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REPORT OF THE SUPERINTENDENT

OF THE

U. S. COAST AND GEODETIC SURVEY

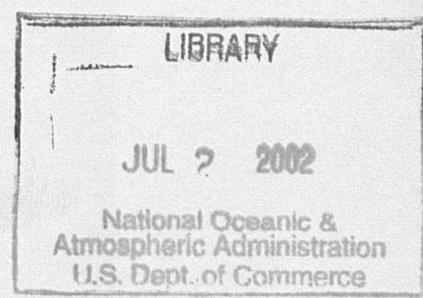
SHOWING

THE PROGRESS OF THE WORK

DURING THE

FISCAL YEAR ENDING WITH

JUNE, 1895.



WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1896.

National Oceanic and Atmospheric Administration

Annual Report of the Superintendent of the Coast Survey

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LETTER

FROM

THE SECRETARY OF THE TREASURY,

TRANSMITTING

The Report of the Superintendent of the United States Coast and Geodetic Survey, stating progress made in that work during the fiscal year ending June 30, 1895.

TREASURY DEPARTMENT, OFFICE OF THE SECRETARY,
Washington, D. C., December 9, 1895.

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 addressed to this Department by W. W. Duffield, Superintendent of the United States Coast and Geodetic Survey, showing the progress made in that work during the fiscal year ended June 30, 1895, and accompanied by maps illustrating the general advance in the operations of the Survey up to that date.

Respectfully, yours,

J. G. CARLISLE,
Secretary.

The VICE-PRESIDENT OF THE UNITED STATES,
AND PRESIDENT OF THE SENATE.

LETTER OF TRANSMISSION.

UNITED STATES COAST AND GEODETIC SURVEY,

Washington, D. C., December 8, 1895.

SIR: In conformity with law and the regulations of the Treasury Department I have the honor to submit herewith, for transmission to Congress, the Annual Report on the progress of the Coast and Geodetic Survey for the fiscal year ending June 30, 1895. It is accompanied by maps illustrating the general advance in the field work of the Survey up to that date.

Very respectfully, yours,

W. W. DUFFIELD,
Superintendent.

Hon. J. G. CARLISLE,
Secretary of the Treasury.

REPORT OF THE SUPERINTENDENT
OF THE
U. S. COAST AND GEODETIC SURVEY
FOR THE FISCAL YEAR ENDING JUNE 30, 1895.

IN TWO PARTS.

PARTS I AND II.

PREFATORY NOTE.

In this report of the fiscal year 1895 the division into two parts has been retained, but both parts are published in one volume. The octavo form for Part II, while possessing some advantages, has been found unsuitable for some of the scientific and professional papers, especially those requiring extended tables, and the quarto form is therefore readopted.

Part I contains the historical portion. It presents abstracts of progress in field and office work, gives estimates for future work, and a statement of expenditures during the fiscal year.

Part II contains the Appendixes which relate to the methods, discussions, and results of the Survey, with such illustrations as are required.

The usual maps and progress sketches, showing in detail the localities and scope of the field operations, accompany the report; they belong properly to Part I, but for convenience follow after Part II. The illustrations accompany the Appendixes to which they respectively belong.

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REPORT.

PART I.

INTRODUCTORY STATEMENT.

During the fiscal year 1895 upward of seventy-five parties were actively engaged on the various branches of the field work of the Survey, and these were widely distributed, their fields of operation embracing the Atlantic, Gulf, and Pacific coasts, Alaska, and the interior of the country. Work was carried on within the limits or on the coasts of sixteen States and Territories along the seaboard and in nine States and Territories in the interior. It included reconuissance, base-line measures, triangulation, topography, hydrography, physical hydrography, time, latitude, longitude, and azimuth determinations, boundary-line surveys, geodetic leveling, magnetic declination, dip and intensity observations, laying out of meridian lines, gravity determinations, tidal and current observations, oyster-bed surveys, etc.

Among the works of special importance may be mentioned the completion of the topographic and hydrographic resurvey of Boston Harbor and vicinity; the continuation of the Hudson River survey; the beginning of the topographic and hydrographic resurvey of Buzzards Bay; geodetic and other leveling in various sections of the country; the continuation of the hydrographic surveys in Nantucket Sound; and hydrographic examinations in Long Island Sound and Delaware and Chesapeake bays; the continuation of telegraphic longitude determinations, principally in the southwest; the completion of the resurvey of Pensacola Bay and its tributaries; the continuation of the transeontinental triangulation in Colorado; the continuation of the oblique arc in Alabama; furnishing points in aid of State surveys in Tennessee, Kentucky, New Jersey, and Minnesota; surveys in the vicinity of Charleston, S. C.; the completion of the reconuissance of the Rio Grande from its mouth to El Paso; and progress made in the regular Alaskan hydrographic surveys; in the preliminary surveys for the location of the boundary line between southeastern Alaska and British Columbia; in the survey of the California and Nevada oblique boundary line, and in the topographic and hydrographic resurvey of San Francisco Bay and Harbor.

For the United States Commissioner of Fish and Fisheries a further examination was made relative to the natural oyster beds of Mobile Bay and vicinity, and the similar work carried on in the waters of Virginia at the request of the State authorities was brought to a completion.

In the general statement of progress given on the following pages will be found a reference to each piece of work executed during the year, and in Table No. 1 the same information is given in more condensed form. Under the heading "Abstracts of reports from field parties" will be found a detailed account of the operations of each party and a statistical statement of results accomplished. Similar abstracts of the office reports are given, and also a statement of the expenditures made under each head of appropriation during the fiscal year. The usual progress sketches, showing graphically the condition of the work in all parts of the country, will be found at the close of the volume.

Detailed estimates for the conduct of the work during the fiscal year 1897, and a letter explaining the same, will be found in their appropriate places.

SPECIAL APPOINTMENTS AND SERVICE.

In accordance with provisions of law, one of the Assistants of the Survey has continued to serve as a member of the Mississippi River Commission, and another, by appointment of the President, is a member of the International Boundary Commission organized for the location of that part of the United States and Mexican boundary line extending from El Paso to the Pacific. During a portion of the fiscal year, however, the officer assigned to this duty was temporarily relieved, and reported to the Superintendent for regular service in the Coast and Geodetic Survey.

At the request of the honorable Secretary of the Navy, two Assistants were temporarily detailed, one for special triangulation in connection with the laying out of a speed trial course in Long Island Sound, and the other for a survey on a large scale of the vicinity of the dry dock at Port Orchard, Puget Sound.

The detail of an officer for the survey of the Virginia oyster beds, at the request of the governor of the State, was continued during a part of the year, or until the completion of the work, and another was detailed for a short time, at the request of the United States Commissioner of Fish and Fisheries, to make further examination of the oyster beds in Mobile Bay and vicinity. Also, an Assistant was detailed, at the request of the governor and legislature of Virginia, to make a special survey of the Fox islands, Chesapeake Bay. The detail of an Assistant for the Massachusetts triangulation and town boundary survey also continued during the greater part of the fiscal year. Notices more in detail of the work of these officers will be found under the heading "Special operations," toward the close of Part I of this report, and under the same heading summaries of the operations of parties engaged on the Alaska-British Columbia boundary surveys will be given.

OFFICE OF STANDARD WEIGHTS AND MEASURES.

The special operations of this office have been carried on during the year, and the usual amount of work has been done for other Departments of the Government, and for States, colleges, surveyors, manufacturers, and others.

The final comparisons of the weights and measures for the States of North and South Dakota have been completed, and the sets were forwarded to their respective destinations in June. The new Rueprecht balance has been mounted on a suitable pier and a careful test of its accuracy was made, with very satisfactory results; but unfortunately the room in which it is mounted is not well adapted for the purpose, being so damp that it is feared the balance will suffer if a more suitable room is not soon provided.

Further comparisons of the "Committee metre" and "Prototype No. 21" have been made, and although the results are very accordant, there is still a small outstanding discrepancy that is not accounted for. The relation between the two standards will be redetermined by another method as soon as opportunity offers.

The densities and masses of the "X" set of gramme weights have been determined, and the results are given in the report of the Assistant in charge of weights and measures. A tabular statement of the work done by the weights and measures office for other branches of the Government, and for outside parties, and of information furnished during the year, accompanies the same report.

ARRANGEMENT OF THIS REPORT.

The contents of Part I, Report for 1895, are arranged in the following order:

Introductory statement, including notice of special appointments and service; Statement relative to the work of the Office of Standard Weights and Measures; Arrangement of this report, and geographical order and classification of localities of field work; General statements of progress in field and office work, including notices of publications of the Survey during the year; Explanation of estimates for the fiscal year 1897, and the estimates themselves in detail; Abstracts of reports from field parties, and of reports of special operations; Abstracts of office annual reports; Notices of the suboffices of Philadelphia and San Francisco; Supplementary tables, viz, No. 1,

Showing the distribution and personnel of field parties of the Survey; No. 2, Giving statistics of field and office work; No. 3, giving list of information furnished during the year in reply to official and personal calls; Office annual reports, viz, No. 1, Report of the Assistant in charge of the Office, accompanied by reports of the various chiefs of divisions; No. 2, Report of the hydrographic inspector; No. 3, Report of the disbursing agent; No. 4, Report of the Assistant in charge of the Office of Standard Weights and Measures; List of maps and progress sketches to illustrate the work, and the maps and sketches themselves at the end of the volume.

Part II contains the Appendixes and their illustrations, the Appendixes being professional and scientific papers relating to methods, discussions, and results of the Survey.

GEOGRAPHICAL CLASSIFICATION OF LOCALITIES OF FIELD WORK.

The geographical classification of localities adopted in 1891 is still continued in this Report, viz:

- I. The Eastern Division, including all States east of the Mississippi River.
- II. The Middle Division, comprising the States and Territories between the Mississippi River and the Rocky Mountains.
- III. The Western Division, embracing the States and Territories between the Rocky Mountains and the Pacific Ocean.
- IV. The Division of Alaska, including Alaska and the Aleutian and Pribilof islands.

GENERAL STATEMENT OF PROGRESS.

FIELD WORK.

EASTERN DIVISION.—*States east of the Mississippi River.*—Within the limits or off the coasts of the States east of the Mississippi River the following-named operations were begun, continued, or completed during the fiscal year 1895: Topographic and hydrographic survey of Boston Harbor and vicinity, completed; topographic and hydrographic resurvey of Buzzards Bay, Massachusetts, begun and progress made; hydrographic survey of Nantucket Sound, completed; physical hydrography of the north shore of Nantucket Island, continued; determination of town boundaries in Massachusetts, continued; magnetic observations made at Nantucket, Massachusetts; hydrographic resurveys and special developments on the coast of Massachusetts, including the survey of Salem Harbor; hydrographic examinations in Long Island Sound, completed; hydrographic surveys and examinations in Narragansett Bay and vicinity, completed; topographical survey of the Hudson River and triangulation incident thereto, continued; line of levels from Albany to Dobbs Ferry, completed; additional triangulation on Long Island, at the request of the honorable Secretary of the Navy, for use in laying out a speed-trial course for naval vessels, completed; tidal observations at Newport, completed; topographical resurvey of the south shore of Long Island, continued; tidal observations at Fort Hamilton and Willets Point, New York Harbor, continued; triangulation in southeastern New Jersey, continued; magnetic declination, dip and intensity determinations at Sandy Hook, New Jersey, completed; hydrographic examinations in Chesapeake Bay, completed; hydrographic examination in the vicinity of the Delaware Breakwater, completed; cadastral survey of the Naval Observatory Reservation in the District of Columbia, completed; magnetic declination, dip and intensity determinations at Cape Henry, Virginia, completed; special survey of the Fox islands, Chesapeake Bay, at the request of the governor of Virginia, completed; line of precise levels from Richmond, Va., to Washington, D. C., completed; survey of the natural oyster beds of Virginia, completed; topographic and hydrographic survey of Charleston Harbor and the Cooper and Ashley rivers, completed; magnetic declination, dip and intensity determinations at Charleston, S. C., completed; topographical resurvey of Pensacola Bay and its tributaries, completed; hydrographic resurvey of Pensacola Bay and its tributaries, continued; magnetic declination, dip and intensity determinations at Savannah, Ga., completed; reconnaissance, opening lines, and signal building for the extension of the primary triangulation in Alabama to the Gulf of Mexico, continued; redetermination of water densities in Mobile Bay and vicinity, in connection with the oyster-bed survey made for the United States Commission of Fish and Fisheries, completed; occupation of stations in northeastern Tennessee and southeastern Kentucky for the extension of the triangulation of those States to connect with the primary triangulation to the eastward, continued; relative gravity determinations at Washington, D. C.; Deer Park, Md.; Cleveland and Cincinnati, Ohio; Terre Haute, Ind., and Chicago, Ill., completed.

MIDDLE DIVISION.—*States and Territories between the Mississippi River and the Rocky Mountains.*—Within the limits of the Middle Division the following operations were in progress or completed during the fiscal year:

Telegraphic longitude determinations at New Orleans, La., and Austin, Galveston, Laredo, and El Paso, Tex., and the determination of the magnetic elements at the same points, in progress; determinations of the relative force of gravity by means of half-second pendulums at New Orleans, La., and Austin, Galveston, Laredo, and El Paso, Tex., in progress; triangulation and topography

in Minnesota in the vicinity of the cities of St. Paul and Minneapolis, continued; photographic magnetic record at the Magnetic Observatory near San Antonio, Tex., and the monthly absolute determinations at the same place, completed (the series at this point is not so long as is desirable or as was at first contemplated, but the necessity for redetermining the magnetic elements at many other points in order to correct the magnetic information given on the Coast and Geodetic Survey chart compelled the discontinuance of the observatory in April, as the appropriations for magnetic work were too limited to accomplish both objects); reconnaissance of the Rio Grande from its mouth to El Paso, Tex., completed; precise leveling on the line from the Gulf of Mexico to Kansas City, Mo., continued and completed; determinations of relative gravity at St. Louis, Mo., Kansas City, Mo., Ellsworth, and Wallace, Kans., completed; latitude determinations at Laredo, Galveston, and Austin, Tex., completed; reconnaissance for a scheme of triangulation from El Paso, Tex., to the Gulf of Mexico, completed.

WESTERN DIVISION.—*States and Territories west of the Rocky Mountains.*—Within the limits of the Western Division the following operations were in progress or completed during the fiscal year:

Topographic and hydrographic resurvey of San Francisco Bay and Harbor, in progress; tidal record at Sausalito tidal station, continued; telegraphic determinations of differences of longitude at Needles, Cal., and Santa Fe, N. Mex., completed; latitude determination at Needles, and magnetic determinations at Needles and Santa Fe, completed; determination of the magnetic elements at Lake Tahoe, California, and Carson City, Nev., completed; determination of the magnetic elements at various stations in Oregon and Washington, completed; hydrographic surveys in Washington Sound and Straits of Fuca, continued; triangulation and topography of Washington Sound, continued; hydrographic surveys off the coast from Grays Harbor to Quillayute River, completed; hydrographic examination of the water front and harbor of Tacoma, Wash., completed; gravity determinations at various stations in Colorado, Wyoming, and Utah, completed; laying out of a meridian line at Colorado Springs, completed; continuation of the great scheme of transcontinental triangulation in Colorado.

DIVISION OF ALASKA.—In this division, which includes the coasts of Alaska bordering upon the Pacific Ocean, Bering Sea, and the Arctic Ocean, with the sounds, bays, inlets, and rivers, the following field operations were in progress or completed:

Hydrographic surveys of Chatham Strait from Point Augusta to Point Samuel, the west end of Kenasnow Island and Freshwater Bay, Tenakee Inlet (Siwash Passage), and the north end of Hoods Bay, including Killisnoo Harbor, completed; hydrographic and general surveys in Chatham Strait, Hootznahoo or Kootznahoo Inlet and Peril Strait, in progress; transportation of chronometers between astronomical stations, in connection with the astronomical observations of the Alaska boundary survey parties; tidal observations at Sitka continued and completed. (For the continuation of the Alaska boundary surveys, see under head of "Special operations.")

SPECIAL OPERATIONS.—Under this head are included operations undertaken by special authority of Congress or at the request of other Departments of the Government or of State authorities, and the following were in progress or completed during the fiscal year:

Determination of geographical positions for the establishment of a speed-trial course for naval vessels in Long Island Sound, completed (this was done at the request of the honorable Secretary of the Navy); establishment of the Naval Observatory Circle, radius of 1 000 feet, completed (by order of Congress; joint resolution approved August 1, 1894); special survey of the Fox islands, Chesapeake Bay, completed; surveys for the State of Virginia for the mapping of the natural oyster beds, completed; survey of the oyster beds of Mobile Bay and vicinity, for the United States Commission of Fish and Fisheries, completed; operations of the International Boundary Commission for the relocation and marking of the boundary line between the United States and Mexico, from El Paso to the Pacific Ocean, continued; survey of the oblique boundary line between the States of California and Nevada, continued; Alaska boundary surveys, including the various operations of triangulation, astronomical observations, topography, base measurement, etc., continued in various localities, viz, triangulation and topographic reconnaissance of Chilkat and Taiya inlets; topographic reconnaissance to the northward and eastward of Taiya Inlet and River; topographic reconnaissance to the northward and westward of Chilkat Inlet and River;

topographic reconnaissance of Chilkat and Chilkoot inlets; astronomical determinations at Marys Island, the head of Portland Canal and Port Simpson; triangulation of Portland Canal from its head to Port Simpson; transportation of chronometers between the astronomical station at Seattle, Wash., and the various astronomical stations in Alaska, for the determination of the longitude of the latter; triangulation and base measurements between Marys Island and Port Simpson; astronomical observations at Seattle in connection with the Alaska boundary surveys.

Reference to reports made by the officers in charge of the various parties will be found in the body of the report under the appropriate division headings.

OFFICE WORK.

The annual report of the Assistant in charge of the Office, which is accompanied by the reports of the chiefs of the several divisions of the Office, is published as Office Report No. 1, toward the close of Part I, and presents in concise form a statement of the progress made and the results accomplished during the fiscal year. In Office Report No. 2 is given the annual report of the hydrographic inspector and of the divisions under his charge. Abstracts of these reports follow the abstracts of reports of the field parties. Office Report No. 3 contains the report of the disbursing agent, and a statement of the expenditures of the United States Coast and Geodetic Survey and of the Office of Standard Weights and Measures during the fiscal year. Office Report No. 4 contains the report of the Assistant in charge of the Office of Standard Weights and Measures, and is accompanied by an abstract of the verifications made during the year.

NOTICES TO MARINERS.

The prompt publication of discoveries and developments made in the progress of the operations of the Survey has undoubtedly been of great service to navigation and the interests of commerce. In the Notices to Mariners, published monthly during the year, information is given relative to changes in aids to navigation, new dangers discovered, new life-saving stations established, changes of depths of channels and harbor approaches, and generally to all matters of interest to the mariner. Each notice contains also the titles of new charts or new editions of old charts, and a list of all charts cancelled. During the year, 114 000 copies of Notices to Mariners were printed for free distribution. They are sent to the several chart agencies of the Survey, in the principal ports of the United States, to United States custom-houses, to the branch hydrographic offices of the Navy Department in the various seaports, to United States consulates in foreign ports, and are supplied at these places to all applicants, as also at the offices of the Survey, in Washington, San Francisco, and Philadelphia.

BULLETINS.

Professional papers of the Survey which seem to demand immediate publication are given to the public in abridged form as bulletins and are subsequently published in full as Appendixes to the Annual Report. Four bulletins were published during the year, as follows:

Bulletin No. 31: Legal Units of Electrical Measure in the United States.

Bulletin No. 32: The Constant of Aberration as determined from Observations of Latitude at San Francisco, Cal.

Bulletin No. 33: The Direction and Intensity of the Earth's Magnetic Force at San Francisco, Cal.

Bulletin No. 34: Distribution of the Magnetic Declination in Alaska and adjacent Waters for the Year 1895.

Other publications of the Survey during the year will be found enumerated in the Report of the Chief of the Miscellaneous Division.

EXPLANATION OF ESTIMATES.

The estimates submitted to the Secretary of the Treasury for the fiscal year 1897 were accompanied by the following explanations:

TREASURY DEPARTMENT,
OFFICE OF THE COAST AND GEODETIC SURVEY,
Washington, D. C., September 20, 1895.

SIR: I have the honor to transmit herewith the estimates of appropriations required for the service of the United States Coast and Geodetic Survey and Office of Construction of Standard Weights and Measures for the fiscal year ending June 30, 1897.

The amount asked for "field expenses" is \$169 000, as against \$110 500 appropriated for 1895-96, an increase of \$58 500. An increase of appropriation under this head is necessary for the rapid and economical prosecution of surveys urgently demanded in the interest of commerce along our coasts, and for the advancement of other important field operations of the Survey. With a less amount the parties of the Survey can not be employed to full advantage, as it is possible for them to remain in the field only for a portion of the available working months, while the expense of fitting out and transporting parties to the field and return is the same for a short as for a long season. The vessels engaged in the hydrographic portions of the work should be employed almost continuously to keep pace with the demand for surveys and examinations in various important localities, but this will be impracticable with the amount appropriated for the current year.

The original survey of the Chesapeake Bay was made many years ago, and since then the erosive action of the tides has washed away entire points, eaten into the shore and deposited the material into the channel, so that neither the shore lines nor depths of water shown upon the charts of this bay agree with the true condition of affairs at the present time. These charts are therefore defective and misleading, and hence the necessity of an entire resurvey of Chesapeake Bay.

An item of \$5 000 has been inserted for continuing the boundary survey between Alaska and British Columbia and the Northwest Territory.

An appropriation of \$50 000 is also asked to commence the construction of a new vessel for work on the coast of Alaska and among the Aleutian Islands. A suitable vessel for this work is urgently needed to replace the Coast and Geodetic Survey steamer *Hassler*, which has recently been condemned as unfit for further service.

The item for repairs of vessels is \$25 000 as against \$38 000 for the current year, a decrease of \$13 000.

The items of the estimate for pay of field force are identical with those of the appropriation for 1895-96, except that an addition of \$1 500 is asked for the pay of temporary aids. A slight increase in the number of those employed under this designation will be advantageous in enabling the Survey to secure the service of qualified young men who are willing to remain permanently in the service with the hope of advancement to a higher grade.

In the appropriation for pay of office force, an addition of \$200 per annum to the pay of one of the carpenters is asked. The master carpenter originally received \$1 600 per annum which the last appropriation reduced to \$1 200. The present incumbent is a skillful joiner, as well as carpenter, and as the duties of this position deserve a higher compensation than those now paid, an increase from \$1 200 to \$1 400 has been recommended.

It is proposed to increase the force of copper plate engravers by the addition of one at \$1 400 and one at \$1 000, and to increase the appropriation for extra engravers by the amount of \$100.

The paragraph under the head of "office expenses," containing an item for extra engraving, is reduced, however, by the amount of \$2 500, as the proposed increase of force will lessen the amount of extra engraving to be done under contract.

Under the paragraph for "Electrotypers and photographers, plate printers and their helpers," etc., it is proposed to increase the pay of four employees from \$1 000 to \$1 100 each, and the pay of four employees from \$700 to \$750 each. The pay of these employees has been reduced by former appropriations below the standard paid for the same character of work elsewhere, and the rates herein recommended are not yet up to the full standard rates.

In the force of computers it is recommended that one be increased from \$1 200 to \$1 600, and one from \$1 400 to \$1 600, in order that the rates of pay may conform more nearly to the value of the services performed by individuals.

It is believed that these increases will add considerably to the efficiency of the office force.

The items of the estimates for Office of Construction of Standard Weights and Measures are the same as those of the appropriation for the current year, except that an increase of \$300 is asked in the salary of the adjuster, whose services are well worth the increased amount recommended.

Respectfully, yours,

W. W. DUFFIELD,
Superintendent.

The SECRETARY OF THE TREASURY,
Washington, D. C.

ESTIMATES FOR THE FISCAL YEAR ENDING JUNE 30, 1897.

For every expenditure requisite for and incident to the survey of the Atlantic, Gulf, and Pacific coasts of the United States and the coast of the Territory of Alaska, including the survey of rivers to the head of tide water or ship navigation; deep-sea soundings, temperature, and current observations along the coast and throughout the Gulf Stream and Japan Stream flowing off the said coasts; tidal observations; the necessary resurveys; the preparation of the Coast Pilot; continuing researches, and other work relating to terrestrial magnetism and the magnetic maps of the United States and adjacent waters, and the tables of magnetic declination, dip and intensity usually accompanying them; and including compensation not otherwise appropriated for, of persons employed in the field work, in conformity with the regulations for the Government of the Coast and Geodetic Survey adopted by the Secretary of the Treasury; for special examinations that may be required by the Light-House Board or other proper authority, and including traveling expenses of officers and men of the Navy on duty; for commutation to officers of the field force while on field duty, at a rate to be fixed by the Secretary of the Treasury, not exceeding \$2.50 per day each; outfit, equipment, and care of vessels used in the Survey, and also the repairs and maintenance of the complement of vessels; to be expended in accordance with the regulations relating to the Coast and Geodetic Survey from time to time prescribed by the Secretary of the Treasury and under the following heads: *Provided*, That no advance of money to chiefs of field parties under this appropriation shall be made unless to a commissioned officer or to a civilian officer who shall give bond in such sum as the Secretary of the Treasury may direct:

FOR FIELD EXPENSES:

For survey of unfinished portions of the Atlantic Coast from Maine to Florida, including Portsmouth Harbor and Piscataqua River, Hudson River to Troy, and for the necessary resurveys including the coast from Lynn to Cape Ann, the shores of Marthas Vineyard, and Nantucket Sound, approaches to New Bedford, Buzzards Bay, Chesapeake Bay, and tributaries and Savannah River Bar.....	\$30 000
To continue the primary triangulation from the vicinity of Montgomery toward Mobile, and for triangulation, topography, and hydrography of unfinished portions of the Gulf Coast, including Lake Pontchartrain and Sabine Lake, and for the necessary resurveys.....	10 000
For offshore soundings along the Atlantic and Gulf coasts, and current and temperature observations in the Gulf Stream.....	8 000
For triangulation, topography, and hydrography of the coasts of California, Oregon, and Washington and for necessary resurveys, San Francisco Harbor, triangulation, topography, and hydrography.	25 000

FOR FIELD EXPENSES—Continued.

For continuing explorations in the waters of Alaska and making hydrographic surveys in the same, including survey of the Aleutian Islands and examination of the mouth of Yukon River, and for the establishment of latitude, longitude, and magnetic stations.....	\$20 000
For continuing the boundary survey between Alaska and British Columbia and the Northwest Territory.....	5 000
For continuing the researches in physical hydrography relating to harbors and bars, including computations and plattings, and for tidal and current observations on the Atlantic, Gulf, and Pacific coasts.....	10 000
For examination of reported dangers on the Atlantic, Gulf, and Pacific coasts, and to continue the compilation of the Coast Pilot and to make special hydrographic examinations, and including the employment of such pilots and nautical experts in the field and office as may be necessary for the same.....	5 000
To continue magnetic observations in all parts of the United States.....	2 500
For continuing the line of exact levels between the Atlantic, Pacific, and Gulf coasts.....	2 500
For furnishing points to State surveys, to be applied as far as practicable in States where points have not been furnished; and for surveying and distinctly marking with permanent monuments that portion of the eastern boundary of the State of California commencing at and running south-eastward from the intersection of the thirty-ninth degree of north latitude with the one hundred and twentieth degree of longitude west from Greenwich, and for the primary triangulation along the Rio Grande.....	20 000
For determinations of geographical positions and to continue gravity observations.....	3 500
For continuing the transcontinental geodetic work on the line between the Atlantic and Pacific oceans, and for beginning the measurement of a meridian arc in about longitude 98° west of Greenwich..	18 000
For traveling expenses of officers and men of the Navy on duty, and for any special surveys that may be required by the Light-House Board or other proper authority, and contingent expenses incident thereto.....	3 500
For objects not hereinbefore named that may be deemed urgent, including the actual necessary expenses of officers of the field force temporarily ordered to the office at Washington for consultation with the Superintendent, to be paid as directed by the Superintendent, in accordance with the Treasury regulations.....	6 000
[For contribution to the International Geodetic Association for the Measurement of the Earth, \$550, or so much thereof as may be necessary, to be expended through the office of the American Embassy at Berlin; and for expenses of the attendance of the American delegate to the general conference of said association, \$550, or so much thereof as may be necessary: <i>Provided</i> , That such contribution and expenses of attendance shall be payable out of the item "for objects not named;" and 20 per cent of the foregoing amounts shall be available interchangeably for expenditure on the objects named.]	
In all, for field expenses.....	<u>169 000</u>
FOR REPAIRS AND MAINTENANCE OF VESSELS:	
For repairs and maintenance of the complement of vessels used in the Coast and Geodetic Survey, including the traveling expenses of the person inspecting the repairs.....	25 000
FOR A NEW STEAMER FOR USE IN ALASKA:	
For constructing a steamer under the direction of the Secretary of the Treasury for service in Alaska and the Aleutian Islands.....	<u>50 000</u>
[And the Secretary of the Treasury is hereby authorized to contract for building said vessel at a cost not to exceed \$125 000.]	
SALARIES COAST AND GEODETIC SURVEY:	
For Superintendent.....	6 000
For pay of assistants, to be employed either in the field or office, as the Superintendent may direct:	
For two assistants, at \$4 000 each.....	8 000
For one assistant.....	3 200
For four assistants, at \$3 000 each.....	12 000
For four assistants, at \$2 500 each.....	10 000
For seven assistants, at \$2 200 each.....	15 400
For seven assistants, at \$2 000 each.....	14 000
For three assistants, at \$1 800 each.....	5 400
For three assistants, at \$1 600 each.....	4 800
For three assistants, at \$1 400 each.....	4 200
For four assistants, at \$1 200 each.....	4 800
For aids temporarily employed, at a salary not greater than \$900 per annum each.....	5 100
In all.....	<u>92 900</u>

PAY OF OFFICE FORCE:

For one disbursing agent.....	\$2 200
For one general office assistant.....	1 800
For one chief of division of library and archives.....	1 800
For one clerk to Superintendent.....	1 200
For one clerk to the assistant in charge of office and topography.....	1 000
For clerical force, namely:	
For two, at \$1 650 each.....	3 300
For three, at \$1 400 each.....	4 200
For five, at \$1 200 each.....	6 000
For three, at \$1 000 each.....	3 000
For chart correctors, buoy colorists, stenographers, writers, typewriters, and copyists, namely:	
For two, at \$1 200 each.....	2 400
For three, at \$900 each.....	2 700
For one.....	800
For seven, at \$720 each.....	5 040
For one.....	600
For topographic and hydrographic draftsmen, namely:	
For one.....	2 400
For one.....	2 200
For two, at \$2 000 each.....	4 000
For three, at \$1 800 each.....	5 400
For two, at \$1 400 each.....	2 800
For one.....	1 200
For two, at \$1 000 each.....	2 000
For two, at \$900 each.....	1 800
For astronomical, geodetic, tidal, and miscellaneous computers, namely:	
For two, at \$2 000 each.....	4 000
For five, at \$1 600 each.....	8 000
For one.....	1 400
For one.....	1 200
For two, at \$1 000 each.....	2 000
For copperplate engravers, namely:	
For two, at \$2 000 each.....	4 000
For two, at \$1 800 each.....	3 600
For two, at \$1 600 each.....	3 200
For one.....	1 400
For two, at \$1 200 each.....	2 400
For two, at \$1 000 each.....	2 000
For additional engravers, at not to exceed \$900 per annum each.....	4 100
For electrotypers and photographers, plate printers and their helpers, instrument makers, carpenters, engineer, and other skilled laborers, namely:	
For two, at \$1 800 each.....	3 600
For one.....	1 600
For one.....	1 400
For one.....	1 200
For four, at \$1 100 each.....	4 400
For six, at \$1 000 each.....	6 000
For two, at \$900 each.....	1 800
For four, at \$750 each.....	3 000
For three, at \$700 each.....	2 100
For watchmen, firemen, messengers and laborers, packers and folders, and miscellaneous work, namely:	
For three, at \$880 each.....	2 640
For six, at \$820 each.....	4 920
For two, at \$700 each.....	1 400
For three, at \$640 each.....	1 920
For four, at \$630 each.....	2 520
For four, at \$550 each.....	2 200
For two, at \$365 each.....	730
In all.....	136 570

OFFICE EXPENSES:

For the purchase of new instruments, for materials and supplies required in the instrument shop, carpenter shop, and drawing division, and for books, maps, charts, and subscriptions.....	\$8 000
For copperplates, chart paper, printer's ink, copper, zinc, and chemicals for electrotyping and photographing; engraving, printing, photographing, and electrotyping supplies; for extra engraving and drawing, and for photolithographing charts and printing from stone and copper for immediate use	15 500
For stationery for the office and field parties, transportation of instruments and supplies, when not charged to party expenses, office wagon and horses, fuel, gas, telegrams, ice, and washing.....	6 000
For miscellaneous expenses, contingencies of all kinds, office furniture, repairs, and extra labor, and for traveling expenses of assistants and others employed in the office sent on special duty in the service of the office	4 500
	34 000

PUBLISHING OBSERVATIONS:

For the discussion and publication of observations.....	1 000
[That no part of the money herein appropriated for the Coast and Geodetic Survey shall be available for allowance to civilians or other officers for subsistence while on duty at Washington (except as hereinbefore provided for officers of the field force ordered to Washington for short periods for consultation with the Superintendent), or to officers of the Navy attached to the Survey except as now provided by law.]	

PRINTING AND BINDING, COAST AND GEODETIC SURVEY:

For printing and lithographing, photolithographing, photoengraving, and all forms of illustration done by the Public Printer, on requisition by the Treasury Department, for the Coast and Geodetic Survey, namely:	
Tide tables, coast pilots, appendixes to the Superintendent's annual reports, published separately; notices to mariners, circulars, blank books, blank forms, and miscellaneous printing, including the cost of all binding and covering; the necessary stock and materials and binding for the library and archives.....	20 935

NOTE.—No engraving is done by the Public Printer for the Coast and Geodetic Survey.

Total Coast and Geodetic Survey, exclusive of printing and binding.....	508 470
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OFFICE OF CONSTRUCTION OF STANDARD WEIGHTS AND MEASURES:

Salaries, Office of Standard Weights and Measures—

For construction and verification of standard weights and measures, including metric standards, for the custom-houses, other offices of the United States and for the several States, and mural standards of length in Washington, D. C.—	
For 1 adjuster	1 800
For 1 mechanician	1 250
For 1 assistant messenger and 1 watchman.....	1 440
In all	4 490

Contingent expenses, Office of Standard Weights and Measures—

For purchase of materials and apparatus, and incidental expenses.....	500
For expenses of the attendance of the American member of the International Committee on Weights and Measures at the general conference provided for in the convention signed May 20, 1875, the sum of \$475, or so much thereof as may be necessary.....	475
Total, contingent expenses, Office of Standard Weights and Measures.....	975

ABSTRACTS OF REPORTS FROM FIELD PARTIES, FISCAL YEAR 1895.

EASTERN DIVISION.

STATES EAST OF THE MISSISSIPPI RIVER.

- | | | |
|-------------------|---------------------------|--------------------|
| 1. Maine. | 10. Delaware. | 19. Mississippi. |
| 2. New Hampshire. | 11. Maryland. | 20. Michigan. |
| 3. Vermont. | 12. District of Columbia. | 21. Wisconsin. |
| 4. Massachusetts. | 13. Virginia. | 22. Ohio. |
| 5. Rhode Island. | 14. North Carolina. | 23. Indiana. |
| 6. Connecticut. | 15. South Carolina. | 24. Illinois. |
| 7. New York. | 16. Georgia. | 25. West Virginia. |
| 8. New Jersey. | 17. Florida. | 26. Kentucky. |
| 9. Pennsylvania. | 18. Alabama. | 27. Tennessee. |

Progress Sketches, Nos. 1 to 14, inclusive, show the localities of field work in the Eastern Division. A list of Progress Sketches will be found at the close of this volume.

Continuation of the topographic resurvey of Boston Harbor and vicinity.—As stated in the report of the previous fiscal year it had been decided to expedite the resurvey of Boston Harbor and vicinity by putting in the field a force sufficient to complete the remaining part of the work in a single season, and five topographical parties were therefore organized in June, 1894, and a sixth in the following August. The parties were under the charge respectively of Assistant Herbert G. Ogden, Otto H. Tittmann, R. Meade Bache, Charles H. Boyd, Washington I. Vinal, and Dallas B. Wainwright. Assistant Henry L. Whiting was charged with the general supervision of the whole, and the various chiefs of parties were directed to confer freely with him in regard to sheet limits, methods of delineation and generalization, and other details, with a view to securing uniformity in these matters in all parts of the finished map. The work was laid out on seven projections, on a scale of 1-10 000, numbered consecutively, and embracing the whole shore line, with bays, islands, indentations, etc., from the vicinity of Cedar Point to the northern limit of Nahant Bay, the width of the solid topography averaging about 3 miles, but varying, according to local requirements, from 2 to 5 miles.

To avoid the expense of making a complete survey of the streets of Boston and adjacent towns and villages, access was obtained, through the courtesy of the local officials, to the city engineer's maps, and these were reduced to the scale of the survey and platted in their proper places on the topographical sheets, a sufficient number of points of control being first determined by the plane table to make their accurate platting and orientation practicable. The greater part of this compilation was assigned to Assistant Wainwright, but some was also done by the other parties. The limits of the work on the seven field sheets, as originally laid out, may be given approximately as follows:

Sheet No. 1 extends from a point 1 mile above Cedar Point, northward to Minots Ledge Light, and westward to a small creek about 2 miles east of Hingham, embracing an area of topography of about 10 square miles.

Sheet No. 2 extends from the eastern limits of sheet No. 1, as above given, to Weymouth Fore River, and includes about the same area of topography.

Sheet No. 3 extends from Weymouth Fore River to Neponset River, embracing an area of about 8 square miles.

Sheet No. 4 extends from the Neponset River to Charles River, including Roxbury, Dorchester, etc., but excluding the city of Boston, an area of about 13 square miles.

Sheet No. 5 extends from the northern limits of sheet No. 4 to an irregular line along the northern side of the city, and includes Boston, South Boston, East Boston, Cambridge, East Cambridge, and Chelsea, and several islands of the inner harbor, an area of about 12 square miles.

Sheet No. 6 extends from the irregular line along the north side of Cambridge, Boston, and Chelsea, northward to Medford and Center Village, and extends to the shores of Broad Sound, embracing an area of 14 square miles of topography.

Sheet No. 7 extends from Chelsea Creek to the northern and eastern limits of Nahant Bay, including Nahant, Lynn Harbor, and a portion of the city of Lynn, approximate area of topography 5 square miles. These limits were, in some cases, somewhat modified as the season advanced, according to the rates of progress made by the various parties, with a view to insuring the completion of the whole work before winter. These modifications could be readily made owing to the fact that the projections necessarily overlapped each other to some extent.

The different sections of the work will be taken up seriatim, and the statistics of each party will be given separately.

Mr. Whiting continued in general charge of the resurvey until the close of the season, and from time to time inspected the work of the parties in the field. He was absent, however, for short periods on special business connected with his duties as chairman of the Massachusetts Topographical and Town Boundary Commission, and member of the Mississippi River Commission.

Topographic resurvey of Boston Harbor.—Cohasset and Quincy sheets.—Projections Nos. 1 and 3, embracing the limits already given, and designed as the Cohasset and Quincy sheets, respectively, were assigned to the party under the direction of Assistant Herbert G. Ogden. The party was organized at Cohasset on June 13, and field operations were at once commenced. The first sheet was completed by September 9 and the other by November 19. Mr. Ogden remarks that these sheets contain an unusual amount of detail of natural features, as the country is much broken, but without any considerable elevations except Scituate and Turkey hills on the Cohasset sheet, and Forbes Hill on the Quincy sheet. At Cohasset there are large tracts of densely wooded land, involving intricate contours which took much time to delineate, although no attempt was made to secure the same degree of accuracy as was required in the open country. At Quincy a large area is subdivided into town sites, but Mr. Ogden was able to obtain from Mr. Whitman, a civil engineer of that place, a complete plan of the subdivisions, and this, reduced to the scale of the topographic sheets and platted thereon, saved a large amount of labor and time in the field. The weather throughout the season was very favorable until about the 1st of November, and the few remaining fair days then necessary to complete the work were not obtained until the 19th. Mr. Ogden concludes from this and former experience that, except in cases of emergency, parties in this section of the country should not attempt to keep in the field after November 1.

The statistics of the work of the season are given as follows:

Area surveyed, in square statute miles	17½
Coast line surveyed, in statute miles	11½
Shore line of rivers surveyed, in statute miles	23½
Shore line of creeks surveyed, in statute miles	29½
Shore line of ponds surveyed, in statute miles	5½
Roads surveyed, in statute miles	118½
Marsh line surveyed, in statute miles	35½
Number of finished topographic sheets	2

After disbanding the party Assistant Ogden, accompanied by his recorder, in accordance with special instructions, proceeded, on November 22, to Greenport, Long Island, for the purpose of executing some supplemental triangulation to determine points for the establishment of a speed trial course on Long Island Sound. On the completion of this work, which will be noticed in detail under the proper geographical heading, he proceeded to Washington, reporting at the Coast and Geodetic Survey Office December 18. From that date to the close of the fiscal year Mr. Ogden was occupied in inking his topographical sheets, computing his triangulation, and completing and computing the records of his previous season's work in Alaska.

Topographical resurvey of Boston Harbor.—Lynn sheet.—The party under the charge of Assistant O. H. Tittmann was organized just before the close of the last fiscal year, and field work was commenced on June 15, 1894, as mentioned in the report for that year. The section assigned to this party is covered by Projection No. 7, and extends from the eastern limit of Assistant Iardella's work, about 1 mile west of the Point of Pines, to Phillips Beach, and includes a relatively narrow strip of topography. A portion of the city of Lynn falls within the limits of this topographic sheet, but only the streets running to the water's edge, or near it, were determined by actual survey. The plat of the streets farther back was derived from Byer's map of 1876, with such corrections as were indicated by Mr. Charles W. Gay, the city engineer of Lynn. From Mr. Gay's records some heights were also obtained, which facilitated the tracing of the contour lines in the city.

Mr. Tittmann reports that the principal changes that have taken place in this section since the date of the earlier survey are to be found in the artificial features, the most important of these being in the dock and wharf lines in Lynn Harbor; in the railway crossings of Chelsea Creek and Saugus River; and those caused by the erection of many new and prominent buildings. Many of the old triangulation points having disappeared, Mr. Tittmann obtained from the Massachusetts State Topographical Survey, through Assistant H. L. Whiting, the geographical positions of a number of their stations, and determined trigonometrically such additional points as were necessary.

Mr. Tittmann, in accordance with the Superintendent's instructions, conferred freely with Assistant Whiting in regard to topographical limits and methods of delineation, and by the latter's direction the contour lines throughout the work were referred to mean sea level instead of to mean high water, as heretofore, this being also in conformity with the recommendations of the Topographic Conference held at the Coast and Geodetic Survey Office in 1892.

The season's work closed August 25, the sheet assigned to the party being completed by that date, and Mr. Tittmann disbanded his party and returned to Washington, resuming charge there of the Office of Standard Weights and Measures.

The statistics of the season's work are as follows:

Shore line surveyed, in statute miles	25
Railroads surveyed, in statute miles.....	8
Streets and roads surveyed, in statute miles	38
Area surveyed, in square statute miles.....	5½

The report of the chief of the party is accompanied by a sketch showing the area of topography executed and the positions of the new trigonometric points determined.

Topographic resurvey of Boston Harbor.—Hingham sheet.—In the topographic resurvey of Boston Harbor, the area covered by projection No. 2, the limits of which have already been given, was assigned to the party under the direction of Assistant R. M. Bache. This projection, which has for convenience been designated the Hingham sheet, includes in its area the towns of Weymouth, North Weymouth, East Weymouth, and Hingham.

Mr. Bache reached the working ground June 26, organized his party, and began the erection of signals on the 28th. The necessary preliminary triangulation was executed by July 10, and the topographical work proper was inaugurated July 11 and continued until November 1, when the sheet was completed.

Mr. Bache reports that this topography is of a more intricate character than any he has ever seen within a like area, even in the same region. With the exception of a few great hills, the country is composed of a jumble of accidents of surface, varying from 50 to 80 feet in height complicated by wooded swamps at various elevations, and covered with numerous highways and private roads. The towns of Weymouth, North Weymouth, East Weymouth, and Hingham, with their connecting roads interspersed with houses, practically form one continuous village occupying an area of nearly 8 square miles.

On the completion of the season's work the party was disbanded and Assistant Bache returned to Philadelphia, Pa., and resumed charge of the Coast and Geodetic Survey suboffice.

The statistics of the field work are given as follows:

Number of signals erected	3
Number of geographical positions determined, trigonometrically.....	2
Area of topography surveyed, in square miles.....	10½
River shore line surveyed, in square miles.....	12½
Creek and pond shore line surveyed, in statute miles.....	8½
Length of roads and streets surveyed, in statute miles.....	54½
Length of railroad surveyed, in statute miles.....	8
Number of topographical sheets completed.....	1

Topographical resurvey of Boston Harbor.—Roxbury sheet.—Projection No. 4, extending from the Neponset River to Charles River, was assigned to Assistant Charles H. Boyd, who organized a party and began work on the southern part of the sheet on June 15. The area covered by this sheet, besides containing a large variety of natural topographical details, is thickly dotted with suburban villages and residences, and the dense foliage of shade and fruit trees and ornamental shrubbery, by restricting the view, interfered considerably with the execution of the field work. Notwithstanding these difficulties, however, fair progress was made until August 26, when Assistant Boyd, in accordance with instructions, disbanded his party and turned over the instruments and unfinished sheet to Assistant D. B. Wainwright, who was about to begin work on the adjoining projection, No. 5.

The statistics of the work to that date are as follows:

Area surveyed, in square statute miles.....	4
Shore line surveyed, in statute miles.....	17½

Topographical resurvey of Boston Harbor.—Boston sheet.—Projection No. 5, embracing the city of Boston north of Massachusetts avenue, parts of Somerville, Cambridge, Brookline, etc., was assigned to Assistant D. B. Wainwright, and subsequently the unfinished part of projection No. 4 was added in consequence of the discontinuance of Assistant Boyd's party, as already mentioned. Mr. Wainwright organized his party and began operations on the Boston sheet in the latter part of August, first determining with the plane table a large number of objects, such as church spires, towers, etc., to be used as signals on the further prosecution of the work. The surroundings of the cities were completely surveyed with the plane table, as were also the wharf lines, water fronts, and such streets and avenues as furnished the best means of controlling the platting of the compilations and reductions from the city maps. The bulk of the cities of Boston, Cambridge, Somerville, and Brookline were thus compiled and reduced and platted on the topographical sheets, thus saving the Survey great expense, and Mr. Wainwright acknowledges the courtesy of the city engineer, city surveyor, and chief engineer of the board of survey, of Boston; the city engineers of Cambridge, Somerville, and Brighton, and the several members of the State Topographical Survey, in furnishing much valuable data and giving access to their maps. To Mr. Hodgden, the chief engineer of the board of harbor commissioners, he was especially indebted for placing at his disposal a comfortable drafting room in the Commonwealth Building.

Work was continued until December 21, when, owing to the lateness of the season and continued inclement weather, the party was disbanded and Assistant Wainwright returned to Washington, where he was engaged upon his office work until April 1. The resumption and completion of the work in the spring of 1895 will be treated in another paragraph.

The statistics of the season's work are as follows:

Area surveyed and compiled, in square statute miles.....	19
Length of wharf and river line surveyed, in statute miles.....	89
Number of topographic sheets worked on.....	2

Topographic resurvey of Boston Harbor.—Chelsea sheet.—Projection No. 6, with limits modified to include Chelsea, and including also the corporate limits of Everett and Revere and portions of the cities of Malden, Medford, and Somerville, was assigned to Assistant Washington I. Vinal, who organized his party and began field operations on June 13, 1894.

Work was continued without intermission until November 9, when the sheet being completed, the party was disbanded and Assistant Vinal returned to Washington and took up the inking and other office work incident to his field labors.

Mr. Vinal, in his report, acknowledges the valuable assistance, in the way of bench heights, tracings, etc., which was given him by the engineers of the cities that came within the limits of his survey, as well as by the office assistants of the Massachusetts Town Boundary Survey, and states that owing to the rapid growth of the suburban towns and cities, the recent adoption of a comprehensive sewage system, the opening and grading of new streets, and the reclaiming of extensive tracts of marsh lands, it was found necessary to go over the entire area carefully with the plane table to note artificial changes of the surface and deviation from original plans.

He gives a full description of the country covered by his sheet, and enumerates the works of improvement now in progress.

The work of the season is platted on one topographical sheet, scale 1-10 000, and the following is a tabular statement of the results obtained:

Area surveyed, in square statute miles.....	14
Length of shore line of river, including wharves, in statute miles.....	24
Length of shore line of creeks, ponds, etc.....	33
Length of roads, including streets and railroads, in statute miles.....	160
Topographic sheets finished, scale 1-10 000.....	1

Resumption and completion of the resurvey of Boston Harbor in the spring of 1895.—On April 1, Assistant D. B. Wainwright reorganized his party for the completion of the work on projections Nos. 4 and 5, including the city of Boston and surrounding towns, and continued in the field until near the close of the fiscal year, when the work was finished. During the latter part of June a portion of the party was sent to New Bedford to recover stations, erect signals, and make other preparations for the survey in that vicinity, and the remainder of the party followed on the close of the Boston work.

In his final report on the Boston resurvey, Mr. Wainwright gives an interesting historical account of the laying out of the city of Boston at the time of its first settlement, and the great topographical changes that have since taken place, especially since the date of the last survey, about forty years ago. These changes apply to the natural as well as the artificial features, many hills having entirely disappeared, while others have been much reduced in height, the material having been used in filling up coves and shallows, and producing the more regular outline of water front that exists to-day, and extensive areas of marsh land having been reclaimed and closely built upon.

The statistics of the work from April 1 until the close of the fiscal year are as follows:

Area surveyed and compiled, in square statute miles.....	9
Length of river shore line surveyed, in statute miles.....	12
Number of topographical sheets completed.....	2

Hydrographic resurveys near Boston, Mass.—By the Superintendent's instructions, dated June 29, Lieut. Robert G. Peck, U. S. N., Assistant, Coast and Geodetic Survey, commanding the steamer *A. D. Bache*, was directed to conduct hydrographic surveys on the coast of Massachusetts. Work was begun on July 16 and closed November 12. Of the four months occupied by this work about two weeks were spent in special hydrographic developments in that portion of Boston Bay extending from Cohasset to Scituate and in the waters of Broad Sound. Several discoveries of sunken rocks were made, and concerning these special reports were at once addressed to the office.

Between August 22 and September 20, a hydrographic resurvey of Lynn Harbor, Saugus River, and Chelsea Creek was made, and then the resurvey of the waters extending from Nahant to Cat Island, including the harbor of Marblehead, was taken up and prosecuted until November 6. The general soundings in this area were completed, but special developments remain to be made during a subsequent season.

A special examination, called for by supplemental instructions dated July 5, was made of Tinkers Ledge and of other shoal water to the eastward of Tinkers Island.

Leaving Marblehead on November 7, the *Bache* made a special examination of seven shoal spots in the approaches to Boston Harbor, which had been noted in the survey of 1892, and which had been afterwards searched for unsuccessfully.

Field work closed November 12.

The officers of the ship were Lieut. Robert G. Peck, U. S. N., commanding; Lieut. W. S. Benson; Ensigns G. W. Kline, C. M. McCormick, and J. W. Oman; Passed Asst. Surg. G. H. Barber; Asst. Engineer A. McAllister. Pay Yeoman J. L. Dunn served as draftsman, and Thomas S. Martin and William H. De Luce as recorders.

The statistics of the season's work are given as follows:

Area sounded, in square geographic miles.....	41
Number of miles run while sounding.....	981
Number of angles measured.....	17 179
Number of soundings recorded.....	63 461
Number of tidal stations established.....	8

Hydrographic examinations of reported dangers in Buzzards Bay, Massachusetts.—After completing the hydrographic examination in the vicinity of York Spit, Chesapeake Bay, in July, 1894, the steamer *Endeavor*, under the command of Lieut. L. M. Garrett, U. S. N., proceeded to Buzzards Bay and made special examinations of reported dangers in that locality. A number of sunken rocks were found in the entrance to Catamount Harbor, off Monument Beach, and off Mishaum. The Ribbon Reef was also newly developed.

On the completion of this work Lieutenant Garrett proceeded with the vessel to Narragansett Bay for the purpose of making further special hydrographic examinations.

The statistics of the Buzzards Bay hydrography are as follows:

Number of angles measured.....	218
Number of soundings taken.....	537
Number of miles of sounding lines run.....	13

Topographic resurvey of the shores of Buzzards Bay, Massachusetts.—A resurvey of Buzzard Bay being urgently needed, on account of the numerous changes reported since the last survey, completed fifty years ago, four topographical parties have been assigned to duty in this region, and it is hoped and expected that the work will be completed this season. Owing to the lack of funds the parties were not able to take the field before the latter part of June, so that the result of the resurvey can not be given in this report. The parties are under the charge, respectively, of Assistants W. I. Vinal, Stehman Forney, D. B. Wainwright, and J. A. Flemer.

Hydrographic resurvey of New Bedford Harbor and approaches.—This being a part of the contemplated resurvey of Buzzards Bay, and being of the first importance, Lieut. G. C. Hanus, commanding the schooner *Eagre*, was directed to begin work in May, or as soon as the repairs of his vessel were completed. There being a sufficient number of well-determined points available at this locality from which others could be determined, the hydrography could be executed in advance of the topography. The hydrographic resurvey of the whole bay will follow in order as soon as the topographic parties can complete the shore line and furnish the requisite geographical positions.

The naval officers composing the party of Lieutenant Hanus are as follows: Lieut. C. S. Ripley, Ensign W. A. Edgar, and Pay Yeoman William B. Proctor.

The statistics of the work to June 30 are as follows:

Number of miles (geographical) of sounding lines.....	341½
Number of angles measured.....	3 308
Number of soundings taken.....	22 985

Hydrographic resurveys and special developments on the coast of Massachusetts.—Lieut. W. F. Low, U. S. N., Assistant Coast and Geodetic Survey, in command of the schooner *Eagre*, was engaged on July 25 in verifying the position of rocks and shoals, and running lines and soundings for the development of special features on hydrographic sheets 2167, 2161, 2163, and 2146, Boston Harbor and approaches.

On July 27 the survey of Salem Harbor was commenced and carried on until October 9, when the *Eagre* was moved to Gloucester for the survey of that harbor. This was carried on until October 23, after which work was resumed on the Salem sheet and prosecuted up to December 8, when it was finished.

The following officers were attached to the *Eagre*: Lieut. W. F. Low, U. S. N., commanding; Lieut. C. S. Ripley, U. S. N.; Ensigns L. H. Chandler and W. A. Edgar, U. S. N.; Pay Yeoman William B. Proctor; Ships Writer James Proctor.

Statistics from June 30 to December 8 are as follows:

Number of geographical miles run while sounding.....	820
Number of angles measured.....	13 086
Number of soundings recorded.....	63 972
Number of tidal stations established.....	3
Hydrographic sheets finished, scale 1-10 000.....	1

Physical hydrography.—North shore of Nantucket Island, Massachusetts.—At the beginning of the fiscal year, the party of Assistant H. L. Marindin was already in the field in pursuance of instructions from the Superintendent, dated May 17. The camp was first located at Trotts Hill, about 3 miles west of the town of Nantucket, and active field operations were begun on June 7. Mr. M. V. Safford, who had considerable previous experience in this class of work, was assigned to the party as additional observer, while Messrs. B. H. Griswold and H. T. Marshall served as recorders, and Mr. Fred McElroy as tidal observer. A crew of men to row the boat and assist in the topographic and leveling work completed the party organization.

The main object of the expedition was to secure accurate data for the construction of a base map for comparison with future surveys, in order to determine the movements of the coast line and the laws and forces governing them, but the survey also serves the immediate purpose of correcting and supplementing the inshore hydrography of the published charts.

The survey of the southern shore of the island was completed in 1891, but it was then decided that the survey should be extended to include the remaining shores, and those of Marthas Vineyard also, in order to obtain a more comprehensive view of the effect of current and tidal action in the locality.

In detail the work consists of laying out cross sections normal to the shore at regular distances, and in sounding accurately along these lines until a depth of from 30 to 36 feet is reached. The cross sections are then continued inland for a short distance by lines of levels referred to the plane of mean sea level, as derived from a permanent tidal station in the vicinity. In this instance the tidal station was located at Swain's Wharf, in Nantucket Harbor, and continuous observations were made there from June to September, but as the work progressed, temporary staffs were also erected at various points, and connected with the main station by simultaneous tidal readings. Permanent bench marks were established at various points, and connected by spirit leveling with the cross-section lines and with the plane of mean sea level, as deduced from the tidal observations. By means of the data furnished by Assistant Marindin it will be possible at any time in the future to reproduce any or all of the cross-section lines established by him, and a comparison of the elevations and depths then found upon them, with those now existing, will show the nature and extent of the natural changes accomplished or in progress. Any extension or erosion of the coast line, or its gradual elevation or subsidence, will thus be indicated, and much light thrown upon important physical problems. The ordinary hydrographic surveys for chart publication in the interests of navigation will not suffice for such purposes, as in them the relations between land and water areas are not determined, and moreover, the soundings taken near shore are not sufficiently numerous, nor measured and located with sufficient accuracy.

