 feet south of the line of the south side of the church, extended. It is also 91.6 feet from the stone wall south of the churchyard. It is marked by a cement post about 16 inches long, projecting about 1 inch above ground, and having a bottle set in the center of it. The location can be pointed out by John Apa. The following true bearings were determined:

	° ′	
Flag pole of house (mark)	20 21.0	east of south
Extreme left edge of "Kauiki Head"	59 15.9	east of south
Flag pole near post-office	43 05.7	west of south

Hana, Station B, Maui Island.—The station is in the large open space in front of the house occupied by Mr. Chalmers, manager of Hana plantation. It is about three-fourths of a mile from the Station A and on considerably higher ground, at an elevation of several hundred feet. It is outside the gate of Mr. Chalmers' yard, in line with the gate and the southeast corner of the house, and near the path which leads from the gate to the plantation office across the road. It is 31.1 feet from the yard fence and 28.8 feet south of a wire fence at right angles to the yard fence. The station was marked only by a wooden tent stake, driven so as to project about 2 inches above ground. The following true bearings were determined:

	° ′	
Spire of native church (mark)	57 54.4	east of north
Left edge of chimney of plantation mill	81 08.6	east of south

Hanalei, Station A, Kauai Island.—Station A is Preston's latitude station of 1887, which is also a triangulation station of the Territorial Survey. It is on a prominent hill on the bluff just east of Hanalei, overlooking the valley and village. The hill is called Pooku (sometimes, incorrectly, Crow's

Descriptions of stations—Continued.

HAWAII—Continued.

Nest Hill). The station is marked by a brick pier, over the center of which the observations were made. The following true bearings were determined:

	° ′	
Flag pole at Wilcox place (mark)	82 00.5	west of north
Left edge of chimney of Kilauea mill	84 49.1	east of north

Hanalei, Station B, Kauai Island.—The station is in the valley near the seashore. It is about midway between the bluffs which inclose the valley, in the open space along the water front. It is on the highest part of the sand ridge between the road and the sea, about 100 feet from the grass limit along the sandy beach. It is directly in line with the north end of Mrs. Deverill's house and 85 feet from the fence in front of Mrs. Deverill's yard. The station was marked by two bottles filled with sand and placed one above the other, the upper one projecting very slightly above the surface of the sandy soil. The following true bearings were determined:

	° ′	
Base of flag pole Wilcox place (mark)	25 17.7	east of north
Magnetic Station A	86 21.4	east of south

Hilo, Cocoanut Island, Hawaii Island.—The station of 1892 and 1900 was reoccupied. It is the triangulation station "Mokuola," and is marked by a triangular concrete monument, about 4 feet on each side, having a granite stone set in the center of it. It is inscribed "Bureau of Public Lands, A. B. Lobenstein, 1896." This whole monument has apparently shifted about 18 inches toward the northwest and subsided somewhat (especially on the northwest side), so that it is no longer level on account of the washing out of the sand on the northwest side by the action of high waves. This change has probably taken place since the observations of 1900. The attention of local surveyors and of the Hilo office of the Territorial Survey was called to the change. The present observations were made over the center of the stone in its present position on account of the difficulty of determining the exact original position and the impracticability of setting up the instrument so close beside the large monument. The following true bearings were determined:

	° ′	
Base of flag pole on small house on Cocoanut Island (mark)	52 30.4	east of south
Triangulation station Halai	62 41.6	west of south
Triangulation station Isabelle Point	81 15.0	west of south
Base of flag pole, Mooheau Hall	67 06.2	west of south

Hilo, Mooheau Park, Hawaii Island.—As some local attraction was suspected at the station on Cocoanut Island a new station was selected on the mainland, in Mooheau Park, about a mile from the former one. It is located near the center of the park, about 100 yards from the seashore. It is directly in line with the second row of pillars in Mooheau Hall and 220 feet from the nearest pillar in that row. It is 182.5 feet from the fence along the street and about 72 yards from the railroad along the beach. It is marked by a rough stone 16 inches long and about 6 inches square, set flush with the ground and having a half-inch drill hole to mark the exact point. The soil here is black sand. The following true bearings were determined:

	° ′	
Mormon Church spire (mark)	18 50.5	west of south
Triangulation station Halai	60 09.5	west of south
Triangulation station Isabelle Point	37 26.1	west of north
Triangulation station Mokuola	64 58.7	east of north

Honolulu, Oahu Island.—The station of 1900 was reoccupied. It is in the public yard near the Government Survey building. The precise point is marked by a wooden stake with a nail in the top of it and can be pointed out by the members of the Hawaiian Survey office. The mark used is the triangulation station on Punch-bowl hill, bearing 55° 19′.5 east of north.

Honolulu Magnetic Observatory, Oahu Island.—The observatory is about 12½ miles west of Honolulu and about three-fourths of a mile south of the station Sisal on the Oahu Railway. The observatory is described in Appendix 5, Report for 1902.

Descriptions of stations—Continued.

HAWAII—Continued.

Kaena Point, Oahu Island.—The station is located between the railroad and the sea, just opposite the beginning (coming from Waiahia) of the main curve of the railroad around the point. It is on practically the only spot of solid red soil on the point, the surrounding soil being almost entirely sand. It is about 12 feet to the right of the path (not very definite) leading from the gap in the railroad fence toward the extreme point. It is 48 paces from the railroad fence and 68 paces from the sand limit along the rocky coast. It is marked by a wooden stake driven flush with the ground, over which was placed a large bowlder about 15 inches in diameter, rather flat on one side, with the letters U. S. roughly chipped on top. This is the only bowlder of any size within a radius of 25 or 30 feet. The tent pegs were all left in place, driven almost flush with the ground. The azimuth mark used was the center of the "Railroad Crossing" sign post, seen thru the cut toward Waiahia, bearing 80° 03′.0 east of north.

Kahuku Ranch, Oahu Island.—The station of 1900 was reoccupied. It is situated in the yard, on the north side (i. e. toward the railroad track) of the dwelling house occupied by the manager of the Kahuku Ranch, about half way between the northeast edge of the house and the northwest corner of stone wall of yard, 4 paces west of algaroba tree and 23 paces east of west stone wall. It is marked by a stone set flush with the ground, with a drill hole in the middle, the center of the hole being 73.8 feet from the northeast edge of the spring house, 112.5 feet from the northwest edge of small extension to dwelling house, and 145.3 feet from northeast edge of house. The mark used was the left edge of a prominent bowlder in the slope of the mountain ridge to the west, bearing 65° 11′.8 west of south.

Kahului, Maui Island.—The station of 1899 was reoccupied. It is on the first prominent sand dune east of Kahului, about 200 feet back from the beach. It is marked by a subsurface mark of a bottle in cement and a similar surface mark. The present dip station coincides with the magnetometer station, as it was impossible to relocate the former dip station exactly. The soil is a coral sand, covered with sparse grass and vines. The following true bearings were determined:

	° ′	
Base of flag pole at railway office (mark)	75 23.5	west of south
Left edge of main chimney of Puunene mill	17 05.6	east of south
Left one of two chimneys at pumping station across the lake	66,57.4	east of south

Ka Lae, Hawaii Island.—The station is at the extreme south point of Hawaii Island near the light-house. It was reached by a horseback ride of 15 miles from Naalehu, a native man serving as guide and a pack animal carrying the instruments.

The station was not marked, but it can be recovered with sufficient accuracy from the following: It is in line between the triangulation stations Ka Lae and Palahemo (both permanently marked), and is 31.0 feet from the center (27.0 feet from the edge) of the monument marking Ka Lae. It is 26.8 feet from the center of the concrete foundation of the old latitude pier, and 62.6 feet from a cross mark on a large stone firmly imbedded in the ground near the fence. This cross mark is 43.2 feet northwest of the northwest edge of Ka Lae triangulation monument. The following true bearings were determined:

	° ′	
Pole on Palahemo triangulation station (mark)	54 36.0	east of north
Left edge of vertical post of light-house	12 44.0	west of south

Kapoho, Hawaii Island.—The station is in the pasture north of Mr. Henry J. Lyman's house, directly in line between it and the schoolhouse, and a little less than half way from the former. It is 39.8 feet a little north of west of a mango tree, practically the only tree in the pasture. The location can be pointed out by Mr. Lyman. The formation consists of about 6 or 8 inches of soil over solid lava rock (pahoehoe). The station was marked by a rough stone about 10 inches long and 6 inches square on top, set on the solid rock and projecting about 2 inches above the ground. A half-inch hole drilled in the stone marks the exact spot. The letters U. S. were roughly chipped on the top of the stone. The following true bearing was determined:

Flagpole on schoolhouse	23 25.7	east of north

Descriptions of stations—Continued.

HAWAII—Continued.

Kihei, Maui Island.—The station at Kihei (Maalaea Bay) is in the yard in front of the house occupied by the manager of Kihei Plantation, Mr. Scott. It is 16.1 feet from the terrace along the curved driveway leading from the public road to the rear of the premises, and 18.4 feet from the walk which leads from the driveway to the front steps of the house. It is also 33.3 feet from the end of an irregular stone terrace which divides the higher from the lower part of the yard. The station was not marked. The following true bearings were determined:

	°	′	
Left edge of Union Oil Company's tank (mark)	75	41.3	west of north
Vertical post of light-house on opposite shore of Maalaea Bay	86	48.6	west of south
Left edge of chimney at pumping station	37	08.8	west of north

Kilauea, Hawaii Island.—The station of 1900 was reoccupied as nearly as could be determined. It is just opposite the Volcano House, and 94.5 feet southeast of the northeast corner of the triangulation station monument. The station was marked only by a wooden stake projecting about 2 inches above the ground. The following true bearings were determined:

	°	′	
Umekahuna triangulation station (mark)	72	07.6	west of south
Flag pole on the Volcano House	20	36.3	west of north
Northeast corner triangulation monument	62	14.1	west of north

Lahaina, Maui Island.—The station of 1900 was reoccupied as nearly as could be determined. It is on the lawn in the rear of the court-house, 92 feet from the north corner of the court-house and 110 feet from the east corner of the stone barn. It is 57 feet from the north fence and 136½ feet from the west fence of the court-house yard; also 77 feet from an ironwood tree toward the west and 39 feet from a cocoanut tree toward the north. The following true bearings were determined:

	°	′	
East corner of court-house (mark)	2	16.9	east of south
North corner of court-house	17	43.8	west of south
Base of flag pole in front of court-house	36	31.0	west of south

Laupahoehoe, Hawaii Island.—The station is near the extreme point of land on the lot on which the light-house is situated. This lot is at present owned by Mr. E. W. Barnard, but it is understood that negotiations are under way for its purchase by the U. S. Light-house Board as a permanent site. The station is 169.5 feet a little west of south from the vertical post of the light-house, 50 feet from the southeast stone fence, and 64.8 feet from the southwest stone fence of the lot. By the kindness of Hon. H. S. Rickard the station was marked by two stones, placed one above the other, and both firmly bedded in cement. The top stone extends about 1 inch above the surface of the ground, has a half-inch drill hole to mark the exact spot, and the letters U. S. roughly chipped on top. The location can be pointed out by Judge Rickard, Mr. E. W. Barnard, or Paul Nobriga. The following true bearings were determined:

	°	′	
Flag pole in schoolhouse yard (mark)	49	43.5	west of south
Left edge of chimney of Papaloa Plantation mill	51	49.3	east of south
Left edge of vertical post of light-house	20	39.8	east of north

Napoopoo, Hawaii Island.—The station of 1892 was reoccupied as nearly as could be determined, within a very few feet. It is marked by a large oval stone about 2 feet long by 10 by 15 inches. The top of the stone is nicely oval, and projects about 6 inches above the ground, and has the letters U. S. cut in the north side. It is 50 feet south of the south wall of the old Heian, just north of the village. It is 15, 41, and 41 feet, respectively, from the three nearest cocoanut trees, and 36 feet from the nearest mango tree. The location can be pointed out by S. P. Kalua or John Au. Dip observations were also made as near as possible to Preston's dip station, at a point 70 feet south of the south wall

Descriptions of stations—Continued.

HAWAII—Continued.

of the Heian and 40 feet from the magnetometer station, almost opposite the azimuth mark. The following true bearings were determined:

	° ′
Point of Captain Cook's monument (mark)	65 51.4 west of north
Base of flag pole on Mr. Paris's place	68 19.6 west of north

Nawiliwili Bay, Kauai Island.—The station is located on the grounds of the U. S. Light-house at Ninini Point, opposite the entrance to the bay. It is about 55 yards north of the light keeper's house, in a small space free from stones near the highest point of the ridge. It is 112 feet from the north corner of the stable, and 164 feet from the gatepost at the east corner of fence around the light keeper's house. It is marked by a concrete post about 18 inches deep, with the top nicely rounded and projecting slightly above the ground. The intersection of the cross marks on top denotes the exact point. The location is easily found and can be pointed out by the light keeper. The following true bearings were determined:

	° ′
Base of court-house flag pole (mark)	81 46.6 west of north
Right edge of white house on hill	63 28.5 west of north
Center of base of wireless telegraph pole	46 48.5 east of north

Waikane, Oahu Island.—The station is located in the large yard in front of the residence of Mr. Sol. Peck, fronting on the Government road. The Peck house is the second house north of the native church. The station is 34.8 feet from the north fence and 67.8 feet from the west fence of the yard and about 90 feet from the base of the front steps of the house. It is marked by a wooden stake driven almost flush with the ground. The following true bearings were determined:

	° ′
Catholic Church spire (mark)	2 19.3 west of south
Perpendicular cliff in second ridge of mountains to the north	20 06.5 west of north
First perpendicular cliff from the left in the first ridge of mountains to the north	12 14.2 west of north
Small perpendicular cliff near the east end of the mountain range	9 54.8 east of north

Waimea, Kauai Island.—Station A of 1892 was reoccupied. It is near the old Transit of Venus pier in front of the house now occupied by Doctor Sandow. The present observations were made at a point in line with the west end of the house, 30.2 feet from the stone terrace and 80.5 feet from the northeast edge of the Transit of Venus pier. The following true bearings were determined:

	° ′
Base of pole on church spire (mark)	59 39.8 west of north
Pole near Makaweli Plantation mill	77 11.3 east of south

Waimea, Hawaii Island.—The station at the Hawaiian Government Survey triangulation station, West Base, was reoccupied. The station is permanently marked and is easily found, being about 200 yards north of the church. The following true bearings were determined:

	° ′
Left edge of bowlder on hill (mark)	16 24.5 west of north
Left edge of church tower	7 29.0 west of south

IDAHO.

Boise City, Ada County.—The station is about three-quarters of a mile east of the center of the town, on the Boise Military Reservation. It is about 300 feet east of the Parade Ground, and about the same distance west of the house of the officer in charge. It is 255.6 feet southeast of the southeast corner of the guardhouse, 262.6 feet northeast of the northeast corner of the infantry headquarters and

Descriptions of stations—Continued.

IDAHO—Continued.

245 feet almost directly east of the southeast corner of a barracks building. The station is marked by a granite post 7 by 7 by 24 inches, set flush with the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	°	′	
Cross on top of tower of St. Teresa's School (mark)	44	10.6	west of south
Flagstaff on tower of First Methodist Episcopal Church	89	17.5	west of south
Flagstaff on cupola of State Capitol	68	28.9	west of south
Flagstaff on tower a little to the south of St. Teresa's School	42	59.5	west of south

Council, Washington County.—The station is on property owned by Mr. Haas of Haas Brothers mining-supply store. It is just south of the first long fence extending east and west to the railroad track and about 300 or 400 feet south of the church, and a short distance east of an acre of ground fenced off for a garden. It is 76.7 feet east of the eastern fence surrounding the garden and 95 feet south of the long fence referred to above. The station is marked by an oak post 4 by 5 by 30 inches, projecting about 10 inches above ground. The following true bearings were determined:

	°	′	
Schoolhouse belfry (mark)	20	55.5	west of north
Flag pole on new store	29	31.9	west of north
Southern central ornamental point on church belfry	4	57.2	west of north
Southern point at top of roof of Oregon Short Line Railroad station	35	32.2	east of north

Hailey, Blaine County.—The station is about one-half mile south of the center of town, within the race track, near the center of its southern circle. It is 158.5 feet west of the eastern part of the fence on the outside edge of the race track, 227.3 feet north of the southern part of the outside fence on the edge of the race track, and 135 feet northwest of the one-eighth milepost. The station is marked by an 8-inch glazed pipe partly filled with cement, showing about 2 inches above ground, and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	°	′	
Base of flagstaff on county court-house (mark)	32	21.5	west of north
Top of rod on cupola of large house	19	51.2	west of north
Highest point of pyramidal mountain peak	17	25.2	west of north
Cross on Catholic Church	38	37.4	west of north
Flagstaff on City Livery and Feed Stable	36	07.6	west of north

Mountain Home, Mountain Home County.—The station is about one-half mile northeast of the center of the town, in the northeast corner of the grounds surrounding the public school. It is 237.6 feet northeast of the east corner of the school building and 261.9 feet northeast of the northwest corner of the school building. The station is marked by a glazed earthen pipe 6 inches in diameter and 2½ feet long, partly filled with cement, set flush with the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	°	′	
Ball on short rod on steeple of Congregational Church (mark)	77	19.8	west of north
Rod on belfry of Baptist Church	75	20.9	west of north
Cross on Catholic Church	55	34.2	west of south

Moyie River, Kootenai County. The station is on the first bench on the west side of the Moyie River. It is on the boundary line between triangulation stations 56 and 57. It is 86.0 feet west of the triangulation station 56, which is 135.8 feet west of boundary monument 56. The right of way of the Corbin road (C. P. R. R. into Spokane) passes to the east of the station at the foot of the bench above referred to. The station is marked by a small pine stake driven nearly flush with the ground and surrounded by half a dozen fairly large bowlders. The following true bearings were determined:

	°	′	
Three-inch blazed pine stump 200 feet from the station	8	13.0	west of south
Harper triangulation station	26	49.8	east of north

Descriptions of stations—Continued.

IDAHO—Continued.

Murray, Shoshone County.—The station is on a hill about one-quarter of a mile northwest of the center of town, about 1 000 feet west of and across a gulch from the town water tank. It is 19 feet west of the edge of a steep grade on the west side of the above gulch and is about in line with the belfry on the schoolhouse and the monument on Granite Peak. It is 46.5 feet north of a large stump about 2 feet in diameter. It is marked by a cedar post 5 inches in diameter and 2½ feet long, showing about 1 foot above the ground, with stones piled up around it. The following true bearings were determined:

	° ′	
South corner of town water tank, just under top plate (mark)	70 39.0	east of south
Monument on Granite Peak	45 22.9	east of south
Schoolhouse belfry	44 26.8	east of south
Top of northwest edge of Louisville Hotel	55 34.2	east of south

Porthill, Kootenai County.—The station is on the east bank of the Kootenai River, just north of town. It is on a grass-covered flat between the Kootenai Valley Railroad and the Kootenai River. It is very nearly on the boundary line. The boundary monument is east of the station and just east of the railroad. The Kootenai River bank (high-water mark) is 24.1 feet from the station, and a cottonwood tree on the south bank of Rykert Creek near its junction with Kootenai River is 36.3 feet. Three old tent pins were driven about the station within an inch of the exact point. The following true bearings were determined:

	° ′	
Northeast edge of Porthill Inn	9 49.9	east of south
Cupola on the Klockman House	65 17.9	west of south
Boundary monument No. 65	89 59.1	east of south
Flag pole of Canadian customs-house	1 10.6	west of north

Summit Lake, Kootenai County.—The station is in the boundary vista, on or very near the line. It is 52 feet east of the boundary monument on the ridge just south of Summit Lake. The station and monument are on high ground surrounded by trees, fallen timber, logs, stumps, and granite in places. The ground slopes away to the east and west and somewhat to the south and north. The station is marked by a stout balsam stake 2 or 3 inches in diameter with a tack in the top. The following true bearing was determined:

	° ′	
Ten-inch blazed balsam tree 300 feet away	14 57.8	east of south

Weiser, Washington County.—The station is about 1½ miles north of the center of the town, on the grounds of the Weiser Congregational Academy. The position of the station may be found by referring to the three principal academy buildings, which extend in a line almost east and west. It is 147.3 feet southeast of the southeast corner of the most western of these buildings, and is 180.8 feet southwest of the southwest corner of the central building. The station is marked by a glazed pipe 6 by 30 inches, set flush with the ground and half filled with cement. It is lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′	
Belfry on Methodist Church (mark)	2 20.4	west of south
Top of steeple of Congregational Church	3 45.6	east of south
Flagstaff on cupola of High School	9 54.3	east of south
Flagstaff on cupola	4 39.1	west of south

ILLINOIS.

Effingham, Effingham County.—The station is in the new part of the Protestant Cemetery, 1 mile east of town. It is 21.2 feet east of a graded street running thru the grounds from north to south and 203.0 feet from the east edge of the main cross street. The station is marked by a Bedford stone post

Descriptions of stations—Continued.

ILLINOIS—Continued.

6 by 6 by 30 inches, set flush with the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′	
Catholic Church spire (mark)	84 49.2	west of south
West edge of Stewart Phelon monument	12 28.8	west of north

Highland, Madison County.—The station is near the entrance of Lindenthal Park, about the middle of a triangular plot used for baseball. It is 105.0 feet from a line of trees along the south side of the driveway. The station is marked by a Bedford stone post 5 by 8 by 30 inches, sunk 3 inches below the surface and lettered U. S. C. & G. S., 1905. A meridian line was laid off by the observer and subsequently marked by Mr. Louis Blattner, a local surveyor, who set a cement block 6 by 6 by 30 inches at the north end, about 300 feet from the station. The following true bearings were determined:

	° ′	
Cross on spire of St. Paul's Catholic Church (mark)	30 16.5	west of north
Middle of large brick flue on Helvetia Cream Condensing Company's plant	27 04.8	west of north

Joliet, Will County.—The station is in a pasture about 6 miles southwest of Joliet, lying between the Chicago, Rock Island and Pacific Railroad and the old Michigan Canal, and north of Rock Run Park. The station is 120 paces north of the park and 247.5 feet from the edge of the canal. The station is marked by a marble post 4 by 8 by 27 inches, sunk 1 inch below the surface and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′	
Tall stack of Joliet Enterprise Wire Mills (mark)	65 47.6	east of north
Smokestack of Joliet Crematory	71 39.8	east of north

Marion, Williamson County.—The station is in what is locally called the "New Cemetery," which is about 1 mile north of the town on the east side of the road, which is a continuation of Court street. It is marked with a Bedford stone post 6 by 8 by 32 inches, projecting about 1 inch above the surface of the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′	
Free Will Baptist Church spire (mark)	84 13.1	west of north
Flour mill, iron stack	1 44.0	east of south
First Baptist Church spire	11 05.7	east of south
Water tank, tip	81 40.1	east of north

The station is about 180 feet from this road, 105 feet from the main entrance road, 54.4 feet northeast of the northwest corner of the base of the White monument, and 27.5 feet south of the southwest corner of the base of the Benson monument.

Olney, Richland County.—The station is on the grounds surrounding the public school, southeast of the building. It is in line between the meridian stones set by the U. S. Lake Survey, being 37.8 feet from the drill hole marking the south monument center and 176.6 feet from the north side of the north monument. Both monuments are very substantially set and it was thought unnecessary to mark the magnetic station further than by reference to same. The south monument stands about 26 inches above the ground, the capstone being 10 inches thick and lettered U. S. The north marker is set about 2 inches above the ground and a groove marks the meridian. The following true bearings were determined:

	° ′	
Methodist Episcopal Church spire	13 10.4	east of north
Standpipe	28 08.6	east of north
New church	78 13.6	east of north
Northeast corner McDonald's house	20 05.3	east of south

Descriptions of stations—Continued.

ILLINOIS—Continued.

Paxton, Ford County.—The station is in Glen Cemetery, 51 paces from a line of trees along the west side. It is 36.9 feet from the base of the Day monument, 28.8 feet from the base of the Johnson monument, and 15.4 feet from the base of the Dillon monument. The station is marked by a Bedford stone post 5 by 7 by 27 inches, sunk flush with the surface and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′	
Cross on spire of St. Mary's Catholic Church (mark)	4 49.0	east of north
Apex of Hanson monument	66 53.4	east of south
Ludlow Methodist Church spire	22 13.0	west of south

An auxiliary station (B), 34.7 feet south of the main station and precisely in line with it and the azimuth mark, was also occupied.

Shabbona, Dekalb County.—The station is in the northwest part of Rose Hill Cemetery at the intersection of two alleys. It is 126.0 feet west of the middle of the main drive, 78.3 feet from the north fence, and 105.3 feet from the west fence—both wire. The station is marked by a cement block 7 by 7 by 30 inches, the top of which is flush with the surface and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′	
Congregational Church spire (mark)	47 01.7	east of south
Baptist Church spire	34 15.6	east of south
Central flue on W. McCormick's residence	9 22.4	east of north

Tuscola, Douglas County.—The station is in the Protestant Cemetery, about three-fourths of a mile southeast of town. It is in the main street of the cemetery, at the intersection with a cross street about 430 feet from the public road. It is 27.6 feet south of a temporary wooden fence and 98.6 feet north of the Madison monument. The station is marked by a Bedford stone post, flush with the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′	
Center of cupola on High School (mark)	52 47.5	west of north
Tip of roof on a broom-corn warehouse	42 22.6	west of north

Woodstock, McHenry County.—The station is on the McHenry County Fair Grounds, 76.6 feet from the west fence, 55.8 feet west of the Manufactures Building, and 125.4 feet north of the Dining Hall. The station is marked by a marble post, sunk flush with the surface of the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′	
Staff on tower of City Hall (mark)	87 00.4	west of south
Staff on dome of court-house	88 07.8	west of north
Spire on St. Johannes Church	84 35.4	west of south

INDIANA.

Albion, Noble County.—The station is on the grounds of the Albion Cemetery Association, about one-fourth mile east of the court-house. It is in the higher part, in the path between Kiblinger and Cleland lots. It is 18.1 feet, 19.0 feet, 30.5 feet, and 37.6 feet, respectively, from the southeast corner of base of Cleland monument, southwest corner of base of Riddle monument, the northwest corner of base of Stanley monument, and the northeast corner of base of Martin monument. The station is marked by a sandstone post 4 by 7 by 28 inches, set flush with the ground, a three-fourths inch drill hole indicating the exact point. The following true bearings were determined:

	° ′	
Tip of tower on court-house (mark)	78 26.0	east of south
Southwest corner Albion School building	56 36.9	east of south
East gable Mrs. Mark's house	34 17.2	west of south
Ed. Engel's windmill	59 33.3	west of north

Descriptions of stations—Continued.

INDIANA—Continued.

A second marker establishing a meridian line was planted 2 feet from the fence line toward the road. This consists of a 1½-inch iron rod 3 feet long, set with top 1 inch above the ground, and is 264.4 feet north of the station.

Anderson, Madison County.—The station is on the ground of the Anderson Country Club, overlooking the city, about 2 miles west of north of the court-house, on the east side of the road which is a prolongation of Madison avenue. It is about 1 000 feet north of White River. It is within the oval made by the driveway south of the club house, about 175 feet from the southwest corner of the house and 88 feet from the northwest corner of the barn. It is 48.4 feet southeast of a large elm tree, 37.4 feet south of one oak tree and 40 feet west of another. The station is marked by a marble post 4 by 4 by 19 inches, set flush with the surface and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′	
Court-house tower (mark)	35 53.0	east of south
High School tower	14 30.8	east of south
Methodist Episcopal Church steeple	25 25.3	east of south
Christian Church steeple	28 52.6	east of south
Catholic Church dome	37 53.1	east of south
Flag pole Buckeye Works	38 40.9	west of south

Bloomington, Monroe County.—The station is on the campus of the Indiana State University, approximately in line between the northwest corner of Kirkwood Hall and Kirkwood Observatory, about 265 feet from the former and 386 feet from the latter. It is approximately in line between the tower of Indiana University Library and east gable of Mr. Bollenbacher's residence; also approximately in line between tallest stack of gas works and entrance to Kirkwood Hall. The station is marked with a Bedford stone post 27½ by 6 by 8 inches, projecting about 1½ inches above the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′	
East gable, Bollenbacher's house (mark)	1 53.0	east of south
Tip of cupola on Professor Miller's house	50 17.5	west of south
Flag pole on Central School building	74 06.4	west of south
Tallest stack gas works	84 37.9	west of south
Southwest corner at top of square brick tower of Christian Church	83 17.0	west of north
Extreme south post of ironwork on top tower of court-house	82 06.9	west of north

Brownstown, Jackson County.—The station is on ground of the county farm, about three-eighths of a mile southwest of the court-house. It is the south stone of the county meridian line, 305 feet long, and is 30½ feet from a fence to the west and 21 feet from a fence to the south. It is also 26½ feet from a 20-inch maple tree, 27¾ feet from a 16-inch maple tree, and 44¾ feet from a 24-inch pine tree. The station is marked by a sandstone post 5 by 5 inches at top, set 3 or 4 feet in the ground, a small copper pin denoting the exact spot. The intermediate and north monuments are similarly marked. The following true bearings were determined:

	° ′	
Court-house tower (mark)	62 15.2	west of north
South gable of H. Eggersman's house	18 09.5	east of north
Lightning rod on Niersmann's chimney	7 19.3	west of south
Presbyterian Church steeple	53 45.7	west of north
East gable Mrs. Hayes's house	40 28.1	west of north
North monument	0 01.5	west of north

Columbus, Bartholomew County.—The station is on the property of Mr. J. A. Hack, about 3½ miles southwest of the court-house. It is in an apple orchard south of his residence, being 47.1 feet from the east fence and 28.7 feet from the fence marking the south line of Mr. Hack's property. It is between the second and third of the north-south rows and between the first and second of the east-west rows of trees, counting from the east and south. The station is marked by an oak post 34 inches long, set 4 inches below the surface, a truncated cone of pure cement 8¾ inches in diameter at top,

Descriptions of stations—Continued.

INDIANA—Continued.

10¼ inches in diameter at bottom, and 5 inches deep is set over the post with earth packed solidly around. The top is roughly lettered U. S. C. S. The following true bearings were determined:

	° ′
Telegraph pole (mark)	8 25.6 east of south
Court-house tower	35 25.4 east of north
South gable of A. Perkins's house	40 36.2 east of north
East gable of Silas Lawyer's house	16 27.9 west of south
Center of Wolf's windmill	42 28.3 west of south
East gable of Gottlieb Lohr's house	70 50.1 west of south

Greencastle, Putnam County.—The station is in Forest Hill Cemetery, about 1 mile due south of the court-house. It is in the western part of the cemetery in a plot across the road northeast of the prominent Bowman monument; it is about in the center of the path between lots and about 12 feet from the nearest edge of roadway. The station is marked with a Bedford stone post 5 by 7 by 31 inches, projecting 3 inches above the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′
Locust Street Church steeple (mark)	15 00.8 west of north
De Pauw University laboratory building, round tower	17 58.3 west of north
Court-house tower	14 20.1 west of north
Standpipe	6 40.7 east of north

It is 38.4 feet from the Leatherman monument, 43.4 feet from the Wood monument, 75.0 feet from the Black monument, and 95.2 feet from the Bowman monument, measuring from the northeast corner of the base in each case.

Jasper, Dubois County.—The station is on the grounds of the Jasper Catholic College, on the east side of the walk leading to the college building. It is about one-half mile northwest of the court-house. The station is in line between the English schoolhouse and the house of Morton Reas. It is 133 feet from a 28-inch beech tree to the east and 31 feet from a 21-inch wild cherry tree to the northwest. It is also 64 feet from a line of young maple trees recently set out on east side of the brick walk leading to the college. The station is marked by a Bedford limestone post 5 by 8 by 30 inches, projecting about 1 inch above the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′
English School tower (mark)	31 10.1 east of south
Tower Catholic School	53 30.9 east of north
Steeple Catholic Church	64 08.1 east of north
Trinity Church steeple	62 13.4 east of south
Southwest corner Methodist Episcopal Church tower	22 02.4 east of south
East gable Hoffman House	18 28.4 east of south
Gable of east dormer window of Kremp house	75 41.8 west of south
Southwest corner of college building	50 18.5 west of north

Kentland, Newton County.—The station is in Fairlawn Cemetery, in the middle of the central driveway. It is 130.6 feet from the iron fence along the north side of the cemetery and 80.7 feet from the base of the Kent monument. The station is marked by a Bedford stone post 6 by 6 by 30 inches, sunk flush with the surface of the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′
Spire on St. Joseph's Catholic Church (mark)	5 52.0 east of north
Center of city water tower	0 51.6 east of north

Lawrenceburg, Dearborn County.—The station is in the Greendale Cemetery, about 2 miles northwest of the court-house in Lawrenceburg. The station is in the east-west path between lots 40 and 42 of section I. It is 14.2, 27.9, 27.6, 7.9, and 14.0 feet, respectively, from southeast corner of No.

Descriptions of stations---Continued.

INDIANA—Continued.

40, southwest corner No. 39, northwest corner of No. 41, northeast corner of No. 41, and northeast corner of No. 42. The station is marked by a Bedford stone post 6 by 8 by 38 inches, set flush with the ground and lettered U. S. C. & G. S., 1905. A second station B was established 70.7 feet from this one and in line with the cupola on Cook residence. The following true bearings were determined at station A:

	° ′	
Spire old Methodist Episcopal Church, Bellevue	54 34.6	east of north
Tower of public vault, cemetery	68 08.0	east of south
Cupola of Probasco House	20 22.2	east of south
Cupola on Cook residence	9 58.9	east of south
Greendale public school belfry	3 03.0	east of south
East gable of Ludlow mansion	71 12.1	west of south

Reynolds, White County.—The station is as near the station of 1874 as could be determined from the meager description. It is on property owned by Mr. William Koepp, northeast of the house and northwest of an old abandoned artificial pond. It is about 70 feet south of the center of the road and one-fourth mile due west of the post-office. It is in line between a 30-inch oak tree near the northwest corner of the house and a 15-inch maple at the northeast edge of the artificial pond. It is also 26.1 feet from the northeast corner of the main part of the Koepp dwelling and 25.6 feet from the northeast corner of the L. The station is marked by a round cedar post 40 inches long and 5 to 6 inches in diameter, projecting about 2 inches above the ground and lettered U. S. C. S. The following true bearings were determined:

	° ′	
Cupola of Scowden stable (mark)	31 41.1	east of north
Lutheran Church steeple	75 23.2	east of north
Cross on Catholic Church tower	53 35.2	east of south
North gable of Britton House	32 34.4	east of south
South gable of Geiger House	87 17.8	west of south

San Pierre, Starke County.—The station is in the Protestant Cemetery, about one-fourth mile due east of the post-office. It is on the west side of the main north and south road from entrance, about 1 foot east of a line of lots as marked by stone lot corners and 7.6 feet north of the center of the corner marked 38. It is 49.6 feet northeast of the northwest corner of the base of the McLaughlin monument and 24.6 feet southeast of the northeast corner of the base of the Brown monument. The station is marked by an oak post about 5 inches in diameter at top and 38 inches long, projecting about 1½ inches above the ground and roughly lettered U. S. C. S. The following true bearings were determined:

	° ′	
Methodist Episcopal Church spire (mark)	73 03.9	west of south
Lutheran Church spire	87 28.1	west of north

Vincennes, Knox County.—The station of 1896 could not be recovered and a new station was established in the Catholic Cemetery, probably not more than 35 feet from the location of the former station. The cemetery is one-half to three-quarters of a mile southwest of the court-house. The station is on a high ridge in lot southwest of main southeast-northwest driveway. It is 38.4 feet from the northeast corner of the foundation of the Berry monument and 38.8 feet from the northwest corner of the foundation of the Caney monument. It is marked by a Bedford stone post 6 by 6 by 36 inches, set flush with the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′	
East gable on strawboard works	12 30.3	west of north
Court-house tower	56 46.9	east of north
Tall steeple of Catholic Church (mark)	64 50.0	east of north
Small steeple of Catholic Church	65 33.6	east of north
Tip of water tank Star Foundry	79 02.7	east of south

Descriptions of stations—Continued.

INDIANA—Continued.

Wabash, Wabash County.—The station is in the Wabash Cemetery, about three-quarters of a mile northwest of the court-house. It is on the circular plot of ground reserved by the cemetery at the intersection of the driveways. The plot is about 22 feet in diameter and the station is about 6½ feet northwest of the center. It is 101.4 feet from the McCowen vault and 30.4 feet from the base of marker to Ad. Lee. The station is marked by a Bedford sandstone post 8 by 8 by 30 inches, set flush with the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	°	′	
Chimney on Pioneer Hat Works (mark)	67	58.7	east of north
Lutheran Church spire	72	04.4	east of south
Cupola of W. P. Jones's house	70	15.6	east of south
Flag pole on court-house	49	20.9	east of south
Tip of Hanna monument	11	54.8	west of south

INDIAN TERRITORY.

Antlers, Reservation No. 24.—The station is about one-half mile northeast of the center of town in the northeast corner of the grounds surrounding the Presbyterian School. It is 49.5 feet south of the north fence, 42.3 feet west of the east fence and 229 feet northeast of the northeast corner of the school building. The station is marked by a hickory stake 30 by 3 by 4 inches, flush with the ground. The following true bearings were determined:

	°	′	
Methodist Church belfry (mark)	49	55.0	west of south
Northwest corner of top of belfry on Baptist Church	0	35.3	west of south
Northern point of roof of tallest building at Catholic School	60	34.1	east of south

Ardmore, Reservation No. 21.—The station is in the western part of City Park. It is 107.4 feet northeast of the northwest corner of the board fence surrounding the Fair Grounds and 137.1 feet east of the fence on the west side of the road along the west side of the Fair Grounds. The station is marked by a sandstone post 8 by 8 inches, projecting 4 inches above ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	°	′	
Methodist Church steeple (mark)	57	13.8	west of north
Flagstaff on cupola over Whittington Hotel	25	51.6	west of north
Broadway Methodist Episcopal Church steeple	21	22.4	west of north
Spire just over top of hill	2	48.8	east of north

Atoka, Reservation No 23.—The station is about 1½ miles southwest of the center of town, outside of the fence surrounding the cemetery. It is 98 feet west of the southwest corner of this fence and 131 feet north of the fence, marking a section line just across the road on the south side of the cemetery. The station is marked by a hickory stake 3½ by 3 by 30 inches, projecting 4 inches above the ground. The following true bearings were determined:

	°	′	
Cupola on public school (mark)	41	59.1	east of north
Southwest point of roof of house	1	20.7	west of north
Top of Oliver White monument in cemetery	77	07.0	east of north

Observations were also made in a vacant lot about 250 feet west of the station of 1878.

Pauls Valley, Reservation No. 17.—The station is about one-half mile east of the center of town, in the southwest corner of City Park and about 400 feet south of the Santa Fe Railroad track. The location may be found by referring to the fence surrounding a small frame house about 175 feet south of the station and across the road at the southwest corner of the park. The station is 111.9 feet northeast of the northwest corner of this fence, and 78.9 feet northwest of the eastern post of the gate

Descriptions of stations—Continued.

INDIAN TERRITORY—Continued.

leading to the north entrance of the house. The station is marked by a hickory stake 30 by 5 by 3 inches, showing 2½ inches above ground. The following true bearings were determined:

	° ′	
Ball on top of town water tank (mark)	60 42.5	west of north
North edge of smokestack on cotton gin	79 00.2	west of north
West edge of water tank at cotton compress	80 07.2	east of north

Poteau, Reservation No. 14.—The station is in the northern part of the town park and in the southeast corner of the baseball ground. It is 167 feet northeast of the northeast corner of the park refreshment building and 165 feet north of the northwest corner of the box around the park well. It is also about 45 feet west of a small creek along the eastern side of the ball ground. The station is marked by a hickory stake 30 inches long and 3 inches in diameter at the top. This stake shows 4 inches above ground. The following true bearings were determined:

	° ′	
Cupola on First National Bank (mark)	14 02.8	east of north
Christian Church steeple	23 32.3	east of north
Tip of water tank at Frisco Railroad station	7 02.0	east of north

South McAlester, Reservation No. 15.—The station is about 2 miles north of the center of town, on ground owned by the city and fenced in to protect the watershed and pumping station. It is in the southeastern part of the grounds near a corner of the fence along the southern border, where it takes a turn to the north along the property owned by Mr. R. B. Coleman. The station is 142 feet north of the south fence and 153 feet west of the fence to the east. The station is marked by a limestone post 5½ by 5½ by 30 inches, showing 5 inches above ground and lettered U. S. C. & G. S., 1905. The location of the stone is known to Mr. I. C. Shreve, superintendent of waterworks. The following true bearings were determined:

	° ′	
Steeple on Methodist Church (mark)	7 19.8	east of south
Upper eastern corner of standpipe	19 11.7	east of south
Eastern point of roof of Busby Hotel	14 34.3	east of south

Talihiva, Reservation No. 14.—The station is about three-quarters of a mile east of the center of town on a piece of land about the size of three blocks, belonging to Mr. John J. Thomas, which will probably be used as a park. This piece of land is the inclosure just northeast of a lot on which is the only brick house in the eastern part of the town. It may be recognized by the hog-proof fence on the south and a strong iron network gate at the western entrance. The station is 136 feet east of the fence bounding this piece of land on the west and 164.5 feet north of the fence on the south. The station is marked by a hickory stake 30 by 3½ by 3½ inches, projecting 4 inches above ground. The following true bearings were determined:

	° ′	
Presbyterian Church steeple (mark)	66 24.5	west of south
North point of roof of eastern cotton gin	88 53.3	west of north
South gable of house across the first fence to the west	77 58.6	west of north

Wewoka, Seminole Reservation.—The station is about half a mile west of the county court-house, in the southeast corner of a block reserved for public buildings. This block is between Cedar and Main streets on the north and south and between Seminole and Ocheesee avenues on the east and west. The station is 193.4 feet from the southwest corner of a fence surrounding a house on the southwest corner of Main street and Seminole avenue and 189 feet from the northwest corner of the same fence. The station is marked by a hickory stake 30 inches long by 2½ by 2½ inches at the top. The following true bearings were determined:

	° ′	
Ball on steeple of church (mark)	53 59.0	east of south
Flag pole on county court-house	79 54.4	east of south
South edge at top of water tank at the cotton gin	67 04.0	east of north

Descriptions of stations—Continued.

IOWA.

Sioux City, Woodbury County.—The station of 1891 being no longer available for magnetic observations, a new station was established on the grounds of the U. S. Sioux Ice Harbor, a tract of land lying along the west (right) bank of the Sioux River (in South Dakota) and about 8 miles in a northwesterly direction from Morningside, the location of 1891. It is near the upper (west) end of the reservation, about 33 feet from the river bank, 42 feet from the fence along the south side, and 80 feet from the northwest corner at the river bank. The station is marked by a limestone post 6 by 6 by 30 inches, set 4 inches above the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	°	′	
Flag pole on pavilion in park (mark)	36	55.1	east of south
West gable of United States machine shop	54	34.7	east of south
Upper north edge of water tank on bluff	43	58.7	east of south
North gable of red barn	35	29.8	east of south

KANSAS.

Baldwin Magnetic Observatory, Baldwin, Douglas County.—Observations were made in the absolute house of the magnetic observatory. The mark used is the flagstaff on Science Hall, Baker University, and bears 48° 20′.6 west of true north.

KENTUCKY.

Scottsville, Allen County.—The station is in the grounds surrounding the newly erected schoolhouse. It is 121.6 feet from the northwest corner of the schoolhouse, 105.6 feet from the southwest corner, 16.0 feet from a hickory tree 8 inches in diameter, 17.6 feet from a chestnut tree 14 inches in diameter, and 23.3 feet from a chestnut tree 10 inches in diameter. The station is marked by a blue sandstone post, set flush with the ground and roughly lettered U. S., 1905. The following true bearings were determined:

	°	′	
Methodist Church spire (mark)	33	14.6	west of south
Presbyterian Church spire	52	59.8	west of south
Court-house	66	57.6	west of south
Colored Church	9	16.0	west of north
Northwest corner of schoolhouse	66	39.8	east of north

MAINE.

Bailey Island, Cumberland County.—The magnetic station is in the southwest part of the island, in front of the Stokes Cottage. It is 96 feet from the south corner of the porch, and 36.9 feet from the iron bolt in line with the corner of the porch. The following true bearings were determined:

	°	′	
West gable Day cottage	15	34.4	east of north
Southeast gable window of Stokes cottage	44	22.0	west of north
Light-house	24	37.6	west of south

Declination observations were also made at two other points near by. Station A is in front of the Day cottage in the middle of trap rock. Station B is about 35 feet in the direction of the Poole cottage chimney.

Bangor, Penobscot County.—The stone marking the station of 1895 could not be located and a new station was established on Thomas Hill, near the center of a vacant lot owned by Mr. Prentiss and about 92 feet from the old station. It is 76.3 feet northeast of a tree, 126.1 feet from the fence on the north side of Highland avenue, and 133.9 feet from the fence on the west side of Governor Davis's

Descriptions of stations—Continued.

MAINE—Continued.

yard. The station is marked by a granite bowlder smoothed on the top and lettered U. S. C. & G. S. The following true bearings were determined:

	°	′	
Spire of East Bangor meetinghouse	20	03.0	west of north
Flag pole on reservoir	24	28.0	east of north

Beans Island, Hancock County.—The station of 1904 was reoccupied. It is on the highest part of the western end of the island. A higher part of the island is to the eastward. The best way to reach the station is to land at a small beach on the northwest side of the island and walk due south about 325 feet. The station is marked by a cross cut on a bowlder. A 2 by 4 stake is driven near by. The following true bearings were determined in 1904:

	°	′	
Crabtree Ledge Light-house (mark)	61	55.2	west of south
Flagstaff on point just south of Jellison Cove	43	52.6	west of north
Dome of Bluff Hotel	20	00.3	west of north

Farmington, Franklin County.—The station is not far from the station of 1887, on low ground south of the railroad station, about 300 yards away. It is on the line of the south side of Cross street extended, 314.8 feet from its end, and 129 feet north of the north bank of Sandy River. The station is not marked. The following true bearings were determined:

	°	′	
Baptist Church spire, West Farmington (mark)	30	39.4	west of south
Congregational Church spire	25	15.2	east of north
Normal School cupola	28	48.4	east of north

Harpswell Neck, Cumberland County.—As the station of 1863 could not readily be found, a new station was established on the extreme southeast point of Harpswell Neck and on the highest point of land south of the Merryconeag Hotel. The station is in line with two lone pine trees and is 32 feet east of the east one; it is marked by an inch pine stake, driven flush with the ground. The south gable of the Merryconeag Hotel bears 32° 11′.9 east of north.

Kimballs Island, Hancock County.—This station is located on the eastern end of Kimballs Island. It is exactly on range between hydrographic signals Chant and Spire, Isle au Haut Church. The station is situated on the eastern slope of the high knob at the extremity of the island, at the highest point of the given range. The exact spot is marked by a small circular depression in the base of a granite rock, distant 22 feet from two spruce trees close together bearing north 75° east, and 48 feet from a lone spruce tree bearing south 34° west. The following true bearings were determined from the Hydrographic sheet:

	°	′	
Bay Ledge spindle	59	23.0	west of north
Chant (mark)	8	35.5	west of north
Spire	8	35.5	east of south

Rangeley, Franklin County.—The station is in the pasture belonging to John R. Toothaker, about one-eighth of a mile north of the outlet of Haley pond and about 75 yards from the end of a point of land projecting into the west side of the pond. It is in line with two large granite bowlders, 52.5 feet east of one and 51.7 feet west of the other. The station is marked by a stone post 36 inches long by 7 inches square, sunk flush with the ground. This stone is the south end of a meridian line 400 feet long. The following true bearings were determined:

	°	′	
Base of flag pole, High School building (mark)	72	15.0	west of north
Cupola of High School	72	33.0	west of north
Baptist Church, east corner of cupola	26	01.7	west of south
Weather vane, Butler and Richardson stables	15	15.7	west of south

Rockland, Hancock County.—This station is situated on the golf links of the Samoset Hotel on Jamesons Point, near Rockland. The station is most easily reached from Rockland Harbor by landing

Descriptions of stations—Continued.

MAINE—Continued.

at the Breakwater landing, follow breakwater and road beginning at its end to where this road joins the main road going north. Near the junction of the roads, 10 feet east of the main road, 20 feet north of the breakwater road, there is found a granite bowlder with a cross cut in its highest part. This marks the station. The following true bearings were determined:

	° ′	
Owl's Head Light-house	48 11.5	east of south
Breakwater Light-house (mark)	14 02.5	east of south
Left tangent Atlantic Wharf	30 48.7	west of south
Flag pole in front of Samoset Hotel	85 01.5	west of south
Flag pole on Samoset Hotel	69 02.0	west of north

Southwest Harbor, Hancock County.—The station is located as near as possible to the one occupied in 1856. It is about half a mile south of the post-office of Seawall and is in a meadow belonging to Mr. John Moore, about 250 feet southeast of the position where Joseph Moore's barn stood in 1856. The station is marked by a cross which is cut in a rock extending about 10 inches above the ground. Three hundred and thirty-two feet to the northward a stake was driven 5.1 feet south of the footstone at the grave of Joann S. Moore. At this stake the angle between the station and Cranberry Island Church spire is 89° 37′. The following true bearings were determined:

	° ′	
West edge of main chimney on house of Amos Toliver (mark)	1 44.8	east of north
Cranberry Island Church spire	83 50.6	east of north

MARYLAND.

Cheltenham, Prince George County.—The station is at the Coast and Geodetic Survey magnetic observatory, on the grounds of the State Reform School.

Baltimore, Patterson Park I, Baltimore City County.—The station of 1904 was reoccupied as nearly as could be determined. It is a little to the eastward of the center of Patterson Park, about 200 feet south of a shelter house and on a terrace below the same. It is 43.2 feet northwest from the edge of a roadway. This roadway leads south to the Luzerne street entrance on Eastern avenue. It is 13.8 29.8, and 41.2 feet west-northwest, north by east, and northeast, respectively, from small trees. The distance to the foot of the embankment to the northward is 20.5 feet (approximately). The station is marked by a stone post 6 by 6 by 30 inches, lettered U. S. C. & G. S., 1905, and sunk flush with the sod. The nearest street-car line is on Eastern avenue about 1 000 feet south. Electric light wires pass over the shelter house. The following true bearings were determined:

	° ′	
Dome of insane asylum (mark)	88 10.4	east of north
Church spire to southeast	62 47.8	east of south

Baltimore, Patterson Park II, Baltimore City County.—The station of June, 1905, was reoccupied as nearly as could be determined from the description (within 4 feet, perhaps). It is about 200 feet south-southeast of the Casino building, 80.9 feet northwest of a roadway, 64.6 feet east-northeast of a path, 21.9 feet east of a large maple tree, 48.6 feet northwest of another maple, and 40.2 feet southeast of a cypress. The station is not marked. The nearest car line is 1 000 feet south on Eastern avenue. The following true bearings were determined:

	° ′	
Dome of Insane Asylum (mark)	89 00.9	east of north
Chimney in Highlandtown	69 48.3	east of south
Tip of stone structure in Park lake	66 50.5	east of south

Baltimore, Patterson Park III, Baltimore City County.—Recent improvements to the Park have rendered stations I and II less suitable for magnetic observations. A new station was therefore chosen in the northeastern part of the Park, about 600 feet northeast of a large stone building formerly used

Descriptions of stations—Continued.

MARYLAND—Continued.

as a casino. The station is in the open field, 70 feet to westward of driveway, 16 feet south of a small cottonwood tree that stands alone and nearly on line with an electric-light pole 600 feet to the eastward (not in operation in the daytime) and the dome of the Insane Asylum. There is no disturbance of any kind in the vicinity and there are no street-car lines within three-fourths of a mile. The station is marked by wooden peg flush with ground. The following true bearings were determined:

	°	′	
Dome of Insane Asylum (mark)	87	15.6	east of south
Church of Sacred Heart spire	54	55.6	east of south
St. Elizabeth Church cross	42	17.9	east of north
Weather vane on Park shelter house	7	16.6	east of south

MASSACHUSETTS.

Athol, Worcester County.—The station is on land belonging to John Swan, on the top of a high bluff about 1 mile west of the center of the town. It is about 100 yards nearly due north of the spire on Mr. Swan's stable. It is 95.5 feet north of a chestnut tree and 48.5 feet southwest of a second chestnut tree. It is also 159 feet south of the stone wall on the north side of Mr. Swan's pasture and 41 feet east of the pasture fence. The station is marked by an oak post 30 by 3 by 4 inches, projecting about 6 inches above the ground and protected by a pile of stone heaped about it. The following true bearings were determined:

	°	′	
Baptist Church spire (mark)	81	24.8	east of north
High School cupola	88	38.9	east of south
Unitarian Church spire	86	07.1	east of north
Weather vane, Mr. Swan's stable	00	09.9	east of south

Concord, Middlesex County.—The station is on the reservoir grounds, on Nashawtuc Hill, about one-half mile northwest of the town. It is on the east side of the south end of the oval east of the reservoir. The southeast corner of the reservoir is 40 yards west of the station. The station is 55 feet west of the east wall around the reservation and 116 feet east of the west wall. It is 19 feet from the west side of the east driveway and 30.3 feet east of a 6 by 6 inch granite boundary mark having an iron bolt in its top. It is also 80 feet northeast of the east post of the gateway. The station is marked by a granite post 30 by 7 by 7 inches, projecting about 2 inches above the ground and lettered U. S. C. S. The following true bearings were determined:

	°	′	
Concord Reformatory flag pole (mark)	83	18.7	west of north
Church spire, West Concord	66	19.1	west of north
Church spire, Cambridge street	73	28.7	east of south
Church spire, Main street	67	17.1	east of south

Huntington, Hampshire County.—The station is in the pasture belonging to Mr. O. D. Fisk, about one-half mile west of the town. It is northeast of Mr. Fisk's buildings and about 300 yards due north of the dam across the river. It is on the hillside and in line between two walnut trees—64 feet east of one and 54 feet west of the other. It is 19 feet northeast of the top of a large granite bowlder and 60½ feet due north of the northeast corner of a henhouse, and also 94 feet due north of the pasture fence. The station is marked by a hard-wood peg 24 by 4 by 4 inches, driven flush with the ground, with a nail driven in the top. The following true bearings were determined:

	°	′	
Second Congregational Church spire (mark)	42	02.6	east of south
Catholic Church spire	69	37.2	east of south

Lawrence, Essex County.—The station is the south stone of a meridian line established by Essex County in 1874 in the city common. It is nearly in line with the center of Garden street extended

Descriptions of stations—Continued.

MASSACHUSETTS—Continued.

and is 71.1 feet due west of the curbstone on the west side of Jackson street. The north stone is a few feet south of the sidewalk on Haverhill street. There is a third stone midway between the two. These monuments are of granite and project about 18 inches above ground. They are hexagonal in shape and have a circular brass plate bolted in the top. A cross is cut in the plate, and the center of the cross marks the exact spot. The following true bearings were determined:

	° ′
Congregational Church spire (mark)	30 07.4 west of north
North meridian stone	0 05.8 west of north
Middle meridian stone	0 04.6 west of north

Mansfield, Bristol County.—The station is 1 mile east of the town, on the town poor farm. It is about 250 yards southeast of the buildings of the poor farm, on the highest gravel hill in that direction. It is 120.2 feet northeast of an old apple tree and 154.5 feet northwest of a large oak tree in the pasture to the southeast. The station is marked by a granite post, unlettered, 24 by 6 by 6 inches, the top flush with the ground and a drill hole marking the exact spot. The northwest corner of the extreme westerly chimney of house on the poor farm bears 57° 55′.9 west of north.

Newburyport, Essex County.—The station is about 4 miles east of the city on Plum Island, north of the Plum Island Hotel, as near the station of 1898 as could be determined from the description. It is 465 feet nearly due north of the northwest corner of the hotel barn, 12 feet east of a road running nearly due north and 195.8 feet southwest of the larger of two cherry trees. The following true bearings were determined:

	° ′
Congregational Church spire (mark)	88 04.1 west of south
Old South Church spire	78 27.7 west of north
Weather vane on hotel barn	30 44.2 east of south

Pittsfield, Berkshire County.—The station is on the grounds of the sewer pumping station, southeast of the city, and about 80 yards southwest of the south end of the storage tanks. A meridian line was established with the north stone 397.7 feet distant, near a driveway to the city gravel pit. The north stone is 62 feet west of a small tree across this roadway and 2 feet south of the fence. Both monuments are of marble 60 by 6 by 6 inches, set about 1 foot above the ground, and lettered U. S. C. & G. S. The following true bearings were determined at the south monument:

	° ′
Spire on house on South street (mark)	45 51.6 west of north
Southeast corner of granite foundation of pumping station	39 27.8 east of north
South gable of white house across the bridge	68 58.1 east of north

Sheffield, Berkshire County.—The station is in Pine Knoll Park, about one-half mile southeast of the railroad station. It is nearly due south of the schoolhouse and exactly in line with the southeast corner of the schoolhouse and the west gatepost. It is 96.3 feet from this gatepost, 17 feet west of an elm tree and 41.8 feet east of a second elm tree, and 27 feet northwest of a maple tree. The station is marked by an oak peg 4 inches in diameter and 2½ feet long, driven flush with the ground. The following true bearings were determined:

	° ′
Baptist Church spire (mark)	79 38.5 west of south
Cross on Catholic Church	53 17.8 east of north
Congregational Church spire	13 50.8 west of north

MICHIGAN.

Ann Arbor, Washtenaw County.—The station of 1870 being no longer suitable, a new station was established in the oval race track of the Washtenaw County Fair Grounds. It is in the eastern part of the oval, 161.2 feet from the quarter milepost; 13.6 feet from the east fence, and 44.3 feet from the

Descriptions of stations—Continued.

MICHIGAN—Continued.

most northern of a line of hitching posts. The station is marked by a Bedford limestone post, lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	°	′	
Lightning rod on Mrs. C. Eiberbach's dwelling (mark)	84	19.2	west of north
East gable of grand stand	47	13.2	west of north
South gable on large frame house	22	19.5	east of north

Bessemer, Gogebic County.—The station is in the cemetery, in the north-and-south driveway. It is a little to the east of the center of the driveway, and is 28.8 feet from a small tree east of the road, and in the corner of a lot formed by the intersection of two roads. It is 26.4 feet from a small tree situated in the apex of a triangular lot on the west side of the road. It is also 82.2 feet from the base of the Cavendar monument The station is marked by a marble post 6 by 6 by 30 inches, set flush with the ground and lettered U. S. C. N. G. S., 1905. (Mistake by stonecutter.) The following true bearings were determined:

	°	′	
Court-house flag pole (mark)	56	27.1	west of south
Catholic Church spire	32	28.3	west of south
Bank flag pole	39	28.7	west of south

Big Rapids, Mecosta County.—The station is in the Mecosta County Fair Grounds. It is approximately in the center of the oval race track, 305.3 feet a little south of east from the northeast corner of the larger grand stand; 357.5 feet a little west of north from the northwest corner of the smaller (baseball) grand stand. It is also 232.5 feet from the east fence. The station is marked by a Bedford limestone post 6 by 6 by 30 inches, projecting about 3 inches above the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	°	′	
Catholic Church spire (mark)	84	32.6	east of south
Mercy Hospital cross	58	56.1	east of south
Flag pole Third Ward schoolhouse	42	51.1	east of south

Cadillac, Wexford County.—The station is in the northeast corner of Maple Hill Cemetery. It is in an unlaid-out portion of the cemetery, on the top of a hill sloping to the north and east. It is 113.7 feet west from the northwest corner of a monument marked "Stiewe," 123.5 feet a little west of north of one marked "De Boer," and 105.3 feet a little south of east from one marked "Ferris." The location of station is known to the sexton. It is marked by a Bedford limestone post 5 by 5 by 20 inches, set flush with the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	°	′	
Catholic Church spire (mark)	5	44.4	east of north
High School cupola	10	13.2	west of north

Flint, Genesee County.—The station is in the Genesee County Fair Grounds. It is approximately in the center of the race-track oval. There are 10 large oak trees in the oval. The station is 46.8 feet from the second tree, counting from the southeast; 96.3 feet from the third tree. It is also 173 feet from the fence, measured to the east of south. The station is marked with a Bedford limestone post 6 by 6 by 34 inches, projecting about 4 inches above the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	°	′	
Vane on W. F. Stewart's barn (mark)	23	40.2	west of north
Judges' stand, tip of roof	76	53.5	west of north
West stable, south gable	69	31.8	west of south
East gable of grand stand	67	20.7	west of north

Gaylord, Otsego County.—The station is north of town in the Otsego County Fair Grounds. It is on the east side of the oval race track, 306.8 feet northeast of the northeast corner of the judges' stand, 155.7 feet from the north post of gate to inner fence of oval to the east, and 135.3 feet from the four-

Descriptions of stations—Continued.

MICHIGAN—Continued.

teenth post to the north of gate. The station is marked by a cement post 6 by 4½ by 30 inches, with the top projecting about 4 inches above ground. The following true bearings were determined:

	° ′	
Court-house flag pole (mark)	3 49.5	west of south
Pinnacle of water tank	10 48.3	east of south
Mount Carmel Catholic Church spire	9 01.9	west of south
Old Catholic Church spire	11 18.8	west of south
Flag pole on grand stand	21 34.5	west of south
Flag pole on judges' stand	27 02.2	west of south

Gladwin, Gladwin County.—The station is in the Gladwin Cemetery, southwest of the town. It is near the center of the cemetery, at the intersection of what may become the two principal driveways. It is 14.7 feet northeast of a tombstone marked "Gifford," 83.2 feet from one marked "Long," and 41.5 feet from one marked "M. J. Moore." The station is marked by a 6-inch sewer pipe sunk slightly below the surface, and inclosing a bottle to mark the exact spot. The following true bearings were determined:

	° ′	
Methodist Episcopal Church spire (mark)	41 17.4	east of north
Dome of schoolhouse	33 27.2	east of north
Tower of F. L. Smith's house	40 02.8	east of north

Hastings, Barry County.—The station is in the oval race track of the Barry County Fair Grounds, approximately in the west center of the oval. It is 254.8 feet from the fence to the north, 193.0 feet from the fence to the south, and 243.3 feet from the fence to the west. It is also 86.8 feet from the most western of a grove of trees within the oval. The station is marked by a hard-wood stake, 2½ inches in diameter and about 20 inches long, driven flush with the ground. The following true bearings were determined:

	° ′	
East gable horseshed No. 1 (mark)	38 47.0	west of north
Sheep and hog shed, east gable	71 34.9	west of north
South gable on Mr. Toby's barn	76 00.0	west of north
East gable McOmber's barn	3 00.7	east of south

Jackson, Jackson County.—The station is within the oval race track of the Jackson County Fair Grounds. It is northwest of the center oval, 43.3 feet from the west inner fence of oval. It is also 166.1 feet from the northeast corner of the fair-ground stable, 204.1 feet from the southeast corner of the same, and 216.3 feet from the nearer of two large trees. The station is marked by a substantial white-oak stake driven flush with the ground, its approximate dimensions being 2 by 3 by 24 inches. The following true bearings were determined:

	° ′	
Cupola on dwelling of Welling estate (mark)	49 12.4	west of south
West Union High School vane	5 46.8	west of south
Prison tower	80 03.6	east of south
Cupola district schoolhouse	23 31.6	west of south

Lansing, Ingram County.—The station is in the grounds of the State Industrial School. It is near the northeast corner of the more northern of two adjacent playgrounds. It is 6.5 feet from the north fence, 31.3 feet from the east fence, and 32.0 feet from the northeast corner of the playground. The station is marked by a Bedford limestone post 6 by 6 by 30 inches, projecting about 2 inches above the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′	
Upper northwest corner of cottage No. 1 (mark)	27 38.8	west of south
Cupola of cottage No. 1	23 20.0	west of south
Upper southeast corner of McKinley cottage	69 02.4	west of south
Cupola of barn	57 54.4	east of south

Descriptions of stations—Continued.

MICHIGAN—Continued.

Mackinac Island, Mackinac County.—The station is a little east of north of the point on the west side of the Parade Ground occupied by L. A. Bauer in 1903. The station of 1902 was 148 feet from the southwest corner of a frame building and 103.5 feet from the east post of the back gate of the fence around the cottage west of the one occupied by the superintendent. It was marked by an irregular-shaped limestone rock jutting out flush with the surface, the apex of a triangular corner being the precise point used. The following true bearings were determined at the new station, which was not marked:

	° ′
Flag pole Fort Holmes (mark)	19 47.4 east of north
Lower southwest corner powder magazine	59 56.9 east of north
Lower northeast corner middle blockhouse	54 01.6 east of south

Mackinac Island, Station II (east side of Parade Grounds), Mackinac County.—The station of 1902 was reoccupied. It is in the line connecting the Lake Survey triangulation stone near the fence at the northeast corner of the Parade Grounds with the north edge of the stone foundation of the east blockhouse, erected in 1780. The precise point is 132.7 feet from the middle of the stone, 166.7 feet from the southeast corner of a one-story frame dwelling and 199 feet from the northwest edge of the small powder magazine. The station is marked by the middle one of five stakes driven flush with the ground. The following true bearings were determined:

	° ′
Lower northeast corner of powder magazine	62 19.1 east of south
Lower north corner of blockhouse	24 06.9 east of south
Northwest corner of powder magazine	57 59.9 east of south

Newberry, Luce County.—The station is in the cemetery, in the driveway leading from the west entrance. It is a little to the west of center of driveway and is 98.6 feet from the gate. It is 44.7 feet from the base of the Harcourt monument, 42.1 feet from the base of James Devine headstone, and 78.2 feet from the base of the Donegan monument. The station is marked with a bottle set about 4 inches below the surface of the ground and placed in the center of a section of terra-cotta drainpipe 23 inches long and 6¼ inches in diameter. The drainpipe is planted about 2 inches beneath the surface. The following true bearings were determined:

	° ′
Court-house flag pole (mark)	83 41.0 east of north
Episcopal Church spire	67 20.3 east of north
Public school flag pole	68 06.4 east of north

Roscommon, Roscommon County.—The station is near the eastern corner of the public school grounds, to the rear of the building. It is 28.6 feet from the fence running approximately northwest and southeast, 208.9 feet from the south corner, and 197.1 feet from the east corner of the school building. The station is marked by a draintile 24 by 9.5 inches, inclosing a bottle to mark the exact spot, both slightly below the surface of the ground. The following true bearing was determined:

	° ′
North corner of schoolhouse (mark)	53 57.0 west of north

Stanton, Montcalm County.—The station is in a 3-acre lot belonging to the town, which may at some future date be laid out as a park. The station is in the north-central part of the grounds near an improvised fence of tree stumps. It is marked by a cement block, 8 by 9 by 32 inches, projecting about 8 inches above the surface. The following true bearings were determined:

	° ′
Judge's stand (mark)	18 40.7 east of south
East gable L. D. Darnell's barn	56 02.5 west of south
Upper northeast corner Chas. Holland's house	12 55.3 east of south

St. Johns, Clinton County.—The station is in the cemetery, northeast of the center of town. It is near the middle eastern boundary of the present cemetery, about 23.7 feet from the eastern fence.