The mean range of the tide at Swain's Wharf, as derived from 112 readings of high and low water, is 3.07 feet, a result differing by only a few hundredths of a foot from that obtained from a long series of observations at the same point in 1854.

The subsidiary tidal stations on Nantucket Island were located at Trotts Hill, Eel Point, Maddequet Harbor, and Smiths Point, but the observations at Trotts Hill and Maddequet Harbor only were used in the reduction of soundings. The observations at Smiths Point indicate an interference both as to time and range of tide, the interference being due to the opening in the south beach. How far the effect reaches into the sound was not ascertained.

By September 6 the circuit of the Island was completed by connecting with the work of 1891 at Smiths Point, and the camp was then transferred to Marthas Vineyard and pitched between Edgartown and Cottage City. From this point the north shore of Chappaquiddick Island could be reached and the work extended westward as far as the lateness of the season would permit.

A self-registering tide gauge was established at Edgartown Light-House, and subsidiary gauges at the railroad bridge and at Bath House Wharf on Chappaquiddick Island. The mean range of the tide at Edgartown tidal station was found to be 2.20 feet.

Work was continued until October 19, when the party was disbanded and Mr. Marindin returned to Washington. During the latter part of the season the weather was very unfavorable and much delayed the progress of the work, and on October 10 a severe gale did considerable damage to the camp and outfit.

The results of the season's work are shown on two hydrographic sheets and on the progress sketches which accompanied Mr. Marindin's report, and the statistics furnished are as follows:

Number of cross sections laid out	226
Number of cross sections sounded	266
Number of angles to determine soundings on cross sections	5 636
Number of angles to determine theodolite stations	1 522
Number of miles of levels run	23.2
Number of miles of levels on cross sections	14.6
Number of permanent bench marks established	11
Number of tidal stations	8

Mr. Marindin commends highly the efficiency and zeal of Messrs. Safford, Griswold, and Marshall.

Mr. Marindin was occupied at the office in Washington until the close of the fiscal year in working up the results of his season's field operations and in preparing a report on the changes of the bar at the entrance of Nantucket's inner harbor since 1888. This paper will appear as an appendix to this report.

Hydrographic resurveys in Nantucket Sound and hydrographic examination in Narragansett Bay.—The steamer *Blake*, Lieut. G. W. Mentz, U. S. N., Assistant, Coast and Geodetic Survey, commanding, was undergoing repairs at New York from June 30 to July 31. Under instructions from the Superintendent, the *Blake* arrived at Hyannis, Mass., August 3, and began the resurvey of that part of Nantucket Sound between Falmouth and Hyannis and Hyannis and Great Point. Tidal observations were made night and day from August 6 to September 6 at a gauge established at Hyannis. Another gauge was established at Monomoy Island, and a series of continuous observations for a plane of reference for that part of the sound were made from September 24 to October 26, and the planes of the two gauges were related to each other by simultaneous observations on September 25 and 26.

The hydrographic work was platted on two sheets on scales of 1-20 000 and 1-40 000, but owing to unfavorable weather neither of the sheets were completed when the work was brought to a close on December 1, 1894.

After leaving Nantucket Sound the *Blake* made a successful search in the vicinity of Wickford Harbor for the rock upon which the steamer *General* had struck earlier in the year, and determined its position. The *Blake* reached New York on December 14.

Lieutenant Mentz speaks in terms of the highest praise of the services of Lieutenant Tillman, and commends the zeal of the other officers and men in the performance of the duties assigned to them.

The following officers served on the *Blake*: Lieut. G. W. Mentz (commanding), Lieut. J. A. Shearman, Lieut. E. H. Tillman, Ensign H. K. Hines (from October 27), P. A. Engineer K. McAlpine, Asst. Surg. B. R. Ward, and W. S. Crosby, pay yeoman and recorder.

The following are the statistics of the season:

Area sounded, in geographical miles	73
Number of geographical miles run while sounding	819
Number of angles measured	6 389
Number of soundings	43 285
Number of tidal stations established	2
Number of hydrographic sheets	2

At the close of the season the *Blake* proceeded to New York for necessary repairs, and in the latter part of the fiscal year Lieutenant Mentz was directed to resume the work and to make certain special examinations in Nantucket and Vineyard sounds. The results will be duly set forth in the next annual report.

Town boundary line surveys for the State of Massachusetts, continued under the direction of the Topographical Survey Commission of the State.—Assistant Henry L. Whiting, during the fiscal

year, continued to serve as chairman of the Topographical Survey Commission of the State of Massachusetts, and under his direction the work was carried forward westerly from the limits reached in the previous field season. This work was originally commenced in the cities and towns on, or near, the seacoast because of the advantages and facilities afforded by the numerous triangulation points of the Coast and Geodetic Survey, which gave already-determined bases, but as the survey extended into the interior of the State these determined points became more sparse, and it became necessary to interpolate others by means of a secondary triangulation. The execution of this supplemental triangulation was assigned to Assistant C. H. Van Orden, but he was unable to take the field in person until October 1, as he was engaged from July to September, inclusive, on running a line of levels from Albany to Dobbs Ferry, N. Y., as mentioned elsewhere in this report. Two other parties, however, were in the field early in the season connecting the town boundaries with the existing triangulation; these parties were under the charge, respectively, of Messrs. E. E. Peirce and W. C. Hawley. Mr. Peirce continued the surveys in Middlesex County to the close of the field season of 1894, and in the spring of 1895 transferred his party to the Connecticut River Valley, determining the valley townships from the Connecticut State line northward. Mr. Hawley was assigned to duty in the southeastern part of Worcester County, and remained in the field from July to October.

Assistant Van Orden took up the triangulation east of the Connecticut River on October 1, and continued in the field until the end of November. Work was again resumed in the spring, but Mr. Van Orden, having meanwhile been granted a six month's furlough, the charge of the party was given to Mr. James B. Tolley. The work was still in progress at the close of the fiscal year.

The original descriptions of the main triangulation stations, with sketches, their geographical positions and other data necessary for the prosecution of this work, have been furnished to the State Commission by the Coast and Geodetic Survey Office.

Assistant H. L. Whiting, in addition to his duties in connection with the State survey, has had general supervision over the survey of Boston Harbor and vicinity, as mentioned under that head, and from time to time inspected the work of the topographical parties; he has also continued to serve as a member of the Mississippi River Commission, and attended the various meetings of that body during the year. The first meeting was held at New York in August, 1894; the second at St. Louis, Mo., in November, and on this occasion the semiannual inspection of the river from the mouth of the Ohio to the head of the passes was made; the third meeting was also held at St. Louis in March, 1895, and the second inspection of the river was then made; the fourth and last meeting was held in New York in June, 1895.

A special report on the changes in New Orleans Harbor was presented by Assistant Whiting at the June meeting of the Commission, and will probably appear in their annual report.

Hydrographic examinations, and additional hydrography in Narragansett Bay and vicinity.—The steamer *Endeavor*, under the command of Lieut. L. M. Garrett, U. S. N., after the completion of the hydrographic examinations in Buzzards Bay, Massachusetts, proceeded to Narragansett Bay and made a search for a shoal which had been reported as existing off the west side of Hog Island. The shoal was found and a thorough hydrographic survey was made of the vicinity. The shoal has a depth of 15 feet at mean low water. Additional hydrography was then executed in Potters Cove, the northern part of Sakonet River, and "The Cove." Lieutenant Garrett, on the completion of this work, proceeded with his vessel to his regular season's work in Long Island Sound.

The statistics of the work in Narragansett Bay and vicinity are as follows:

Number of miles of sounding lines run (geographical)	22
Number of angles measured	91
Number of soundings taken	1 826
Area surveyed, in square geographical miles	2

Close of the record at the automatic tide gauge station at Newport, R. I.—The tide gauge station at Fort Adams, Newport, R. I., established in March, 1892, was discontinued on February 7, 1895, the record for the fiscal year being completed to that date, and the series from 1892 being sufficient for the purposes of this Survey. Mr. David Hamilton conducted the observations as heretofore, under the superintendence of the United States engineers stationed at the post, who kindly consented to render this service.

Hydrographic examinations in Long Island Sound.—The steamer *Endeavor*, under the command of Lieut. L. M. Garrett, U. S. N., after the completion of the special examinations in Narragansett Bay, described above, made a hydrographic examination along the northern shores of Long Island Sound from Fishers Island to Throgs Neck. A large number of rocks were located and many special features developed, the season's work closing in November.

Lieutenant Garrett, with his party, also assisted in the establishment of the range signals for the naval speed-trial course in Long Island Sound between Cornfield Point and Stratford Shoal, and located the red sector of the light-house on Execution Rocks. After the completion of this work, Lieutenant Garrett, with his vessel, proceeded to the mouth of Delaware Bay for the purpose of making a hydrographic resurvey of the breakwater anchorage.

The statistics of the Long Island Sound work are as follows:

Area surveyed, in square geographical miles.....	10
Number of geographical miles run in sounding.....	328
Number of angles measured.....	6 186
Number of soundings taken.....	24 350

The naval officers attached to Lieutenant Garrett's party during the season were Lieut. John J. Blandin, Ensign C. P. Plunkett, Pay Yeoman C. Lee Green, Machinist A. J. Miskimon, and Writer Eugene Veith.

At the close of the season Ensign C. P. Plunkett was relieved by Ensign C. M. McCormick, and Machinist A. J. Miskimon resigned and was replaced by Mr. J. C. Richards, who was transferred from the Coast and Geodetic Survey steamer *Blake*.

Continuation of the topographical resurvey of the south shore of Long Island.—Before the close of the previous fiscal year Assistant C. T. Iardella had taken the field for the continuation of the topographical resurvey of Long Island from the vicinity of Bellport westward to Patchogue, and eastward to Center Moriches, and thence to Speonk. This work was carried on until October 19, when the party was disbanded, and Mr. Iardella returned to Washington.

The statistics of the season's work are as follows:

Area surveyed, in square statute miles.....	34
Length of shore line of creeks, in statute miles.....	5
Length of roads, in statute miles.....	100
Number of topographic sheets.....	3½

Mr. F. F. Weld, who was assigned to the party as recorder, rendered acceptable service.

Mr. Iardella reports that upon the shores of East Bay numerous hotels and cottages have been erected, and the locality has acquired considerable reputation as a healthful and attractive summer resort.

In June, 1895, Assistant Iardella was directed to resume the Long Island work, and at the close of the fiscal year had organized his party at Speonk.

Aid H. C. Denson was assigned to the party, and Messrs. Richard B. Derrickson and R. J. Griffin, jr., were appointed as rodmen.

The statistics of the work will appear in the next annual report.

Continuation of the tidal record at Fort Hamilton, New York Harbor, by a self-registering gauge.—The self-registering tide gauge at the Fort Hamilton tidal station, established in December, 1892, has continued in operation during the whole fiscal year, and no break has occurred in the record. Observer J. J. Spaulding has continued in charge of the gauge, and has made the monthly tabulations and forwarded them with the maregrams to the office.

The tidal indicator at this point has also continued in use, and has proved very valuable to the maritime interests of the harbor. A similar indicator will shortly be established on the Delaware River at Reedy Island, an appropriation for that purpose having been inserted in the appropriation act for the fiscal year 1896.

Continuation of the tidal record at the automatic tidal station at Willets Point, New York.—The self-registering tide gauge set up at Willets Point in July, 1891, has continued in operation during the whole fiscal year, and has furnished a valuable continuous record as heretofore. The United States engineer officers stationed at the post have kindly attended to the gauge and transmitted the records.

Continuation of the topographic survey of the Hudson River.—The continuation of the topographic survey of the Hudson River northward from the work of 1892 was assigned to Assistant John W. Donn, who, as stated in the last annual report, made his headquarters at Newburg, where the only steam ferry within a radius of 16 miles connects the two shores of the river.

It was found in general that the progress of improvements or the degradation caused by excavations made by brick manufacturers had destroyed the reference marks of the old triangulation near the river shore. It was therefore necessary to use the line Prospect Hill—Bald Hill of the triangulation of 1854–1856—as a base for establishing new points required in topographic work.

The season's work begun June 17 and closed October 30, and during that time the topography was extended northward from Newburg to Matteawan.

The principal statistics of the season's work are as follows:

Area of triangulation, in square statute miles.....	49
Number of geographical positions determined.....	7
Area of topography, in square statute miles.....	13
Length of shore line of rivers, in statute miles.....	11
Length of railroads, in statute miles.....	13
Length of roads, in statute miles.....	67
Topographic sheets finished, scale 1-10 000.....	1

Resumption of the survey of the Hudson River in the spring of 1895.—In order to expedite the completion of the Hudson River survey it was deemed expedient to detail two parties to this locality, a larger force being precluded by the limited appropriations and by the necessity of taking up other equally important work.

Assistants John W. Donn and William C. Hodgkins were therefore instructed to organize parties and begin operations in the latter part of June, 1895. Before executing the topography, however, it will be necessary to extend the limits of the triangulation in order to furnish the requisite geographical positions.

Messrs. H. P. Izard, Frank S. Nichols, and C. J. Skinner have been assigned to Assistant Donn's party and Messrs. Ed. Meredith and John J. Carlisle to that of Assistant Hodgkins; other necessary employees will be engaged in the locality of the work.

The statistics of the season will appear in the next annual report.

Leveling operations in New York, from Greenbush to Dobbs Ferry.—In the early part of the fiscal year Assistant C. H. Van Orden was temporarily relieved from duty under the direction of the Town Boundary Survey of Massachusetts and directed to run a double line of levels from the so-called "Grist Mill" bench mark at Greenbush to the Coast and Geodetic Survey primary bench "V" at Dobbs Ferry. The party was organized and work begun July 2 and continued to September 25, when the lines were completed. Mr. Van Orden assumed for the height of the bench mark at Greenbush the value obtained by him in 1893 when leveling to that point from Boston, and his result at Dobbs Ferry is that bench mark "V" is 10.388 feet above mean tide level at Boston. A previous determination of the Dobbs Ferry bench mark by a line of levels from Sandy Hook gives its elevation above mean sea level of that place as 9.525 feet. This discrepancy—0.863 feet—is rather large for the distance run, but does not necessarily indicate an error either in the line from Boston via Greenbush or in the one from Sandy Hook, as the identity of the planes of mean sea level at the two starting points has not yet been established.

On the completion of the leveling work Assistant Van Orden returned to Boston and resumed his duties under the direction of the Massachusetts Topographical Town Boundary Commission.

Geodetic operations.—Continuation of the reconnaissance and triangulation in southern New Jersey.—In accordance with instructions dated June 27, 1894, Prof. E. A. Bowser, Acting Assistant, resumed the geodetic work in southern New Jersey on July 5. The first work of the season was the building of a tripod and scaffold signal 64 feet high at Burden, and temporary observing signals at Colsons, Bridgeton, and Lippincott, their heights ranging from 48 to 55 feet. These elevations were necessary to avoid expensive cutting of lines through the timber. A successful search was then made for the underground mark at Pine Mount, buried in 1839, and a signal 61 feet high was erected over the old point.

The regular triangulation observations were begun at Burden Station on the 4th of August and completed September 5. Pine Mount station was re-marked so that it may be recovered whenever necessary in the future. A cone sunk to the depth of 4.5 feet was used for the underground mark, and over it was placed a granite monument 3.5 feet long, dressed 6 inches square, and with the letters "U. S." cut on each of its four sides and a triangle on the top. The whole was set in hydraulic cement to within 6 inches of the top, and a full description, with sketch, accompanies Professor Bowser's report.

The season's work closed on September 5, and Professor Bowser returned to New Brunswick, and at the date of his report, October 1, the computations and progress sketch had been completed.

The statistics of the work are as follows:

Area of triangulation, in square statute miles.....	250
Number of signal poles erected.....	6
Number of tripod and scaffold signals erected.....	1
Number of stations occupied for horizontal and vertical measures.....	1
Number of geographical positions determined.....	6

On April 2, 1895, Professor Bowser resumed field work and made a reconnoissance of the lines Bridgeton-Newfield and Bridgeton-Kellogg, to determine the heights necessary for the observing scaffolds to be erected at these points. This was completed by April 9, and Professor Bowser returned to New Brunswick. This closed the work for the year, as it had been determined to discontinue the employment of acting assistants on the State geodetic work. This work will hereafter, except in special cases, be executed by the regular permanent force of the Survey.

Assistant George A. Fairfield continued in general charge of the State survey work, as in previous years, until May 12, 1895, when he was relieved from that duty in pursuance of the new policy above outlined.

Resurvey of Delaware Breakwater anchorage.—The steamer *Endeavor*, under the command of Lieut. L. M. Garrett, U. S. N., on her way to Baltimore after the close of the season's work in Long Island Sound, in accordance with instructions, stopped at the Delaware Breakwater for the purpose of making a resurvey of the anchorage. The work was executed between November 20 and 26, 1894, and shows a general shoaling of about 2 feet since 1883. Lieutenant Garrett reports that the gap between the breakwater and the ice breaker has been filled and presents an appearance similar to the breakwater itself. It is all uncovered at low water, and only a few portions are covered by the average high tide.

After completing this resurvey and locating the light-ships off Delaware Bay entrance, Lieutenant Garrett proceeded with the vessel to Baltimore and immediately set about making preparations for the winter campaign on the southern coast, the special work assigned to him being the resurvey of Charleston Harbor and its approaches.

The statistics of the work in Delaware Bay are as follows:

Area surveyed, in square geographic miles.....	3
Number of miles (geographic) of sounding lines run.....	69
Number of angles measured.....	863
Number of soundings taken.....	4 128

Hydrographic examination of York Spit and vicinity, Chesapeake Bay.—Early in July, 1894, the steamer *Endeavor*, under the command of Lieut. L. M. Garrett, U. S. N., left Baltimore, Md., for the mouth of the York River for the purpose of making a hydrographic survey of the reported extension of "York Spit," the steamer *Atlantic* having reported grounding on a shoal not indicated on the Coast and Geodetic Survey charts. Work was begun on July 3, and a careful and thorough examination was made, which proved the nonexistence of a shoal in the locality indicated, and the correctness of the existing charts.

Lieutenant Garrett also determined the positions of the light-houses at Tue Marshes and Wolf Trap Spit, after which he proceeded with the vessel to Buzzards Bay, Mass. The subsequent work of the *Endeavor* will be noticed under the appropriate geographical headings.

The statistics of the work in the Chesapeake Bay are as follows:

Number of miles of sounding lines run.....	60
Number of angles measured.....	361
Number of soundings taken.....	1 790
Area surveyed (in square geographical miles).....	3

Continuation of the tidal record at the automatic gauge station at the United States Navy-Yard, Washington, D. C.—The self-registering tide gauge, which was set up at the United States Navy-Yard at Washington, D. C., in July, 1891, was kept in operation during the entire year, under the charge of the chief of the tidal division of the Office, and, with the exception of a few short breaks caused by ice during the unusually severe winter, the record was continuous.

Precise leveling from Richmond, Va., to Washington, D. C.—This important line had previously been leveled in 1884, but the computation of the work developed a discrepancy beyond the allowable limit of error, and it was deemed necessary to revise the work. Instructions were accordingly issued March 25, 1895, to Assistant Isaac Winston to begin at the Richmond bench mark and run a double simultaneous line to Washington. Mr. Winston left Washington on April 4, accompanied by Aid A. L. Baldwin and Messrs. C. F. Smith and F. C. S. Hunter, who had been designated as members of the party, and reached Richmond the same day. Messrs. R. B. Derickson and F. C. Kendrick, also members of the party, reported to Mr. Winston on his arrival at Richmond, and the organization was complete. The instruments were adjusted the following day and the necessary instructions were given to the new rodmen, etc., and the regular work of leveling was inaugurated on the 6th. The line began on the two bench marks established in 1884 and followed the route of the Richmond, Fredericksburg and Potomac Railroad to Quantico, and that of the Pennsylvania Railroad from Quantico to Washington. The old permanent bench marks of 1884 at Ashland, Doswell, Fredericksburg, Alexandria, and Georgetown were recovered and connected with, and twelve additional permanent bench marks were established at other towns along the line. Temporary bench marks were also located at intervals of 1 kilometre to serve as comparison points as the work progressed. No special difficulties were encountered south of Quantico, but north of that point three long trestles had to be crossed. A calm day was selected for this part of the work, and the instrument and rods were placed on the trestles at the usual distances, but the precaution was taken of placing a plank across the rails for the observer to stand upon while leveling. It was found that in this way the instrument was quite steady, and that good results could be obtained. As an additional check, the first trestle was recrossed by observing the whole length directly from the banks, and the agreement of results was found to be quite satisfactory.

The bench mark on the north abutment of the Aqueduct Bridge at Georgetown (West Washington) was reached on June 28, and the party disbanded and Assistant Winston returned to the office to complete his computations and prepared for field work in the West.

During the season a new form of leveling rod, devised and constructed at the Coast and Geodetic Survey Office, was used for the first time and gave entire satisfaction. A detailed description of these rods is in course of preparation by Assistant Winston, and will appear as an appendix to this report.

Aid A. L. Baldwin rendered valuable assistance as recorder and computer in the party until May 15, when it became necessary to assign him to duty on the California and Nevada Boundary Line Survey. He was relieved by Aid H. C. Denson, who served acceptably until the close of the work.

The statistics of the leveling executed are as follows:

Length of double line leveled, in kilometres.....	186
Number of permanent bench marks established.....	12

The further services of Assistant Winston and Aids A. L. Baldwin and H. C. Denson will be noticed elsewhere in this report.

Hydrographic resurvey of Charleston Harbor, South Carolina, and its approaches.—Lieut. L. M. Garrett, U. S. N., commanding the Coast and Geodetic Survey steamer *Endeavor*, in accordance with instructions, left Baltimore, Md., in January, 1895, and proceeded direct for Charleston, S. C., for the purpose of making a resurvey of the harbor and its approaches. On arriving at Charleston he conferred with Capt. Frederick V. Abbott, U. S. A., the engineer in charge of the harbor improvement, and Commander M. R. S. Mackenzie, U. S. N., the light-house inspector of the sixth district, both of whom kindly afforded him every facility in their power for the proper execution of the work, and furnished much valuable information. The survey was begun January 24 in the Cooper and Ashley rivers at the points where the *Bache's* work of the previous year closed, and continued through the old main channel, such portions of the harbor as have recently been

surveyed by the United States engineers being omitted. Captain Abbott gave the party access to his unfinished topographical sheet, covering the greater part of the harbor, and allowed them to make a tracing of his shore line.

The low and marshy banks of the Cooper and Ashley rivers are overflowed at every high tide, and the irregular line of marsh grass forms the only visible line of demarkation, and it was therefore considered that the determined ends of the sounding lines would define the high-water shore line sufficiently well, as well in fact as it could be determined by other means. The city front shore line, wharves, etc., as shown on the tracing, were surveyed by the engineers prior to the heavy gales of two years ago, and in order to bring them up to date sextant positions and measurements, as well as soundings, were taken by Lieutenant Garrett's party along the entire city front. The shore line of Morris Island was found to have undergone considerable change since the date of the old survey. The recent triangulation of the Coast and Geodetic Survey left little to be desired in the way of determined points, and very few additional signals were required to be built. With the exception of some soundings close inshore, and a few special development lines, for which a small boat was needed, the entire inside harbor work was done by means of a 22-foot naphtha launch; the outside sounding lines were necessarily run with the steamer.

The plane of reference for the reduction of the soundings is that derived by the United States engineers from the Coast and Geodetic Survey gauge at Fort Sumter, but comparative gauges were set up at other points also, and whenever practicable the soundings were referred directly to the gauge nearest to them; in other cases a time correction was applied and the reductions made with reference to the Fort Sumter gauge. Special developments were made of all shoal spots found in or near any channel or fairway, and this part of the work was done so thoroughly that it is believed that no further resurvey of the harbor will be required for many years. The old Main Channel has partially filled up and is now practically abandoned in favor of the Jetty Channel, but sounding lines were run over it sufficiently close together to afford means of correcting the charts.

The season's work was completed by May 11, and on the 13th of May the *Endeavor* sailed for Baltimore in charge of Lieut. John J. Blandin, while Lieutenant Garrett proceeded to Washington by rail, having been ordered there by the Navy Department for examination for promotion.

The *Endeavor* arrived in Baltimore May 16, and has since been undergoing repairs.

The statistics of the Charleston Harbor work are as follows:

Area surveyed, in square geographical miles	37
Number of miles of sounding lines	625
Number of angles measured	8 302
Number of soundings taken	41 031

The list of naval officers attached to Lieutenant Garrett's party was as follows: Lieut. John J. Blandin, Ensign Charles M. McCormick, Pay Yeoman O. Lee Green, Machinist in charge J. C. Richards, and Writer Eugene Veith.

Completion of the topographic survey in the vicinity of Charleston, S. C.—In May, 1895, when preparing for publication the records of the topographic and hydrographic surveys recently made of the Cooper, Ashley, and Wando rivers, it was found that a small area, not exceeding 1 square mile, had been inadvertently omitted and not surveyed, and Assistant John W. Donn was at once detailed to supply the deficiency. He proceeded to Charleston and began the work May 26, and completed it by the end of the month, after which he returned to Washington.

Magnetic observations in various Atlantic States.—In May, 1895, Assistant J. B. Baylor was directed to determine the magnetic elements at a number of points in various States along the Atlantic Seaboard. He took the field on May 20, and by the close of the fiscal year the magnetic declination, dip and intensity determinations were completed at the following places: Savannah, Ga.; Charleston, S. C.; Cape Henry, Va.; Sandy Hook, N. J.; and Nantucket, Mass.

The old Coast and Geodetic Survey secular variation stations were reoccupied in each instance, and three days' observations were made at each, together with the necessary astronomical observations for azimuth. The work at other stations was continued after June 30, and the results will appear in the next annual report.

Examination of Charlotte Harbor entrance and search for reported shoal.—The steamer *Bache*, Lieut. Robert G. Peck commanding, while en route from Pensacola, Fla., to New York at the close of the season's work in the vicinity of Pensacola Bay, in accordance with instructions, stopped at Charlotte Harbor, Florida, for the purpose of investigating a shoal which had been reported by Capt. Thomas Jackson of the British steamer *Beaconsfield*, as existing about 4 miles SW. $\frac{3}{4}$ W. from the entrance buoy, and also making a reexamination of the bar at said entrance and determining the position of the light-house. The *Bache* reached Charlotte Harbor on the 13th of May and work was begun at once. A thorough search, in which Lieutenant Peck was assisted by all the pilots of Gasparilla Island, failed to discover the alleged shoal, although a wide area was examined and sounded, and Lieutenant Peck reports that he is satisfied that no such shoal exists. The pilot who took the *Beaconsfield* into the harbor was one of those who assisted in the search. A thorough examination was also made of the channel leading over the bar and into Charlotte Harbor, and the so-called 16-foot shoal in the channel way was definitely located. Sundry prominent objects suitable for land marks and ranges were determined, after which the *Bache* proceeded on her way to New York, where she arrived May 25.

Examination of Palatine Shoal, off Tampa Bay, Florida.—In accordance with instructions, Lieut. Robert G. Peck, commanding the Coast and Geodetic Survey steamer *Bache*, while en route to Pensacola Bay to continue the hydrographic survey from the point reached by the steamer *Blake* during the previous year, stopped at Tampa Bay for the purpose of making an examination of the Palatine Shoal, and determining the position of buoys, beacons, wharves, and prominent buildings. The *Bache* arrived at Tampa Bay January 25, and after some delay, due to bad weather, a sufficient number of old stations were recovered and the work of sounding proceeded. Three shoal spots were found, the unreduced depths being $19\frac{1}{2}$, $19\frac{3}{4}$, and $20\frac{1}{2}$ feet, situated respectively about 197 metres west southwest, 162 metres southwest, and 344 metres south by east from the U. S. buoy placed to mark the shoal. A careful examination was made of the whole locality, but these were the least depths found. The soundings were taken at about half tide, but as no tide gauge was set up the amount of reduction to be applied is uncertain. It is probable, however, that as the wind had for some time been blowing constantly from the southward the general level of the water was raised considerably above the normal, and a reduction of 2 feet would not seem excessive.

The objects determined for indication on the chart were the entrance buoys, tank of quarantine station, wharf of quarantine station, house near north end of Anna Maria Key, new beacons in the north and southwest channels, pilot lookout station, hospital of quarantine station, and house near south end of Egmont Key.

Lieutenant Peck reports some changes in the shore line since the date of the last survey, especially at the north end of Mullet Key, where a considerable amount of washing away has taken place.

The *Bache* then proceeded to Pensacola, where she arrived February 3. Her work in that region is described in the following paragraph:

Completion of the topographic resurvey of Pensacola Bay and its tributaries.—Under instructions dated December 17, 1894, Assistant P. A. Welker proceeded early in January to Pensacola, Fla., and organized a party for the completion of the survey of the remaining parts of Pensacola Bay and its tributaries. The schooner *Transit*, being of light draft, was placed at his disposal, the first work being in Big Lagoon, where the waters are shallow; but subsequently the party was transferred to the schooner *Quick*, a much more comfortable and commodious vessel.

Assistant John Nelson and Aid R. L. Faris were assigned to the party, and reported to Assistant Welker at Pensacola in time to assist in the fitting out and equipment of the vessel. Field operations were begun January 11, and as most of the old triangulation points were recovered without difficulty (some of the signals still remaining standing), the interpolation of but few additional points was necessary and the topographic work proceeded without delay. Considerable stormy weather was experienced, and some time was lost in consequence, but nevertheless the progress made was very satisfactory. Mr. Welker, in his report, expresses his high appreciation of the excellent services rendered by Assistant John Nelson and Aid R. L. Faris, and attributes much of the successful outcome of the season's work to their zeal and efficiency.

While at Pensacola Navy-Yard Mr. Welker availed himself of the opportunity to redetermine the magnetic elements, and the regular series of three days' observations were made for declination, dip and intensity. He also, by direction of the Superintendent, disposed of, at public sale, a lot of condemned property which had gradually accumulated aboard the Survey vessels and at the navy-yard.

The season's work closed on March 23, and the vessels were laid up in charge of a ship keeper, the party disbanded, and Messrs. Welker, Nelson, and Faris proceeded to Washington. Their subsequent services during the fiscal year will be mentioned elsewhere in this report.

The statistics of the Pensacola Bay work have been tabulated as follows:

Number of miles of shore line surveyed.....	76½
Number of miles of roads and railroads surveyed.....	98
Number of miles of creeks surveyed.....	8
Number of miles of swamp line surveyed.....	53
Area of topography surveyed, in square statute miles.....	49
Number of topographic sheets completed.....	4½
Number of stations occupied for horizontal angles.....	2
Number of magnetic stations observed.....	1

Continuation of the hydrographic resurvey in Pensacola Bay and vicinity.—In December, 1894, Lieut. Robert G. Peck, commanding the steamer *Bache*, was directed to resume the hydrographic resurvey of Pensacola Bay and vicinity. The *Bache*, having been prepared for sea, left New York, January 9, 1895, and arrived at Pensacola February 3. Several brief stops were made en route, viz, at Hampton Roads, in consequence of bad weather; at Key West, Fla., to overhaul machinery and obtain fresh water; at Punta Rasa, Fla., to take in tow the schooner *Spy*, laid up at that point in charge of a ship keeper; and at Tampa Bay, Florida, to make an examination of Palatine Shoal, as above reported.

The work assigned to the *Bache* was embraced on four projections furnished by the office, and numbered 2, 4, 5, and 7, respectively, on the general scheme. Nos. 5 and 7 covered East Bay; No. 4, that part of Pensacola Bay extending from the city of Pensacola to East Bay; No. 2, the bar and entrance and that part of the bay extending from the entrance to a point a short distance beyond the navy-yard. In addition to these, sheet No. 3, including that portion of the bay abreast of the city and extending southward to Santa Rosa Island, and the hydrography of which was executed by the *Blake* in the early part of 1894, was also sent to Lieutenant Peck for special developments. All of the work thus assigned was completed, excepting sheet No. 2, which had to be postponed to another season.

The *Bache*, on May 11, left Pensacola for New York, stopping en route at Charlotte Harbor, Florida, for special examinations in that locality, as already noticed, and arrived at New York May 25.

The list of officers attached to Lieutenant Peck's party is as follows: Lieut. E. H. Tillman, U. S. N.; Ensigns G. W. Kline, H. K. Hines, A. H. Davis, and F. M. Russell; P. A. Surg. G. H. Harber; Asst. Eng. A. McAllister; Pay Yeoman J. L. Duun; and Recorders, Thomas S. Martin and William H. De Luce.

The statistics for the season's work are given as follows:

Area sounded, in geographical miles.....	54.8
Number of miles of sounding lines.....	1 340.5
Number of angles measured.....	12 761
Number of soundings.....	85 366
Number of tidal stations established.....	4
Number of finished hydrographic sheets.....	3
Number of special examinations (Tampa Bay and Charlotte Harbor).....	2

At the close of the fiscal year the *Bache* was preparing for the resumption of work on the coast of Massachusetts.

Continuation of the triangulation of the oblique arc in Alabama.—In March, 1895, Assistant F. W. Perkins was directed to proceed to Mobile and arrange for the continuation of the main triangulation through the southern part of the State of Alabama. This triangulation forms part of the great oblique arc, and its terminus will be Mobile Bay. Mr. Perkins arrived at Mobile

on the 18th of March, and as the reconnaissance had previously been completed and sites selected for the observing stations, the first work to be undertaken was the building of the signals. The experience gained on the transcontinental arc in Indiana, Illinois, and Ohio had amply demonstrated the practicability of attaining a high degree of accuracy in the measurement of angles from towers 100 feet or more in height, and on account of the great economy of time resulting from their use in a heavily timbered country, the reconnaissance in Alabama was made with a view of building high signals rather than resorting to the cutting of expensive lines of sight through the heavy timber. Furthermore, the new method of building signals, devised by Assistant Perkins, has materially lessened the cost of such structures, the signals built during this season occupying each, on an average, only seven and a half days, exclusive of time spent in traveling from one point to another and getting the lumber on the ground.

By the 8th of June six towers were completed, their heights ranging from 80 to 120 feet, although an unprecedented number of rainy days (thirty-three) occurred during May and June. Work was carried on through the rains regardless of considerations of personal comfort. By June 8 the allotment of funds for the work was so nearly expended that it was necessary to reduce the numerical strength of the party for the remainder of the month, and the signal building was therefore discontinued until the new appropriation became available. The time was utilized, however, in verifying lines of sight and executing such cutting as was essential. The party is still in the field, the observing to be taken up as soon as all the signals are erected. The results of the complete season's work will be given in the next annual report.

Laying out of a true meridian line at Terre Haute, Ind.—In October, 1894, Assistant G. R. Putnam, while occupying the Terre Haute Station for the determination of gravity, laid out, at the request of Prof. M. A. Howe, a true meridian line for the use of engineers and local surveyors in testing the needles of their compasses and determining the changes of magnetic declination.

Geodetic operations.—Continuation of the triangulation in northeastern Tennessee and southeastern Kentucky, and along the Kentucky, Virginia, and Tennessee State lines.—On the 11th of June, 1894, the party under the charge of Prof. A. H. Buchanan, Acting Assistant, took the field for the extension of the Tennessee and Kentucky triangulation to the northward and eastward toward a junction with the primary work lying between the Maryland and Georgia base lines. Work was continued until October 18, when the party was disbanded and Professor Buchanan returned to Lebanon.

Good progress was made during the season, and the weather, except when the party was occupying Rogers Station, was generally favorable. At Rogers Station a long period of unusually hazy and foggy weather seriously delayed the party, the occupation of that station consuming ten weeks. Roan High Bluff, on the other hand, also a primary station, was completed in two weeks.

The party was again organized, and took the field about the middle of June, and is now making the usual progress. Four additional stations were established during the year, and horizontal and vertical measures were made at three primary and six secondary stations, the former being at English, Rogers, and Roan High Bluff, and the latter at Chimney, Holston, Clinch, Briston, Dunn, and Damascus.

A sketch showing the progress made and the relative positions of the stations occupied, accompanies Professor Buchanan's report.

Determination of relative gravity with half-second pendulums, and other pendulum investigations.—The pendulum campaign inaugurated in March, 1894, resulted in the determination of six stations up to the close of the fiscal year, as described in the last annual report, and since that time of twenty additional ones in a transcontinental series extending as far west as Utah, and generally in the neighborhood of the thirty-ninth parallel of latitude. The work was under the charge of Assistant G. R. Putnam, and the reference or base station, as before, was the one specially fitted up for the purpose in the basement of the United States Coast and Geodetic Survey Office at Washington, D. C. This line of gravity stations was carefully selected, and, including as it does a wide variety of orographic features, and altitudes varying from 14 to 4 285 metres above sea level, is peculiarly well adapted to throw light on the continental variations of gravity, the proper method of reduction to sea level, and questions relating to the nature and condition of the earth's crust. The question of the proper method of reduction to sea level is of primary importance in connection

with the application of gravity measurements to the problem of the earth's figure. Several stations were selected on account of peculiar local features, and others with a view to obtaining data for computing the earth's mean density. The comparison of results with different kinds of apparatus and with pendulums of different lengths was also borne in mind in the selection, and four of *Commandant Defforges's* stations of 1893 were therefore included; also at three stations, in addition to the regular observations with the half-second pendulums, independent observations with a quarter-second (one-sixteenth metre) pendulum apparatus recently constructed at the Coast and Geodetic Survey Office were made.

The latitudes and longitudes of the stations were mostly derived directly or indirectly from previous Coast and Geodetic Survey determinations, but at eight stations they were determined by actual observation, the latitudes by the usual method and the longitudes by chronometric differences of time. The elevations were obtained from the most accurate data available.

As Mr. Putnam's detailed report on this work is published in full as Appendix No. I, in Part II, of the Report for 1894, it is not necessary here to give a description of the improved instruments used or the methods of observations adopted, but simply a brief notice of the stations belonging to the three geographical divisions. Those belonging to the Middle and Western divisions will be mentioned also under their appropriate headings.

The stations already described in the last fiscal year's report are Washington, D. C.; Boston, Mass.; Cambridge, Mass.; Princeton, N. J.; Ithaca, N. Y.; Philadelphia, Pa.; and Charlottesville, Va. The additional stations in the Eastern Division observed during the present fiscal year are Deer Park, Md.; Cleveland, Ohio; Cincinnati, Ohio; Terre Haute, Ind.; and Chicago, Ill. The stations of the Middle Division are St. Louis, Mo.; Kansas City, Mo.; Ellsworth, Kans.; and Wallace, Kans. Those of the Western Division are Colorado Springs, Colo.; Denver, Colo.; Pikes Peak, Colorado; Gunnison, Colo.; Grand Junction, Colo.; Green River, Utah; Grand Canyon, Wyoming; Norris Geyser Basin, Wyoming; Lower Geyser Basin, Wyoming; Pleasant Valley Junction, Utah; and Salt Lake City, Utah.

The station at Deer Park, Md., was located at the east corner of the swimming-pool building, west of the Deer Park Hotel, and the instruments were supported on a stone pier built for the purpose. The latitude of the station is $39^{\circ} 25' 02''$ N., the longitude $79^{\circ} 19' 50''$ W., and the elevation above mean sea level 770 metres.

At Cleveland, Ohio, the station was located in the west corner of the basement of Adelbert College, in the "balance room" of Professor Morley, the instruments being supported on a large brick pier with capstone. The latitude is $41^{\circ} 30' 22''$ N., longitude $81^{\circ} 36' 38''$ W., and elevation above mean sea level 210 metres.

At Cincinnati, Ohio, the station was the Cincinnati Observatory, on Mount Lookout, in the basement, north of the foundation of the meridian circle, on a brick pier. Latitude $39^{\circ} 08' 20''$ N., longitude $84^{\circ} 25' 20''$ W.; elevation above mean sea level, 245 metres.

At Terre Haute, Ind., the station was the west room of the basement of the main building of the Rose Polytechnic Institute, on a large brick pier topped with slate. Latitude $39^{\circ} 28' 42''$ N., longitude $87^{\circ} 23' 49''$ W.; elevation above mean sea level, 151 metres.

At Chicago, Ill., the station was located on a massive brick pier in the "constant temperature room," northeast part of main floor of the Ryerson Physical Laboratory, University of Chicago. Latitude $41^{\circ} 47' 25''$ N., longitude $87^{\circ} 36' 03''$ W.; elevation above mean sea level, 182 metres.

At St. Louis, Mo., the pendulum station was located on a pier in the south basement room of the chemical laboratory of the Washington University, near the northwest corner of St. Charles and Seventeenth streets. Latitude $38^{\circ} 38' 03''$ N., longitude $90^{\circ} 12' 13''$ W.; elevation above mean sea level, 154 metres.

At Kansas City, Mo., the apparatus was supported on bricks cemented to the concrete floor of a small storeroom in the south part of the basement of the Franklin School, at the northeast corner of Washington avenue and Fourteenth street. Latitude $39^{\circ} 05' 50''$ N., longitude $94^{\circ} 35' 21''$ W.; elevation above mean sea level, 278 metres.

At Ellsworth, Kans., the station was on a large stone doorsill, near the center of basement of the court-house of Ellsworth County. Latitude $38^{\circ} 43' 43''$ N., longitude $98^{\circ} 13' 32''$ W.; elevation above mean sea level, 469 metres.

At Wallace, Kans., the station was on a stone doorsill in the basement of a stone residence belonging to the Union Pacific Railway, and situated a short distance northwest of the railroad station. Latitude $38^{\circ} 54' 44''$ N., longitude $101^{\circ} 35' 26''$ W.; elevation above mean sea level, 1 005 metres.

At Lower Geyser Basin, Wyoming (Yellowstone Park), the station was on a brick pier built for the purpose in an unfinished basement room in the north end of the central wing of the Fountain Hotel. Latitude $44^{\circ} 33' 21''$ N., longitude $110^{\circ} 48' 08''$ W.; elevation above mean sea level, 2 200 metres.

At Norris Geyser Basin, Wyoming (Yellowstone Park), the station was in a small room at the entrance to storehouse, west of lunch station. Three wooden posts driven into the ground and well braced served as a support for the pendulum apparatus. Latitude $44^{\circ} 44' 09''$ N., longitude $110^{\circ} 42' 02''$ W.; elevation above mean sea level, 2 276 metres.

At Grand Canyon, Wyoming (Yellowstone Park), the station was on a brick pier built for the purpose in the unfinished basement of the west end of the main building of the Canyon Hotel. Latitude $44^{\circ} 43' 16''$ N., longitude $110^{\circ} 29' 44''$ W.; elevation above mean sea level, 2 386 metres.

At Salt Lake City, Utah, the gravity station was on a stone pier in the small astronomical observatory in the southeast corner of Temple Block. Latitude $40^{\circ} 46' 04''$ N., longitude $111^{\circ} 53' 46''$ W.; elevation above mean sea level, 1 322 metres.

At Pleasant Valley Junction, Utah, the station was on a brick pier built for the purpose in the west corner of the cellar under the residence of Mr. T. Arrowsmith, about 65 metres north of the Rio Grande Western Railway station. Latitude $39^{\circ} 50' 47''$ N., longitude $111^{\circ} 00' 46''$ W.; elevation above mean sea level, 2 191 metres.

At Green River, Utah, the station was on a brick pier built in the east corner of the cellar under the south part of the Palmer House. Latitude $38^{\circ} 59' 23''$ N., longitude $110^{\circ} 09' 56''$ W.; elevation above mean sea level, 1 243 metres.

At Grand Junction, Colo., the station was on a new brick pier of the cellar under the northeast corner of the Brunswick Hotel, Main street, west of Fourth. Latitude $39^{\circ} 04' 09''$ N., longitude $108^{\circ} 33' 56''$ W.; elevation above mean sea level, 1 398 metres.

At Gunnison, Colo., the station was on a heavy stone door sill of a small room beneath the sidewalk at the northeast corner of the La Veta Hotel. Latitude $38^{\circ} 32' 33''$ N., longitude $106^{\circ} 56' 02''$ W.; elevation above mean sea level, 2 340 metres.

At Colorado Springs, Colo., the gravity station was on a pier in a small room near the northeast corner of basement of Hagerman Hall, Colorado College. Latitude $38^{\circ} 50' 44''$ N., longitude $104^{\circ} 49' 02''$ W.; elevation above mean sea level, 1 841 metres.

At Pikes Peak, Colorado, the gravity apparatus was supported on large stones cemented to the concrete floor of the small storeroom at the south end of the Stone Building on the east side of the summit of the mountain. Latitude $38^{\circ} 50' 20''$ N., longitude $105^{\circ} 02' 02''$ W.; elevation above mean sea level, 4 293 metres.

At Denver, Colo., the pendulum apparatus was supported by large stones cemented to the concrete floor of the basement of the Chamberlain Observatory of the University of Denver, located in University Park. The station is a short distance south of the equatorial foundation. Latitude $39^{\circ} 40' 36''$ N., longitude $104^{\circ} 56' 55''$ W.; elevation above mean sea level, 1 638 metres.

The base station for all of the above is a massive brick pier with capstone, built in the "pendulum room" of the southwest corner of the basement of the United States Coast and Geodetic Survey Office at Washington, D. C. Latitude $38^{\circ} 53' 13''$ N., longitude $77^{\circ} 00' 32''$ W.; elevation above mean sea level, 14 metres.

The season's work closed on October 26, when, the available funds being exhausted, the party returned to Washington.

The average time required per station, including traveling and all incidental delays, was only five and one-fourth days, and the average expense per station was approximately \$60. This rapidity of work was largely due to remarkably favorable weather conditions, there being only two days' delay during the season caused by inability to obtain time observations.

The work at a station comprised the setting up and adjusting the apparatus, swinging the pendulums continuously for at least forty-eight hours, making time observations each favorable

evening, connecting the station with known points, both as regards geographical position and elevation, or determining the latitude and longitude when necessary, and keeping up the field records and computations. Certain additional work was also carried on, as follows: The testing of a set of smaller pendulums by swinging them simultaneously with the others at three stations; testing the wear of the pendulum knife edge by swinging the half-second pendulums on an additional standard edge at two stations; and laying out of meridian lines at Colorado Springs, Colo., and Terre Haute, Ind.

On Assistant Putnam's arrival at Washington he reoccupied the Washington base station, determining the periods of both sets of pendulums; he also investigated the temperature coefficients of the small pendulums and completed and checked his records and computations. He was then employed on miscellaneous office duty until sent again to the field on telegraphic longitude determinations in the Southwest, as described in another part of this report.

From July 1 to September 16 Mr. Putnam was assisted by Mr. C. E. Mendenhall, extra observer, but after that date he executed the work alone.

The importance of gravity determinations, aside from their bearing on problems of geodesy, is becoming widely recognized, especially in geologic research. Mr. G. K. Gilbert, of the United States Geological Survey, who during the summer visited ten of Assistant Putnam's pendulum stations for the purpose of making a study of the geology in connection with the gravity results, has made an interesting report on the subject, which is published with Assistant Putnam's paper in Appendix I, Part II, Report for 1894.

ABSTRACTS OF REPORTS FROM FIELD PARTIES, FISCAL YEAR 1895.

MIDDLE DIVISION.

STATES AND TERRITORIES BETWEEN THE MISSISSIPPI RIVER AND THE ROCKY MOUNTAINS.

28. Minnesota.	32. Nebraska.	36. Indian Territory.
29. North Dakota.	33. Missouri.	37. Oklahoma Territory.
30. South Dakota.	34. Kansas.	38. Louisiana.
31. Iowa.	35. Arkansas.	39. Texas.

Progress Sketches Nos. 2, 10, 15, and 5, 6, 7, 16, show the localities of field work in the Middle Division. A list of Progress Sketches will be found at the close of this volume.

Geodetic and topographical operations in Minnesota.—Continuation of the triangulation and topography in the vicinity of Minneapolis and St. Paul.—At the beginning of the fiscal year the party under the charge of Assistant W. C. Hodgkins was stationed at Minneapolis, having begun the preliminary operations in June, in consequence of a previous request from the State topographer and the regents of the State University, for the determination of additional points in the vicinity of the cities of Minneapolis and St. Paul, with a view to inaugurating a topographical survey of the State of Minnesota. After conference with the State topographer, Prof. William R. Hoag, it had been decided that as far as possible these points should be determined by the graphic methods of the plane table, and at his suggestion it was further decided to extend the work from the mere determination of trigonometric points to a thorough exposition of the methods in use in the Coast and Geodetic Survey for the determination of topographic forms and artificial detail. This proposition, contemplating the instruction of the State topographers in the use of the plane table, and being, therefore, of benefit mainly to the State topographical survey, was approved and accepted by the Superintendent only on the condition that the State of Minnesota should bear all expenses of the work except the pay and subsistence of Assistant Hodgkins and Acting Assistant W. R. Hoag, the latter being also an active member of the party. After completing a projection on a scale of 1-20 000 it was found that the number of triangulation points in some sections was rather limited, and a few additional ones were added in the usual manner. The principal stations of the triangulation were then occupied with the plane table and lines obtained to a large number of prominent objects, the intersection of these lines completing the determination of the objects observed upon. Numerous other points were determined by the methods of resection, and these methods were also carefully explained to the State topographers. Heights were also determined at each station by means of vertical angles. All the topographic details obtainable at any station were delineated before moving to the next, and finally a complete topographic survey of a portion known as the "midway district" was taken up and carried as far as the remaining time at the disposal of the party would permit.

During the season, as opportunity offered, detailed surveys were made of detached localities of special interest, e. g., Minnehaha Park with the celebrated falls of that name, portions of lakes Como, Amelia, Cedar, etc., and a part of the Mississippi River, including the famous falls of St. Anthony.

The country included within the limits of the topographical sheet is of a rolling character, rising rather gently in general from the edges of the gorge through which the Mississippi River flows, but in the vicinity of St. Paul the hills rise more abruptly from the river.

The range of elevation is about 400 feet, or from 700 feet above sea level, at the bottom of the gorge, to 1 100 feet above sea level at "Wallace" Station.

The weather was almost continually hot and dry, and the party suffered much discomfort in consequence.

Field work was closed and the party disbanded on September 27, and Mr. Hodgkins then proceeded to Washington, D. C., where he was engaged on miscellaneous office duty until again ordered to the field. His subsequent services in Chesapeake Bay and on the Hudson River will be mentioned under appropriate geographical headings in other parts of this report.

The statistics of the Minnesota work are as follows:

Area of topography surveyed, in square statute miles.....	21
Shore line surveyed, in statute miles.....	20
Roads and streets surveyed, in statute miles.....	207
Number of topographic sheets completed.....	1
Number of triangulation points occupied with theodolite.....	3

Determination of relative gravity with half-second pendulums, in the States of Missouri and Kansas.—The pendulum stations in Missouri and Kansas—St. Louis and Kansas City in the former State and Ellsworth and Wallace in the latter—were determined by the party under the charge of Assistant G. R. Putnam in September and October, 1894, and form part of the trans-continental series already mentioned under the head of the "Eastern Division." For further particulars concerning this work, see the account on page 28 et seq. of this volume, and Assistant Putnam's paper, published as Appendix No. I, in Part II of the Report of the Superintendent of the United States Coast and Geodetic Survey for the fiscal year ending June 30, 1894.

Continuation of the precise leveling in Missouri and Arkansas.—Assistant Isaac Winston, under instructions dated June 8, 1894, proceeded to Lamar, Mo., leaving Washington on the 15th of June and arriving at the working ground on the 17th. The party was at once organized and preparations made to begin work, when it was discovered that the instrument had suffered damage in transportation, rendering it necessary to send it to Washington for repairs. Another level was at once forwarded so that only a few days' delay was caused by the accident. The time was profitably spent in training the rodmen and recorder in their respective duties. On June 22 the new instrument was received from Washington and leveling operations were commenced the same day. The two bench marks established at the close of the previous season were found in good condition and undisturbed. Connection was made with both and the line of levels was carried southward along the Lexington and Southern Division of the Missouri Pacific Railway at Carthage, Mo., thence along the Kansas Division of the St. Louis and San Francisco Railway to Monett, Mo., and thence along the Texas Division of the same road to Chester, Ark., where a junction was made with two bench marks whose elevation above the mean level of the Gulf of Mexico had been previously determined. This closed the gap in the line from the Gulf to Kansas City, and completed the season's work on October 9.

The season's work began on the rolling prairie or table land of southwest Missouri and extended in the mountainous region of northwest Arkansas, and the line, for convenience, followed closely the roadbed of the railroad, except at Winslow, Ark., where it was taken over the mountain to avoid the railroad tunnel at that place. A check line was, however, subsequently run through the tunnel. The method of observing was the same as before, viz, two simultaneous lines were run in one direction. Mr. Winston reports that no special obstacles were encountered during the season, but that very heavy grades were found in the mountainous region from Winslow to Chester, there being at one place a fall of over 300 metres in a distance of 18 kilometres. Some delay was caused by the strong winds peculiar to that region, but most of the route was protected by adjacent hills or forests, and very good progress was made during the season.

Bench marks were established at the various towns and villages along the line, and the elevation of the railroad track at each railroad station was determined. Velocipede cars were used by the party as a daily means of transportation to and from work, and proved very effective, and also resulted in a great saving of both time and money.

Mr. E. M. Stayton served as recorder in the party during the season, and assisted on the office work. The field computations have been completed and show very satisfactory results.

The statistics of the season's work are as follows:

Distance, in kilometres, of leveling executed	243
Number of bench marks established	27

At the close of the season Mr. Winston was excused from duty for ten days, after which he returned to Washington, and was engaged in computing his field results and on other office duty until again sent in the field in Virginia. His services in that section of the country have already been noticed under the proper head.

Subsequently he was directed to resume leveling in Kansas on the Transcontinental Line, special notice of which will appear farther on in this report.

Longitude determinations by exchange of telegraphic signals at stations in California, New Mexico, Texas, and Louisiana.—For the completion of the main scheme of longitudes in the southwestern part of the United States, the differences of longitude between Needles, Cal., and Santa Fe, N. Mex.; Santa Fe, N. Mex., and El Paso, Tex.; El Paso, Tex., and Austin, Tex.; Austin, Tex., and Galveston, Tex.; Austin, Tex., and New Orleans, La.; Austin, Tex., and Laredo, Tex., were required, and these determinations are of further importance as furnishing connections with the series of longitudes determined in 1892 for the International Boundary Commission.

All of these lines, excepting Austin, Tex., to Laredo, Tex., are of the primary class, requiring ten nights' simultaneous observation at each end and an interchange of observers in the center of the series to eliminate effects of personal equation.

The charge of this work was assigned to Assistant C. H. Sinclair, with Assistant Edwin Smith in charge of the cooperating party.

Messrs. Sinclair and Smith left Washington on February 1, 1895, the former proceeding to Needles, Cal., and the latter to Santa Fe, N. Mex., and immediately preparing the stations for occupation. On account of the excessive heat prevailing at the Needles during a large part of the year it was desirable to make the observations during the winter and early spring, and therefore these stations were first occupied. At Santa Fe, however, the season selected was not the most favorable, as on account of its high altitude severe cold was likely to be experienced. While the party was at this station temperatures as low as 15 degrees below zero were recorded, but this was unusually severe for the month of February. At the Needles, during the same period, it was not necessary to have fire in the residences or in the observatory. Cloudy weather prevailed to such an extent at the Needles during the month of February that only five exchanges of signals were obtained, viz: On the 8th, 17th, 18th, 22d, and 27th. As this completed one-half the required series the observers exchanged stations, Mr. Sinclair proceeding to Santa Fe and Mr. Smith to the Needles. The remaining required exchanges were obtained on March 4, 7, 8, 9, and 10, thus completing the line.

At the Needles the old longitude pier, located in 1889 in the grounds of the Catholic Church, was found intact, and was utilized for the new observations. Latitude was also determined by means of Zenith Telescope No. 6, using fifteen pairs of stars, and seventy-one observations were made on five nights. The latitude station, a temporary wooden structure, was located 50 inches due west of the longitude pier.

In Santa Fe the station of Lieutenant Wheeler, of the United States Engineers, located in the parade ground of Fort Marcy, and used by the Coast and Geodetic Survey in 1886, was reoccupied. The pier of this station is a single large block of stone.

The lines, Needles to Santa Fe and Santa Fe to El Paso, close two of the great circuits in the longitude scheme, and by the field computation of Assistant Sinclair the closing errors seem to be very small, being only nine-thousandths of a second in one case and twenty-three-thousandths of a second in the other—a very satisfactory result.