Descriptions of stations—Continued.

MICHIGAN—Continued.

It is 99.7 feet somewhat east of north from the northeast corner of the Babcock vault, 113.5 feet northeast of the northeast corner of the McCabe monument and 74.0 feet in a southeasterly direction from the McGuire monument. It is also just south of the line joining a hickory and a white oak tree, 10.8 feet from the former and 10.7 feet from the latter. The station is marked by a sandstone post, 6 by 6 by 30 inches, projecting about 2½ inches above the surface of the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	°	′	
Southwest edge of horizontal arm of cross of Moinet monument (mark)	42	08.2	west of north
Vane on Steel's barn	3	28.8	east of north
North gable Babcock vault	10	34.8	west of south
East gable distant barn	18	48.3	west of north

MINNESOTA.

Brainerd, Crow Wing County.—The station of 1900 was reoccupied. It is at the exact center of the intersection of Juniper street and Bluff avenue, 3 squares north of the N. P. R. R. depot and 5 squares west of Sixth street and on the edge of the town, overlooking the Mississippi River. It is 40 feet from the northeast corner of Juniper street and Bluff avenue, 27.6 feet from the line of trees on the north side of the street, 24.6 feet from the line of posts on the north side of the street, and 44.6 feet from the center of the large pine tree just east of south. The station is marked by an oak stub 1 by 2 by 12 inches, with copper nail in the top to mark the exact spot. The following true bearings were determined in 1905:

	°	′	
Catholic Church spire (mark)	88	51.5	east of north
East corner Charles Hughes's house	28	32.9	west of north
Brick chimney in East Brainerd	89	55.4	east of south
Northeast edge of house across ravine	33	01.3	east of south

Deer River, Itasca County.—The station is near the southeast corner of the public school grounds, 13.8 feet from the east fence and 33.6 feet from the west fence. It is 146 feet southeast of the nearest corner of the school building, a frame structure. The station is marked by a cement block 5 by 7 by 20 inches, set flush with the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	°	′	
Southwest corner of Hotel Mohr (mark)	6	48.5	east of south
South corner of New Home Hotel	52	50.9	west of south
Northeast corner of schoolhouse	38	48.6	west of north

Douglas, Aitkin County.—The station is near the center of NE. ¼ of SW. ¼ of sec. 28, T. 46, R. 22, about 3½ miles by road west of south from Tamarack Railroad station, and on land owned by Mr. E. L. Douglas. It is 125.5 feet from the triangulation station, and is 4 feet to westward of trail, in brush and small timber. The station is marked by a 2 by 2 by 24 inch wooden stub. The mark was a plumb line over triangulation station, which bears 21° 44′.6 west of south.

Fosston, Polk County.—The station is on a vacant block owned by Lewis Lohn, as nearly as could be determined, at the southwest corner of the block, at the intersection of Larson and Lohn streets. The block is not fenced and the street lines are not well defined. The station is 81 feet from the fence on the west side of Larson street and 52.5 feet from the fence on the south side of Lohn street. It is marked by a sandstone post set flush with the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	°	′	
Flag pole on mill (mark)	21	03.1	west of south
Tip of cap on water tower	30	58.3	west of south
Spire of Lutheran Church	62	33.8	west of south
Spire of First Lutheran Church	81	34.6	west of south

Descriptions of stations—Continued.

MINNESOTA—Continued.

Northome, Itasca County.—The station is on land belonging to the Northern Pacific Railroad Company, north of the depot, on the east side of the track. It is 147 feet east of the center of the main track, measured down to the bottom of the cut, 252 feet northeast of the railroad water tank, and 27.5 feet southwest of the center of a wagon trail. The station is marked by a granite bowlder, sunk in the ground, lettered U. S. The following true bearings were determined:

	° ′
Flag pole on schoolhouse (mark)	84 03.3 east of north
Tip of city water tower	60 27.4 east of south
Tip of railroad water tank	39 41.8 west of south

Osakis, Todd County.—The triangulation station is near the center of sec. 7, T. 128 N., R. 35 W., in West Union Township, 3 miles south and 1 mile east of Osakis, on a hill at the north edge of a wheat field belonging to A. L. Markthaler, living three-eighths mile west. It is 11.3 feet south from north fence, 98.1 feet east from fence running north to house of C. A. Markthaler, and 173.2 feet west from four fence corners at center of section. Marked by concrete and tile.

The magnetic station is located 63.9 feet north of west from the triangulation station, and in prolongation of the line from the short cupola on the Catholic farm building to the triangulation station. It is also 22.3 feet north of the south fence and 45.4 feet east of the west fence, these fences being the first and second fences mentioned above. The following true bearings were determined:

	° ′
Cupola on C. A. Markthaler's barn (mark)	7 50.2 west of north
Cupola on Bert Anderson's barn	50 31.6 east of north
Short cupola on house on Catholic farm	59 20.0 east of south

Royalton South Base, Benton County.—The station is in the open field just east of the center of the south side of sec. 33, T. 38 N., R. 31 W., on land belonging to Mrs. A. T. Frommett. It is 128.8 feet from the Royalton South Base triangulation station, in line between the triangulation station and the spire on the Catholic Church in Rice, Minn. The station is marked by a 2 by 2 by 24 inch wooden stake projecting one-half inch above the ground. The following true bearings were determined:

	° ′
Spire on Catholic Church, Rice (mark)	28 39.4 west of north
Spire on church in Brockway	56 05.8 west of south
Brockway triangulation station	65 41.9 west of north
Spire on Methodist Church, Rice	39 28.7 west of north

Stephen West Base, Marshall County.—Stephen West Base triangulation station is about 100 paces east of the ¼ corner on the south side of sec. 33, T. 158, R. 48, in an open field owned by Mr. J. Gillespie, about 1½ miles by road northeast of Stephen. It is 14 paces north of the center of the road, and is marked by a heavy mass of stone and concrete.

The magnetic station is in line between West Base and East Base, 467.3 feet from West Base. It is 133.3 feet east from the latitude pier. The station is marked by a 2 by 4 by 24 inch wooden stub driven so that 1 inch projects above the ground. The following true bearings were determined:

	° ′
East Base (mark)	73 19.2 east of north
Catholic Church spire, Stephen	65 13.9 west of south
Methodist Church spire	69 59.2 west of south
West edge of house one-half mile away	20 11.9 west of north

Tilden, Polk County.—Tilden triangulation station is in an open field in the southwest corner of sec. 20, T. 149, R. 44, on land belonging to John Clayton. It is about 175 yards north of the Great Northern Railroad, at a road crossing nearly 2 miles west of Tilden. It is 48.9 feet east of the center of the wagon road and 42.0 feet east of the section line on the west side of section 20. The latitude pier is 34.9 feet due west of the triangulation station.

Descriptions of stations—Continued.

MINNESOTA—Continued.

The magnetic station is almost due north of the latitude pier and is 120.2 feet from the triangulation station. It is also 9.8 feet east of section line and 19.7 feet east of the wagon road. The station is marked by a 2 by 4 by 24 inch stub driven flush with the ground. The following true bearings were determined:

	° ′	
West edge of ridge of Nels Anderson's house (mark)	4 18.0	west of south
Short spire of railroad signal tower	86 36.4	east of south
Center of elevator at Lees	30 43.2	east of south
Crookston water tower (?)	69 29.5	west of north
Tilden triangulation station	15 22.7	east of south

Tower, St. Louis County.—The station is on a tract of waste land belonging to a mining company at the east end of Third street, near the foot of the steep hill rising back of the town. It is 84.5 feet from the fence on the south side of Third street, about 50 feet south of the base of the steep part of the hill, and 156.5 feet east of the fence around the last house on the north side of Third street. The station is marked by a cross chiseled in the top of a native gray granite bowlder, which is also lettered U. S., 1905. The station is located in an iron-mining district, and it is probable that the hill near the station contains magnetic ore. The following true bearings were determined:

	° ′	
Flag pole on schoolhouse (mark)	80 17.2	west of south
Spire of Catholic Church	74 46.1	west of south
McKinley monument	45 38.4	west of south

Two Harbors, Lake County.—The station is on a piece of waste land southeast of the light-house belonging to the Duluth and Iron Range Railroad, close to the edge of vegetation on the lake shore. It is in line with the south fence of the light-house grounds, 139.7 feet from the southeast corner. The station is marked by a sandstone cornice block, curved side up, bedded in the layer of turf covering the bed rock and lettered on one side U. S. C. & G. S., 1905. The exact point is marked by a rectangular hole chiseled in the bed rock, which is to be found by raising the marking stone. The following true bearings were determined:

	° ′	
Northeast corner of light-house (mark)	56 01.1	west of north
Tip on light-house tower	64 14.5	west of north
South edge of fog-horn chimney	82 17.5	west of north

MISSISSIPPI.

Corinth, Alcorn County.—The station is in the grounds of the public school, 76.3 feet from the southeast corner of the building and 86.6 feet from the northeast corner. It is 30.7 feet from the fence to the south. The station is marked by a blue limestone post, set flush with the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′	
Baptist Church spire (mark)	57 42.2	west of north
West gable of house	6 26.7	west of south
Dormer window of same house	5 35.1	west of south
Iron pipe on S. D. Bramlitt's house	70 44.7	east of south
East gable of C. S. Graham's house	48 11.4	west of south

MISSOURI.

Cassville, Barry County.—The station is in the southeastern corner of the school grounds, 30 feet from the fence on the south, 33.3 feet from the fence on the east, and 91 feet from a large oak tree near the wood shed. It is marked by a limestone post, 4 by 6 by 30 inches, projecting about 1 inch above the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′	
Cumberland Presbyterian Church spire (mark)	50 19.1	east of south
Southwest corner of school building	71 02.9	west of south

Descriptions of stations—Continued.

MISSOURI—Continued.

Hermann, Gasconade County.—The station of 1900 was reoccupied. It is on Blust's Hill, southeast of the depot, on land owned by the city. It is 48.2 feet south of the fence running east and west across the hill, and is marked by a gray limestone post, 6 inches square on top and lettered U. S. C. & G. S. (the lettering very faint in 1906), extending 4 inches above the ground. The following true bearings were determined:

	° ′
Court-house spire (mark)	62 34.2 west of north
Pole (tree) on distant ridge	21 17.2 west of north
Flagstaff of Stone Hill Wine Company	58 14.8 west of south
Catholic Church cross	87 51.7 west of south
Spire of Evangelical Church	73 26.8 west of north
Spire of Methodist Church	70 03.6 west of north

Lamar, Barton County.—The station is on the grounds of the Lamar College, northwest of the main building. It is 69.8 feet from the west line of the campus, 92.3 feet from the north line of the campus, and 73.3 feet from the northwest corner of the main building. The station is marked by a Carthage marble post, 6 by 6 by 30 inches, sunk flush with the surface of the ground and lettered U. S. C. & G. S., 1905. The following true bearing was determined:

	° ′
St. Mary's Catholic Church spire (mark)	87 30.1 west of north

Normal, Johnson County.—The triangulation station is located in the center of the northwest block of stone capping the large chimney of the main building of the State Normal School at Warrensburg. The reference mark of 1883 is 188 feet south of this on a lawn. The magnetic station is in the grounds of the Normal school, about 115 paces south of the building. It is 112 paces west of south of reference mark, 16.4 feet east of trees, 25.6 feet north of the south fence of the campus, and 83.5 feet west of the west edge of north-and-south walk. It is marked by a stone post, 6 by 6 by 26 inches, set flush with surface of ground. The top has two diagonal grooves with drill hole in center. Mark used was the upright inner edge of the wooden suppport to the stairway at the southeast corner of the building. The following true bearings were determined:

	° ′
Upright support of stairway (mark)	9 27.2 east of north
Von Fingerlin House spire	10 55.1 east of south
Northeast corner of Whitman House	87 16.5 west of south
Normal School spire	2 30.1 east of north
Reference mark of 1883	12 27.6 east of north

Steelville, Crawford County.—The station is in the public school grounds, 86.8 feet from the north fence, 110.1 feet from the east fence, and 126.9 feet from the northwest corner of the school building. The station is marked by a limestone block 6 by 10 by 15 inches, set 1 inch below the surface of the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′
Steeple on Presbyterian Church (mark)	10 11.3 west of north
Steeple on Methodist Church	5 41.4 west of north
East edge of flue on John Boss's house	15 46.0 east of north

Waynesville, Pulaski County.—The station is on the point of a bluff southwest of the court-house on a small tract of land owned by Prof. W. A. Lumpkin. It is 55.6 feet from a wire fence on the south side, 82.6 feet from a similar fence on the north side, and 55.5 feet from a locust tree that bears about 10° south of east. The station is marked by a white sandstone post 8 by 8 by 30 inches, sunk flush with the surface and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′
Staff on belfry of Baptist Church (mark)	34 23.7 east of north
Center of roof of cupola on court-house	49 33.8 east of north

Descriptions of stations—Continued.

MISSOURI—Continued.

West Plains, Howell County.—The station is in the southwest corner of the college campus, which is about three-fourths of a mile due east of the court-house and town. It is 33 feet from the wire fence on the west and 51.2 feet from the wire fence on the south. It is also 22 feet from a maple tree a little east of north and 48 feet from a second maple tree a little west of south. The station is marked by a Bedford limestone post 30 inches long and about 8 inches square, projecting about 1 inch above the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′
Flag pole on court-house (mark)	84 35.0 west of north
Flag pole on college building	84 10.9 east of north

MONTANA.

Anaconda, Deer Lodge County.—The station is about 1½ miles west of the center of town, in the northwest corner of the Anaconda Fair Grounds, in the northwest part of the oval within the large race track. It is 252.5 feet southeast of the three-eighth milepost and 185.6 feet southwest of the seven-sixteenth milepost on the race track. It is marked by a 6-inch glazed pipe partly filled with cement and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′
Center of cupola on court-house (mark)	48 42.2 east of south
Flag pole on High School cupola	55 58.9 east of south
Belfry of Baptist Church	55 04.4 east of south
Flagstaff on tower of Prescott School	61 47.2 east of south
Catholic Church steeple	67 03.6 east of south
Spire of church corner of East Fourth and Main streets	60 47.9 east of south

Crow Agency, Crow Indian Reservation.—The station is in an inclosed lot belonging to the Indian School, and now used as an alfalfa meadow. The lot is west of the Indian School and about 500 feet from the railroad. The station is situated so that a large cottonwood tree near the center of the lot lines with the most westerly of a row of cottonwood trees across the south side. The lot is bounded by an open board fence and the station is 27.1 feet south of the fence and 213 feet from the west side measured from the second post south of the gateway. The northwest corner of the girls' dormitory is 264.7 feet to the southeast and the cottonwood tree nearest the corner of the lot is 162.7 feet distant. The station is marked by a sandstone post 7 by 7 by 27 inches set flush with the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′
Tip of railroad water tank (mark)	14 09.0 west of south
Tip of Agency reservoir tank	71 36.0 west of south
Southeast corner of Agency barn	39 45.0 east of north
Chimney on teacher's home at upper southwest corner	39 50.9 east of south

Dillon, Beaverhead County.—The station is in the northeast corner of the grounds surrounding the State Normal School, about 1 mile southeast of the town. It is about 18 feet north of the northeastern part of the running track. It is 93.4 feet west of the fence bounding the school grounds on the east, 203.5 feet south of the fence on the north, and 208 feet south of east from the northeast corner of the northern dormitory. The station is marked by a 6-inch glazed pipe partly filled with cement, projecting about 1 inch above ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′
Baptist Church spire (mark)	1 29.0 east of north
Methodist Church belfry	13 18.8 east of north
Court-house cupola	21 06.7 east of north

Gateway, Flathead County.—The station is northwest of the town, 650 feet east of the railroad tracks, on an open, level flat or bench elevated above the town and river. It is 119 feet north of the

Descriptions of stations—Continued.

MONTANA—Continued.

station of 1903, in a meridian line about 1 150 feet long, each end of which is marked with an iron pipe. The station is 109.1 feet north of the south meridian post and about 700 feet west of the boundary monument. It is marked by a yellow pine post 32 by 8 by 8 inches set 2 feet in the ground and having a wire nail driven in the center of the top.

Glasgow, Valley County.—The station of 1903 being no longer available, a new station was located in Highland Cemetery, in the center of the driveway leading into the cemetery. The driveway is very ill defined, however. It is 98.9 feet from the base of Nelson's monument; 67.1 feet from Edward Mundy's, and 78.4 feet from a granite rectangle, marked Lynn, on the foot piece, and inclosing the grave of Lee Cook. The station is marked by a black pyramidal rock 6 by 8 by 9 inches, roughly, and about 7 inches in altitude. The apex projects about 1 inch above the surface of the ground, and has a cross-shaped hole drilled into it about an eighth of an inch to mark the exact spot. The following true bearings were determined:

	° ′	
High School flag pole (mark)	48 46.3	west of south
Public School flag pole	67 11.3	west of south
Court-house flag pole	48 38.2	west of south

Harlem, Choteau County.—The station is located just to the east of the cemetery, but within the fence inclosing the cemetery. It is 57.1 feet from the ninth fence post of the fence bounding the cemetery on the east. Posts were counted from the southeast corner, with corner post as No. 1. It is 186.6 feet from the fifth fence post of the fence bounding the cemetery on south, posts being counted as above from southeast corner with corner post as No. 1. It is also 154.4 feet from the southeast corner of fence surrounding an unmarked grave (only iron fence in cemetery). The station is marked by a round half-pint bottle, planted base downward with mouth of bottle about flush with surface of the ground. Four pine stakes are driven in ground so as to form a square around the bottle, with the bottle about the center of the square. Center of mouth of bottle marks the exact spot. The following true bearings were determined:

	° ′	
Presbyterian Church spire (mark)	4 18.6	west of south
Flag pole, New England Hotel	9 17.1	west of south

Helena, Lewis and Clarke County.—The station of 1904 was reoccupied. It is located near St. Joseph Catholic Orphan Asylum, about 1 mile north of the city limits. It is 453 feet east of the inner edge of Montana avenue extended, 78 feet north of the plank fence around the asylum grounds, and 250 feet northeast of the northeast corner of the asylum building. It is marked by a marble slab, 24 by 6 by 6 inches, with a drill hole in its top, which is flush with the ground. The following true bearings were determined in 1904:

	° ′	
Spire of Public School	1 59.6	east of south
Spire of Statehouse	0 38.6	east of south

Lewistown, Fergus County.—The station is about 1½ miles north of the town, in the southeast corner of the Lewistown Fair Grounds, in the southeast part of the oval within the race track. It is 399.4 feet north of the fence bounding the fair grounds on the south, 265.4 feet west of the fence on the east, and 494.5 feet northeast of the halfmile post on the race track. The station is marked with a glazed earthen 6-inch pipe partly filled with cement and projecting about 1 inch above the ground. The top is lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′	
Flagstaff on High School (mark)	6 47.1	east of south
Methodist Church spire	2 43.2	east of south
Belfry of old High School	3 38.5	east of south
Flagstaff on Public School	1 57.0	east of south
Presbyterian Church spire	2 27.8	east of south

Malta, Valley County.—The station is located in the cemetery, at the intersection of two walks, and is 98.8 feet from the tombstone of Anna Doores, 82.8 feet from that of Alice Moore, and

Descriptions of stations—Continued.

MONTANA—Continued.

166.5 feet from the iron fence surrounding the grave and tombstone of Mrs. Sarah Olive Spellman. The station is marked by a round quart bottle, planted base downward and with the neck projecting about a half inch above the surface of the ground. Small stones are piled around bottle. The center of the mouth of bottle marks the exact spot. The following true bearings were determined:

	°	′	
High School flag pole (mark)	32	58.0	west of north
Catholic Church spire	55	53.3	west of north

Missoula, Missoula County.—The station is on the grounds of the State University, north of the eastern part and about 1 mile southeast of the town. It is in the southeast corner of the running track and athletic field and east of University Hall. It is 67.7 feet west of the fence bounding the athletic field on the east and 143.5 feet north of the fence bounding the athletic field on the south. The station is marked by a granite post 6 by 6 by 24 inches, projecting 1 inch above ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	°	′	
First Methodist Episcopal Church spire (mark)	31	39.3	west of north
Steeple of Christ Church	29	16.9	west of north
Rod on cupola	75	29.1	west of north
Cupola on University Hall	83	10.8	west of south

Phillips Ranch, Flathead County.—The station is on Davis's ranch in Montana, just across the line from the old Phillips ranch, now owned by Mr. Scott. It is about 300 feet southwest of the station of 1903, on an open knoll, 266.2 feet a little west of south from the boundary monument by the road and 92 feet east of the fence line on the east edge of the road. The station is marked by a 3-inch fir post driven about 1 foot in the ground and projecting 1 foot above the ground. The following true bearings were determined:

	°	′	
Triangulation signal on ridge on west side of valley (mark)	77	10.3	west of north
Southeast gable of Phillips's ranch house	29	26.8	west of north
South meridian post on rock bluff	36	15.4	east of north

Stevensville, Ravalli County.—The station is in the southeast corner of the grounds surrounding the Stevensville Training School, about 1 mile southeast of the town. It is 159 feet north of the fence bounding the school grounds on the south, 149 feet west of the fence on the east and 412.9 feet southeast of the southwest corner of the school building. The station is marked by an oak stake 4 by 4 by 30 inches, projecting about 6 inches above the ground. The following true bearings were determined:

	°	′	
Baptist Church spire (mark)	66	59.0	west of north
Steeple of Methodist Episcopal Church	59	47.0	west of north
Ball on southern gable of schoolhouse	50	49.5	west of north

Superior, Missoula County.—The station is in the southeast corner of the public school grounds, about one-fourth mile southeast of the town. It is about three-fourths of a mile northwest of the railroad station at Iron Mountain and about 400 feet south of a heavy wooden bridge with iron tension pieces. It is 31.4 feet north of the fence on the southern side of the school grounds, 49.8 feet east of the fence on the west side and 195.7 feet southwest of the southwest corner of the school building. The station is marked by an ash stake 3 by 2½ by 24 inches, set flush with the ground. The following true bearings were determined:

	°	′	
Rod on roof of railroad station	29	58.0	east of south
Rod on N. P. Rwy. water tank	28	08.6	east of south
South gable of building of Independent Order of Red Men, in Superior	13	07.1	west of north

Descriptions of stations—Continued.

MONTANA—Continued.

Yaak River, North or Middle Fork, Flathead County.—The station is on American soil on the east bank of the river on one of a series of rocky points outcroppings of a well-defined ledge of rock running east along the boundary from the river. The station is 38.1 feet east of boundary monument No. 14 and 38 feet east of the triangulation signal just a few feet south of the above monument. An 18-inch tamarack tree, the largest near the station, is 13 feet distant to the north. The station was not marked. The following true bearings were determined:

	°	′	
Triangulation signal a few feet east of boundary monument No. 13	88	56.6	east of north
Two-foot blazed tamarack tree 280 feet from station	1	56.8	east of south
Signal near monument No. 14	86	09.9	west of south

NEVADA.

Caliente, Lincoln County.—The station is in a pasture belonging to Mr. Charles Culverell, about 1 200 feet northeast of the S. P. & S. L. R. R. station and a little north of west of the public school. It is 285 feet west of the southwest corner of the fence surrounding the public school house and 285 feet a little south of west from the northwest corner of this fence. It is marked by a hickory stake with the bark on, about 4½ inches in diameter and about 36 inches long, showing above ground 7 inches and with a cross sawed in the top to mark the exact spot. The following true bearings were determined:

	°	′	
North gable of railroad station (mark)	14	13.6	west of south
West edge of railroad water tank just under top plate	75	14.2	east of south
Top of southwest edge on raised front of Opera House	35	44.9	east of south
Base of Geological Survey signal on conical hill to the southeast	86	51.6	east of south

Las Vegas, Lincoln County.—The station is in the southeastern corner of the block reserved for public purposes, between Bridger and Carson streets and between Second and Third streets. It is 108.5 feet northwest of the curb on Third street and 91 feet northeast of the curb on Bridger street. The station is marked by a California red-wood stake 4 by 4 by 36 inches, showing 6 inches above the ground, with a cross sawed in the top to mark the exact spot. The following true bearings were determined:

	°	′	
Southwest corner of S. P. & S. L. Railroad station (mark)	33	06.6	west of north
Southeast corner of Nevada Hotel	23	33.1	west of north
Northeast corner of Thomas Building	7	42.8	west of north

Rox, Lincoln County.—The station is about halfway between Las Vegas and Caliente, about 1 400 feet northwest and across the creek from the section house called Rox. It is west of the water tank on a small grassy clearing among the bushes, just in front of a semicircular depression in the western edge of the canyon. It is marked by a wooden stake 2 by 6 inches, showing about 6 inches above ground, with a cross cut in the top. A hole at the center of this cross marks the exact spot. The following true bearings were determined:

	°	′	
Point at top of the section-house roof (mark)	24	08.0	east of south
North edge of water tank just under top plate	59	09.3	east of south

NEW HAMPSHIRE.

Colebrook, Coos County.—The station is on the top of a small hill in a pasture belonging to Mr. J. E. Lombard and is back of Lombard Hill. It is southeast from the gate to the pasture and 140 yards from the road to the north. From the station an outcropping point of the bed rock is 37.3 feet bearing 49° west of north, a second point is 40.6 feet bearing 25° west of north, and a third point is

Descriptions of stations—Continued.

NEW HAMPSHIRE—Continued.

29.6 feet bearing 54° east of south. The station is marked by a marble post 8 by 8 by 13 inches, sunk flush with the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	°	′	
South gable of Mr. W. Corbett's house on top of ridge 2½ miles away (mark)	54	25.2	east of north
Methodist Church spire	37	36.2	west of north
Congregational Church spire	26	48.1	west of north
Crucifix on Catholic Church	16	40.8	west of north

Hanover, Grafton County.—The station of 1898 being no longer available for magnetic observations, a new station was selected near the highest and most northern point of the golf grounds of the Hanover Country Club. A cherry tree is 72 feet from the station, bearing 26½° west of north. A pine tree (the northeast one of two adjacent pines) nearly in line with the cherry tree, is 104 feet away. The last elm tree of the row along the road bears 56° 6′ east of south. The station is marked by a marble post 6 by 6 by 50 inches, projecting 1 foot above the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	°	′	
Top of stone tower (mark)	2	55.2	west of south
Rod of wind vane on College Church	17	25.4	west of south
North cupola of a barn	53	37.8	east of north
C. & G. S. Station on Balch Hill	80	24.0	east of south

Newport, Sullivan County.—The station is east of the village, about 150 yards back (north) of Mr. Henry C. Stearns's house and barn. From the station 17° 13′ east of south to a vertical mark 6 inches long, cut on the north face of a large stone, is 57.5 feet. From the station to the stone fence to the westward is 60 yards. An apple tree near this fence bears 26° 45′ west of south. Observations were made over a white flint stone, the uncovered top measuring about 14 inches across, on which a cross mark and the letters U. S. are cut. The following true bearings were determined:

	°	′	
Southeast corner of Mr. McNabb's house on ridge across the valley (mark)	72	13.8	west of south
Crucifix on Catholic Church	87	13.7	west of north
Rod of wind vane on cupola of Mr. Sergeant's stable	68	24.7	west of north
Tree at top of bare ridge	6	12.1	west of north

Plymouth, Grafton County.—The station is west of the village, on Mr. D. M. Tenney's farm. It is near the top of a knoll, back of a wood of small trees. Observations were made over the exposed top, level with the ground, of a granite stone or portion of the bed rock, which was marked with the letters U. S. From the station to the end of an arrow cut across the top of a large rounded stone is 19.7 feet, bearing 79° 40′ west of south. The north face of a stone is 67.7 feet a little west of south and another stone is 80.1 feet a little east of south. The following true bearings were determined:

	°	′	
West gable of distant large barn (mark)	58	06.9	east of north
West gable of house in village	84	43.6	east of south
Northeast gable of Mr. C. Preece's house	64	29.8	west of north
East edge of large stone in pasture 1 mile away	4	24.9	west of north

NEW MEXICO.

Alamogordo, Otero County.—The station of 1902 being no longer available a new station was established south of the central part of the grounds of the Asylum for the Blind, about 1 mile north of the county court-house. It is about 400 feet southeast of the Asylum building and about 500 feet east of the road along the west side of the Asylum grounds. The station is marked by a stone 8 by 8

Descriptions of stations—Continued.

NEW MEXICO—Continued.

by 30 inches, showing about 6 inches above ground, with a cross on top to mark the exact spot. The following true bearings were determined:

	°	′	
Cupola of county court-house (mark)	3	23.8	east of south
Baptist Church spire	6	47.1	east of south
Cupola of State College	54	33.9	east of south
Highest point on White or Snow Mountain	15	16.6	east of north

Cloudcroft, Otero County.—The station is in the northern part of Zenith Park, on the southwest edge of a low hill, and about 280 feet a little north of east of the seats at the baseball ground. It is 195 feet south of the rail fence bounding the park on the north, and 233 feet southeast of the southeast corner of a high board fence surrounding a log house in the northwestern part of the park. The station is marked by a rough limestone from the field. This stone is about 5½ inches in diameter at the top and about 2 feet long. It shows 1½ inches above ground, and a shallow hole or watermark about 1 inch in diameter at the top marks the exact spot. The following true bearings were determined:

	°	′	
Upper western corner on front of old Cloudcroft Hotel (mark)	69	46.3	west of north
North point on roof of 5-gabled house on Possum avenue	74	05.5	west of south
East point on roof of white house just south of general Church	50	28.8	west of north

Deming, Grant County.—The station is in the northwest corner of a lot owned by Mr. W. C. Wallis, about 1 mile south of the Presbyterian Church and one-half mile west of a water tank and windmill at a ranch house. It is 150.4 feet a little south of east of a stone marking the southwest corner of the town section, 99 feet south of the southern town section line, and about 132 feet east of a property line to the west, running north and south. The station is marked by a stone 30 by 6 by 6 inches, lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	°	′	
Cross on Catholic Church (mark)	39	49.2	east of north
Flag pole on public school	32	24.8	east of north
Top of belfry Presbyterian Church	20	32.2	east of north
Highest point on Cook's Peak	6	18.1	west of south

Engle, Sierra County.—The station is in a pasture a little south of west of the Santa Fe Railroad station. It is about 151 feet west of the center of the fence on the west side of the lot upon which the post-office stands. It is about 2 000 feet east of a small lake. The station is marked by a cedar post about 5 inches in diameter, showing 7 inches above ground, with a cross sawed in the top to mark the exact spot. The following true bearings were determined:

	°	′	
Santa Fe Railroad water tank (mark)	83	21.0	east of north
South gable of Santa Fe Railroad station	79	59.5	east of north
Tall white chimney on ranch house	80	24.2	west of north

Jarilla, Otero County.—The station is near the northwest corner of Grace street and Powell avenue, about one-fourth mile a little west of north of the town's center. It is about 150 feet almost directly south of the office of the Southwest Smelting and Refining Company. It is 82.2 feet south of a stake about 6 by 2 inches showing about 2 feet above ground and painted white. This stake is on a section line extending east and west, and is about 200 feet northwest of the corner of Grace street and Powell avenue. The station is also 159 feet west of the stake marking the northwest corner of Grace street and Powell avenue. The station is marked by a dark yellowish or brown glass bottle, about 8 inches under ground. This spot is also indicated by two small stakes about 3 feet apart to the east and west of the glass bottle. The following true bearings were determined:

	°	′	
Southeast corner at top of roof of new hotel (mark)	17	30.5	west of south
Base of flagstaff on office of The Fidelity Real Estate Company	13	47.1	west of south

Descriptions of stations—Continued.

NEW MEXICO—Continued.

Las Cruces, Donna Ana County.—The station is in the northern part of the grounds surrounding the Alameda Sanitarium, about 1½ miles northwest of the center of the town. It is 89.6 feet east of the southeastern of four posts or tree trunks (each about 5 inches in diameter), arranged in a parallelogram about 15 feet apart. It is 214 feet a little north of east from the northeast corner of the sanitarium building and about 105 feet south of a bank about 8 feet high extending east and west. The station is marked by a piece of broken composite sidewalk 1 inch thick, with a point projecting about 2 inches above ground to mark the exact spot. The following true bearings were determined:

	°	′	
Cupola on county court-house (mark)	17	32.6	east of south
Pyramidal cupola on a house	29	03.2	east of south
Low cupola at top of windmill tower	26	18.9	east of south

Nara Visa, Union County.—The station is about 700 or 800 feet south of the Rock Island Railroad station and southeast of the hotel. It is 313 feet south of an iron pipe 6 inches in diameter, which was sunk for a well. It is also 212 feet southeast of the southeast corner of the fence surrounding the hotel. The station is marked by a cedar post about 6 inches in diameter, showing 7 inches above ground, with a cross sawed in the top to mark the exact spot. The following true bearings were determined:

	°	′	
Rock Island Railroad water tank (mark)	3	01.9	west of north
Southwest point at top of roof of Rock Island Railroad station	14	17.8	west of north
Southern point at top of roof of general store	32	02.5	west of north

Orange, Otero County.—The station is about 1½ miles north of the Texas border, and a short distance south of east of the store and post-office. It is 230.5 feet southeast of the southeast corner of the fence surrounding the dwelling of Mr. F. M. Holmsley and 272.5 feet southeast of the northeast corner of the store and post-office. The station is marked by a cedar post about 5 inches in diameter, showing 3 inches above ground, with a cross sawed in the top to mark the exact spot. The following true bearings were determined:

	°	′	
Southeast corner of Brownfield ranch house (mark)	26	16.2	west of south
Center of top of frame of Brownfield north windmill	15	03.8	west of south
Projecting point on east side of mountains	3	05.1	west of south

Prather's Ranch, Otero County.—The station is north of J. E. Prather's ranch house and about 700 feet northeast of Prather's water tank and windmill. It is also about 33 feet west of a ditch coming from the hills to the north. It is 218.4 feet northeast of the northeast corner of J. E. Prather's ranch house and 344 feet north of the first barbed-wire fence south of Prather's house. The station is marked by a hollowed stone used by the Indians to grind corn in, standing on edge about 3 inches above ground, with a depression pounded in the top to mark the exact spot. The following true bearings were determined:

	°	′	
Highest point on White Mountain (mark)	12	05.0	east of south
Center of iron shaft at the top of Prather's windmill	51	44.1	west of south

Santa Rosa, Leonard Wood County.—The station is in a town block, about one-fourth mile east of the Rock Island Railroad station, and a short distance east of the corner of Sixth street and Corona avenue. It is 50 feet southeast of the stake marking the northwest corner of block 26 and 77 feet a little south of east of the stake marking the northeast corner of block 27. It is marked by a sandstone post 6 by 6 by 24 inches, showing about 3½ inches above ground, with a cross in the top to mark the exact spot. The following true bearings were determined:

	°	′	
Cupola of public school (mark)	5	24.8	west of south
Catholic Church steeple, cross	20	42.8	east of south
South corner of Rock Island Railroad station, just under roof	86	31.3	west of south

Descriptions of stations—Continued.

NEW MEXICO—Continued.

Silver City, Grant County.—The station is in the northwest corner of the grounds of the Normal School of New Mexico, about 1 mile north of the center of the town and about 800 or 900 feet a little north of west of the main Normal School building. It is 228 feet east of the west fence and 156.8 feet south of the north fence. Arrangements were made to have the station marked by a 6 by 6 by 30 inch limestone, lettered in the usual way. The following true bearings were determined:

	°	′	
Episcopal Church spire (mark)	55	20.9	east of south
Northern rod on iron railing on court-house cupola	33	24.2	east of south
Cross on Catholic Church cupola	45	20.7	east of south
West point at top of roof of a Catholic institution	46	56.4	east of south

Torrance, Torrance County.—The station is on a block to be reserved for a park, just to the northwest of the block containing the general store and post-office. It is about 600 feet northwest of the general store and about 165 feet southeast of the small shack where the powder of the store is kept. There are no permanent objects near enough for tape-line measurements. The station is marked by a stake about 4 inches in diameter, showing 3 inches above ground, with a hole about three-fourths inch deep in the top to mark the exact spot. The following true bearings were determined:

	°	′	
Base of rod on water tank of Rock Island Railroad	5	40.9	west of south
Northeast corner at top of roof of Rock Island Railroad station	56	17.2	east of south
Northwestern point at top of roof of general store	47	38.6	east of south

Tucumcari, Guadalupe County.—Observations were made over the stake marking the southwest corner of block 30, which is about one-fourth mile southwest of the County Court-house. The stake is 3 by 3½ inches and shows 1 inch above ground. It may be found by reference to the town map. The following true bearings were determined:

	°	′	
Base of flagstaff on cupola of public school (mark)	67	32.6	east of north
Baptist Church spire	46	36.8	east of north
Rock Island Railroad water tank	16	07.6	east of north

NEW YORK.

Albany, Albany County—Station A.—The station of 1896 was reoccupied. It is on the grounds of the old Dudley Observatory, now Dudley Park, and owned by the city. It is 209 feet south and 70 feet west of the center of the West Transit pier of the Observatory. The station is marked by a marble post 24 by 4 by 4 inches sunk flush with the surface of the ground. The old observatory has been partially destroyed by fire, but the walls are still standing and the building will probably be repaired. The following true bearings were determined:

	°	′	
St. Joseph's Church spire (mark)	4	19.8	west of south
Flag pole on Capitol	23	00.9	west of south
Flag pole on Capitol	22	55.5	west of south
Church spire across river, just visible to left of tree near station	28	36.7	east of south

Albany, Albany County—Station B.—The station is on a hill west of the Loudonville road, about 1 mile north of station A. It is on land of the Van Renssalaer estate, in a field in front of a farm-house occupied by Mr. Van Wely. It is also 8 feet from the base of a white marble post, 8 by 8 inches, projecting 3 feet above the ground, in the direction of the west tower of the State Capitol. This post marks a point on the Albany city line. The station is 95 feet west from a fence and farm road. The following true bearings were determined:

	°	′	
West tower of Capitol, apex (mark)	12	09.8	west of south
Tower of City Hall	6	20.9	west of south
St. Joseph's Church spire	0	39.7	west of south

Descriptions of stations—Continued.

NEW YORK—Continued.

Antwerp, Jefferson County.—The station is in a pasture belonging to Mr. George McAllaster, on the south side of the Rockwell Creek road, southeast of the village. A ridge of rock runs thru this pasture and the station is 130 yards due east from the highest point of this ridge and in range with it and the Beaumart cheese factory. From the station south to a fence corner is 83 yards; northwest to a maple tree just beyond the ridge of rock is 83 yards; northwest to the road is 110 yards. The station is on a low outcropping of the bed rock and is marked by a 1½-inch hole drilled in the granite. The letters U. S. are chiseled beside the hole. The following true bearings were determined:

	° ′	
Crucifix on Catholic Church (mark)	49 10.6	west of north
Monument to M. Augsbury in cemetery	17 34.0	west of north
East gable of farmhouse	85 44.0	east of north
Cupola on Antwerp High School building	65 52.8	west of north

Beaver River, Herkimer County.—The station is about 600 feet southwest of the railroad tank and not far from the edge of a pond. It is 30 feet south of the edge of a cultivated field. Lines from the station to the south gable of Mr. B. B. Bullock's house and to the end of the ridge of earth where the railroad Y terminates make right angles. The station is marked by a marble post 6 by 6 by 30 inches, lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′	
South gable of Mr. B. B. Bullock's house (mark)	46 57.7	west of north
Center of cover on railroad water tank	58 44.8	west of north

Belmont, Allegany County. –The station is on a lot used as a baseball ground back of Mr. M. E. Horner's residence. It is 171 feet from a board fence a little north of west and 138 feet from a thick row of willow trees, south-southeast. The station is marked by a brass screw head in the center of the top of a section of drain pipe filled with cement. The top is just below the level of the ground. The following true bearings were determined:

	° ′	
Southwest corner of Belmont Hotel (mark)	12 04.3	west of north
Southeast corner of brick school building (top of first-story window)	79 29.3	west of south
Southeast corner of main part of M. E. Horner's house	7 52.6	east of north

Big Indian, Ulster County.—The station is an apple orchard belonging to Mr. Joseph Cruickshank, about 1 mile southwest of the town. It is between the third and fourth rows of apple trees parallel to the road and the sixth and seventh rows at right angles. It is 12.3, 29.6, and 16.1 feet, respectively, from young apple trees at the southwest, southeast, and northwest corners of this square. It is also 92.9, 84.4, and 61.9 feet, respectively, from a 12-inch apple tree, bearing 8° 35′ west of true south; a 24-inch double apple tree, bearing 67° 25′ west of true north, and an 18-inch apple tree, bearing 19° 25′ east of true north. The station is marked with a chestnut post 36 by 5 by 5 inches, set 29 inches in the ground. An iron pipe projecting 20 inches out of the ground was set 188.9 feet due north of the magnetic station. The following true bearings were determined:

	° ′	
East gable Jewish Working Girls' Home	20 43.6	west of north
South gable Mr. Cruickshank's farmhouse	21 41.1	east of north
South corner of foundation of spring house across the road	72 42.1	east of south

Bronx Park, New York County.—The station is in the New York Botanical Gardens, east of and across the Bronx River from the Botanical Museum. It is in a meadow, about 270 feet southwest of a stone hut. A cross is chiseled on the vertical face of a low ledge of stone 81.2 feet distant and bears 71° 44′.1 east of north from the station. Another cross is chiseled on a stone 100.6 feet distant and bears 51° 33′.0 west of north. The following true bearings were determined:

	° ′	
Cross mark chiseled on stone in southwest corner of stone hut	33 09.9	east of north
Iron pin (⅛ by 2 inches) set in old drill hole in rock ledge	1 05.3	west of north

Descriptions of stations—Continued.

NEW YORK—Continued.

Delhi, Delaware County.—The station of June, 1905, was reoccupied. It is on the County Farm, 2 miles southwest of the village, on the hillside southwest of the dwellings. It is about 63 yards southwest of the nearest corner of the smaller dwelling house; about 100 yards southeast of the nearest corner of the barn. The station is marked by a marble post 5 by 8 by 24 inches, the top about 3 inches above the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined in June, 1905:

	° ′	
Northwest gable of E. B. Sheldon's house (mark)	30 01.5	east of north
West gable of R. B. McFarlane's barn	78 38.3	east of north
East gable of T. D. Middlemist's barn	71 30.5	west of north
Tip of ventilator on farm barn	38 01.5	west of north

Elizabethtown, Essex County.—The station is on the country estate of Mr. L. H. Hyde, southeast of the village. It is on a hill back of the stables and is 49.7 feet from an elm tree and 29.4 feet from a pine tree to the southeast. The station is marked by a marble post 6 by 6 by 28 inches, set with its top 4 inches above ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′	
Top of belfry on Baptist Church (mark)	63 45.9	west of north
East gable of Miss Gilbert's cottage	36 20.4	west of north
Spire of Congregational Church	58 49.7	west of north
Spire of Episcopal Church	68 46.2	west of north

Elmira, Chemung County.—The station is on the first high hill crest, nearly half a mile back from the New York State Reformatory. The hill slopes down sharply about 100 feet from the station. The only pine tree in the edge of the woods between the station and the Reformatory bears 34½° east of north. A tree on the hillside (top only visible) bears 66½° west of north. The station is marked by a marble post 6 by 6 by 24 inches, projecting 3 inches above ground and lettered on top U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′	
St. Patrick's Church spire, Park Place and Clinton street (mark)	39 14.4	east of south
Flag pole on Tower of Elmira College	29 46.8	east of south
Near corner of top of main tower on Reformatory	61 49.7	east of south
Apex of tower of Elmira City Hall	43 44.5	east of south
State Survey Triangulation monument	11 24.5	west of north

Johnstown, Fulton County.—The station is west of the village on a farm owned by Mr. William Potter. It is on a knoll in the pasture several hundred yards northwest of the barn. From the station eastward to the fence and farm road is 250 feet. The station is in line with the fence on the other side of the farm road. A stone fence is 390 feet to the north. It is marked by a marble post 6 by 6 by 28 inches, with its top 3 inches above ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′	
Catholic Church spire (mark)	88 15.8	east of south
Cupola Union School building	84 08.6	east of south
Lutheran Church spire	81 39.4	east of north
Presbyterian Church spire	82 35.4	east of north
Northeast corner Potter's barn	49 01.6	east of south

Lake George, Warren County.—The station is about a mile southeast of the village, across the end of the lake. It is in the pasture in front of Mr. Antoine Merrick's house. From the station west to a large chestnut tree on the east side of the road in front of Mr. Merrick's house is 55 yards; a little west of north to a young hickory tree is 7 feet; southeast to a chestnut tree is 49 feet. The sta-

Descriptions of stations—Continued.

NEW YORK—Continued.

tion is marked by a marble post 6 by 6 by 30 inches, with its top 6 inches above ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′	
Crucifix on Catholic Church (mark)	70 12.3	west of north
Flag pole on top of Prospect Mountain	75 53.0	west of north
North gable of Mr. Kimber's house	70 33.5	west of south

Little Valley, Cattaraugus County.—The station is on the Fair Grounds, inside of the race course; the inner fence along the track is 88 feet a little west of south. A tree is 164.4 feet a little north of west; a maple tree is 85 feet north, and a tree northeast of the maple is 102.2 feet from the station. The station is marked by a cement post 6 by 6 by 30 inches. The following true bearings were determined:

	° ′	
Cupola on court-house (mark)	58 11.2	east of south
Prominent monument in western part of cemetery	15 44.8	east of south
East gable on Mr. Charles Lincoln's house	69 51.7	west of north

Malone, Franklin County.—The station is on property of the Northern New York School for Deaf-mutes, in a field back of the buildings. It is in range with the power-house stack and the central chimney of the main building of the school. It is about 85 yards from the fence to the south, bounding the land belonging to the institution. It is also 117.3 feet a little west of south from the only tree near the station. The station is marked by a marble post 5½ by 5½ by 28 inches, set 2 inches above the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′	
Catholic Church spire (mark)	62 02.2	west of north
Baptist Church spire	58 40.3	west of north
Methodist Church spire	54 59.0	west of north
Northeast corner of main building of deaf-mute school	20 43.5	west of north

Plattsburg, Clinton County.—The station is on the target grounds of the army post. It is in line with the row of posts marking the 300-yard range and is 165 feet from Post No. 8. From the station northwest to the road along the side of the grounds is 215 feet. From the station northeast to the end of a trench and low embankment is about 50 feet. The station is marked by a marble post 6 by 6 by 30 inches, set flush with the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′	
Flag pole at center of middle tower on Hotel Champlain (mark)	19 28.1	east of south
Gable of house half a mile away	12 55.0	west of north
Spire of St. Peter's Church	8 31.2	west of north
West gable on south end of band quarters	44 20.3	east of north

Saranac Lake, Franklin County.—The station is about 1 mile west of the center of the village, in a pasture lying between the road known as Lake avenue and the golf grounds of the Ampersand Hotel. It is about 300 feet south of this road and is 65 feet north of the fence between the pasture and the golf grounds. From the station southwest to an ash tree is 39.6 feet; a little south of west to a birch tree is 27.3 feet. The station is marked by a marble post 5½ by 5½ by 27 inches, projecting 3 inches above the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′	
Flag pole on tower of Von Dorrien Hotel (mark)	28 22.2	west of north
Center of west dial of clock on Town Hall	68 05.6	east of north
East gable at north end of Ampersand Hotel	56 30.6	west of north

Warsaw, Wyoming County.—The station is on the farm of Mr. A. S. Perkins, on the hillside, three-eighths of a mile southeast of the B. R. & P. station. It is between two roads, about 90 feet from each and 250 feet from their conjunction to the east. From the station to an apple tree is 6.3 feet, a little west of north; to a maple tree near the road to the north is 78.9 feet; to an apple tree

Descriptions of stations—Continued.

NEW YORK—Continued.

northeast is 44.3 feet, and to an oak tree southwest is 129.4 feet. The station is marked by a marble post 5 by 5 by 24 inches, projecting 4 inches above the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′	
German Evangelical Church spire (mark)	83 47.2	west of south
Southeast corner of Union Academy	69 05.1	west of south
Catholic Church spire	78 38.9	west of north
East gable of house near top of hills to west	72 36.3	west of north

NORTH DAKOTA.

Bottineau, Bottineau County.—The station is on the grounds of the Racing Association, inside of the race track, at a point very near the center of the semicircular turn at the south end. The distances to the sides (measured by pacing) are as follows: To the rail, south, 69 paces; to the rail, east, 72 paces; to the rail, west, 70 paces. It is about 80 paces northwesterly to the judges' stand. The station is marked by a cement block 6 by 10 by 24 inches, set nearly flush with the ground. The following true bearings were determined:

	° ′	
Flag pole on schoolhouse (mark)	13 12.5	west of south
Flag pole on court-house	37 31.3	west of south
Tip of barn cupola	80 25.0	east of south
Middle cupola on large barn (5 miles north)	5 08.5	west of north

Cando, Towner County.—The station is within the race track on the fair grounds, about three-fourths of a mile northeast of the business center of the town. It is directly back of the judges' stand, very nearly in the line of the wire and about 125 feet from the rail. The precise point is the drill hole in the top of a Kasota limestone post, set flush with the top of the ground and lettered U. S. C. & G. S., 1906. (Stone is 5 by 6 by 20 inches.) The following true bearings were determined:

	° ′	
Court-house flag pole (mark)	73 49.6	west of south
Schoolhouse cupola	56 53.0	west of south
Church spire	27 01.2	west of south
House 2 miles off, west gable	74 02.6	east of south

Carrington, Foster County.—The station is in the ball grounds, in right field, 51.2 feet north of second base, 70 feet west of first base, 197.9 feet west of the northwest corner of the grand stand, and 125.9 feet southwest of the southwest corner of a shed. It is marked by a sandstone post 6 by 8 by 20 inches, set flush with the surface of the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′	
West gable of barn (mark)	7 00.9	west of south
East gable of creamery	6 45.0	west of north
Flag pole on Kirkwood Hotel	72 52.6	east of north
Church spire	84 47.3	east of north

Ellendale, Dickey County.—The station is on the grounds of the State Normal Training School. It is 270.5 feet southeast from the southeast corner of Science Hall and 74 paces from the north and south fence marking the eastern boundary of the grounds. The station is marked by a sandstone post 8 by 10 by 20 inches, set nearly flush with the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′	
Spire of Baptist Church (mark)	82 38.0	west of north
Public school tower	46 26.0	west of north
Northeast corner of Carnegie Hall	18 01.9	west of north

Descriptions of stations—Continued.

NORTH DAKOTA—Continued.

Fargo, Cass County.—The station is in the Fargo Cemetery, on the edge of the river basin, 215 feet north by east of the northwest corner of the pump house, 63.2 feet south of the Morris monument, 8.8 feet south of the corner of lot 15 and 9.0 feet from the south corner of lot 16. The station is marked by a sandstone post 8 by 8 by 20 inches, the top set flush with the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′	
High School tower (mark)	16 59.2	west of north
Spire on Fargo College	10 47.9	west of north
Chimney on farmhouse, south edge	59 35.1	west of south
Pole on barn	27 26.6	west of south

Grand Forks, Grand Forks County.—The station is in the grounds of the State University, near the southwest corner of the inclosed campus, 41.3 feet east of the west fence and 284.9 feet north of the center of the Great Northern track. It is 17.4 feet southeast of a cottonwood, 20.9 feet south of an elm, and 23.5 feet west of a second elm, all small trees. The station is marked by a sandstone post 6 by 8 by 24 inches, the top set flush with the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′	
Northwest corner of Mr. Richard's house (mark)	24 01.6	west of south
South gable of district schoolhouse	82 19.8	west of north
Southwest corner of base of power-house chimney	50 59.3	east of north
Southeast corner of south tower of main building	74 49.3	east of north

Hope, Steele County.—The station is on the grounds of the public school, near the northeast corner, 166 feet from the northeast corner of the school building. It is 14 feet from the edge of the race track as at present graded, 20 feet south of the inside sidewalk line on Main street. The station is marked by a sandstone post, 7 by 9 by 20 inches. The top is set flush with the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′	
Methodist Church spire (mark)	75 05.4	west of south
Congregational Church spire	63 49.5	west of north
North edge of chimney on Courron's house	87 43.2	east of south

Lakota, Nelson County.—The station is in the southwest corner of the court-house grounds, 90 feet east of the center of Fourth street, 50 feet south of the center of Steven avenue, 129 feet from the nearest corner of the court-house—a wooden building—and 14.5 feet southwest of the north stone of a meridian line established by the U. S. Geological Survey. The station is marked by a sandstone post 6 by 8 by 24 inches, set flush with the surface of the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′	
West edge of flagstaff on schoolhouse (mark)	40 06.3	east of north
Episcopal Church spire	4 46.2	east of north
Pole on fire-bell tower	65 09.4	east of south

Langdon, Cavalier County.—The station is within the race track of the Langdon Driving Association. It is on a straight line from the judges' stand to the southwest corner of the inclosure, about 330 feet from the stand and 60 feet from the inner rail of the race track and 285 feet from the southwest corner of the inclosure, all in said line. It is also about 215 feet from the main entrance and 55 feet from the inner rail, measured due west. The station is marked by a red sandstone post, 6 by 8 by 26 inches, projecting 3 inches above the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′	
Flag pole of Masonic Temple	1 03.6	east of south
East edge of chimney on Barney Caton's house	15 40.6	east of north
Flag pole on court-house	14 21.2	east of south
West edge of cross on Catholic Church spire	9 17.8	east of south

Descriptions of stations—Continued.

NORTH DAKOTA—Continued.

Minot, Ward County.—The station is on the Fair and Racing Association grounds inside of the race track near the quarter-mile post. It is 35 feet from the inner rail, 45.0 feet from the quarter-mile post, and is in line with the flag pole on the judges' stand and the most southerly flag pole on the grand stand. It is marked by a solid red cement block, about 7 by 10 by 24 inches, projecting 3 inches above the surface. The following true bearings were determined:

	° ′	
Chimney on white house 3 miles away (mark)	18 41.6	west of south
Flag pole on judges' stand	40 33.3	west of south
Northwest corner of inclosure	65 13.6	west of north
North edge of elevator at Surrey (8 miles)	77 36.1	east of north

Mohall, Ward County.—The station is at the school ground on the north side of the village, just beyond a strip of ground used as a pasture and owned by M. O. Hall. It is on the north edge of the drive leading to the school building, and opposite the end of the eighth row of trees (seedlings) counting from the street. The station is marked by a stone post 5 by 6 by 20 inches set 1 inch above the surface and marked U. S. C. & G. S. This point is 143.4 feet southwesterly from the nearest corner of the schoolhouse, and 42.7 feet north of a wire fence which marks the boundary of the school grounds. The following true bearings were determined:

	° ′	
Base of flag pole on the white elevator, No. 1 (mark)	1 26.4	east of south
Junction of molding in gable of Doherty's house	89 44.6	west of north
Nearest corner of schoolhouse	77 00.3	east of north
Spire Congregational Church	52 09.9	east of south

Pembina, Pembina County.—Observations were made as near the station of 1896 as could be determined from the changed surroundings and indefinite description. The new station is about 700 feet southward from the junction of the Pembina and Red rivers, on land held by the city and now used as a baseball park. It is 536 feet from the west side of the county road and 73 feet from the board fence inclosing the park, measured in prolongation of the line perpendicular to the county road. From a point 6 feet west of the station a flag pole and the Catholic Church spire appear in line. The station is marked by a cement block 6 by 10 by 24 inches sunk flush with the ground and marked U. S. 1905. The following true bearings were determined:

	° ′	
Icelandic Lutheran Church spire (mark)	41 53.8	west of south
Catholic Church spire	9 56.0	west of north
East dormer gable Oliver's house	70 26.1	west of south

Rolla, Rolette County.—The station is in a public street near some low-lying land not likely to be used for residences, and now used as meadow or pasture. It is reached by going five blocks northeast of the Great Northern depot, or four blocks from the Taylor House along Main street and one block to the right (southeast). It is 8 feet from the stake that marks the eastern corner of block 13, measured along the northeast side of the block produced. (Blocks are 300 feet square.) The station is marked by a Kasota limestone post 5 by 6 by 20 inches, lettered U. S. C. & G. S., 1906, and set flush with the surface of the ground. The precise point is marked by a drill hole in the center. The following true bearings were determined:

	° ′	
Tip on ridge of A. O. Graham's house, west end to right of main chimney (mark)	45 54.4	west of south
Schoolhouse cupola, base of rod	86 16.5	west of north
Peak on cupola of distant barn	82 58.8	east of south

Washburn, McLean County.—The station is located on a stony bank of a deep ravine, on the eastern side of the town. It is east of the north-and-south section line bounding the town on the east, about one and one-half blocks southeast from the schoolhouse and one block east of the courthouse square (reserved for new court-house). It is 46 feet to the eastward of the extension of the

Descriptions of stations—Continued.

NORTH DAKOTA—Continued.

south line of the Methodist Episcopal Church; about 15.0 feet to the edge of the ravine toward the east and 50 feet toward the south. Observations were made over a granite bowlder, size unknown. The exposed portion resembles a tetrahedron about 12 to 15 inches on each edge. A cross was chiseled in the top, and the letters U. S. 05 on the east and west faces, respectively. The following true bearings were determined:

	°	′	
Chimney on red house across the river (mark)	22	24.7	west of south
South edge of chimney on Maycumber's farmhouse	71	28.4	east of south
Methodist Episcopal Church spire	28	15.7	west of south
Flag pole on schoolhouse	77	00.2	west of north

OHIO.

Dayton, Montgomery County.—Observations were made as near the station of 1900 as could be determined from the changed surroundings, probably within 2 or 3 feet. The station is in the grounds of the National Soldiers' Home, 103.2 feet from a double ash tree, 155.3 feet from a 12-inch ash tree to the northeast, and 65.4 feet from the middle of West Virginia avenue. It is marked by a marble post 6 by 6 by 21 inches, set flush with the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	°	′	
Memorial Hall tower (mark)	88	18.9	east of north
Cupola on hospital building	56	51.6	east of north
Power-house chimney	79	57.5	east of north
Protestant Chapel steeple	81	35.0	east of north
Standpipe	52	06.7	east of south

OKLAHOMA.

Tecumseh, Pottawatomie Reservation.—The station is about one-quarter of a mile west of the center of town in the town park. It is about 500 feet northwest of the frame schoolhouse in the park, and about 600 feet west of the Rock Island Railroad track. It is 64.9 feet east of the fence bounding the park on the west and 65.5 feet south of the fence bounding the park on the north. The station is marked by a fence rail about 3½ inches in diameter projecting about 1½ feet above the ground. The center of the natural rings of wood marks the exact spot. The following true bearings were determined:

	°	′	
Flagstaff on brick schoolhouse (mark)	63	57.5	west of south
Lightning rod on house in line with brick schoolhouse	63	11.8	west of south
Upper southeast corner (just under roof) of cotton-seed oil factory	42	07.4	east of north

OREGON.

Baker, Baker County.—The station is about 1½ miles northwest of the center of the town, in the northwestern corner of the grounds of the Baker Driving and Fair Association. It is about 600 feet north of the grand stand, 76.7 feet east of the west fence, 116 feet south of the north fence, and 101.2 feet west of the fence along the western outside edge of the race track. The station is marked by a lava post 6 by 6 by 30 inches, showing about 2 inches above ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	°	′	
Spire on tower of High School (mark)	24	29.9	east of south
Flag pole on cupola of Sagamore Hotel	28	49.4	east of south
Ornament at top of clock tower on City Hall	27	39.1	east of south
Steeple of a white church	19	57.5	east of south

Detroit, Marion County.—The station is about 600 feet west of the general store, where the train comes in, and east of a steep bank about 15 or 20 feet high, on the west edge of the clearing. It is in

Descriptions of stations—Continued.

OREGON—Continued.

line with the general store and a burned hollow stump of peculiar shape, about 16 feet high, and is 15 feet east of the stump. It is marked by a cedar post, 30 by 6 by 4½ inches, showing 4 inches above ground, with a cross sawed in the top to mark the exact spot. The following true bearings were determined:

	° ′	
South gable of hotel (mark)	86 24.7	east of south
South gable of post-office	38 41.6	east of south
West gable of schoolhouse	56 00.2	east of south

Elgin, Union County.—The station is about one-half mile south of the center of town, on land owned by the Union Real Estate Company, a short distance north of the baseball grounds and between the entrance to these grounds and two pine trees about 12 feet apart, in line nearly east and west. It is 122.4 feet north of the eastern gatepost of the entrance to the baseball grounds, 40.8 feet southwest of the western of the above pine trees and 50.5 feet southwest of the eastern pine tree. The station is marked by a 6-inch glazed pipe, partly filled with cement, showing about 1 inch above ground, and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′	
Church spire (mark)	3 37.8	east of north
Northeast edge of flour mill, below roof	23 55.5	west of north
Center of shaft pipe at top of old windmill	16 44.6	east of north
West gable of farmhouse, about 1 mile to the east	82 33.4	east of south

Estacada, Clackamas County.—The station is about one-fourth mile north of The Oregon Water Power and Railroad Company's station and about in the center of a street running north and south just west of this station. It is situated where this street is interrupted by a steep bank, and is on the upper edge of this bank. It is 40.6 feet southeast of a stake marked B 20 and L 12, marking the limits of the road, and 41.5 feet southwest of a similar stake marked B 19 and L 1. It is marked by a green glass bottle, buried 3 or 4 inches underground. The following true bearings were determined:

	° ′	
Southwest corner, just under roof of Estacada Hotel	15 34.2	east of south
Northwest point at top of roof of freight station	6 37.5	east of south
North point at top of roof of engine house	4 52.7	east of south

Eugene, Lane County.—The station is in the southwestern corner of the grounds of the State University, near the northwest corner of the football grounds and about 1 mile southeast of the center of town. It is marked by a sandstone post 6 by 6 by 30 inches, showing about 2 inches above ground and lettered U. S. C. & G. S., 1906. A small hole in center of top marks the exact spot. The following true bearings were determined:

	° ′	
Top of cupola on gymnasium (mark)	65 16.1	east of north
Triangulation station at top of Spencer Butte	11 22.8	west of south
Rod on tower on Paterson public school	78 18.8	west of north

Jacksonville, Jackson County.—The station is in the northwestern corner of the grounds surrounding the public school, about one-fourth mile east of the center of town. It is about 200 feet northwest of the station of 1881. It is 52.5 feet south of the fence bounding the school grounds on the north and 87.8 feet east of the fence bounding the school grounds on the west. It is about 195 feet a little north of west from the northwest corner of the school building. It is marked by a cedar stake 4 by 3.5 by 30 inches, showing about 3.5 inches above ground, with a cross sawed in the top to mark the exact spot. The following true bearings were determined:

	° ′	
Peak on eastern upper corner of Table Mountain (mark)	17 50.0	east of north
Point on roof of white tower	44 56.8	west of north
Flagstaff on court-house cupola	65 25.6	west of south

Descriptions of stations—Continued.

OREGON—Continued.

McMinnville, Yamhill County.—The station is in the southwest corner of the grounds of the Baptist College, about 1 mile southwest of the center of the town. It is on the outer southwest edge of the running track and southwest of the grand stand. It is 64 feet north of the fence bounding the college grounds on the south and 59 feet east of the fence bounding the college grounds on the west. It is marked by a glazed earthen pipe 6 inches in diameter, partly filled with cement, showing about 3 inches above ground. The top of the cement is lettered in the usual way, and a cross marks the exact spot. The following true bearings were determined:

	° ′	
North edge of the dome on observatory (mark)	82 34.2	east of north
Cupola on college building	65 05.6	east of north
Top of the vertical shaft on college windmill	72 01.0	east of north

Pendleton, Umatilla County.—The station is about one-fourth of a mile southeast of the center of the town, in the grounds surrounding the High School, southeast of the main brick building. It is 37.9 feet from a wooden fence to the south, 47.1 feet from a wooden fence to the east, and 204 feet southeast of the southeast corner of the main High School building. The station is marked by a lava post 5 by 8 by 24 inches, set flush with the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′	
Christian Church spire (mark)	28 13.2	west of north
Methodist Church spire	19 45.8	west of north
Baptist (?) Church spire	12 25.6	west of north
Flagstaff on large central cupola of court-house	11 25.5	west of north

Portland, Multnomah County.—The station of 1900 was recovered, but as the azimuth marks are not now visible from this point, observations were taken at a new station 4 feet to the north (magnetic) of the old one. The station of 1900 is on the hill near the northwest corner of City Park, on the highest ground, within the loop which terminates the driveway. It is marked by a sandstone post, 6 inches square on top, the pyramidal top projecting above the surface. The following true bearings were taken:

	° ′	
Central tower of Marquham Building	77 09.4	east of south
Court-house dome	68 30.2	east of south

Sumpter, Baker County.—The station is about three-fourths of a mile west of the center of the town, on Government land, in the old Ellis placer claim. It is 52.3 feet southwest from a stake marked G. W. 6—399 and 212 feet southeast of a stake marked G. W. 6—397. These two stakes are on record. The station is marked by an 8-inch glazed pipe partly filled with cement and showing about 1 inch above ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′	
Presbyterian Church spire (mark)	47 29.8	east of south
Flag pole on cupola of schoolhouse	50 40.4	east of south
Methodist Church steeple	65 06.0	east of south
West gable of hospital	51 18.0	east of south

Union, Union County.—The station is on the State Experimental Farm about three-fourths of a mile west of the City Hall. It is in a pasture a short distance west of the first fence west of the brick experimental station and is about one-fourth of a mile north of the farm barn. It is 58 feet from a fence to the west along an irrigation ditch, 65.5 feet from a fence to the east, and 247 feet from a fence along a road to the south. The station is marked by an oak post 4 by 5 by 30 inches, showing about 3 inches above ground. The following true bearings were determined:

	° ′	
Christian Church spire (mark)	86 55.4	east of south
Cross on Catholic Church	86 43.5	east of south
City Hall cupola	87 57.4	east of south
Northern cupola on Experimental Farm barn	5 06.2	east of south

Descriptions of stations—Continued.

OREGON—Continued.