Magnetic observations, declination, dip, and intensity were also observed at both stations by Assistant Smith. On the completion of the line, Assistant Smith moved the Needles instruments and outfit to El Paso, Tex., Assistant Sinclair remaining at Santa Fe. At El Paso, Mr. Smith found the pier and observatory erected in 1893, in the old Government cemetery (now a city park) still standing, and preparations for beginning observations were therefore soon completed. Signals were exchanged between El Paso and Santa Fe on March 15, 16, 19, 21, and 22, and again, after the usual interchange of observers, on March 24, 25, 26, 27, and 28. This completed the line

Santa Fe to El Paso, and the instruments and outfit at the former station were next moved to Austin, Tex., by Mr. Smith, Mr. Sinclair remaining at El Paso. At Austin, in the capitol grounds, is a large meridian mark built and established by Assistant William Eimbeck, of the United States Coast and Geodetic Survey, in 1892, and the longitude pier of the present season was built 14.5 feet to the northward of it. Signals were exchanged between El Paso and Austin, on April 7, 8, 9, 10, and 11, and again, after interchange of observers, on April 16, 17, 18, 20, and 21, making the required number to complete the line. Magnetic observations were also observed at both stations by Assistant Smith.

On April 23 Assistant Sinclair received notice by telegraph that his wife was critically ill, and would probably not survive many hours, and immediately telegraphed for authority to leave the field and proceed to his home in Charlottesville, Va. This was granted, and as the time was close at hand when it would be necessary for him to resume work on the resurvey of the California and Nevada boundary line, Assistant G. R. Putnam was at once detailed to take his place on the longitude work. Mr. Putnam arrived at Austin on April 27, and meanwhile Assistant Smith had moved to Laredo, Tex., and was preparing the pier and observatory at that place. These preparations were completed by April 29, and the regular observations were begun the same night. Exchange signals were obtained between Austin and Laredo on April 29, May 1, 2, 6, and 7, and again, after the usual interchange of observers, on May 9, 10, 12, 14, and 17, thus completing the line. In addition to the observations pertaining to the longitude determination, a full set of magnetic observations for declination, dip and intensity was made at each of these stations by Assistant Smith, and gravity determinations were made at both by Assistant Putnam. These observations being made in the daytime did not interfere with or delay the regular work of the party. Latitude observations were also made at Laredo by Assistant Putnam. Mr. Putnam then moved his instruments and outfit to Galveston, Tex., and had that station ready for occupation by May 21, but owing to continuous unfavorable weather, signals were not exchanged with Austin until the 26th, and frequent interruptions from the same cause occurred after that date. The exchanges of signals between Austin and Galveston were finally obtained on the nights of May 26, 31, June 1, 2, and 3, and again, after interchange of observers, on June 5, 6, 12, 13, and 16. A full set of magnetic observations, declination, dip and intensity, was also made at Galveston by Assistant Smith, and gravity determinations by Assistant Putnam. Mr. Putnam also made a trigonometric connection of the longitude station at Galveston with prominent points in the city. In the gravity determination at Austin, two stations were occupied, one in the State capitol, and the other in the State University. Assistant Smith then moved to New Orleans, La., and had that station ready for use on June 21. Mr. Putnam remained at Austin, and exchanges of signals between the two stations were obtained on three nights, viz, June 23, 25, and 27, when work was temporarily suspended in consequence of the departure of Mr. Smith for Washington, his connection with the Survey ceasing on June 30. Assistant A. T. Mosman was then detailed to complete the programme of work laid out for the party, arriving at New Orleans on July 2. The remainder of the season's work, falling in a new fiscal year, will properly appear in the next annual report.

It may here be mentioned that while Assistant Sinclair was observing at the El Paso station, signals were also exchanged with the Mexican National Observatory at Tacubaya, near the City of Mexico, and also with the Palacio Observatory, in the City of Mexico. This was done at the request of the officials of the Tacubaya Observatory, for the purpose of obtaining an accurate connection of the longitude system of the two countries, equally valuable to both. A determination of the difference of longitude between Tacubaya and St. Louis, Mo. (Washington University), had been made some years before, but as the observers did not exchange stations the error due to personal equation was not eliminated, and its amount was unknown. In the present case the interchange of observers was also omitted, but Signor Camilo A. Gonzales, the Mexican observer, subsequently came to Washington and observed with Mr. Sinclair at the Coast and Geodetic Survey Observatory, and also at the United States Naval Observatory for personal equation, so that the necessary correction to the field observations can be made. Exchanges of signals between El Paso and Tacubaya took place on nine nights, viz, March 29, 30, April 1, 2, 6, 7, 8, 9, and 10, and on four of these nights exchanges of signals were made also with the Palacio Observatory, City of Mexico.

The field computation of the nine nights' observations gives a probable error of $\pm 0.0087^{\circ}$ in the resulting difference of longitude. This is a very good result, especially in view of the fact that the telegraph circuit was 1 408 miles in length, and that there were repeaters at two points in the line.

Determination of latitude at Laredo, Tex.—The latitude of the station at Laredo, occupied by the telegraphic longitude party in the regular course of their longitude work, was determined astronomically by Assistant G. R. Putnam, in May, 1895. Other stations determined incidentally in the same way will be noticed under their appropriate geographical headings.

Magnetic observations at various stations in the State of Texas.—The regular series of three days' observations of magnetic declination, dip and intensity were made at El Paso, Austin, Laredo, and Galveston during the months of May and June, 1895, by Assistant Edwin Smith, while occupying these stations in the regular course of the telegraphic longitude determinations, as noticed in another part of this report. These observations were merely incidental to the main work of the party, and were so arranged as not to interfere with or delay it.

Determination of relative gravity with half-second pendulums at various stations in Texas.—During the progress of the telegraphic longitude work in the Southwest, described under its proper heading in this report, the spare time of the party was utilized in making other observations. In this way gravity observations were made by Assistant G. R. Putnam at Laredo, Galveston, and at two stations in Austin during the months of May and June, 1895. The improved apparatus heretofore described was used for this work, and the usual method of observation was followed. The reference or base station, as in all relative gravity determinations, was the one located in the "pendulum room" in the basement of the Coast and Geodetic Survey Office at Washington, D. C., the pendulums being swung there usually at the beginning and end of each field season.

Completion of the reconnaissance for a scheme of triangulation along the Rio Grande, from El Paso, Tex., to the Gulf of Mexico.—As stated in the 1894 report, Assistant Stehman Forney, under instructions dated February 28, 1894, had resumed the reconnaissance along the Rio Grande, his stations being selected on both sides of the stream. During the season, which lasted until September 30, about 500 miles of the river were examined, and 61 points for the triangulation selected and marked. The area of country covered by the figures laid out is about 11 700 square miles, and a suitable site for a base line, 5 miles in length, was found about 7 miles east of Brownsville.

The country from Eagle Pass to Fort Ringgold is high and rolling, the ridges being of nearly the same elevation, parallel to each other, and approximately at right angles to the general course of the river. The hills alternately approach and recede from the shores, and the descent to the alluvial plain, which varies in width from a few hundred feet to several miles, is usually very abrupt. A dense growth of mesquite brush and cactus extends to the river banks. On the Mexican side of the river the hills and ridges are higher, but the general character of the country is the same. Numerous creeks, dry or nearly so in summer, wind their way to the river, frequently forming deep gulches. From Fort Ringgold to the mouth of the river, a distance of 140 miles, the country is flat and slopes gently to the Gulf. The same dense growth of mesquite and cactus continues, and this section presented the greatest difficulties to the reconnaissance, and will involve considerable expense in the execution of the triangulation. Many of the stations will require tripods and observing scaffolds from 25 to 75 feet in height, and, owing to the hazy state of the atmosphere at all seasons of the year, the use of heliotropes will be necessary, or the observations will have to be made by means of night signals, as suggested by Mr. Forney in a previous report. The country from Eagle Pass to Brownsville was suffering from a protracted drought, but during August and September copious rains fell, causing the river to overflow its banks, and in a short time the narrow, sluggish stream became a wide and rapid torrent. Such freshets produce great changes in the bed of the river, which frequently shifts its position by considerable distances, so that it will probably be impracticable to trace the channel as it existed in 1848, at the time of the signing of the Guadalupe Hidalgo treaty. The portion of the river below Rio Grande City will present some difficult questions for the Boundary Commission to adjust and settle.

The low, marshy regions near the mouth of the river are frequently entirely covered with water, salt during easterly storms and fresh during river freshets. The prospect of a good harbor at the mouth of the Rio Grande is very slight, the bar being very shallow and frequently shifting its

position. Under the most favorable conditions 11 feet of water is on the bar at Brazos de Santiago, but here also the depth and position vary with every gale. The Morgan Line runs a steamer from Morgan City, La., to Brazos de Santiago once every ten days during the spring and summer months, but later in the season the trips are irregular and uncertain, as ten to fifteen days are sometimes lost in waiting for an opportunity to reach the anchorage inside the bar. From this point passengers and freight are carried by lighters to the wharf at Point Isabel and thence by a narrow gauge railroad to Brownsville.

The Laguna de la Madre, which flows into the Gulf of Mexico at Brazos de Santiago, extends to the northward the entire length of Padre Island to Corpus Christi, but is navigable only for small boats.

The triangulation from El Paso to the mouth of the Rio Grande should be taken up and pushed to completion at the earliest opportunity, but with the present very restricted appropriations this work will require a number of years.

The reconnaissance was completed on the 30th of September and the party disbanded. Assistant Forney was then granted a month's leave of absence, on the expiration of which he returned to Washington and completed the records and sketches of his season's work. He was then assigned to temporary office duty, first in the drawing division and then in the tidal division. Subsequently he was directed to organize a party to participate in the topographical resurvey of Buzzards Bay, Mass., as already noticed in a previous part of this report.

Magnetic records continued at the magnetic observatory near San Antonio, Tex., by means of the self-recording Adie Magnetographs, and absolute values determined monthly by means of portable instruments.—The magnetic observatory at Hillside Ranch, near San Antonio, Tex., continued under the charge of L. G. Schultz, and the instrumental outfit was the same as described in previous reports. Mr. Schultz personally attended to the magnetographs and made the monthly determinations of absolute values—in short, attended to all the actual observations—while Assistant R. E. Halter assisted in the computations and prepared the records for transmission to the office.

Complete photographic records from the three magnetographs were obtained from the beginning of the fiscal year to March 8, 1895, excepting July 4 and 5, when twenty hours' record of the vertical force was lost through a defective adjustment of focus, and on January 25, when the breaking of a cylinder clamp caused the stoppage of the driving clock for an hour and a half.

The scale coefficients (κ), representing the change of magnetic force corresponding to a change of one scale division, were redetermined twice during the year for the horizontal force and vertical force instruments; during July and March for the former and November and March for the latter. These values remained very constant throughout the whole period, a few units in the sixth decimal place covering the extreme range. The March determinations were made in consequence of instructions to discontinue and close the observatory about April 1, as the reduction of the appropriations rendered its further continuance impracticable.

From July 1 to October 1 the photographic sheets were changed every fourth day, each sheet thus containing four days' record, and for the remainder of the time every second day.

The statistics relating to the magnetograph records are as follows:

Number of photographic sheets developed.....	342
Number of scale readings observed.....	1 644
Number of trace readings of declination.....	6 576
Number of trace readings of horizontal force.....	6 576
Number of trace readings of vertical force.....	6 556
Number of trace readings of thermograph.....	6 576
Number of temperature observations.....	1 644

This tabulation refers to the routine work and does not include the large number of observations and readings made in determining scale coefficients and other instrumental constants.

At the request of the Chief of the Weather Bureau, and by direction of the Superintendent, special reports were made to the former every second day from October to March, these reports including, besides the records of the magnetographs, numerous copies of photographic traces, and a special record of trace readings for the determination of the times and extent of magnetic variations during meteorological disturbances within the United States.

Absolute determinations of the magnetic elements, declination, dip and intensity were made on five days of each month during the whole period, but the March observations were omitted in consequence of the loss of the magnetometer by robbery on March 9. The instrument was afterwards recovered, but not in season to obtain the observations. The instrumental constants were carefully determined and frequently checked, and all observations for the determination of force, both oscillations and deflections, were made in the afternoon when the temperature was most steady. Declination observations were always made in both morning and afternoon hours, and the dip only in the afternoon, and time observations for the rating of the observatory chronometer were made once a month.

The following is a tabulation of the observations, etc., made in connection with the absolute determinations:

	Observations.	Determinations.
Declination.....	800	40
Oscillations.....	640	40
Deflections.....	800	80
Dip.....	3 860	80
Time.....	192	8
Temperature.....	440	

The earth-current observations were discontinued early in the fiscal year, as it was found that the results were vitiated by the too near proximity of the electric car lines of San Antonio. During a few days in July, however, Mr. Schultz was authorized to conduct experiments at Rockport, Tex., but these were without definite result, as abnormal weather conditions prevailed during their continuance.

The observatory was finally abandoned on April 17, and Mr. Schultz returned to Washington, where he was engaged until the close of the fiscal year in completing his reductions and computations.

ABSTRACTS OF REPORTS FROM FIELD PARTIES, FISCAL YEAR 1895.

WESTERN DIVISION.

STATES AND TERRITORIES BETWEEN THE ROCKY MOUNTAINS AND THE PACIFIC.

- | | | |
|-----------------|---------------------|---------------------------|
| 40. California. | 44. Montana. | 48. Colorado. |
| 41. Oregon. | 45. Wyoming. | 49. Arizona Territory. |
| 42. Washington. | 46. Nevada. | 50. New Mexico Territory. |
| 43. Idaho. | 47. Utah Territory. | |

Progress Sketches Nos. 2, 4, 11, 12, and 5, 6, 7, 16, show the localities of field work in the Western Division. A list of Progress Sketches is given at the close of this volume.

Topographical resurvey of San Francisco Bay and Harbor.—At the close of the last fiscal year the party under the charge of Assistant A. F. Rodgers was already in the field engaged in preparatory work for the topographical resurvey of San Francisco Bay and Harbor. On July 9 the observing of horizontal angles on the supplemental triangulation was begun at Candlestick Point and continued to Point San Bruno. The new points were computed, abstracted, and platted on a projection, scale of 1-10 000, and the topographical work was then taken up from Point Avisadero southward. A second sheet was then laid out from Belle Air Island southward, but it was then found that owing to the disappearance of many of the points of the old triangulation, executed nearly forty years ago, it would be necessary to determine a large number of new positions. Authority for executing this additional work having been obtained, Assistant Rodgers erected the necessary signals and began the extension of the triangulation October 24. Much delay was occasioned at times by bad weather, and especially by the smoky condition of the atmosphere, and some of the longer lines had to be postponed to a more favorable season of the year. The party was engaged alternately on triangulation and topography until December 31, when on account of unfavorable weather conditions the party was temporarily disbanded. Assistant Rodgers proceeded to San Francisco and utilized the time in completing his records and computations. In the latter part of February the party was reorganized and field operations were resumed and continued to the close of the fiscal year. Assistant Rodgers was called upon from time to time by the hydrographic parties engaged on the resurvey of the bay for additional points, and these were in all cases furnished as promptly as circumstances would permit.

The statistics of the season's work are given by Assistant Rodgers as follows:

Number of triangulation stations occupied	36
Number of points determined trigonometrically	180
Number of pointings made in observing	2 670
Area covered by triangulation, in square statute miles.....	135
Area of topography survey, in square statute miles.....	38
Number of miles of shore line surveyed.....	35
Number of miles of creeks surveyed.....	11
Number of miles of roads surveyed.....	57
Number of miles of railroad surveyed.....	39
Number of topographic sheets completed.....	3

Hydrographic resurvey of San Francisco Bay and Entrance.—For the execution of this important work two parties, on the steamers *Gedney* and *McArthur*, respectively, were detailed.

The steamer *Gedney*, under the command of Lieut. Lucian Flynne, after completing the season's work in Washington Sound and Strait of Juan de Fuca, proceeded, in accordance with instructions, to San Francisco, arriving there November 9, 1894. After repairing and refitting at Oakland, Cal., the hydrographic work was commenced March 29, 1895, and continued to the close of the fiscal year.

The statistics of the work accomplished by June 30 are as follows:

Area sounded, in square geographical miles.....	10
Number of miles run while sounding.....	374.8
Number of angles measured.....	6 585
Number of soundings taken.....	12 383
Number of tidal stations established.....	3

The sheet upon which the party was engaged embraces that portion of San Francisco Bay from Alcatraz Island to Fort Point, including Richardsons Bay and Raccoon Straits.

The steamer *McArthur*, under the command of Lieut. James H. Sears, proceeded to San Francisco, Cal., after the close of the season's work on the west coast of Washington, and after the completion of necessary repairs, began work in the Bonita Channel and northern part of the Golden Gate February 1, 1895. Work was continued without interruption to the close of the fiscal year.

The statistics to the date of this report, June 30, are as follows:

Area sounded, in square geographical miles.....	25.4
Number of miles (geographical) run while sounding.....	903
Number of angles measured.....	15 185
Number of soundings taken.....	55 450
Number of tidal stations established.....	7

Both parties are still engaged upon this work, and the full statement of statistics and results will appear in the next annual report.

Continuation of tidal record at the Sausalito (San Francisco Bay) tidal station.—The self-registering tide gauge at the Sausalito tidal station, under the immediate charge of observer Emmet Gray, and under the supervision of Assistant George Davidson, continued in operation during the entire fiscal year, and furnished an unbroken record. The relation of the gauge to the permanent bench marks in the vicinity has been frequently verified, and the station chronometer has been rated and corrected by means of time observations at Lafayette Park observatory.

In connection with the hydrographic resurvey of San Francisco Bay and Harbor, another self-registering gauge has been set up at the wharf of the Union Iron Works at San Francisco, and placed in charge of the Coast and Geodetic Survey suboffice. Observations at this station will be maintained only during the continuance of the survey, but the low-water readings of both gauges will be corrected by a line of levels.

Longitude determinations by exchanges of telegraphic signals at stations in California and New Mexico.—For the account of this work, under the charge of Assistant C. H. Sinclair, see Middle Division, where the California and New Mexico stations, Needles and Santa Fe, are treated in connection with those of Texas and Louisiana.

Determination of latitude at Needles, Cal.—In February, 1895, Assistant C. H. Sinclair, in charge of the party engaged in determining telegraphic differences of longitude at various stations in the southwestern part of the United States, incidentally determined astronomically the latitude of the station at Needles, Cal. The station is located in the grounds of the Catholic Church, a short distance (about 50 inches) west of the pier used in the longitude determination. Zenith Telescope No. 6 was used and 71 observations were made on five nights, using fifteen pairs of stars. Other latitudes determined in connection with the longitude work will be noticed under their appropriate geographical headings.

Magnetic observations in California and New Mexico.—A full series of three days' observations for the determination of the magnetic elements, dip, declination, and intensity were made at Needles, Cal., and Santa Fe, N. Mex., by Assistant Edwin Smith during February and March, 1895. The observations were made incidentally, while the stations were being occupied for the determination of longitude, as already noticed in the account of the telegraphic longitude work, and being made in the daytime did not delay or interfere with the regular work of the party.

Magnetic observations at Carson City, Nev., and at Lake Tahoe, California.—In November, 1894, magnetic observations, declination, dip and intensity were made at Carson City, Nev., and Lake Tahoe, California, by the party engaged under the direction of Assistant C. H. Sinclair on the survey of the California and Nevada oblique boundary line. This was done at the close of the season and while the storing of the camp outfit, etc., was in progress, as stated in the account of the boundary survey work.

The station at Carson City was located in the grounds of the Pardion and in the meridian of the transit of Mr. C. W. Friend's observatory, and one square south of it.

The station at Lake Tahoe was located 25 metres due south of the longitude pier of 1893, near the Lakeside Tavern at the southeast end of the lake. Both stations are so marked that they can be recovered when necessary in the future.

Magnetic observations in the States of Washington and Oregon.—During the autumn and winter of 1894–95, Assistant J. J. Gilbert was instructed to redetermine the magnetic elements at various points in the States of Washington and Oregon. The first observations were made at Port Townsend, Wash., between the 13th and 21st of November. The old magnetic station was occupied, but on account of local disturbances the period of observation was extended several days beyond the usual time. Observations for magnetic declination, dip and intensity were next made at Olympia, Wash., during four days, viz, December 12, 13, 14, and 15. On February 12, Assistant Gilbert proceeded to Seattle and Tacoma, where dip only was required, one day being spent in observations at each place.

On February 18 Mr. Gilbert proceeded to Portland, Oreg., and made a full series of observations during three days, viz, February 20, 21, and 22, at the old magnetic station in the grounds of the United States custom-house. The observations at this station subsequently proved unsatisfactory, and it was found that the close proximity of the electric wires and other disturbing causes had vitiated the results. It was necessary, therefore, to select a new station free from such local disturbances, and this was done later in the season by Mr. Gilbert, who revisited Portland for that purpose in March, 1895. The new station, with the consent of the local authorities, was located in the city park, and observations for declination, dip and intensity were obtained on March 6, 7, and 8. On February 24, 25, 26, and 27 similar observations were made at Cape Disappointment, the old magnetic station near the house of the light keeper being reoccupied; and on March 1, 2, 3, and 4 at Vancouver, Wash. At Vancouver the old magnetic station of the Coast and Geodetic Survey could not be recovered, and a new one was therefore selected and carefully marked for future reference. The chronometer used in the magnetic work was rated by means of time signals telegraphed from the Lick Observatory.

Continuation of the hydrographic survey of the Strait of Juan de Fuca and Washington Sound, Washington.—As already stated, the steamer *Gedney*, under the command of Lieut. Lucian Flynne, was placed at the disposal of Assistant J. J. Gilbert, and the commanding officer directed to furnish every facility for the prosecution of the triangulation and topography; also, as opportunity afforded, to make a hydrographic survey of Washington Sound in the vicinity of San Juan, Oreas, and Stuart islands, and of the Strait of Juan de Fuca from the vicinity of Port Angeles to Whidby Island.

The hydrography is embraced on seven sheets, two of which relate to the Strait of Juan de Fuca and the remainder to Washington Sound. The shore line and geographical positions needed were furnished by Assistant Gilbert as his work progressed.

The party of Lieutenant Flynne collected much valuable information in relation to the harbors, channels, and dangers of this part of the coast, which will be utilized in the preparation of charts and in the Coast Pilot publications of the Coast and Geodetic Survey.

The *Gedney* arrived on the working ground May 19, 1894, and worked continuously until October 18, when, Assistant Gilbert's work being also completed, she proceeded to Port Townsend, and thence to Seattle, where certain necessary repairs were made. She then proceeded to San Francisco, arriving there November 9. After repairing and refitting at Oakland the vessel, still under the command of Lieutenant Flynne, was assigned to duty in connection with the resurvey of San Francisco Bay, as already noticed.

The statistics of the season's hydrographic work in Washington Sound and Strait of Juan de Fuca are as follows:

Area sounded, in square geographical miles.....	475
Number of miles (geographical) of sounding lines.....	1 233.5
Number of angles measured.....	10 145
Number of soundings taken.....	11 665
Number of tidal stations established.....	3
Number of specimens of bottom preserved.....	18
Number of hydrographic sheets finished.....	6

The list of naval officers attached to the hydrographic party of the steamer *Gedney* is as follows:

Lieut. Lucian Flynne, commanding officer; Lieut. L. J. Clark; F. C. Schubert, pay yeoman and draftsman; A. F. Berryhill, apothecary and observer; P. N. Christiansen, observer; and A. E. Brisman, recorder.

Continuation of the survey of Washington Sound, Washington, triangulation and topography.—In accordance with instructions of May 14, 1894, Assistant J. J. Gilbert had taken the field prior to the close of the last fiscal year, and the steamer *Gedney*, under command of Lieut. Lucian Flynne, was placed at his disposal. Lieutenant Flynne was directed to furnish every facility for the prosecution of the work of Mr. Gilbert, and, as opportunity offered, to execute the hydrography. Assistant Gilbert joined the *Gedney* at Port Townsend on the 18th of May, and as soon as the necessary supplies were obtained the vessel proceeded to Friday Harbor. The erection of signals was at once begun, and, during the remainder of May, 65 were completed along and near the shores of Haro Strait. Triangulation observations were begun June 1 and completed July 27, during which time the triangulation was extended through Haro Strait, President Channel, Middle Channel, Harney Channel, and West Sound, including Deer Harbor, Mosquito Pass, Rock Harbor, and Westcott Bay. The balance of July was occupied in making projections for the topographic sheets. The topography was begun August 1 and closed October 17, during which interval three sheets were completed.

Owing to the requirements of the hydrography, the triangulation was extended far beyond the limits necessary for the season's topography, and by working every night Assistant Gilbert was able to keep up the computations and furnish geographical positions to the hydrographic party without any delay to either class of field work.

The statistics of the season's work are as follows:

Area of triangulation, in square statute miles.....	215
Number of signals erected.,	142
Number of stations occupied.....	93
Number of geographical positions determined.....	146
Area of topography, in square statute miles.....	36.6
Length of general coast line surveyed, in statute miles.....	96.8
Length of roads surveyed, in statute miles.....	51.3
Number of topographic sheets completed.....	3

The topography executed includes the northwest part of Orcas Island, and San Juan Island from the middle of the Spieden Channel to Dead-Mans Bay, and the following complete islands: Shipjack, Bare, Waldron, Gull, Flattop, Stuart, Johns, Cactus, Spieden, Henry, Morse, and Barren.

After closing the work, Assistant Gilbert proceeded on the *Gedney* to Port Townsend, where he stored his instruments, and thence to Seattle, where he left the vessel and proceeded to Olympia for the completion of his office work.

Subsequently he was directed to make certain magnetic observations in Washington and Oregon, which will be noticed in the proper place.

In his report Assistant Gilbert expresses his high appreciation of the uniform courtesy of Lieutenant Flynne and the other officers of the *Gedney*, and the zeal displayed in the prosecution of the work.

Hydrography off the coast of Washington.—At the close of the previous fiscal year the steamer *McArthur*, under the command of Lieut. F. H. Crosby, U. S. N., was engaged in making a hydrographic survey of the coast of Washington, from Grays Harbor to the Quillayute River.

On the 18th of August, while attempting to land through the surf near the mouth of Jo Creek, for the purpose of building a signal, the whaleboat, containing the commanding officer and nine men, was capsized, and Lieutenant Crosby and four seamen were drowned. This distressing accident was reported by Ensign O. P. Eaton, upon whom the command of the vessel temporarily devolved, as follows:

STEAMER MCARTHUR,
Ocosta, Grays Harbor, Washington, August 20, 1894.

SIR: It is my painful duty to report the death by drowning of Lieut. F. H. Crosby, Quartermaster Third Class John Freyer, and Seamen William Nehm, Alexander Smith, and Jens Gudmundsen, while attempting to land through the surf near Jo Creek, about 17 miles north of Grays Harbor, on the west coast of Washington, about 8 a. m., Saturday, August 18.

The *McArthur* anchored about a mile and a half offshore at this point Friday afternoon. That afternoon Lieutenant Crosby, the commanding officer, with nine men, landed through the surf, and commenced to erect a hydrographic signal. At this time the sea was smooth, with hardly any swell. Saturday morning there was a dense fog and long swell. Lieutenant Crosby left the ship, with nine men, on the whaleboat at 7:20, to complete the signal. When outside the surf he directed the men to take off their shoes and heavy clothing, cast off the trailing lines of the oars, unship rudder and steer with an oar. He cautioned them that a boat might go through the surf with safety ninety-nine times and be capsized on the hundredth; he then cautioned them if upset to get hold of life-preservers or oars, dive under the breakers and come up between them to breathe, and make for the beach. They then pulled a few strokes toward the beach, when a big breaker caught the boat and swung her to starboard, nearly broadside to the surf. Before they could turn the boat another breaker caught and capsized her. After a hard struggle, five men, Erik Carlson, quartermaster, second class; Seamen Jan Rask, Charles Hagerstrom, and M. Becker, and First-Class Fireman O. Danielson succeeded in getting ashore, most of them in a dazed and exhausted condition. They were cared for by the settlers along the beach. As soon as sufficiently revived, they and a number of settlers patrolled the beach, searching for the others. The whaleboat was washed ashore about one mile below where most of the survivors landed. There are white settlers every mile or so along the beach, and both white men and Indians are constantly traveling back and forth, but the fog was so thick that morning that one could see only 40 or 50 yards, and the settlers first knew of the accident by the survivors of the whaleboat going to their houses.

About 11 a. m. the fog began to clear. I had a lookout kept from the ship, and watched constantly myself with the glasses for the captain and party. I saw no signs of them at work on the signal, and feared an accident had happened, especially as the surf was very heavy. I ran in as close to the shore with the ship as was safe, and after a while saw a man waving a tablecloth as a signal. Knowing that I could do nothing from outside with the ship or boats, I ran inside Grays Harbor and anchored near Damons Point. On the way down I kept a careful lookout for any signs of the party, knowing that there was a strong inshore current to the southward. I felt that nothing could be done by us under the circumstances, however, as such a long time—over three hours—had elapsed since the whaleboat must have entered the surf. Immediately upon arrival at Damons Point I secured a team and drove up the beach to the scene of the disaster, and found that five men had reached the beach in safety. They patrolled the beach until 2 p. m., and then returned to the ship. The settlers patrolled the beach that day until dark, and all the next day. They did all in their power to render assistance. The whaleboat, oars, etc., were washed ashore, but no bodies have been found up to this time.

Mrs. Crosby, who has been living in Ocosta this summer, has been notified.

I gathered the tools, gear, etc., they had ashore, and engaged a wagon to bring the whaleboat down to the Oye hut, where I can get it, and knowing I could do no further good, started back for the ship. On the way down our team ran away while crossing a bridge over swampy land, and Roscoe, the apothecary, the driver, and myself were thrown out. Roscoe had a bad hole made in front of his left leg above the ankle, reaching to the bone, and from his complaints I feared he had suffered internal injuries also.

I got another team, and, as soon as we got back to the ship, came to Ocosta. Fortunately, the doctor says Roscoe's injuries are not serious, but the hole in his leg will lay him up for several weeks, probably. I escaped with a sprained hand and leg and bruised head, and will probably be all right in three or four days.

A little steamer makes daily trips to the Oye hut from Ocosta, and the settlers along the beach will keep me informed as to whether any bodies are found. I expect to go to the Oye hut after the whaleboat in a few days, if able, or will have it and the gear brought over by the steamer. I directed that they be left in the care of the storekeeper at the Oye hut.

From the accounts of the settlers the bodies may be washed ashore in from three to ten days, or not at all.

The safe is locked and the combination unknown on board, so I can not ascertain the state of the accounts of Lieutenant Crosby, and of the men. I respectfully request instructions under the circumstances, and as to entries to be made on enlistment records, etc.

Respectfully,

C. P. EATON,
Ensign U. S. N., Commanding.

To Lieut. Commander J. F. MOSER, U. S. N.,
Hydrographic Inspector.

The bodies of Lieutenant Crosby and three of the men were subsequently washed ashore at various dates; that of Lieutenant Crosby on September 28, or about six weeks after the accident.

By this sad mishap the Survey and the Navy lost a valuable and efficient officer. Some account of his services will be given in the report of the hydrographic inspector in the "Office Report No. 2" of this volume.

Lieut. James H. Sears was assigned to the command of the *McArthur*, and reported on board September 3. The season's work closed a few days later, September 10.

The following are statistics of work accomplished during the season:

Area sounded, in square geographical miles.....	773
Number of miles run while sounding.....	1 177.5
Number of angles measured.....	6 683
Number of soundings.....	22 001
Number of tidal stations established.....	1
Number of current stations.....	22
Number of hydrographic sheets finished.....	2

The *McArthur* then proceeded to San Francisco, Cal., to assist in the resurvey of San Francisco Bay, as already noticed in the proper place.

Examination of depths of the water front of Tacoma, Wash.—In consequence of the landslide which occurred at Tacoma in November last, and in response to numerous requests, it was deemed advisable to make an examination of the depths near the water front, and as the steamer *Hassler* was laid up in the vicinity, the commanding officer, Lieut. G. B. Harber, was directed to make the survey.

The results have been platted and show that considerable changes have taken place.

The statistics of the work are as follows:

Number of miles (geographical) of sounding lines.....	12.8
Number of angles measured.....	394
Number of soundings taken.....	438
Number of tidal stations established.....	1
Area sounded, in square geographical miles.....	0.25

Determination of relative gravity with half-second pendulums in Colorado, Wyoming, and Utah.—Gravity determinations with the new half-second pendulums were made at various stations in these States and Territories by the party under the charge of Assistant G. R. Putnam during the months of July, August, and September, 1894.

The stations in Colorado were located at Denver, Colorado Springs, Pikes Peak, Gunnison, and Grand Junction; those in Wyoming at Grand Canyon, Norris Geyser Basin, and Lower Geyser Basin (all in the Yellowstone Park); and those in Utah at Salt Lake City, Green River, and Pleasant Valley Junction. These stations form part of the transcontinental series already mentioned and described in the general account of the season's gravity work under the head of "The Eastern Division." For further particulars, see pages 28 et seq. of this volume, and Assistant Putnam's paper, published as Appendix No. I, in Part II of the Report of the Superintendent of the United States Coast and Geodetic Survey for the fiscal year 1894.

It may here be mentioned that the localities of the stations at Pikes Peak and Colorado Springs were selected with a view to obtaining, incidentally, data for the determination of the mean density of the earth. The observations have been computed by Mr. Putnam, and give 5.63 as the value of the earth's mean density.

Laying out a meridian line at Colorado Springs, Colo.—In August, 1894, Assistant G. R. Putnam, while occupying the station at Colorado Springs for the determination of gravity, laid out, at the request of Prof. F. H. Loud, a true meridian line, for the use of local surveyors in testing their compass needles and determining the magnetic declination.

Geodetic work.—Continuation of the transcontinental triangulation in Colorado.—At the close of the last fiscal year the party under the charge of Assistant William Eimbeck had completed the reconnaissance eastward from Mount Ouray and was engaged in transporting camp and outfit up that mountain and making the preliminary arrangements for its occupation. Mount Ouray is one of the main stations of the great transcontinental triangulation, is located on the axial line of the Continental Divide, and rises to an altitude of 14 100 feet. The work at this station comprised all the classes of geodetic, astronomical, and magnetic observations usually made at primary points in the mountain region, and these observations, particularly those for horizontal

directions, were extended over a sufficient interval of time to include varied meteorological conditions, and thus secure results reasonably free from the vitiating effects of atmospheric refraction.

Eight primary and many secondary points were observed upon for horizontal directions, heliotropes being used on all the primary lines, and zenith distances for the determination of relative elevations were also observed on both primary and secondary points. The astronomical work consisted of time, latitude, and azimuth determinations, and the magnetic work of the usual observations for declination, dip and intensity. The occupation of the station was completed early in August, after which a short base was measured at the lower camp by means of a steel tape, and a local triangulation was executed to connect the railroad station at Marshall Pass, and differences of elevation were carried through the scheme by means of zenith distance measures. A bench mark was established at Marshall Pass, so that the spirit-leveling work of the survey may ultimately connect with the points determined trigonometrically. A similar trigonometrical connection, for the same purpose, was effected the preceding spring at Grand Junction. While the occupation of Mount Ouray was in progress, three cooperating parties, under Mr. Eimbeck's general direction, simultaneously occupied the stations at Mount Elbert, Bison Peak, and Plateau. The special notice of the work of these parties will appear farther on.

Assistant Eimbeck, in accordance with instructions, closed field operations on the 31st of August, and disbanded his party at Gunnison, Colo., and the cooperating parties were also directed to suspend work about the same time. Aid R. L. Faris and Recorder A. C. Walker, attached to Assistant Eimbeck's immediate party, returned to Washington early in September, and were temporarily employed at the office on the records and computations. Assistant Eimbeck, after settling up his party affairs, also returned to Washington by September 20, and was engaged during the winter in completing his records, making the necessary computations, abstracting results, etc. Aid R. L. Faris was detached from the party on January 4 and assigned to duty in the party of Assistant P. A. Welker, in Pensacola Bay, Florida., as mentioned elsewhere in this report.

In the spring of 1895 the field work in Colorado was resumed, and Assistant Eimbeck reorganized his party at Grand Junction early in May, Assistant John Nelson, Aid R. L. Faris, and Recorder Willis M. Baum and Walter H. Clay reporting to him for duty at that place. For the work in the vicinity of Grand Junction the party was divided, Assistant Eimbeck, with W. H. Clay as recorder, taking charge of the occupation of "Chiquita" station, while Messrs. Nelson and Faris, with W. M. Baum as recorder, executed the trigonometric connection of the Grand Junction astronomical station with the main triangulation. Both of these operations, in spite of unfavorable weather conditions, were completed by June 6, when the two branches of the party were consolidated for the main work of the season which involved the occupation of Treasury Peak, Pikes Peak, and Uncompahgre. The party was transferred first to Gunnison and thence to the Elk Mountains, and on the 16th of June went into camp at State Creek Canyon, about 4 000 feet below the summit of Treasury Peak. Here considerable delay was occasioned by the fact that the snow was yet deep, the former camping ground of 1893 near the summit being still buried under an extensive snowdrift 15 feet deep. Assistant Nelson was detailed to prepare the Pikes Peak station for occupation and the same condition of affairs was found to exist there, and similar difficulties were also encountered in stationing the heliotropes at Mount Elbert and Mount Ouray. In addition to these obstacles to progress, the party had to contend also, during the latter part of June, with severe and boisterous weather, snowstorms occurring almost daily, and the temperature being very low. The instruments were mounted by the 23d of June, but at the close of the fiscal year little progress had been made in the observations at either station, although the preparatory work was all completed.

Incidental to the main work at Grand Junction a line of spirit levels was run from the trigonometric station to connect with the railroad levels at the Denver and Rio Grande depot, and certain gravimetric observations were made with a view to determining later the relative gravity intensity at the summit of Uncompahgre. Magnetic observations, declination, dip, and intensity were also made at "Chiquita" station.

Assistant Eimbeck, in his report, highly commends Assistant John Nelson, Aid R. L. Faris, and the recorders of the party for their untiring diligence and painstaking devotion to the interests of the work, and the creditable discharge of the arduous duties devolving upon them.

The party being still in the field, the results of the season's work will appear in the next annual report.

Geodetic work.—Continuation of the transcontinental triangulation in Colorado.—At the beginning of the fiscal year Assistant F. D. Granger was assigned to duty on the transcontinental triangulation in Colorado, and proceeded to Pueblo early in July and organized a party for the occupation of Plateau, a station in the main scheme previously selected by Assistant William Eimbeck, and located about 9 miles to the northeast of Pueblo. The station was prepared and in readiness for observations by the 18th of July, but owing to unfavorable weather conditions they were not begun until the 22d. Three primary and twenty tertiary objects, mostly mountain peaks, were here observed for horizontal directions, and double zenith distances of all the primary and most of the tertiary points were also determined. The three primaries observed were Pikes Peak, Mount Ouray, and Mount Bison, and a fourth—Cramers Gulch—was also desired, but the line to it was found impracticable on account of high intervening ridges. Observations at Plateau were completed by August 14, and the station was then carefully marked and described, and a target-tripod signal was then erected over it. Preparations were then made for the transfer of the party and outfit to Big Springs, but the nonarrival of funds caused a delay until the 20th, when telegraphic orders were received to close field operations and disband party, the balance of appropriation remaining not being sufficient for the occupation of another station. The camp outfit, instruments, etc., were moved to Pueblo and stored by the 27th, when the party was disbanded, and Assistant Granger returned to Washington, accompanied by his recorder, C. K. Knight, who rendered valuable service during the season.

Assistant Granger, after computing the results of his field work, was assigned to duty in the office until May 16, 1895, when he was directed to prepare for the resumption of field work on the transcontinental triangulation early in June. Leaving the East on June 2 he arrived at Pueblo on the 5th, and by the 14th the party was organized and en route to Big Springs, distant from Pueblo by wagon road about 50 miles. The station was prepared for observations, heliotropes being posted at Plateau, Pikes Peak, and Divide, and the work was fairly under way before the close of the fiscal year. A reconnaissance was also made for the location of a secondary station between Big Springs and Plateau, the line from the latter to Cramers Gulch having proved impracticable, and the point Dry Camp was selected.

The observations at Big Springs will determine the horizontal directions and the elevations of four primary, one secondary, and a number of tertiary points, and the usual determinations of magnetic declination will be made. The primary stations are Cramers Gulch, Plateau, Pikes Peak, and Divide, and the secondary station is the newly selected one at Dry Camp. Mr. J. B. Bontelle, a computer in the office, was detailed to act as recorder and to assist in the observations, and Mr. E. E. Torrey was assigned to the party as foreman; and Assistant Granger, in his report, highly commends both for their efficient services rendered in the prosecution of the work.

Mr. Granger's report for the fiscal year is accompanied by a sketch showing the relative positions and distances of the primary and secondary points, the distances observed ranging from 20 to 90 miles.

The principal statistics of the party's work for the year have been tabulated as follows:

Area of triangulation, in square statute miles.....	1 130
Number of signals erected.....	6
Number of stations occupied for horizontal measures.....	2
Number of stations occupied for vertical measures.....	2
Number of geographical positions determined.....	6
Number of elevations determined trigonometrically.....	6
Number of magnetic declinations determined.....	1
Number of new stations selected.....	1
Number of primary stations observed for horizontal directions.....	7
Number of secondary stations observed for horizontal directions.....	1
Number of tertiary stations observed for horizontal directions.....	.20

Continuation of the reconnaissance and transcontinental triangulation in Colorado.—As the result of the conference between the Superintendent and the chiefs of the four parties to be engaged on the Colorado section of the transcontinental triangulation, the reconnaissance and occupation of the

northeastern portion of the great figure which has Pikes Peak for its central point, the Continental Divide for its western limit, and includes to the eastward points in the scheme crossing the Colorado Plains, was assigned to Assistant F. W. Perkins, who took the field about the middle of June, 1894. The king peaks of the Saguache Range, Mount Ouray and Mount Elbert, had already been selected, Pikes Peak was known to be visible from both of them, and the valley of the Arkansas River makes an opening between the Arkansas Hills and the Wet Mountains, through which, from Mount Ouray, the plains had been seen past the northern end of the Sangre de Christo Range. On the north over a hundred miles of unpromising country lay between "Mount Elbert" and the northernmost plains station "Divide," and the Park Range, the Puma Hills, the Tarryall Mountains, and the Rampart Range crossing the line between these two points, it was feared that it might be impracticable, and that recourse would be necessary either to two extra intermediate stations, or to Mount Evans, 30 miles to the north, and known to be very difficult of access, especially to a party laden with instruments and camp outfit. To reconnoiter this country, settle questions of intervisibility, and project the most practicable scheme of connection, was the first duty of Mr. Perkins, after which he was to make the necessary observations at as many of the selected stations as time and available funds would permit.

Assistant Perkins reached Denver on the 11th of June, and immediately began preparations for the reconnaissance. Pikes Peak and Divide Station were first visited, and it was soon demonstrated that the line from the latter to Mount Elbert was impracticable owing to the great height of the intervening Rampart Range. A little to the northward of the line, however, a peak was visible which was identified as Bison, the highest peak of the Tarryall Mountains. This peak was reached after considerable difficulty, and from it Pikes Peak, Mount Evans, Mount Ouray, the Divide of the Arkansas and Platte, and Mount Elbert, were found to be visible, the latter just showing through a depression in the intervening Mosquito Range. Bison was therefore suitable for the connecting station, and further reconnaissance being unnecessary, Mr. Perkins returned to Pikes Peak to erect a signal and post a heliotrope, leaving his recorder, Frederick L. Olmsted, to cut the trail and prepare Bison Station for occupation. This was accomplished in due time, and observations were begun at Bison on the 15th of July, heliotrope signals having first been exchanged with all the stations to be observed, except Mount Elbert.

The observations were completed early in August in spite of very unfavorable weather conditions. Rain, hail, or snow fell nearly every afternoon, and consequently a large part of the observations were taken in the morning hours, but a sufficient number of afternoon measurements were obtained to verify the results. Mr. Olmsted was then sent to prepare the Pikes Peak Station, but owing to the nonarrival of funds the main party was delayed at Bison until August 23, and additional observations were made meanwhile. At that date instructions were received to close field operations and disband party, as the remaining funds would not suffice for the occupation of another station.

The moving of the party from the mountains, the collecting and storing the outfit and instruments, and final disbanding of party were accomplished by the 29th, and Assistant Perkins returned to Washington.

The statistics of the season's work are given as follows:

Number of new points selected for the scheme	1
Number of lines of intervisibility determined	4
Aggregate length of lines, in statute miles	212
Area of reconnaissance, in square statute miles	2 900
Number of stations occupied for horizontal and vertical measures	1
Number of signals erected	1
Number of observing piers erected	3
Number of directions determined	5
Number of observations for horizontal direction	3 420
Number of elevations determined trigonometrically	4
Number of observations for vertical angles	1 004
Number of magnetic declinations determined	1

The horizontal measures were made by Assistant F. W. Perkins, and the vertical and magnetic observations mainly by Recorder F. L. Olmsted.

Assistant Perkins has submitted a very full report concerning the country traversed by him in the reconnaissance and on his geodetic work. The report is also accompanied by a sketch showing the relative positions and distances of the main points of the scheme. The distances observed in the triangulation this season range from 36 to 70 miles.

His subsequent services on the oblique arc in Alabama have been mentioned elsewhere in this report.

Continuation of the transcontinental triangulation in the vicinity of the thirty-ninth parallel, in Colorado.—At the beginning of the fiscal year the party under the charge of Assistant P. A. Welker had reached the summit of Mount Elbert, a high peak of Lake County, Colo., and was nearly ready to begin observations. Mount Elbert is located on the Continental Divide, and has an altitude of about 14 436 feet, and is therefore the highest point ever occupied as a triangulation station. It is, moreover, one of the most difficult of access, and the difficulties encountered in making the ascent, establishing camp, and preparing the station were very great. The preliminary preparations were completed by July 8, and the observations were begun the following day. Owing to the peculiar weather conditions, the majority of the observations were made during the morning hours, there being rarely an opportunity for obtaining them in the afternoon on account of wind, snow, and thunder storms. Regarding the abnormal atmospheric conditions which prevailed during the occupancy of the station, Mr. Welker reports as follows:

It would be difficult to describe the terrible experience of the party at this station. During my years of service in these mountains, I have never seen anything that could be compared to it. Every day during its occupation, with one exception, there were heavy snowstorms, accompanied by wind and the most terrific lightning and thunder that can be imagined. At times the mountain was charged with electricity, numerous suspended electric lights were seen, and different members of the party received violent shocks. The storms invariably continued from noon until about 9 o'clock at night. The observatory and theodolite were struck twice, the vertical circle twice, the azimuth mark once, and a rock cairn near the summit once. One bolt destroyed the brick pier of the theodolite, and plowed an 8-inch furrow about 15 yards long through the rocky surface of the summit. The sunshade at the end of the theodolite telescope was twice pierced by lightning, the molten metal spattering over the object glass and shattering it, and the Y's, pivots, and foot screws of the instrument were badly burned.

The damaged instrument was repaired as well as possible with the limited tools and facilities available, and the observations completed, after which it was returned to Washington for thorough repair.

Although the electric storms were unusually violent and continuous this season, it is an established fact that on the higher mountains they are always severe during the months of July and August, and the occupation of the summit should, as far as possible, be avoided during these months. Unfortunately the season when observations are practicable in these high altitudes is at best short, but September and October are usually very favorable.

All observations for horizontal directions were referred to a mark located on a sharp peak at a distance of about $2\frac{1}{2}$ miles from the station. The observations were made in 16 positions of the theodolite circle, one observation with telescope erect, and one with telescope reversed being considered a series. The series in each position were necessarily much broken on account of all the objects not showing at the same time, but these were eventually all observed.

The work at the station consisted of observations for horizontal directions, vertical measures, and magnetic declination. For the horizontal and vertical observations heliotropes were stationed at five main points of the triangulation scheme, viz, at Ouray, Uncompahgre, Treasury, Bison, and Pikes Peak, and the same heliotropes were utilized for showing to the observers of the other parties simultaneously employed on the transcontinental geodetic work. Observations were also made upon 26 secondary peaks, and five prominent objects at Leadville and Twin Lakes were determined. The length of triangle sides in the main scheme ranged from 36 to 91 miles. The cupola of the Ninth street schoolhouse at Leadville was also occupied for the purpose of connecting the town with the main triangulation and determining positions of secondary points.

The observations at Mount Elbert were finished July 27, after which the work above mentioned was done, and preparations made for the occupation of Mount Uncompahgre, but before reaching the latter station the party was recalled, owing to the exhaustion of the appropriation, the amount having been reduced by the appropriation act which passed in August.

The party was disbanded August 30 after suitable provision had been made for the storage and care of the property.

Assistant John Nelson was attached to the party during the season, and made all the observations for vertical measures and magnetic declination, and his zeal and hearty cooperation are highly commended by Mr. Welker.

Messrs. Welker and Nelson, at the close of the season, returned to Washington, and were engaged on the reductions and computations of their field work until again assigned to other duty. Their further field services are mentioned under the appropriate headings elsewhere in this report.

Mr. Welker's report is accompanied by a sketch showing the work accomplished, and the connection of Mount Elbert with the other points of the great transcontinental triangulation.

The statistics of the season's work have been tabulated as follows:

Number of observations of horizontal direction.....	869
Number of observations for vertical measures.....	1 005
Number of determinations of magnetic declination.....	5
Number of points observed for horizontal direction.....	37
Number of points observed for vertical measures.....	13

ABSTRACTS OF REPORTS FROM FIELD PARTIES, FISCAL YEAR 1895.

DIVISION OF ALASKA.

[Under this heading are included the coasts of Alaska which border on the North Pacific Ocean, on Bering Sea, and on the Arctic Ocean; also the inlets, sounds, bays, and rivers.]

The localities of field operations in Alaska are shown in Progress Sketches Nos. 3, 4, and 17 to 24, inclusive. See a list of Progress Sketches at the close of this volume.

Hydrographic and general surveys in Alaska.—The steamer *Patterson*, under the command of Lieut. Commander W. I. Moore, at the beginning of the fiscal year was engaged in the survey of Chatham Straits, Alaska, having previously landed the parties of Assistants Dickens, Morse, and McGrath at their respective stations at the head of Behm Canal, Sitka, and Yakutat Bay. She reached her working ground and began work on May 27. The work assigned for the season included the survey of Chatham Straits from Point Augusta to Point Samuel, the west end of Kenasnow Island and Freshwater Bay, Tenakee Inlet (Siwash Passage), and the north end of Hoods Bay, including Killisnoo Harbor. The triangulation, shore line, and hydrography were completed to Point Samuel, with the exception of Kootsnahoo Inlet, but part of the sketching of the topography was left unfinished, owing to the interruption of the work caused by the necessity of transporting the civilian parties engaged on the Alaskan Boundary Survey.

A base line of 1 950½ metres was measured on the north shore of Tenakee Inlet, and the triangulation was carried northward from it to connect with Lieutenant Commander Mansfield's work of 1890, and southward to Point Samuel.

During the progress of the work tide gauges were established at Funter Bay, Parlor Harbor (Nasanki), and Killisnoo, and astronomical stations were determined at East Point and at Angoon village, near Killisnoo.

The *Patterson* left the working ground on August 2 for Yakutat Bay, and proceeded thence with Assistant McGrath's party to Lituya Bay, returning to Chatham Straits August 14, but a topographical party was kept in the field during her absence. On August 14 the season's work closed, and Lieutenant Commander Moore proceeded with the vessel to Sitka to take on board Assistant Morse's party, and then returned to Port Townsend and San Francisco, arriving at the former place August 30 and at the latter September 7. The *Patterson* remained at San Francisco during the winter, and on March 15 Lieut. Commander W. I. Moore was relieved of the command of the vessel and was succeeded by Lieut. Commander E. K. Moore.

The following is a list of naval officers and others attached to the party during the season: Lieut. Commander W. I. Moore, commanding officer; Lieut. James H. Sears; Lieut. R. F. Lopez, astronomer; Lieut. Hugh Rodman; Ensign W. B. Hoggatt; Ensign Glennie Tarbox; P. A. Surg. C. J. Decker; Assistant Engineer H. G. Leopold; Draftsmen and Records H. L. Ford, W. G. Appleton, and H. Rodman.

The statistics of the season's work are tabulated as follows:

Number of base lines measured.....	1
Number of triangulation signals erected.....	44
Number of other signals erected.....	276
Number of stations at which angles were measured.....	291
Number of stations occupied for vertical measures.....	48
Number of latitude stations determined.....	2

Number of pairs of stars observed for latitude	41
Number of chronometric longitude stations	2
Number of azimuth stations	2
Area of topography sketched, in square statute miles	385
Length of shore line delineated, in statute miles	301
Number of topographic sheets worked on	3
Area sounded, in square geographic miles	320
Number of miles (geographic) run in sounding	830
Number of angles measured	4 143
Number of soundings taken	6 619
Number of tidal stations established	3
Number of specimens of bottom preserved	8
Number of hydrographic sheets completed	4

The resumption of work by the steamer *Patterson*, in the spring of 1895, will be mentioned in the next paragraph.

Resumption of hydrographic and general surveys in Alaska in the spring of 1895.—The steamer *Patterson*, under the command of Lieut. Commander E. K. Moore, was again fitted out in the spring of 1895 for the continuation of the hydrographic and general surveys in Alaska, and sailed from San Francisco on the 11th of April, touching at Seattle and Tacoma on the way. By direction of the Superintendent she was required to furnish transportation to the various civilian parties of the survey, to be engaged on the Alaskan Boundary Survey, to their respective fields of work, and Assistants E. F. Dickins and Fremont Morse, with two men and the outfit and stores for four field parties, accordingly joined the steamer at San Francisco, and Assistant P. A. Welker Aids O. B. French and C. C. Yates, and extra observers H. A. Grady and R. L. Livingston, with eight men and the remaining party equipments, were taken on board at Seattle. Assistant Morse was landed at Seattle, that being the base station for the determination of Alaskan chronometric longitudes, and the other parties were landed at Port Simpson, the head of Portland Canal and Mary's Island, respectively. The schooner *Earnest*, laden with coal for the season's consumption, was taken in tow at Tacoma and left at Port Simpson in temporary charge of the civilian parties, and the steam launch *Fuca* was delivered at the head of Portland Canal to Assistant P. A. Welker for the use of his party in the chronometric longitude work. The *Patterson* then proceeded to her own working ground, stopping on the way at Wrangell Narrows to locate an uncharted shoal reported by the *City of Topeka*, at Killisnoo to land signal lumber, and at Sitka to take on board the boats and equipments stored at the close of the previous season.

The regular field work of the season was begun May 13 in Chatham Straits at the point reached last autumn, and at the close of the fiscal year the party had made good progress. A tide gauge was established on the east face of the "Alaska Oil and Guano Company's" wharf at Killisnoo, and a base line 700 metres in length was measured at the mouth of Hootz or Hood Bay; this base, the longest that could be obtained in the locality, was connected with the triangulation of the previous season, making a satisfactory junction, and from it the triangulation was extended into Hootznahoo or Kootznahoo Inlet and across Chatham Straits into Peril Strait as far as Broad Island. The hydrography has been nearly completed within the same limits, but in certain localities some further development may be necessary; and the sketching of the topography has been carried down Chatham Strait on the west side as far as the north side of Peril Strait, and on the east side to Danger Point, including Hootznahoo Inlet. Hootznahoo Inlet is a dangerous sheet of water about 12 miles in length by 5 in width, filled with islands, rocks, reefs, and rapids, but there are channels through which vessels of moderate size can pass at slack water, and fair anchorage exists in its two principal bays. Coal has been found here, and some has been mined, and it was deemed advisable, therefore, to make a thorough local survey, and Ensign W. B. Hoggatt was left for six weeks with a detached party in camp for this purpose. Hootz Bay contains some rocks and reefs, but there is a good channel at the entrance, plenty of water inside, and a fair anchorage at the head. At present these two bays or inlets are used chiefly by the Alaska Oil and Guano Company, which has extensive works and a good wharf at Killisnoo, and runs a number of steamers, scows, and other boats. This company is well equipped, and is prepared to do a large business, but during the stay of the *Patterson* in the vicinity the works were closed in consequence of the prevailing "hard times."

An astronomical station was also established at Killisnoo, the longitude being obtained by chronometric exchanges with the Alaska Boundary Survey parties and the latitude by direct observation.

On June 25 the vessel moved to Pogibshi Anchorage, north of Pogibshi Point, at the west end of Peril Strait, and here a tide gauge was erected and sites selected for an observatory and an additional base line.

The north end of Peril Strait is a wide sheet of navigable water, deep to the shore line, but containing many outlying islands, rocks, and sunken reefs; the shores are abrupt, and the surrounding hills, like those in nearly all parts of southeastern Alaska, are high, rugged, and covered to a height of about 2 000 feet with a dense growth of timber. This region is within the limits of the fishing and hunting grounds of the Sitka Indians, and they are frequently met with in their canoes and temporary camps. Fish are plentiful, both in the straits and in the mountain streams, but game is becoming comparatively scarce, although some deer, bear, and grouse are still found. Vegetation is rank along the beach and in places reached by the rays of the sun, and blueberries, salmon berries, and wild flowers are abundant. More than thirty varieties of the latter were collected within an area of three or four acres at Pogibshi Point; among them, sweet peas, violets, columbines, flags, water lilies, and others known to warmer climates and more southern latitudes.