Yaquina, Lincoln County.—The station of 1888 was reoccupied as nearly as could be determined. It is on the bluff above and north of the town near a white church with a bell tower on the west end. It is 66.9 feet due south of the cement base marking the site of the astronomical station of 1888 and 108 feet from the southwest corner of the church. The station is marked by a hard-wood post about 4 inches in diameter, set flush with the ground. The following true bearings were determined:

	° ′	
Cupola at Newport (mark)	55 12.9	west of north
Steeple of small wooden church	54 54.1	west of north
White water tower with brown roof	59 01.4	west of north

PENNSYLVANIA.

Doylestown, Bucks County.—The station of 1902 was reoccupied. It is on the grounds of the National Farm School for Jewish Boys, about 1½ miles west of the court-house. It is about in the line of memorial elms planted on the west side of the institution road from the public highway, about 190 feet from the center line of the public road and 18½ feet west of the center line of the institution road. It is also 8.9 feet, 37.7 feet, 49.9 feet, and 31.7 feet, respectively, from elm trees planted in memory of Mrs. J. Miller, Alex. Reinstine, Milton Mayers, and F. Greenburg. The station is marked by a marble post, 6 by 6 by 30 inches, projecting 6 inches above the ground and lettered U. S. C. & G. S., 1902. The following true bearings were determined in 1902:

	° ′	
Gable on southeast side of large barn (mark)	33 15.6	west of north
East gable on S. Bakshorn's house	87 46.2	west of north
West gable, Slater house	10 22.0	east of north

In 1905 an iron pipe was set 386.0 feet due south of the magnetic station to mark the true meridian. It projects about 17 inches above ground.

Philadelphia, Philadelphia County.—The station of 1895, in the grounds of the Philadelphia Hospital for the Insane, was recovered, but owing to the nearness of a sun pavilion containing a large amount of structural iron work, it was thought best to occupy a station somewhat farther removed from this building. A new station was accordingly selected, 40.9 feet from the station of 1895. It is 91.3 feet from the northwest corner of the pavilion foundation. It is 43 feet, 62.3 feet, and 121.9 feet, respectively, from a 40-inch locust tree, a 12-inch wild cherry tree, and a 36-inch pine tree. The station is marked by a 1 by 1½ by 15 inch oak stake. The following true bearings were determined:

	° ′	
Reform Episcopal Church spire (mark)	13 34.8	east of south
Rod on north chimney of Fisher ward	89 34.1	west of south
Northwest edge of washhouse chimney	12 13.8	east of south

PORTO RICO.

Obispo Cayo.—The station of 1903–1905 was reoccupied. It is on the northeast shore of Obispo Cayo, about 10 paces from the water and 12 feet from high-water mark. It is about the middle of an opening in the mangroves, which extend for about 60 feet along the beach. All the horizon from Cape San Juan Light-house to Palominos Island is visible from the station. The station is marked by an oak stake driven flush with the ground and covered with sand. The following true bearings were determined:

	° ′	
Cape San Juan Light-house (mark)	1 47.0	east of north
Hydrographic signal Nob	50 02.0	east of north
Hydrographic signal Palominos	81 59.0	east of north

Porto Rico Magnetic Observatory, Vieques Island.—In connection with the establishment of a temporary magnetic observatory at Fort Isabel, a station for absolute observations was established on the hill east of the fort, about half way up.

Descriptions of stations—Continued

PORTO RICO—Continued.

Salinas.—This station is situated on Salinas Point, on the western end of the westernmost of the Ratones Islands, at the entrance of Jobos Harbor. The station is on a bank of blackened coral, directly inshore from the north end of the reef. It is 6 feet west of a dead tree, 13 feet east from the shore line, and 62 feet south-southwest from the largest tree in this end of the island. The station is marked by an oak stake 2 by 1 inches with three copper tacks in the top. To prevent its being pulled up a piece of coral is placed on the stake. The following true bearings were determined:

	°	′	
Muertos Island Light-house (mark)	78	40.7	west of south
Hydrographic signal Rock	75	38.7	west of south
Sugar mill stack High	66	37.3	west of north
Hydrographic signal Mat	29	36.7	east of north

Water Key, Vieques Island.—This station is situated near the northern extremity of Water Key, south of Port Real, Vieques Island. It is situated on a sandy beach and is surrounded on all sides by low bushes. It is 78 feet south by west from the north point of the island, 25 feet from the western shore of the island, and 45 feet north of a twisted clump of trees. The station is marked by an oak stake driven flush with the ground. The following true bearings were determined from the Hydrographic sheet:

	°	′	
Triangulation station Playa Grande (mark)	84	41.0	west of north
Triangulation station Esperanza	2	53.0	east of north
Triangulation station Campo Silo	60	34.0	east of north

SOUTH CAROLINA.

Camden, Kershaw County.—The station is in the park adjacent to the school grounds. It is 55.1 feet from a large white oak tree 2 feet in diameter, 107.3 feet from a pine tree 2 feet in diameter to the northeast, and 48 feet from a similar pine tree to the northwest. The station is marked by a lead pipe 1 inch in diameter, driven flush with the ground. The following true bearings were determined:

	°	′	
Schoolhouse cupola (mark)	84	19.2	east of north
West gable of McClain's barn	7	47.6	east of south
The Dickson monument	58	30.9	west of north

Columbia, Richland County.—The station is the south stone of a meridian line established by the U. S. Geological Survey in 1900. It is on the golf links east of the brick wall inclosing the buildings of the South Carolina College and just across the road from the southeast corner of the brick wall. The north stone is on the northern margin of the tennis courts.

Lancaster, Lancaster County.—The station is on the grounds of the public school, east of the building. It is 85.2 feet from the northeast corner and 93.0 feet from the southeast corner of the school building, and 9.0 feet from the top of the embankment marking the eastern boundary of the grounds. The station is marked with a marble slab 5 by 2½ by 30 inches, lettered U. S. The following true bearings were determined:

	°	′	
Presbyterian Church spire (mark)	4	28.2	east of south
Lightning rod on T. Carter's house	85	51.7	west of north
Baptist Church spire	72	14.8	east of south
West lightning rod on court-house	73	09.5	east of north

Yorkville, York County.—The station is on the public school grounds, a little west of south of the building. It is 143.0 feet from the southwest corner and 137.0 feet from the southeast corner of the building, and 98.4 feet from a large white oak 30 inches in diameter to the east. The station is

Descriptions of stations—Continued.

SOUTH CAROLINA—Continued.

marked by a sandstone post, lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	°	′	
Presbyterian Church spire (mark)	19	59.7	west of north
West side of brick chimney of cabin	43	47.4	west of south
Southeast corner of schoolhouse	36	55.4	east of north
North side of smokestack of factory	85	58.8	west of south

SOUTH DAKOTA.

Bellefourche, Butte County.—The station is in the meridian line established by the U. S. Geological Survey, about 100 feet south from the north monument. The south meridian monument is in the yard of the court-house, near the south fence along the street and about 30 feet from the east fence. The north monument is on the highest point across the Bellefouche River and about 20 rods back rom the bank. The magnetic station is marked by a sandstone post 9 by 9 by 27 inches, lettered U. S. C. & G. S., 1905, and set 6 inches above the ground. The following true bearings were determined:

	°	′	
Chimney on farmhouse	69	57.6	east of south
Pole on one-story brick schoolhouse	13	44.3	east of south
Tip on water tank	2	52.5	west of south

Chamberlain, Brule County.—The station is on the right bank of the Missouri River, on grounds belonging to the Chamberlain Indian School. It is on a point lying between the river bank and a deep ravine crossing the grounds in front of the main buildings. It is 45 feet from the river bank, 55 feet from the bank of the ravine, and 65 feet from their intersection. It is also 274.0 feet from the nearest corner of the school building. The station is marked by a sandstone post 8 by 10 by 20 inches and lettered U. S. C. & G. S. The following true bearings were determined:

	°	′	
Catholic Church spire (mark)	16	06.4	west of south
Rural school, west side of river	2	52.3	west of north
West side of chimney, house on bluff	5	10.2	west of south
Flag pole Chamberlain public school	10	26.1	west of south

Eureka, McPherson County.—The station is on a high stony knoll at the northwest corner of the village, in the intersection of the two bounding streets, First avenue on the north and Fourth street on the west. It is 13.9 feet southeast from the oak corner stake marking the outside intersection of above-named streets, measuring 9 feet to the south and about 10 feet to the east from said oak corner post. The station is marked by a sandstone post 8 by 10 by 20 inches, set flush with the ground, and lettered U. S. C. & G. S. 1905. The following true bearings were determined:

	°	′	
Congregational Church spire (mark)	0	56.2	west of south
Northeast cornice on large farmhouse	80	13.7	west of south
Chimney on house on prairie	3	31.4	west of north
German Lutheran Church spire	67	15.3	east of south

Hot Springs, Fall River County.—The station is on the grounds of the Government Sanitarium for Soldiers and Sailors, east of the group of buildings, and on a narrow ridge extending toward the mountain. From the station the northwest corner of the east side schoolhouse is seen in line with the southeast corner of the west side schoolhouse. The tower of Hungerford cottage, on the cliff, west bank of brook, is seen immediately above the southeast corner of the city hall. The station is marked

Descriptions of stations—Continued.

SOUTH DAKOTA—Continued.

by a sandstone monument 12 by 12 by 36 inches, projecting 12 inches above the ground and lettered on top U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′	
Cupola on Hungerford cottage, on cliff (mark)	18 14.6	west of south
Flag pole west side schoolhouse	41 09.0	west of south
Tip on court-house cupola	78 11.9	west of north

Rapid City, Pennington County.—The station is on the grounds of the State School of Mines, near the southeast corner of the tract. It is 267.5 feet from the nearest corner of the metallurgical building and 260.3 feet from the nearest corner of the heating plant. The station is marked by a sandstone post 9 by 9 by 27 inches, set 4 inches above the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′	
Tower on abandoned college building (mark)	11 55.7	west of north
Woods monument in old cemetery	88 39.8	east of south
North edge of brick flue (at top), chlorination plant	29 53.3	east of south
East gable of brick hotel (now used for dormitory for school of mines)	53 55.6	west of north

Yankton, Yankton County.—The station of 1896 was not available and a new station was established on the grounds of Yankton College, on what is known as Observatory Hill. A young elm tree is 46.1 feet to the southeast and lies in a line with the station and the center of the observatory dome. The southeast corner of the observatory is 205.1 feet from the station and the northeast corner of Science Hall is seen immediately over the southwest corner of the new library. The station is marked by a limestone post 6 by 6 by 30 inches, lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′	
Pinnacle on southeast corner of tower below dome of new court-house (mark)	25 27.1	west of south
Flag pole on old court-house	7 10.8	west of south
Ball on spire southwest corner of main college hall	5 08.0	east of north

TENNESSEE.

Brownsville, Haywood County.—The station is in the Oakwood Cemetery, southwest of the town. It is in the northeast corner of the cemetery, not far from the main entrance. It is 72.4 feet from the eastern fence, 46.2 feet from the R. W. Dawson monument, 52.2 feet from the main driveway, 41.3 feet from a row of sugar maples about 2 inches in diameter, along the east margin of driveway, and 127.2 feet from the T. S. Anthony monument. The station is marked by a limestone post 6 by 7 by 24 inches, a cross marking the exact spot. The following true bearings were determined:

	° ′	
Baptist Church spire (mark)	43 43.6	east of north
Lower southeast corner Catherine P. Fader monument	34 53.0	west of south
Cupola public school	9 24.5	east of north

Charlotte, Dickson County.—The station is in the northwest corner of the grounds surrounding the county court-house. It is 55.5 feet northwest from the northwest corner of the court-house, 29.9 feet from the north fence, and 28.3 feet from the west fence. The station is marked by an oak stake driven flush with the ground, a tack marking the exact spot. The following true bearings were determined:

	° ′	
Spire Cumberland Presbyterian Church (mark)	38 48.7	east of south
Upper southwest corner of same	36 53.0	east of south
Southeast corner of bank	52 18.0	west of south
Vane on court-house	66 48.6	east of south

Descriptions of stations—Continued.

TENNESSEE—Continued.

Cookeville, Putnam County.—The station is approximately in the center of the cemetery. It is 35.9 feet from the northeast corner of the Lewis family lot, 32.2 feet from the southeast corner of the same, and 24.2 feet from a thicket of white-oak saplings. The station is marked by a marble post 6 by 5 by 20 inches, sunk flush with the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′	
Court-house (mark)	79 05.3	east of north
North gable of R. O. Gentry's house	27 47.4	west of south
Martin monument	83 17.5	west of north
Arnold monument	4 23.0	west of north

Huntingdon, Carroll County.—The station is on the front campus of the Southern Normal University. It is 219.6 feet from the southeast corner of the main building, 187.8 feet from the southwest corner of same, 63.1 feet from the main walk, and 110.9 feet from the southeast corner of the fence surrounding Prof. J. A. Baber's dwelling. The station is marked with an oak stake driven flush with the ground, a tack marking the exact spot. The following true bearings were determined:

	° ′	
Tower on J. B. Sander's house (mark)	52 15.6	east of north
Upper southeast corner of Mr. Norton's house	9 38.0	east of south
Tower on J. A. Baber's house	56 44.6	west of north
Tower on Miss Grizzard's house	52 40.0	west of south
Tower on B. Woodward's house	71 02.1	west of north

Memphis, Shelby County.—The station of 1901 was reoccupied. It is in the southwest corner of the U. S. Marine Hospital grounds, 33 feet from the upper edge of the terrace which marks the south boundary of the grounds, and 52.3 feet from the west fence. The station is marked by a sandstone post 6 by 6 inches on the top, sunk flush with the surface. The following true bearings were determined in 1905:

	° ′	
Marine Hospital flag pole (mark)	82 22.6	east of south
Northern flag pole on park building	13 05.3	east of south
South side of smokestack on factory on Mississippi River	82 04.4	west of north

Nashville, Davidson County.—The station is in the Mount Olivet Cemetery, about 3 miles from the center of the city. It is in the southwestern portion of the laid-out part, 61.0 feet from the monument marked "Wade," 89.7 feet from one marked "Collins," and 96.8 feet from a large white oak tree across the driveway. The station is marked by a Bedford limestone post 5 by 8 by 30 inches, projecting about 6 inches above the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′	
Cupola on Charles Cole's dwelling (mark)	4 46.8	east of south
Dome of Capitol	64 08.4	west of north
Compton Obelisk	76 55.4	east of north
Bart W. Hooper Obelisk	73 44.6	east of south

TEXAS.

Austin, Travis County.—The station of 1901 was reoccupied. It is in the northwest part of the grounds of the State Deaf and Dumb School and is the north end of a meridian line 570 feet long. The south end of this line is about 6 feet from the northwest corner of the laundry building. Both stones are lettered U. S. C. & G. S., the south stone being set flush with the ground. The following true bearings were determined in 1906:

	° ′	
Middle tower on main building of University of Texas (mark)	17 49.4	east of north
Congregational Church spire	19 44.8	east of north
Cross over entrance to St. Mary's Academy	33 28.9	east of north
East spire main building Deaf and Dumb School	17 04.6	east of south
South meridian (mark)	0 01.4	east of south

Descriptions of stations—Continued.

TEXAS—Continued.

Alpine, Brewster County.—Observations were made in the open country a short distance east of a small house owned by John Martin and about 700 feet south of the Southern Pacific Railroad. The station is not marked.

Beeville, Beeville County.—The station of 1890 was reoccupied. It is in the northeast corner of the court-house grounds, 68 feet from the north fence and 49 feet from the east fence. The station is marked by a 6-inch sewer tile, the flange down, and filled with concrete made of fine sand and cement. A copper nail, head down and point projecting, marks the station. The tile projects about 5 inches above the ground. The following true bearings were determined:

	°	′	
South rod on Lindell Hotel (mark)	87	46.2	west of north
Southeast edge of Lindell Hotel addition	82	45.4	west of south
Spire on brick store of Smith & Co.	58	46.5	west of north
Spire on brick store of W. S. Brown & Co	33	26.3	east of north

A meridian line has been established by R. W. Fenner, county surveyor, on the west side of the court-house grounds. It was tested and found correct.

Boquillas, Brewster County.—The station is about 200 feet northeast of the general store of Mr. M. A. Ernest, and about 6 or 7 miles north of the Rio Grande River. The town consists of Mr. Ernest's store and three or four Mexican adobe huts. The station is 100.2 feet east from the nearest point of the Geological Survey bench mark of 1903, which is inscribed "2 133 feet," and is near the southeast corner of a small adobe shack used as a kitchen. The station is also 141.5 feet a little to the north of west from the pipe of Mr. Ernest's well. No mark was left. The following true bearings were determined:

	°	′	
Highest point on Roy Peak (mark)	12	15.3	west of north
A projection at the top of Emory Mountains	77	00.9	west of north

Chambliss, Hamilton County.—The station is 3 miles south of the town of Hamilton on the more northern of two prominent knolls, on land owned by J. M. Chambliss. It is near the north brow of the knoll, 200.1 feet north of the triangulation station and in line with the triangulation station and the spire of the public schoolhouse in Hamilton. The triangulation station is marked by a tile and concrete station mark. The magnetic station is marked with a wooden stub with a copper nail in the top. The following true bearings were determined:

	°	′	
Spire on public school (mark)	2	10.2	west of north
Dome on court-house	1	36.0	east of north
South end of ridge of Mr. Carpenter's house	48	14.3	east of north
Northeast corner of Mr. Chambliss's house	31	46.7	east of south

Corpus Christi, Nueces County.—The station of 1890 being no longer available, a new station was selected about three-fourths of a mile southwest of the court-house, on open ground partly grown up in mesquite, near the southeast corner of block 5. It is 79.0 feet from the southeast corner of Mr. Lovinggood's lot and 84.8 feet from the southwest corner, 10.8 feet west of the east fence line (prolonged south), and about 170 paces from milepost 161 of the Texas and Mexican Railroad. The station is in line between Corpus and Portland triangulation stations and 816.9 feet from the former. The station is marked by a 2 by 3 by 24 inch wooden stub, driven flush with the ground and having a copper nail to mark the center. The following true bearings were determined:

	°	′	
Corpus triangulation station (mark)	34	03.2	west of south
Corpus Christi standpipe, center	19	11.6	east of north
Catholic Church, cross on spire	51	50.6	east of north
Railroad mile pole 161	15	24.6	east of south

Descriptions of stations—Continued.

TEXAS—Continued.

Fort Stockton, Pecos County.—The station is a short distance a little south of west of the northwest corner of the old adobe fort. It is about 108 feet from the northwest corner of the adobe wall surrounding the fort and about 300 feet from the southwest corner. The station is marked by a cedar post about 4 by 36 inches, showing 1 foot above ground, with a cross sawed in the top to mark the exact spot. The following true bearings were determined:

	°	′	
Point at top of cupola on jail (mark)	12	51.0	west of south
Northeast corner at top of court-house tower	17	15.4	west of south
Top of monument to Barney K. Riggs, in cemetery	14	31.2	west of north

Fronton, Cameron County.—Fronton triangulation station is in the town of Point Isabel, on the same ridge with and about 100 yards north of the light-house. It is in the yard of Mrs. Wren, 10.9 feet from the southwest corner of the porch and 21.6 feet from the southwest corner of the yard fence. It is marked by a tile and concrete station mark. The magnetic station is at the foot of slope of ridge 131.7 feet east of the triangulation station and about 17 paces from the shore line, in open ground having some small mesquite bushes and cactus. The station is marked by a wooden stub 2 by 2 by 24 inches with a cross and copper nail in the top. The following true bearings were determined:

	°	′	
Spire on band stand	34	23.7	east of south
West edge of Champion's store	16	02.0	west of south
Spire on light-house	47	42.6	west of south
Ornamental west gable railroad depot	42	14.7	east of south
Fronton triangulation station	86	24.7	west of north

Galveston, Galveston County.—The station is located on the Government Military Reserve, Fort Crockett, in the west end of the city of Galveston. It is about 300 yards northwesterly from the main mortar battery and about 166 feet south-southwesterly from the north fence of the reservation. It is marked by a granite post, about 3 feet long by 6 by 6 inches on top, which is sunk flush with the ground, its upper end marked thus: U. S. C. & G. S., 1905. A hole drilled in the top surface marks the exact spot of the observations. The station is in range with a U. S. Army Engineers' bench mark in the north fence line of the reservation and the northward group of windows on the west side of the Catholic Orphanage, and is 275.8 feet to the southward of the bench mark. This bench mark is below the surface, protected from filling by a barrel, and is in the fence line at the foot of Forty-ninth street. The following true bearings were determined:

	°	′	
Cross on cupola of Catholic Orphanage (mark)	37	16.1	east of north
Triangulation station on Battery Wade Hampton	85	59.9	east of south
White dome, Calvary Cemetery	81	07.8	west of south
Power house chimney, S. P. docks	4	30.4	west of north
Electric Company's water tower	27	38.4	east of north

Jasper, Jasper County.—The station is about one-fourth mile a little north of east of the county court-house, in a field on the south side of the road running west from the Santa Fe Railroad station to the town. The field is situated where the road takes a turn to the south for about 300 feet before taking another turn west into town. The station is also about 400 feet east of the line of a railroad survey which crosses the road at the above corner. It is 78 feet south of the fence bounding this field on the north and 156.8 feet east of the fence bounding the field on the west. The station is marked by an oak stake, 4 by 3 by 30 inches, showing about 6 inches above ground, with a cross sawed in the top to indicate the exact spot. The following true bearings were determined:

	°	′	
Most northern rod to be seen on iron fence at top of court-house tower (mark)	72	48.5	west of south
Eastern gable of white house	77	13.1	west of north
Point at top of cupola on jail	68	16.4	west of south
South point at top of roof on cotton gin	39	26.1	west of north

Descriptions of stations—Continued.

TEXAS—Continued.

Karnes, Karnes County.—The station of 1901 was reoccupied. It is near the northeast corner of the court-house square, 35 feet from the north fence, 25.6 feet from the east fence, and about 123 feet from the court-house. The station is marked by a limestone post 8 inches square on top, projecting 3 or 4 inches above the ground and lettered U. S. C. & G. M. S. M. The south stone of the meridian line is 215.9 feet distant, in the southeast corner of the square. The following true bearings were determined:

	°	′	
East rod on livery barn (mark)	10	18.0	east of south
Drill hole in south meridian mark	00	02.8	east of south
Center spire on court-house	25	02.7	west of south
Spire on public school	64	34.0	east of north
Spire on Methodist Church	68	15.4	east of north
Spire on Baptist Church	70	08.7	east of south

Lampasas, Southwest Base, Burnet County.—The station is 2 miles south of Lampasas, one-third of a mile east of the settlement road and 1 mile west of the Lampasas-Austin road, on land of J. H. Berry. It is on a ridge having no trees, 64.5 feet north of the triangulation station (where magnetic observations were made in 1901), and in line between that station and the spire of the Baptist Church in Lampasas. The triangulation station is marked by a heavy mass of concrete with a bronze cap in the top surface, the whole flush with the surface of the ground. The magnetic station is marked by a copper nail in the top of a wooden stub 2 by 2 inches. The following true bearings were determined:

	°	′	
Baptist Church spire (mark)	10	45.8	west of north
Center of court-house tower	5	37.7	west of north
Bachelor triangulation station	66	09.1	east of south

Marathon, Buchel County.—The new station is within a few feet of the one established by E. D. Preston in 1902. It is 142.8 feet from the southeast corner of the fence surrounding the house on the northwest corner of Avenue D and North Second street, and 231.9 feet from the southwest corner of the public schoolhouse. The station is marked by a cedar post 3½ inches in diameter, showing about 1.2 feet above ground, with a cross sawed in the top. The following true bearings were determined:

	°	′	
Top of oil tank of Southern Pacific Railroad (mark)	63	52.5	west of south
Top of water tank of Southern Pacific Railroad	18	59.2	west of south
Top of tower on pumping station	7	12.7	east of south
Lone pine tree at top of conical hill	48	22.8	east of south

Mission, Comal County.—The station is on Mission hill about 3 miles by road from New Braunfels. It is on the east slope of the hill directly in line between the triangulation station and cross on Catholic Church in New Braunfels. It is about 10 feet lower in elevation and 53.1 feet from the triangulation station, and about 125 feet from the northeast corner of Frank Careth's house. It is marked by a wooden stub 2 by 2 by 12 inches, with a copper nail in the top. The following true bearings were determined:

	°	′	
Catholic Church spire (mark)	70	22.7	east of south
Spire of court-house	71	50.2	east of south
Tip of standpipe	64	20.3	east of south
Northeast corner of Frank Careth's house	9	38.8	east of south

San Diego, Duval County.—The station of 1890 was in the northwest corner of the court-house grounds. Owing to the erection of a brick jail in close proximity, it is no longer suitable for magnetic observations. Observations were made in 1905 at a point 208.0 feet north of the station of 1890 and in the exact prolongation of the line from the cross on the Catholic Church to the 1890 station. The station of 1905 is very near the center of the street bounding the court-house square on the north.

Descriptions of stations—Continued.

TEXAS—Continued.

The north side of the street is fenced, but the south side is still open to the court-house fence. The station is 35.4 feet south of the fence on the north and 63.5 feet east of the west fence, prolonged southward. It is marked by a 3-inch mesquite stake set flush with the ground, with a copper nail in the top. The following true bearings were determined:

	°	′	
Cross on Catholic Church (mark)	31	36.4	west of south
Short spire belfry Mexican Church	38	11.6	west of south
Slim spire on Beeches' store	43	27.2	west of south
Spire on Methodist Church	54	48.6	west of south
Ball on spire of court-house	19	44.6	west of south

Topo, Cameron County.—Topo triangulation station is about 30 miles southeast of Katherine, in the King pasture on the old Topo Ranch, near the old Topo landing on the mainland side of the Laguna Madre. It is on a small island (the most southerly one of the group in this vicinity) connected at the south with the mainland by a narrow strip of sand at low water. The station is 23 feet north of the south shore and 57 paces east of the west shore and is marked by a tile filled with cement projecting about 8 inches above ground and a bottle for a center mark. The magnetic station is 13 paces from the eastern bluff of the island, 10 paces north from the point where neck of land joins the island, and 342.4 feet from the triangulation station. The station is marked by a 2 by 2 by 24 inch stub, flush with the ground, with a copper nail in the top. The following true bearing was determined:

	°	′	
Topo triangulation station	88	01.2	west of south

UTAH.

Green River, Emery County.—The station is on land owned by the Denver and Rio Grande Railroad, about one-fourth of a mile southwest of the center of the town and about 700 feet south of the railroad station. It is about 600 feet southeast of the longitude station of 1898 and south of the Palmer Hotel. It is 348.2 feet south of the southeast corner of the fence surrounding the Palmer Hotel and 389 feet southeast of the southwest corner of the same fence. The station is marked by a redwood post 7 by 5 by 30 inches, projecting 6 inches above the ground. The following true bearings were determined:

	°	′	
Tip of eastern water tank (mark)	89	14.8	east of north
Flagstaff on Palmer Hotel cupola	26	34.6	east of north
Tip of western water tank	5	44.2	east of north

Price, Carbon County.—The station is in the southwest corner of a lot owned by Mr. G. W. Fitzgerald, about 500 feet southeast of the center of the town and about 350 feet north of the Denver and Rio Grande Railroad track. It is 58.8 feet southwest from the southwest corner of the fence surrounding Mr. Fitzgerald's house and 58.9 feet southeast from the southeast corner of the fence surrounding the Weeter lumber yard. The station is marked by an oak stake 4½ by 2 by 30 inches, showing 7 inches above the ground. The following true bearings were determined:

	°	′	
Southern point of roof of jail (mark)	65	10.5	west of south
East edge of ball on flagstaff on bank building	34	51.4	west of north
East point of roof of eastern freight house	85	52.3	west of north
East point of roof of western freight house	77	58.7	west of north

VERMONT.

Burlington, Chittenden County.—The station of 1898 was reoccupied. It is the south stone of the meridian line on the campus of the University of Vermont, in the rear of the buildings. It is

Descriptions of stations—Continued.

VERMONT—Continued.

marked by a granite post. The north stone is 719.3 feet distant and projects about 6 inches above the ground. The following true bearings were determined:

	°	′	
Rod on cupola of college barn (mark)	35	33.7	east of south
Northeast corner of granite base wall of Walker Science Hall	52	15.1	west of north

Hyde Park, Lamoille County.—The station is north of the village, west of the Eden road, and is in a pasture belonging to Mr. Vernon D. Fitch, west of his house and barn. A pine tree 48.5 feet from the station bears 6° west of north. The highest part of a limestone ridge 115 yards away bears 60½° east of south, and to a stone pile a little south of east is 105 feet. Observations were taken over a cross mark chiseled in a low protrusion of white limestone. The uncovered part of this stone is about 18 inches across, only a few inches above ground, and rather flat. The letters U. S. are also cut on the stone. The following true bearings were determined:

	°	′	
Wind-vane rod on Town Hall (mark)	15	14.1	west of south
Second Congregational Church spire	26	47.7	west of south
Catholic Church crucifix	46	37.0	west of south
Cupola on distant barn	6	56.6	west of south

Manchester, Bennington County.—The station is on the hillside southwest of the buildings of the Burr and Burton Seminary. A large elm tree is 170 feet northwest and an ash tree is 170 feet a little east of north. The station is marked by a marble post 6 by 6 by 28 inches, lettered U. S. C. & G. S., 1905, and projecting 6 inches above ground. The following true bearings were determined:

	°	′	
North gable of house three-fourths mile away (mark)	13	37.0	west of south
Cupola of public school in Manchester Center	51	30.9	east of north
Round tower on house near railroad station	62	07.2	east of north
Congregational Church spire	88	08.7	east of south
Northwest corner of seminary	38	47.2	east of north
Southeast corner of seminary	51	34.1	east of north

Middlebury, Addison County.—The station is in a field belonging to the Middlebury College, on the ridge back of the buildings and ball ground. It is marked by a marble post 6 by 6 by 28 inches, lettered U. S. C. & G. S., 1905, set 2 inches above the ground. The following true bearings were determined:

	°	′	
Crucifix on St. Mary's Chapel (mark)	37	58.4	east of north
Southwest corner of Starr Hall dormitory	84	26.0	east of south
East gable of house 1½ miles away	68	51.8	west of north
West gable of E. J. Hunt's house	28	53.5	east of north
Top of college chapel tower	76	17.0	east of north

Rutland, Rutland County.—The station is on land of the city home for the poor, just south of the graveyard. From the station northwest to the southwest corner of the graveyard fence is 47.9 feet; northeast to the southeast fence corner is 72 feet. The station is marked by a white sandstone rock lettered U. S., 1905. The following true bearings were determined:

	°	′	
North gable of barn (mark)	7	06.9	west of south
Highest east gable of City Poor House	58	02.8	west of south
Top of water tower	4	23.7	east of north
West gable of farm house	80	11.3	east of south

St. Albans, Franklin County.—The station is on the hillside, back of Mr. E. C. Smith's house on Congress street, on ground owned by the town. Observations were made over a rounded outcropping stone about 2 feet across. An oak tree is 66 feet from the station and bears 49½° west of true north.

Descriptions of stations—Continued.

VERMONT—Continued.

Mr. Smith's observatory is about 100 yards away and bears 35° west of true south. The station is marked by a lead plug in the stone and the letters U. S., 1905 cut on its face. The following true bearings were determined:

	° ′	
French Catholic Church spire (mark)	72 40.6	west of south
Southeast corner of basement of Mr. Stevenson's house	27 25.7	west of south
Spire of Irish Catholic Church	47 00.7	west of south
Spire of church on northeast corner of public square	59 02.2	west of south

St. Johnsbury, Caledonia County.—The station is in a pasture belonging to the E. and T. Fairbanks Company, on a sand hill south of the village and immediately south of Mr. Stevenson's house and yard. The finial of a small tower on Mr. Fairbanks's house and the spire of St. Aloysius Church are in range with the station. To the corner of the fence around Mr. Stevenson's yard is 145 feet, bearing 8° 51′ east of north. The station is marked by a marble post 5 by 5 by 36 inches, projecting 4 inches above ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′	
St. Aloysius Church spire (mark)	5 00.1	east of north
West gable of house 1½ miles away	26 44.5	east of north
Finial of tower on house across the river	36 04.1	east of north
Cupola of barn 1 mile away	45 51.8	west of north

WASHINGTON.

Blaine, Whatcom County.—The station is just across the line from Blaine, Wash., in British Columbia. It is 1 mile northwest from the Blaine Hotel, on the south edge of an Indian reservation, and about 60 feet northwest of the junction of three roads—Washington avenue, Coast Meridian road, leading into British Columbia, and the beach or shore road leading northwesterly around the shore line of Semiahmoo Bay. The northwest corner of St. Leonard Hotel is 68.4 feet from the station, the iron boundary monument a little east of south is 70.0 feet, the nearest telephone pole south of east from the station is 105.9 feet. The station is 12.2 feet from the nearest alder tree on south bank of a ditch and 24.4 feet from a maple tree across the ditch. The station is marked by a cedar post 42 by 6 by 6 inches, set flush with the ground, having a cross cut in the top and three wire nails driven between. The following true bearings were determined:

	° ′	
Semiahmoo Light-house (mark)	60 28.2	west of south
West gable of J. Milholand's house	34 38.4	east of south
Right edge of right stack of Monarch Mills Company	17 40.5	west of south
Right edge of short stack Alaska Packing Association Fish Cannery on Semiahmoo Spit	39 30.8	west of south

Carson, Stevens County.—The station is west of the Kettle River and about 22 feet west of the edge of the bluff or bench which is just west of the hotel at Carson. The station is about three-quarters of a mile, a little west of north, from Danville post-office, in Washington. It is in the meridian line established in 1901. This meridian line is about one-half mile in length and is marked by an iron post at either end, the south end being on the boundary line. The magnetic station is 210 feet north of the south meridian post. The meridian line and magnetic station are on land belonging to W. H. Collins. The station is marked by a seasoned cedar post 42 inches long, about 5 inches in diameter, projecting 9 or 10 inches above the ground. A tack in the top marks the exact spot.