The weather during the season was favorable for the execution of triangulation and hydrography, but the topography and astronomical work were somewhat delayed by drizzling rains, low-hanging clouds, and fogs, the latter concealing the hill and mountain tops, but not interfering with sights on the lower levels.

The statistics to the close of the fiscal year are given by Lieutenant Commander Moore as follows:

Number of base lines measured.....	1
Area covered by triangulation, in square statute miles.....	140
Number of signal poles erected.....	742
Number of stations occupied for horizontal angles.....	546
Number of astronomical stations determined.....	1
Number of pairs of stars observed for latitude.....	30
Number of chronometric longitudes determined.....	1
Number of azimuths observed.....	1
Area of topography sketched, in square statute miles.....	125
Length of shore line surveyed, in statute miles.....	148
Area sounded, in square geographical miles.....	117
Number of miles (geographical) run while sounding.....	506
Number of sextant angles measured.....	3 147
Number of soundings recorded.....	3 736
Number of tidal stations established.....	4
Number of specimens of bottom preserved.....	7
Number of current stations occupied.....	1

The further results of the season's work will appear in the next annual report.

The naval officers attached to the *Patterson* during the season are as follows: Commanding officer, Lieut. Commander E. K. Moore; Lieut. A. G. Rogers, Lieut. R. F. Lopez, Lieut. Hugh Rodman, Ensign W. B. Hoggatt, Ensign H. K. Benham, P. A. Surg. R. M. Kennedy, Assistant Engineer S. E. Moses, and Draftsmen and Records H. L. Ford, W. G. Appleton, and Hugh Rodman.

Transportation of boundary survey parties, of chronometers between astronomical stations, and hydrographic and topographic developments.—At the beginning of the fiscal year the *Hassler*, Lieut. Giles B. Harber, U. S. N., commanding, was engaged in transporting chronometers between Pyramid Harbor and Sitka for the purpose of enabling the astronomical observers at those two points to determine their difference of longitude. In all, seven and one-half round trips were made, and during and between these trips the topography along the route traversed was sketched. At first these sketches were made from the ship, angular measurements, referring to peaks already platted on the sailing charts, being made with the sextant. This proved unsatisfactory and recourse was had to theodolite operations, but, for lack of a vertical circle, elevations were deter-

mined with the sextant. Photographs were also taken to assist the draftsman in contouring the areas involved. About 1 040 square miles of topography were sketched in this way.

Lieutenant Harber concludes his report on the season's operations with a list of corrections to the published charts and Coast Pilot.

The *Hassler* and *Patterson*, with the boundary survey parties on board, sailed from Sitka on August 20, and arrived at Port Townsend on August 30. The *Hassler* then proceeded to Tacoma, where she was laid up.

Reference to a hydrographic examination of the water front at Tacoma, in the locality of the landslide which occurred in November, will be found on a previous page.

The list of naval officers attached to Lieutenant Harber's party during the season in Alaska is as follows: Lieut. A. C. Almy, Ensign W. S. Cloke, Ensign H. K. Benham, P. A. Surg. C. H. T. Lowndes, Assistant Engineer W. C. Herbert, Draftsman C. W. Fitzgerald, Pay Yeoman P. T. Manning, and Writer T. P. Toohey.

Tidal observations at Sitka, Alaska.—The Stierle self-registering tide gauge, set up at Sitka by Assistant Fremont Morse in June, 1893, remained in operation until August 6, 1894, when the series of observations obtained being sufficient the station was discontinued. These observations have already been mentioned elsewhere in this report.

SPECIAL OPERATIONS.

Determination of geographical positions for the establishment of a speed-trial course for naval vessels in Long Island Sound.—Under date of November 3, 1894, the honorable Secretary of the Navy requested the Superintendent of the Coast and Geodetic Survey to determine trigonometrically the geographical positions of certain points along the north shore of Long Island, from the eastern end to Stratford Shoal, to facilitate the establishment in Long Island Sound of a speed-trial course for naval vessels. In compliance with this request instructions were issued to Assistant Herbert G. Ogden to proceed to the locality indicated immediately on the completion of the topographical work upon which he was then engaged in the vicinity of Quincy, Mass., and to execute the necessary supplemental triangulation. Mr. Ogden, accompanied by his recorder, left Quincy on the 22d of November and arrived at Greenport, Long Island, on the 24th. The triangulation was at once begun, and was successfully completed by December 14, Mr. Ogden reaching Washington and reporting at the Survey Office December 18. The resulting geographical positions were furnished to the Navy Department as soon as they could be computed.

The statistics of the field work are as follows:

Area covered by triangulation, in square statute miles.....	40
Number of signals erected.....	9
Number of stations occupied for horizontal measures.....	11
Number of geographical positions determined.....	18
Number of pointings made in observing.....	385
Number of directions determined.....	60

Assistant Ogden's services during the remainder of the fiscal year have already been mentioned.

Establishment of the Naval Observatory circle.—A joint resolution of Congress, approved August 1, 1894, provided for the establishment of a circle around the United States Naval Observatory, and required the United States Coast and Geodetic Survey to make the necessary surveys.

According to the provisions of the act, certain tracts of land were to be acquired by purchase, and others, already a part of the Observatory site, were to be sold in order to transform the present irregular-shaped Government property into a circle having a radius of 1 000 feet.

On September 5, Assistant E. D. Preston was directed to report to the Commissioners appointed by the Secretary of the Navy and to proceed with the work of defining the circle. This work was successfully accomplished by October 1. It was then found necessary to make a resurvey of the original plat because some of the old points could not be recovered. This resurvey was completed by October 6, and all the results, including a map, were turned over to the commissioners on October 13.

Mr. Preston was assisted in the field work by Messrs. J. B. Boutelle and C. C. Yates, and in the computations by Messrs. F. D. Granger, H. F. Flynn, and R. A. Harris.

Special survey of the Fox islands, Chesapeake Bay, at the request of the Virginia State authorities.—The Fox islands lie on the eastern side of Chesapeake Bay, in Accomac County, Va., and form the dividing line between Tangier and Pocomoke sounds. The group is composed of a series of low, marshy islands of irregular shapes, separated from one another by narrow channels. The direction of the axis of the group is about north and south. About a mile to the eastward is a second series of small islets, separated by broad passages, and lying nearly in a straight line

running about north-northwest and south-southeast; these are also considered as a part of the Fox Island group. The owner of these islands being interested in oyster culture, and desiring to pursue certain investigations and experiments in developing his interests, entered into negotiations with the State authorities in order to acquire full control over a certain area of water suitable for his purpose. The result was an act of the general assembly, approved by the governor February 26, 1894, entitled "An act to define and establish by straight lines the low-water mark lines for the riparian owner of the shores of Fox Island, or Fox islands, in the county of Accomac, in the State of Virginia." In this act is a provision that the United States Coast and Geodetic Survey be requested to compute the acreage of the area between high and low water mark lines, and that their computation shall be accepted as final both by the State authorities and the riparian owner; and consequently in the spring of 1894 the parties interested made application to Superintendent Mendenhall for the necessary information. The data in the archives of the Survey being insufficient for the purpose, it was proposed on the part of the State and the riparian owner, and agreed to on the part of the Superintendent, that a new and special survey be made, the expenses of the same to be borne by the parties interested. No action could be taken however at that time, as the assistants of the Survey were otherwise employed, and the matter was necessarily deferred until the spring of 1895, when the present Superintendent of the Coast and Geodetic Survey, with the approval of the honorable Secretary of the Treasury, directed Assistant W. C. Hodgkins to proceed with the work.

Tidal observations for the determination of the plane of mean low water were begun March 27, and the topographic and hydrographic survey early in May. Some triangulation was necessary, as the old points of the former survey had mostly disappeared, and a base line, 1 319 metres in length, was measured by means of a steel tape on Great Fox Island. The topography and hydrography followed in order, and were completed by May 28. The tide gauge was kept running, under the charge of Mr. R. W. Maupin, until the close of the work, so that with the exception of a few tides, lost through accidental causes, we have a three months' continuous series of observations.

The only specially notable feature developed in this survey is the great amount of erosion that has taken place along all parts of the shores of these islands since the former survey was made. The total loss since 1851 is estimated by Assistant Hodgkins as 36 per cent of the existing area, a ratio of wear that seems to indicate that the Fox islands will, before many years, disappear entirely. The wear is most marked, of course, on the western or Tangier side, the extensive shoals on the Pocomoke side materially reducing the effect of storm waves.

On the completion of the survey, Assistant Hodgkins returned to Washington, and was engaged on his office work until assigned to duty on the Hudson River Survey, as already mentioned on a previous page.

The statistics of the Fox islands work are as follows:

Number of base lines measured	1
Area of triangulation, in square statute miles	10
Number of signals erected	21
Number of stations occupied for horizontal angles	11
Number of miles of leveling	8
Number of azimuth stations occupied	1
Area of topography, in square statute miles	1
Length of coast line surveyed, in statute miles	16
Number of topographical sheets	1
Area sounded, in square geographical miles	10
Number of miles of sounding lines run	103
Number of angles measured	1 936
Number of soundings taken	11 363
Number of tidal stations occupied	1
Number of hydrographic sheets	1

Physical hydrography.—Continuation of the surveys of the location and mapping of the natural oyster beds in the waters of the State of Virginia.—This important work, commenced in 1892 at the request of the governor and legislature of the State of Virginia, and which has been continuously under the charge of Assistant J. B. Baylor, has now been completed. Field and office work pertaining to this survey occupied Mr. Baylor during the present fiscal year from July 1, 1894, to May

20, 1895, and during that time seven elaborate oyster charts have been prepared and printed in colors, and two reports containing 106 pages of printed matter, giving angles, distances, etc., as determined trigonometrically from marked shore stations, have been published.

The statistics as given by Assistant Baylor are as follows:

In Accomac County (ocean side) 69 natural oyster rocks were surveyed, embracing an area of 14 242.2 acres.

In Northampton County (ocean side) 49 natural oyster rocks, embracing an area of 30 349.3 acres, were surveyed.

Six hundred and eighty-five corners of natural oyster rocks were determined by angular measures from shore stations.

The printed reports referred to contain, in addition to the distances and bearings of the corners from the shore stations, the depths of water, tidal information, descriptions of stations, and full directions to the civil engineer and others for finding any desired corner. The method of conducting the work and making the determinations is also described.

All expenses of this work throughout its continuance, excepting the salary of the chief of party, have been paid by the State of Virginia, but during the last season the United States Commissioner of Fish and Fisheries placed the steam launch *Petrel* and her crew at Mr. Baylor's disposal while engaged on the field work. On the completion of the survey Mr. Baylor was directed to make magnetic observations at various points along the Atlantic coast. This work will be noticed in another part of this report.

Mobile Bay and vicinity; survey of oyster grounds for the United States Commissioner of Fish and Fisheries.—As mentioned in the report for 1894, Mr. Homer P. Ritter, at the request of the United States Commissioner of Fish and Fisheries, and by direction of the Superintendent of the United States Coast and Geodetic Survey, made a survey of the oyster beds of Mobile Bay and vicinity during the months of February and March of that year. The observed water densities, however, proved unsatisfactory, owing to the fact that during the whole time the survey was in progress extensive freshets prevailed in the streams tributary to Mobile Bay, and the waters of Mobile Bay and Mississippi Sound were consequently much less saline than under normal conditions. The Commissioner of Fish and Fisheries therefore requested that Mr. Ritter, on his return from Alaska, where he had meanwhile been assigned to duty in connection with the International Boundary Survey, be again detailed to supplement the first survey and to redetermine the water densities. Mr. Ritter accordingly proceeded to Mobile Bay in the latter part of November, 1894, chartered a small oyster schooner, and began work December 1. Temperature and density observations were repeated throughout the oyster area, and additional angles and soundings were measured, and some additional specimens were collected. The work was completed by December 8, and Mr. Ritter then returned to Washington. He has submitted a full report on the surveys, and a map embodying their results, copies of which have been furnished to the Commissioner of Fish and Fisheries.

Resurvey of the international boundary line between the United States and Mexico.—From July 1, 1894, to January 5, 1895, Assistant A. T. Mosman continued on duty as member of the International Boundary Commission, with headquarters at San Diego, Cal., the time until October 11 being occupied in completing the field maps of the northern side of the boundary.

On October 11 the Joint Commission adjourned to meet in Washington, D. C., one year from that date, and all records and maps pertaining to the United States section were sent to the State Department early in November.

Mr. Mosman was instructed by the honorable Secretary of State to report to the Superintendent of the United States Coast and Geodetic Survey on January 5, 1895, for duty under his direction until October 1, when his services will again be required on the Boundary Commission. Mr. Mosman was assigned by the Superintendent to duty in the computing division, and served until June 4, when he was directed to assume temporary charge of the drawing division. On June 30 he proceeded to New Orleans, La., to assume charge of the telegraphic longitude party operating in that section of the country.

Continuation of the resurvey of that part of the boundary line between the States of California and Nevada which extends from a point in Lake Tahoe to the Colorado River.—On the completion

of the longitude work at Seattle and Tacoma, Wash., near the close of the previous fiscal year, Assistant C. H. Sinclair proceeded to San Francisco and made preparations for the resumption of work on the California and Nevada boundary line, intending to take the field on the 1st of July, and meanwhile Assistant Walter B. Fairfield was engaged in selecting and purchasing the necessary live stock and outfit and transporting them to Carson City, Nev. Owing to the great railway strike inaugurated June 28, Mr. Sinclair was unable to leave San Francisco until July 27, causing a vexatious delay and a loss of nearly a month of the most favorable time for field work. The instruments sent from Washington for the use of the party were delayed for the same reason and did not arrive at Carson City until the latter part of July.

The party was organized at Carson City, and on July 29 reached the southeast end of Lake Tahoe, where an azimuth was determined in order to begin the ranging out of the oblique boundary. Mr. Sinclair took personal charge of the ranging out of the line, and detailed Assistant W. B. Fairfield to take charge of the triangulation, topographical sketching, and magnetic observations. The point selected for the azimuth was 805.15 metres due north of the longitude pier of 1893, being the computed position of the intersection of the meridian of that station with the oblique boundary near its northeast end. From the azimuth station a point was fixed 460.5 metres northwest, near the shore of Lake Tahoe, and called "Initial, 1894." The azimuth station itself is designated as "T₁," and successive points along the line as "T₂," "T₃," "T₄," etc. For the first part of the line the sights were short, "T₁" being only 4 miles distant from "Initial," but from "T₇" a number of points in the Carson Valley were located, the farthest one being "T₂₂," on the summit of the Antelope Range, a distance of 16.4 miles. Then the theodolite was taken back to "T₆," as that point had greater elevation, and points located to "T₃₂," on the east slope of the "Middle Sister," in the Sweetwater Mountains. To this point was a clear sight of 43.8 miles, the longest sight in ranging out a boundary line of which we have any record, but it was greatly exceeded by the following one from "T₃₂" to the White Mountains, a distance of 68.8 miles. This great sight was made with the aid of a small pocket Steinheil heliotrope with a mirror only 1 by 1¼ inches, and the signals were clearly interpreted at that distance. This point is "T₆₀," and is the southeast limit of the ranging-out work of the season, a total distance of 116.2 miles from "Initial." Points were located on the summit of all important ridges on the line and at the crossing of the Carson and Colorado Narrow Gauge Railroad, and, as will be seen from the number of points established in the given distance, the average distance apart of the points to be permanently marked is less than 2 miles. The points were temporarily marked by a drill hole in the rock, in which were set poles surrounded by piles of stones.

As the ranging-out work progressed more rapidly than the triangulation, and as it was desirable to keep the two classes of work together, Assistant Sinclair from time to time suspended the ranging-out operations and assisted the other branch of the party. The triangulation was carried along over the high mountains just south of Lake Tahoe, thence across the Carson Valley and over the Antelope Range, thence across the Antelope Valley and over the Sweetwater Mountains, and finally to the summit of the White Mountains, a total distance of 116 miles, and hence bringing the triangulation to the limit reached by the ranging-out party. The base for this triangulation was derived from the primary triangulation of the Coast and Geodetic Survey, which in crossing the continent passes near Lake Tahoe. The sides of the triangles are from 2 to 5 miles in length, and the angles were measured for the most part with a 6-inch repeating theodolite. For some angles, however, a 10-inch instrument was used. In the course of the work a number of the old boundary posts, located by Von Schmidt in 1873, were found, and in all cases these were carefully determined by the triangulation party. During the progress of the work the magnetic declination was determined at all points on the line, and observations for height were made at all line points and at most of the trigonometrical points. The topography was also sketched throughout the line for a distance of half a mile on each side.

Both sections of the party were able to subsist on the country at the various ranches and small hotels, and hay and grain for the animals could generally be procured in the immediate neighborhood of the work; but over one section of the line a desert 30 miles in extent had to be traversed, and here some difficulty was encountered on account of the total absence of water. The teams of the party had, therefore, to be employed a part of the time in carrying water from a

distance for the use of the men and animals. The whole party consisted of eleven men and the two officers named, with two four-mule teams, one thorough-brace wagon drawn by a pair of mules, and thirteen saddle and pack animals.

On the completion of the triangulation, November 10, the whole party returned to Carson City, reaching that point November 16, where the instruments, wagon, and outfit were stored, and the animals quartered for the winter. While this was being done, magnetic observations were made at Carson City and at Lake Tahoe. The magnetic station at Carson City was located in the grounds of the Pardion and in the meridian of the transit of Mr. C. W. Friend's observatory (one square south of it). The station was marked so that it can be recovered when necessary in the future. The station at Lake Tahoe was located 25 metres due south of the longitude pier of 1893, near the Lakeside Tavern, at the southeast end of the lake. Magnetic bearings of the lines of the triangulation were also observed during the progress of the work with a compass declinometer.

On the completion of the magnetic observations, and the storing of the property, Messrs. Sinclair and Fairfield, in accordance with instructions, returned to San Francisco, and after conference with Assistant George Davidson, who was charged with a general supervision of matters connected with the boundary survey, and settling up of party accounts, proceeded to Washington. The office work and computations pertaining to the field work were then taken up and continued until interrupted by the assignment of Messrs. Sinclair and Fairfield to other field duty; the former, on February 1, 1895, to telegraphic longitude work in the Southwest, and the latter, on May 16, to the California and Nevada boundary work.

The statistics, on account of the noncompletion of the office work, are incomplete, but may be given in part as follows:

Number of miles of line ranged out.....	116.2
Number of line points located.....	60
Number of ranging-out stations occupied.....	16
Number of azimuths observed.....	1
Number of signals erected for triangulation.....	37
Number of stations occupied in the triangulation.....	65
Number of points trigonometrically determined.....	106
Number of horizontal angular measurements.....	13 542
Number of magnetic declinations determined with compass declinometer.....	60
Number of magnetic stations occupied with magnetometer and dip circle.....	2

An account of Assistant Sinclair's longitude work in California, New Mexico, and Texas, and also of his and Assistant Fairfield's subsequent work on the California and Nevada boundary line, will appear under the appropriate headings elsewhere in this report.

Resumption of the resurvey of the oblique boundary line between the States of California and Nevada in the spring of 1895.—On May 15, 1895, Assistant C. H. Sinclair was directed to make preparations for the resumption of the resurvey of the oblique boundary line between the States of California and Nevada, from the point reached in the previous season, and Assistant W. B. Fairfield was again assigned to his party. Assistant A. L. Baldwin was also assigned to the party. Messrs. Sinclair, Fairfield, and Baldwin left Washington on May 22 for San Francisco, where the final preparations were completed by June 3. The party then proceeded to Carson City, Nev., and from this point to the field of operations, a distance of over 150 miles, it was necessary to drive, there being no railway transportation. This drive was accomplished in five days, and work was commenced on the 14th of June at line station "T₅₉," where the Carson and Colorado Railroad crosses the boundary line. Here an azimuth was observed and a check base 1 080 metres in length was laid out and twice measured with a steel tape. The base was measured along the rails of the railroad, and was subsequently connected with the triangulation in the usual manner. Mr. Sinclair again took charge of the ranging out of the line, and Mr. Fairfield of the triangulation, topographic sketching, and magnetic observations. To Mr. Baldwin was assigned the charge of the forward subdivision of the ranging party. The ranging out began at "T₆₀," the southernmost point reached during the former season, on the summit of the White Mountains, and at an elevation of nearly 14 000 feet above sea level. This station is very difficult of access, and

the climbing arduous and in places dangerous. A start was made for the summit on June 17, and Mr. Sinclair's section of the party camped for the night at the highest point where water is to be found. The ascent was continued the next morning, but it was soon necessary to leave the animals and continue without them, and after five hours of severe exertion the summit was reached. It was then necessary to shovel away the snow in order to see forward to the next station, 12 miles to the southeast. This latter point, which overlooks the Fish Lake Valley and commands the country for 30 or 40 miles, was next occupied. Line points are being located every few miles across this valley, and on all the conspicuous ridges, as far as the topography of the country will permit.

Assistant Fairfield has connected the base line above referred to with the triangulation, and is now carrying the latter across the southeast slopes of the White Mountains, a very difficult and troublesome region to traverse with a small scheme of triangulation. The work will probably proceed this season with greater rapidity than last, as the employment of two additional men will much facilitate the execution of the reconnaissance and the erection of signals.

Mr. Sinclair, in his report, acknowledges in complimentary terms the hearty cooperation of Assistants Fairfield and Baldwin in every phase of the work, and the commendable zeal displayed by every member of the party.

At the close of the fiscal year the party was still in the field, and the statistics of the work will therefore appear in the next annual report.

Special topographic and hydrographic survey of the vicinity of the Port Orchard dry dock, Washington, for the use of the Navy Department.—The honorable Secretary of the Navy having made requisition on the Coast and Geodetic Survey for a large scale detailed topographic and hydrographic survey of the vicinity of the Port Orchard dry dock, Puget Sound, Washington, Assistant J. J. Gilbert was at once detailed to execute the work.

Mr. Gilbert left Olympia on the 23d of April, arriving at Port Orchard on the following day, and immediately began operations. Hands for his party were at first supplied by the naval officer in charge of the dry dock, but subsequently a crew was detailed from the steamer *Hassler*. The shore line was traced and the topographic details delineated by means of the plane table, on a scale of 1-1 000, and the elevation contours for successive intervals of 3 feet were accurately located by actual spirit leveling. The hydrography was closely surveyed to a depth of 6 fathoms, the sounding lines being run at intervals never exceeding 50 feet. The survey was completed by May 20, and the finished sheet was a few days later forwarded to the Coast and Geodetic Survey Office, where a certified copy was made for the use of the Navy Department.

Assistant Gilbert, on the completion of the work, returned to Olympia and resumed the computation of his triangulation of 1894. At the close of the fiscal year he was engaged in making preparations for the resumption of field work in Washington Sound.

Alaska boundary work.—Chronometric exchanges of time comparisons between Sitka Observatory and Pyramid Harbor Station, for the determination of the longitude of the latter.—At the beginning of the fiscal year Assistant Fremont Morse was engaged in making time observations at Sitka in connection with chronometric longitude determinations for the Alaska Boundary Survey. Chronometers were carried in the usual manner by the steamer *Hassler* between Sitka and the astronomical station at Pyramid Harbor near the head of Lynn Canal. The chronometers were in charge of Mr. James Page, a member of Mr. Morse's party, and were intercompared daily, and on the arrival of the steamer at either station they were compared by two observers with the station chronometers. Time observations were made on every clear night in order to determine accurately the chronometer rates. Longitudes were also determined in the same manner at two of the steamer *Patterson's* stations, viz, at Freshwater Bay and Killisnoo.

During the season the tidal observations at Sitka were also continued until August 6, at which date the series begun June 27, 1893, were considered complete. Magnetic observations were also made at the Sitka magnetic station.

The longitude work was finished by August 19, and Assistant Morse then returned to San Francisco where he completed the records and computations pertaining to his field work. He was then engaged with Assistant Davidson in latitude computations and miscellaneous office work until the following spring, when he was reassigned to the determination of Alaskan longitudes, as already mentioned in another part of this report.

The principal statistics of the season's work are as follows:

Number of azimuths observed.....	1
Number of nights on which time observations were made.....	34
Number of magnetic stations occupied.....	1

Survey from the south end of Malaspina Base to the Yahtse River, and determination of points near Lituya Bay.—The completion of the survey of this stretch of coast was described in the annual report for 1894.

Assistant McGrath, in his report dated January 10, 1895, furnished a more detailed description of the progress and results of this survey. His topographic map covers the coast from the Osar River to Icy Cape in front of the Malaspina Glacier. A large forest fills the area that is bounded by the Osar River on the east and the Manby on the west. The dense growth of spruce extends up to the very foot of the moraine that marks the glacier, and on its inner edge the occasional spasmodic advances of the glacier have recorded themselves in the destruction caused in the forest by such invasions.

The Manby River flows through a wide plain which is thickly overgrown in the summer with wild rye and peas. Bordering the drainage basin of the Manby in the east is found a section which is dotted with thrifty patches of woods. At a distance of about 16 kilometres from Point Manby the great glacier advances to the very edge of the sea, and for 13 kilometres a most painful and difficult course must be pursued to reach the west end of the icy Sitkagi Bluffs. Receding again from the shore line, the face of the glacier sweeps inland to a distance of 7 kilometres from the shore at the center of the Yahtse Delta, and then it curves seaward to Icy Cape, where the ice begins to discharge again into the ocean.

The distance from the west end of the Sitkagi Bluffs to Icy Cape is about 42 kilometres. This section is traversed by many arms of the Fountain, Yahna, and Yahtse rivers. In this stretch are several lakes and patches of forest. The seacoast border of the delta of the Yahtse was a great expanse of glacial mud at the time of Mr. McGrath's visit. In ordinary seasons the shore of this region assumes a very friendly aspect. Dense grass springs up everywhere, and the bright green of this vegetation is variegated and beautified by the gay colors of countless wild flowers. Strawberries grow in great abundance, but had not ripened at the time of his departure, while in 1892 many were gathered as early as July 4.

The absence of gold-bearing sand was noted. The men of the party tried it in various places without getting any pay prospect; though in one spot, near East Yahtse Base, several patches of ruby sand were found, there was not enough of this material to warrant anyone in taking up a claim and working it.

Just to the eastward of where the glacier enters the sea a small, sandy islet was discovered. This makes a fine lee during the prevalence of easterly winds (the prevailing summer wind), and affords the best landing place between the Osar River and Yakategi. The dangers incident to landing along this beach were sadly exemplified in the loss of six men by drowning when Professor Russell's party disembarked near the mouth of the Yahtse River. Only a few miles west of the scene of this tragedy was the little harbor above referred to. The depth of water in it makes the place useless as an anchorage for anything larger than the small sloops used by seal and otter hunters and minor traders who go up and down this coast, but as it is almost at the nearest point of the coast to Mount St. Elias a knowledge of it may prove of some value to future expeditions which may be planned to attempt the ascent of the mountain from the side that Professor Russell essayed in his first trial.

While awaiting the coming of the *Patterson* at his camp on the Osar, Assistant McGrath made observations to check the distances and elevations of Mount St. Elias and Mount Logan, which had been determined from the Malaspina Base in 1892.

The *Patterson* arrived on August 2, and transferred Assistant McGrath's party to Lituya Bay, off which she arrived on August 4.

Since the loss of 21 officers and men of La Perouse's expedition at the entrance of Lituya Bay, this latter has borne the reputation of being very dangerous. La Perouse, however, entered it with his two vessels in 1786, and Captain Hereendeen, who piloted the Coast Survey schooner *Yukon* into it in 1874, has visited the bay in a whaleship. The strength of the tidal current

pouring in and out of the bay was shown by the foaming white waters of the ebb tide, which could be noted by the *Patterson* nearly a mile outside the rocks which marked the channel way.

Awaiting the slack of the tide, Mr. McGrath's party was landed by the small boats of the *Patterson*, which returned to Yakutat Bay to await the completion of the work assigned to Mr. McGrath. While in the bay it was learned that miners, with only the most elementary knowledge of handling sailing vessels, frequently pass in and out of the bay without accident, and Mr. McGrath concludes that the entrance to the bay is undeserving the terrible reputation it has. Vessels may often have to lie off the mouth of the bay to await a proper stage of the tide, and that this can be conveniently done, if the wind is favorable, was shown by the fact that the *Patterson* found a good anchorage fully a mile out from the shore. Lituya Bay may become important if the mining industry in the Fairweather region continues to increase. In that case it must become the principal depot of supplies, as no other harbor can be depended upon between Cross Sound and Yakutat Bay.

There is at present no permanent Indian settlement on the bay, though, according to legend, a flourishing village existed on its eastern shore before the advent of the whites in the country, but a great wave swept in one day and drowned all the inhabitants except two, and since then only hunting cabins have been established. There were, however, about twenty white men living on the bay engaged in working the "ruby" sand between the bay and Cape Fairweather, for the beaches in the vicinity produce considerable gold.

On the outside of the beach just west of the bay Mr. McGrath found a stretch suitable for measuring a base about 1.6 kilometres in length, which he expanded to a length of about 5.4 kilometres, and from this base horizontal and vertical angles were obtained on all the prominent peaks within sight. A solar azimuth was measured also, and at one station the magnetic declination was obtained with the aid of a compass declinometer. There was no difficulty in determining the positions and elevations of Mount Fairweather, Mount Lituya, Mount La Perouse, and Mount D'Azelet, but if the published value of the elevation of Mount Crillon is correct, then the peak is hidden from the beach about Lituya by a high mountain which is in line and between it and the shore.

The field work was completed August 12, and the *Patterson* arrived on the next day. Throughout the season Mr. McGrath was efficiently assisted by Dr. H. W. Edmonds, whose loyalty, energy, and ability he highly commends.

On the 14th the party reembarked and was ready to start southward again. Port Townsend was reached on August 30, where some of the men were discharged. Others continued on the *Patterson* to San Francisco, where they arrived on September 7. Having discharged the men, completed his inventories, and stored the equipage, Mr. McGrath returned to Washington.

The principal statistics for the season are given as follows:

Base lines, secondary, length of, in metres.....	7 625
Beach measurement in statute miles.....	38
Area of triangulation, square statute miles.....	396
Geographical positions determined, number of.....	15
Elevations determined trigonometrically.....	15
Azimuth stations, number of.....	2
Number of day azimuth observations.....	2
Number of stars observed for azimuth.....	2
Magnetic declinations determined.....	2
Topography:	
Area surveyed, in square statute miles.....	105
Length of coast line, in statute miles.....	66
Length of shore line of rivers, in statute miles.....	43
Length of shore line of creeks, in statute miles.....	34
Topographic sheets finished, scale 1-80 000.....	2

Triangulation and topographic reconnaissance of Chilkat and Taiya inlets.—The party under the direction of Assistant J. F. Pratt continued the survey of the Chilkat and Taiya inlets, a brief account of which was given in the last annual report, until August 16 of the present year. The Chilkat Inlet and River were completed by July 14, and the triangulation and topographic reconnaissance of the Taiya Inlet and River were at once begun and carried as rapidly as weather

conditions would permit to a point a little beyond the "ten marine league" limit. The wind blows strongly and continuously in these inlets at this season of the year, and as the shores are steep and rocky, the landing with canoes and small boats was more or less hazardous. The Taiya is a glacial stream, navigable for small boats for about 6 miles above the mouth, but the navigation is difficult and dangerous on account of the rapid and swirling current and the strong winds already mentioned. The party had considerable wading to do at places, and in water but 2 or 3 degrees above freezing point. The valley of the Taiya is rather narrow, its bottom composed of gravel beds dividing the stream irregularly and forming numerous islands, most of which are covered with a dense and tolerably large growth of cottonwood trees. This rendered triangulation difficult and expensive, and, therefore, for a considerable part of the distance, direct measurement with steel tapes was resorted to. Long azimuth lines were observed to control the directions, and two bases were measured to control the distances in the triangulation between the mouth of the Katsehin River and the head of Taiya Inlet.

The topographic reconnaissance was also satisfactorily accomplished to a junction with the work of Messrs. J. A. Flemer and H. P. Ritter, and the magnetic declination was observed at one station on the Taiya River. On August 9 the party moved to Anchorage Point and made a trigonometric connection across the peninsula between the Chilkat and Chilkoot inlets. Work was completed by August 16, and the party, with its camp and outfit, was taken on board the steamer *Hassler* and the schooner *Earnest* and conveyed to Puget Sound via Sitka.

Subassistant F. A. Young, Aids J. F. Hayford and A. L. Baldwin, and Recorder T. C. Taylor were attached to the party during the season and rendered acceptable service.

On the arrival of the *Hassler* at Seattle, on August 30, the instruments and outfit were stored, and the party disbanded. Mr. Pratt then took up the office work, and Messrs. Young, Hayford, and Baldwin proceeded to Washington, D. C., and were assigned to duty in the office.

Subsequently Assistant Pratt was ordered to Washington for the purpose of taking charge of the instrument division of the Office. He left Seattle on the 28th of December, 1894, reached Washington January 7, 1895, and entered on his new duties as chief of the instrument division January 18.

The statistics of the season's work in Alaska are given as follows:

Area of triangulation, in square statute miles	90
Number of points selected.....	211
Number of secondary bases measured.....	7
Number of signal poles erected.....	190
Number of stations occupied for horizontal measures	177
Number of stations occupied for vertical measures.....	19
Number of geographical positions determined.....	211
Number of elevations determined trigonometrically.....	21
Number of astronomical stations occupied	1
Number of magnetic stations occupied	4
Area of topographic reconnaissance, in square statute miles.....	135
Length of river and creek shore line mapped, in statute miles.....	43
Number of topographical sheets completed	1

Topographic reconnaissance to the northward and eastward of Taiya Inlet and River, Alaska.—Assistant Flemer's report of the results of his topographic reconnaissance, begun during the last fiscal year, around Chilkoot and Taiya inlets, is dated January 19, 1895. The shore line and adjacent topography were platted and sketched, using a small mountain plane table of Coast Survey pattern, while the topographic features of the interior country were secured by photographic panorama views, taken from prominent mountain peaks, as well as from lower camera stations. On the plane table he used for the greater part of the work a xylonite sheet, which gave very satisfactory results in the humid atmosphere of the coast, under circumstances which would have made the use of paper an impossibility. He states that he would consider xylonite an ideal substance for plane table sheets in wet weather if he had not found that on his return it showed a decided contraction under the influence of the drying atmosphere of Washington.

His report dwells largely on the methods best adapted to secure satisfactory photographs for topographic purposes. The use which he made of the camera largely extended the area covered by his reconnaissance.

He reports the mountains between the Chilkat, Chilkoot, Taiya Sahnka, and Taiya inlets as forming either groups by themselves or spurs emanating from the range forming the divide between the feeders of these waters and the head waters of the Yukon. These mountains are so cut up by glacial abrasion, and by erosion, that they often appear divided into separate distinct groups rather than to be outrunners and spurs of the interior range, yet the highest peaks increase in elevation when going inland toward the dividing range, which is crossed by the Chilkat, Chilkoot, Perrier, and White passes, which at present offer the only means of reaching the head waters of the Yukon and Dease waters from the south and west. At present the principal road of ingress is through the Taiya Valley over Perrier Pass, which is about 1 190 metres (3 900 feet) high. It is about 20 miles from the mouth of the Taiya River (Wilson's store) to the summit of this pass, and 13 miles from there to Lake Lindeman on the other side.

Skaguay River Valley was explored by Mr. Poudre in 1891, and by others, in the hope of finding a shorter road to the interior, but it was found to be unsuitable for a trail across the mountains.

Mr. Poudre gives the following distances:

	Miles.
Mouth of Skaguay to first fork.....	12
Mouth of Skaguay to above timber line	13
Mouth of Skaguay to summit (White Pass).....	18

The principal statistics of the season's work are given as follows:

Topography—plane table reconnaissance:	
Area, in square statute miles	165
Total area, including photography, square statute miles	300
Length of general coast line, statute miles	67
Length of shore line of rivers and creeks, statute miles.....	30
Topographic sheets, scale 1-80 000.....	4

The season's work closed August 14, and Mr. Flemer returned by the steamer *Hassler* to Port Townsend, and after disbanding party, proceeded to Washington, where he was occupied for some time in reducing and plating the results of his photographic work. His subsequent services in the eastern section are noticed elsewhere in this report.

Topographic reconnaissance to the northward and westward of Chilkat Inlet and River.—The topographical party under the charge of Mr. Homer P. Ritter began work at Pyramid Harbor on the 15th of May, 1894, and its progress to the close of that fiscal year was noted in the last annual report.

Work was continued during the early part of the present fiscal year, and a considerable area of difficult country was mapped, principally by means of the mountain plane table. The triangulation of 1890 was utilized for this work, and additional points were furnished from time to time by the party of Assistant J. F. Pratt, operating in the same region. The topography was developed on both sides of the inlet to the mouth of the Chilkat River, and the camp was moved to the mouth of the Takhin. From this point a large area was obtained, and numerous excursions were made up the valley of the Takhin as far as Bertha Glacier, and also to the head of the Chalzekahin River. The moving of camp through this country was a work of great difficulty, the boats having to be dragged over innumerable quicksand bars, and progress on land was much impeded by the dense and tangled growth of underbrush, through which it was necessary to cut trails. From the last camp occupied by the party the topography of the valley and adjacent mountains was developed as far as Klukwan and the northern end of Chilkat Lake.

On the 14th of August the work of the season closed, and Mr. Ritter proceeded to Pyramid Harbor, where the steamer *Hassler* was waiting to convey the various parties to Puget Sound. She sailed on the 16th, and arrived at Seattle August 31. Here the party was disbanded, and Mr. Ritter, in accordance with instructions, returned to Washington.

The results of the reconnaissance are shown on a topographical map which has been completed and turned into the archives of the Survey. The area surveyed during the season was 315 square statute miles.

Mr. Ritter's subsequent services in Mobile Bay, Alabama, have already been mentioned on a previous page of this report.

Topographic reconnaissance on Chilkat and Chilkoot inlets.—It was stated in last year's report that Assistant E. F. Dickins, after having completed the reconnaissance survey of the Unuk River, transferred his party to Chilkat Inlet. On June 18 he began the topographic reconnaissance of the inlet, connecting with Mr. Ritter's work near the Guauegastaki Village, and having finished this work on July 18 he transferred his party to the Chilkoot, filling in the topography of the lower part of the inlet and connecting with Assistant Flemer's work. This task was completed on August 12, and three days later he sailed for Sitka on the *Hassler*, from which ship he transferred his party to the *Patterson*, reaching Port Townsend on her on August 30.

At this point Mr. S. B. Tinsley, by direction of the Superintendent, was relieved from duty on the party and proceeded to Washington, D. C. Mr. Dickins proceeded by rail to San Francisco, and on the arrival there of the *Patterson*, September 8, landed and stored his outfit and instruments and disbanded his party. He then occupied himself at the suboffice in the completion of his records and computations.

Assistant Dickins commends the services of Mr. S. B. Tinsley, temporary aid, for his willingness to do all in his power to advance the work.

The principal statistics of his work are given as follows:

Area of topography covered, square statute miles.....	118
Miles of shore line surveyed.....	65
Elevations determined trigonometrically	74
Miles of rivers surveyed.....	5
Number of signals erected.....	38

Alaska boundary work.—*Triangulation, topography, astronomical determinations of latitude and azimuth, and chronometric determinations of differences of longitude.*—The initial points of the boundary line between British Columbia and southeast Alaska depend at present on the rather crude triangulation executed in past years by the naval hydrographic parties. This triangulation, while sufficiently good for mere charting purposes, for which it was only intended, does not possess the accuracy necessary for such important work as the location of a boundary line, its bases having been measured by rough and only approximate methods, and its angular measurements and astronomical determinations having in many cases been made by inexperienced observers. The discrepancies that have developed in the attempt to fit together and adjust the different sections of this work prove conclusively that a better triangulation and additional astronomical observations are necessary to afford a reliable basis for the boundary survey. It was therefore determined to fit out a strong party of civilian assistants to measure a base, determine astronomical positions, and execute a new triangulation from Port Simpson to Marys Island, and to the head of Portland Canal. The general programme of the work outlined was as follows: The steamer *Patterson*, while en route to her own field of work in Chatham and Peril straits, to transport the parties, with their outfits, stores, etc., from San Francisco and Seattle and land them at their respective stations; the astronomical and chronometric longitude work to be first undertaken, astronomical stations being established at Port Simpson, Marys Island, and the head of Portland Canal, and the astronomical station at Seattle to be used as the base station for longitudes; Assistant Fremont Morse to occupy the Seattle observatory, while the astronomical stations at Port Simpson, Marys Island, and head of Portland Canal were simultaneously occupied by the parties of Aid O. B. French and Assistants E. F. Dickins and P. A. Welker, respectively; nine chronometers, in charge of Assistant F. A. Young, to be carried on four successive trips of the steamer *City of Topoka*, between Seattle and the stations at Port Simpson and Marys Island, while the steamer *Fuca*, with five chronometers, similarly plied between Port Simpson and the head of Portland Canal; base lines to be measured at or near Port Simpson and the head of Portland Canal, and such triangulation, topography, magnetics, and other necessary work as could be accomplished without interfering with the longitude determinations to be also carried on; on the successful completion of the astronomical work, Assistant Morse to return to San Francisco, and all the Alaskan parties to be consolidated under the direction of Assistant E. F. Dickins, for the execution of the main triangulation.

Assistants E. F. Dickins and Fremont Morse, with two men and the outfit and stores for four parties, joined the steamer *Patterson* at San Francisco on April 11, and the latter was landed at

Seattle on the 17th. Assistant P. A. Welker, Aids O. B. French and C. C. Yates, and Extra Observers H. A. Grady and R. L. Livingston, with eight men and the remaining party equipments, joined the steamer at Seattle on April 22. Mr. French was landed at Port Simpson April 29; Messrs. Welker, Yates, Grady, and five men, and the steam launch *Fuca* and crew of three men, at Lion Point near the head of Portland Canal on May 2; and Messrs. Dickins and Livingston and two men at Marys Island on May 4. Sites for astronomical stations were at once selected and the building of piers and observatories begun. Owing to rainy weather time observations were not obtained at either station until May 14, but after that date, and to the close of the fiscal year, when the astronomical work was practically finished, no serious interference from that cause occurred, except at the Marys Island station.

Mr. O. B. French reports that by the end of June the astronomical work at Port Simpson station, including time, latitude, and azimuth, was entirely completed, and the station connected by a small triangulation with previous stations.

Assistant E. F. Dickins reports the successful completion of the time observations for the longitude determination at the Mary Island Station, but some additional latitude observations are still necessary, as clouds and fogs considerably delayed this work.

Assistant Welker reports the successful completion of all the astronomical observations at the Point Lion Station, near the head of Portland Canal, and also that Aid C. C. Yates, under his direction, had measured a base 1 297 metres in length at the mouth of Salmon River, carried the triangulation from it to the mouth of Bear River, and run a traverse from the latter point to the fifty-sixth parallel of north latitude. The valley of the Bear River has an average width of 1 mile, but is so covered with a dense growth of brush and large cottonwood trees that a triangulation up the river was considered impracticable on account of the labor and expense involved, and it was decided by Mr. Welker to substitute the traverse line, in which the distances were accurately measured with a steel tape. This also was a work of some difficulty owing to the numerous crossings of swift mountain streams, but the result obtained was satisfactory, and probably better than could be expected from a small scheme of triangulation. The length of the traverse line is 8 472.8 metres, corrected for temperature, inclination, and catenary. The azimuth observed at the astronomical station was carried to Bear River in one sight, and to the fifty-sixth parallel in four additional sights. Six points of the old hydrographic triangulation were also determined, and a topographic survey made from the vicinity of the astronomical station to the boundary line.

Mr. Welker furnished the following tabulation of the results accomplished by his party to the close of the fiscal year:

Number of time determinations.....	20
Number of exchanges of time for longitude determinations.....	11
Number of latitude observations.....	93
Number of observations for micrometer value.....	5
Number of determinations of azimuth.....	13
Number of observations for horizontal angles.....	15
Number of signals erected.....	17
Number of base line measurements.....	3
Number of traverse line measurements.....	2
Number of determinations of magnetic elements.....	3
Area of topography surveyed, in square statute miles.....	20
Number of photographic negatives made for topographic use.....	63

Assistant F. A. Young, with nine chronometers, made four round trips on the steamer *City of Topeka*, attended to the winding of the instruments and their daily intercomparison on each arrival at an astronomical station, and carefully compared them with those of the station. These comparisons were also repeated by the astronomer of the station.

The steamer *Fuca*, carrying five chronometers, during the same time made seven and a half round trips between Port Simpson and the station at the head of Portland Canal. The data thus obtained will furnish 72 determinations of the longitude of the Port Simpson and Marys Island stations, and 65 for that at the head of Portland Canal.

Assistant Fremont Morse, at the Seattle base station, observed for time on thirty-five nights during the season, and on each arrival of the *City of Topeka* compared his chronometer with those

carried by Assistant Young. By the close of the fiscal year three and a half round trips had been completed, and the fourth was finished a few days later, viz, July 7. Mr. Morse then dismounted and packed his instruments and returned to San Francisco, in accordance with his instructions, arriving there on the 20th of July.

Occupation of the Seattle astronomical station in connection with chronometric longitude determinations in Alaska.—The Seattle astronomical station, in the grounds of the Washington State University, was used as the base station for the determination of chronometric longitudes in Alaska, and was occupied for this purpose by Assistant Fremont Morse. Mr. Morse was landed by the steamer *Patterson* on April 17, 1895, and immediately began the preparation of the station, and mounted a meridian instrument for time observations. His standard chronometer was rated by means of time observations on every clear night, and the other two were daily compared with it at the time of winding. Special precautions were taken to protect the chronometers from sudden or extreme changes of temperature, so that the daily range to which they were exposed did not exceed 2° C. The first time observations were obtained on April 23, and 35 complete series were obtained during the season. A set of nine chronometers, also carefully protected and inter-compared daily, was carried by Assistant F. A. Young on the steamer *City of Topeka* on four consecutive round trips between Seattle and the Alaska stations at Port Simpson and Mary Island, and carefully compared with the station chronometers at the beginning and end of each trip, and by both observers.

The weather proved very favorable, and time observations were always obtained very near to the time of arrival and departure of the steamer, so that the results are not dependent on the constancy of chronometer rates in any case for a longer period than fourteen hours.

The fourth round trip of the steamer was completed on the 7th of July, and the following day Mr. Morse dismounted and packed his instruments, and on July 17 sailed for San Francisco, the intervening time being occupied in finishing up the records and computations.

Mr. Morse arrived at San Francisco on July 20, and reported for duty at the suboffice.

ABSTRACT OF ANNUAL REPORTS FROM THE ASSISTANT IN CHARGE
OF THE OFFICE, THE HYDROGRAPHIC INSPECTOR, AND THE
ASSISTANT IN CHARGE OF THE OFFICE OF STANDARD WEIGHTS
AND MEASURES.

ABSTRACT OF THE ANNUAL REPORT OF THE ASSISTANT IN CHARGE OF THE
OFFICE.

In Office Report No. 1 will be found the annual report of Mr. Andrew Braid, who served as assistant in charge of the office during the latter part of the fiscal year, his predecessor, Mr. B. A. Colonna, having resigned in March, 1895. Assistant Braid's report is accompanied by the annual reports of the various chiefs of divisions, and the details and statistics of the various operations of the office are fully set forth.

Assistant C. A. Schott, chief of the computing division, has attended as usual to the affairs of that division, and has made a number of special reports on the results of the computation of important field operations, among which may be mentioned those on the results of spirit leveling across the Peninsula of Florida, the geodetic results in the Mount St. Elias region, Alaska, and the results of the astronomical work in Alaska by the late Assistant J. H. Turner in 1889 and 1890. The important astronomical and trigonometrical work executed by Assistant J. E. McGrath, in connection with the Alaska boundary survey, is now being discussed and computed, and will soon be ready for the use of the State Department. A special study of the longitude system of the United States has been made with a view to supplying missing links necessary for its early completion.

The tidal division, under the charge of Acting Chief L. P. Shidy, has made satisfactory progress in the discussion and tabulation of tidal data, and owing to the great additional labor involved in the preparation for publication of the new and extended tide tables for the year 1896, it was found necessary to increase the force of the division temporarily by the detail of a number of field assistants. The regular force of the division also voluntarily worked overtime for a considerable period in order to expedite the preparation of the tables, and at the same time keep up to date the current work.

The reports of the drawing and engraving divisions have both been submitted by Assistant W. Ward Duffield, who assumed charge of the former on June 16, and of the latter on July 1, 1895, the two divisions being consolidated on the latter date. The general assignment of work in both divisions has been similar to that of previous years. During the year drawings were completed for 22 new charts to be photolithographed, and the drawings for 6 others are now in progress. The drawings of 43 charts were revised and corrected for new editions, and 85 for reprints. The usual number of diagrams, sketches, and illustrations for the report of the Superintendent were also drawn or revised; 20 topographic and 35 hydrographic projections were constructed for field parties, and 51 projections were made on copperplates; 21 field topographic sheets were inked and lettered. Fifty-seven calls for information from various Departments of the Government and from the public were received and attended to, many of them involving the preparation of drawings, tracings, or blue prints. A detailed list of these applications accompanies Assistant

Duffield's report. The engraved plates for 16 new charts, 23 for new editions and 7 for sketches and illustrations, have been completed, and a large number have been corrected and brought up to date; 28 basso and 35 alto plates have been completed in the electrotyping branch of the engraving division, and the usual number of photographs, blue, nigrosine, and silver prints have been made. The number of impressions from copperplates in the plate-printing department is given as 41 951.

The chart division has continued, as heretofore, under the direction of Assistant Gershom Bradford, and his report presents an interesting tabular comparison of the issue of charts during the present year and those of the previous six years. It appears that the total issue for 1895, viz, 51 456 charts, is a trifle smaller than for 1894, and 5 per cent less than the average of the six years, but this diminution is in the free distribution, as the net sales have increased 9 per cent over those of the previous year.

Mr. W. P. Ramsey succeeded Mr. M. W. Wines as chief of the miscellaneous division on August 31, 1894, and his report shows the number of the various publications of the Survey distributed and sold during the year, and the number of reports, appendices, Coast Pilots, bulletins, Tide Tables, and Notices to Mariners received from the Public Printer. Ten new agencies for the sale of charts and other publications were established during the year, eight on the Atlantic and Gulf coasts and two on the Pacific Coast, and four old ones were discontinued.

In the instrument division, Assistant J. F. Pratt succeeded Edwin Smith as chief on January 7, the latter being, at his own request, assigned to field duty. Assistant Pratt's report shows that very satisfactory progress has been made, and that a large amount of important work has been accomplished, both in the instrument and carpenter shops. The immediate direction of the work of the instrument makers has remained with the chief mechanic, Mr. E. G. Fischer.

Mr. H. Sidney King succeeded Mr. F. H. Parsons as chief of the library and archives division on the 21st of August, 1894, and his report shows the additions to the library during the year and the number of volumes of records and original topographical and hydrographic sheets received from the field officers of the Survey.

In the office of the assistant in charge, Mr. A. B. Simons rendered satisfactory service as executive and financial clerk, and Mr. E. B. Wills has continued to keep the leave of absence records and those of freight, express, and registered mail. Miss Kate Lawn and Miss Sophie Hein served as typewriters. Miss Ida M. Peck, early in the fiscal year, was transferred to the office of the disbursing agent, and served there for the rest of the year, excepting during the month of April, when she was temporarily detailed for special duty at the Treasury Department. Mr. W. B. Chilton continued his service as clerk in the Superintendent's office during the entire year.

ABSTRACT OF THE ANNUAL REPORT OF THE HYDROGRAPHIC INSPECTOR.

The assignment of Lieut. Commander Jeff. F. Moser, U. S. N., as hydrographic inspector, Coast and Geodetic Survey, was continued during the whole fiscal year. He has presented a very full report of the hydrographic work executed by the naval parties, under his direction, on the Atlantic, Gulf, and Pacific coasts, and in Alaska, and also submits the reports of the naval officer in charge of the hydrographic and coast pilot divisions of the office. His report is accompanied by statistical tables showing the results accomplished by each field hydrographic party and the number of officers attached to each vessel; a detailed statement of the repairs made to each vessel and the amounts expended therefor is also given.

The hydrographic inspector renews his recommendations of last year relative to the making of more extended current observations, the exploration of the Yukon River, in Alaska, and the survey of the Aleutian Islands. As the steamer *Hassler* is now unserviceable and condemned, a new steamer will be necessary for this purpose, and the immediate authorization by Congress for the building of such a steamer is strongly urged. The estimated cost of the new vessel is \$125 000.

Lieutenant Commander Moser refers at length to the great loss sustained by the Survey and the naval service by the death of Lieut. F. H. Crosby, who lost his life in the performance of duty on the coast of Washington, as already mentioned elsewhere in this report. He speaks in the highest terms of his energy and skill and the valuable service rendered by him during the many years of his connection with the Survey.

The report of the hydrographic division, by its chief, Lieut. Walter McLean, U. S. N., shows that a large amount of work has been accomplished, and refers in complimentary terms to the zeal and efficiency of all the members of the division. Twenty-nine new hydrographic sheets have been drawn and platted, and the results of extensive resurveys have been platted on 24 old sheets. The work on these 53 original sheets involved the study and use of 228 volumes of records and the platting of 77 697 angles and 361 172 soundings. Ninety reduced drawings of hydrography have also been revised, verified, and corrected; the aids to navigation, including light tables, have been platted on charts, and 143 proofs of new issues have been revised, verified, and corrected; also a large amount of miscellaneous work, including the preparation of the monthly notices to mariners, comparison of old and new surveys, and the preparation of schemes for new surveys and resurveys. Lieutenant McLean also submits the report of the coast pilot division, which was under his charge from the beginning of the fiscal year to September 22, 1894, and again from June 21, 1895, to the close of the year. From September 22, 1894, to June 21, 1895, the division was under the charge of Lieut. Franklin Swift, U. S. N., who, at the latter date, was recalled by the Navy Department and assigned to sea duty.

During the year a new volume of the Coast Pilot, known as Part VII, and including the coast from Chesapeake Bay entrance to Key West, was completed and sent to the printer, and five supplements to previous volumes, embodying all corrections up to date, were also compiled.

Lieutenant McLean acknowledges the valuable assistance rendered by the various hydrographic parties in the field and by the commanding officers of the revenue cutters stationed along the parts of the coast covered by the volumes named. All the members of this division have also rendered very satisfactory service.

ABSTRACT OF THE ANNUAL REPORT OF THE ASSISTANT IN CHARGE OF THE OFFICE OF STANDARD WEIGHTS AND MEASURES.

The charge of the Office of Standard Weights and Measures continued with Assistant O. H. Tittmann, but during the early part of the year, from July 1 to September 10, while he was engaged on field duty on the resurvey of Boston Harbor, the temporary charge of the division devolved on Mr. L. A. Fischer.

The annual report of the Office of Standard Weights and Measures is submitted by Assistant O. H. Tittmann, and is published in full as Office Report No. 4. It is accompanied by an abstract, in tabular form, of the verifications of weights and measures made during the year.

The regular force of this division remained unchanged during the year, and Assistant John F. Hayford was detailed for duty, under Assistant Tittmann's direction, from September 8, 1894, to June 4, 1895. He determined the densities and masses of the new X set of gramme weights; made a redetermination of the errors of the foot graduation of the United States bench standard, and investigated the behavior of the new balance of precision. A special report on this balance has been prepared by Mr. Hayford for publication. The elaborate and tedious preparation and adjustment of the State sets of weights for North and South Dakota were finally completed, and the sets were forwarded to their respective destinations in June, 1895. All the work of adjustment and verification of these standards devolved upon Mr. L. A. Fischer, who also gilded and adjusted the X set of gramme weights, and made four groups of direct comparisons between the "Committee metre" and the new "Prototype No. 21," with a view to determining finally their relations. Some additional comparisons, however, will be necessary before this relation can be considered as definitely and conclusively established.

SUPERINTENDENT'S OFFICE.

At the beginning of the fiscal year Superintendent T. C. Mendenhall was absent in Europe, and Hon. William H. Pugh, Commissioner of Customs, was designated by the President as Acting Superintendent, and served in that capacity until October 1, 1894. Dr. Mendenhall's resignation was accepted September 20, 1894, and the appointment of his successor, Gen. W. W. Duffield, the present incumbent, bears the same date.

Assistant Andrew Braid continued to serve as executive officer to the superintendent until

March 11, 1895, when he was detailed to act as Assistant in charge of the Office. He was duly appointed to that office by the honorable Secretary of the Treasury, April 11, 1895, and was also designated as the Assistant to perform the functions of the Superintendent during the latter's absence. From March 12, 1895, to the close of the year the responsible duties of executive officer were performed by Assistant E. D. Preston.

Assistant O. H. Tittmann continued, under the Superintendent's direction, in charge of the Office of Standard Weights and Measures, and, in addition, took charge of the preparation for publication and the editing of the annual reports and bulletins of the Survey.

Assistant George A. Fairfield, in addition to the duties described elsewhere, continued in charge of matters pertaining to State surveys until May 17, 1895, when he was relieved and directed to turn over to the executive officer all papers and data belonging thereto.

Mr. William B. Chilton served efficiently during the year as clerk to the Superintendent, and Martin Hensel as secretary until September 15, at which time his resignation took effect. Mr. John F. Renfro was appointed secretary February 1, 1895, and served to the close of the year.

SUBOFFICES.

Suboffice in Philadelphia.—Assistant R. M. Bache continued in charge of the suboffice in Philadelphia, but from July 1 to November 1, during Mr. Bache's absence on field duty (the resurvey of Boston Harbor), the office was temporarily closed. Mr. Bache, on his return from Boston, in addition to attending to the duties pertaining to the suboffice, completed and inked his topographic sheet of Hingham Harbor and vicinity. As usual, copies of the Coast and Geodetic Survey Charts, Tide Tables, annual reports, and other publications were supplied to officers on duty in the city representing the United States Engineer Corps, the Light-House Board, the branch hydrographic office of the Navy Department, etc.; also to the city engineer and surveyor, the Philadelphia Maritime Exchange, etc.

At the close of the fiscal year this suboffice was discontinued, not being deemed longer essential on account of its proximity to the main office at Washington.

Suboffice in San Francisco.—Assistant George Davidson continued in charge of the San Francisco suboffice during the year, and during brief absences was temporarily relieved by Assistant A. F. Rodgers. Mr. Davidson conferred with his colleagues in all matters relating to the work on the Pacific Coast; answered all calls for information, and aided the Alaska boundary parties in the preparations for their work. He attended as usual to the repairs of the instruments of the hydrographic parties, and forwarded to the Washington Office such instruments as were called for. He has also, with the assistance of Assistant Fremont Morse, continued necessary astronomical and magnetic observations, and superintended the running of the tidal stations at Sausalito and San Francisco, rendering monthly reports of the same and transmitting the records and computations to Washington. Other officers of the Survey, engaged on the Pacific Coast work, were from time to time detailed to the suboffice, either for the completion of their own records and computations or to assist in the work of the office.

Mr. Ferdinand Westdahl, draftsman, continued on duty as heretofore, and Mr. Frank W. Edmonds performed the clerical duties of the office. Mr. Vincent Denis, messenger and porter, performed his usual duties, attending also to the equipments, etc., of the Survey stored at the suboffice, and their receipts and transfers; he was also required to wind regularly the chronometer and astronomical clock at the Lafayette Park Observatory.

At the close of the fiscal year Assistant Davidson was relieved of the charge of the suboffice, and was succeeded by Assistant A. F. Rodgers.

UNITED STATES COAST AND GEODETIC SURVEY REPORT FOR 1895.

PART I.

FIELD AND OFFICE DETAILS.

TABULAR STATEMENTS AND ANNUAL OFFICE REPORTS.

TABLE NO. 1.—Distribution of the field parties of the Coast and Geodetic Survey upon the Atlantic, Gulf of Mexico, and Pacific coasts, and in the interior of the United States during the fiscal year ending June 30, 1895.

TABLE NO. 2.—Statistics of field and office work of the Coast and Geodetic Survey for the fiscal year 1894, and total to June 30, 1895.

TABLE NO. 3.—Information furnished to Departments of the Government in reply to special requests, and to individuals upon application, during the fiscal year ending June 30, 1895.

OFFICE REPORT NO. 1.—Report of the Assistant in charge of the Office for the fiscal year ending June 30, 1895.

OFFICE REPORT NO. 2.—Report of the Hydrographic Inspector for the fiscal year ending June 30, 1895.

OFFICE REPORT NO. 3.—Report of the Disbursing Agent for the fiscal year ending June 30, 1895.

OFFICE REPORT NO. 4.—Report of the Assistant in charge of the Office of Standard Weights and Measures for the fiscal year ending June 30, 1895.

TABLE No. 1—1895.

Distribution of the field parties of the Coast and Geodetic Survey upon the Atlantic, Gulf of Mexico, and Pacific coasts, and in the interior of the United States, during the fiscal year ending June 30, 1895.

I.—EASTERN DIVISION—STATES EAST OF THE MISSISSIPPI RIVER.

- | | | | |
|-------------------|---------------------------|---------------------|--------------------|
| 1. Maine. | 8. New Jersey. | 15. South Carolina. | 22. Ohio. |
| 2. New Hampshire. | 9. Pennsylvania. | 16. Georgia. | 23. Indiana. |
| 3. Vermont. | 10. Delaware. | 17. Florida. | 24. Illinois. |
| 4. Massachusetts. | 11. Maryland. | 18. Alabama. | 25. West Virginia. |
| 5. Rhode Island. | 12. District of Columbia. | 19. Mississippi. | 26. Kentucky. |
| 6. Connecticut. | 13. Virginia. | 20. Michigan. | 27. Tennessee. |
| 7. New York. | 14. North Carolina. | 21. Wisconsin. | |

States.	Parties.	Operations.	Persons conducting operations.	Localities of work.
Massachusetts	No. 1	Topography.....	H. L. Whiting, assistant.....	Topographic resurvey of Boston Harbor and vicinity.
Massachusetts	2	Topography.....	H. G. Ogden, assistant	Topographic resurvey of Boston Harbor and vicinity.
Massachusetts	3	Topography.....	O. H. Tittmann, assistant	Topographic resurvey of Boston Harbor and vicinity.
Massachusetts	4	Topography.....	R. M. Bache, assistant	Topographic resurvey of Boston Harbor and vicinity.
Massachusetts	5	Topography.....	C. H. Boyd, assistant	Topographic resurvey of Boston Harbor and vicinity.
Massachusetts	6	Topography.....	D. B. Wainwright, assistant	Topographic resurvey of Boston Harbor and vicinity.
Massachusetts	7	Topography.....	W. I. Vinal, assistant	Topographic resurvey of Boston Harbor and vicinity.
Massachusetts	8	Hydrography	Lieut. Robert G. Peck, U. S. N., assistant.	Hydrographic resurveys in Boston Bay from Cohasset to Scituate and in Broad Sound, Lynn Harbor, Saugus River, and Chelsea Creek; also from Nahant to Cat Island, including Marblehead Harbor; also special examinations of Tinkers Ledge and the shoal waters to the eastward of Tinkers Island.
Massachusetts	9	Hydrographic examinations.	Lieut. L. M. Garrett, U. S. N., assistant.	Hydrographic examinations of reported dangers in Buzzards Bay.
Massachusetts	10	Topography.....	W. I. Vinal, assistant	Topographic resurvey of Buzzards Bay.
Massachusetts	11	Topography.....	D. B. Wainwright, assistant	Topographic resurvey of Buzzards Bay.
Massachusetts	12	Topography.....	J. A. Flemer, assistant	Topographic resurvey of Buzzards Bay.
Massachusetts	13	Topography.....	Stehman Forney, assistant	Topographic resurvey of Buzzards Bay.
Massachusetts	14	Hydrography	Lieut. G. C. Hanus, U. S. N., assistant.	Hydrographic resurvey of New Bedford Harbor and approaches.
Massachusetts	15	Hydrography	Lieut. W. F. Low, U. S. N., assistant.	Hydrographic resurveys and special developments on the coast of Massachusetts, including the survey of Salem Harbor.
Massachusetts	16	Physical hydrography.	H. L. Marindin, assistant.....	Continuation of the physical hydrographic survey of the shores of Marthas Vineyard.
Massachusetts	17	Hydrography	Lieut. G. W. Mentz, U. S. N. assistant.	Completion of the hydrographic survey of Nantucket Sound.
Massachusetts	18	Town Boundary Survey.	Henry L. Whiting, assistant and Commissioner of the Massachusetts State Survey; C. H. Van Order, assistant.	Continuation of the determinations of town boundaries in the State.
Rhode Island	19	Hydrography	Lieut. L. M. Garrett, U. S. N. assistant.	Hydrographic surveys and special hydrographic examinations in Narragansett Bay and vicinity.

Distribution of the field parties of the Coast and Geodetic Survey, etc.—Continued

I.—EASTERN DIVISION—STATES EAST OF THE MISSISSIPPI RIVER—Continued.

States.	Parties.	Operations.	Persons conducting operations.	Localities of work.
Rhode Island	20	Tidal observations...	David Hamilton, observer under the supervision of officers of the U. S. Engineer Corps.	Tidal observations at the automatic tide-gauge station at Newport. The station was discontinued February 7, 1895.
New York.....	21	Hydrographic examinations.	Lieut. L. M. Garrett, U. S. N., assistant.	Hydrographic examinations in Long Island Sound, and establishment of range signals for the naval speed-trial course.
New York.....	22	Topography	C. T. Iardella, assistant.....	Continuation of the topographical resurvey of the south shore of Long Island.
New York.....	23	Tidal observations...	J. G. Spaulding, tidal observer ..	Continuation of tidal record at the automatic tidal station at Fort Hamilton, New York Harbor.
New York.....	24	Tidal observations...	Officers of the U. S. Corps of Engineers.	Continuation of tidal record at the automatic tidal station at Willets Point.
New York.....	25	Topography and triangulation.	John W. Donn, assistant.....	Continuation of the topographical survey of the Hudson River north of Newburg.
New York.....	26	Topography.....	W. C. Hodgkins, assistant.....	Continuation of the topographical survey of the Hudson River.
New York.....	27	Leveling	C. H. Van Orden, assistant	Line of levels run from Greenbush to Dobbs Ferry.
New York.....	28	Geodetic operations..	Prof. E. A. Bowser, acting assistant; G. A. Fairfield, assistant in charge of State surveys.	Advance of reconnaissance and triangulation in the southwestern part of the State.
Delaware	29	Hydrography	Lieut. L. M. Garrett, U. S. N., assistant.	Resurvey of Delaware breakwater anchorage.
District of Columbia..	30	Tidal observations...	Tidal Division, U. S. Coast and Geodetic Survey Office.	Continuation of the automatic tidal record at the navy-yard.
Virginia.....	31	Hydrography	Lieut. L. M. Garrett, U. S. N., assistant.	Hydrographic examinations, in Chesapeake Bay, near the mouth of York River, etc.
Virginia.....	32	Precise leveling.....	Isaac Winston, assistant.....	Line of precise leveling, run from Richmond, Va., to Washington, D. C.
South Carolina.....	33	Hydrography	Lieut. L. M. Garrett, U. S. N., assistant.	Hydrographic resurvey of Charleston Harbor and its approaches.
South Carolina.....	34	Topography	John W. Donn, assistant.....	Completion of the topographic resurvey in the vicinity of Charleston.
South Carolina, Georgia, Virginia, New Jersey, and Massachusetts.	35	Magnetic observations.	J. B. Baylor, assistant.....	Magnetic determinations at Charleston, Savannah, Cape Henry, Sandy Hook, and Nantucket.
Florida.....	36	Hydrographic examinations.	Lieut. Robert G. Peck, U. S. N., assistant.	Hydrographic examination of Charlotte Harbor entrance and search for a reported shoal.
Florida.....	37	Hydrographic examinations.	Lieut. Robert G. Peck, U. S. N....	Hydrographic examination of Palatine Shoal off Tampa Bay.
Florida.....	38	Topography	P. A. Welker, assistant.....	Completion of the topographic resurvey of Pensacola Bay and its tributaries.
Florida.....	39	Hydrography	Lieut. Robert G. Peck, U. S. N., assistant.	Continuation of the hydrographic resurvey of Pensacola Bay and its tributaries.
Alabama	40	Triangulation	F. W. Perkins, assistant.....	Signal building for the triangulation of the oblique arc.
Indiana	41	Astronomical	G. R. Putnam, assistant.....	Laying out a true meridian line at Terre Haute.
Kentucky and Tennessee.	42	Geodetic	Prof. A. H. Buchanan, acting assistant; G. A. Fairfield, assistant in charge of State surveys.	Continuation of the triangulation of Tennessee toward a junction with the primary work lying between the Maryland and Georgia base lines.
Maryland, Ohio, Indiana, Illinois, and District of Columbia.	43	Gravity determinations.	G. R. Putnam, assistant.....	Relative gravity determinations, with half-second pendulums, at Deer Park, Md.; Cleveland, Ohio; Cincinnati, Ohio; Terre Haute, Ind.; Chicago, Ill.; and Washington, D. C. (For other stations, see Middle and Western Divisions.)

Distribution of the field parties of the Coast and Geodetic Survey, etc.—Continued.

II.—MIDDLE DIVISION—STATES AND TERRITORIES BETWEEN THE MISSISSIPPI RIVER AND THE ROCKY MOUNTAINS.

28. Minneste.	31. Iowa.	34. Kansas.	37. Oklahoma Territory.
29. North Dakota.	32. Nebraska.	35. Arkansas.	38. Louisiana.
30. South Dakota.	33. Missouri.	36. Indian Territory.	39. Texas.

State or Territory.	Parties.	Operations.	Persons conducting operations.	Localities of work.
Minnesota	No. 44	Topography and triangulation.	W. C. Hodgkins, assistant; G. A. Fairfield, assistant in charge of State surveys.	Continuation of the geodetic work and topography in the vicinity of Minneapolis and St. Paul.
Missouri and Kansas..	45	Gravity observations.	G. R. Putnam, assistant	Determinations of relative gravity at St. Louis, Kansas City, Ellsworth, and Wallace.
Missouri and Arkansas.	46	Precise leveling	Isaac Winston, assistant	Double line of precise levels run from Lamar, Mo., to Chester, Ark.
California, New Mexico, Texas and Louisiana.	47	Telegraphic longitude determinations.	C. H. Sinclair, assistant; Edwin Smith, assistant; A. T. Mosman, assistant; G. R. Putnam, assistant.	Telegraphic longitude determinations at Needles, Cal.; Santa Fe, N. Mex.; El Paso, Tex.; Austin, Tex.; Galveston, Tex.; New Orleans, La.; and Laredo, Tex., with incidental latitude, magnetic and gravity determinations.
Texas	48	Astronomical	G. R. Putnam, assistant	Latitude determination at Laredo.
Texas	49	Magnetic	Edwin Smith, assistant	Magnetic determinations at El Paso, Austin, Laredo, and Galveston.
Texas	50	Gravity determinations.	G. R. Putnam, assistant	Determinations of relative gravity at Laredo, Galveston, and Austin.
Texas	51	Reconnaissance	Stehman Forney, assistant	Completion of the reconnaissance for a scheme of triangulation from El Paso to the Gulf of Mexico.
Texas	52	Magnetic	L. G. Schultz, observer; R. E. Halter, assistant.	Completion of the magnetic record at the observatory at Hillside Ranch near San Antonio.

III.—WESTERN DIVISION—STATES AND TERRITORIES BETWEEN THE ROCKY MOUNTAINS AND THE PACIFIC.

40. California.	43. Idaho.	46. Nevada.	49. Arizona Territory.
41. Oregon.	44. Montana.	47. Utah Territory.	50. Territory of New Mexico.
42. Washington.	45. Wyoming.	48. Colorado.	

States or Territories.	Parties.	Operations.	Persons conducting operations.	Localities of work.
California	No. 53	Topography	A. F. Rogers, assistant	Topographical resurvey of San Francisco Bay and Harbor.
California	54	Hydrography	Lieut. Lucian Flynn, U. S. N., assistant.	Hydrographic resurvey of San Francisco Bay and Harbor.
California	55	Hydrography	Lieut. Jas. H. Sears, U. S. N., assistant.	Hydrographic resurvey of San Francisco Bay and Harbor.
California	56	Tidal observations	Emmet Gray, observer, under the supervision of George Davidson, assistant.	Continuation of the tidal record at Sausalito Tidal Station.
California and New Mexico.	57	Telegraphic longitude determinations.	C. H. Sinclair, assistant; Edwin Smith, assistant.	Telegraphic determinations of differences of longitude at Needles and Santa Fe. (For other stations, see Middle Division.)
California	58	Astronomical	C. H. Sinclair, assistant	Latitude determination at Needles.
California and New Mexico.	59	Magnetic	Edwin Smith, assistant	Determination of the magnetic elements at Needles and Santa Fe.
California and Nevada.	60	Magnetic	C. H. Sinclair, assistant	Determination of the magnetic elements at Lake Tahoe and Carson City.
Oregon and Washington.	61	Magnetic	J. J. Gilbert, assistant	Determination of the magnetic elements at Portland, Cape Disappointment, Vancouver, Port Townsend, Seattle, and Tacoma.
Washington	62	Hydrography	Lieut. Lucian Flynn, U. S. N., assistant.	Hydrographic surveys in Washington Sound and Strait of Juan de Fuca.
Washington	63	Triangulation and topography.	J. J. Gilbert, assistant	Continuation of the triangulation and topography of Washington Sound.
Washington	64	Hydrography	Lieut. F. H. Crosby, U. S. N., assistant; Lieut. James H. Sears, U. S. N., assistant.	Hydrographic surveys off the coast from Grays Harbor to the Quillayute River.

Distribution of the field parties of the Coast and Geodetic Survey, etc.—Continued.

III.—WESTERN DIVISION—STATES AND TERRITORIES BETWEEN THE ROCKY MOUNTAINS AND THE PACIFIC—Continued.

States or Territories.	Parties.	Operations.	Persons conducting operations.	Localities of work.
Washington.....	65	Hydrography	Lieut. G. B. Harber, U. S. N., assistant.	Hydrographic examination of the water front and harbor of Tacoma to determine changes caused by the landslide of November, 1894.
Colorado, Wyoming, and Utah.	66	Gravity determinations.	G. R. Putnam, assistant.....	Gravity determinations at Denver, Colorado Springs, Pikes Peak, Gunnison, Grand Junction, Grand Canyon, Norris Geyser Basin, Lower Geyser Basin, Salt Lake City, Green River and Pleasant Valley Junction.
Colorado	67	Meridian line determination.	G. R. Putnam, assistant.....	Laying out of a meridian line at Colorado Springs.
Colorado	68	Geodetic	William Eimbeck, assistant	Continuation of the transcontinental triangulation.
Colorado	69	Geodetic	F. D. Granger, assistant.....	Continuation of the transcontinental triangulation.
Colorado	70	Geodetic	F. W. Perkins, assistant	Continuation of the transcontinental triangulation.
Colorado	71	Geodetic	P. A. Welker, assistant	Continuation of the transcontinental triangulation.

IV.—THE DIVISION OF ALASKA, INCLUDING ITS COASTS BORDERING ON THE PACIFIC OCEAN, ON BERING SEA, AND ON THE ARCTIC OCEAN; ALSO ITS INLETS, SOUNDS, BAYS, RIVERS, AND THE ALEUTIAN AND PRIBILOF ISLANDS.

Territory.	Parties.	Operations.	Persons conducting operations.	Localities of work.
Southeastern Alaska..	No. 72	Hydrography and general surveys.	Lieut. Commander W. I. Moore, U. S. N., assistant.	Survey of Chatham Straits from Point Augusta to Point Samuel, the west end of Kenasnow Island, and Freshwater Bay, Tenakee Inlet (Siwash Passage), and the north end of Hood's Bay, including Killisnoo Harbor.
Southeastern Alaska..	73	Hydrography and general surveys.	Lieut. Commander E. K. Moore, U. S. N., assistant.	Resumption of the hydrographic and general surveys in southeastern Alaska in the spring of 1895. Localities of work, Chatham Straits, Hootznahoo (or Kootznahoo) Inlet, and Peril Strait. The <i>Pullerson</i> also carried the civilian parties for the boundary survey and landed them at their respective stations.
Southeastern Alaska..	74	Topographic sketching and transportation of chronometers.	Lieut. G. B. Harber, U. S. N., assistant.	Transportation of chronometers between Sitka and Pyramid Harbor for the determination of difference of longitude, both astronomical stations being in charge of civilian assistants engaged on the Alaska boundary.
Southeastern Alaska..	75	Tidal observations...	Fremont Morse, assistant	Completion of the series of tidal observations at Sitka.

The names of chiefs of parties engaged in the Alaska boundary work, and the localities of their surveys, will be found under the heading of "Special operations."

SPECIAL OPERATIONS.

States or Territories.	Parties.	Persons conducting operations.	Localities of work.
New York.....	No. 76	H. G. Ogden, assistant	Determination of geographical positions for the establishment of a speed-trial course for naval vessels in Long Island Sound. Survey made at the request of the honorable Secretary of the Navy.
District of Columbia..	77	E. D. Preston, assistant	Establishment of the Naval Observatory Circle, radius 1 000 feet. Survey made by authority of a joint resolution of Congress, approved August 1, 1894.
Virginia.....	78	W. C. Hodgkins, assistant	Special survey of the Fox islands, Chesapeake Bay, for the determination of acreage included between high and low water lines. Survey made at the request of the State authorities.

Distribution of the field parties of the Coast and Geodetic Survey, etc.—Continued.

SPECIAL OPERATIONS—Continued.

States or Territories.	Parties.	Persons conducting operations.	Localities of work.
Virginia.....	79	J. B. Baylor, assistant	Completion of the surveys for the State of Virginia for the mapping of the natural oyster beds.
Alabama	80	H. P. Ritter, observer.....	Completion of the survey of the oyster grounds of Mobile Bay and vicinity for the United States Commission of Fish and Fisheries.
California	81	A. T. Mosman, assistant, and member of the Boundary Commission.	Continuation of the operations of the International Boundary Commission for the relocation and marking of the boundary line between the United States and Mexico, from El Paso to the Pacific Ocean.
California and Nevada.	82	C. H. Sinclair, assistant, and W. B. Fairfield, assistant.	Continuation of the survey of the oblique boundary between California and Nevada.
Washington.....	83	J. J. Gilbert, assistant	Special topographic and hydrographic survey of the vicinity of Port Orchard at the request of the honorable Secretary of the Navy.
Southeastern Alaska..	84	Fremont Morse, assistant.....	<i>Alaska Boundary Survey.</i> —Occupation of the Sitka astronomical station for time observations and chronometric exchanges with Pyramid Harbor astronomical station for the determination of the longitude of the latter.
Southeastern Alaska..	85	J. H. McGrath, assistant.....	<i>Alaska Boundary Survey.</i> —Survey from the south end of Malaspina Base to the Yaktse River, and determination of points near Lituya Bay.
Southeastern Alaska..	86	J. F. Pratt, assistant	<i>Alaska Boundary Survey.</i> —Triangulation and topographic reconnaissance of Chilkat and Taiya inlets.
Southeastern Alaska..	87	J. A. Flemer, assistant.....	<i>Alaska Boundary Survey.</i> —Topographic reconnaissance to the northward and eastward of Taiya Inlet and River.
Southeastern Alaska..	88	H. P. Ritter, expert observer.....	<i>Alaska Boundary Survey.</i> —Topographic reconnaissance to the northward and westward of Chilkat Inlet and River.
Southeastern Alaska..	89	E. F. Dickins, assistant.....	<i>Alaska Boundary Survey.</i> —Topographic reconnaissance on Chilkat and Chilkoot inlets.
Southeastern Alaska..	90	E. F. Dickins, assistant.....	<i>Alaska Boundary Survey.</i> —Astronomical observations at Marys Island, and triangulation between that point and Port Simpson, in the spring of 1895.
Southeastern Alaska..	91	P. A. Welker, assistant.....	<i>Alaska Boundary Survey.</i> —Astronomical observations at the head of Portland Canal and trigonometric survey of Portland Canal.
Southeastern Alaska and Washington.	92	F. A. Young, assistant.....	<i>Alaska Boundary Survey.</i> —Transportation of chronometers to and fro between the astronomical station in Seattle, and the Alaskan astronomical stations, for longitude determinations.
Washington.....	93	Fremont Morse, assistant.....	<i>Alaska Boundary Survey.</i> —Occupation of the Seattle astronomical station for the chronometric determination of Alaskan longitudes.
British Columbia.....	94	O. B. French, aid.....	<i>Alaska Boundary Survey.</i> —Astronomical observations at Port Simpson.

At the close of the astronomical work the various parties of 1895 were consolidated, under the direction of Assistants E. F. Dickins and P. A. Welker, for the execution of the triangulation.

TABLE No. 2-1895.

Statistics of field and office work of the Coast and Geodetic Survey for the fiscal year 1895, and total to June 30, 1895.

	Total to June 30, 1894.	During fiscal year 1895.	Total to June 30, 1895.
RECONNAISSANCE.			
Area in square statute miles.....	445 710	11 700	457 410
Parties, number of		3	
BASE LINES.			
Primary, number of	16		16
Primary, length of, in statute miles	105		105
Subordinate, number of.....	159	7	166
Subordinate and beach measures, length of	578	81	659
TRIANGULATION.			
Area in square statute miles.....	306 310	7 760	314 070
Stations occupied for horizontal measures, number of.....	14 280	469	14 749
Geographical positions determined, number of.....	26 988	776	27 764
Stations occupied for vertical measures, number of.....	1 073	21	1 094
Elevations determined trigonometrically, number of	2 638	29	2 667
Heights of permanent bench marks by spirit leveling, number of	974	39	1 013
Lines of spirit leveling, length of, in statute miles.....	4 791	152	4 943
Triangulation and leveling parties, number of.....		22	
ASTRONOMICAL WORK.			
Azimuth stations, number of.....	251	8	259
Latitude stations, number of.....	405	12	417
Longitude stations, telegraphic, number of.....	173	*6	174
Longitude stations, chronometric or lunar, number of	119	3	122
Astronomical parties, number of		10	
MAGNETIC WORK.			
Stations occupied, number of	995	87	1 082
Magnetic observatories occupied, number of	5	†2	5
Magnetic parties, number of		8	
GRAVITY MEASURES.			
Home stations occupied, number of	30	24	54
Foreign stations occupied, number of.....	28		28
Parties, number of		1	

* Five old stations.

† Old stations.

Statistics of field and office work of the Coast and Geodetic Survey—Continued.

	Total to June 30, 1894.	During fiscal year 1895.	Total to June 30, 1895.
TOPOGRAPHY.			
Area surveyed, in square statute miles.....	37 801	*246	380 47
Length of general coast, in statute miles.....	11 137	121	11 258
Length of shore line, in statute miles, including rivers, creeks, and ponds.....	99 345	434	99 779
Length of roads, in statute miles.....	49 300	1 110	50 410
Topographical parties, number of.....		14	
HYDROGRAPHY.			
Parties, number of, in charge of naval officers.....		13	
Parties, number of, in charge of civilian officers.....		1	
Number of miles (geographical) run while sounding.....	498 204	9 277	507 481
Area sounded, in square geographical miles.....	159 684	1 604	161 288
Miles run, additional, of outside or deep-sea soundings.....	92 955		
Number of soundings.....	21 838 388	451 044	21 834 932
Deep-sea soundings.....	13 270		13 270
Deep-sea temperature observations.....	17 955		17 955
Current stations, number of, occupied by hydrographic parties.....		27	
Deep-sea current stations, number of.....			
Deep-sea subcurrent observations, number of.....			
Deep-sea surface current observations, number of.....			
Specimens of bottom, number of.....	14 015	33	14 048
Automatic tide gauges established.....	105	3	108
Automatic tide gauges discontinued.....	99	4	103
Parties doing tidal work exclusively.....		2	
Parties doing tidal work in connection with hydrographic work.....		13	
Staff and box gauges established.....	2 309	43	2 352
Staff and box gauges discontinued.....	2 305	47	2 352
RECORDS.			
Tidal and current observations, originals, number of vols..	5 110	88	5 198
Tidal and current observations, duplicates, number of vols..	3 397	64	3 461
Aggregate years of record for automatic tide gauges.....	311	6	317
Tidal stations for which reductions have been made.....	1 655	57	1 712
Aggregate years of record reduced.....	328	13	341
Triangulation, originals, number of volumes.....	6 660	153	6 813
Triangulation, originals, number of cahiers.....		7	24
Astronomical observations, originals, number of volumes..	2 206	33	2 239
Astronomical observations, originals, number of cahiers...		2	6
Magnetic observations, originals, number of volumes.....	697	1	698
Magnetic observations, originals, number of cahiers.....		52	117
Pendulum observations, originals, number of volumes.....		10	22
Duplicates of above, number of volumes.....	7 346	227	7 573
Duplicates of above, number of cahiers.....		56	110
Geodetic leveling observations, number of vols., originals..		40	88

* Not including topographical reconnaissance and special examinations in Alaska, which extended over an approximate area of 1 850 square miles.

Statistics of field and office work of the Coast and Geodetic Survey, etc.—Continued.

	Total to June 30, 1894.	During fiscal year 1895.	Total to June 30, 1895.
RECORDS—continued.			
Geodetic leveling observations, number of vols., duplicates.....		62	89
Computations, number of volumes.....	4 382	13	4 395
Computations, number of cahiers.....		233	500
Hydrographic soundings and angles, originals, number of volumes.....	12 747	213	12 960
Hydrographic soundings and angles, duplicates, number of volumes.....	4 294	189	4 483
MAPS AND CHARTS.			
Topographic maps, originals.....	2 169	29	2 198
Hydrographic charts, originals.....	2 392	26	2 418
ENGRAVING.			
Engraved plates of charts.....	554	48	602
Engraved plates of preliminary charts and diagrams for the Coast and Geodetic Survey reports, and of maps of the District of Columbia.....	854	13	867
Engraved plates of Coast Pilot charts.....	80		80
Engraved plates of Coast Pilot views.....	104		104
Electrotype plates made.....	2 425	61	2 486
PRINTING.			
Sheets of charts and maps deposited with sale agents.....	480 338	25 635	505 973
Sheets of charts and maps sold at Coast and Geodetic Sur- vey Office.....		929	
Sheets of charts and maps distributed to Congress, Execu- tive Departments, foreign Governments, libraries, etc.....		24 892	
Sheets of charts and maps, total distribution.....	994 949	51 456	1 046 405

TABLE No. 3—1895.

Information furnished to Departments of the Government in reply to special requests, and to individuals upon application, during the fiscal year ending June 30, 1895.

Date.	Name.	Data furnished.
1894.		
July 2	P. Julian Latham, C. E., Orange Springs, Fla	Magnetic declination about 1833-1835 in Marion County, Fla.; probable change since, and present annual change.
2	U. S. Geological Survey, Washington, D. C.	Geographical positions of three stations in Vermont and description of a station in the same State.
2	A. L. Corthell, C. E., 71 Broadway, New York	Description of three bench marks and tidal information.
7	F. M. Eppley, New York	Geographical positions and descriptions of stations in the vicinity of Hell Gate, New York Harbor.
9	H. N. Ogden, Woodford, Me.	Geographical positions and descriptions of stations in the vicinity of Portland, Me.
10	J. A. Ockerson, principal assistant engineer of the Mississippi River Commission.	Appendices Nos. 7 and 14 of Coast and Geodetic Report for 1887, in reply to request for information.
10	W. B. Edwards, Enido, Ky	Change of magnetic declinations in Boyle County, Ky., between 1836 and 1894, and present annual decrease of each declination.
12	M. Taylor, Hill Station, Va.	Three publications on magnetic declination, in reply to request for information on the subject.
16	J. W. Chickering, Ripton, Vt.	Elevation of Potato Hill Station above mean sea level.
16	Dr. Th. Albrecht, Potsdam, Germany.	Results of observations made at San Francisco and other stations for the determination of the variation of latitude.
18	Randal Hagner, Washington, D. C.	Tidal data relating to the Washington, D. C., Navy-Yard.
18	W. W. Austen, Winchester, Ky	Formula for computing sunrise and sunset.
21	W. M. Fraser & Co., surveyors, Altoona, Pa	Information in regard to a meridian line established at Altoona, Pa., and three appendices on terrestrial magnetism.
25	U. S. Commission of Fish and Fisheries, Washington, D. C.	Descriptions of trigonometric stations on the St. Croix River, Maine.
25	W. W. Austen, Winchester, Ky	Explanation of tide tables and of the formation of a table of semi-diurnal arcs.
25	H. B. Whitcom, Richmond, Va.	Mean tidal level in tidal rivers.
26	F. F. B. Coffin, Huron, S. C.	Information respecting the earth's figure in connection with its rotation.
26	W. Kaucher, Oregon, Mo.	Geographical positions, distances, angles, and azimuths of six stations of the secondary triangulation of the Missouri River.
26	J. F. Noble, Trenton, N. C.	Magnetic declination at Newbern, N. C., between the years 1770 and 1900.
27	U. S. Geological Survey, Washington, D. C.	Geographical positions and descriptions of trigonometric stations in California.
7	Lucien Minor, Galveston, Tex.	Depths of water at the entrances of the principal ports of the United States and also at Havre, France, and Liverpool, England.
16	Lieut. Geo. A. Trim, U. S. E.	Two blue prints made from special tracing of original hydrographic sheet No. 1325—Cubits Crevasse Mississippi River.
31	Dr. F. R. Helmert, International Geodetic Association, Berlin, Germany.	Diagrams of the variation of latitude at San Francisco, according to observations of 1891-92; also variation according to Chandler's formula, at San Francisco, Cal.; Waikiki, Hawaiian Islands; Rockville, Md., and Berlin, Germany.
	Dr. B. A. Gould, Cambridge, Mass	Diagrams showing the variation of latitude at San Francisco, Cal., according to the observations of 1891 and 1892; also the variation according to Chandler's formula at San Francisco, Cal.; Waikiki, Hawaiian Islands; Rockville, Md., and Berlin, Germany.
	Col. Geo. Defforges, Paris, France.	Diagrams showing the variation of latitude at San Francisco, Cal., according to the observations of 1891 and 1892; also the variation according to Chandler's formula at San Francisco, Cal.; Waikiki, Hawaiian Islands; Rockville, Md., and Berlin, Germany.
18	Capt. B. A. Fahm, Brunswick, Ga.	Information concerning St. Simons Entrance, Georgia, and blue print from our latest survey.

Information furnished to Departments of the Government in reply to special requests, etc.—Continued.

Date.	Name.	Data furnished.
1894.		
July 19	Henry N. Ogden, city engineer, Deering, Me.....	Tracings of sketches of trigonometric stations east of Saco River, Maine, work of 1850-1852, and stations in the vicinity of Portland, Me., work of 1868-69.
25	Capt. H. C. Taylor, president of Naval War College, Newport, R. I.	Maps of the eastern end of Long Island Sound, mounted and colored, with shore line strengthened, etc.
28	Wm. C. Murdock, secretary Fish Commission, San Francisco, Cal.	Length of general coast line, coast line of the mainland, coast line of the mainland and islands, and coast line of the islands, of the States bordering on the Atlantic and Gulf coasts of the United States.
Aug. 3	J. E. Emery, New Haven, Conn.....	Elevations in Vermont; appendix No. 7, United States Coast and Geodetic Survey Report of 1887; references to heights.
3	H. A. Gill, Acting Commissioner of Fish and Fisheries.	Descriptions of two trigonometrical stations, their geographical positions, distances, and azimuths.
7	Lieut. M. M. Macomb, U. S. A., Washington, D. C.....	Length of base line near Fort Myer.
7	B. F. Haynes, Marion, Ind.....	Change in magnetic declination in Somerset County, Md., between the years 1721 and 1894.
9	S. B. McKee.....	Geographical positions of two light-houses on Lake Champlain; revised position of station Bald Peak of the Adirondack survey.
10	R. W. Morris, West Point, N. Y.....	Geographical positions of two trigonometric points.
16	L. M. Haupt, Philadelphia, Pa.....	Geographical positions and descriptions of trigonometric stations between the Delaware and Raritan rivers; Appendix No. 11 of United States Coast and Geodetic Survey Report of 1882, on spirit levels in the same region.
17	Prof. Dwight Porter, Institute of Technology, Boston, Mass.	Sea-water temperatures in Boston Harbor during the year 1893.
20	J. H. Cummings, Talmage, Mo.....	Elevation of the St. Louis bench mark above mean sea level.
21	F. N. Cole, University of Michigan, Ann Arbor, Mich..	Latest information respecting the secular variation of the magnetic declination; tables of variations corrected to date; table of annual change for 1890-1895, and 1900, arranged by States and Territories; tables of times of culminations and elongations of Polaris between the years 1889 and 1910.
22	W. C. Bristol, South Bend, Wash.....	Descriptions of three bench marks, and tidal information.
31	O. D. Wheeler, St. Paul, Minn.....	Height of Mount Ranier, Washington.
6	Henry Woodward, Middletown, Conn.....	Distances on the Connecticut River between the bridge at Middletown and Hartford.
13	Lieut. Spencer Crosby, U. S. E., assistant engineer fourth light-house district.	Tracings of hydrographic sheets Nos. 1504a and 1504b and parts of topographic sheets Nos. 1547a and 1550, vicinity of Reedy Island, Delaware River.
22	C. A. Corliss, C. E., Bath, Me.....	Tracing of McMahons Island, Sheepscott River, Me., from original topographic sheet.
27	F. M. Eppley, 140 Nassau street, New York.....	Tracing of shore line of East River in the vicinity of Stony Point from topographic surveys of 1837, 1855, and 1885, and hydrographic survey of 1837.
30	W. F. King, Canadian Commissioner on Alaskan and northeast boundaries, Ottawa, Canada.	Chart showing the Coast and Geodetic Survey triangulation of Lynn Canal, Alaska.
30	Capt. T. W. Symons, U. S. E., Portland, Oreg.....	Tracing of the hydrography of Clallam Bay, Straits of Fuca, from original hydrographic sheet.
Sept. 1	C. A. Denton, Board of Education, Butler, Mo.....	Elevation of Coast and Geodetic Survey bench mark at Butler, Mo., above mean sea level.
4	M. D. Gravatt, B. S., Manalapan, N. J.....	Information concerning terrestrial magnetism—three appendices.
6	John Baily & Co., Philadelphia, Pa.....	Explanation of Tide Tables.
7	E. A. Giesler, Savannah, Ga.....	High and low waters at 14 stations on the Hudson River and approaches.
7	Maj. Thos. H. Handbury, U. S. E.....	Tides at Cape Canaveral, Florida.
8	J. Atwell, Mitchells Station, Va.....	Table of secular variation of the magnetic declination for 1750 and two pamphlets on terrestrial magnetism.
10	Maj. Thos. H. Handbury, U. S. E.....	Geodetic data for the vicinity of Cape Canaveral, Florida.
11	H. W. Swasey, Portland, Me.....	Height of Black-strap Hill.
11	G. W. Hayes, C. E., Lebanon, Pa.....	Three appendices and one bulletin relating to magnetic declinations.
11	A. P. Killington, Cedar Springs, Va.....	Three appendices on magnetic declination.
15	G. W. Hayes, C. E., Lebanon, Pa.....	Information relative to the determination of the azimuth of Polaris.
15	J. G. Gholson, Broughton, Ill.....	Information relative to the moon's position when the tide wave begins in the Pacific Ocean; the effect of mountain masses upon the mean sea level.
17	E. A. Doyle, New York.....	Geographical positions of 24 stations on the north side of Long Island.

Information furnished to Departments of the Government in reply to special requests, etc.—Continued.

Date.	Name.	Data furnished.
1894.		
Sept. 19	W. A. Gathright, Dabneys, Va.	Times of high water at Savannah and Savannah entrance for October 1, 1894.
20	G. W. Hayes, C. E., Lebanon, Pa.	Table and formulæ for computing the azimuth of a polar star for any hour angle, and latitude.
19	Lieut. M. L. Walker, U. S. E., Willets Point, N. Y.	Instructions relative to management of a tide gauge.
20	B. Erickson.	Descriptions and geographical positions of 17 trigonometrical points on Long Island, N. Y.
20	A. B. Warren, Richmond, Va.	Appendices 7 of Report for 1888 and 11 of Report of 1889.
27	Commander C. S. Sigsbee, U. S. N., Hydrographic Office, Washington, D. C.	Descriptions and geographical positions of 56 trigonometric points in New York, Connecticut, New Hampshire, and Maine.
28	J. O. Andrews, Gainesville, Fla.	Height of Gainesville and Hawthorn above mean sea level.
28	G. & C. Merriam and Company.	Geographic position of Mount St. Elias, and information concerning the boundary line between Alaska and British Columbia.
1	Chief of Engineers, U. S. A.	Tracings of Richs and Agate passages, Puget Sound, from original topographic and hydrographic sheets.
10	R. H. Brown, assistant engineer of the Delaware and Hudson Canal Company.	Tracing from original sheets of Lake Champlain, vicinity of Fort Ticonderoga.
15	Capt. H. C. Taylor, U. S. Naval War College, Newport, R. I.	Tracing of topography of Robbins, Gardiners, Shelter, and Plum islands, east end of Long Island Sound, from original sheets.
18	Thompson and Slater, Washington, D. C.	Tracings of Homasassa River and Withlacoochie River, Florida, from original hydrographic sheets.
19	Maj. Thos. H. Handbury, U. S. E.	Tracing of hydrography in the vicinity of Cape Canaveral, Florida, from original sheets.
21	Capt. T. W. Symons, U. S. E.	Tracing of topography on the coast of Washington from original sheet No. 1788.
24	Col. W. P. Craighill, U. S. E.	Tracing of hydrography in the vicinity of Tilghmans Point, Chesapeake Bay, from original sheets.
26	John H. Fountain, Crisfield, Md.	Platting of the boundary line between Maryland and Virginia on Chart No. 133.
28	Lieut. Geo. A. Trim, U. S. E.	Copy of topographical sheet of the survey of Cubit's Gap, Mississippi River.
Oct. 2	H. B. Bradford, Wilmington, Del.	Information concerning terrestrial magnetism generally, and the present annual change of declination in Cecil County, Md.
10	H. F. Gunnison, editor of the Eagle Almanac, Brooklyn, N. Y.	Predicted tides for the year 1895 at Governors Island, N. Y.
11	O. W. Guerdrum, Topographic Office of Post-Office Department.	Positions of astronomical stations in Georgia.
12	Prof. Leonard S. Smith, University of Wisconsin.	Information concerning refraction and unsteadiness of the atmosphere in connection with telemeter work.
15	W. H. Knight, Los Angeles, Cal.	Information concerning magnetic observations at Los Angeles during a period of seven years.
16	A. J. Johnson, Baltimore and Ohio Railroad.	Copy of Appendix No. 11 of Report of 1881, on result of spirit leveling.
19	G. B. Stovall, jr., Atlanta, Ga.	Appendices relating to magnetic declinations in Georgia, during the years 1894 and 1895.
27	Lieut. C. C. Marsh, U. S. N., U. S. Naval Observatory, Washington, D. C.	Eight appendices relating to magnetic observation and results of the United States Coast and Geodetic Survey.
29	U. S. Light-House Board, U. S. Treasury Department, Washington, D. C.	Magnetic chart (isogonic), region of the Great Lakes, for the epoch 1895.
29	J. C. Russell, Ann Arbor, Mich.	Heights and geographical positions of Mount St. Elias and Mount Logan, Alaska.
29	A. S. Christie, Washington, D. C.	Copies of three communications on the subject of latitude variations.
30	A. M. Spear, Gardiner, Me.	Data relating to the Coast and Geodetic Survey bench mark at Gardiner, Me.
30	The Funk & Wagnalls Publishing Company, New York.	Heights and geographical positions of Mount St. Elias and Mount Logan.
31	J. J. Knoch, Arkansas Industrial University.	Elevation of bench mark at Fayetteville Industrial University above mean sea level.
1	Colonel Mendell, U. S. E., San Francisco, Cal.	Tracing of hydrography in the vicinity of certain rocks and dangers in San Francisco Bay and approaches, from original sheets.
3	J. Lyon, Interior Department, Washington, D. C.	Tracing of country between Lakes Pontchartrain and Maurepas, Louisiana.
5	Geo. Davidson, San Francisco, Cal.	Tracing of topography and hydrography from Cayucos Landing to Estero Point, from original sheets.
5	Capt. T. W. Symons, Portland, Oreg.	Tracing of hydrography of entrance to Grays Harbor, from original sheets of the 1891 survey.

Information furnished to Departments of the Government in reply to special requests, etc.—Continued.

Date.	Name.	Data furnished.
1894.		
Oct. 11	Maj. Thos. H. Handbury, U. S. E.	Tracing of hydrography in the vicinity of Cape Canaveral, Florida, from original sheets.
12	Maj. Charles E. R. B. Davis, U. S. E.	Tracing of hydrography of Quantico Creek, Ware River, and Harris Creek, Virginia, from original sheets.
13	W. F. King, Canadian Boundary Commissioner, Ottawa, Canada.	Sketch of Coast and Geodetic Survey triangulation in Alaska, platte on Charts Nos. 8100, 8200, and 8300.
20	James P. Bogart, State Commission of Fish and Fisheries, New Haven, Conn.	Tracing of topography of Bridgeport and vicinity, from original sheets.
26	Wm. Jackson, C. E., city engineer of Boston, Mass.	Tracing of hydrography of the flats off East Boston, from original sheets.
Nov. 2	J. P. N. Bell, Gainesville, Fla.	Latitude, longitude, and elevation above mean sea level of the bench mark at Gainesville, Fla.
2	C. M. Gulde, West Point Pleasant, N. J.	Geographical position of S. Osborn; ratio of metric and British units of weight and measure; dimensions of the earth adopted by the United States Coast and Geodetic Survey.
5	A. A. Schenck, chief assistant engineer of the New York Central and Hudson River Railroad.	Information concerning results of spirit leveling; half-tide level of the ocean and New York Harbor; descriptions of 4 bench marks at Jersey City and Governors Island.
5	A. M. Ford, Salem, N. J.	Explanation of Tide Tables for 1895.
8	Lieut. A. Slaker, U. S. A., David Island, N. Y.	Geographical positions of 8 trigonometric points in the vicinity of David Island.
12	W. and L. E. Gurley, Troy, N. Y.	Table of times of elongations and azimuths of Polaris between the years 1890 and 1910.
12	A. M. Ford, Salem, N. J.	Explanations of Tide Tables published by Coast and Geodetic Survey.
12	D. A. Compton, Hawley, Pa.	Information as to the velocity of the tide wave in the Hudson and Delaware rivers.
15	Osceola Phosphate Company, Albion, Fla.	Elevation of the Albion bench mark above mean sea level.
16	J. M. Searles, Vicksburg, Miss.	Magnetic declination and annual change for 1890 at Vicksburg, Miss.
16	R. M. Rich, Beverly, Mass.	Magnetic declination and annual change for 1890 at Bucksport, Me.
17	W. R. Hillyer, Port Richmond, N. Y.	Magnetic declination at Port Richmond in 1824.
20	J. L. Bryan, Cambridge, Md.	Magnetic declination at Cambridge, Md., in 1894, and annual increase.
20	W. S. Rich, Cambridge, Mass.	Information concerning the size and figure of the earth; Coast and Geodetic Survey Report for 1890 and 1892.
21	G. A. Sanders, Laconia, N. H.	Air line distance from Laconia to Wentworth and from Wentworth to Littleton.
22	L. C. Baker, United States Marine-Hospital Service, Washington, D. C.	Position of the geographical center of the United States.
23	W. H. Temme, Canal, Ind.	Appendices on terrestrial magnetism; secular change of the declination in Warrick County, Ind.
26	Maj. D. P. Heap, U. S. E., Portland, Me.	Descriptions of three bench marks in various parts of Maine.
26	J. Marden, secretary Board of Tide Land Appraisers, Tacoma, Wash.	Geographical positions and descriptions of 21 trigonometric stations in the vicinity of Steilacoom and Commencement Bay, Puget Sound.
30	U. S. Geological Survey, Washington, D. C. — Hunt, engineer of bridges, Washington, D. C.	Geographical position of station "Plateau," Colorado. Height of bench mark 46 in District of Columbia.
7	W. F. King, International Boundary Commissioner, Ottawa, Canada.	Tracings of original topographical sheets of Taku Inlet, Bradfield, Portland, and Behm canals, Earnest Sound, Frederick Sound, and Stephens Passage.
8	Olmstead & Elliot, Brookline, Mass.	Tracing of original sheet of Lynn Harbor, Mass.
17	Henry W. Brower, C. E., Georgetown, D. C.	Copy of survey of U. S. Naval Observatory grounds.
19	Maj. W. S. Stanton, U. S. E., Wilmington, N. C.	Tracing of upper part of Alligator River, North Carolina, from original hydrographic sheets Nos. 218 and 1315.
21	Lt. Col. Peter C. Hains, U. S. E., Portland, Me.	Tracing of hydrography of Cape Porpoise Harbor from original sheet.
24	Lt. Col. H. M. Robert, U. S. E., New York	Copy of topographical survey from Far Rockaway to Great Bar Haddock, Long Island, N. Y., from original sheet No. 1471a.
Dec. 1	H. L. Fairchild, Rochester, N. Y.	Elevation above mean sea level of bench mark at Albany, N. Y.
1	L. C. Heywood, Pawtucket, R. I.	Geographical positions and descriptions of seven trigonometric points in the vicinity of Pawtucket; results of latest adjustment of the triangulation; two appendices.
	Assistant district attorney, Washington, D. C.	Information concerning tides in the Potomac River.
12	H. P. Simpson, Hydrographic Office, Navy Department, Washington, D. C.	Geographical positions and descriptions of stations "Friars Head" and "Crane Neck," New York.
13	W. & L. E. Gurley, Troy, N. Y.	Two copies of Bulletin No. 14; Appendices Nos. 11 of 1889 and 6 of 1885; 2 isogonic maps for 1885.
13	L. C. Heywood, Pawtucket, R. I.	Information in regard to the computation of geographical positions.

Information furnished to Departments of the Government in reply to special requests, etc.—Continued.

Date.	Name.	Data furnished.
1894.		
Dec. 17	U. S. Geological Survey, Washington, D. C.	Geographical positions, descriptions, and elevations of 4 trigonometric stations in Tennessee.
5	Lieut. C. E. Gillette, U. S. E., San Francisco, Cal.	Copy of hydrographic survey of Suisun Bay, California, from original sheets.
5	Capt. W. H. Bixby, U. S. E., Newport, R. I.	Copy of hydrographic survey of Stonington Harbor, from original sheet No. 1577 <i>a</i> .
5	W. F. King, International Boundary Commissioner, Ottawa, Canada.	Geodetic positions of points in the vicinity of Chickamin River and Portland Canal, Alaska.
13	Bureau of Education, Washington, D. C.	Map of Alaska prepared for photolithography, to show reindeer stations.
13	Capt. H. C. Taylor, U. S. N., Naval War College, Newport, R. I.	Tracings from original hydrographic sheets Nos. 1844-1879, and 1947-Nantucket Sound.
1895.		
Jan. 2	O. A. Veazey, Dego, W. Va.	Latitude, longitude, azimuth, and elevation of trigonometric stations Table Rock, Holmes, and Summersville.
2	S. M. Holdridge, San Francisco, Cal.	Geographical position (approximate) of Ukiah C. H., Cal.
2	U. S. Geological Survey, Washington, D. C.	Geographical position of Pikes Peak, Colo.
3	H. von Bayer, U. S. Fish Commission, Washington, D. C.	Three appendices treating of magnetic declination; copy of Bulletin No. 14.
8	E. D. Hardesty, Harlowe, N. C.	Table of magnetic declinations for Beaufort and Newbern, between the years 1770 and 1900; three appendices treating of magnetism.
8	H. L. Dillworth, Centerville, Del.	Table showing changes in the magnetic declination in the vicinity of Wilmington, Del., during the past 50 years.
9	U. S. Geological Survey, Washington, D. C.	Geographical positions of 3 trigonometric stations in Georgia.
11	C. S. Woodard, Ypsilanti, Mich.	Table of changes of magnetic declination at Ypsilanti, Mich.; results of discussion of magnetic observations at Los Angeles, Cal.
15	Theodore Moreno, Gainesville, Ga.	Magnetic declination at Gainesville for 1895; Appendix No. 12 of report for 1886 and Bulletin No. 14.
16	H. J. Hayes & Son, Winslow, Ark.	Elevation of bench marks at Winslow railroad station and Summit Hotel, above the mean level of the Gulf of Mexico.
17	Shedd & Sarle, civil engineers, Providence, R. I.	Geographical positions and descriptions of 2 trigonometric points, and data for geodetic computation.
18	U. S. N. Hydrographic Office, Washington, D. C.	Two isogonic charts showing the curves for 1895 in the NE. Pacific, Bering Sea, and northern Alaska.
18	Richard B. Wall, Waterford, Conn.	Description of station "Manetuck" and copy of Appendix No. 8 of report for 1888.
18	H. D. Jefferson, Franklin, Tenn.	Three appendices on magnetic declination and Bulletin No. 14.
18	U. S. Geological Survey, Washington, D. C.	Geographical positions of 4 trigonometric stations in the vicinity of the Kansas and Colorado boundary line.
19	H. D. Whitcomb, U. S. E., Richmond, Va.	Elevation of bench mark at Old Point light-house above mean sea level.
22	J. D. Davis, Reeds, Mo.	Elevation of bench mark at Reeds, Mo., above mean level of the Gulf of Mexico.
23	Lieut. Commander C. H. Arnold, U. S. N., branch hydrographic office, New York.	Hourly readings of the Fort Hamilton tide gauge for August 19 and 20, 1893.
25	Capt. F. V. Abbot, U. S. E., Charleston, S. C.	Descriptions of two bench marks at St. Simons Sound.
25	Sawyer-Man Electric Company, New York.	Magnetic dip and horizontal force in the United States for 1885, and declination for 1890.
26	F. G. Plummer, C. E., Tacoma, Wash.	Magnetic declination for Tacoma and annual change for the State of Washington.
26	R. H. Rich, Beverly, Mass.	Table of elongations and azimuths of Polaris; geographical position of Beverly, Mass.
28	James M. Gibboney, Wytheville, Va.	Table of secular variation of the magnetic declination between the years 1795 and 1900; time of zero declination and present value.
29	J. H. Leippe, Reading, Pa.	Latitude and longitude of trigonometric station "Black Spot."
29	Prof. Thomas Grey, Rose Polytechnic Institute, Terre Haute, Ind.	Results of the pendulum research of the Coast and Geodetic Survey during the year 1894.
31	H. T. Douglas, chief engineer of the Baltimore Topographical Survey.	Explanatory remarks concerning the relation of the work of the Coast and Geodetic Survey and that of the city of Baltimore, with resulting lengths of certain trigonometric lines.
8	Board of Park Commissioners, Cambridge, Mass.	Sheet of Boston Harbor with results of latest hydrographic survey.
9	C. B. Northrop, Charleston, S. C.	Tracing of topography in the vicinity of St. Augustine, Fla., from original topographic sheet.
14	Bureau of Education, Washington, D. C.	Sketch map of Alaska, prepared for photolithographing, showing proposed reindeer mail routes.

Information furnished to Departments of the Government in reply to special requests, etc.—Continued.

Date.	Name.	Data furnished.
1895.		
Jan. 19	Virginia State Oyster Survey.....	Four projections on scale of $\frac{1}{250,000}$, outer coast of Virginia, with shoreline and trigonometric positions.
Feb. 2	W. B. Getchell, C. E., Augusta, Me.....	Descriptions of bench marks at Augusta and Hallowell, Me.
2	J. P. Bogart, C. E., New Haven, Conn.....	Information concerning geographical positions in the vicinity of New Haven, Conn.
4	J. P. Bryant, C. E., New Haven, Conn.....	Azimuths and times of elongation of Polaris.
4	E. F. Smith, Madera, Cal.....	Information concerning magnetic declination.
4	U. S. Geological Survey, Washington, D. C.....	Geodetic data for 2 trigonometric points in eastern Colorado.
5	F. G. Cudworth, Fort Ethan Allen, Vermont.....	Elevation of Lake Champlain; Appendix No. 7 of report for 1887.
6	O. H. Tripp, C. E., Rockland, Me.....	Geographical positions of 6 primary and 12 subordinate trigonometric points in the vicinity of Rockland, Me.
8	Capt. S. S. Smith, U. S. E.....	Height of bench mark at Fort Montgomery, Lake Champlain.
9	W. W. Blakeley, C. E., Philadelphia, Pa.....	Horizontal angles measured at Governor Dick and Swatara stations; latitude, longitude, and azimuth of the same stations.
9	Chas. A. Ferry, New Haven, Conn.....	Expression for the magnetic declination at New Haven; copy of Bulletin No. 14.
9	W. W. Hodges, Chicago, Ill.....	Starting level of the line of levels from New York to St. Louis, and reference to the survey of the lakes by the U. S. Engineers.
12	Prof. L. M. Haupt, University of Pennsylvania, Philadelphia, Pa.	Descriptions of two bench marks at Aransas Pass, Tex.
13	Frank M. Duffy, Guthrie, Ky.....	Magnetic declination at Guthrie, Ky., and various publications relating to magnetism.
14	O. H. Tripp, C. E., Rockland, Me.....	Descriptions of 3 trigonometric stations near Rockland, Me.
16	E. T. Cox, Albion, Fla.....	Elevations of various bench marks on the line across the peninsula of Florida from St. Augustine to Cedar Keys.
16	Z. B. Newton, Hope Mills, N. C.....	Information concerning the position of the north magnetic pole, and collections of magnetic observations; various appendices on the subject of terrestrial magnetism.
16	Prof. L. M. Haupt, Philadelphia, Pa.....	Description of bench mark at Ropesville, Aransas Pass, Tex.
16	Convers & Kirlin, New York.....	Tides at Delaware Breakwater for November 23 and 24, 1894.
18	J. F. Schmeltzer, Manteno, Ill.....	Appendices Nos. 7 of 1888 and 11 of 1889 and Bulletin No. 14.
23	Prof. M. Merriman, Lehigh College, Pennsylvania.....	Additions to the table for the times of culmination and elongation of Polaris during the period 1895 to 1905.
25	Prof. Geo. H. Hamlin, Orona, Me.....	Descriptions of bench marks at Bangor, Me.
26	Rev. J. J. Abell, Bethlehem Academy, St. John, Ky.....	Geographical positions of 4 trigonometric stations in the vicinity of Louisville, Ky.
26	J. W. Brower, St. Paul, Minn.....	Latitude and longitude of Lima, Beaverhead County, Mont.
26	F. W. Starbuck, Racine, Wis.....	Elevations above sea level of Santa Rosa, San Luis Obispo, and San Jose, Cal.
7	E. R. Sharwood, secretary Philadelphia Maritime Exchange.	Tracing of hydrographic survey of the vicinity of the Delaware Breakwater.
12	H. C. Ripley, Galveston, Tex.....	Tracing of the shore line of Galveston Bay from the mouth of Dickinsons Bayou to Highland Bay, from original topographical sheets.
27	Theodore C. White, School of Mines, Columbia College, New York.	Blue print from tracing of the topography of Great and Little Cranberry islands, Me., from original sheets.
Mar. 1	W. S. Taylor, State University of Louisiana.....	Latitude and longitude of the astronomical station at Baton Rouge, La.; elevation of two bench marks above the mean level of the Gulf of Mexico.
5	F. M. Duffey, Guthrie, Ky.....	Magnetic declination at Guthrie, Ky., in 1895; copies of appendices Nos. 7 of 1888 and 11 of 1889.
6	C. B. Twing, University of Wisconsin.....	Suggestions for tabular statements of magnetic constants for the United States; eight appendices on the subject of terrestrial magnetism.
8	W. McC. Brown, Bayard, W. Va.....	Time of eastern elongation and azimuth of Polaris for March 3, 1895.
8	Rear-Admiral W. J. L. Wharton, R. N., London, England.	High and low waters at Sausalito, Cal., for the year 1894, and harmonic constants for the same station for the year 1889.
11	J. A. Ockerson, St. Louis, Mo.....	Geographical position and description of the station at La Crosse, Wis.
12	Alfred Meads, Ontonagon, Mich.....	Appendices Nos. 6 of 1885, 7 of 1888, and 11 of 1889.
12	J. W. Lockhart, Bluff City, Tenn.....	Elevation of Bristol, Tenn.; magnetic declination of Bristol, Tenn.
12	J. Stanley Brown, Washington, D. C.....	Distances and azimuths between Washington Old Observatory, University of Virginia, Lynchburg, Va., and Statesville, N. C.
12	G. M. Donham, Portland, Me.....	Advance copies of tide predictions for Eastport and Portland, Me., for the first four months of 1896.
19	C. J. Brown, engineer of St. Louis and San Francisco R. R.	Elevations of bench marks on the line between Carthage, Mo., and Chester, Ark.