Colfax, Whitman County.—The station is about one-half mile west of the center of town, on the grounds of the English Collegiate School. It is on a small, level piece of ground on the side of the hill, about 45 feet long by 30 feet wide, about 300 feet southwest of the school building and almost in line with a road running east and west on the south side of the school. It is 46.6 feet from the northwest corner of a yard fenced in for chickens, 40.4 feet south of an apple tree—the fourth from the east

Descriptions of stations—Continued.

WASHINGTON—Continued.

in a row extending east and west a short distance north of the station—and 152.8 feet west of the northwest corner of the sheds on the west side of the barn. The station is marked by a 6-inch glazed pipe, partly filled with cement, set flush with the ground, and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	°	′	
Cross on steeple of Catholic Church (mark)	12	37.5	east of south
Cross on cupola of Catholic Hospital	20	16.1	east of south
Base of flagstaff on court-house	36	43.6	east of north
Cross on spire of Episcopal Church	39	19.3	east of south
Flagstaff on public school	44	07.8	east of south

Depot Creek, Whatcom County.—The station is 9 or 10 miles west of the Skagit River and a little east of Depot Creek. It is 23.7 feet east of boundary monument No. 52 (old number) and 10 feet from a large stump a little south of west. The station is north or east of the edge of the trail and probably on American soil—about 2 or 3 feet south of the line. The station was not marked.

Ellensburg, Kittitas County.—The station is about 150 feet above the level of the city, on the highest point of the ridge on the eastern side of town. It is about 200 feet north of the old upper reservoir and in the prolongation of the street on which the State Normal School building stands. The station is marked by a sandstone monument, set about 30 inches deep, with about 5 inches projecting, and lettered U. S. C. & G. S., 1906, with a cross. It was set over the exact spot marking "Reservoir" station, established by a local surveyor, Mr. Anderson, in his surveys in the Kittitas Valley. This triangulation was connected directly with that of the Geological Survey of 1899. The following true bearings were determined from the above triangulation:

	°	′	
Spire of Mrs. Rowell's house (mark)	45	48.8	west of south
City School, clock tower spire	72	16.6	west of south
State Normal School, spire of lower southeast tower	88	30.1	west of north

Hot Springs, King County.—The station is near the mouth of the little gully opening down into the northwest corner of the upper small park-like plot of ground, just across Green River from the Kloeber Hotel. It is about 450 feet northeast of the hotel, 300 feet east of the "spring house," 1 100 feet north of the railway, and 200 feet from the river. It is best reached by the road which crosses the bridge on the east side of the hotel grounds, and follows down the north side of the river to the garden. The station is marked by a sandstone monument, 6 inches square, set about 30 inches deep with about 7 inches projecting above the level platform of earth, some 10 by 14 feet in size, spaded up for the purpose and extending out from the low sloping side of the mountain. The stone is lettered U. S. C. & G. S., 1906, with a cross. The following true bearings were determined:

	°	′	
Northwest corner of railroad station	13	24.7	west of south
West gable of H. E. Dean's house	21	35.0	west of south
Right tangent to hotel, below eaves	47	15.8	west of south
Right tangent cottage west of power house	56	27.1	west of south

Laurier, Stevens County.—The station is in a pine grove one-quarter of a mile west of the railroad depot near Huckleberry Mountain. It is in a meridian line about 350 yards long, marked at each end by a piece of railroad iron, the south end being on the boundary line. The magnetic station is about 300 feet north of the south meridian post, 36 feet from the center of the road to the west, 21 feet from the south edge of the road to the south and 63 feet northeast of the cross roads center. A wire fence is 81 feet east of the station and the nearest boundary monument is 350 feet or more south-southwest of the station. The house of Frank Rowell is over 600 feet west of the station. There is a large blazed pine tree 15.3 feet a little south of west from the station. The station is marked by a cedar post 4 feet long and 7 inches in diameter, set flush with the ground, with a wire nail in the top. Two auxiliary stakes 2 feet long and 2½ inches in diameter, projecting several inches above the ground, were placed 1.2 feet to the east and west of the post.

Descriptions of stations—Continued.

WASHINGTON—Continued.

Leavenworth, Chelan County.—The station is nearly a mile to the northeast of the railway station and almost on the southern summit of the mound-shaped elevation of about 100 feet just west of "Rattlesnake Hill." It is on land owned by Mr. John Emig, who lives about 30 rods west and south at the foot of the slope. The hill is covered with several hundred large scattering pines and is thickly strewn with bowlders, which were rolled away around the station. The station is marked by a sandstone monument, lettered U. S. C. & G. S., with a cross, and 1906. It is set about 30 inches deep, with about 10 inches projecting. There are two witness trees, each a 2-foot blazed pine, with a triangle of nails. The first bears by compass 55° 30′ west of south, distant 24 feet; the second 58° 25′ east of south, distant 68.6 feet. The following true bearings were determined:

	° ′	
Spire of Congregational Church (mark)	7 31.8	east of south
East gable Mrs. H. A. Anderson's house	4 53.8	east of south
Right tangent to Marion Block	6 06.1	west of south
Cupola of old city water tank	8 03.5	west of south
Left tangent to L. W. Bloom's residence	23 01.9	west of south

Lemolo, Whatcom County.—The station is in the Cascade Mountains near the base of Black Mountain, about 1 mile northeast of Lemolo, Wash., 3 or 4 miles northwest of Silver Lake and 5 or 6 miles south from Cultus Lake. It is on a small clearing belonging to Mr. Funk, 37.6 feet north of the boundary line and about 126 feet from the rail fence along the east side of the road leading from Lemolo northerly to Cultus Lake schoolhouse, where the road terminates. The station is about 300 feet from the Funk house, about 650 feet from the iron post or boundary monument and 61.1 feet from a blazed hemlock tree about 1 foot in diameter south-southeast of the station standing on the east side of the trail leading from Funk's clearing to the next iron boundary post to the east of the station. The station is marked by a cedar post 42 by 5 by 5 inches, projecting 6 inches above the ground and lettered on top U. S. C. B. S. The following true bearings were determined:

	° ′	
Iron boundary post (mark)	87 01.0	west of south
East gable Mr. Funk's house	52 57.4	west of north

Midway, Stevens County.—The station is on the northern edge of Colville Indian Reservation, across Boundary Creek from the place of Mr. Gunderson, a squatter on the reserve. It is on a gravel sand bar, awash at high water (spring freshets) of Boundary Creek. It is 119.3 feet due south of the south monument of the meridian line established in 1901, which also marks the magnetic station of 1901. The north monument of the meridian line is a mile from the station, on the hillside. Both meridian monuments are iron posts. The station was not marked.

North Yakima, Yakima County.—The station is in the center of the southwest quarter of block 245, in Tahoma Cemetery, 3½ miles southwest of the city. The station is 154 feet south and 48 feet east of the large G. A. R. monument. It is marked by a sandstone monument 6 inches square on top and lettered U. S. C. & G. S., 1906; it is set about 3 feet deep, with about 3 inches projecting. The following true bearings were determined:

	° ′	
West edge of sanitarium (mark)	2 09.0	west of north
North cupola Congdon's barn	26 28.9	east of north
Spire, Catholic Church	36 36.9	east of north
Spire of Nachez School	44 37.9	east of north

Olympia (Howard), Douglas County.—The station of 1894 was reoccupied. It is about 400 feet up from the street on a ridge on the land of Mrs. Gilmore, 704 East Bay avenue, and about 300 feet north of the gravel pits. The station is now marked by a sandstone monument 6 by 7 inches, lettered U. S. C. & G. S., 1906, and projecting about 6 inches above ground. It is set in the ground about

Descriptions of stations—Continued.

WASHINGTON—Continued.

30 inches, on top of the triangulation rock beneath and exactly over the drill hole marking the old triangulation station, Howard. The following true bearings were determined in 1894:

	° ′	
Washington School flagstaff	9 58.1	east of south
Lincoln School flagstaff	3 50.4	west of south
Capitol spire	25 20.0	west of south

Osoyoos Lake, Okanogan County.—The station is on the east side of Lake Osoyoos, on the east slope of a sand bluff covered with sagebrush and small cactus. The station is 119.9 feet from the boundary monument to the west, and is just north of the line. It is 75.4 feet from the fence to the north. The station is not marked. The following true bearing was determined:

	° ′	
South gable of Richter's road house	37 55.1	west of north

Pasayten River, Okanogan County.—The station is about 450 feet east of the water's edge of the Pasayten, about the same distance west of the nearest boundary monument, No. 60, and about 1 600 feet or less from monument No. 59 on the west side of the Pasayten. It is 19.4 feet to a 15-inch black pine a little east of south, 57.8 feet to a 20-inch black pine south-southeast, 56.8 feet to the Geological Survey bench mark No. 3853 (an iron pipe 0.3 foot in diameter projecting 1 foot above ground), 46 feet to trail on the line to Geological Survey bench mark 3853, and 66.2 feet to a 16-inch black pine east-northeast. All trees are blazed about 2½ feet above ground and are on the east or south side of trail, except the last one. The station is marked by a 3-inch pine stake projecting 10 inches above the ground. The following true bearings were determined:

	° ′	
Monument No. 59 (mark)	89 58.4	west of north
Black vertical mark on blaze on a 17-inch black pine 350 feet distant	9 31.7	west of south

Pend Oreille River, Stevens County.—The station is 72.4 feet east of south from the boundary monument on the east bank of Pend Oreille River. It is 600 feet or more from the boundary monument on the west bank of the river, about 85 feet from the east bank of the river and about 1 100 feet from Gould's cabin. It is about 95 feet north of a small water course known as Boundary Creek and is about midway between the trail and the river bank. The station is not marked save by tent pegs left in position. The point of observation is known to Mr. Gould and to Packer Adie, of Waneta, British Columbia. The following true bearings were determined:

	° ′	
Boundary monument on west side of river	84 26.2	west of north
North gable of Gould's cabin	23 21.6	east of south

Point Roberts, Whatcom County.—The station is in a small opening or clearing to the west of the road along the top of the bluff, about 1 mile north from Point Roberts town. It is 16.5 feet from the edge of a steep bluff at a point where the trail leads down to the waters's edge, 68.6 feet west of the west side of the boundary obelisk at a point about 8 inches above the rough foundation, 15.1 feet west of the west edge of the road leading north from Point Roberts to Port Guichon and Ladner's along the edge of the bluff, and 85.8 feet northwest of the largest fir tree in the vicinity. The station was not marked.

Port Orchard, Kitsap County.—The station is on a knoll in the southwest corner of the court-house square, 52 feet from the southwest corner stake, about 14 feet from the west line of the square, and 280 feet from the northwest corner of the court-house. The station is marked by a 6-inch sandstone monument, lettered U. S. C. & G. S., 1906, set about 33 inches deep, and with about 4 inches projecting. The county authorities kindly placed a load of gravel around the station. The following true bearings were determined:

	° ′	
Navy-yard flagstaff (mark)	7 00.0	east of north
West tangent to administration building	8 14.2	east of north
Southeast corner main building	11 15.1	east of north
East edge of base of power-house chimney	13 09.2	east of north
Northwest corner of court-house	50 20.0	east of north

Descriptions of stations—Continued.

WASHINGTON—Continued.

Sawmill Creek, Okanogan County.—The station is about 275 feet west of Sawmill Creek, locally known as Baker Creek, in a pasture belonging to the Tedrow estate. It is 119.5 feet from the nearest post of a fence on Canadian soil, roughly paralleling the boundary line. The station is 113.5 feet from the boundary monument. The distance from Gillespie's road house to Molson is counted 4 miles. The boundary is 2 miles from either, along the road between them. The following true bearings were determined:

	° ′	
West gable of more distant of two barns (mark)	15 59.0	east of south
Boundary monument	19 40.3	west of north

Seattle, King County.—The station of 1903–4 in the grounds of the State University was reoccupied. It is about 600 feet north of the administration building, 315 feet from the southwest corner of the gymnasium, and 20 feet west of the path between the administration building and the gymnasium building. The station is marked by a stone post 8 inches square, projecting 5 inches above ground, and lettered U. S. C. & G. S., 1903. The following true bearings were determined in 1904:

	° ′	
East corner of the administration building (mark)	23 08.5	west of south
Spire of the administration building	28 33.5	west of south

Sheep Creek, Stevens County.—The station is about three-eighths of a mile from the railroad depot at Patterson, British Columbia, 100 feet northeast of the bridge across Sheep Creek, and 360 feet or more west of the railroad track. It is about 75 feet north of the wood road, about 420 feet from the boundary monument east of the railroad track, about 420 feet from the Manson House, and about 30 feet from the fence to the north. It is surrounded by fallen timber, brush, and standing trees. The station is a few feet north of the boundary line. It is not marked, but tent stakes were left in position. The following true bearings were determined:

	° ′	
West gable of yellow house belonging to Manson	36 46.6	east of south
Southeast edge of Hotel Edna	6 17.0	east of north

Silicia Creek, Whatcom County.—The station is on the east bank of Silicia Creek and on the boundary line as nearly as could be ascertained. It is 9.4 feet east of the cairn of stones and iron pipe on the boundary. There is a hemlock stump 1½ feet in diameter 5.6 feet a little south of east from the station. A second hemlock stump 6 inches in diameter is 3.2 feet a little north of east. A balsam stump 16 inches in diameter is 14.7 feet east of the station. To a dead hemlock tree a little west of south, the nearest of any size to the station, is 16.4 feet. A 2-foot white fir tree is 38.6 feet northwest of the station. The trail leading into and out of Silicia Creek canyon is 40 feet southwest of the station. The mark used was a strip of bright red cloth nailed to a blaze in a 3½-foot hemlock tree trunk, about 350 feet away, and bears 16° 01′.0 west of true south.

Similkameen River, Okanogan County.—The station is very nearly on the boundary line, probably a few inches on the American side. It is 62 feet east of the boundary monument on the east bank of the Similkameen River and 44 feet east of the trail down the east side of the river. It is about 117 feet from the water's edge, as the water was at the time of occupation (low water), and about 40 feet west of the foot of a rocky slope. The station is marked by a small cairn of loose stones, the point being surrounded by rock in place. The following true bearings were determined:

	° ′	
Boundary monument on west side of Similkameen Canyon (mark)	89 59.3	west of north
Blazed pine tree, 1 foot in diameter, 280 feet distant	5 07.4	west of south
Mount Chopaca	63 21.2	west of south
Center of boundary cut on summit west of Similkameen Canyon	89 59.2	west of south

Sixteen miles west of Similkameen River, Okanogan County.—The station is very nearly on the boundary line, possibly a little on the Canadian side. It is on a round, low summit where the line passes thru a dead-pine district. There are no live trees in the neighborhood of the station. It is 88.9

Descriptions of stations—Continued.

WASHINGTON—Continued.

feet west from the boundary monument No. 7 (?) and 19.1 feet a little north of west from a 15-inch pine stump. The station is about 2 miles off the trail, which is south of the boundary. This is the commission trail and the only route of travel thru the country. There is no trail to the station or to the monument near it. The station is marked by a pine stake surrounded by a cairn of stones. The following true bearings were determined:

	° ′
A vertical mark on a blaze on a dead pine tree 400 feet away (mark)	32 03.4 west of south
Boundary monument	89 55.0 east of south
Highest point on Cathedral rock visible from the station	83 03.4 west of south

Skagit River, Whatcom County.—The station is a little less than three-fourths of a mile west of the west bank of the Skagit River where it crosses the boundary and is in the center of the trail leading from Whitworth's ranch toward Chilliwack Lake. The station is probably 5 or 6 feet north of the boundary line and is about 230 feet east of the boundary monument, consisting of a pile of rocks—a rock cairn—near the foot of the west slope of the canyon of the Skagit River. There is a similar cairn on the boundary about a mile and a half east from the station near the foot of the east slope of the canyon of the Skagit. The station is not marked. The mark used was a vertical line on a blaze in the trunk of a white-fir tree, about 4 feet above the ground, and bears 14° 36′.7 east of true south.

Sumas, Whatcom County.—The station is on the north edge of the town, about 10 feet south of the forty-ninth parallel, three blocks north of the Hotel Mount Baker, and five blocks north of the Methodist Episcopal Church. It is about 650 feet east of the railroad tracks and depot of the Canadian Pacific and Northern Pacific railroads. The station is in Boundary street just north of lot 4, lot 5, or lot 6 of block 16 of the Barkerville addition to the town of Sumas. The nearest boundary monument is about a quarter of a mile west of the station on the bluff or hill just west of the town and the railroad tracks. The station is marked by a square cedar post, 48 by 6 by 6 inches, projecting 5 inches above the ground with a cross cut in the top. The following true bearings were determined:

	° ′
Ball on top of belfry of Methodist Episcopal Church (mark)	00 47.2 east of south
Triangulation signal over iron post on boundary	89 28.7 west of north
Southeast edge of chimney on J. A. Lochbaum's house	46 44.0 west of south

Tacoma, Pierce County.—The station of 1894 was reoccupied. It is in the northwest corner of Wright Park, 498½ feet due south of the astronomic station. It is marked by a granite block, 8 inches square on the top, projecting about 4 inches above the walk in which it is planted. A second block, 8 by 11 inches on top, was set 435½ feet farther south to mark a true meridian, and is located at the north edge of the graded plaza on which a large brass cannon is mounted. The spire of the Swedish Lutheran Church bears 5° 38′.1 west of true south.

Walla Walla, Walla Walla County.—The station of 1887 being no longer suitable for magnetic observations, a new station was established about a mile and a half west of the center of town, on the military reservation at Fort Walla Walla. It is south of the center of the reservation, and a little north of west of the barracks. It is 319.5 feet north of the northwest corner of the ammunition house, and 313.4 feet southwest of the center of the sill on the central door of the storehouse, next to the quartermaster's office. The station is marked by a sandstone post, 6 by 6 by 24 inches, set flush with the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′
Spire of Cumberland Presbyterian Church (mark)	51 09.3 east of north
Cross on steeple of Catholic Church	46 06.6 east of north
Flag pole on cupola of court-house	44 22.0 east of north
Small triangular cupola	49 29.4 east of north

Waneta (Boundary), Stevens County.—The station is on the westernmost of three points in the bank or bench on the north side of the gulch thru which the railroad runs. It is about 160 feet

Descriptions of stations—Continued.

WASHINGTON—Continued.

north-northwest from the railroad track, about 200 feet north of the boundary line, about 400 feet northeast of the boundary monument, and about a quarter of a mile a little north of west from the hotel. It is about one-half mile westerly from the iron railroad bridge across the Pend Oreille River, and about 550 feet from the schoolhouse in Boundary, Wash. A blazed pine tree is 16 feet a little west of north from the station. The station is not marked save by tent stakes left in position. The following true bearings were determined:

	°	′	
Right edge of base of flag pole on schoolhouse	37	10.0	west of south
Tip of boundary monument	56	53.8	west of south

Wilson Creek, Douglas County.—The station is on the second lava bench north of town, about a quarter of a mile due north of the brick schoolhouse and in line with the east face of the building. It is on land owned by Mr. J. P. Schroeder, who lives about 60 rods southwest of the station. On account of heavy winds the station was placed about 20 feet down the south side of the lava bluff and on the shelf of lava, which is here about 60 feet wide and runs along below the bluff. The cemetery is almost due west. The sage brush was cleared away for about 20 feet around the station. In order to find enough earth to set a monument the station was put up at the foot of the slope of crumbled lava. The station is marked by a sandstone monument, 6 inches square, set 2 feet deep with 5 inches projecting. The top face is lettered U. S. C. & G. S., 1906, with a cross. The following true bearings were determined:

	°	′	
Flagstaff of schoolhouse (mark)	2	00.8	west of south
Cupola of Great Northern Railway tank	15	44.9	west of south
Right tangent to coal bunkers	19	16.6	west of south
Left tangent to J. P. Schroeder's house	22	56.0	west of south
Right tangent to old Doctor Mitchell house	12	51.4	east of south

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Ashland, Ashland County.—The station is in the southwest corner of the grounds of the North Wisconsin Academy. It is 142.3 feet from a fence to the southeast, 122.0 feet from the west fence, and 236.2 feet from the intersection of the two fences. The station is marked by a Bedford limestone post, 6 by 6 by 30 inches, set about 3 inches above the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	°	′	
Lutheran Church spire (mark)	65	40.8	west of north
Ellis School flag pole	80	30.3	west of north
Methodist Church spire	64	38.4	west of north
Norwegian Church spire	49	32.6	west of north
Public School spire	9	50.4	west of north

Chippewa Falls, Chippewa County.—The station is on the property of ex-Governor Pound, on the crest of a small ridge. It is south of the intersection of the Asylum road and an old road lined with poplars leading to a field above the station. The station is about one-fourth of a mile from the Asylum road, about 500 yards from the other road, and 123 feet northwest of a wire fence. It is marked by a Bedford limestone post, 6 by 6 by 30 inches, set flush with the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	°	′	
German Methodist Episcopal Church spire (mark)	55	07.3	west of north
Spire of French Catholic Church	74	15.9	west of south
Spire of German Catholic Church	53	12.7	west of north
Spire of St. Joseph Hospital	52	25.4	west of north
Flagstaff on court-house	40	58.6	west of north
Flagstaff of insane asylum	34	47.5	east of north

Descriptions of stations—Continued.

WISCONSIN—Continued.

Elkhorn, Walworth County.—The station is in the southwest corner of the Walworth County Fair Grounds. It is 108.3 feet from the south fence, about 165 feet from the west fence, and 218.2 feet from a large tree near the race course. The station is marked by a Bedford stone post, 6 by 6 by 30 inches, sunk flush with the surface and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′
Base of standpipe, south edge of top course of stone (mark)	76 30.1 west of south
South edge of standpipe, near top	76 32.2 west of south
Staff on cupola of High School	57 27.1 west of south

Florence, Florence County.—The station is in the old Florence Cemetery, in the north and south driveway that leads to the entrance of the cemetery. The station is 45.0 feet from the small headstone of Clarence H. Morrison, 94.2 feet from the headstone marked Jennie E. N. Carlson, and 93.6 feet from the headstone marked Charles Schulte. The station is marked by a Bedford limestone post, 6 by 6 by 28 inches, set flush with the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′
High School spire (mark)	85 54.4 west of north
Court-house pinnacle	76 17.6 west of south
Catholic Church spire	87 30.4 west of north

Fond du Lac, Fond du Lac County.—The station is in the southern part of Taylor Park, 148 feet from the south side of the park and 216.4 feet from a line of small trees along the west side. It is 44.6 feet, 39.9 feet, and 37.0 feet from large trees situated respectively northwest, northeast, and south of the station. The station is marked by a Bedford stone post 6 by 6 by 30 inches, sunk flush with the surface and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′
East edge of central flue on Mr. Carl Helmold's residence (mark)	47 45.4 west of south
Iron post, south side of northwest entrance to park	52 15.4 east of north
Iron post, east side of north entrance to park	15 15.3 west of north

Grand Rapids, Wood County.—The station is in the public park or fair grounds, on the east edge of the baseball field. It is 31.8 feet from the center of the old road east of the station, 48.8 feet from a small oak tree on the east side of road, and 48.7 feet from a double oak tree nearly south from the station. It is marked by a Bedford limestone post 6 by 6 by 24 inches projecting 2 inches above the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′
Flagstaff of Howe Building (mark)	9 15.6 east of north
Lincoln School flagstaff	36 37.5 west of north
Pinnacle of city water tank	17 41.0 west of north

Grantsburg, Burnett County.—The station is in the race-track grounds, near the south turn of the track and almost diagonally across the grounds from the grand stand. It is 7.9 feet from the edge and 29.9 feet from the center of the race track (points ill defined; estimated). It is 154.3 feet from a dilapidated fence on the east boundary of the grounds and 134.4 feet from the extension of the same fence bounding the grounds on the south. The station is marked by a Bedford limestone post 6 by 6 by 30 inches, set flush with the surface of the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′
Flag pole on schoolhouse (mark)	12 12.3 west of north
Flag pole on exhibit building	75 20.1 west of north
Spire of Methodist Church	28 09.1 west of north

Marinette, Marinette County.—The station is in the southwest portion of the Forest Home Cemetery, to the east of the elevated ground that is used for single graves. The east and west fence

Descriptions of stations—Continued.

WISCONSIN—Continued.

south of the cemetery is placed in the center of ground that was originally intended for a street. The station is 31.0 feet north of the fence and 1 foot north of the north boundary of the street. Two small pine trees alongside of the fence are 37.1 feet and 47.2 feet from the station, the most westerly tree being the nearer one. The station is marked by a Bedford limestone post 6 by 6 by 30 inches, set about 2 inches above the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′	
German Catholic Church spire (mark)	33 05.5	east of north
South corner of I. Stephenson's monument	30 22.4	east of north
Flag pole on soldiers' lot	31 41.4	east of north
Spire of German Lutheran Church	58 49.4	east of north

Mountain, Oconto County.—The station is in the cemetery, practically in the center of the intersection of the second alley from the west side and the first alley from the south side. It is 61.3 feet from the fence on the south boundary of the cemetery and 60.9 feet from the fence on the west boundary, both measurements being taken along the center of the alley. It is 57.7 feet from the base of a small headstone marked Hazel Green, to the north and west. The station is marked by a Bedford limestone post 6 by 6 by 30 inches, set about 3 inches above the surface of the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′	
Public school flag pole, in yard (mark)	73 22.9	west of north
South corner of public school building	75 36.5	west of north

Neillsville, Clark County.—The station is in the Protestant Cemetery, on the lot dedicated to soldiers and "our unknown dead." It is in the corner of the lot about 2 feet from the south side and about 3 feet from the east side. It is 92.1 feet from the wire fence bounding the west side of the cemetery, 47.3 feet from the base of the Markey monument, 25.6 feet from the small monument inscribed Deborah H. Newcomb, and 35.4 feet from the base of the Huntley monument. The station is marked by a Bedford limestone post 6 by 6 by 30 inches, set flush with the surface of the ground and lettered U. S. C. and G. S., 1905. The following true bearings were determined:

	° ′	
Episcopal Church spire (mark)	33 38.4	west of south
Ladder alongside of water tower	15 54.3	west of south
Methodist Church spire	29 18.4	west of south
Lutheran Church spire	51 40.3	west of south
Catholic Church spire	86 42.7	west of north

Osceola, Polk County.—The station is on the property of L. P. Nason, in the pasture between Mr. Nason's residence and barn and a little north of the path leading from the dwelling to the barn. It is 125.0 feet from a wire fence to the west between the dwelling and barn, 156.8 feet from a wire fence to the north and adjacent to the road, and 47.6 feet from a hard maple tree about 1 foot in diameter, south and west of station. The station is marked by a bottle set about 2 inches below the surface of the ground and placed in the center of a piece of vitrified sewer pipe 17 inches long by 6 inches in diameter, set flush with the ground. The following true bearings were determined:

	° ′	
Public school flag pole (mark)	13 07.4	east of north
Baptist Church spire	1 10.3	west of north

Observations were also made at a point (A) about 70 feet nearer to the railroad.

Rhinelander, Oneida County.—The station is in the Protestant Cemetery near the center of the second driveway from the north entrance and a little west of the north and south line joining the southeast and northeast corners of the Bronstead and Clark lots, respectively. To the base of the Clark monument is 15.1 feet, to the base of the Paysse monument is 32.0 feet, and to the base of the Bronstead monument is 37.5 feet. The station is marked by a Bedford limestone post 6 by 6 by 30

Descriptions of stations—Continued.

WISCONSIN—Continued.

inches, set flush with the surface of the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′
Court-house flag pole (mark)	42 38.1 west of north
Spire of Catholic Church	58 28.5 west of north

Shawano, Shawano County.—The station is in the Fair Grounds, to the south and east of the portion laid out as a baseball diamond. It is 204.6 feet from the fence to the northeast bounding the inner side of the race track, 197.3 feet from the fence to the southwest, 314.8 feet from the south corner of the judges' stand, and about 137 feet to second base of the baseball grounds. The station is marked by a Bedford limestone post 6 by 6 by 30 inches, set flush with the surface of the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′
Flag pole on brewery (mark)	65 34.7 west of north
Catholic Church spire	80 19.6 west of south
High School flag pole	85 02.5 west of south

Shell Lake, Washburn County.—The station is on a small ridge in the western part of the cemetery. In the southwest corner of the cemetery is a small hill which is separated from the ridge on which the station is located by a valley. The station is 128.0 feet (measured on incline) from the fence bounding the west side of the cemetery, and 100.2 feet from the corner of the tool house, 7.4 feet southwest of the center of an oak tree about 1 foot in diameter, and 13.3 feet east of a second oak tree. The station is marked by a Bedford limestone post set flush with the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′
Scandinavian Church spire (mark)	54 41.1 west of south
Court-house flag pole	38 37.6 west of south
Catholic Church spire	49 20.4 west of south

Wausau, Marathon County.—The station is on the property of August F. Marquardt on the top of Marquardt's hill. It is on the northern edge of a small rocky knoll that marks the exact top of the hill and is 9.0 feet from a small butternut tree on the knoll southeast from the station. The station is marked by a Bedford limestone post 6 by 6 by 24 inches, set flush with the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′
Court-house flag pole (mark)	78 21.0 east of south
Polish Catholic Church spire	77 28.4 east of north
Public school flag pole	85 00.1 east of north
Lincoln School flag pole	61 10.9 east of south

WYOMING.

Casper, Natrona County.—The station is on the south side of a block of land reserved for a city park, and lying in the south part of town, on the east side of the main street. It is in the east alley line 2.4 feet north of the street line, marked by a corner stake. A line of trees in the park to the west would pass, if produced, about 6 feet to the north of the station. A small barn in the block to the south, on the same alley line, is 116.5 feet distant. To the northwest corner of a dwelling house eastward is about 79 paces. The southeast corner of a brick schoolhouse is about 122 paces to the southwest. The station is marked by a sandstone post 6 by 6 by 36 inches, the top drest (hexagonal) and marked U. S. C. & G. S., 1905. The following true bearings were determined:

	° ′
Base of pole on City Hall belfry (mark)	7 09.5 west of north
Southeast corner of brick schoolhouse	49 03.9 west of south
Flag pole on north side schoolhouse	2 34.5 east of north
Northwest corner of dwelling at southeast corner of park	80 18.7 east of north

Descriptions of stations—Continued.

WYOMING—Continued.

Douglas, Converse County.—The station is on an elevated knoll belonging to the Town-site Company and forming a bench against the west side of the higher bluff upon which the city reservoir is situated. It overlooks the cemetery on the south, the brick plant on the northeast and the county court-house and the city beyond, to the westward. The south line of the east and west street, lying next south of the main street, would, if produced, pass about 10 feet north of the station. The west line of the cemetery, if produced, would pass about 45 feet to the west of the station. The station is marked by a sandstone post 6 by 6 by 30 inches, cut octagonal on top and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	°	′	
Southwest corner of public school building (mark)	27	51.9	west of north
Spire of Methodist Episcopal Church	78	30.2	west of north
Summit of Laramie Peak (35 miles)	5	42.1	west of south
Cupola of south gable of brick plant	34	46.6	east of north

Gillett, Crook County.—The station is on the open prairie to the southward of the village, and about in the west line of the street next eastward from the business street produced, being immediately south of the schoolhouse. It is about 300 feet to the south and a little to the west of a large outcropping sand rock, and about 60 feet to the westward from the bank of the ravine, which extends southward into a group of sand hills. The station is marked by a sandstone post 7 by 7 by 27 inches, projecting 4 inches above the ground and marked U. S. C. & G. S., 1905. The following true bearings were determined:

	°	′	
Tip on water tank in railroad yard (mark)	9	59.1	west of north
Tip on water tank on hill	76	24.2	west of north
Flag pole on schoolhouse	1	21.1	west of north

Newcastle, Weston County.—The station is on the public school grounds, in the northeastern part of the city. It is 210.5 feet southwest of the south corner of the schoolhouse, the measurement being taken along the surface of the ground down a rather steep slope, and 35.4 feet inside of the fence along the street to the westward. The station is nearly in front of the schoolhouse and is marked by a sandstone post 7 by 7 by 27 inches, projecting 4 inches above the ground. The following true bearings were determined:

	°	′	
Tip on cupola, Duling & Smith livery barn (mark)	41	23.9	west of north
Northeast corner of flour mill	82	12.0	west of north
Tip on Burlington water tank	66	52.4	west of north

Sheridan, Sheridan County.—The station is on the military reservation at Fort McKenzie, 602 feet nearly south of the building now used as a noncommissioned officers' residence, and about 100 feet south of the main drive entering the grounds, and a little to the west of the point of junction with the road to the quartermaster's storehouse. The eastern corner of the noncommissioned officers' residence appears in line with the gable of the bakery, and the western corner of the first of the barracks lines with the commanding officer's residence. (A new barracks is planned which may obscure this line.) The station is marked by a sandstone post 7 by 7 by 27 inches, projecting 4 inches above the ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined:

	°	′	
Pole on county court-house (mark)	32	29.1	east of south
East vertical edge of notch in Cloud Peak	18	15.9	west of south
South gable of officers' residence (nearest)	48	24.9	west of north
Front gable of State Hospital	57	39.3	east of south

Wheatland, Laramie County.—The station is at the intersection of Eleventh and Water streets, on a barren knoll in the bend of the irrigating ditch and rising above it. It is about 15.5 feet west of the east line of Eleventh street and about 15 feet south of the north line of Water street, being 20.8

Descriptions of stations—Continued.