Information furnished to Departments of the Government in reply to special requests, etc.—Continued.

Date.	Name.	Data furnished.
1895.		
Mar. 19	M. Harrington, Chief of Weather Bureau, Washington, D. C.	Elevation of bench marks on the line from St. Louis, Mo., to Kansas City, Mo.
20	W. B. Dawson, department of marine and fisheries, Ottawa, Canada.	High and low waters at Fort Hamilton, N. Y., for December, 1894, and January, 1895.
22	B. H. Wright, Penn Yan, N. Y.	Table of the semimensual phase inequality in time and height, for Savannah, Ga.
25	O. J. Klotz, Canadian boundary commission	Geographical positions of 7 astronomical stations of the Coast and Geodetic Survey.
26	J. C. Nagle	Appendices Nos. 6 of 1885, 12 of 1886, 7 of 1888, and 11 of 1889.
20	J. W. Kendrick, St. Paul, Minn.	Tracing of hydrography of part of Tacoma Harbor, Washington, from original sheet of 1895 survey.
Apr. 1	J. V. Davies, chief engineer N. Y. & L. I. Bridge Company, New York.	Descriptions of five bench marks in the vicinity of New York.
5	C. S. Weber & Co., New York	Distance between New York City and Hartford, Conn.
8	J. A. Holmes, State geologist of North Carolina	Table of secular magnetic variation 1760 to 1895, 5; appendices Nos. 7 of 1888, and 12 of 1886.
8	Maj. D. P. Heap, U. S. E., Portland, Me.	Descriptions of five bench marks on the Kennebec River, Me.
8	W. Bell Dawson, department of marine and fisheries, Ottawa, Canada.	Explanation of variations in the tidal difference between two stations.
9	J. P. Perkins, Sacaton, Ariz.	Information as to the present annual change of magnetic declination in Arizona; appendices Nos. 7 of 1888 and 11 of 1889.
15	U. S. Geological Survey, Washington, D. C.	Geographical positions of 3 trigonometric stations in West Virginia.
16	O. J. Klotz, Ottawa, Canada	Geographical position of Mount Fairweather, Alaska, with azimuths and elevation.
19	U. S. General Land Office, Washington, D. C.	Geographical positions and descriptions of stations on the south side of the Columbia River, along the coast to Tillamook Bay, and in the vicinity of Port Orford and Coos Bay, Oregon.
16	Henry Meier, Baltimore, Md.	Predicted times of high water for Baltimore, Md., for the year 1896; list of establishments for 48 places on the Upper Chesapeake.
18	W. F. Belknap, C. E., Brooklyn, N. Y.	Information as to the highest tide recorded at Sandy Hook, New Jersey.
20	U. S. Geological Survey, Washington, D. C.	Geographical position and description of trigonometric station "Clinch," Tennessee.
22	J. S. Peter, Corpus Christi, Tex.	Geographical positions and descriptions of 8 trigonometric stations in the vicinity of Baffin Bay and Laguna Madre, Texas.
22	Col. Anson Mills, U. S. A.	Descriptions of reconuissance stations along the Rio Grande from El Paso to the Gulf of Mexico.
22	Capt. G. A. Zinn, U. S. E., Mississippi River Commission.	Geographical positions and descriptions of stations along the Mississippi River from Minneapolis southward.
22	Adolfo Faidigo, astronomical and meteorological observatory, Trieste, Austria.	Description of the tide-predicting machine in use by the Coast and Geodetic Survey.
22	Cambridgeport Diary Company, Cambridgeport, Mass.	Tidal predictions for San Francisco, Cal.; San Diego, Cal.; Astoria, Oreg.; Port Townsend, Wash., and Sitka, Alaska, for the year 1896.
24	W. F. Hardesty, Salt Lake City, Utah	Appendices treating of terrestrial magnetism.
25	U. S. Geological Survey, Washington, D. C.	Geographical positions of 230 trigonometric stations along the coast of Oregon.
27	W. B. Cochrane, Stamford, Conn.	Identification of a number of trigonometric positions in the vicinity of Stamford, Conn.
29	H. N. Shultz, Foxville, Md.	Information concerning local deviations of the magnetic needle; Appendices Nos. 6 of 1885 and 11 of 1889.
May 2	U. S. Geological Survey, Washington, D. C.	Geographical positions and descriptions of three trigonometric stations in the vicinity of Nashville, Tenn.
3	J. A. Bullock	Information as to methods of determining the true bearing of the Virginia and North Carolina boundary.
3	U. S. Geological Survey, Washington, D. C.	Geographical positions and descriptions of 3 trigonometric stations near the southern boundary of New Hampshire.
3	Capt. T. A. Bingham, U. S. E.	Geographical positions and descriptions of 17 trigonometric points in the vicinity of Chattanooga, Tenn.
3	U. S. Geological Survey, Washington, D. C.	Geographical positions and descriptions of 2 trigonometric stations in southern New Hampshire.
6	U. S. Geological Survey, Washington, D. C.	Geographical positions and descriptions of 3 primary trigonometric stations in Colorado.
6	T. W. G. Davidson, C. E., New York	Appendix No. 7 of report for 1888.
7	U. S. Geological Survey, Washington, D. C.	Geographical positions and descriptions of 2 trigonometric stations in New York and Vermont.

Information furnished to Departments of the Government in reply to special requests, etc.—Continued.

Date.	Name.	Data furnished.
1895.		
May 7	C. S. Kemper, Acting Supervising Architect, Treasury Department, Washington, D. C.	Tracing of hydrography in the vicinity of Reedy Island, Delaware River, from original sheet.
8	L. Wilson, Haverstraw, N. Y.	Geographical position and description of a trigonometric station on the Hudson River.
9	F. J. Houston, Philadelphia, Pa.	Information concerning terrestrial magnetism, and 10 appendices on the subject.
10	W. B. Cochrane, C. E., Stamford, Conn.	Descriptions of 4 trigonometric stations in the vicinity of Stamford, Conn.
10	Kiggins and Tooker Company, New York	Predicted times of high water at San Francisco, San Diego, Astoria, and Port Townsend for the year 1896.
15	W. H. Holmes, Philadelphia, Pa.	Geographical position and elevation of Mount St. Elias, Alaska, and reference of the same to the international boundary.
18	E. Mitchell, C. E., Manchester, Va.	Elevations and descriptions of 3 bench marks at Richmond, Va.
20	U. S. Geological Survey, Washington, D. C.	Geographical positions of 7 trigonometric stations in Alabama.
22	C. A. Gonzales, Mexico, Mexico	Appendices Nos. 7 of 1888 and 6 of 1885.
22	Professor Keith, Philadelphia Public Ledger, Philadelphia, Pa.	Predicted times and heights of high and low water at Philadelphia for the year 1896.
23	W. H. Holmes, Philadelphia, Pa.	Elevations of the 3 highest mountains in Alaska.
23	U. S. Geological Survey, Washington, D. C.	Geographical positions and descriptions of 67 trigonometric stations in California.
23	E. E. Rose, Philadelphia, Pa.	Magnetic declination at Philadelphia, its annual change and diurnal variation; Appendices Nos. 7 of 1888, and 11 of 1889.
24	O. Klotz, topographical survey, department of the interior, Ottawa, Canada.	Geographical positions and elevations of Mount Fairweather and Mount La Perouse.
24	H. C. Lord, Ohio State University, Columbus, Ohio	Latitude and longitude of the State House at Columbus, Ohio.
24	U. S. Geological Survey, Washington, D. C.	Geographical positions and descriptions of 7 trigonometric stations in Alabama.
27	U. S. Geological Survey, Washington, D. C.	Geographical positions and descriptions of 32 trigonometric stations in California.
28	J. S. Peter, C. E., Corpus Christi, Tex.	Geographical positions and descriptions of 5 trigonometric stations near Baffin Bay, Texas.
28	U. S. Geological Survey, Washington, D. C.	Geographical positions and descriptions of 17 trigonometric stations in Chesapeake Bay.
31	U. S. Geological Survey, Washington, D. C.	Geographical positions and descriptions of 70 trigonometric stations in the State of Washington.
June 1	Nautical Almanac Office, Washington, D. C.	Predicted tides for San Francisco, San Diego, Astoria, Port Townsend, Sitka, St. Paul, Honolulu, and Panama, for the year 1896.
5	W. Bryant, Salt Lake City, Utah	Various expressions for the intensity of gravity, with reference to results, particularly for places in the United States.
6	Lieut. E. A. Anderson, U. S. N., Cleveland, Ohio	Latitude and longitude of the Marine Hospital at Cleveland, Ohio, and magnetic declination at the same place.
10	S. Dean, surveyor, Glenwood, Iowa	Appendices Nos. 6 of 1885, 7 of 1888, and 11 of 1889.
12	United States Geological Survey, Washington, D. C.	Geographical position and description of the astronomical station at Trinidad, Colo.
13	H. Van Duzee, Philadelphia, Pa.	Geographical positions and descriptions of three trigonometric stations in the vicinity of Glenholden Borough, Pa., with azimuths and distances.
18	M. Taylor, surveyor, Hill Station, Va.	Appendix No. 7 of report for 1888.
18	W. D. Chesterman, Richmond, Va.	Heights of Mitchells High Peak, Blackstock Knob, Richland Balsam Mountain, and Mount Washington.
18	U. S. Navy Department, Washington, D. C.	Tracing of original sheet of the special survey of Puget Sound Naval Station, Port Orchard, Washington.
19	Prof. J. E. Denton, Stevens Institute of Technology, Hoboken, N. J.	Information concerning currents in Long Island Sound.
22	Louisiana State Survey	Proof of unfinished chart No. 197, Baratavia Bay to Terrebonne Bay, Louisiana.
24	G. S. Ely, Washington, D. C.	Magnetic declination at Dunkirk, N. Y., from 1790 to 1900.
26	H. C. Lord, Columbus, Ohio	Relative weights of modern star catalogues.
26	H. M. Chittenden, U. S. Engineers Office, Columbus, Ohio.	Latitude, longitude, and magnetic declination of the Yellowstone Park station determined by the Coast and Geodetic Survey in 1892.
28	N. Spofford, surveyor	Information concerning the position of station "Warwick," on the Massachusetts and New Hampshire boundary line.
28	T. M. Draney	Distance from Washington, D. C., to Norfolk, Va.
28	S. J. Flavell, Sea Cliff, Long Island, N. Y.	Tidal differences for Governors Island and Sea Cliff, N. Y.

Information furnished to Departments of the Government in reply to special requests, etc.—Continued.

Date.	Name.	Data furnished.
1895.		
June 28	Frederick D. Fisk, Boston, Mass	Descriptions of bench marks at Charlestown Navy-Yard, and estimate of cost of replatting certain hydrography in Charles River.
28	J. W. Merritt, Brooklyn, N. Y. (for the Brooklyn Eagle Almanac).	Predicted times and heights of high and low water at New London, New York, and Sandy Hook, for the year 1896; explanation of manner of using tidal differences and ratios.
28	U. S. Navy Department, Washington, D. C.....	Tracing of survey of the Hudson River from Eightieth street, New York, to Yonkers, from original sheets.
28	Britton & Gray, San Francisco, Cal.....	Tracings of hydrography of Tacoma Harbor from the surveys of 1877 and 1895. Scale, 1:2500.

OFFICE REPORT NO. 1—1895.

REPORT OF THE ASSISTANT IN CHARGE OF THE OFFICE FOR THE FISCAL
YEAR ENDING JUNE 30, 1895.

UNITED STATES COAST AND GEODETIC SURVEY OFFICE,
Washington, D. C., June 30, 1895.

SIR: I have the honor to submit the annual report of the Office for the fiscal year ending June 30, 1895, accompanied by the annual reports of the various divisions thereof as follows:

1. The computing division, by Assistant C. A. Schott, chief.
2. The tidal division, by Mr. L. P. Shidy, acting chief.
3. The drawing division, by Assistant Will Ward Duffield, chief.
4. The engraving division, by Assistant Will Ward Duffield, chief.
5. The chart division, by Assistant Gershom Bradford, chief.
6. The miscellaneous division, by Mr. W. P. Ramsey, chief.
7. The instrument division, by Assistant J. Pratt, chief.
8. The library and archives division, by Mr. H. S. King, chief.

Assistant B. A. Colonna served as Assistant in Charge of the Office from the beginning of the fiscal year until March 11, 1895, when he tendered his resignation to take effect April 10, leave of absence for the intervening time being granted him. By your instructions of March 11, I was detailed to act as Assistant in Charge of the Office during this interim, and on its expiration was duly appointed to the position by the Honorable Secretary of the Treasury and was also directed to act as Superintendent during your absence.

The computing division has continued under the supervision of Assistant C. A. Schott, and the usual amount of work has been accomplished. The force of this division is too small for the great demands made upon it, but it has been reinforced from time to time by the temporary detail of assistants when not actively engaged in the field. The following-named members of the field force have thus been detailed for short periods: Assistants A. T. Mosman, H. G. Ogden, F. D. Granger, Isaac Winston, and John Nelson. Subassistants F. A. Young, and Aids A. L. Baldwin, O. B. French, S. B. Tinsley, and H. C. Denson. Mr. L. G. Schultz, expert observer, was also similarly detailed after the close of the work at the San Antonio Magnetic Observatory. An account of the special duty performed by each of these officers will be found in the report of Assistant C. A. Schott.

The tidal division during the whole year was under the immediate direction of Mr. L. P. Shidy, as acting chief, and his report contains a full account of the work performed during that time. The large amount of extra labor involved in the change of form of the annual Tide Tables, the addition of a large number of foreign ports, and the fact that considerable time was necessarily spent in discussing the proposed changes, rendered a considerable reenforcement of the division necessary, and the following-named field officers were at various times detailed to assist in the computations and compilations: Assistants F. W. Perkins, E. D. Preston, W. I. Vinal, Stehman Forney, G. R. Putnam, Subassistant F. A. Young, and Aid C. C. Yates. Notwithstanding this assistance the issue of the Tide Tables for 1896 was delayed several months beyond the proper time, and the regular force of the division voluntarily worked overtime in order to expedite the publication. The usual amount of work in supplying field parties with necessary data, and outside parties with desired information, was accomplished, and plans for a new tide-predicting machine,

embodying the best features of the Thomson and Ferrel machines, have, with the cooperation of the instrument division, been prepared, and approved by the instrument board. The construction of the machine is now in progress.

The drawing division continued under the charge of Assistant W. H. Dennis until May 8, 1895, when his connection with the Survey ceased, and Assistant A. T. Mosman took temporary charge pending the appointment of a new chief. Assistant Will Ward Duffield was designated as chief of the division on June 16, and at once entered upon his duties. His report for the fiscal year contains a full exhibit of the work accomplished, and is accompanied by a tabular statement of information furnished to, and work done for, other departments of the Government, and for private individuals in reply to special requests.

The engraving division, from the beginning of the year to June 26, 1895, was under the immediate direction of Assistant George A. Fairfield, as acting chief, the regular chief, Assistant H. G. Ogden, having been assigned to special field duty. Mr. Ogden resumed duty as chief of the division for the remaining few days of the year and was succeeded on July 1 by Assistant Will Ward Duffield, the consolidation of the drawing and engraving divisions being effected at that date. The annual report of the division is submitted by Assistant Duffield, and contains a very full and complete account of the various classes of work executed, and is accompanied by tabular statistics relating to the engraving, photolithographing, electrotyping, chart printing, and photographing operations. The reduction of the force of engravers by the resignation of Mr. A. Petersen, the long-continued sickness of Mr. E. J. Enthoffer, the death of Mr. Gilbert F. Dawson, and the suspension of the three "extra engravers" seriously hampered the engraving work of the division for a time. In this connection I desire to recommend strongly the abolition of the system of "contract engraving," which has been in vogue for a number of years, and that in future all such work be done in the Office by regularly employed engravers. This will necessitate a slight increase in the regular force of the division, but will not cost the Government anything additional, as the sums now appropriated for the contract work will suffice to pay the new employees. The advantages of this change are obvious, as the work will be then under the constant supervision of the Office, no risk of loss of plates or damage in transportation will exist, and the Government will be saved the cost of advertising for bidders. Under the present system advertising is necessary for each plate or set of plates to be engraved by contract, and the cost during the year is quite considerable.

The chart division has continued during the whole year under the charge of Assistant Gershon Bradford, and the usual amount of work in correcting charts and bringing aids to navigation up to date of issue has been accomplished. Assistant Bradford's report shows in concise tabular form the number of engraved and photolithographed charts received and issued during the year, and a comparison of the issue with that of the six previous years.

The miscellaneous division continued under the direction of Mr. M. W. Wines until August 31, 1894, when he was succeeded by Mr. W. P. Ramsey, who has satisfactorily performed the duties of chief of the division. His annual report gives all the necessary information in regard to the chart agencies of the Survey and the distribution of the various official publications.

The instrument division continued under the charge of Assistant Edward Smith until January 17, when, at his own request, he was relieved and assigned to field duty. He was succeeded by Assistant J. F. Pratt, who has efficiently conducted the business of the division and who submits its annual report.

The library and archives division since August 21, 1894, has been under the charge of Mr. H. Sidney King, the resignation of the former chief, Mr. F. H. Parsons, having taken effect on that date. In his report, Mr. King makes valuable suggestions as to the better arrangement and cataloguing of the books of the library and these are now being carried out. His report also contains the usual statistics showing the number of volumes, maps, and charts purchased, presented, or obtained by exchange during the year, and the number of volumes of original and duplicate records of field work of all kinds, and the number of original topographic and hydrographic sheets deposited and registered in the archives.

The changes in the personnel of the Office due to deaths, resignations, and dismissals have been unusually numerous, but being given in detail in the reports of the various chiefs of divisions, need not be enumerated here. In my immediate office no changes occurred in the clerical force,

Mr. A. B. Simons continuing to serve as clerk to the Assistant in charge and Mr. E. B. Wills in charge of the leave of absence accounts and of the freight, express, and registered mail matters. Miss Kate Lawn and Miss Sophie Hein attended to the typewriting and copying for the Office and also performed miscellaneous clerical work. All have attended to their duties in a satisfactory manner. Miss Ida M. Peck, early in the fiscal year was assigned to duty in the office of the disbursing agent and rendered valuable service there throughout the year. For one month, however, she was detailed to the Treasury Department for special duty.

Mrs. Mary L. Godwin, who was appointed as chart corrector on April 26, was detailed to the Treasury Department on May 1, and continued on duty there until the close of the year, when she was permanently transferred to that Department.

Mr. N. G. Henry, clerk and cashier, and Mrs. Jennie H. Fitch, clerk, have satisfactorily performed their respective duties in the office of the disbursing agent, and Mr. William B. Chilton has continued to serve in the Superintendent's Office.

In addition to the regular duties of the office, the Assistant in charge has presided over the meetings of the various advisory boards, and acted as Superintendent during your absences.

Yours, respectfully,

ANDREW BRAID,
Assistant in Charge of Office.

Mr. W. W. DUFFIELD,
Superintendent U. S. Coast and Geodetic Survey.

REPORT OF THE COMPUTING DIVISION, COAST AND GEODETIC SURVEY OFFICE, FOR THE FISCAL YEAR ENDING JUNE 30, 1895.

COMPUTING DIVISION, *June 30, 1895.*

SIR: In conformity with the regulations of the Survey, I have the honor to submit herewith the annual report of the work accomplished in the computing division of the Office during the year ending June 30, 1895.

The charge of this division has remained with me, and the personnel of the computing force is the same in number as in the preceding year; the position vacated by the resignation of Mr. Henry Farquhar resulted in the promotion of Mr. H. F. Flynn, and in the probationary employment of Mr. J. Pawling as computer. By the resignation of Mr. Farquhar, on February 8, 1895, after fifteen years of service, the Survey lost an experienced computer, and one who had especially distinguished himself in the assignment of excellent mean places of stars for the latitude work. Mr. J. Pawling reported for duty March 29, 1895. During the winter season temporary assistance was given this division by the attachment of a number of members of the field force, with the advantage to the Survey of keeping them steadily employed, and affording them the means of becoming more familiar with the methods of computation. Their names, and the dates when they served temporarily in this division, will be given further on, in connection with the statement of the special work engaged upon.

The duties devolved upon me as chief of the computing division include the direction of the work of each computer, distributing the same according to his special qualifications, and timing it so as to secure the best cooperation. They include the reporting of the results reached and their critical value; the preparation of information demanded for field and office use, and in the general correspondence of the Office and related to this division, and the preparation of replies to questions asked and referred to it. After discharging these and other duties of smaller import, time was found to revise computations and prepare for publication the resulting lengths of the Holton and the St. Albans base lines; to collect and discuss observations of magnetic declination in Alaska and adjacent regions, showing annual change and distribution by an isogonic chart for the year 1895; to discuss the changes of the magnetic force (in direction and intensity) at San Francisco; to compute the magnetic observations made at Port Townsend and at Olympia, Wash.; to keep

up to date the magnetic discussions demanded to supply the charts with the compass variations; to compute the longitude of Camp Colonna, on the Porcupine River, Alaska (boundary survey), from observations of moon culminations and one occultation; to take part in proof reading for report, and in the preparation of the annual and the special statistics of astronomic work of the Survey (longitudes, latitudes, and azimuths) during the years 1888 and 1895, for publications by the International Geodetic Association. The transit of Mercury of November 10, 1894, was observed by me, and the result, together with those of other observers, was submitted for use at the United States Naval Observatory.

Among a series of reports I may mention one on the results of spirit leveling across the peninsula of Florida, one on the geodetic results in the Mount St. Elias region, Alaska, and one on the results of the astronomic work by the late Assistant Turner in Alaska during 1889 and 1890.

A study was made of the present state of the general telegraphic longitude net of the United States, with a view of supplying a few links for its speedy completion.

A condensed specification of the work done during the fiscal year by each computer is herewith presented. It is made up from the daily and monthly reports, as submitted.

Edward H. Courtenay was engaged in the computations and adjustments of the following triangulations: Vicinity of Lake Tahoe, California and Nevada, 1893; coast triangulation from Mendocino Bay to Shelter Cove, California, 1872-1874, fitting it in with the main triangulation of later date; vicinity of Unuk and Taku inlets, Alaska, 1893; coast of Louisiana between Vermilion Bay and Sabine Pass, 1882-1889; vicinity of Camp Colonna, on the Porcupine River, 1890, and of St. Michael, Alaska, 1891. He also directed the adjustment of the additional triangulation on the south side of Long Island, New York, 1888; advanced the office computation of the triangulations of Chilkoot and Chilkat inlets, Alaska, 1894; computed a number of base lines; attended to various geodetic computations, and assisted in the preparation of the geodetic statistics, arranged records and computations for the binder, and in general supervised the work of Mr. J. B. Boutelle, of Mr. Kummell, and directed the work of the copyist. I have also to acknowledge his assistance in the collection and preparation of such geodetic data or information as were required or specially called for.

Myrick H. Doolittle attended to the reduction of the primary triangulation in Utah east of the Wasatch Range, carrying the adjustment of the line Mount Ellen to Patmos Head; computed and adjusted the main triangulation in western Kansas, of 1893; prepared abstracts of horizontal measures at stations surrounding the old base line in El Paso County, Colo., and assisted in the preparation of geodetic statistics. During part of April and during May Mr. Doolittle's health failed him. Since his resumption of work he has computed the secondary triangulations about Ibepah and Pilot Peak, Utah, 1889, for which data had been received but recently.

Henry Farquhar computed the places of stars, and the latitudes of the following stations: El Paso, Tex., 1892; Mount Conness, California, 1890; Mount Ellen, Utah, 1891; Anchorage Point, Chilkat Inlet, Alaska, 1894; and nearly completed the latitude computation of station Mount Waas, Utah, 1893. He also prepared a list of mean places of stars for the latitude work at San Francisco of 1894.

Charles H. Kummell was chiefly engaged in the solution of equations required in the adjustments of angles, of triangulations, or in magnetic work; in revising and checking computations and tabulations of results. He assisted in the preparation of abstracts of horizontal angles on the Stikine River triangulation, 1893; computed geographical positions of the coast triangulation of California, and between Pensacola and Perdido Bay, Alabama, and computed apparent places of stars for latitude work.

John B. Boutelle was principally engaged in attending to the geographical registers kept in the computing and drawing divisions; in preparing and revising abstracts of angles, and in preparing copies of results for use in the field or in response to applications, and in copying reports for transmission; also in attending to the selection of records of description of stations, and their copying by the clerk for immediate use. Mr. Boutelle completed the computations of the triangulations of Suisun Bay, California, 1886-1888; of Mobile Bay entrance, Alabama, 1892, and of the south side of Long Island, New York, 1888. He was on field duty between September 6 and October 7, 1894, and again from May 29 to the close of the fiscal year.

Daniel L. Hazard computed the following telegraphic differences of longitude: San Francisco and Oakland, 1889; Helena and Salt Lake City, 1890; Helena and Bismarck, 1890; Bismarck and Minneapolis, 1890; Cape May and Albany, 1891; Albany and Detroit, 1891; Detroit and Chicago, 1891; Chicago and Minneapolis, 1891; Minneapolis and Omaha, 1891; San Diego and Los Angeles, 1892, and Tacoma and Seattle, 1894, with three secondary stations in Ohio and Indiana; also the chronometric longitude Sitka to Chilkat, 1894, and the longitude of Fort Yukon and of the old Rampart House on the Porcupine River, Alaska, 1891. Mr. Hazard reduced the transit observations at San Francisco, Cal., 1890-91; at Camp Colonna, eastern boundary of northern Alaska, 1890-91, and at St. Michael, Alaska, 1890-91; deduced the longitude of the last two places from moon culminations and occultations; computed the astronomic azimuths at Bear, Ala., 1889; at Chilkat, Alaska, 1894; at Lituya Bay, Alaska, 1894, and at St. Michael, Alaska, 1890-91. He also computed the magnetic observations made in Alaska in 1893; in California in 1890-1893; in Southern and Western States by Assistant Baylor in 1891-1893; in Utah in 1891-1893, and at Carson and Lake Tahoe, Nevada, 1894. Much credit is due to this computer for the great output of work and its excellent character.

Harry F. Flynn assisted in the computations for geographical positions in the triangulations of vicinity of Lake Tahoe, California and Nevada; of Mendocino City to Shelter Cove, California; of entrance to Stikine River, Alaska; of Unuk and Taku rivers, Alaska, and of Pensacola and Perdido bays, Florida and Alabama; reduced the base line at Baltimore, 1894, and computed the area of certain parts of ground about the new United States Naval Observatory. He also computed mean places of stars, and made some magnetic computations; computed the latitudes of Camp Colonna, on the Porcupine River, 1890; of St. Michael, 1891, and of Camp Davidson, Yukon River, 1889; also made computations of some miscellaneous astronomic work at Fort Yukon and the Porcupine River of 1890-91.

Lilian Pike was engaged principally upon the computation, inclusive of adjustment, of the triangulation of Stikine River from observations by Assistants O. H. Tittmann, J. E. McGrath, and H. G. Ogden, 1893. She also took part in the position computations of the triangulations about Lake Tahoe; on the California coast above Mendocino City; of Lituya Bay, Alaska, 1894, and of Chilkat Inlet, and attended to some miscellaneous work.

Jesse Pawling, jr., reported for duty in the computing division March 29, 1895, and was engaged with computations of apparent places of stars; in computations of geographical positions, and other miscellaneous geodetic work.

Daniel Hurley attended to clerical duties, preparing copies of descriptions of trigonometric stations for use by field parties, and duplicating some leveling and other records. His efficiency is much impaired through ill health.

The following members of the field force were temporarily assigned to duty in this division:

A. L. Baldwin, from September 10, 1894, to January 21, 1895, was employed in computations of the triangulations of Atchafalaya, Cote Blanche, and Vermilion bays, adjusting and basing the work on modern data, and extending the computations to the Texas boundary work. The years comprised were 1882, 1885-1890.

F. A. Young, from September 10 to October 9, and reassigned from October 29 to December 27, 1894, was engaged in preparing abstracts of horizontal angles, Taku River triangulation, 1893, and in reducing spirit-level observations in Florida, 1894.

S. B. Tinsley, from September 26 to October 15, when he resigned, was engaged on spirit-level computations in Florida.

F. D. Granger reported for duty October 15, 1894; established and solved normal equations, computed astronomic azimuths on the Taku and Stikine rivers, prepared tables for the computation of geographic positions for printing, computed the azimuth at Fort Morgau, Ala., 1892, and computed positions on the Chilkat River, 1894. Assistant Granger was relieved of office duty December 19, 1894, and reported again for duty January 14, 1895, and up to May 16, 1895, was engaged on adjustments of horizontal angles, triangulation coast of California; on computing the traverse line south of Mount St. Elias, 1894, and in computing triangles and positions on Chilkat Inlet, 1894.

O. B. French, from November 6, 1894, to April 5, 1895, was engaged on computations of spirit-level work across Florida, 1892, and from Old Point Comfort to Richmond, Va., and assisted in computations connected with the survey of Chilkoot and Chilkat inlets, 1894.

J. Nelson, from November 12 to December 18, when ordered to field duty, computed geographical positions of coast triangulation, California, and attended to some magnetic reductions.

I. Winston reported for duty December 1, 1894, and between this date and March 25, 1895, when he resumed field duty, was occupied with preparing the results of spirit levels from Jefferson City, Mo., to Kansas City, Mo., for printing.

A. T. Mosman reported for duty January 7, 1895, and was engaged in the reduction of transit observations and telegraphic longitudes between Washington, D. C., and Gainesville, Fla., 1890; Washington and Augusta, Ga., 1890; and Washington and Jacksonville, Tex., 1890. Assistant Mosman reduced the transits and moon culminations observed at Camp Colonna, Alaska, 1889-90, and made good progress with the reductions of transit observations made at St. Michael, Alaska, 1890-91.

H. C. Denson was connected with this division from January 9 to May 15, 1895, when he joined a field party. He prepared abstracts of horizontal angles of the triangulation of Perdido Bay and River, and attended to miscellaneous geodetic computations to serve for introduction to some of the Survey methods.

L. G. Schultz reported for duty April 24 and engaged in the arrangement and examination of the magnetic records of San Antonio and Hill Side Ranch, Texas, 1890-1895, and commenced the tabulation of the monthly deflection observations. His services were discontinued June 1, 1895.

H. G. Ogden reported for duty June 20, and engaged in the reduction of spirit levels, but was ordered to take temporary charge of the engraving division on the 26th.

S. Hein, of the office of the assistant in charge, has given occasional but effective assistance during the month of June in copying descriptions of stations required by field parties.

Yours, respectfully,

CHARLES A. SCHOTT,
Assistant in Charge of Computing Division.

Mr. ANDREW BRAID,
Assistant in Charge of the Office.

REPORT OF THE TIDAL DIVISION, COAST AND GEODETIC SURVEY OFFICE, FOR THE FISCAL YEAR ENDING JUNE 30, 1895.

TIDAL DIVISION, *June 30, 1895.*

SIR: I have the honor to submit the following report of the tidal division for the fiscal year ending June 30, 1895:

SUMMARY OF THE WORK DONE DURING THE YEAR.

The Tide Tables for 1896 were prepared and submitted for publication. A number of important changes have been made in this work as compared with former years.

1. The name of the volume, which heretofore has been issued in two parts as "Atlantic" and "Pacific Coast Tide Tables," has been changed into "Tide Tables for 1896 by the United States Coast and Geodetic Survey."

2. The tables have been extended to the whole world; the number of subordinate stations given has been doubled, and the ports for which full predictions are made have been increased from a total of 23 for both coasts in 1895 to 70 in 1896. These principal ports are distributed over the seacoast of the world, as well as our present information in regard to tidal constants would permit; 2 are in Canada, 14 are on our Atlantic Coast, 2 on our Gulf Coast, 4 on our Pacific Coast, 2 in Alaska, 3 in South America, 2 in Japan, 4 in China, 3 in the Pacific Islands, 1 in New Zealand, 3 in Australia, 8 in southern Asia, 1 in Africa, 4 in France, 7 in England, 1 in Wales, 3 in Scotland, 5 in Ireland, and 1 in Germany.

3. The form for publishing the predicted tides, which has been devised by me, differs radically from any hitherto used. The tides are placed in the order of occurrence, as heretofore, but the

heights have been placed below their times, instead of to the right of them; the resulting condensation is such that three months, instead of one, are presented on a page.

4. The moon's phases, declination, apogee, and perigee are indicated on the days of their occurrence.

5. The time is reckoned from midnight without changing the count at noon; the hours less than 12 are in the morning; those greater are in the afternoon, and when diminished by 12 give the usual reckoning. This avoids all uncertainty as to morning or afternoon times, no matter how irregular the tides may be.

6. A brief treatise on tides has been added.

7. The subordinate stations have been arranged, as nearly as possible, in geographic order, going around the continents in the direction of the hands of a clock.

8. A column headed "Standard port for reference" has been added, which enables us to refer the station to that port for which full predictions are given which most nearly resembles it in type of tide.

9. The table of tidal constants was remodeled and extended, and in the explanation of tables various formulae were added showing how to approximately derive a number of additional constants from those which are given.

10. An effort was made to indicate the interval and height of the diurnal tide wave in all parts of the earth, but owing to lack of sufficient data at present, little more than a beginning has been made in this volume.

Our Tide Tables now cover practically the entire seacoast of the world, but are far from being equally satisfactory for all ports, and we hope in future years to gradually replace the defective values as additional information is obtained.

The harmonic analyses, which had been begun before this fiscal year, have been completed for a year of hourly ordinates at Portland, Me., and old Point Comfort, Va., and for two sets of hourly ordinates at Philadelphia, Pa., consisting of five months in 1891, and eight months in 1892. Harmonic analyses from a year each of hourly ordinates have been made entirely during the year for Galveston, Tex.; Sitka, Alaska; and Buenos Ayres, Argentina. From high and low waters during one or two months harmonic analyses have been made for St. Johns, Newfoundland; Halifax, Nova Scotia; Baltimore, Md.; Cape Horn, South America; Tientsin entrance, Shanghai, and Amoy, China; Port Russell, New Zealand; Sidney and Melbourne, Australia; and Rochelle and Havre, France. The total work done on harmonic analysis during the year is the equivalent of the complete analysis of about five years of continuous records.

The nonharmonic reductions completed during the year consist of 27 series, the equivalent of about six years of continuous observations, which have been discussed by the first or interval reduction method; and of 12 series, the equivalent of about two years of continuous records, for which second or phase reductions, declination reductions, and parallax reductions have been made.

Tide notes have been prepared and furnished for 133 stations on 40 charts.

Requisitions from eight field parties have been filled, requiring the description of 47 bench marks, and tidal data for 26 stations.

Tidal information has been called for by 44 persons not connected with the Survey, the response to which required the preparation of 35 descriptions of bench marks, current tables for 5 stations, and tidal data for 105 stations, together with technical letters explaining tidal phenomenon.

An aggregate of about five years and eight months of record from automatic tide gauges has been received, examined, and registered. About two years of tabulated hourly heights of the sea, high and low waters, temperature and density of the sea, and meteorological data, as also 118 original and 114 duplicate volumes of tidal observations from staff and box gauges, were received.

The portion of a Manual on Tides, which was referred to in my last annual report, was completed and submitted for publication last December. This has since appeared as Appendix No. 7, Report for 1894. On account of the extension of the tide tables already referred to, Mr. Harris was diverted from original work, so that he has been able to little more than begin the continuation of the manual during the fiscal year.

A general idea of a new tide predictor, which would combine the desirable features of the Thomson and Ferrel machines, was outlined by Mr. Harris in Appendix No. 7, Report for 1894.

During the present year he developed this scheme a little more fully and submitted a rough plan of it to the instrument board of this Survey. The instrument and tidal divisions were instructed to cooperate in preparing sufficient details to afford a basis for estimating the probable cost of constructing a tide predictor; the former selecting such mechanical devices as seemed best adapted to the purposes of the proposed machine, and making the necessary drawings, while the latter was to furnish a list of components, with their greatest amplitudes, and the number of teeth which would give their proper speeds. It was finally decided to undertake the construction of the tide predictor as thus proposed, the distinguishing features of which are that it will show, simultaneously and accurately, both times and heights upon the face of the machine, as well as trace a tidal curve with marks upon its axis to indicate the exact times of the maxima and minima.

PERSONNEL OF THE TIDAL DIVISION.

Mr. L. P. Shidy, acting chief throughout the year.
 Mr. F. M. Little, employed all the year.
 Mr. R. A. Harris, employed all the year.
 Miss Alice G. Reville, employed all the year.
 Mrs. Virginia Harrison employed all the year.
 Miss Florence Brower (Mrs. F. B. Burlingame), employed from July 1, 1894, to January 23, 1895.*
 Mr. Deane S. Bliss, employed on probation from April 26 to June 30, 1895.
 Mr. F. V. Moss, temporarily employed from July 1 to July 15, 1894.
 Miss Gertrude Harrison, temporarily employed, March 13 to June 30, 1895.
 Mr. F. C. Kendrick, temporarily employed, May 18 to June 30, 1895.
 Mr. James A. Dorsey, employed as messenger, and assisted in adding and copying, October 20, 1894, to June 30, 1895.
 Mr. D. Hurley, clerk of the computing division, was employed during the month of March copying our predictions.

In consequence of the great amount of labor incident to the preparation of the Tide Tables for 1896, the following field officers were assigned to this division for the periods mentioned:

Mr. G. R. Putnam, January 30 to April 24, 1895.
 Mr. C. C. Yates, January 30 to April 3, 1895.
 Mr. E. D. Preston, February 19 to March 12, 1895.
 Mr. F. W. Perkins, February 27 to March 16, 1895.
 Mr. F. A. Young, February 28 to April 24, 1895.
 Mr. W. I. Vinal, April 17 to June 15, 1895.
 Mr. Stehman Forney, May 6 to 23 and June 5 to 15, 1895.

CONCLUDING REMARKS.

It is very much to be desired that the estimate of expenses for 1896 be made to include provision for at least two additional tidal computers; such an increase of employees would enable us to greatly improve the values given in our Tide Tables and on the charts, for, as mentioned in my last annual report, the working force of this division for many years past has been entirely inadequate for really satisfactory service. It was found necessary to have the whole regular force of the division work overtime in order to complete the manuscript Tide Tables for 1896, and it gives me pleasure to testify to their general zeal and industry.

Respectfully, yours,

L. P. SHIDY,
Acting Chief of the Tidal Division.

Mr. ANDREW BRAID,
Assistant in Charge of the Office.

*Miss Brower, having married in July, was reappointed as Mrs. F. B. Burlingame; although reckoned as only a writer on the pay roll, she was an exceptionally good computer, and her resignation was a real loss to our service.

REPORT OF THE DRAWING DIVISION, COAST AND GEODETIC SURVEY OFFICE,
FOR THE FISCAL YEAR ENDING JUNE 30, 1895.DRAWING DIVISION, *June 30, 1895.*

SIR: I have the honor to submit the report of the drawing division for the past fiscal year.

The drawing division was under the charge of Assistant W. H. Dennis until the 8th of May, 1895, when he was relieved by Assistant A. T. Mosman, who acted as chief of the division until June 16, at which date I was put in charge.

The same draftsmen who were employed at the close of the fiscal year 1894 continued their service through the past year, with the exception of Mr. G. F. Pohlers, who was dropped from the rolls on August 31, 1894.

The disposal of the current work among the draftsmen has been about as follows:

Mr. A. Linden Kohl has attended to the corrections of the charts rendered necessary by recent surveys and examinations, especially those called for by the work of the Army engineers upon river and harbor improvements. He has also continued to prepare the progress sketches for the annual report, and to construct the projections on copperplates. When not otherwise employed he has made an examination of the temperature and specific gravity observations made by the Survey in the waters of the Gulf of Mexico and the Gulf Stream, and prepared a sketch with report on these subjects.

Messrs. H. Linden Kohl, E. H. Fowler, D. M. Hildreth, C. H. Deetz, G. F. Pohlers, E. P. Ellis, and W. R. Doores, have been mostly engaged upon drawings of harbor charts for publication by photolithography. Among the most noticeable of these may be mentioned a chart of the coast of California near Point Pinos; one of Sitka Harbor; Charleston Harbor; a series of charts of the Connecticut River to Hartford; a map of the District of Columbia, scale 1-9600; and several additions to the series of charts comprising the north shore of Long Island Sound.

Mr. E. J. Sommer has continued to make computations of triangulations in Alaska; to make drawings for the series of charts of the Alexander Archipelago, and to prepare information for the field parties in Alaska. Since March, 1895, his attention has been principally devoted to the construction of an atlas of the Alaska boundary, called for by the Joint Boundary Commission.

Messrs. Fowler and Hildreth have prepared the greater number of projections applied for by field parties.

Messrs. Deetz, Ellis, and Doores have drawn a number of illustrations and diagrams for the report, and the last two mentioned and Mr. P. von Erichsen have usually made the tracings of surveys in answer to applications for information.

Mr. von Erichsen, besides the employment just mentioned, has been engaged upon inking plane-table sheets, measuring areas, mechanical drawings, and other miscellaneous duties.

Mr. Charles Mahon has been employed on clerical work.

During the past year the practice has been continued of retaining the tracings made in the office in answer to calls for information, and sending blue prints instead, whenever that could be done with propriety. In this way quite a respectable number of copies of topographic sheets has been obtained, which may serve many other purposes.

The general work of the division during the year may be summarized as follows:

Drawings were completed for 22 new charts to be photolithographed, and the drawings for 6 charts are in progress.

The drawings of 43 charts were revised and corrected for the new editions. In addition to this work there were revised and corrected for reprints the drawings of 85 charts.

The usual diagrams, sketches, and illustrations were drawn or revised for the report of the superintendent.

Twenty topographic and 35 hydrographic projections were constructed, and 51 projections on copperplates.

Twenty-one topographic sheets were inked and lettered, and a sheet containing all deep-sea soundings of the northwest Atlantic brought up to date.

Fifty-seven calls for information were received from the various Departments, and from the public, for which blue prints, tracings, or other information were furnished, a detailed list of which is hereto attached.

In conclusion, I beg leave to state that although the number of draftsmen has been found sufficient to answer promptly to all calls for their services from other divisions of the office, as well as from other parties, it has been found none too large to secure the desirable dispatch in the publication of new surveys and in the incorporation upon our charts of important information, such as is almost daily received, which dispatch is extremely desirable, equally on account of the reputation of the institution, the safety of navigation and the dissemination of useful knowledge.

Respectfully, yours,

WILL WARD DUFFIELD,
Assistant in Charge of the Drawing Division.

Mr. ANDREW BRAID,
Assistant in Charge of Office and Topography.

REPORT OF THE ENGRAVING DIVISION, COAST AND GEODETIC SURVEY
OFFICE, FOR THE FISCAL YEAR ENDING JUNE 30, 1895.

ENGRAVING DIVISION, *June 30, 1895.*

SIR: I respectfully submit the following report of the operations of this division during the fiscal year ending June 30, 1895. The statistics are as follows:

ENGRAVING.

Number of new charts completed.....	16
Number of new editions of charts completed.....	23
Number of sketches and illustrations completed.....	7
Number of new printing plates reissued.....	2
Thirteen section maps of the District of Columbia completed, 4 plates each.....	52
Number of new charts commenced.....	6
Number of new additions of charts commenced.....	21
Number of sketches and illustrations commenced.....	3
Ten section maps of the District of Columbia commenced, 4 plates each.....	40
Number of new printing plates, reissue commenced.....	1
Number of chart plates corrected for printing.....	428
Number of chart plates printed for the chart room.....	709
Number of sketches and illustrations corrected for printing.....	31
Number of plates in progress during the year, not completed.....	47
Number of unfinished plates on hand at the close of the year, viz:	
New charts.....	15
New editions of charts.....	13
Sketches and illustrations.....	17
Five section maps of the District of Columbia, 4 plates each.....	20

ELECTROTYPING.

Number of pounds of copper deposited.....	1 912½
Number of square inches on which deposit was made.....	77 458
Number of plates made, viz:	
Basso plates.....	28
Alto plates.....	35
	63

Of this number, one basso and one alto plate were made for the State Department, the "Declaration of Independence."

PHOTOGRAPHING.

Number of negatives made	122
Number of blue prints made	889
Number of silver prints made	165
Number of lantern slides made for archives, northwest boundary, etc.....	61
Number of nigrosine, or black prints made	32
Number of enlarged prints of Alaska views.....	35

PRINTING.

Number of impressions for the chart rooms	37 289
Number of impressions for Assistant in charge of Office.....	4 005
Number of impressions for hydrographic inspector.....	74
Number of impressions for engraving division.....	458
Number of impressions for lithographers (transfer proofs).....	125
Total number of impressions	41 951

The force of engravers was reduced very materially during the year by the resignation of Mr. A. Petersen, the absence, on account of sickness, of Mr. E. J. Enthoffer, and the death of Mr. Gilbert F. Dawson, and for a time the suspension of three extra engravers—William Mackenzie, Peter H. Geddes, and David Morris, the first two from December 28, 1894, to March 7 and April 19, 1895—which lessened the output of work very much. Otherwise the force has continued through the fiscal year as heretofore reported.

The old, or expert, engravers have been employed on the branches of the work that they have made specialties, with the exception of such interruption as was necessary through the corrections arising from resurveys and work necessary to prepare the plates for publication.

Contracts for engraving were given out during the latter part of the year to Messrs. R. F. Bartle & Son, of this city, to engrave ten plates, viz:

Catalogue No.	Title.	Scale.
200	Vermilion Bay to Pecan Island.....	1-80 000
213	Nantucket Shoals, Massachusetts.....	1-80 000
247	Hyannis Harbor	1-20 000
271	Rye Neck to New Rochelle	1-10 000
362	New Haven Harbor, Connecticut.....	1-20 000
353 ²	Newport Harbor	1-20 000
5525	Mare Island Strait.....	1-10 000
6303	Port Angeles.....	1-10 000
6185	Willapa Bay	1-40 000
8240	Sitka Sound	1-80 000

And also ten sets of topographical sheets of the District of Columbia survey, 40 plates, Sheets Nos. 25, 26, 27, 28, 35, 9, 10, 19, 20, and 29, scale $\frac{1}{40000}$, and Progress Sketch No. 16, Utah and Nevada, scale $\frac{1}{100000}$.

The most important charts completed during the year are as follows:

Catalogue No. 6, Quoddy Head to Cape Cod, scale $\frac{1}{40000}$, completing that series on the coast of Maine.

Catalogue No. 120, New York Bay and Harbor, scale $\frac{1}{80000}$, showing all improvements up to date.

Catalogue No. 300, Passamaquoddy Bay and St. Croix River, scale $\frac{1}{40000}$, completing the series of $\frac{1}{40000}$ charts on the coast of Maine.

Catalogue No. 384, Baltimore Harbor and approaches, scale $\frac{1}{40000}$, being a resurvey, and showing the improvements of the harbor, by the engineer of the harbor board of Baltimore.

Catalogue No. 400, Hampton Roads, Virginia, scale $\frac{1}{20000}$, being a large scale chart engraved on copper in the place of a photolithograph.

Chart No. S, San Francisco to Bering Sea, scale $\frac{1}{300000}$, showing all improvements up to date, including the isogonic lines.

Catalogue No. 8 100, Clarence Strait, Revillagiedo Channel, and Portland Canal.

Catalogue No. 8 200, Frederick Sound and Sumner Strait.

Catalogue No. 8 300, Lynn Canal and Stephens Passage, being copperplate engraving, showing corrections of surveys up to date.

There were also completed and published during the year four charts, new editions, showing extensive and important corrections, viz:

Catalogue No.	Title.	Scale.
155	Hunting Island to Ossabaw Island	1-80 000
156	Savannah to Sapelo Island.	1-80 000
44	Tybee Roads, Savannah River and Wassaw Sound.*	1-40 000
431	Charleston Harbor †	1-30 000

* Showing the improvements of the Savannah River by the United States Engineers up to December, 1894.

† Showing the surveys made by Assistants J. W. Donn, W. C. Hodgkins, and C. H. Boyd in 1894.

In fact, the number of original charts and plates of new editions of charts completed during the year is much larger than has heretofore been reported, and embraces a great deal of new work and recent surveys.

A large number of important plates were continued during the year, and many of them advanced so far that they will be completed and published at an early date.

The requisitions for printing made by the chart rooms have been in excess of the work done by over 4 500 sheets, as compared with the work done for the fiscal year ending June 30, 1894, which is accounted for to a great extent by the printing, during the months of July and September, 1894, and March, 1895, of 2 677 sheets from the plates of the District of Columbia survey, 1 000 of which were registered, that is to say, that it required the printing of four plates to make one registered proof, equal to 4 000 proofs, consequently a great deal of time was consumed, say two months, that could otherwise have been devoted to the regular chart printing. The proofs were for the District of Columbia Engineer Commissioner, and for distribution by the chart division.

The registration of the photolithograph work has been continued in this division for the fiscal year ending June 30, 1895. Thirty-five new charts, new editions, new prints, and reprints were furnished during the year, making an aggregate of 10 000 copies, together with 500 copies of chart showing the tides and currents of East River and Hell Gate, and 500 pasters showing the resurvey of Charleston Harbor, and 5 000 copies of sheets Nos. 1, 2, 3, 4, and 6 of the District of Columbia survey, enlarged four times.

The plate printing office was continued under the direction of Mr. F. Moore, foreman, until April 9, 1895, when he was taken sick, and was run by Mr. Charles J. Harlow, acting foreman, until the 20th day of June, 1895, when Mr. D. N. Hoover, a former printer of the establishment, was appointed foreman. The force of the printers and helpers has remained unchanged, with the exception of the removal of Abraham D. Levi, printer, March 31, 1895, and the appointment of George B. Crawford, a former printer in the office, in his place, April 1, 1895.

The electrotype and photograph rooms were continued under the direction of Mr. D. C. Chapman, assisted by Mr. L. P. Keyser, until the death of Mr. Chapman, January 3, 1895, and on the 1st day of February, 1895, Mr. Keyser was appointed on probation. On the 14th of June, 1895, he was appointed in Mr. Chapman's place, the appointment taking effect July 1, 1895.

The promotion of Mr. Keyser on probation caused a vacancy in the position of helper in the laboratory, which was filled by the appointment of Mr. Roy Thomas, February 15, 1895.

The general work of the division has been performed by Mr. John H. Smoot, in his usual acceptable manner; and the correspondence and detail work in regard to photolithographing, by Mr. Eugene Rhodes, who performed his duties very satisfactorily until September 30, 1894, when his connection with the Survey ceased. On the 5th day of February, 1895, Mr. John H. Hobgood, writer, was assigned to the division, on probation, and has rendered very satisfactory service.

The chief of the division, H. G. Ogden, having been ordered on special duty June 9, 1894, making a resurvey of Boston Harbor, did not take charge of the division the entire fiscal year,

except for four days, from June 26 to 29, inclusive, when the acting chief, George A. Fairfield, had been relieved; otherwise Mr. Fairfield performed the duties as acting chief the entire year.