WYOMING—Continued.

feet to the southwest from the corner stake that marks the northeast corner of this street intersection. The ditch lies to the west about 245 feet and to the north about 240 feet. The station is marked by a red cedar post 8 inches in diameter and 30 inches long, set about 6 inches above ground and lettered U. S., 1905. The following true bearings were determined:

	° ′
Rod on schoolhouse tower (mark)	17 03.0 west of north
South edge of chimney on large farmhouse	77 29.5 west of north
Notch in mountain peak (20 miles)	87 14.2 west of south

FOREIGN COUNTRIES.

Montreal, Canada.—The station is on the cricket and football field of McGill University, 148 feet from the southeast corner of the grand stand, 178.8 feet from the northeast corner, and 129.6 feet from the middle of the road. The following true bearings were determined:

	° ′
Flag pole on tower of Arts Building	43 04.3 west of north
Tip of tower of Presbyterian College	86 29.8 west of north
North gable of lodge near entrance to grounds	74 28.9 east of south
Southwest corner (at ground) of Monson Building	58 23.0 west of north

Quebec, Canada.—The station of 1859 and 1879 being no longer available, a new station was established on the "Plains of Abraham," in the portion formerly used as a race course, about in line with the rear wall of the jail; also in line with the north corner of the jail and a church spire. The precise point is marked by an inch stake driven flush with the ground in the middle of a depression about 3½ feet in diameter. It is 168.4 feet from the boundary stone at the intersection of two fences.

Union, British Columbia.—The station of 1903 and 1904 was reoccupied. It is on an alluvial spit, about a quarter of a mile north of the Wellington Colliery Company's pier and about half that distance east of the railroad and coke ovens. It is about 10 feet east of the cart path, 100 feet north of a large wooden post about 18 inches in diameter and 8 feet high, and 75 feet from high-water mark. The station is marked by a fir post about 6 inches in diameter and projecting about 10 inches above the ground. The following true bearings were determined:

	° ′
Northeast edge of chimney at brickkiln	19 50.4 west of south
Church spire at Comox	18 44.8 west of north

As a spur track of the railroad has been built within about 80 feet of the old station, observations were also made at a second station about 1,000 feet north of the old one, in a direct line to the church spire at Comox, on a low shingle spit across the small stream. The station was marked by a drest post of fir, 3 inches square and set about 30 inches deep, and projecting about 8 inches above ground. A small heap of stones was left around the post, and the letters U. S. and a cross were cut in the top surface.

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APPENDIX 4

REPORT 1906

DISTRIBUTION OF THE MAGNETIC DECLINATION IN THE UNITED STATES FOR JANUARY 1, 1905

WITH ISOGONIC CHART AND SECULAR CHANGE TABLES

By L. A. BAUER

Inspector of Magnetic Work and Chief of Division of Terrestrial Magnetism, Assistant, Coast and Geodetic Survey

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DISTRIBUTION OF THE MAGNETIC DECLINATION IN THE UNITED STATES FOR THE PERIOD JANUARY 1, 1905, WITH ISOGONIC CHART AND SECULAR CHANGE TABLES.

By L. A. BAUER,
Inspector of Magnetic Work and Chief of Division of Terrestrial Magnetism, Assistant, Coast and Geodetic Survey.

LINES OF EQUAL MAGNETIC DECLINATION FOR 1905.

The large number of new, reliable, and well-distributed determinations of the magnetic elements made by the Coast and Geodetic Survey, chiefly within the past seven years, has made it possible to undertake the construction of new magnetic maps for the United States with an accuracy not hitherto attainable.

In the present publication is given the first of these new maps—the one for which there is at present greatest demand—viz, the Isogonic Chart or the Chart of the Lines of Equal Magnetic Declination and of Equal Annual Change in the United States for 1905. There will appear later a special publication entitled The Distribution of the Magnetic Elements in the United States and Regions under its Jurisdiction for January 1, 1905, which, besides giving the isogonic lines for the United States proper, will likewise give them for the outlying islands and territories under the jurisdiction of the United States, as also the Charts of the Lines of Equal Magnetic Dip and of Equal Horizontal Intensity for 1905. The common period selected for all of these charts, January 1, 1905, is one for which, owing to the recent numerous reoccupations of "repeat" stations, the secular change reductions are, in general, well known over the entire region embraced.

The last Isogonic Chart for the United States, for January 1, 1902, was published separately and also appeared in the United States Magnetic Declination Tables for 1902.* This chart, with the accompanying text and tables, was in such great demand that shortly after its issue a second edition was required, which in turn is almost exhausted. It was therefore urgent to issue a new chart for as recent a period as practicable and one which should embody the results of the many recent determinations of the magnetic declination and its secular change.

For the first time it has become possible also to construct an isogonic chart for the United States, utilizing only data the value of which is precisely known. In other

*United States Magnetic Declination Tables and Isogonic Charts for 1902 and Principal Facts Relating to the Earth's Magnetism, by L. A. Bauer. Washington, Government Printing Office, 1902. A second edition of this special publication of the Coast and Geodetic Survey was issued in 1903.

words, only such values of the magnetic declination have been utilized as were obtained with well-tested instruments, either magnetometers, declinometers, or compasses. In former years, owing to the meagerness of available accurate data, it was necessary to utilize values obtained by surveyors or by others who had not determined the corrections of their instruments, which may easily, for one reason or another, amount to from one-fourth degree to a whole degree and more at times.

It may be said, in round numbers, that the present chart depends upon accurate observations at 3 500 fairly uniformly distributed points over the United States. The actual number of observations made is of course more than 3 500, for a "repeat" station has only been counted once. Of this number of points about 3 000 represent observations by the Coast and Geodetic Survey, and the remainder were obtained partly by parties with whom the Survey cooperated and partly by parties working under the auspices of other organizations. Of the latter, chief mention should be made of the work of the United States Lake Survey engineers around the Great Lakes, the State magnetic surveys of Missouri, New Jersey, Maryland, North Carolina, and Louisiana, and the series of observations made under the auspices of the Bache Fund of the National Academy of Sciences, 1872–1876.

Since almost all of the values utilized are already in print in one form or another, it is not deemed expedient to republish them here. However, in the special publication referred to above it is proposed to do so, not only for the magnetic declination, but likewise for the other magnetic elements; not only will the observed values be given with full reference to source, but also the values reduced to January 1, 1905.

A new feature of the present chart is the extention of the isogonic lines over the oceanic areas embraced by the chart. These extensions rest upon all available recent sea observations resulting from complete swings of the vessel and obtained chiefly by the Coast and Geodetic Survey, the United States Navy, and the British navy.

Doubtless what will most impress one who looks at the present chart is the large number of twists and turns and peculiar features exhibited by the isogonic lines over the land. In this respect this chart represents more of these sinuosities and irregularities than any hitherto issued for this country. This must be accepted as sufficient proof that the present chart gives a more accurate representation of the actual facts of nature than any previous one; for it is a well-known fact that the more numerous the reliable observations are the more devious become the lines of equal magnetic declination. In fact, experience is teaching more and more that it is not the irregularities which are the abnormal features, but that, on the contrary, *they* are the *normal* features; regularities or uniformities in the distribution of the earth's magnetism over the land do not exist in nature, at least not for any extended area. Gracefully flowing curves of equal magnetic declination usually mean that either the observations were too few or that no dependence could be put upon the irregularities shown by them, or that the attempt was purposely made to eliminate the local disturbances.

When discussing the general magnetic conditions of the entire earth some smoothing-out process is desirable; however, when studying the actual magnetic conditions of a certain area the first endeavor must be to get at the real facts as thoroly and as accurately as possible.

Mean values of the magnetic declination for an area are not wanted even by those who must make practical use of such data any more than the hydraulic engineer desires

for his special problems the average altitude or, say, the average contour line of a whole district or county. Hence, in the present chart, no well-substantiated fact of nature has been eliminated, the lines were drawn to conform as closely as possible with the plotted, observed data. But even in the present instance it must be borne in mind that the true and complete representation of all the present facts (to say nothing of those which still more detailed work will reveal) can not be given by lines of equal values. All that is claimed is that the endeavor has been made to give as true a representation as possible on the scale of the base map used. With multiplication of data it may be depended upon that the twists and turns will become still more numerous. If the scale of the charts permits, it is best to reproduce the actual plotted values.

By carefully examining the isogonic lines it will be seen that there are a number of most interesting correspondences between the twists and turns of the lines and well-known physiographic features, such as coast lines, mountain ranges, rivers, etc. Such correspondences were apparent to a certain extent in the chart for 1902, but in the present one they stand out much more clearly, primarily because of the more numerous data. But these features, however interesting, can not be dwelt upon at length here, but will receive proper attention in a special publication, where a combined treatment of the local disturbances shown by the three magnetic elements, declination, dip, and intensity, will be undertaken.

The isogonic lines are broken in certain regions to indicate that there the observations were not sufficient to make sure of their precise course.

The magnetic survey of the United States as far as completed embraces, on the average for the entire country, one station at which the three magnetic elements have been reliably determined for an area of about 900 square miles, or 30 miles square. In some States, for one reason or another, the stations were more frequent or less frequent, as the case may be, than these figures would imply. This will be set forth more fully in the complete publication already cited. Suffice it to say here, that not only has it become possible in the construction of the present isogonic chart to embrace only such declination data as were known to be reliable, but, likewise, for the first time has it become possible to construct the three sets of charts (declination, dip, and intensity) as based upon practically the same stations, or, in other words, upon practically homogeneous data. It may therefore be expected that a discussion and mathematical analysis of the local and regional magnetic disturbances will be more fruitful than was possible hitherto. The future magnetic survey work will consist in multiplication of stations in regions where the number falls considerably short of the average given above, and in disturbed regions, and also the repetition of observations at "repeat" or well-selected stations for effectively controlling, with the addition of the data derived from the magnetic observatories, the secular changes, thus making it possible to always reduce past work to a future date.*

It may also be said that, considering the area involved (3 025 600 square miles—nearly equal to that of Europe—or about one-sixteenth of the entire land area of the globe), the United States of North America possesses the most complete magnetic survey of any country. Certainly nowhere else have the secular variation data received

* *Cf.* The Magnetic Work of the United States Coast and Geodetic Survey, by L. A. Bauer, Appendix 10, Report for 1898–99, page 948. Washington, Government Printing Office, 1900.

so much attention and been so completely studied as in the United States. Had equal attention been paid in other countries to this important matter, the knowledge of the secular changes over the globe would be in a much more satisfactory condition than is the case now.

LINES OF EQUAL ANNUAL CHANGE FOR 1905.

These lines (the dotted ones on the chart) give in minutes the amount of change in the magnetic declination per annum. It will be seen that this amount varies over the entire country, from nothing to 4′, so that the amount of annual motion of the lines of equal magnetic declination varies from nothing to about $\frac{1}{15}$ of the distance between any two of them. It will be noticed that the annual change lines differ considerably from those of 1902 owing to the great increase of data within recent years and because of peculiar changes amounting even to reversals of direction encountered in certain parts of the country, which could not have been anticipated with the data available at that time.

The note on the chart states that "The north end of the compass is moving to the westward for places east of the line of no change, and to the eastward for places west of the said line, at an annual rate indicated by the *lines of equal annual change* (dotted lines). In other words, east of the line of no change the isogonic lines are moving westward, whereas to the west of the line of no change they are moving eastward."

Accordingly three regions must be distinguished:

(*a*) In the region of the United States east of the agonic line or line of no magnetic declination, where west declination prevails thruout, there the declination is increasing from about 2′ to 4′ per annum. It will be seen that the amount increases with distance from the agonic line until the New England States are reached, where the maximum change occurs, thence, with further progression northeastward, the annual change begins to decrease until a region is reached, which can not be shown on the map, where there is no change, viz, where west declination has reached a maximum value and is, in consequence, nearly stationary at present.

(*b*) In the region between the agonic line and the line of no annual change, which runs practically parallel to the agonic line, the magnetic declination (east) is decreasing at the rate of 0′ to 2′ per annum.

(*c*) In the region west of the line of no annual change, where the magnetic declination is east thruout, it is increasing at the rate of 0′ to 4′ per annum.

In pursuance of the supposed steady progression of the secular variation waves westward, it was thought that when easterly declination had reached a maximum amount or turning point—as actually took place, for example, along the California coast between 1880 and 1890—that thereafter east declination would diminish. On the contrary, however, after remaining nearly stationary for a while, it began to increase very rapidly, so that at present the annual increase is 3½′ to 4′. In other words, the maximum of 1880 to 1890 was apparently not a principal one, but a secondary one.

This extremely interesting tho troublesome reversal of the secular change has moved to the eastward, and so rapidly that in twenty years it had already crossed the Mississippi River, and it appears to be still progressing eastward. It was due chiefly to this feature of the secular change that a new reduction of the previously utilized data became necessary.

On the other hand, there is also no question but that the phase of maximum west declination, which, as intimated above, has already set in in Labrador and Newfoundland, is steadily moving southwestward. Hence, there is occurring in the United States at present a most interesting conflict of secular waves, which will necessitate keeping a close watch on the changes for some time to come. The effect of these complicated changes, as pointed out in the note cited above, is to move the isogonic lines which lie east of the line of no annual change, westward, and those west of the no-annual-change line, eastward, or in other words, the lines are being crowded together from both sides of the line of no change. This effect, considered in company with the known changes in dip and intensity, as will be shown in the complete publication mentioned above, implies that the magnetic north pole has moved during the past twenty years chiefly southward, the west component of motion being greatly subordinate to the southerly one.

Some statement can also be made as to the general character of the changes in the West Indies and Mexico. The line of annual change 2′, lying east of the line of no annual change, after leaving South Carolina, skirts the east coasts of the Bahama Islands, then presumably passing thru Haiti, proceeds southward of Jamaica a degree or two in latitude, then touching the southwest corner of Cuba passes thru the Gulf of Mexico to the north of Yucatan, and then most likely proceeds almost westward thru Mexico. East declination is diminishing at the rate of about 3′ per annum in the vicinity of Mexico City. Since, as shown in the Chart, east declination is increasing at the rate of about 3′ per annum along the entire north boundary of Mexico, it is evident that somewhere between the boundary and the parallel of 17°, the line of no annual change after leaving Alabama and passing thru the Gulf, proceeds westward thru Mexico in about latitude 24°—the precise delineation must be deferred until more data from Mexico are at hand. In Porto Rico, at the eastern end, west declination is at present increasing at the rate of 7′ per annum.

SECULAR CHANGE TABLES.

Owing to the facts related above, it became necessary to revise the secular change tables of the magnetic declination given in the Declination Tables for 1902.

An exhaustive recompilation of all available reliable data for the entire country was undertaken, and from the statements already made it is apparent that the data now possess a completeness not hitherto possessed. By a graphical process, which will be more fully explained in the special publication where the changes for the other magnetic elements will likewise be treated, the secular changes were determined for the regions represented by the tabular groups. In order to avoid the necessity of using signs to indicate the direction of the secular changes the tables have been put in the most readily serviceable form possible by referring the changes to some well-known place in the locality and giving the actual declination at that place for ten-year intervals. It should be borne in mind, however, that the actual changes were deduced from all the data in the vicinity. This procedure will suffice for any use that the land surveyor may make of the tables in relocating old boundary lines run by the compass.

More elaborate tables, restricted on the average to about thirty years prior to 1905, were utilized in the reduction of the declinations to 1905 used in the construction of the Chart.

Explanatory remarks to the practical use of the Secular Change Tables.

On the following pages will be found for each State and Territory one or more tables, arranged alphabetically, showing the change in declination from 1750, or the date of the earliest available observations to the present time. The figures on any line refer to the 1st of January of the year given in the first column. Each table is based on the average value of declination observed at the place given in parentheses, but represents equally well the *change* in direction of the compass needle in other parts of the general region to which it refers.

In using these tables the surveyor must bear in mind the uncertainties incident to the use of the compass and not be surprized if, for example, the change in declination for the last hundred years, as given by the tables, differs by half a degree or more from the value indicated by his own determinations. Even at the present time many compasses are in error by as much as a quarter of a degree, owing to imperfect construction or lack of proper care, and one hundred years ago the state of affairs was still worse, so that an error of half a degree was not unusual. These tables give approximately the actual change in the magnetic declination and do not take into account the error of any particular compass.

Whenever the surveyor is called upon to redetermine the boundary line of a tract of land run out at some previous period with a compass, and can find in the vicinity a well-defined line known to have been established with the same compass and at about the same time as the survey of the tract under consideration, he can not do better than determine the amount of the change in the compass bearing of this well-defined line and use it to obtain the present bearings of the boundary lines to be reestablished. In this way he will take into account and eliminate the errors of the compasses used in the original and in the present survey. Only in the absence of such definite information is the use of the following tables recommended.

Months and days exprest as a fraction of a year.

Jan 0	0.00	Apr 1	0.25	July 2	0.50	Oct 1	0.75
Jan 18	0.05	Apr 20	0.30	July 20	0.55	Oct 19	0.80
Feb 6	0.10	May 8	0.35	Aug 7	0.60	Nov 7	0.85
Feb 24	0.15	May 26	0.40	Aug 25	0.65	Nov 25	0.90
Mar 14	0.20	June 13	0.45	Sept 13	0.70	Dec 13	0.95

The use of the tables may best be explained by a few examples:

(1) What was the change in declination at Augusta, Ga., between June 1, 1825, and September 1, 1906?

In the table for Georgia the values for 1820 and 1830 are 5° 53′ E. and 5° 44′ E., showing an average annual decrease of 0′.9; hence the value for 1825, June 1, would be $5° 53′ - (0.9 \times 5.4) = 5° 48′$ E. Similarly, the table gives for 1905 the value 2° 02′ E., with an annual decrease of 0′.5; hence the value for 1906, September 1, would be $2° 02′ - (0.5 \times 6.7) = 1° 59′$ E. Therefore the north end of the needle pointed 3° 49′ more to the west September 1, 1906, than it did June 1, 1825.

(2) The magnetic declination at Allegheny, Pa., was 2° 56′ W. in August, 1885. What was it in January, 1800?

From the table for western Pennsylvania are derived the values 0° 37′ W. for January, 1800, and 4° 12′ W. for August, 1885, showing a change of 3° 35′ in the interval; hence the declination at Allegheny for the earlier date was 2° 56′ W.−3° 35′, or 0° 39′ E.

(3) A rectangular piece of land at Santa Barbara, Cal., was surveyed by compass in May, 1832, and the bearings recorded as follows: N. 20° 15′ W., N. 75° 30′ E., S. 18° 45′ E., and S. 78° 00′ W. What bearings should be used in order to retrace the lines in September, 1906?

From the table for southern California the values 13° 16′ E. for 1832 and 15° 16′ E. for 1906 show a change of 2° to the eastward in the interval. The desired bearings are, therefore, N. 22° 15′ W., N. 73° 30′ E., S. 20° 45′ E., and S. 76° 00′ W.

Table giving the Secular Change of the Magnetic Declination in the United States.

Year (Jan. 1)	Alabama (Montgomery)	Arizona, east (Holbrook)	Arizona, west (Prescott)	Arkansas (Little Rock)	California, south (Los Angeles)	California, middle (San Jose)
	° ′	° ′	° ′	° ′	° ′	° ′
1750	2 52 E					
60	3 28					
70	4 03					
80	4 34				10 24 E	13 37 E
90	5 02				10 58	14 03
1800	5 24			8 13 E	11 32	14 32
10	5 39			8 36	12 07	15 01
20	5 47			8 51	12 39	15 30
30	5 46			9 00	13 09	15 57
40	5 38			8 59	13 36	16 22
50	5 22	13 33 E	13 19 E	8 51	13 57	16 45
60	5 00	13 44	13 33	8 34	14 13	17 05
70	4 32	13 47	13 40	8 14	14 24	17 20
80	3 54	13 40	13 36	7 38	14 33	17 28
90	3 15	13 25	13 32	7 01	14 36	17 32
1900	2 49	13 29	13 44	6 38	14 52	17 51
05	2 48 E	13 41 E	14 00 E	6 44 E	15 10 E	18 10 E
Annual change in 1905	1′.0 incr.	2′.4 incr.	3′.2 incr.	2′.0 incr.	3′.6 incr.	3′.8 incr.

Year (Jan. 1)	California, north (Redding)	Colorado, east (Pueblo)	Colorado, west (Glenwood Springs)	Connecticut (Hartford)	Delaware (Dover)	District of Columbia (Washington)
	° ′	° ′	° ′	° ′	° ′	° ′
1750				5 47 W	3 23 W	1 41 W
60				5 18	2 46	1 02
70				4 57	2 16	0 28
80	14 07 E			4 45	1 52	0 01 W
90	14 35			4 43	1 37	0 19 E
1800	15 04			4 51	1 33	0 28
10	15 34			5 08	1 37	0 28
20	16 04			5 34	1 52	0 19 E
30	16 33			6 07	2 16	0 01 W
40	17 01			6 47	2 46	0 28
50	17 26	13 47 E	16 07 E	7 31	3 23	1 02
60	17 47	13 50	16 15	8 09	4 03	1 41
70	18 06	13 46	16 16	8 43	4 41	2 21
80	18 15	13 31	16 04	9 24	5 20	3 00
90	18 20	13 00	15 40	9 51	5 54	3 36
1900	18 39	12 53	15 39	10 25	6 26	4 11
05	18 58 E	13 04 E	15 52 E	10 41 W	6 42 W	4 27 W
Annual change in 1905	3′.8 incr.	2′.2 incr.	2′.6 incr.	3′.2 incr.	3′.2 incr.	3′.2 incr.

Table giving the Secular Change of the Magnetic Declination in the United States.

Year (Jan. 1)	Florida, east (Jacksonville)	Florida, west (Pensacola)	Florida, south (Tampa)	Georgia (Macon)	Idaho, east (Pocatello)	Idaho, west (Boise)
	° ′	° ′	° ′	° ′	° ′	° ′
1750	2 27 E	5 00 E	5 00 E	3 16 E		
60	3 04	5 37	5 30	3 53		
70	3 40	6 13	5 55	4 29		
80	4 12	6 44	6 15	5 01		
90	4 37	7 11	6 26	5 26		
1800	4 55	7 32	6 30	5 44		
10	5 04	7 45	6 26	5 53		
20	5 04	7 50	6 15	5 53		
30	4 55	7 45	5 55	5 44		
40	4 37	7 31	5 30	5 26		
50	4 12	7 12	5 00	5 01	17 21 E	17 59 E
60	3 40	6 45	4 28	4 29	17 40	18 21
70	3 04	6 13	3 53	3 53	17 51	18 36
80	2 25	5 34	3 16	3 14	17 54	18 43
90	1 50	4 57	2 48	2 39	17 43	18 39
1900	1 19	4 29	2 19	2 08	17 51	18 51
05	1 13 E	4 25 E	2 11 E	2 02 E	18 07 E	19 08 E
Annual change in 1905	1′.2 decr.	0′.8 decr.	1′.6 decr.	0′.5 decr.	3′.2 incr.	3′.4 incr.

Year (Jan. 1)	Illinois (Bloomington)	Indiana (Indianapolis)	Indian Territory (Okmulgee)	Iowa (Des Moines)	Kansas, east (Emporia)	Kansas, west (Ness City)
	° ′	° ′	° ′	° ′	° ′	° ′
1750						
60						
70						
80						
90						
1800	5 54 E	4 44 E				
10	6 18	4 59				
20	6 33	6 04		10 09 E		
30	6 37	4 59		10 24		
40	6 33	4 44		10 30		
50	6 18	4 21	10 15 E	10 24	11 34 E	12 24 E
60	5 54	3 50	10 06	10 09	11 28	12 23
70	5 26	3 13	9 51	9 44	11 12	12 12
80	4 44	2 35	9 24	9 06	10 45	11 54
90	4 05	1 57	8 45	8 21	10 07	11 21
1900	3 36	1 24	8 31	7 54	9 50	11 08
05	3 31 E	1 15 E	8 43 E	7 57 E	9 59 E	11 16 E
Annual change in 1905	1′.0 decr.	1′.5 decr.	2′.4 incr.	1′.5 incr.	2′.0 incr.	2′.0 incr.

Table giving the Secular Change of the Magnetic Declination in the United States.

Year (Jan. 1)	Kentucky, east (Lexington)	Kentucky, west (Princeton)	Louisiana (Alexandria)	Maine, northeast (Eastport)	Maine, southwest (Portland)	Maryland (Baltimore)
	° ′	° ′	° ′	° ′	° ′	° ′
1750				12 05 W	8 34 W	3 05 W
60				11 53	8 15	2 16
70				11 53	8 10	1 52
80				12 05	8 10	1 25
90				12 26	8 15	1 05
1800	4 22 E	6 32 E	8 04 E	12 58	8 34	0 56
10	4 31	6 50	8 25	13 38	9 02	0 56
20	4 31	6 59	8 41	14 23	9 38	1 05
30	4 22	6 59	8 49	15 12	10 18	1 25
40	4 04	6 50	8 48	16 02	10 57	1 52
50	3 39	6 32	8 40	16 58	11 38	2 26
60	3 07	6 07	8 24	17 43	12 18	3 05
70	2 31	5 37	8 02	18 13	12 48	3 45
80	1 53	4 57	7 26	18 34	13 22	4 24
90	1 15	4 20	6 53	18 44	13 51	5 00
1900	0 41	3 51	6 33	19 02	14 21	5 35
05	0 32 E	3 44 E	6 40 E	19 14 W	14 36 W	5 51 W
Annual change in 1905	1′.0 decr.	0′.0	2′.0 incr.	2′.4 incr.	3′.0 incr.	3′.2 incr.

Year (Jan. 1)	Massachusetts, east (Boston)	Massachusetts, west (Pittsfield)	Michigan, north (Marquette)	Michigan, south (Lansing)	Minnesota, north (Northome)	Minnesota, south (Mankato)
	° ′	° ′	° ′	° ′	° ′	° ′
1750	7 46 W	6 21 W				
60	7 19	5 52				
70	7 00	5 31				
80	6 50	5 19				
90	6 50	5 17				
1800	7 01	5 25				
10	7 20	5 54				
20	7 47	6 08	6 42 E	4 10 E	10 27 E	11 20 E
30	8 22	6 41	6 42	4 04	10 44	11 36
40	9 04	7 21	6 28	3 46	10 50	11 42
50	9 48	8 05	6 02	3 20	10 44	11 36
60	10 28	8 43	5 25	2 46	10 27	11 20
70	11 01	9 17	4 38	2 04	9 59	10 54
80	11 32	9 58	3 47	1 17	9 17	10 22
90	12 02	10 25	2 58	0 32 E	8 33	9 32
1900	12 34	10 59	2 20	0 02 W	7 58	9 01
05	12 51 W	11 15 W	2 08 E	0 14 W	7 58 E	9 02 E
Annual change in 1905	3′.4 incr.	3′.2 incr.	1′.5 decr.	2′.0 decr.	1′.0 incr.	1′.0 incr.

Table giving the Secular Change of the Magnetic Declination in the United States.

Year (Jan. 1)	Mississippi (Jackson)	Missouri (Sedalia)	Montana, east (Forsyth)	Montana, west (Helena)	Nebraska, east (Hastings)	Nebraska, west (Alliance)
	° ′	° ′	° ′	° ′	° ′	° ′
1750						
60						
70						
80						
90						
1800	7 54 E					
10	8 13					
20	8 24	10 03 E			11 39 E	
30	8 28	10 13			11 57	
40	8 24	10 13	18 09 E	18 53 E	12 07	
50	8 13	10 04	18 27	19 18	12 07	15 27 E
60	7 57	9 46	18 36	19 36	11 59	15 27
70	7 31	9 24	18 36	19 45	11 41	15 18
80	6 55	8 44	18 21	19 34	11 10	14 50
90	6 21	8 02	17 53	19 23	10 31	14 20
1900	5 58	7 38	17 50	19 31	10 14	14 10
05	6 02 E	7 43 E	18 04 E	19 47 E	10 22 E	14 18 E
Annual change in 1905	1′.5 incr.	2′.0 incr.	2′.8 incr.	3′.2 incr.	2′.0 incr.	2′.5 incr.

Year (Jan. 1)	Nevada, east (Elko)	Nevada, west (Hawthorne)	New Hampshire (Hanover)	New Jersey (Trenton)	New Mexico, east (Santa Rosa)	New Mexico, west (Laguna)
	° ′	° ′	° ′	° ′	° ′	° ′
1750			8 02 W	4 43 W		
60			7 28	4 04		
70			7 03	3 31		
80			6 47	3 06		
90			6 42	2 50		
1800			6 49	2 45		
10			7 06	2 50		
20			7 32	3 06		
30			8 11	3 31		
40			8 56	4 04		
50	17 20 E	16 16 E	9 46	4 43	12 43 E	13 26 E
60	17 36	16 37	10 31	5 22	12 47	13 33
70	17 41	16 52	11 08	6 01	12 43	13 34
80	17 44	17 00	11 38	6 41	12 29	13 22
90	17 38	17 02	12 03	7 14	12 03	13 02
1900	17 49	17 17	12 31	7 49	11 59	13 02
05	18 04 E	17 33 E	12 46 W	8 06 W	12 11 E	13 14 E
Annual change in 1905	3′.0 incr.	3′.2 incr.	3′.0 incr.	3′.2 incr.	2′.5 incr.	2′.5 incr.

Table giving the Secular Change in the Magnetic Declination in the United States.

Year (Jan. 1)	New York, east (Albany)	New York, west (Elmira)	North Carolina, east (Newbern)	North Carolina, west (Salisbury)	North Dakota, east (Jamestown)	North Dakota, west (Dickinson)
	° ′	° ′	° ′	° ′	° ′	° ′
1750	7 35 W	4 40 W	0 18 W	1 31 E		
60	6 53	3 57	0 18 E	2 08		
70	6 17	3 18	0 50	2 42		
80	5 50	2 46	1 17	3 12		
90	5 34	2 24	1 35	3 34		
1800	5 28	2 13	1 44	3 48		
10	5 34	2 13	1 44	3 52		
20	5 50	2 24	1 35	3 48		
30	6 17	2 46	1 16	3 33		
40	6 53	3 18	0 50	3 10		
50	7 39	3 57	0 17 E	2 40	14 31 E	17 37 E
60	8 25	4 46	0 19 W	2 06	14 21	17 37
70	9 04	5 23	0 58	1 29	14 02	17 27
80	9 51	6 16	1 35	0 51	13 31	17 00
90	10 14	6 57	2 14	0 13 E	12 43	16 21
1900	10 48	7 37	2 51	0 23 W	12 24	16 10
05	11 06 W	7 51 W	3 06 W	0 33 W	12 35 E	16 23 E
Annual change in 1905	3′.5 incr.	2′.5 incr.	3′.0 incr.	2′.0 incr.	2′.2 incr.	2′.6 incr.

Year (Jan. 1)	Ohio (Columbus)	Oklahoma (Enid)	Oregon, east (Sumpter)	Oregon, west (Detroit)	Pennsylvania, east (Philadelphia)	Pennsylvania, west (Altoona)
	° ′	° ′	° ′	° ′	° ′	° ′
1750					4 47 W	
60					4 01	
70					3 19	
80					2 44	1 16 W
90					2 21	0 52
1800	3 13 E			16 05 E	2 08	0 37
10	3 22			16 43	2 09	0 31
20	3 22			17 22	2 22	0 37
30	3 13			18 01	2 47	0 52
40	2 53			18 38	3 21	1 16
50	2 24	11 13 E	19 15 E	19 12	4 04	1 48
60	1 50	11 08	19 40	19 41	4 46	2 26
70	1 14	10 56	19 58	20 06	5 32	3 06
80	0 37 E	10 33	20 09	20 24	6 16	3 50
90	0 02 W	9 54	20 11	20 32	6 50	4 28
1900	0 42	9 40	20 26	20 50	7 25	5 07
05	0 54 W	9 52 E	20 44 E	21 09 E	7 42 W	5 21 W
Annual change in 1905	2′.0 incr.	2′.4 incr.	3′.6 incr.	3′.8 incr.	3′.4 incr.	2′.5 incr.

Table giving the Secular Change of the Magnetic Declination in the United States.