The following statistical tables show in detail the work of various classes executed by the division during the year:

Catalogue No.	Plate No.	Title.	Scale.
ORIGINAL PLATES COMPLETED.			
6	2349	Quoddy Head to Cape Cod	1-400 000
111	2393	Nantucket Sound and eastern approaches	1-80 000
120	2184	New York Bay and Harbor	1-80 000
172	2196	Cape Sable to Seminole Point	1-80 000
300	2356	Passamaquoddy Bay and St. Croix River	1-40 000
343	2390	Nantucket Harbor	1-10 000
346	2396	Edgartown Harbor	1-20 000
361 ⁴	2346	Port Jefferson, Long Island	1-10 000
375	2333	Raritan River, Raritan Bay to New Brunswick	1-20 000
384	2247	Baltimore Harbor and approaches	1-40 000
400	2281	Hampton Roads	1-20 000
S	2363	San Francisco to Bering Sea	1-3 600 000
6462	2326	Olympia Harbor, Puget Sound	1-20 000
8100	2354	Clarence Strait, Revillagigedo Channel, etc	1-200 000
8200	2361	Frederick Sound and Sumner Strait	1-200 000
8300	2362	Lynn Canal and Stephens Passage	1-200 000
NEW EDITIONS COMPLETED.			
15	2049	Straits of Florida	1-400 000
18	1780	Cape San Blas to Mississippi Passes	1-400 000
115	2005	Plum Island to Stratford Shoal	1-80 000
116	2006	Stratford Shoal to New York	1-80 000
135	1947	Choptank River to Magothy River	1-80 000
155	1946	Hunting Island to Ossabaw Island	1-80 000
156	1341	Savannah to Sapelo Island	1-80 000
167	2380	From The Elbow to Lower Matecumbe Key	1-80 000
168	2188	Long Key to Newfound Harbor Key	1-80 000
176	1990	Lemon Bay to Tampa Bay	1-80 000
188	2306	Mobile Bay and entrance	1-80 000
189	2314	Mobile entrance and eastern part of Mississippi Sound	1-80 000
194	1845	From the Passes to Grand Prairie	1-80 000
379	1944	Cape Henlopen and the Delaware Breakwater	1-20 000
384	2406	Baltimore Harbor and approaches	1-40 000
431	2306	Charleston Harbor	1-30 000
440	1934	Tybee Roads and Savannah River	1-40 000
477	1400	Tampa Bay	1-40 000
5106	2395	San Diego Bay	1-40 000
5050	2029	San Francisco Bay to Straits of Juan de Fuca	1-1 200 000
8000	1880	Dixon entrance to Cape St. Elias	1-1 200 000
8500	1133	Icy Bay to Semidi Islands	1-1 200 000
T	2408	General chart of Alaska	1-3 600 000
REISSUES COMPLETED.			
109	2364	Boston Bay and Harbor	1-80 000
369	2387	New York Bay and Harbor, upper	1-40 000
MISCELLANEOUS PLATES COMPLETED.			
	2321	Base map, triangulation between western Nevada and Pacific coast	
	2392	Base map, triangulation between western Nevada and Pacific coast	
	2397	Base map, title and notes	
	2399	Sketch of distribution of the principal astronomic stations	
	2351	Base map of Alaska	1-13 700 000
	2402	Base map of Alaska, isogonic lines	1-13 700 000
	2405	Base map of Alaska, stations	1-13 700 000
DISTRICT MAPS COMPLETED.			
5	2365	Map of the District of Columbia, roads	1-4 800
5	2365	Map of the District of Columbia, water	1-4 800

Catalogue No.	Plate No.	Title.	Scale.
DISTRICT MAPS COMPLETED—continued.			
5	2365	Map of the District of Columbia, woods	1-4 800
5	2365	Map of the District of Columbia, curves	1-4 800
6	2366	Map of the District of Columbia, roads	1-4 800
6	2366	Map of the District of Columbia, water	1-4 800
6	2366	Map of the District of Columbia, woods	1-4 800
6	2366	Map of the District of Columbia, curves	1-4 800
7	2367	Map of the District of Columbia, roads	1-4 800
7	2367	Map of the District of Columbia, water	1-4 800
7	2367	Map of the District of Columbia, woods	1-4 800
7	2367	Map of the District of Columbia, curves	1-4 800
8	2368	Map of the District of Columbia, roads	1-4 800
8	2368	Map of the District of Columbia, water	1-4 800
8	2368	Map of the District of Columbia, woods	1-4 800
8	2368	Map of the District of Columbia, curves	1-4 800
15	2374	Map of the District of Columbia, roads	1-4 800
15	2374	Map of the District of Columbia, water	1-4 800
15	2374	Map of the District of Columbia, woods	1-4 800
15	2374	Map of the District of Columbia, curves	1-4 800
16	2375	Map of the District of Columbia, roads	1-4 800
16	2375	Map of the District of Columbia, water	1-4 800
16	2375	Map of the District of Columbia, woods	1-4 800
16	2375	Map of the District of Columbia, curves	1-4 800
17	2376	Map of the District of Columbia, roads	1-4 800
17	2376	Map of the District of Columbia, water	1-4 800
17	2376	Map of the District of Columbia, woods	1-4 800
17	2376	Map of the District of Columbia, curves	1-4 800
18	2377	Map of the District of Columbia, roads	1-4 800
18	2377	Map of the District of Columbia, water	1-4 800
18	2377	Map of the District of Columbia, woods	1-4 800
18	2377	Map of the District of Columbia, curves	1-4 800
25	2382	Map of the District of Columbia, roads	1-4 800
25	2382	Map of the District of Columbia, water	1-4 800
25	2382	Map of the District of Columbia, woods	1-4 800
25	2382	Map of the District of Columbia, curves	1-4 800
26	2383	Map of the District of Columbia, roads	1-4 800
26	2383	Map of the District of Columbia, water	1-4 800
26	2383	Map of the District of Columbia, woods	1-4 800
26	2383	Map of the District of Columbia, curves	1-4 800
27	2384	Map of the District of Columbia, roads	1-4 800
27	2384	Map of the District of Columbia, water	1-4 800
27	2384	Map of the District of Columbia, woods	1-4 800
27	2384	Map of the District of Columbia, curves	1-4 800
28	2385	Map of the District of Columbia, roads	1-4 800
28	2385	Map of the District of Columbia, water	1-4 800
28	2385	Map of the District of Columbia, woods	1-4 800
28	2385	Map of the District of Columbia, curves	1-4 800
35	2386	Map of the District of Columbia, roads	1-4 800
35	2386	Map of the District of Columbia, water	1-4 800
35	2386	Map of the District of Columbia, woods	1-4 800
35	2386	Map of the District of Columbia, curves	1-4 800
PLATES COMMENCED, ORIGINALS.			
200	2418	Vermilion Bay to Pecan Island	1-80 000
250	2400	Eastern entrance to Nantucket Sound	1-40 000
271	2419	Rye Neck to New Rochelle	1-10 000
362	2416	New Haven Harbor	1-20 000
6400	2403	Seacoast and interior harbors of Washington	1-300 000
8240	2414	Sitka Sound, Alaska	1-80 000
NEW EDITIONS OF PLATES COMMENCED.			
15	2049	Straits of Florida	1-400 000
18	1780	Cape San Blas to the Mississippi Passes	1-400 000
115	2005	Long Island Sound, Plum Island to Stratford Shoal	1-80 000
116	2006	Long Island Sound, Stratford Shoal to New York	1-80 000
155	1946	Hunting Island to Ossabaw Island	1-80 000
156	1341	Savannah to Sapelo Island	1-80 000
175	2413	San Carlos Bay to Lemon Bay, including Charlotte Harbor	1-80 000
176	1990	Lemon Bay to Tampa Bay	1-80 000
194	1845	Mississippi River, from the Passes to Grand Prairie	1-80 000
331	2410	Newburyport Harbor	1-20 000
379	1944	Cape Henlopen and the Delaware Breakwater	1-20 000

Catalogue No.	Plate No.	Title.	Scale.
NEW EDITIONS OF PLATES COMMENCED—continued.			
384	2406	Baltimore Harbor and approaches.....	1-40 000
431	2306	Charleston Harbor.....	1-30 000
440	1934	Tybee Roads, Savannah River, and Wassaw Sound.....	1-40 000
469	2415	Key West Harbor.....	1-50 000
477	1400	Entrance to Tampa Bay.....	1-40 000
5106	2395	San Diego Bay, California.....	1-40 000
5050	2029	San Francisco Bay to the Strait of Juan de Fuca.....	1-1 200 000
8000	1880	Dixon entrance to Cape St. Elias.....	1-1 200 000
8500	1133	Icy Bay to Semidi Islands.....	1-1 200 000
T	2408	General chart of Alaska.....	1-3 600 000
REISSUES COMMENCED.			
369	2387	New York Bay and Harbor.....	1-40 000
MISCELLANEOUS, COMMENCED.			
	2397	Plate of title and notes for progress sketches.....	
	2402	Base map of Alaska, isogonic lines.....	
	2405	Base map of Alaska, stations.....	
DISTRICT OF COLUMBIA SURVEY.			
25	2382	Map of the District of Columbia, roads.....	1-4 800
25	2382	Map of the District of Columbia, water.....	1-4 800
25	2382	Map of the District of Columbia, woods.....	1-4 800
25	2382	Map of the District of Columbia, curves.....	1-4 800
26	2383	Map of the District of Columbia, roads.....	1-4 800
26	2383	Map of the District of Columbia, water.....	1-4 800
26	2383	Map of the District of Columbia, woods.....	1-4 800
26	2383	Map of the District of Columbia, curves.....	1-4 800
27	2384	Map of the District of Columbia, roads.....	1-4 800
27	2384	Map of the District of Columbia, water.....	1-4 800
27	2384	Map of the District of Columbia, woods.....	1-4 800
27	2384	Map of the District of Columbia, curves.....	1-4 800
28	2385	Map of the District of Columbia, roads.....	1-4 800
28	2385	Map of the District of Columbia, water.....	1-4 800
28	2385	Map of the District of Columbia, woods.....	1-4 800
28	2385	Map of the District of Columbia, curves.....	1-4 800
35	2386	Map of the District of Columbia, roads.....	1-4 800
35	2386	Map of the District of Columbia, water.....	1-4 800
35	2386	Map of the District of Columbia, woods.....	1-4 800
35	2386	Map of the District of Columbia, curves.....	1-4 800
9	2404	Map of the District of Columbia, roads.....	1-4 800
9	2404	Map of the District of Columbia, water.....	1-4 800
9	2404	Map of the District of Columbia, woods.....	1-4 800
9	2404	Map of the District of Columbia, curves.....	1-4 800
10	2409	Map of the District of Columbia, roads.....	1-4 800
10	2409	Map of the District of Columbia, water.....	1-4 800
10	2409	Map of the District of Columbia, woods.....	1-4 800
10	2409	Map of the District of Columbia, curves.....	1-4 800
19	2411	Map of the District of Columbia, roads.....	1-4 800
19	2411	Map of the District of Columbia, water.....	1-4 800
19	2411	Map of the District of Columbia, woods.....	1-4 800
19	2411	Map of the District of Columbia, curves.....	1-4 800
20	2412	Map of the District of Columbia, roads.....	1-4 800
20	2412	Map of the District of Columbia, water.....	1-4 800
20	2412	Map of the District of Columbia, woods.....	1-4 800
20	2412	Map of the District of Columbia, curves.....	1-4 800
29	2420	Map of the District of Columbia, roads.....	1-4 800
29	2420	Map of the District of Columbia, water.....	1-4 800
29	2420	Map of the District of Columbia, woods.....	1-4 800
29	2420	Map of the District of Columbia, curves.....	1-4 800
UNFINISHED CHARTS CONTINUED.			
191	906	Lakes Borgne and Pontchartrain.....	1-80 000
197	2372	Southwest Light to Ship Island Shoal.....	1-80 000
199	2373	Point au Fer to Marsh Island.....	1-80 000
200	2418	Vermillion Bay to Pecan Island.....	1-80 000
250	2400	Eastern entrance to Nantucket Sound.....	1-40 000
271	2419	Rye Neck to New Rochelle.....	1-10 000
348	2332	Woods Holl.....	1-10 000

Catalogue No.	Plate No.	Title.	Scale.
UNFINISHED CHARTS—continued.			
353 ³	2344	Newport Harbor, etc	1-20 000
362	2416	New Haven Harbor, Connecticut	1-20 000
6405	2352	Port Townsend, Washington	1-20 000
6300	2119	Strait of Juan de Fuca	1-200 000
6400	2403	Seacoast and interior harbors of Washington	1-300 000
5795	2330	Cape Mendocino and vicinity	1-40 000
8240	2414	Sitka Sound, Alaska	1-80 000
6441	2166	Seattle Harbor	1-20 000
114	1969	Newport to Plum Island	1-80 000
115	2162	Plum Island to Stratford Shoal	1-80 000
116	2154	Stratford Shoal to New York	1-80 000
126	1935	Delaware River, Penns Neck to Philadelphia	1-80 000
134	1992	Potomac River to Choptank River	1-80 000
175	2413	San Carlos Bay to Lemon Bay	1-80 000
353	2359	Narragansett Bay, Upper	1-40 000
353	2360	Narragansett Bay, Lower	1-40 000
369	2370	New York Bay and Harbor, Upper	1-40 000
369	2371	New York Bay and Harbor, Lower	1-40 000
428	4345	Winyah Bay and Georgetown Harbor	1-40 000
469	2515	Key West Harbor	1-50 000
5100	1534	San Diego to Santa Monica	1-200 000
PROGRESS SKETCHES, UNFINISHED.			
12	2316	Sketch No. 12, Pennsylvania, New Jersey, and Virginia ..	1-1 000 000
16	2317	Sketch No. 16, Nevada and Utah, rivers	1-1 000 000
16	2338	Sketch No. 16, Nevada and Utah, triangulation	1-1 000 000
	2350	General base map of the United States, rivers	
DISTRICT OF COLUMBIA SURVEY, UNFINISHED.			
9	2404	Map of the District of Columbia, roads	1-4 800
9	2404	Map of the District of Columbia, woods	1-4 800
9	2404	Map of the District of Columbia, water	1-4 800
9	2404	Map of the District of Columbia, curves	1-4 800
10	2409	Map of the District of Columbia, roads	1-4 800
10	2409	Map of the District of Columbia, woods	1-4 800
10	2409	Map of the District of Columbia, water	1-4 800
10	2409	Map of the District of Columbia, curves	1-4 800
19	2411	Map of the District of Columbia, roads	1-4 800
19	2411	Map of the District of Columbia, woods	1-4 800
19	2411	Map of the District of Columbia, water	1-4 800
19	2411	Map of the District of Columbia, curves	1-4 800
20	2412	Map of the District of Columbia, roads	1-4 800
20	2412	Map of the District of Columbia, woods	1-4 800
20	2412	Map of the District of Columbia, water	1-4 800
20	2412	Map of the District of Columbia, curves	1-4 800
29	2420	Map of the District of Columbia, roads	1-4 800
29	2420	Map of the District of Columbia, woods	1-4 800
29	2420	Map of the District of Columbia, water	1-4 800
20	2420	Map of the District of Columbia, curves	1-4 800
ATLANTIC COAST.			
	1717	Atlantic Coast Pilot views, etc	
	1718	Atlantic Coast Pilot views, etc	
	1702	Atlantic Coast Pilot views, etc	
	1720	Atlantic Coast Pilot views, etc	
	1721	Atlantic Coast Pilot views, etc	
	1873	Atlantic Coast Pilot views, etc	
	1874	Atlantic Coast Pilot views, etc	
	1723	Atlantic Coast Pilot views, etc	
	1728	Atlantic Coast Pilot views, etc	
	1744	Atlantic Coast Pilot views, etc	
	1705	Atlantic Coast Pilot views, etc	
	1781	Atlantic Coast Pilot views, etc	
	1763	Atlantic Coast Pilot views, etc	

UNITED STATES COAST AND GEODETIC SURVEY.

Statement of electrotyping for the fiscal year from July 1, 1894, to June 30, 1895.

Date.	Number of pounds of copper deposited.	Number of square inches upon which deposit was made.	For the Coast Survey.		For the State Department.	
			Altos.	Bassos.	Alto.	Basso.
1894.						
July	194	7 779	4	2		
August	220½	9 451	4	3		
September	209	6 409	2	5		
October	117	3 089	2	3		
November	78	3 859	4			
December	130½	6 165	3	1	1	
1895.						
January	91	3 809	1	1		1
February	137½	5 712	2	3		
March	172	6 237	3	2		
April	124	5 559	4	1		
May	225	10 996	4	2		
June	214	8 393	1	4		
Total	1 912½	77 458	34	27	1	1

Statement of photographing, from July 1, 1894, to June 30, 1895.

Date.	Negatives.	Blue prints.	Nigrosine prints.	Lantern slides of Northwest Boundary for archives.	Silver prints.	Enlarged prints of Alaska views.
1894.						
July	4	150				
August	1	32				
September		12	12			
October	4	48				
November	48	162			49	35
December	8	166			53	
1895.						
January	2	2	8	21	15	
February	11	21	11			
March	5	17	1	40		
April	9	50				
May	13	172			48	
June	17	57				
Total	122	889	32	61	165	35

Statement of printing from July 1, 1894, to June 30, 1895.

Date.	Chart room.	Engraving division.		Hydrographic Office.	Ordered by Office.	Old files.	For the lithographer.	Proofs of District plates.	For the Supreme Court.	For the State Department.	Proofs condemned.	Total printing.
		Files.	Verification.									
1894.												
July.....	2 276	12	28	.....	51	8	.....	441	.....	.....	.....	2 816
August.....	2 874	2	40	.....	62	.....	.....	62	.....	.....	.....	3 040
September....	1 710	1	41	.....	98	.....	28	649	.....	.....	.....	2 527
October.....	1 954	9	48	.....	64	.....	.....	181	.....	.....	.....	2 256
November.....	2 711	.....	49	.....	76	.....	34	14	61	.....	.....	2 945
December.....	2 594	.....	22	3	52	.....	14	13	.....	.....	.....	2 698
1895.												
January.....	4 121	4	18	.....	85	.....	33	.....	.....	.....	.....	4 261
February.....	3 305	3	20	.....	87	.....	10	28	.....	12	.....	3 465
March.....	3 239	10	22	.....	54	.....	.....	1 587	.....	.....	116	5 028
April.....	3 907	5	64	45	88	.....	4	.....	.....	.....	.....	4 113
May.....	3 520	.....	27	26	61	.....	.....	.....	.....	.....	.....	3 634
June.....	5 078	.....	25	.....	63	.....	2	.....	.....	.....	.....	5 168
Total.....	37 289	46	404	74	841	8	125	2 975	61	12	116	41 951

Number of plates printed from for the chart room from July 1, 1894, to June 30, 1895.

Date.	32-inch press.	36-inch press.	37-inch press, new.	37-inch press, old.	38-inch press, new.	38-inch press, old.	Total printing.
1894.							
July.....	8	4	10	10	.....	32
August.....	18	19	16	7	.....	60
September....	5	19	20	.....	4	48
October.....	11	16	11	10	1	49
November.....	19	25	19	10	1	74
December.....	24	15	4	10	.....	53
1895.							
January.....	26	15	19	12	.....	72
February.....	19	17	14	17	2	69
March.....	17	15	12	2	6	52
April.....	6	22	14	20	14	7	83
May.....	11	5	25	8	2	51
June.....	17	21	14	14	.....	66
Total.....	6	197	185	184	114	23	709

Four hundred and twenty-eight plates corrected for printing.

Respectfully, yours,

WILL WARD DUFFIELD,
Assistant and Chief of the Drawing Division.

Mr. ANDREW BRAID,
Assistant in Charge of the Office.

REPORT OF THE CHART DIVISION, COAST AND GEODETIC SURVEY OFFICE,
FOR THE FISCAL YEAR ENDING JUNE 30, 1895.

CHART DIVISION, *June 30, 1895.*

SIR: I have the honor to submit the following report of the chart division for the fiscal year ending June 30, 1895:

This division has been under my charge during the year, and the following-named persons have been attached to it, whose general duties have been as noted:

Miss L. A. Mapes, bookkeeping and correspondence.
Mr. H. R. Garland, issuing and correcting charts.
Mr. J. H. Barker, correcting charts.
Miss M. L. Handlan, coloring charts.
Mr. Neil Bryant, receiving and stamping charts.
Mr. A. G. Randall, correcting charts.
Mr. H. Sidney King, coloring and correcting charts.
Mr. J. K. Hagmann, messenger.
Mr. A. Upperman, mounting sheets and joining charts.
Mr. Preston Boisseau, messenger.
Mr. J. A. Dorsey, coloring charts.
Mrs. Mary L. Godwin, coloring charts.
Mr. John W. Miner, messenger.

The changes in the force have been as follows:

Mr. J. K. Hagmann, dismissed July 11.
Mr. Preston Boisseau, assigned July 25.
Mr. H. Sidney King, transferred to division of library and archives August 15.
Mr. J. A. Dorsey, detailed to other duty in Office September 25.
Mr. J. H. Barker, died October 31.
Mr. Preston Boisseau, transferred to division of library and archives April 27.
Mrs. Mary L. Godwin, assigned on April 26, and was detailed for duty at the Treasury Department on May 1, and was permanently transferred to that Department on July 1.
Mr. John W. Miner, assigned April 29; transferred to other duty in office June 6.
Mr. Preston Boisseau, assigned June 7.

Misses Mapes and Handlan and Messrs. Bryant, Garland, Randall, Upperman, and Boisseau are now on duty in the division.

The following persons were temporarily assigned in the month of July from other divisions in the Office:

Mr. Daniel Hurley, coloring charts, two days, from computing division.
Mr. H. R. McCabe, correcting charts, ten days, from engraving division.
Mr. G. Hergesheimer, correcting charts, ten days, from engraving division.
Mr. H. Thompson, correcting charts, ten days, from engraving division.

The force in this division has been too small to properly attend to the work assigned to it, having been only seven in number from November to June, inclusive, in consequence of which there was unavoidable delay in filling orders, and especially so in May and June when the call for charts is comparatively large. There should be nine persons in the force, which would even then be smaller by one or two than in the years from 1889 to 1893.

The following table represents in brief the more important features of the relation of the chart issue of this year to that of the six years next preceding:

Comparison of issues of charts during the fiscal years noted.

Year.	Total.		Free distribution.		Gross sales.		Net sales.	
	Copies.	Values.	Copies.	Values.	Copies.	Values.	Copies.	Values.
1889.....	49 312	\$20 096	21 088	\$8 266	28 224	\$11 830	26 540	\$11 280
1890.....	63 152	26 178	30 112	12 121	33 040	14 057	31 806	13 575
1891.....	52 959	23 457	20 811	8 846	32 148	14 611	28 473	13 141
1892.....	52 675	23 041	23 451	9 831	29 224	13 209	27 214	12 506
1893.....	55 026	24 215	27 310	11 805	27 716	12 409	25 366	11 605
1894.....	51 671	22 476	22 702	11 845	23 969	10 631	21 230	9 595
1895.....	51 456	22 280	24 892	10 507	26 564	11 773	23 136	10 405

The total issue is a trifle smaller than that of last year, and 5 per cent smaller than the average of the previous six years. The net sales, i. e., the gross sales less copies returned by sales agents, have increased 9 per cent in copies and 8 per cent in value as compared with the previous year, and are 13 per cent less in copies and value than those of the previous six years.

The distribution of charts to libraries has been continued, as noted in the table of issues, etc., given further on.

A new edition of the chart catalogue was received in January, 1895, and about 1 500 copies have since been distributed.

The correspondence for the year has amounted to 3 558 letters written.

There have been delivered to this division for issue in the past year three new charts from copperplates and sixteen new lithographic charts and maps, nineteen in all, viz:

Date.	Catalogue No.	Title.
ENGRAVED.		
1894. July 25	198	Caillou Bay and Ship Shoal, Louisiana.
1895. Jan. 29	300	Passamaquoddy Bay and St. Croix River, Maine.
June 10	6	Quoddy Head to Cape Cod.
LITHOGRAPHED.		
1894. Oct. 3	3061	District of Columbia, No. 1, topographic map.
Oct. 3	3062	District of Columbia, No. 2, topographic map.
Oct. 3	3063	District of Columbia, No. 3, topographic map.
Oct. 3	3064	District of Columbia, No. 4, topographic map.
Oct. 3	3066	District of Columbia, No. 6, topographic map.
Oct. 25	8244	Sitka Harbor and approaches, Alaska.
Nov. 6	247	Hyannis Harbor, Massachusetts.
Dec. 13	8240	Sitka Sound, Alaska.
1895. Feb. 2	8050	Dixon entrance to head of Lynn Canal, Alaska.
Apr. 22	254	Connecticut River, Deep River to Higganum, Conn.
Apr. 29	255	Connecticut River, Higganum to Rocky Hill, Conn.
Apr. 29	5476	Pfeiffer Point to Cypress Point, California.
May 27	468	St. Johns River, Palatka to Lake Monroe, Florida.
May 31	266	Fairfield to Georges Rock, Connecticut.
June 19	265	East Bridgeport to Fairfield, Conn.
June 21	253	Connecticut River, entrance to Deep River, Connecticut.

Thirty nine new copper-plate editions of charts and eight new lithographic editions, forty-seven in all, have been delivered to this division for issue.

The receipts, issues, and general distribution of charts are given in the following tables:

	July 1, 1894, to June 30, 1895.	
	Number.	Value.
ISSUES OF CHARTS.		
Sales agents.....	25 635	\$11 427'15
Sales by office and chart division.....	929	345'95
Congressional account.....	3 372	1 588'45
Hydrographic Office, Navy.....	9 570	4 017'10
Light-House Board.....	2 116	855'75
Coast and Geodetic Survey Office.....	3 243	1 410'45
Executive Departments.....	3 033	1 183'05
Foreign Governments.....	286	131'50
Libraries.....	2 237	824'30
Miscellaneous.....	1 035	495'95
Total.....	51 456	22 279'65
Condemned.....	7 712	3 122'65
Total issued and condemned.....	59 168	25 402'30
CHARTS ON HAND AND RECEIVED.		
On hand by count July 1, 1894.....	42 360	15 677'30
Received from engraving division.....	35 600	16 139'25
Received from lithographers.....	12 262	4 979'85
Returned.....	3 431	1 369'50
Total on hand and received.....	93 653	38 165'90
Total issued and condemned.....	59 168	25 402'30
On hand by book July 1, 1895.....	34 485	12 763'60
Difference between book and count.....	205	82'65
On hand by count July 1, 1895.....	34 280	12 680'95

Very respectfully, yours,

GERSHOM BRADFORD,
Assistant and Chief of the Chart Division.

Mr. ANDREW BRAID,
Assistant in Charge of the Office.

REPORT OF THE MISCELLANEOUS DIVISION, COAST AND GEODETIC SURVEY OFFICE, FOR THE FISCAL YEAR ENDING JUNE 30, 1895.

MISCELLANEOUS DIVISION, June 30, 1895.

SIR: I have the honor to submit herewith the report of the miscellaneous division for the fiscal year ending June 30, 1895.

The volume of work done in the division, so far as it is susceptible of tabulation, is shown by the following figures:

Letters written (sales agents, 3 056; miscellaneous, 638).....	3 694
Ledger accounts kept (sales agents).....	97
Quarterly statements of sales agents examined and verified.....	282
Circulars to sales agents issued.....	28
Charts sent to sales agents.....	25 635
Orders for purchases issued.....	108
Requisitions made for printing and binding.....	96
Requisitions for stationery filled.....	426
Requisitions for miscellaneous supplies and repairs filled.....	209
Annual reports distributed (see tabulated statement).....	2 947
Tide Tables issued.....	5 691
Atlantic Coast Pilots issued.....	4
Subdivisions, Atlantic Local Coast Pilot, issued.....	110

United States Coast Pilots, Atlantic Coast, issued.....	445
Pacific Coast Pilot, Alaska, Part I, issued	23
Pacific Coast Pilot, "California, Oregon, and Washington," issued	13

Two thousand and ninety-five more charts were sent to sales agents during the year than in the preceding year, being an increase of nearly 9 per cent.

Ten agencies for the sale of publications—eight on the Atlantic and Gulf coasts, and two on the Pacific Coast were established during the year, and four were discontinued, three on the Atlantic Coast and one on the Pacific Coast. The total number of agencies on June 30, 1895, was 90, 69 on the Atlantic and Gulf coasts and 21 on the Pacific Coast.

The following publications were sent to press: Annual Reports of the Superintendent for the fiscal years ended June 30, 1893, and June 30, 1894; United States Coast Pilot, Atlantic Coast, Part VII, "Chesapeake Bay Entrance to Key West;" Tide Tables for the year 1896; Bulletins 31, 32, 33, and 34; and Notices to Mariners Nos. 181 to 193, inclusive.

The usual distribution was made of the annual reports of the Superintendent, the appendices to the same printed separately in pamphlet form, bulletins, and Notices to Mariners, and they were also furnished in large numbers in response to numerous special applications. The distribution of annual reports was as follows:

Date of report.	Domestic distribution.		Foreign distribution.		Total.
	To institu- tions.	To individ- uals.	To institu- tions.	To individ- uals.	
1851.....	2		1		3
1852.....	2		1		3
1853.....	1	1	1		3
1854.....	2		1		3
1855.....	1				1
1856.....	3	1			4
1857.....	2				2
1858.....	3				3
1859.....	4				4
1860.....	2				2
1861.....	1	1			2
1862.....	2				2
1863.....	3				3
1864.....	1				1
1865.....	1				1
1866.....	2				2
1867.....	3				3
1868.....	3	1			4
1869.....	2				2
1870.....	3				3
1871.....	2	1			3
1872.....	3				3
1873.....	8	3			11
1874.....	8	5			13
1875.....	10	1			11
1876.....	9	5			14
1877.....	10	2			12
1878.....	9	3			12
1879.....	14	12	2	1	29
1880.....	12	45	2	2	61
1881.....	12	22	2	2	38
1882.....	13	18	2	2	35
1883.....	12	22	3	2	39
1884.....	13	46	3	3	65
1885.....	12	21	3	2	38
1886.....	13	15	3	2	33
1887.....	14	20	3	2	39
1888.....	13	32	4	2	51
1889.....	13	36	3	3	55
1890.....	15	46	4	3	68
1891, Part 1.....	70	35	5		110
1891, Part 2.....	18	84	4	3	109
1892, Part 1.....	232	176	80	3	491
1892, Part 2.....	724	563	246	23	1 556
Total.....	1 302	1 217	373	55	2 947

The following is a list of the publications of the Survey, with the number of copies of each, received during the year from the Public Printer:

Name of publication.	No. of copies.	Name of publication.	No. of copies.
Report of the Superintendent of the United States Coast and Geodetic Survey for the fiscal year ending June 30, 1892, Part I	700	Appendix No. 4, Report for 1893—"Photographic determinations of longitude by lunar distances"	300
Tide Tables for the Pacific Coast of America, together with stations in Asia, Australia, and islands of the Pacific Ocean, for the year 1895	5 518	Appendix No. 5, Report for 1893—"On the measurement of base lines with steel tapes and with steel and brass wires"	300
Supplement to first edition United States Coast Pilot, Atlantic Coast, Parts I-II, "From the St. Croix River to Cape Ann"	500	Appendix No. 6, Report for 1893—"Fundamental standards of length and mass"	1 000
Supplement to first edition United States Coast Pilot, Atlantic Coast, Part III, "From Cape Ann to Point Judith"	500	Appendix No. 7, Report for 1893—"Units of electrical measure"	300
Supplement to second edition United States Coast Pilot, Atlantic Coast, Part IV, "From Point Judith to New York"	525	Appendix No. 8, Report for 1893—"A historical account of the boundary line between the States of Pennsylvania and Delaware"	500
Supplement to second edition United States Coast Pilot, Atlantic Coast, Part V, "From New York to Chesapeake Bay Entrance"	400	Appendix No. 9, Report for 1893—"Proceedings of the Geodetic Conference held at Washington, D. C., January 9 to February 28, 1894"	500
Supplement to first edition United States Coast Pilot, Atlantic Coast, Part VI, "Chesapeake Bay and Tributaries"	525	Appendix No. 10, Report for 1893—"The preparation and arrangement of the exhibit of the United States Coast and Geodetic Survey at the World's Columbian Exposition, 1893"	300
Catalogue of Charts and other publications, 1894	2 708	NOTICES TO MARINERS.	
H. R. Ex. Doc. No. 324, Fifty-third Congress, third session—"Expenditures Coast and Geodetic Survey, 1894"	200	No. 181, June, 1894—Chart corrections during the month ..	9 500
Bulletin No. 31—"Legal units of electrical measure in the United States"	5 000	No. 182, July, 1894—Chart corrections during the month ..	9 500
Bulletin No. 32—"The constant of aberration as determined from observations of latitude at San Francisco, Cal."	2 000	No. 183, August, 1894—Chart corrections during the month ..	9 500
Bulletin No. 33—"The direction and intensity of the earth's magnetic force at San Francisco, Cal."	2 000	No. 184, September, 1894—Chart corrections during the month	9 500
Bulletin No. 34—"Distribution of the magnetic declination in Alaska and adjacent waters for the year 1895" ..	2 000	No. 185, October, 1894—Chart corrections during the month	9 500
Appendix No. 1, Report for 1893—"State laws authorizing entrance upon lands within State limits for the purposes of the United States Coast and Geodetic Survey" ..	300	No. 186, November, 1894—Chart corrections during the month	9 500
Appendix No. 2, Report for 1893—"Heights from geodetic leveling between St. Louis and Jefferson City, Mo., 1882 and 1888"	300	No. 187, December, 1894—Chart corrections during the month	9 500
Appendix No. 3, Report for 1893—"Phototopography as practiced in Italy and in the Dominion of Canada, with a brief historical review of other photographic surveys and publications on the subject"	300	No. 188, Index to Notice to Mariners, 1894; chart corrections	9 500
		No. 189, January, 1895—Chart corrections during the month ..	9 500
		No. 190, February, 1895—Chart corrections during the month	9 500
		No. 191, March, 1895—Chart corrections during the month ..	9 500
		No. 192, April, 1895—Chart corrections during the month ..	9 500
		No. 193, May, 1895—Chart corrections during the month ..	9 500

The following-named persons were employed in the division during the year:

Freeman R. Green, clerk.

Harry J. Van Der Beek, stenographer, transferred to Treasury Department March 19, 1895.

Marie L. Fout, writer, appointed May 6, 1895.

J. A. Watts, engineer, transferred to Treasury Department August 10, 1894.

P. J. Mullen, engineer, appointed August 13, 1894.

David Parker, watchman.

John W. Drum, watchman.

J. A. McDowell, watchman.

Ed. D. Scott, messenger.

Charles Over, messenger.

Thomas McGoinis, messenger.

Charles H. Jones, messenger.

John W. Miner, messenger.

Attrell Richardson, messenger.
 William R. McLane, messenger.
 Horace Dyer, fireman.
 John H. Brown, laborer.
 Baylor Crutchfield, laborer.
 Boston Brown, laborer.
 John H. Mason, laborer.
 Sarah E. Flynn, laborer, services ceased July 15, 1894.
 Virginia McGlincey, laborer, appointed July 18, 1894.
 William Young, extra laborer, died October 24, 1894.
 Alfred Gilbert, extra laborer, appointed November 1, 1894.
 Walter Y. Clark, extra laborer, appointed May 3, 1895.
 Respectfully, yours,

W. P. RAMSEY,
Chief of the Miscellaneous Division.

Mr. ANDREW BRAID,
Assistant in Charge of the Office.

REPORT OF THE INSTRUMENT DIVISION OF THE UNITED STATES COAST AND
 GEODETIC SURVEY OFFICE FOR THE FISCAL YEAR ENDING JUNE 30, 1895.

INSTRUMENT DIVISION, *June 30, 1895.*

SIR: I have the honor to submit the following report of the work of the instrument division for the fiscal year ending June 30, 1895:

This division has to make the needed repairs to instruments; plan and construct new instruments; determine their constants so far as it is practicable to do so at the office; purchase new instruments; send out, receive, and account for all instruments and general property used in the field and the various divisions of the office, and purchase all material needed for carrying on its work.

The force during the year has been as follows:

Edwin Smith, assistant and chief of division, July 1, 1894, to January 17, 1895.
 J. F. Pratt, assistant and chief of division, January 18, 1895, to date.
 William C. Maupin, clerk, entire year.
 E. G. Fischer, chief instrument maker, entire year.
 Otto Storm, mechanic, entire year.
 Clement Jacomini, instrument maker, entire year.
 Jacob Schwartz, instrument maker, July 1, 1895, to April 22, 1895.
 S. A. Kearney, instrument maker, entire year.
 C. E. Regeunas, instrument maker, entire year.
 M. Lauxmann, instrument maker, entire year.
 H. O. French, carpenter, entire year.
 G. W. Clarvoe, carpenter, entire year.
 C. N. Darnall, carpenter, entire year.
 William West, messenger, July 1, 1895, to July 31, 1895.
 J. W. Hunter, messenger, August 14, 1895, to date.

By his own request, Assistant Edwin Smith was relieved from duty as chief of the division on January 17, and the undersigned was detailed to succeed him at that time.

The major part of the work in the instrument and carpenter shops is in the nature of repairs and construction, most of the new work being of special and unusual designs.

The following tables, Nos. I and II, give statistics of repairs and new work, respectively, and Table No. III, a list of instruments purchased.

TABLE I.—*Summary of instruments repaired and remodeled between July 1, 1894, and June 30, 1895.*

Instrument.	Num-ber.	Instrument.	Num-ber.
Alidades, plane table	24	Protractors, three-arm	12
Azimuth circles, marine	2	Ruling machine	1
Base bars	4	Sector	1
Base-bar comparators	2	Station transits	15
Binoculars	20	Sextants	27
Chronographs	3	Sextant mirrors, resilvered	186
Chronodyke	1	Steel tapes, ordinary	43
Compass declinometer	1	Telemeters, plane-table	65
Comptometers	2	Theodolites	38
Condenser connections for break-circuit chronometers	7	Tide gauges, self-registering	9
Current meter, electrical	1	Tide staff	1
Declaration of Independence—new case for original cop- perplate engraving and alto of same	1	Topographic camera	1
Dip circles	4	Transit, astronomical	1
Draw telescopes	6	Typewriter	1
Geodetic level	1	Vertical circle	1
Geodetic leveling rods	4	Zenith telescope	1
Gradienters	2	REPAIR WORK FOR OFFICE OF STANDARD WEIGHTS AND MEASURES.	
Heliotrope	1	Balance (for State of Rhode Island) repaired and repolished	1
Level	1	Half bushels, repolished	3
Magnetometer	1	Sets avoirdupois weights, repolished	4
Meridian telescopes	4	Yards, standard, brass, repolished	10
Pantograph	1	Total number of instruments repaired and remod- eled	544
Sets pendulum apparatus	3		
Plane tables	27		

TABLE II.—*New instruments made between July 1, 1894, and June 30, 1895.*

Instrument.	Num-ber.	Instrument.	Num-ber.
Apparatus for measuring the magnifying power of eye- pieces	1	Tripods for theodolites	9
Apparatus for saturating leveling rods with paraffin	1	Tripods for station transits	4
New sensitive drill presses for shop use	2	Tide staffs	3
File cases for different divisions of the Office	7	NEW WORK EXECUTED FOR THE OFFICE OF STANDARD WEIGHTS AND MEASURES.	
Geodetic leveling rods, saturated with paraffin	2	Cases, for capacity measures, of black walnut and glass	2
Heliotrope	1	Set of fixtures for determining expansion of leveling rods	1
Micrometer eyepieces	1	Guide plate, brass, nicked, for set of small weights	1
Plane-table tops	16	Total number of instruments and apparatus con- structed	81
Plane-table stands	4		
Telemeters	25		
Tripod, for dip circle	1		

TABLE III.—*Instruments purchased between July 1, 1894, and June 30, 1895.*

Instrument.	Num-ber.	Instrument.	Num-ber.
Circles, dip (Kew pattern)	3	Objective for theodolite No. 146	1
Clocks, hydrographic	37	Pens, drawing	6
Clocks for self-registering tide gauges	12	Pens, detail drawing	2
Dividers, ordinary	2	Protractors, celluloid	6
Dividers, hair-spring	6	Protractors, horn	6
Dividers, bow	2	Scale, triangular, boxwood	1
Dividers, steel spacing	3	Sextant, double reflecting	1
Eyepieces, Ramsden's	6	Specimen cups, Stellwagen	6
Floats, copper, for self-registering tide gauges	3	Thermometers	6
Lens, biconcave, for ship's azimuth compass	1	Triangles, celluloid	11
Leveling rods	2	Tripod, folding camera	1
Manometer tubes, for pendulum apparatus	8	Total number of instruments purchased	138
Objectives for microscopes	6		

One hundred and fifty requisitions have been received from field parties and the Office. The filling of many of these has required several days' work of a large portion of the working force. This work, and the repair and construction of carrying and packing cases for field instruments, is not shown in the foregoing tables.

The heating and ventilating appliances of the graduating room have been radically changed, and the room can now be kept at the desired constant high temperature with pure air, thus avoiding the danger of asphyxia so imminent heretofore.

The usual amount of work has been done for the Office in the care of clocks, electric bells, shelving in the library and archives division, making file cases, drawing boards, etc., and such general repairs about the buildings as could be done by the employees of the instrument and carpenter shops.

Eight-inch position theodolites, Nos. 130, 132, and 133, which were useless owing to obsolete construction and design, have been completely remodeled and reconstructed, and are now practically new instruments; the cones of bell metal, in red metal bearings, have been replaced by new double-cone centers of hardened steel in fine grained cast-iron bearings, and an arrangement added so that the position of the circles can be changed without moving them on their centers; the circles have been carefully regraduated, every degree being numbered so that the circle can be read through the micrometer microscopes without resorting to the use of a ten or five degree finder; the circles are protected by a light cover spun from aluminum, and very carefully constructed microscopes have been added. These instruments, although somewhat top-heavy, which is due more or less to their original design, are of a high order, and can be classed with the very best of modern instruments of their size.

Two leveling rods, supposed to be filled with paraffin, were ordered from a maker who makes a specialty of this method of filling rods, but after subjecting them to hygrometric changes, and having them compared during these changes by the office of standard weights and measures, it was found that they were not impervious to moisture, and had so large a change in length, due to that effect, that they were considered valueless for precise leveling; consequently, two new rods were made of thoroughly seasoned white pine, to be saturated with paraffin by this division. This necessitated the designing and constructing of an apparatus for saturating them with paraffin, which proved a success, as the two rods were impregnated with about 83 per cent of their weight of paraffin. These rods are virtually wooden rods, but the graduation marks, placed every 2 centimetres, are on silver-faced metallic plugs carefully inserted in the wood. They were sent to the field party early in the season, and from preliminary reports their behavior has been very satisfactory.

The zenith telescope ordered from Wanshaff of Berlin during the last fiscal year has not yet arrived.

Among the new instruments purchased are three new dip circles ("Kew" pattern) ordered from Casella of London. These instruments are being constructed to order and are not expected for two or three months.

Preliminary plans for a tide-predicting machine, in accordance with data furnished by the tidal division, showing a practical assembling of working parts, were made and approved. The construction of this machine will be commenced early in the next fiscal year, as new work can only be taken up when repairs are not pressing. It is uncertain when this machine will be completed, but probably not for about two years, as a multitude of working parts will have to be made with great accuracy.

I have to call your attention to the very poor and trying light in the instrument shop during the short days of the winter months.

The books and accounts of the division and the inventories of the field parties are in a very satisfactory condition.

A detailed account of each day's work of each employee is kept on file in the division.

It is with pleasure that I have to state that, with slight exceptions, there is a hearty and conscientious interest of the employees of the division in their respective duties.

Respectfully, yours,

J. F. PRATT,
Assistant and Chief of Instrument Division.

Mr. ANDREW BRAID,
Assistant in Charge of the Office.

REPORT OF THE LIBRARY AND ARCHIVES DIVISION, COAST AND GEODETIC SURVEY OFFICE, FOR THE FISCAL YEAR ENDING JUNE 30, 1895.

LIBRARY AND ARCHIVES DIVISION, *June 30, 1895.*

SIR: I have the honor to submit the following report of the library and archives division, for the fiscal year ending June 30, 1895.

Mr. F. H. Parsons resigned August 20, 1894, and I was appointed chief of the division August 21, and assumed charge on that date.

LIBRARY.

The card catalogue is nearly finished; only a few Government publications and a few foreign geodetic works remain uncatalogued.

Two hundred and two volumes have been added to the library by purchase, as against 347 volumes purchased last year. No allotment of money was made to the library this year for the purchase of books, as was done in preceding years.

The library of the United States Coast and Geodetic Survey should be made the best scientific and mathematical library in this city. It contains now several valuable works, recently acquired, such as Crelle's Journal (complete set); Liouville's Journal (complete set); *Mathematische Annalen* (complete set); Quarterly Journal of Mathematics (complete set).

Probably the library of the Coast and Geodetic Survey is the only one in Washington containing complete sets of all the above-named important publications. I would recommend that at least \$1 000 be allotted to the library for the purpose of adding some valuable works which it still needs. New mathematical and other scientific treatises bearing on the work of the Survey should be added as soon as practicable after they are issued, in order to keep this library "up to date." More good text-books of recent date are needed. I think it would be an advantage to the library if the orders for the purchase of books and for subscriptions to serials, and all correspondence relating thereto, emanated from this division.

The system of arranging and cataloguing the library adopted by my predecessor, Mr. Parsons, is incomplete and unsatisfactory as regards finding any particular book from its card in the catalogue. The shelves are not numbered; only the class number (according to the Dewey system of classification) is placed on the shelves, and that number is only placed on the first shelf at the beginning of that class. In case several shelves are occupied with the same class of books, there is nothing on the catalogue card to indicate what shelf contains the book wanted. The shelves should be numbered consecutively, and every book on a shelf should have the number of the shelf on its title page, and the same number should be entered on its card (or cards) in the catalogue; then the catalogue would tell what shelf contained any book wanted, so that anybody could find it. But to do this now would involve a large amount of time and labor, as it would be necessary to handle every book in the library and every card in the catalogue. The services of two good extra clerks would be required probably two months, perhaps longer, to number the books and enter the numbers on the cards.

The library shelves have sharp edges which injure the binding of the books, especially the heavy ones, when they are put on and taken off the shelves. I would recommend that the edges of the shelves be rounded off in order to save the books from further injury.

The services of an intelligent clerk are needed for at least two or three months in the front room of fourth story of fireproof, to finish assorting, arranging, cataloguing and filing the charts and maps therein, many of which are still in a very unsatisfactory condition as regards their accessibility.

The case that was put up while my predecessor was in charge has fixed shelves. The loose charts are injured by being shoved into place on these shelves, and I would recommend that these shelves be changed to sliding shelves, which can be drawn out and the charts removed or replaced without injury, and the shelves then shoved into place. Such shelves were put in the three cases made in the same room upon my requisition.

A case with shelves and doors has been put up in the middle room, third floor of the fireproof, in which standard Coast Survey charts, from 1880 to 1893, are filed for reference. Also, a case with drawers has been placed in the middle room of first floor of fireproof, in which standard Coast Survey charts for 1894 are filed for the same purpose.

Books purchased (volumes).....	202
Books obtained by exchange, presented, and published (volumes).....	465
Serials and pamphlets purchased.....	729
Serials and pamphlets obtained by exchange, presented and published.....	1 833
Maps and charts received by exchange.....	1 025
Books and periodicals sent to the bindery to be bound, all of which were bound and returned (volumes).....	324

ARCHIVES.

Mr. E. H. Courtenay, of the computing division, was employed thirteen days in preparing and arranging original records and computations for binding, in which work he was assisted by Mr. Artemas Martin. Nothing has been done on this work since November, 1894. It should be resumed as soon as Mr. Courtenay can be spared from the computing division for that purpose.

The work of preparing original sounding records for binding had to be suspended for want of help, and it can not be resumed while the division is so short-handed.

Original tidal records of several States were prepared for binding in the tidal division, but in consequence of the loss of the help used for that purpose nothing has been done in that line for several years. This work should be taken up again as soon as possible.

Number of volumes of original records of soundings received from bindery.....	260
Number of volumes of original records of soundings sent to bindery.....	67
(All were returned bound in a substantial manner.)	
Number of volumes of original geodetic records and computations received from bindery.....	43
Number of volumes sent to bindery and not yet returned.....	76

Summary of original and duplicate records, computations, original sheets, etc., received and registered in the archives during the fiscal year:

Original observations, 549 volumes, 123 cahiers, 840 sheets, 1 package, and 90 rolls; duplicate observations, 544 volumes, 76 cahiers, and 456 sheets; field computations, 6 volumes and 146 cahiers; office computations, 7 volumes and 77 cahiers; photography, 169 negatives, 182 blue prints, 22 silver prints, 5 mounted photographs, 61 lantern slides; log books, 46 volumes; specimens of sea bottom, 33 bottles; descriptive reports, topographic sheets, 12 cahiers; descriptive reports, hydrographic sheets, 9 cahiers; topographic sheets, 29; hydrographic sheets, 26; miscellaneous, 13 volumes, 2 boxes, 6 packages, and 20 sheets.

FORCE OF THE DIVISION.

Mr. Artemas Martin was employed in the division the whole year as clerk. He had charge of registering and filing original records and sheets in the archives; of answering calls for the same and keeping account thereof; of registering books received, and answering calls for the same, and keeping account thereof; of preparing books and periodicals for binding; of preparing monthly reports; of entering records, sheets, books, etc., in the daily register and in the personal account books; which duties, with many others, he has performed in a faithful, intelligent, and satisfactory manner.

Mr. John Dale was employed the whole year as writer. He did all the typewriting, and had charge of cataloguing the books and arranging them on the shelves; of the maps and charts on fourth floor of fireproof, and answered calls for the same. Mr. Dale also assisted in clerical work, and in answering calls for books and records. He performed all his duties efficiently and faithfully, and I regret to have to state that he intends to sever his connection with the Survey in a few months. I desire here to express my hearty commendation of the valuable services of both Mr. Martin and Mr. Dale. The success with which I have been enabled to conduct this division is due in a great measure to their experience in the work, their faithfulness, efficiency, and cheerful readiness on all occasions.

Mr. John F. Renfro was appointed and assigned to this division August 21, 1894. On November 17 of the same year he was transferred to the superintendent's office.

Mr. Preston Boisseau was transferred to this division from the chart division April 29, 1895, but was transferred back to the chart division June 7, 1895.

Mr. William H. Butler was assigned to this division as messenger September 1, 1894, and was on duty the rest of the fiscal year. He has made himself particularly useful in many ways, and I desire to express my appreciation of his valuable services.

Respectfully, yours,

H. SIDNEY KING,
Chief of Library and Archives Division.

Mr. ANDREW BRAID,
Assistant in Charge of Office.

OFFICE REPORT NO. 2—1895.

REPORT OF THE HYDROGRAPHIC INSPECTOR FOR THE FISCAL YEAR 1895.

UNITED STATES COAST AND GEODETIC SURVEY,
OFFICE OF THE HYDROGRAPHIC INSPECTOR,
Washington, D. C., June 30, 1895.

SIR: I beg leave to submit the following report for the fiscal year ending June 30, 1895, of the operations of the hydrographic parties under this office, including the movements of the vessels of the Survey and the necessary repairs, and a reference to the work performed by the Hydrographic Division and Coast Pilot party. I also append report from the chief of the last-mentioned division and party, together with a tabulated synopsis of the field work and a roster of officers of the Navy who have been connected with the Survey during the fiscal year.

HYDROGRAPHY—ATLANTIC COAST.

At the beginning of the fiscal year the schooner *Eagre* and party under the charge of Lieut. William F. Low, U. S. N., Assistant, was actively engaged in finishing the special examinations in and about Boston Harbor, mention of which was made in my last annual report. The work was completed on July 25, 1894, and the party transferred to Salem, where a resurvey of the harbor and its approaches was immediately commenced.

The hydrography of Salem Harbor is of the most complicated character, and credit is due to Lieutenant Low and his party for the thoroughness with which the work was carried out. The sounding lines were run with exceeding care, and are close enough to answer all present and future requirements. The soundings on the lines of intersection cross perfectly, which is due largely to the excellent tidal data observed by the party. The plane of reference obtained from the day and night observations of one lunar month agreed when checked by the day tides of two lunar months, within 0.06 of a foot. By comparative observations it was found that high and low water occurred at Bakers Island and Salem at the same time, and that the rise and fall was also the same.

The hydrography of this survey—the first resurvey since the original work of 1850–51—differs materially, on account of the closer developments, from what we now publish on our charts, and I would suggest that it be utilized on our publications as soon as possible. The work of this party was finished on December 8, 1894.

The *Eagre* was moved to Gloucester on October 9, and the resurvey of that harbor commenced and finished October 23, when the Salem work was resumed. The hydrography of Gloucester Harbor, though not of the same complex character as that of Salem, was executed with great care, and the results are very satisfactory.

On December 8 the *Eagre* returned to the Boston Navy-Yard to refit, repair, overhaul the launches, and complete the office work. On January 14, under orders from the Navy Department, Lieutenant Low was relieved from duty on the Survey, having completed a successful tour of duty of three years and five months on this work, and ordered to duty at the Navy-Yard, Boston, Mass. I desire in this connection to express my appreciation of the work executed by Lieutenant Low on board the *Eagre*. He exhibited great skill in carrying out the details, was exact in his methods, and his records reflect credit not only upon himself and his party but upon the general service.

Lieut. C. S. Ripley, U. S. N., after the detachment of Lieutenant Low, remained in charge of the *Eagre* until February 7, when Lieut. G. C. Hanus, U. S. N., who had been detailed by the Navy Department for duty on the Survey, by your direction assumed command of the vessel.

Lieutenant Hanus has entered upon his third tour of duty on the Survey, and from his previous admirable record on this work we have reason to congratulate ourselves in obtaining an officer who carries so excellent a reputation as a hydrographer.

After extensive repairs to the *Eagre* and steam launches, in obedience to your instructions to proceed to Buzzards Bay and commence the resurvey of New Bedford Harbor and approaches, the *Eagre* sailed from Boston May 17 and arrived at New Bedford May 20. The next day the party began the resurvey by building and determining signals, establishing tide gauges, etc. On the 31st of May the party, having built and determined 58 signals and natural objects, commenced sounding with launches 22 and 23. At the end of the fiscal year 341 miles of sounding lines had been located.

Pursuant to instructions to survey the waters of the north shore of Boston Bay from Lynn to Marblehead, the steamer *Bache*, under the command of Lieut. R. G. Peck, U. S. N., Assistant, left the New York Navy-Yard on July 10, 1894, arriving at Boston the next day. After completing final preparations, work was commenced July 16 and was prosecuted until November 12, when the season was brought to a close on account of inclemency of the weather and difficulty in continuing the outside work.

Until August 21 the party was employed in special developments of the survey of 1892, including that portion of Boston Bay extending from Cohasset to Scituate, and the waters of Broad Sound. These examinations were conducted with marked success; several original discoveries of sunken rocks were made, and as they seriously affected navigation, special reports were at once made to the office.

On August 22 work was commenced on sheet No. 1, scale 1-5 000, comprising Lynn Harbor, the Saugus River, and Chelsea Creek. The ground was covered by a rectangular system of lines 80 metres apart, and this distance was reduced in the channels for the east and west lines to 40 metres. Lieutenant Peck took special pains in obtaining the plane of reference. The zero of the gauge was connected with the bench mark at the Boston Navy-Yard by careful simultaneous observations. An intermediate gauge was established at Point Shirley, but found unnecessary; connection was therefore made directly with the navy-yard. In the tide reduction for the Saugus River and Chelsea Creek, a time correction was used for every quarter-mile zone into which the working ground was divided. The results from this survey are especially gratifying, as the office has not before possessed sufficient data to publish a reliable chart of Lynn Harbor.

On September 20 sheet No. 2, scale 1-10 000, covering the coast from Nahant to Cat Island, including the harbor of Marblehead, was taken up and prosecuted until November 6, when the general development of the sheet was finished. The ground was covered by a rectangular system of lines, in general 100 metres apart for the launch work and 150 metres for the ship. In Marblehead Harbor the lines were 50 metres apart, and in the Marblehead Channel the intervals between the north and south lines were 75 metres. The special developments, of which a large number will be required, were necessarily deferred until another season. Two tide gauges were established, one at Nahant and the other at Cat Island, and both gauges were connected with the gauge established by Lieutenant Low at Salem. This survey, as far as completed, differs from the survey of 1854 on account of the more detailed character of the latter.

A special examination of Tinkers Ledge having been ordered, Lieutenant Peck made a careful investigation by sounding and dragging, and developed a least depth of $5\frac{1}{2}$ fathoms where the chart shows $6\frac{1}{2}$ fathoms.

After completing some supplementary examinations of shoal spots in the approaches to Boston Harbor, the steamer *Bache* left Boston for Gloucester, N. J., November 15, and arrived at that place November 20. A new steam whaleboat was received, and the *Bache* returned to New York, arriving November 23, 1894.

The *Bache*, having prepared for work on the west coast of Florida, left New York January 9, 1895, and arrived at Pensacola February 3. Brief stops were made at Hampton Roads, Virginia, Key West, Fla.; and Punta Rasa, Fla., for the purpose of transporting the schooner *Spy* to Pensacola, Fla., and at Tampa Bay to locate the Palatine Shoal.

There existed some doubt as to the correct location of Palatine Shoal, and Lieutenant Peck was specially directed to carefully determine its position. This he accomplished in a most satis-

factory manner, proving at the same time that the former position of the shoal was based on an error in the assumed position of Mullett triangulation station. Beyond question, the original Mullett triangulation station is now to seaward of the present shore line. Besides the exceedingly careful determination of all necessary points in the prosecution of this work, the *Bache* located the quarantine station and wharves, house on north end of Anna Maria Key, pilot lookout station, Egmont Key, isolated house on south end of same key, the new beacon in north and south channels, the entrance and quarantine buoys, all of which were at once inserted in the charts affected.

For the prosecution of the hydrography of Pensacola Bay, four projections were sent to Lieutenant Peck, two of which covered East Bay, one that part of Pensacola Bay extending from the city to East Bay, and the remaining one the bar and entrance of Pensacola Bay. All of the work thus assigned was completed, with the exception of the entrance sheet, which was not begun owing to the lateness of the season. This sheet is now all that remains to complete the resurvey of Pensacola Bay and adjacent waters.

In laying out the work it was believed that the best results would be obtained by lines giving right-angled intersections, and that a distance of 175 metres would be quite close enough to insure good work, due regard being paid to the fact that in work of this character it is safer to err on the side of fullness. Particular attention was paid to the investigation and relocating of all shoal soundings handed down from former surveys. The plane of reference was obtained by two months' continuous day and night tidal observations.

The *Bache* closed work May 11, and left Pensacola the same day for Charlotte Harbor, Florida, to search for a shoal reported off the entrance by the British steamer *Beaconsfield*, to examine the bar and locate a 16-foot shoal reported in the channel, and to determine the position of Gasparilla Island light-house.

After a most thorough search the *Bache* was unable to find any trace of the shoal, and it is the commanding officer's opinion that it does not exist. The party located the light-house and fully developed Boca Grande Channel. The present depth on the bar is $3\frac{1}{2}$ fathoms. In addition to the work assigned, a number of landmarks useful to the navigator were determined.

On May 17 the steamer *Bache* continued to Key West and thence to New York, where she arrived on May 25, 1895. She is now being prepared for work on the New England coast.

In compliance with the instructions from the office, the steamer *Blake* and party, under the charge of Lieut. G. W. Mentz, U. S. N., Assistant, arrived at Hyannis, Mass., August 3, 1894, and immediately began the preliminary work for the survey of the middle part of Nantucket Sound between Hyannis and Great Point, Nantucket.

Sounding commenced on August 7, and continued during suitable weather until December 1, when the work was closed.

Lines were all run by the vessel in a general north and south direction 300 metres apart, intersected at right angles by a similar system.

Tidal observations for full lunar months were made at Hyannis and Monomoy Island, as well as comparative observations at the two points.

The *Blake* was also instructed to make special examinations for certain rocks and shoals, and to supply additional developments in various localities from Hyannis to Falmouth. This work was prosecuted at every possible opportunity, and a large part of it was finished.

The work was located in an exposed position and the party was much delayed by unfavorable conditions. As a rule the points of observation were distant, and it was rarely clear enough to reflect them readily, except during windy weather, when the sea was too rough for either ship or boat. Although every advantage was taken to carry on the work, it was not finished, and the party was obliged to close work on account of the severity of the weather.