Year (Jan. 1)	Rhode Island (Newport)	South Carolina (Columbia)	South Dakota, east (Huron)	South Dakota, west (Rapid City)	Tennessee, east (Chattanooga)	Tennessee, west (Huntingdon)
	° ′	° ′	° ′	° ′	° ′	° ′
1750	7 04 W	2 04 E				
60	6 37	2 41				
70	6 18	3 15				
80	6 08	3 44				
90	6 08	4 06				
1800	6 19	4 19			5 07 E	
10	6 38	4 24			5 16	
20	7 05	4 19			5 16	7 24 E
30	7 40	4 06			5 07	7 24
40	8 22	3 44	13 06 E		4 49	7 16
50	9 06	3 15	13 06	16 26 E	4 24	6 59
60	9 46	2 41	12 57	16 26	3 52	6 35
70	10 19	2 03	12 39	16 16	3 16	6 05
80	10 50	1 25	12 07	15 50	2 36	5 29
90	11 20	0 47	11 25	15 17	2 01	4 53
1900	11 52	0 11	11 07	15 07	1 30	4 24
05	12 09 W	0 02 E	11 16 E	15 15 E	1 22 E	4 20 E
Annual change in 1905	3′.4 incr.	1′.0 decr.	2′.0 incr.	2′.0 incr.	1′.0 decr.	0′.0

Year (Jan. 1)	Texas, east (Houston)	Texas, middle (San Antonio)	Texas, west (Pecos)	Texas, northwest (Floydada)	Utah (Salt Lake)	Vermont (Rutland)
	° ′	° ′	° ′	° ′	° ′	° ′
1750						7 43 W
60						7 09
70						6 44
80						6 28
90						6 23
1800						6 30
10						6 47
20	8 55 E					7 13
30	9 10	9 37 E	10 46 E			7 48
40	9 19	9 48	11 00			8 29
50	9 19	9 53	11 08	11 16 E	16 25 E	9 13
60	9 12	9 48	11 07	11 18	16 36	9 59
70	8 56	9 37	11 00	11 11	16 40	10 39
80	8 29	9 19	10 40	10 52	16 30	11 14
90	7 56	8 52	10 18	10 22	16 20	11 39
1900	7 44	8 43	10 17	10 16	16 28	12 08
05	7 53 E	8 55 E	10 30 E	10 28 E	16 42 E	12 26 W
Annual change in 1905	2′.0 incr.	2′.5 incr.	2′.8 incr.	2′.5 incr.	3′.0 incr.	3′.5 incr.

Table giving the Secular Change of the Magnetic Declination in the United States.

Year (Jan. 1)	Virginia, east (Richmond)	Virginia, west (Lynchburg)	Washington, east (Wilson Creek)	Washington, west (Seattle)	West Virginia (Charleston)	Wisconsin (Madison)
	° ′	° ′	° ′	° ′	° ′	° ′
1750	1 13 W					
60	0 37	0 08 E				
70	0 05 W	0 42				
80	0 20 E	1 11		17 19 E		
90	0 38	1 33		17 52	2 00 E	
1800	0 47	1 46		18 27	2 15	
10	0 47	1 51		19 04	2 20	
20	0 38	1 46		19 41	2 15	8 34 E
30	0 20 E	1 33		20 16	2 00	8 40
40	0 05 W	1 11		20 49	1 37	8 34
50	0 36	0 45	21 16 E	21 19	1 05	8 16
60	1 12	0 10 E	21 37	21 45	0 30 E	7 49
70	1 51	0 29 W	21 52	22 06	0 10 W	7 14
80	2 29	1 09	21 56	22 19	0 51	6 25
90	3 06	1 46	22 06	22 38	1 28	5 36
1900	3 40	2 22	22 22	22 58	2 06	5 01
05	3 56 W	2 37 W	22 38 E	23 14 E	2 20 W	4 55 E
Annual change in 1905	3′.0 incr.	2′.8 incr.	3′.2 incr.	3′.2 incr.	2′.6 incr.	0′.0

Year (Jan. 1)	Wyoming, east (Douglas)	Wyoming, west (Green River)
	° ′	° ′
1750		
60		
70		
80		
90		
1800		
10		
20		
30		
40		
50	15 51 E	16 45 E
60	15 59	16 58
70	15 59	17 02
80	15 47	16 54
90	15 24	16 36
1900	15 19	16 37
05	15 27 E	16 48 E
Annual change in 1905	2′.4 incr.	2′.8 incr.

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U. S. *Coast and geodetic survey.*

. . . Report of the superintendent of the Coast and geodetic survey, showing the progress of the work from July 1, 1905, to June 30, 1906. Washington, Gov't print. off., 1906.

230 p. 1 illus. 1 map and 9 prog. sketches in pocket. 30cm.

At head of title: Department of commerce and labor.

4 appendixes; nos. 3–4 also issued separately.

Contents of appendixes: 1. Details of field operations. 2. Details of office operations. 3. Results of magnetic observations made by the Coast and geodetic survey, between July 1, 1905, and June 30, 1906. By L. A. Bauer. 4. Distribution of the magnetic declination in the United States for January 1, 1905. By L. A. Bauer.

Distribution of the principal astronomic stations occupied by the U.S. Coast and Geodetic Survey for Latitude, Longitude and Azimuth to June 30, 1906.

U. S. Coast and Geodetic Survey

O. H. Tittmann, Superintendent

BASE MAP OF THE UNITED STATES

(Projected on intersecting cone)

Scale 1:7000000

Statute Miles 100 50 0 100 200 300 400

Kilometres 100 50 0 100 200 300 400 500 600 700 800

Explanation of Signs:
- Latitude Stations
- Longitude "
- Azimuth "
- Combination Stations

THE HORUS PETERS CO., WASHINGTON, D. C.

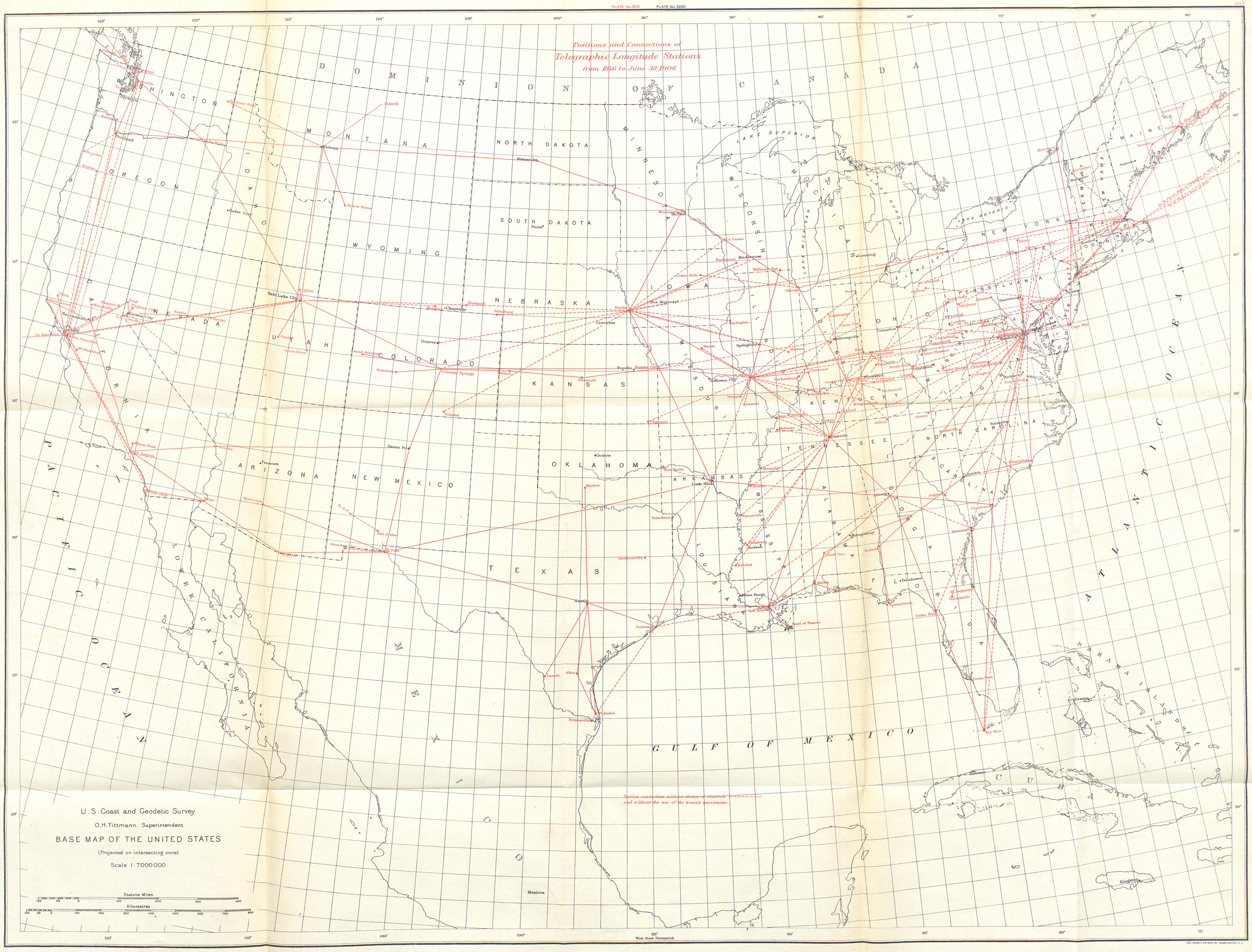
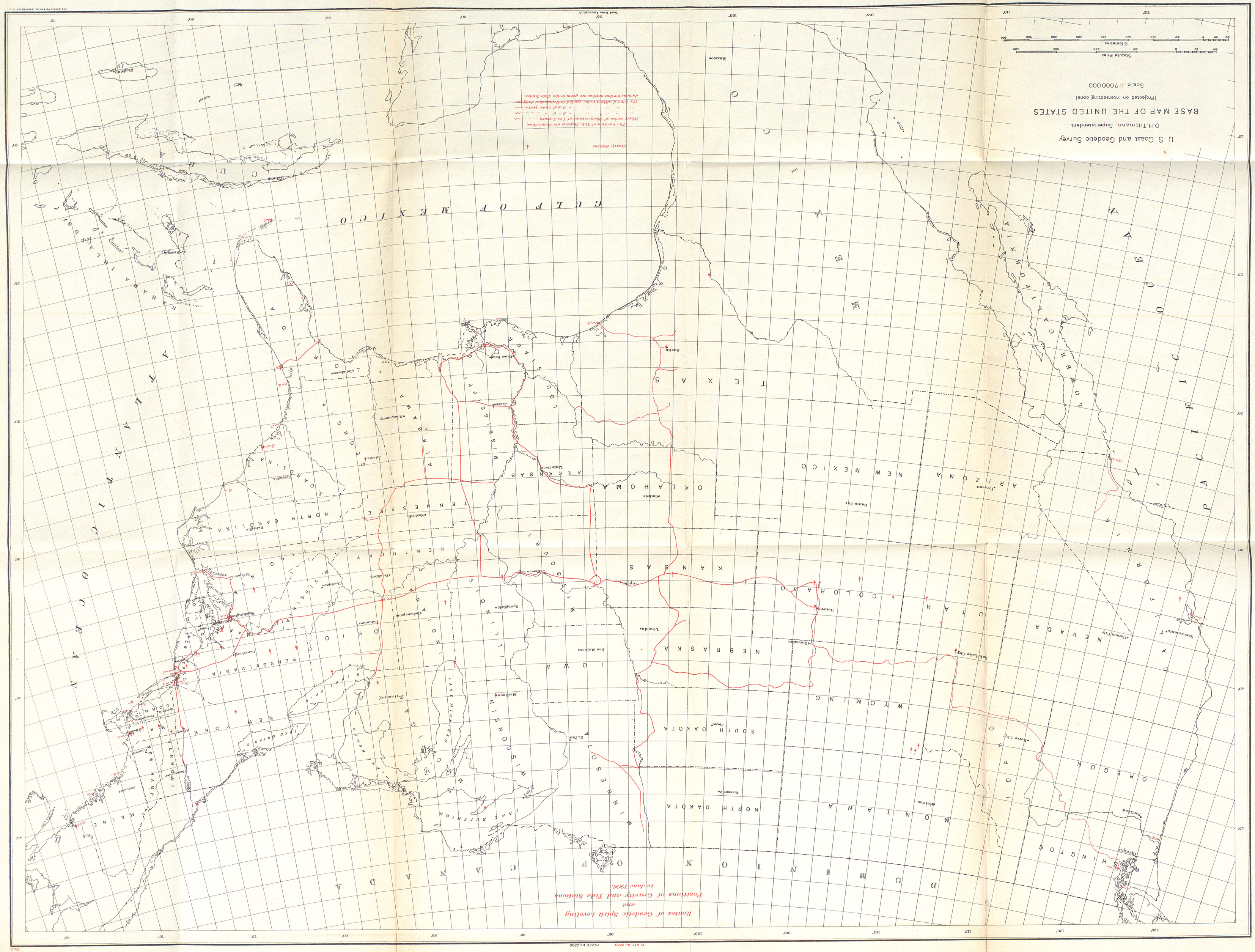


PLATE No. 2231
PLATE No. 2200
Positions and Connections of
Telegraphic Longitude Stations
from 1846 to June 30, 1906
DOMINION OF CANADA
WASHINGTON
OREGON
CALIFORNIA
NEVADA
IDAHO
MONTANA
WYOMING
UTAH
ARIZONA
COLORADO
NEW MEXICO
NORTH DAKOTA
SOUTH DAKOTA
NEBRASKA
KANSAS
OKLAHOMA
TEXAS
MINNESOTA
IOWA
MISSOURI
ARKANSAS
LOUISIANA
WISCONSIN
ILLINOIS
MICHIGAN
INDIANA
OHIO
KENTUCKY
TENNESSEE
MISSISSIPPI
ALABAMA
GEORGIA
FLORIDA
SOUTH CAROLINA
NORTH CAROLINA
VIRGINIA
WEST VIRGINIA
PENNSYLVANIA
NEW YORK
MAINE
NEW HAMP.
VERMONT
MASS.
CONN.
NEW JERSEY
DELAWARE
LAKE SUPERIOR
LAKE MICHIGAN
LAKE HURON
LAKE ERIE
LAKE ONTARIO
PACIFIC OCEAN
ATLANTIC OCEAN
GULF OF MEXICO
MEXICO
LOWER CALIFORNIA
BAHAMA ISLANDS
CUBA
Station connection without change of observers and without the use of the transit micrometer.
U. S. Coast and Geodetic Survey
O. H. Tittmann, Superintendent
BASE MAP OF THE UNITED STATES
(Projected on intersecting cone)
Scale 1:7000000
Statute Miles
Kilometres
West from Greenwich
THE HORRIS PETERS CO., WASHINGTON, D. C.


U.S. Coast and Geodetic Survey
O.H.Tittmann, Superintendent
BASE MAP OF THE UNITED STATES
(Projected on intersecting cone)
Scale 1:7000000
Statute Miles
Kilometres
Routes of Geodetic Spirit Leveling
and
Positions of Gravity and Tide Stations
to June 1906.
GULF OF MEXICO
ATLANTIC OCEAN
PACIFIC OCEAN
DOMINION OF CANADA
TEXAS
OKLAHOMA
KANSAS
NEBRASKA
SOUTH DAKOTA
NORTH DAKOTA
MONTANA
WYOMING
COLORADO
UTAH
NEVADA
ARIZONA
NEW MEXICO
CALIFORNIA
OREGON
WASHINGTON
IDAHO
MINNESOTA
IOWA
MISSOURI
ARKANSAS
LOUISIANA
MISSISSIPPI
ALABAMA
GEORGIA
FLORIDA
SOUTH CAROLINA
NORTH CAROLINA
TENNESSEE
KENTUCKY
VIRGINIA
OHIO
INDIANA
ILLINOIS
WISCONSIN
MICHIGAN
PENNSYLVANIA
NEW YORK
MAINE
VERMONT
NEW HAMP.
LAKE SUPERIOR
LAKE MICHIGAN
LAKE HURON
LAKE ERIE
LAKE ONTARIO
Gravity stations
The location of Tide Stations are shown thus:
Where series of Observations of 1 to 3 years
The letter d affixed to the symbol indicates that daily predictions for that station are given in the Tide Tables.
Mexico
Austin
Baton Rouge
Jackson
Little Rock
Guthrie
Santa Fe
Prescott
Denver
Cheyenne
Salt Lake City
Carson City
Sacramento
Boise City
Helena
Bismarck
Pierre
Des Moines
Lincoln
Topeka
Jefferson City
Springfield
Madison
St. Paul
Lansing
Columbus
Indianapolis
Frankfort
Charleston
Richmond
Washington
Harrisburg
Albany
Montpelier
Augusta
Concord
Portland
Olympia
Kingston
Nassau
Tallahassee
Montgomery
Atlanta
Columbia
Raleigh
Nashville
Cheyenne
Salt Lake City
Boise City
Portland
Sacramento
Kingston
Nassau
West from Greenwich
PLATE No. 2239
PLATE No. 2200

Positions of Magnetic Stations
occupied to June 30, 1906

U. S. Coast and Geodetic Survey
O. H. Tittmann, Superintendent

BASE MAP OF THE UNITED STATES

(Projected on intersecting cone)

Scale 1:7000000

Statute Miles 100 50 0 100 200 300 400

Kilometres 100 50 0 100 200 300 400 500 600 700 800

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LINES OF EQUAL MAGNETIC DECLINATION AND OF EQUAL ANNUAL CHANGE IN THE UNITED STATES FOR 1905

PLATE No. 1655

UNITED STATES
COAST AND GEODETIC SURVEY

SKETCH OF GENERAL PROGRESS

JUNE 30 1906

Eastern Sheet

Scale 5,000,000

Statute Miles

50 40 30 20 10 0 50 100 150 200

105° 100° 95° 90° 85° 80° 75° 70° 65°

50° 45° 40° 35° 30°

NORTH DAKOTA
SOUTH DAKOTA
NEBRASKA
KANSAS
OKLAHOMA
INDIAN TERRITORY
TEXAS
MINNESOTA
IOWA
MISSOURI
ARKANSAS
LOUISIANA
WISCONSIN
ILLINOIS
MICHIGAN
INDIANA
OHIO
KENTUCKY
TENNESSEE
MISSISSIPPI
ALABAMA
GEORGIA
FLORIDA
SOUTH CAROLINA
NORTH CAROLINA
VIRGINIA
WEST VIRGINIA
PENNSYLVANIA
NEW YORK
MAINE
VERMONT
NEW HAMPSHIRE
MASSACHUSETTS
RHODE ISLAND
CONNECTICUT
NEW JERSEY
MARYLAND
DELAWARE
DISTRICT OF COLUMBIA

LAKE SUPERIOR
LAKE MICHIGAN
LAKE HURON
LAKE ERIE
LAKE ONTARIO

ATLANTIC OCEAN

Axes of the Gulf Stream - Warmest Band

Buford
Bismarck
Grand Forks
Devils Lake
Duluth
Aberdeen
Watertown
Belle Fourche
Deadwood
Pierre
St. Paul
St. Peters
Chamberlain
Sioux Falls
Yankton
Sioux City
Alliance
North Platte
Julesburg
Columbus
Omaha
Lincoln
Des Moines
Davenport
Rock Island
Peoria
CHICAGO
Fond du Lac
Madison
Milwaukee
Dubuque
Keokuk
Quincy
Springfield
Colby
Atchison
Topeka
KANSAS CITY
Jefferson City
Scott
Dodge City
Wichita
Guthrie
Amarillo
Memphis
Little Rock
Helena
Texarkana
Greenville
Dallas
Fort Worth
Shreveport
Vicksburg
Montgomery
Birmingham
Atlanta
Macon
Savannah
Charleston
Columbia
Georgetown
Augusta
Wilmington
Raleigh
Newberne
Cape Hatteras
Nashville
Cairo
Evansville
Louisville
Frankfort
Lexington
Cincinnati
Terre Haute
Indianapolis
Fort Wayne
Logansport
Columbus
Zanesville
Cleveland
Toledo
Detroit
Saginaw
Grand Rapids
Lansing
Wheeling
Pittsburg
Harrisburg
Williamsport
Cumberland
Baltimore
Washington
Philadelphia
Fredericksburg
Richmond
Norfolk
Petersburg
Charlottesville
Lynchburg
Roanoke
Bristol
Knoxville
Chattanooga
Corinth
Jackson
Natchez
Meridian
Tuscaloosa
Selma
Pensacola
Mobile
New Orleans
Baton Rouge
Shreveport
Port Arthur
Galveston
Houston
Austin
San Antonio
Waco
Fort Worth
Abilene
Wichita Falls
Amarillo
Albuquerque
Santa Fe
Las Vegas
Trinidad
Pueblo
Colorado Springs
Denver
Cheyenne
Laramie
Rawlins
Rock Springs
Evanston
Ogden
Salt Lake City
Provo
Logan
Pocatello
Boise
Helena
Butte
Great Falls
Havre
Glasgow
Miles City
Billings
Livingston
Bozeman
Yellowstone Park
Cody
Lander
Casper
Douglas
Sheridan
Buffalo
Rochester
Syracuse
Albany
Utica
Binghamton
Elmira
Ithaca
Oswego
Watertown
Ogdensburg
Ottawa
MONTREAL
Toronto
Kingston
Poughkeepsie
Troy
Schenectady
Saratoga
Burlington
Rutland
Bennington
Springfield
Worcester
Boston
Providence
Hartford
New Haven
New London
Portland
Augusta
Bangor
Eastport
St. John
QUEBEC
Cape Sable
Cape Cod

T E X A S

O K L A H O M A

I N D I A N T E R R I T O R Y

A R K A N S A S

L O U I S I A N A

M I S S I S S I P P I

T E N N E S S E E

K E N T U C K Y

A L A B A M A

G E O R G I A

F L O R I D A

S. C A R O L I N A

N O R T H C A R O L I N A

V I R G I N I A

A T L A N T I C O C E A N

G U L F O F M E X I C O

M E X I C O

Y U C A T A N

C U B A

B A H A M A I S L A N D S

Austin
Galveston
Houston
Port Arthur
San Antonio
Eagle Pass
Port Lavaca
Corpus Christi
Laredo
Matamoros
Rio Grande
Monterey
Tampico
Vera Cruz
Coatzacoalcos
Campeche
Progreso
Cape Catoche
Frontera
Belize
C. San Antonio
HAVANA
Cienfuegos
Santiago de Cuba
Torrugos
Key West
Miami
Cape Canaveral
Tampa
Santa Gorda
Nassau
Cape Hatteras
Wilmington
Raleigh
Newberne
Charleston
Georgetown
Columbia
Savannah
Brunswick
Fernandina
Jacksonville
St. Augustine
Tallahassee
Pensacola
Mobile
Apalachicola
Keys
NEW ORLEANS
Baton Rouge
Natchez
Vicksburg
Jackson
Montgomery
Atlanta
Augusta
Macon
Birmingham
Chattanooga
Knoxville
Nashville
Memphis
Cairo
Helena
Little Rock
Texarkana
Shreveport
Dallas
Fort Worth
Greenville
Waco
Amarillo
Guthrie
MEXICO

EXPLANATION OF SYMBOLS

Primary Triangulation
Secondary Tertiary Triangulation
Reconnaissance
Surveyed Topography
do. In-shore Hydrography
do. Off-shore do.
Lines of Deep Sea Soundings
do. Geodetic Levelling

100° 95° 90° 85° 80° 75°
35° 30° 25° 20°

THE HORRIS PETERS CO., WASHINGTON, D. C.

PLATE No. 1654

UNITED STATES

COAST AND GEODETIC SURVEY

SKETCH OF GENERAL PROGRESS

JUNE 30 1906

Western Sheet

Scale 5,000,000

Statute Miles

50 40 30 20 10 0 50 100 150 200

EXPLANATION OF SYMBOLS

- Primary Triangulation
- Secondary, Tertiary } Triangulation
- Reconnaissance
- Surveyed Topography
- do. In-shore Hydrography
- do. Off-shore do.
- Lines of Deep Sea Soundings
- do. Geodetic Levelling

WASHINGTON
OREGON
CALIFORNIA
IDAHO
NEVADA
MONTANA
WYOMING
UTAH
COLORADO
ARIZONA
NEW MEXICO
NORTH DAKOTA
SOUTH DAKOTA
NEBRASKA
KANSAS
OKLAHOMA
TEXAS
MEXICO
PACIFIC OCEAN
GULF OF CALIFORNIA
LOWER CALIFORNIA

Vancouver, Cape Flattery, Whidbey, Port Townsend, Everett, Seattle, Tacoma, Olympia, Cowlitz, Coos Bay, Victoria, Portland, Salem, Toledo, Empire, Eugene City, Roseburg, Crescent City, Cape Mendocino, Eureka, Humboldt, Sacramento, Virginia City, Carson City, Placerville, San Francisco, Monterey, Pt. Conception, Santa Barbara, Los Angeles, San Diego, Guadalupe I., Cerros I., Cape San Lazaro, La Paz, Cape San Lucas, Mazatlan, San Blas, Cape Corrientes, Manzanilla, Tampico, Coos Bay, South Bend, Astoria, Cowlitz, North Yakima, Coulee City, Spokane, Pasco, Dalles, Umatilla, Walla Walla, Lewiston, Baker City, Boise, Shoshone, Pocatello, Logan, Ogden, Salt Lake City, Provo City, Nephi, Manti, Junction, Panguitch, Monticello, Durango, Kingman, Flagstaff, Holbrook, Prescott, Phoenix, Yuma, Tucson, Tombstone, Deming, Juarez, El Paso, Pecos, Presidio del Norte, Chihuahua, Cuaymas, Eagle Pass, Laredo, Roswell, Santa Fe, Albuquerque, Socorro, Amarillo, Shelby, Great Falls, Missoula, Helena, Lewistown, Glasgow, Buford, Miles City, Bismarck, Aberdeen, Pierre, Deadwood, Chamberlain, Yankton, Lander, Douglas, Rawlins, Green River, Alliance, Cheyenne, North Platte, Julesburg, Denver, Colby, Pueblo, Scott, Dodge City, Wichita, Guthrie, Fort Worth, Waco, Campasas, Austin, San Antonio, Rockport, Corpus Christi, Port Isavela, Matamoras, Rio Grande, Monterey, Sheridan, Bellefourche, Columbus, Yuma, Ver

115° 110° 105° 100°

45° 40° 35° 30° 25° 20°

115° 110° 105° 100° 95° 90°

50° 45° 40° 35° 30° 25° 20°

Spokane
Shelby
Glascow
Great Falls
Lewiston
Missoula
Bitford
Grand Forks
Lewistown
Helena
Bismarck
Duluth
Miles City
Virginia City
Aberdeen
Sheridan
Boise
Bellefourche
Watertown
St. Paul
Deadwood
Pierre
St. Peters
Shoshone
Pocatello
Chamberlain
Fond du Lac
Sioux Falls
Madison
Milwaukee
Lander
Douglas
Yankton
Dubuque
Logan
Sioux City
Rawlins
Alliance
Ogden
Green River
Des Moines
Davenport
Peoria
Salt Lake City
Cheyenne
Columbus
Omaha
Rock Island
Provo
Brush City
North Platte
Julesburg
Lincoln
Keokuk
Manti
Denver
Grand Junction
Leadville
Colby
Quincy
Springfield
Atchison
Topeka
KANSAS CITY
Canon City
Colorado Springs
Hutchinson
Salina
Jefferson City
Panguitch
Pueblo
Scott
Monticello
Dodge City
Wichita
Durango
Conejos
Trinidad
Cairo
Kingman
Flagstaff
Guthrie
Santa Fe
Prescott
Holbrook
Albuquerque
Amarillo
Memphis
Little Rock
Socorro
Roswell
Texarkana
Phoenix
Tucson
Greenville
Dallas
Dening
Fort Worth
Shreveport
Tombstone
Juarez
El Paso
Vicksburg
Jackson
Pecos
Waco
Natchez
Tampasas
Austin
Baton Rouge
Presidio del Norte
Houston
Port Arthur
NEW ORLEANS
San Antonio
Galveston
Chihuahua
Eagle Pass
Port Isabel
Guaymas
Rockport
Corpus Christi
Laredo
Monterey
Matamoras
Rio Grande
La Paz
Tampico
Cape San Lucas
Mazatlan
San Blas
Campeche
Cape Corrientes
Manzanilla
Vera Cruz
Frontera
Coatzacoalcos
MEXICO

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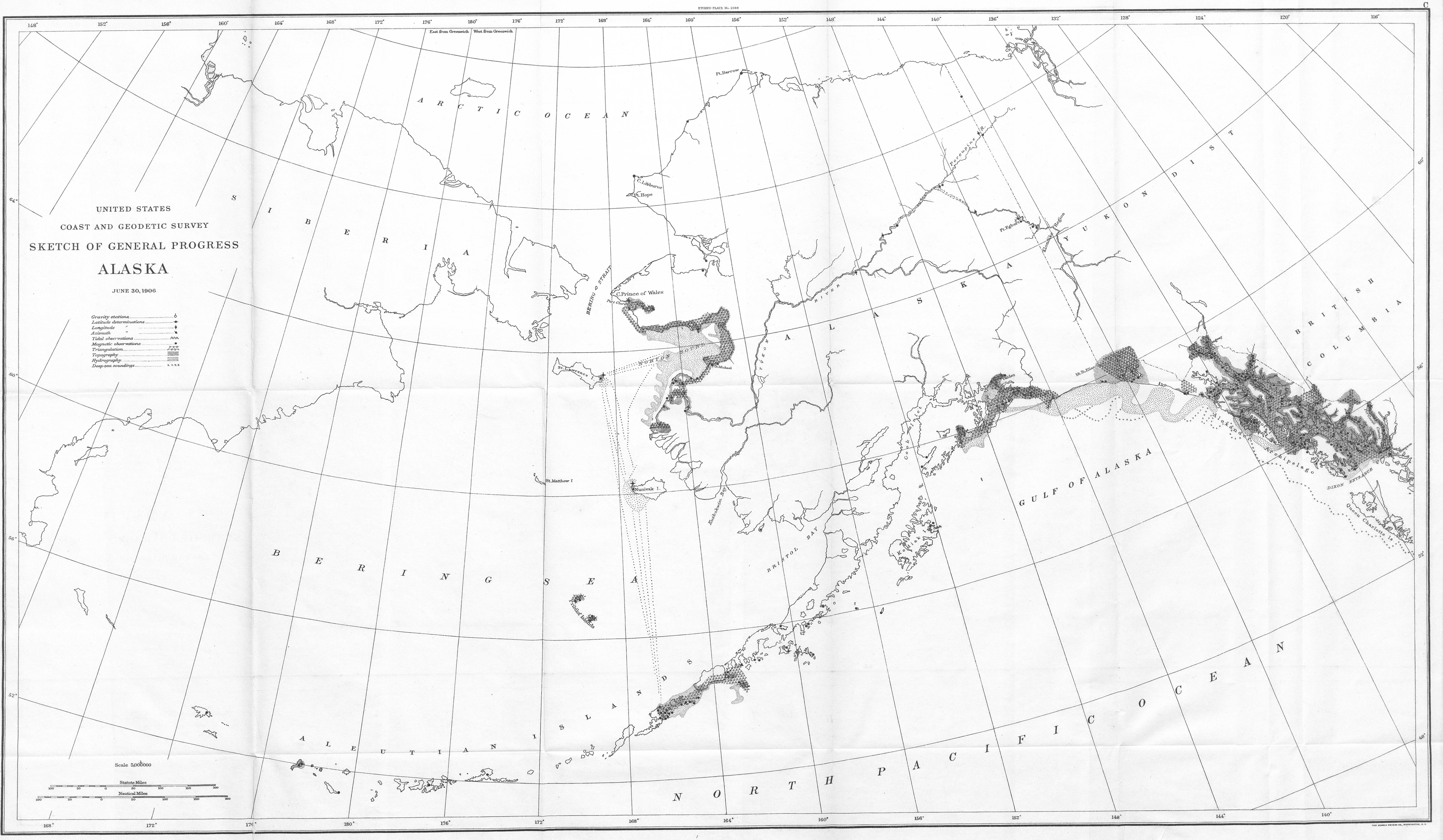
UNITED STATES
COAST AND GEODETIC SURVEY
SKETCH OF GENERAL PROGRESS
ALASKA
JUNE 30, 1906
Gravity stations
Latitude determinations
Longitude "
Azimuth "
Tidal observations
Magnetic observations
Triangulation
Topography
Hydrography
Deep sea soundings
Scale 1/5,000,000
Statute Miles
Nautical Miles
ARCTIC OCEAN
SIBERIA
BERING SEA
ALEUTIAN ISLANDS
NORTH PACIFIC OCEAN
GULF OF ALASKA
ALASKA
YUKON DIST
BRITISH COLUMBIA
BERING STRAIT
NORTON SOUND
BRISTOL BAY
DIXON ENTRANCE
Pt. Barrow
C. Lisburne
Pt. Hope
C. Prince of Wales
St. Lawrence I.
St. Matthew I.
Nunivak I.
Pribilof Islands
Kuskokwim Bay
Yukon River
Porcupine R.
Pt. Egbert
Klondike Region
Mt. St. Elias
Kodiak I.
Queen Charlotte Is.
East from Greenwich
West from Greenwich

GENERAL PROGRESS SKETCH

D.

161° 160° 159° 158° West of Greenwich 157° 156° 155°

22° 21° 20° 19°

KAUAI

Nihau

OAHU

Honolulu

MOLOKAI

Kaunakakai

Lanai

Kahului

MAUI

Kaupo Gap

Kaupo

Kahoolawe

HAWAII

Hilo

HAWAIIAN ISLANDS

(Hawaiian Government Surveys also shown.)

Triangulation

Topography

Hydrography

Deep Sea Sdgs. ++++

Longitude determination (telegraphic) ✝

30° 18°

Desecheo I.

San Juan

Fajardo

Culebra I.

St. Thomas

Mayaguez

Mona I.

Vieques I.

Ponce

Caja de Muertos I.

Guayanilla Bay

Jobos Bay

PORTO RICO

Primary triangulation

Secondary and tertiary triangulation

Topography

Hydrography

67°00′ 30′ West of Greenwich 66°00′ 30′ 65°00′

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Mercator projection $\frac{1}{5000000}$ *in lat. 13° N.*

THE NORRIS PETERS CO., WASHINGTON, D. C.