After leaving Nantucket Sound, the *Blake* proceeded to Narragansett Bay and made an examination in the approaches to Wickford Harbor, R. I., for a rock upon which the steamer *General* struck. The rock was found and located. The light-house on the north end of Conanicut Island was also located. The *Blake* then proceeded to Philadelphia, and after receiving on board a steam launch, she returned to New York, arriving December 14.

As there was no appropriation available under which the vessel could be employed, and as it

was necessary to make some extensive repairs to her hull and machinery, it was decided to place her under repairs. At the close of the fiscal year the *Blake* was still under repairs, of which mention will be made under that head.

The steamer *Endeavor* and its party continued under the charge of Lieut. L. M. Garrett, U. S. N., Assistant.

Early in July the vessel left Baltimore for the mouth of the York River to make a survey of the reported extension of York Spit Shoal. A careful and close development of the locality failed to show any indication of a shoaling. At the same time Lieutenant Garrett determined the position of the light-houses at Tue Marshes and on Wolf Trap Spit.

From Chesapeake Bay the *Endeavor* proceeded to Buzzards Bay and located a number of rocks in the entrance to Cataumet Harbor, off Monument Beach, and off Mishaum. Ribbon Reef was also newly developed.

A shoal having been reported on the west side of Hog Island, Narragansett Bay, and additional hydrography being needed in Potters Cove, the northern part of Sakonet River, and what is known as "The Cove," the *Endeavor* was directed to carry out this work. The shoal, with 15 feet of water on it, was found, and the deficiencies named were supplied; after which the *Endeavor* proceeded to execute the principal part of her summer's work. This consisted in the determination of a large number of rocks and the development of many special features in the hydrography along the north shore of Long Island Sound from Fishers Island to Throgs Neck. This work was carried on with all possible speed and was brought to a satisfactory conclusion early in November, 1894.

While engaged in Long Island Sound, the *Endeavor* assisted in the establishment of the range signals for the naval trial course between Cornfield Point and Stratford Shoal. The red sector of the light-house on Execution Rocks was also located.

Pursuant to your instructions the *Endeavor's* party then proceeded to Delaware Bay to make a resurvey of the Breakwater anchorage. This survey, executed between November 20 and 26, shows a general shoaling of about 2 feet from the condition as shown by the survey of 1883. Lieutenant Garrett reports that the gap between the Breakwater and the ice breaker has been filled, and presents an appearance similar to the Breakwater itself, except that it is lower. It is all above the surface at low water, and only a few portions are covered at high water.

After locating the light-ships off Delaware Bay entrance, the *Endeavor* returned to Baltimore to prepare for work on the Southern coast. She left Baltimore January 12, 1895, for Charleston, S. C., to make a resurvey of Charleston Harbor and approaches. The work was begun January 24, 1895, and completed on May 11, little having been accomplished before the 1st of March, however, on account of the severe winter weather.

The work of the resurvey commenced at the point on the Ashley and Cooper rivers reached by the steamer *Bache's* survey of the preceding year, and continued seaward through the old main channel, omitting such portions as had been recently surveyed by the Corps of Engineers, U. S. A.

With the exception of some alongshore work and special development lines, for which a pulling boat was used, the entire inside work was done in the new 22-foot oil-burning launch No. 30; the outside sounding lines were of necessity located in the steamer.

The recent triangulation left little to be desired in the way of signals, and necessitated the building of very few. Through the courtesy of Captain Abbott, Corps of Engineers, U. S. A., Lieutenant Garrett had a tracing made of the unfinished topographic sheet, which covered the greater part of the desired locality. The low and marshy banks of the Cooper and Ashley rivers present such an indeterminate high-water mark that the ends of sounding lines define the shore line fully as well as any other means. "The fact is," reports Lieutenant Garrett, "that there is no high-water line. The whole extent of these banks is overflowed at high tide, and the irregular ragged line of marsh grass is the only visible line of demarkation." The city front, wharves, etc., of Charleston, on the engineer's drawing were surveyed before the heavy gales of two years ago. To bring this water front up to date as far as possible sextant positions and measurements, as well as soundings, were taken along the entire front. The shore line of Morris Island has changed very materially from the old survey, due, no doubt, to the harbor improvements.

The plane of reference used for the reduction of soundings is that obtained from a long series

of observations by the Corps of Engineers, U. S. A., from the Coast and Geodetic Survey gauge at Fort Sumter. Comparison gauges were erected at different points, and whenever it was possible the soundings were reduced directly from the gauge nearest the line. In other cases a time correction was applied, and reduction was made from the Sumter gauge.

The system of lines adopted on the inner work is that of right-angle intersection 125 metres apart. Splits were introduced where it seemed desirable, and special examinations where the chart showed shoal spots in or near any channel or fairway. The *Endeavor* made this part of the work so complete that it will be many years before another resurvey of the harbor will be necessary, if the conditions are at all stable.

The work in the old main channel was not intended for a resurvey, as that channel is continually changing, and is now practically abandoned for the jetty channel; it was simply desired to cover the ground sufficiently well to correct the charts of the locality.

Having successfully finished the work assigned, the *Endeavor* returned to Baltimore, arriving at that port May 16, 1895, and commenced to refit for the summer's work.

Hydrographic work was also executed by Assistant H. L. Marindin off the north shore of Nantucket and Marthas Vineyard, Mass.

PACIFIC COAST.

As noted in my last annual report, the steamer *Patterson*, Lieut. Commander W. I. Moore, U. S. N., Assistant commanding, arrived on the working ground on May 27, 1894, and at once began work at the north end of Chatham Strait, southeastern Alaska.

The work performed during the season of 1894 includes Chatham Strait, from Point Augusta southward to Point Samuel, west end of Kenasnoo Island, a distance of 31 miles; Tenaku Passage; Freshwater Bay, and Killisnoo Harbor. The coast on both sides of the strait is bold and rocky; the surrounding country is covered with a dense growth of pine and cedar to the high-water mark. The precipitous character of the coast made the building of signals very difficult, and the measurement of base lines by the ordinary methods almost impossible.

The work was interrupted on August 2, the *Patterson* leaving the working ground for Yakutat and Lituya bays on that day for the purpose of transporting the shore parties. During the absence of the *Patterson* the topographical party was kept in the field and continued the work until her return on August 14, on which date the season's work came to an abrupt ending on account of the necessity of transporting the parties of the Alaska boundary survey south.

The season's work includes the measurement of a primary base 1 950·567 metres long; the establishment of two latitude stations, two longitude stations, and two azimuth stations; the erection of 276 signals; 385 square miles of topography, and 320 square miles of hydrography. The results have been mapped on one sheet showing the triangulation, four sheets showing the topography, and five sheets showing the hydrography of the localities covered.

The *Patterson* returned to San Francisco September 7, 1894, where the party was engaged in office work during the winter.

On March 15, 1895, Lieut. Commander E. K. Moore, U. S. N., Assistant, relieved Lieut. Commander W. I. Moore, U. S. N., of the command of the *Patterson*, and prepared the vessel and party under his charge for the next season's work.

The *Patterson* left San Francisco on April 11, 1895, having on board the boundary party under the charge of Assistant E. F. Dickins, stopped at Tacoma, Wash., to take on board Assistant P. A. Welker and party, and proceeded to southeastern Alaska. After landing Mr. Welker and party at the head of Portland Canal, and Mr. Dickins and party at Mary Island, the vessel sailed for her working ground, Chatham Strait, arriving May 11, 1895. On her passage Lieutenant-Commander Moore made a preliminary location of Topeka Rock, north entrance of Wrangell Strait.

The work assigned the *Patterson* includes a continuation of the surveys of Chatham Strait, the eastern part of Peril Strait, Hoonyah Sound, and Kootznahoo Inlet. The survey was commenced May 13, and vigorously prosecuted to the end of the fiscal year, a large amount of work having been accomplished in spite of rather unfavorable weather, and it is hoped that with fair conditions the task assigned the *Patterson* will be successfully finished.

The present commanding officer of the *Patterson*, Lieut. Commander E. K. Moore, U. S. N.,

comes to the Survey well equipped for this work, having previously served a tour of four years on board the *McArthur*, from December 15, 1876, to November 1, 1880, and during the time made an enviable reputation in this office. With a party as well equipped and organized as that of the *Patterson* the results in the field, I am sure, will be very gratifying.

The steamer *Hassler*, under the command of Lieut. G. B. Harber, U. S. N., Assistant, was engaged after June 30, 1894, in carrying chronometer comparisons between observatories at Pyramid Harbor and Sitka, Alaska. Seven and one-half round trips were made in this service throughout the season. During and between the runs the party was employed in determining the topographical features that had been omitted on certain of our Alaska charts, and which, it was thought, might be of service to the mariner. This was accomplished in a highly satisfactory manner, and credit is due to Lieutenant Harber and his party for the care and skill exhibited in the execution of this work. At the end of the season the area covered measured 1 040 square miles, which practically completes the topography within the limits of chart 8300.

Lieutenant Harber also made numerous corrections in the Alaska Coast Pilot, and submitted notes for the correction of charts 8200 and 8300.

The *Hassler*, after giving transportation to a number of boundary parties, returned to Puget Sound in company with the *Patterson*, arriving at Tacoma, Wash., September 5, 1894.

While at Tacoma, Lieutenant Harber was instructed to make a survey off the water front of the city of Tacoma, near the scene of the landslide which occurred in November last, to determine the effect upon the bottom of the bay in that locality. The survey was commenced February 9 and ended February 23, 1895. The lines were carried offshore until the soundings indicated that the limits of that portion of the bay which has undergone a change had been reached.

By direction of the Navy Department Lieutenant Harber was relieved from duty on the Coast and Geodetic Survey on April 11, 1895, and Lieut. A. C. Almy, U. S. N., Assistant, was directed to assume charge of the *Hassler*.

Lieutenant Harber served a full tour of three years on the Survey, and I desire to testify to his ability as a commanding officer, and his zeal and intelligence as chief of party. His command was always in good condition and ready for service, and the work intrusted to his care was performed with intelligence and good judgment.

The steamer *McArthur*, Lieut. F. H. Crosby, U. S. N., Assistant commanding, was, at the close of the fiscal year 1894, actively engaged in surveying the hydrography of the coast of Washington between Grays Harbor and James Island. This stretch of coast is without exception the most difficult and dangerous on the Pacific Coast.

As stated in my report of last year, the progress of the party's work at the close of the fiscal year exceeded my highest expectations, 886 miles of sounding lines having been executed.

The month of July was, considering the locality, favorable for sounding work, and ten days could be utilized in this way. From August 1 to November 7, when the vessel sailed for San Francisco, only three other days could be made use of for that purpose. This is believed to represent the average conditions, notwithstanding that after October 7 the weather was unusually severe, and that the number of disasters to shipping was unprecedented.

The finished work of the season extends from James Island southward to Promontory Point, $1\frac{1}{2}$ miles south of Raft River, and offshore to a distance ranging from 20 to 25 miles.

Between James Island and Destruction Island (which is about halfway between the above points), for an average distance from the shore of about $1\frac{1}{2}$ miles, there are innumerable rocks and reefs. The shore line south of Destruction Island differs in character from that to the north in presenting a lower appearance, the bluffs being of clay or sand in lieu of rocks, while there are very few outlying dangers.

The complications and difficulties in the execution of the hydrography were many, but it is my opinion that no closer or better work has been done along the open coast of the North Pacific Ocean.

The inshore work was most thoroughly developed, so that all curves of equal depth could be drawn with certainty—including the 6, 12, and 18 foot curves—perhaps the only instance of that kind along the coast. The lines from about 12 fathoms out to 50 fathoms were run a mile apart, and from these to beyond the 100-fathom curve, 2 miles apart.

The work of the season was practically closed when, on the morning of August 18, one of the

whaleboats of the vessel, in attempting to land near Jo Creek, in order to complete the building of a signal, was capsized in the surf with most distressing loss of life. The following extracts from the report of Ensign C. P. Eaton, U. S. N., dated on board the *McArthur* at Ocosta, Grays Harbor, Washington, will convey the details of the accident:

It is my painful duty to report the death by drowning of Lieut. F. H. Crosby, Quartermaster (third class) John Freyer, and Seamen William Nehm, Alexander Smith, and Jens Gudmundsen, while attempting to land through the surf near Jo Creek, about 17 miles north of Grays Harbor, on the west coast of Washington, about 8 a. m. Saturday, August 18.

The *McArthur* anchored about a mile and a half offshore at this point Friday afternoon. That afternoon Lieutenant Crosby, the commanding officer, with nine men, landed through the surf and commenced to erect a hydrographic signal. At this time the sea was smooth, with hardly any swell. Saturday morning there was a dense fog and long swell. Lieutenant Crosby left the ship with nine men in the whaleboat at 7:20 to complete the signal. When outside the surf he directed the men to take off their shoes and heavy clothing, cast off the trailing lines of the oars, unship the rudder and steer with an oar. He cautioned them that a boat might go through the surf ninety-nine times and be capsized on the hundredth. He then cautioned them, if upset, to get hold of life-preservers or oars, dive under the breakers and come up between them to breathe, and make for the beach. They then pulled a few strokes toward the beach when a big breaker caught the boat and swung her to starboard nearly broadside to surf. Before they could turn the boat another breaker caught her and capsized her. After a hard struggle, five men—Erik Carlson, quartermaster (second class); Seamen Jan Rask, Charles Hagerstrom, and U. Becker, and First-Class Fireman O. Danielson succeeded in getting ashore, most of them in a dazed, exhausted condition. They were cared for by the settlers along the beach. As soon as sufficiently revived they and a number of settlers patrolled the beach, searching for the others. The whaleboat was washed ashore about 1 mile below where most of the survivors landed.

There are white settlers every mile or so along the beach, and both white men and Indians are constantly traveling back and forth, but the fog was so thick that morning that one could see only 40 or 50 yards, and the settlers first knew of the accident by the survivors of the whaleboat going to their houses. About 11 a. m. the fog began to clear; I had a lookout kept from the ship and watched constantly myself with the glasses for the captain and party. I saw no signs of them at work on the signal, and feared an accident had happened, especially as the surf was very heavy. I ran in as close to the shore with the ship as was safe, and after a while saw a man waving a tablecloth as a signal. Knowing that I could do nothing from outside with the ship or boats, I ran inside Grays Harbor and anchored near Damons Point. On the way down I kept a careful lookout for any signs of the party, knowing that there was a strong inshore current to the southward. I felt that nothing could be done by us under the circumstances, however, as such a long time (three hours) had elapsed since the whaleboat must have entered the surf. Immediately upon arrival at Damons Point I secured a team and drove up the beach to the scene of the disaster, and found that five men had reached the beach in safety. They patrolled the beach until 2 p. m., then returned to the ship. The settlers patrolled the beach that day until dark, and all the next day. They did all in their power to render assistance. The whaleboat, oars, etc., were washed ashore, but no bodies have been found up to this time.

I gathered the tools, gear, etc., they had ashore and engaged a wagon to bring the whaleboat down to the Oyehut where I can get it, and, knowing I could do no further good, started back for the ship. On the way down, our team ran away while crossing a bridge over swampy land, and Roscoe, the apothecary, the driver, and myself were thrown out. Roscoe had a bad hole made in front of his left leg above the ankle, reaching to the bone, and from his complaints I feared he had suffered internal injuries also. I got another team, and as soon as we got back to the ship came to Ocosta. Fortunately, the doctor says Roscoe's injuries are not serious. The hole in his leg will lay him up for several weeks, probably.

I escaped with a sprained hand and leg and bruised head, and will probably be all right in three or four days. A little steamer makes daily trips to the Oyehut from Ocosta, and the settlers along the beach will keep me informed as to whether any bodies are found. I expect to go to the Oyehut after the whaleboat in a few days, if able, or will have it and the gear brought over by the steamer. I directed that they be left in the care of the storekeeper at the Oyehut.

From the accounts of the settlers the bodies may be washed ashore in from three to ten days, or not at all.

A statement of each one of the survivors accompanies letter No. 1698 on file in this office. These statements give practically the same account of the disaster, with the addition of individual experience. The log book also gives a brief account, with a journal of the occurrences from day to day. All of the bodies except that of Seaman Smith, were recovered and interred by the crew of the *McArthur*. Over each grave was erected a cairn and suitable headboards bearing the name, rate, vessel, cause of death, and date. The location of each grave, with full details, will be found with letter No. 1873 of 1894 on file in this office.

The thanks of the office for the generous service of the people along shore, native and white, were conveyed to them by the commanding officer of the *McArthur*.

As it was a wish frequently expressed by Lieutenant Crosby, that his body should lie where life departed, and as his wife, Mrs. Julia H. H. Crosby, coincided with these views, his body was

interred where washed up by the sea, and 30 yards north of Wreck Creek, 20 yards above high-water mark, and next north to that of Seaman Gudmundsen.

The disaster to the whaleboat of the *McArthur* was the worst the Survey has suffered since the loss of Lieut. G. M. Bache, U. S. N., and ten of his crew of the brig *Washington* off Hatteras in the hurricane of September 8, 1846.

Lieutenant Crosby deserves more than a passing notice. He first entered the Survey in November, 1882, and served as executive officer of the *Blake* until March 25, 1884, when he volunteered for the Greely Relief Expedition and went to the Arctic as the executive of the *Bear*. Upon the return of the *Bear*, he was again detailed for Coast Survey service and reported on board the *Blake* October 6, 1884, and on November 28, 1884, he took command of the *Gedney* and remained in charge of that vessel until his detachment by the Navy Department, September 14, 1888. His successful career as a chief of party induced this office to again seek his services, and on June 10, 1893, he reported for duty, and on the 20th of the same month assumed command of the *McArthur* at San Francisco and continued in command of that vessel until his death. His name will always be associated with the surveys of Passamaquoddy and Cobscook bays, St. Croix River, Maine, Long Island Sound, Delaware Bay, and the coast and harbors of Louisiana, and the seacoast of Washington, where he perished in exposing himself to the danger he labored to diminish for others.

In a personal letter to me, written several months prior to his death, he spoke of the dangerous coast on which he was employed, and remarked that he would probably make most of his landings in person, particularly where there was any danger, as he considered it the duty of the commanding officer to personally conduct the most perilous work.

The circumstances surrounding his death bear witness to his value as an officer, and my words can give but feeble praise. His energy, skill, prudence, and discretion made his service particularly valuable to the Survey, and his loss is deeply deplored, not only by this office but by the naval service, of which he was an honorable member. His records speak for themselves in the archives, and I can only add that he perished in the able and faithful performance of his duties.

The names of the brave and faithful seamen who lost their lives with him will be recorded and remembered with gratitude and praise.

Lieut. James H. Sears, U. S. N., Assistant, in accordance with your instructions, assumed command of the *McArthur* September 3, 1894. He makes special acknowledgment to Ensign C. P. Eaton, U. S. N., executive officer under Lieutenant Crosby, for assistance given in the preparation of the descriptive report relating to the season's work.

The *McArthur* left Grays Harbor on November 7 for San Francisco, arriving November 11, 1894.

In accordance with instructions, Lieutenant Sears prepared the vessel and party under his charge for the resurvey of San Francisco Bay and approaches. It is desired to make a very complete resurvey of this important harbor, so it may answer all present and future requirements. The lines of soundings will be located about 125 metres apart, upon the rectangular system, with such special development of rocks, shoals, and wharf lines as may be required.

Lieutenant Sears has been engaged in the work since February 1, 1895. The projection covering the Golden Gate and Bonita Channel is practically finished; the projection covering the bay from San Francisco and Alcatraz Island to Oakland and West Berkeley is nearly finished, and the projection lying to the northward of the last-named sheet, is now well under way. The work completed by the party at this time (June 30, 1895) represents 25 square miles (geographical) in area, and 903 nautical miles of sounding lines.

During the working season, from July 1 to October 18, 1894, the party in the steamer *Gedney*, Lieut. Lucian Flynne, U. S. N., Assistant commanding, was engaged with Assistant J. J. Gilbert in the triangulation, topography, and hydrography of Washington Sound, Washington, in the vicinity of San Juan, Orcas, and Stuart islands, and in a more thorough development of the eastern part of the Strait of Juan de Fuca. As will be noted, the hydrography during the season extends over a large area, and covers in the aggregate 475 square geographical miles.

The locality of the work in the Strait of Juan de Fuca extended from Whidby Island to the westward of Port Angeles. It also included developments of Hein Bank, *McArthur* Bank, Smiths Island, and the bank between Partridge Bank and Middle Bank.

The floating commerce of Puget Sound passes through these waters, and Lieutenant Flynne

reports that it is now considerable and growing in importance. Steamships run regularly between Tacoma and San Francisco; Tacoma and China, also Vancouver to China; and several lines of steamers in local waters, besides numerous sailing vessels to all parts.

The hydrography of Washington Sound is new work, and it is chiefly confined to the waters of San Juan Channel, north of Turn Island, and the passages connecting this channel with the Canal de Haro. Within these limits are a number of important harbors. There is a triweekly steamer carrying mail, passengers, and freight between Seattle and the settlements on the islands of Washington Sound.

Lieutenant Flynne and his party deserve particular mention for the large amount of work accomplished and for the excellent manner in which every detail has been carried out.

Upon conclusion of the season's work, and after making certain repairs, the steamer *Godney* and party proceeded to San Francisco to refit the vessel and prepare the party for the resurvey of that harbor. Actual hydrographic work began on March 29, 1895, and continued until the end of the fiscal year, whenever favorable conditions permitted. The general idea of this resurvey I have alluded to under the *McArthur's* work. The *Godney*, on June 30, had closely developed 10 square geographical miles, covering that part of San Francisco Bay from Alcatraz Island to Fort Point, including Richardsons Bay and Raccoon Strait.

Assistant J. J. Gilbert, assisted by the party on board the *Hassler*, made a topographic and hydrographic survey of part of the Puget Sound Naval Station and the dock front during April and May, 1895, for the Navy Department.

Statement of hydrographic surveys executed during the fiscal year ending June 30, 1895.

Parties.		Localities.	Surveyed by—	No. of sheets.	Scale.	Number of—					Remarks.
Naval.	Civilian.					Vols.	Angles.	Soundings.	Miles.	Square miles.	
1		Gloucester Harbor, Massachusetts.	W. F. Low, U. S. N.	1	10 000	8	1 978	8 294	136	3	
1		Salem Harbor, Massachusetts.	do	1	10 000	25	8 761	48 886	595	14	
1		Entrance to Boston Harbor (additional work for sheet 2146).	do	1	10 000	6	2 147	6 902	88	1	
2		Boston Bay, north shore, from Nahant to Cat Island.	R. G. Peck, U. S. N.	1	10 000	17	3 726	29 831	638		Platted on sheets 2129, 2133, 2146.
2		Lynn Harbor, Massachusetts.	do	1	5 000	11	3 361	21 519	156	41	
2		Boston Harbor and approaches (additional work for 3 sheets).	do	1	10 000	13	4 305	12 111	137		
3		Nantucket Sound, middle part, Great Point to Hyannis.	G. W. Mentz, U. S. N.	1	40 000	11	3 063	25 795	623	58	
3		Approaches to Hyannis Harbor (additional work for sheet 1880).	do	1	20 000	11	3 214	17 450	194	15	
3		Wickford Harbor entrance, location of rock (additional for sheet 992).	do	1	10 000	1	32	112	1		Including locating Conant light-house.
1		North shore of Nantucket Island and Marthas Vineyard.	H. I. Mariudin.	2	10 000	9	5 930	22 780	253	12	
4		Buzzards Bay, location of rocks.	L. M. Garrett, U. S. N.	1	20 000	2	218	537	13		Platted on sheets 154, 160, 1802.
4		Narragansett Bay, location of shoal and additional hydrography.	do	1	20 000	1	91	1 826	22	2	Platted on sheet 792a.
4		Along north shore of Long Island Sound, additional hydrography.	do	1	10 000	20	6 186	24 350	328	10	Platted on sheets 1527, 1603 a b c, 1637a, 1638a, 1698, 1751, 1699, 1683, 1560a.
4		Delaware Breakwater anchorage.	do	1	20 000	2	363	4 128	69	3	Including locating of Delaware entrance light vessels.
4		Search for shoal off York Spit, Chesapeake Bay.	do	1	20 000	1	361	1 790	60	3	Including locating of Wolf Trap and Tue Marshes light-house.
5		Charleston Harbor and Main Channel, South Carolina.	do	2	1-10 000	25	8 302	41 031	625	37	
6		Boca Grande Channel, Charlotte Harbor, Florida, examination.	R. G. Peck, U. S. N.	1	40 000	2	266	2 301	44	2	
6		Palatine Shoal, entrance, to Tampa Bay.	do	1	20 000	2	110	586	3		Platted on sheet 1262.
6		Pensacola Bay and East Bay, Florida.	do	3	10 000	41	11 350	82 499	1 292	55	
7		San Francisco Bay, California.	Lucian Flynne, U. S. N.	1	10 000	7	6 585	12 383	375	10	
8		San Francisco Bay and approaches, California.	J. H. Sears, U. S. N.	2	10 000	27	15 185	55 450	903	25	

Statement of hydrographic surveys executed during the fiscal year ending June 30, 1895—Continued.

Parties.		Localities.	Surveyed by—	No. of sheets.	Scale.	Number of—					Remarks.
Naval.	Civilian.					Vols.	Angles.	Soundings.	Miles.	Square miles.	
9	Coast of Washington, Arch Rock, and James Island.	F. H. Crosby, U. S. N.	2	40 000	11	3 027	10 280	451	521	
10	East end Strait of Juan de Fuca.	Lucian Flynne, U. S. N.	2	40 000	4	3 006	1 634	571	415	
10	San Juan Channel and Canal de Haro.	.....do.....	4	10 000	10	7 235	10 032	662	66	
.....	Puget Sound Naval Station, hydrography in front of dry dock.	J. J. Gilbert.....	1	1 000	1	126	1 203	1	.....
11	Part of Tacoma Harbor, Washington.	G. B. Harber, U. S. N.	1	2 500	1	361	538	13	.....
11	Southeastern Alaska, chart 8300.	.....do.....	.....	.....	.....	.....	.....	.....	.....	411 square miles topographic reconnaissance.
12	Chatham Strait, north of Peril Strait, southeastern Alaska.	W. I. Moore, U. S. N.	4	Various.	3	2 322	3 796	474	163	
13	Chatham Strait, south of Peril Strait, southeastern Alaska.	H. K. Moore, U. S. N.	1	.....	3	2 500	4 000	500	150	Estimated.
13	1	Grand total for year ending June 30, 1895.....	.....	32	Various.	277	105 361	451 044	9 277	1 604	
14											

Naval Party No. 10 was primarily engaged in cooperating with Mr. Gilbert in the triangulation and topography of Washington Sound.

Naval Party No. 11 carried on topographic work during and between trips from Pyramid Harbor and Sitka carrying chronometers. Was also engaged in transporting United States and Canadian boundary survey parties.

Naval Parties Nos. 12 and 13 were part of the time engaged in transporting boundary survey parties.

Number of specimens of bottom, 33.

Current stations occupied by hydrographic parties, 27.

HYDROGRAPHIC DIVISION.

This division has continued in charge of Lieut. Walter McLean, U. S. N., Assistant, who has fully maintained the excellent reputation for efficiency held by this division. Under the able management of Lieutenant McLean the system of chart corrections established is in excellent working order, as attested by the high character of our chart issue.

I beg to ask your attention to the report of Lieutenant McLean, forwarded herewith, relating to the work of the division.

REPAIRS AND MAINTENANCE OF VESSELS.

ATLANTIC COAST.

The vessels of the Survey may be now classed as old, and while they have, with few exceptions, been in commission continuously, they are in fair condition, considering the limited appropriation available for repairs.

Bache.—During the summer of 1893 this vessel, as noted in my former report, received new motive power and extensive overhauling to her hull. That the money was well expended is proved by the expenditures necessary to this vessel during the year, which amounted to about \$100 for repairs to water-closets, launch's cradles, and a few minor items.

The new motive power has proven very satisfactory. The propeller, however, has not sufficient pitch for thorough efficiency, and a new one will be substituted during the next year, which I believe will give the vessel greater economy.

Blake.—This vessel was extensively overhauled, but there still remains some work to be done upon her to place her in good condition. The principal repairs made are as follows:

Cutwater renewed and stem scarfed; new coal bunker bulkheads and floors; new knightheads, port forward chock rail and cathead; new boiler keelsons, and repairs to main keelson; repairs to bottom metal; copper cable for lightning conductor; repairs to injection valve, heating radiators, air ports, galley, boiler cradles, auxiliary suction pipe, condenser, distiller, reeling engine, air pump, valve chest, sea valves, indicator gear, rock shaft, anchor engine, and steam-launch shaft. There were supplied a new crank shaft and brasses, crosshead brasses, crank-pin brasses, cross-

head guide; the eccentrics were turned up, the cylinder rebored, link motion and main and cut-off valves overhauled. There were supplied a new smokestack, Worthington feed pump, Macomb strainer, copper piping, fire-room floor plates, suction and discharge for circulating pump and discharge for bilge pump; the boilers were patched, and new cradles and davits for steam launch and new funnel were supplied. Besides these a number of minor repairs were made, at a total expense of nearly \$4 000. The apron of the vessel is badly decayed, and in the near future it must be replaced.

Eagre.—This vessel received quite an extensive overhauling, as very few repairs have been made for a number of years, and it became necessary to take some steps to prevent deterioration. The running rigging was almost entirely renewed and the standing rigging overhauled, a new bowsprit was supplied, and the spar deck sheathed and calked. The vessel was docked, new limber chains were rove off, and the vessel generally overhauled, at an expense for the year of nearly \$3 700. This included repairing the large launches Nos. 22, 23, and 25.

Endeavor.—Repairs were made on this vessel to the amount of \$880. The principal items were new crosshead, boat davits, forecandle deck, oil tanks, calking, patching metal, and minor repairs to hull, machinery, boiler, and galley.

PACIFIC COAST.

Gedney.—This vessel received during the year a new composition propeller and steel propeller shaft, a new main cylinder and piston, repairs to main valve gear, and minor repairs to boiler and engine. Other repairs were made to the heating system, steam winch, steam launch hoisting gear, deck house, water-closets, steering gear, bulwarks, and galley. The steam launch was thoroughly overhauled. The amount expended on this vessel under repairs was a little over \$1 850.

McArthur.—This vessel received repairs to the amount of \$3 446 during the year. She was calked and remetaled at the Fulton Iron Works at San Francisco, and partly refastened with 1 000 composition spikes. The propeller-shaft casing and stern bearing were renewed, and new piston rings and springs supplied; the spider and follower of piston of main engine were turned up; the cylinder of the circulating pump engine was rebored and new piston ring supplied; the go-ahead eccentric and strap were replaced; the main and crank shafts were lined up; new steam-launch cradle and adjusting davits were supplied, and repairs made to reversing gear, rocker shaft, air shaft and brasses, steam windlass, steering gear, and other minor repairs to hull, engine, boiler, and steam launch.

Patterson.—Nearly \$3 000 were expended on this vessel for repairs generally, as follows:

The vessel was docked at the Union Iron Works and the false keel removed; the starboard bilge keel and main keel repaired; the metal was patched where necessary; a new rudder post was supplied, and the rudder trunk and steering gear repaired; the shaft was disconnected, propeller and stern bearing renewed; pitch of screw changed from 13 to 12 feet; new bronze stern bearing was supplied and secured by Tobin bronze bolts; a large part of the upper deck was repaired and the whole covered with canvas and painted; a new main topmast and six new closets were supplied. The hull, boiler, machinery, and boats were generally overhauled.

The *Cosmos* was overhauled, deck calked, keel and bilge keel repaired, and metal patched where necessary.

Hassler.—Early in February you directed me to proceed to Puget Sound and examine the *Hassler* with reference to her further usefulness on the Survey. Under date of February 15, I reported to you the history of the vessel and her condition, and upon my recommendation you requested permission from the Department to sell her. The sale was properly advertised in all the principal ports of the Pacific Coast of the United States, and sealed bids for the purchase of the *Hassler* were invited. As the highest bid received was far below the appraised value, by direction of the Department the bid was rejected, the officers detached, crew discharged, and the vessel laid up at Port Orchard in charge of a shipkeeper. All the correspondence relating to the vessel is on file in this office.

Quick.—This vessel was almost entirely rebuilt by Mr. John Hoodless, at Milton, Fla., for \$2 750. The work was very well done. The vessel is now in excellent condition, and with ordinary care will be serviceable for many years.

The *Transit* was overhauled and is in good condition.

The *Spy* was towed from Punta Rasa, Fla., to Milton, Fla., where she will be overhauled during the next year.

The *Fuca* was supplied with a new boiler, and the hull and machinery placed into excellent condition.

Minor repairs were made to the *Tarry Not*.

After proper advertisement, a contract was made with William E. Woodall & Co. for rebuilding the schooner *Matchless*. At the end of the fiscal year work on that vessel was commenced.

Four oil-burning launches were purchased from Messrs. Clay & Torbensen, of Gloucester, N. J., and supplied to the *Blake*, *Bache*, *McArthur*, and *Endeavor*. These launches have given excellent satisfaction, and I feel quite sure have paid for themselves in a single season by the increased amount of work returned by the parties.

I beg to renew the recommendation made in my report last year in reference to current observations, the exploration of the Yukon, and the surveys of the Aleutian Islands. I desire to urge the necessity for asking Congress for an appropriation to build a vessel for the Aleutian Islands work. A vessel able to do this work will cost \$125 000.

Mr. J. E. Roeth has satisfactorily performed clerical duties under this office.

Very respectfully,

JEFF. F. MOSER,
Lieut. Commander, U. S. N.,
Hydrographic Inspector Coast and Geodetic Survey.

Gen. W. W. DUFFIELD,
Superintendent United States Coast and Geodetic Survey,
Washington, D. C.

REPORT OF THE HYDROGRAPHIC DIVISION FOR THE FISCAL YEAR ENDING JUNE 30, 1895.

UNITED STATES COAST AND GEODETIC SURVEY,
OFFICE OF THE HYDROGRAPHIC INSPECTOR,
Washington, D. C., July 1, 1895.

SIR: I have the honor to submit the following report of the work of the hydrographic division, under my charge, during the fiscal year ending June 30, 1895.

A few minor functions, not heretofore belonging to it, have devolved on this division during the year, but, in general, the nature and scope of its work have remained what they have been for years past, and but few changes in the method of its execution have been introduced.

Twenty-nine new original hydrographic sheets have been drawn and platted, and the results of extensive surveys have been platted on 24 old sheets. The work on these 53 original sheets has involved the study of 228 volumes of data and the platting of 77 697 angles and 361 172 soundings. Ninety reduced drawings of hydrography have been verified, revised, and corrected. The aids to navigation have been platted on, or the titles and notes, including light tables, have been supplied for 60 new charts; and 148 proofs of new issues of charts have been revised, verified, and corrected.

The work of the division has further included a vast amount of miscellaneous drafting; the investigation and disposal of constantly received information from all sources containing changes and corrections needed on the charts; the preparation of a complete set of sketches showing the progress of finished hydrographic work on the Pacific Coast, including Alaska; the preparation of schemes for new surveys and resurveys; the comparison of old and new surveys for the determination of needed special examinations; the preparation and supervision of the publication of the monthly Notices to Mariners; and a large amount of miscellaneous work, including information furnished other Departments of the Government, and private individuals. The general and routine correspondence of the division also involves a very considerable labor. For a detailed statement of the work performed by the division I beg to refer you to the monthly reports submitted during the year.

The work of the division has at all times been kept well in hand and up to date through the individual zeal and faithfulness of its employees.

The force employed in the division during the year has consisted of Messrs. W. C. Willenbucher, F. C. Donn, and F. W. Clay, draftsmen, and Mr. E. H. Wyvill, chart corrector. These gentlemen have been unremitting in their labors, and deserve every commendation.

As chief draftsman of the division, there devolves on Mr. Willenbucher very great and varied duties, all of which are performed with great promptness, accuracy, and ability. Both Mr. Donn and Mr. Clay have executed the work falling to them with most satisfactory efficiency and faithfulness. In March, 1895, room 74, occupied as a drafting room by Mr. Donn, was flooded, through the bursting of a water pipe overhead, and work then in hand so far injured as to make its reproduction necessary. Since that time Mr. Donn has been compelled to carry on his work in a very inconvenient and cramped space allotted him temporarily in the drawing division, and it has been much retarded in consequence.

I beg to renew my recommendation that the importance and variety of Mr. Wyvill's duties as draftsman and clerk in the office of the division, and the zeal and efficiency with which he performs them, justify his reclassification and advancement.

I desire to again call attention to the desirability of an arrangement whereby this division might promptly and without special request receive information concerning the progress of improvements making under the supervision of the Engineer Corps, United States Army.

Very respectfully,

Lieut. Commander JEFF. F. MOSER, U. S. N.,

Hydrographic Inspector, Coast and Geodetic Survey,

Washington, D. C.

WALTER MCLEAN,
Lieutenant U. S. N.,
Chief of Hydrographic Division.

REPORT OF THE COAST PILOT PARTY FOR THE FISCAL YEAR ENDING JUNE 30, 1895.

UNITED STATES COAST AND GEODETIC SURVEY,
Washington, D. C., June 30, 1895.

SIR: I have the honor to submit the following report of the work of the Coast Pilot party for the fiscal year ending June 30, 1895.

Under the general direction of the Superintendent, and the supervision of the hydrographic inspector, the duties of this party involve the execution of work in the field and work in the Office incidental thereto.

At the beginning of the fiscal year the party was engaged in the compilation of field data, obtained through various sources, for a Coast Pilot volume to be entitled, "United States Coast Pilot, Atlantic Coast, Part VII, from Chesapeake Bay Entrance to Key West." I can not speak too highly of the able assistance in procuring data for this volume that was rendered by the different hydrographic parties in the field, when no vessel was available for the especial purpose. The commanding officers of different revenue cutters stationed along the part of the coast covered by this volume also materially assisted in the collection of the information used in its compilation.

About November 15, 1894, the manuscript for United States Coast Pilot, Atlantic Coast, Part VII, was sent to the printer, and on April 27, 1895, the first proofs of a part of the volume were received from him. Since that date proof has been received at intervals up to June 30, 1895. At the rate the proof is being received the volume should be ready for issue about September 10, 1895.

After the manuscript for United States Coast Pilot, Part VII, had been sent to the printer, the party was engaged in the compilation of five supplements, embodying all corrections up to date, to the five Coast Pilot volumes already published, and which cover the Atlantic Coast of the United States from the St. Croix River to Cape Henry. In the preparation of these supplements data, procured by the party in the field in 1892 and 1893, was issued, together with later information procured by the party from various sources. Between November 17, 1894, and January 30, 1895, manuscript for the five supplements was sent to the printer. The first completed supplement was received from the printer on February 27, 1895, and the last on April 11, 1895.

Besides the preparation of manuscript for new Coast Pilot volumes or their supplements, and the reading of proof, the party has corrected to the date of issue Coast Pilot volumes issued from this office. This necessary and important work involves considerable labor, as the changes in aids to navigation and hydrography along the coast and in harbors are very frequent, and corrections to printed volumes accumulate very rapidly.

The routine work of the party, in keeping up to date detailed records of changes, reported dangers, hydrographic examinations, new information available, and other data which may be used in the compilation or correction of Coast Pilot volumes, is very considerable and constant.

The party was under my charge from the beginning of the fiscal year until September 22, 1894, when I was relieved by Lieut. Franklin Swift, United States Navy. Lieutenant Swift remained in charge until June 21, 1895, when he was detached from duty in the Coast and Geodetic Survey, and the charge of the party again devolved upon me.

Mr. John Ross, nautical expert of the party, has been employed the entire fiscal year in the collection of data, the compilation of manuscript, and the preparation for publication of Coast Pilot volumes and supplements. I beg to add to the testimony of my predecessors in charge of this party, my own acknowledgment of the value of Mr. Ross's services and hearty commendation of his zeal and ability.

Assisting Mr. Ross, Mr. Talbot Pulizzi, copyist, has been engaged during the fiscal year in copying manuscript and entering corrections in Coast Pilot volumes, and other routine matters necessary to the work of the party. These labors Mr. Pulizzi has performed to my entire satisfaction.

Very respectfully,

WALTER MCLEAN,
Lieutenant U. S. N.,
Assistant Coast and Geodetic Survey.

Lieut. Commander JEFF. F. MOSER, U. S. N.,
Hydrographic Inspector, Coast and Geodetic Survey,
Washington, D. C.

List of naval officers attached to the United States Coast and Geodetic Survey during the fiscal year ending June 30, 1895.

Name.	Date attached.	Date detached.	Remarks.
LIEUTENANT COMMANDERS.			
W. I. Moore.....	Nov. 10, 1891	Mar. 15, 1895	Still in service.
Jeff. F. Moser.....	Mar. 24, 1893	}	
	Reattached		
E. K. Moore.....	Oct. 30, 1893		Still in service.
	Jan. 18, 1895		
LIEUTENANTS.			
Giles B. Harber.....	Jan. 26, 1892	Apr. 11, 1895	Still in service.
W. F. Low.....	Aug. 1, 1891	Jan. 14, 1895	
Robert G. Peck.....	June 1, 1893		Drowned Aug. 18, 1894.
F. H. Crosby.....	June 20, 1893		
G. W. Mentz.....	July 9, 1892		Still in service.
G. C. Hanus.....	Feb. 7, 1895		Still in service.
Lucian Flynnne.....	June 6, 1892		Still in service.
J. A. Shearman.....	Jan. 8, 1894		Still in service.
James H. Sears.....	Mar. 31, 1894		Still in service.
Walter McLean.....	Aug. 21, 1893		Still in service.
W. S. Benson.....	Jan. 6, 1894		Still in service.
A. G. Rodgers.....	Nov. 15, 1894		Still in service.
A. C. Almy.....	Mar. 12, 1894		Still in service.
L. M. Garrett.....	July 3, 1893		Still in service.
LIEUTENANTS (JUNIOR GRADE).			
C. S. Ripley.....	May 17, 1892		Still in service.
E. H. Tillman.....	Jan. 4, 1895		Still in service.
R. F. Lopez.....	July 26, 1893		Still in service.
Franklin Swift.....	Sept. 22, 1894	June 21, 1895	
L. G. Clark.....	Sept. 15, 1891	Feb. 21, 1895	

List of naval officers attached to the United States Coast and Geodetic Survey during the fiscal year ending June 30, 1895—Continued.

Name.	Date attached.	Date detached.	Remarks.
LIEUTENANTS (JUNIOR GRADE)—cont'd.			
Hugh Rodman.....	Apr. 1, 1891	.....	Still in service.
J. J. Blandin.....	Oct. 21, 1893	.....	Still in service.
Chas. P. Eaton.....	June 23, 1891	Nov. 19, 1894	.....
W. B. Hoggatt.....	Jan. 17, 1894	.....	Still in service.
ENSIGNS.			
C. P. Plunkett.....	June 3, 1893	Dec. 13, 1894	.....
G. W. Kline.....	Apr. 26, 1892	May 28, 1895	.....
C. N. McCormick.....	Apr. 25, 1893	.....	Still in service.
G. Tarbox.....	Mar. 17, 1892	Mar. 6, 1895	.....
W. A. Edgar.....	Oct. 11, 1894	.....	Still in service.
J. W. Oman.....	July 13, 1891	Dec. 18, 1894	.....
H. K. Hines.....	Oct. 27, 1894	.....	Still in service.
N. A. McCully.....	Nov. 26, 1894	.....	Still in service.
W. S. Clarke.....	Feb. 20, 1893	.....	Resigned Oct. 17, 1894.
Andrew F. Long.....	Apr. 23, 1895	.....	Still in service.
C. Churchill.....	Feb. 18, 1895	.....	Still in service.
C. M. Stone.....	Feb. 20, 1895	.....	Still in service.
A. H. Davis.....	Jan. 7, 1895	.....	Still in service.
F. M. Russell.....	Jan. 7, 1895	.....	Still in service.
L. H. Chandler.....	June 18, 1893	Sept. 1, 1894	.....
H. K. Benham.....	Mar. 31, 1894	.....	Still in service.
F. B. Bassett.....	June 24, 1893	Aug. 1, 1894	.....
PASSED ASSISTANT SURGEONS.			
C. J. Decker.....	Apr. 1, 1892	Sept. 26, 1894	.....
Charles H. T. Lowndes.....	Dec. 1, 1892	May 12, 1895	.....
George H. Barber.....	July 10, 1893	.....	Still in service.
R. M. Kennedy.....	Sept. 26, 1894	.....	Still in service.
ASSISTANT SURGEONS.			
J. A. Guthrie.....	June 1, 1892	July 2, 1894	.....
B. R. Ward.....	July 2, 1894	.....	Still in service.
PASSED ASSISTANT PAYMASTERS.			
Livingston Hunt.....	May 3, 1893	Mar. 2, 1895	.....
John Q. Lovell.....	Mar. 2, 1895	.....	Still in service.
PASSED ASSISTANT ENGINEERS.			
K. McAlpine.....	July 4, 1892	.....	Still in service.
H. G. Leopold.....	Mar. 30, 1893	Mar. 29, 1895	.....
ASSISTANT ENGINEERS.			
Andrew McAllister.....	Jan. 18, 1894	.....	Still in service.
W. C. Herbert.....	Mar. 24, 1892	Apr. 25, 1895	.....
Stanford E. Moses.....	Apr. 10, 1895	.....	Still in service.

RECAPITULATION.

Lieutenant-commanders.....	3
Lieutenants.....	14
Lieutenants (junior grade).....	9
Ensigns.....	17
Passed assistant surgeons.....	4
Assistant surgeons.....	2
Passed assistant paymasters.....	2
Passed assistant engineers.....	2
Assistant engineers.....	3
Total.....	56

NOTE.—From the statement immediately following, it appears that of the 56 officers above named, 36 were on duty in the Survey at the close of the fiscal year.

List of naval officers attached to the United States Coast and Geodetic Survey June 30, 1895.

COAST AND GEODETIC SURVEY OFFICE.

Lieut. Commander Jeff. F. Moser, hydrographic inspector.

Lieut. Walter McLean, chief of hydrographic division.

P. A. Paymaster John Q. Lovell, in charge of Navy pay accounts.

Steamer Bache (Atlantic Coast).—Lieut. Robert G. Peck, commanding; Lieut. E. H. Tillman; Ensigns H. K. Hines, A. H. Davis, and F. M. Russell; P. A. Surg. George H. Barber; Asst. Engineer Andrew McAllister.

Steamer Blake (Atlantic Coast).—Lieut. G. W. Mentz, commanding; Lieuts. J. A. Shearman and W. S. Benson; Ensign Andrew F. Long; Asst. Surg. B. R. Ward; P. A. Engineer K. McAlpine.

Steamer Endeavor (Atlantic Coast).—Lieut. L. M. Garrett, commanding; Lieut. J. J. Blandin; Ensign C. M. McCormick.

Schooner Eagre (Atlantic Coast).—Lieut. G. C. Hanus, commanding; Lieut. C. S. Ripley; Ensign W. A. Edgar.

Steamer Patterson (Pacific Coast).—Lieut. Commander E. K. Moore, commanding; Lieuts. A. G. Rodgers, R. F. Lopez, Hugh Rodman, and W. B. Hoggatt; Ensign H. K. Benham; P. A. Surg. R. M. Kennedy; Asst. Engineer Stanford E. Moses.

Steamer McArthur (Pacific Coast).—Lieut. James H. Sears, commanding; Ensign N. A. McCully; Ensign C. Churchill.

Steamer Gedney (Pacific Coast).—Lieut. Lucian Flynne, commanding; Lieut. A. C. Almy; Ensign C. M. Stone.

Names of vessels, their tonnage, etc., in the service of the United States Coast and Geodetic Survey during the fiscal year ending June 30, 1895.

No.	Name of vessel.	Tonnage.	Complement of—	
			Officers.	Men.
1	Steamer Patterson	453	12	46
2	Steamer Hassler	319	10	34
3	Steamer Blake	235	10	38
4	Steamer Bache	182	10	38
5	Steamer Gedney	174	8	29
6	Steamer McArthur	130	7	30
7	Steamer Endeavor	86	7	24
8	Steamer Cosmos	25	3	7
1	Schooner Eagre	192	6	26
2	Schooner Earnest	80	5	18
3	Schooner Matchless		5	14
4	Schooner Quick	63	4	12
5	Schooner Transit	43	3	9
6	Schooner Spy	35	3	9

RECAPITULATION.

Steamers	8
Schooners	6
Total	14

OFFICE REPORT NO. 3—1895.

REPORT OF THE DISBURSING AGENT FOR THE FISCAL YEAR ENDING JUNE
30, 1895.

UNITED STATES COAST AND GEODETIC SURVEY,
OFFICE OF THE DISBURSING AGENT,
Washington, D. C., June 30, 1895.

SIR: I have the honor to submit the following report of the disbursing office for the fiscal year ending June 30, 1895:

The aggregate of advances to chiefs of field parties during the year was \$111 323.13. The total disbursements on adjusted accounts were \$407 295.83. The number of vouchers, bills, etc., adjusted and paid was 15 342. Additional statistics of the work accomplished will be found on file in this office.

The annual report of expenditures of the United States Coast and Geodetic Survey for the fiscal year ending June 30, 1894, was forwarded to the Honorable Secretary of the Treasury on February 16, 1895, for transmission to Congress. The report for the fiscal year just ended is being compiled and will be ready for transmission to Congress early in the coming calendar year.

The adjustment and settlement of the accounts of this Bureau during the year have been kept, as far as circumstances would permit, nearly up to date. I would also state that all accounts audited and paid in this office have been promptly forwarded to the Auditor for the Treasury Department for his action thereon, and his promptness in settling the same, and that too without the disallowance of a single cent during the entire fiscal year, has been a source of much gratification.

In this connection permit me to say that during the last fiscal year many difficult matters involving the expenditure of money under the law have been made easy of solution by reference, under the Dockery law, to the honorable Comptroller, who, by prompt decisions, has clearly indicated the action to be taken by this office.

The force of the office for the fiscal year has been as follows: Mr. N. G. Henry, clerk and cashier; Miss Ida M. Peck, typewriter and clerk; Mrs. Jennie H. Fitch, clerk.

Respectfully, yours,

R. J. GRIFFIN, *Disbursing Agent.*

Gen. W. W. DUFFIELD,

Superintendent United States Coast and Geodetic Survey,

Washington, D. C.

EXPENDITURES, COAST AND GEODETIC SURVEY, 1895.

UNITED STATES COAST AND GEODETIC SURVEY,
OFFICE OF THE DISBURSING AGENT,
Washington, D. C., January 1, 1896.

SIR: I have the honor to transmit herewith the report of this office, showing a correct exhibit of all expenditures for the United States Coast and Geodetic Survey, and the office of Standard Weights and Measures, for the fiscal year ending June 30, 1895, and for all preceding

years embraced within the limits of the law for making such expenditures, including all accounts rendered and paid up to the close of business on December 31, 1895.

Respectfully, yours,

R. J. GRIFFIN, *Disbursing Agent.*

Gen. W. W. DUFFIELD,

Superintendent United States Coast and Geodetic Survey,

Washington, D. C.

Statement of the expenditures of the United States Coast and Geodetic Survey for the fiscal year ending June 30, 1895.

[Prepared pursuant to an act approved March 3, 1853.]

SALARIES—PAY OF FIELD OFFICERS.

To whom paid.	Time employed.	Amount.
SUPERINTENDENT.		
Thomas C. Mendenhall.....	Two monthstwenty days.....	\$1 336'89
William Ward Duffield.....	Nine months.....	4 500'00
ASSISTANTS.		
Charles A. Schott.....	One year.....	4 000'00
George Davidson.....	do.....	4 000'00
Benjamin A. Colonna.....	Nine monthsthen days.....	2 734'30
Andrew Braid.....	One year.....	2 709'47
Alonzo T. Mosman.....	do.....	3 000'00
William Eimbeck.....	do.....	2 973'90
Herbert G. Ogden.....	do.....	2 947'84
Otto H. Tittmann.....	do.....	2 947'84
Aug. F. Rodgers.....	do.....	2 591'24
George A. Fairfield.....	do.....	2 565'20
John W. Donn.....	do.....	2 539'16
Erasmus D. Preston.....	do.....	2 085'11
Edward Goodfellow.....	One month seventeen days.....	313'07
Charles H. Boyd.....	do.....	286'93
Frank Walley Perkins.....	One year.....	2 200'00
Frank D. Granger.....	do.....	2 200'00
John J. Gilbert.....	do.....	2 226'17
Henry L. Marindin.....	do.....	2 226'17
John F. Pratt.....	do.....	2 173'99
Cephas H. Sinclair.....	do.....	2 173'99
Edmund F. Dickins.....	do.....	2 173'99
Dallas B. Wainwright.....	do.....	2 173'99
William H. Dennis.....	Eleven months.....	1 965'58
Isaac Winston.....	One year.....	1 973'84
Richard M. Bache.....	do.....	2 026'02
William C. Hodgkins.....	do.....	1 973'84
Philip A. Welker.....	do.....	1 693'12
James B. Baylor.....	do.....	1 973'64
John E. McGrath.....	do.....	1 973'84
John A. Flemer.....	do.....	1 973'84
Will Ward Duffield.....	One month.....	164'80
Gershom Bradford.....	One year.....	1 826'17
Edwin Smith.....	do.....	1 826'17
Stehman Forney.....	do.....	1 800'00
Charles H. Van Orden.....	Nine months fifteen days.....	1 398'14
Henry L. Whiting.....	One year.....	1 704'34
John Nelson.....	do.....	1 266'98
Fremont Morse.....	do.....	1 600'00
Walter B. Fairfield.....	do.....	1 599'90
Charles T. Iardella.....	do.....	1 426'17
W. Irving Vinal.....	do.....	1 426'17
George R. Putnam.....	do.....	1 373'95
Richard E. Halter.....	do.....	1 278'20
Fred A. Young.....	do.....	1 226'02
John F. Hayford.....	Two months seven days.....	168'72
Albert L. Baldwin.....	Ten months.....	599'30

Statement of the expenditures of the United States Coast and Geodetic Survey, etc.—Continued.

SALARIES—PAY OF FIELD OFFICERS—Continued.

To whom paid.	Time employed.	Amount.
AIDS.		
John F. Hayford	Nine months twenty-three days	\$975 ⁰⁰
Albert L. Baldwin	Two months	201 ¹⁰
Samuel B. Tinsley	Three months fifteen days	209 ³⁰
Robert L. Faris	One year	751 ¹³
Owen B. French	Eight months fifteen days	538 ⁸⁵
Hugh C. Denson	Five months twenty-five days	379 ¹³
Charles C. Yates	Five months twenty-four days	376 ¹⁰
Expenditures		98 748 ⁷⁵
Appropriation		101 956 ⁴⁰
Expenditures		98 748 ⁷⁵
Unexpended balance		3 207 ⁶⁵

SALARIES—PAY OF OFFICE FORCE, 1895.

To whom paid.	Time employed.	Amount.
DISBURSING AGENT.		
Robert J. Griffin	One year	\$2 200 ⁰⁰
GENERAL OFFICE ASSISTANT.		
Marshall W. Wines	Two months	370 ⁶⁰
Walter P. Ramsey	Ten months	1 496 ⁸⁰
CHIEF OF DIVISION OF LIBRARY AND ARCHIVES.		
Francis H. Parsons	One month twenty days	249 ⁴³
H. Sidney King	Ten months eleven days	1 550 ⁵⁷
CLERK TO SUPERINTENDENT.		
Martin Hensel	Two months fifteen days	251 ¹¹
John F. Renfro	Five months	496 ⁷⁰
CLERK TO ASSISTANT IN CHARGE.		
Adelbert B. Simons	Eleven months twenty-six days	994 ⁵⁷
CLERKS.		
William B. Chilton	One year	1 650 ⁰⁰
Nicholas G. Henry	do.	1 650 ⁰⁰
John H. Smoot	do.	1 400 ⁰⁰
William C. Maupin	do.	1 400 ⁰⁰
Artemas Martin	do.	1 400 ⁰⁰
Eugene B. Wills	do.	1 200 ⁰⁰
Freeman R. Green	do.	1 200 ⁰⁰
Frank W. Edmonds	do.	1 200 ⁰⁰
J. Henry Roeth	do.	1 200 ⁰⁰
Asa G. Randall	do.	1 200 ⁰⁰
Eugene Rhodes	Two months	168 ⁴⁰
Sophie Hein	One year	1 000 ⁰⁰
Ida M. Peck	Four months ten days	358 ⁶⁶
Jennie H. Fitch	Seven months twenty-three days	649 ⁴²
Alice G. Reville	Seven months twenty days	641 ²⁷
CHART CORRECTORS.		
Edward H. Wyvill	One year	1 200 ⁰⁰
James H. Barker	Four months	401 ¹⁰
Ida M. Peck	Seven months twenty days	769 ⁵⁸
Henry R. Garland	One year	900 ⁰⁰
Archie Upperman	do.	720 ⁰⁰
Mary Handlan	do.	720 ⁰⁰

Statement of the expenditures of the United States Coast and Geodetic Survey, etc.—Continued.

SALARIES—PAY OF OFFICE FORCE, 1895—Continued.

To whom paid.	Time employed.	Amount.
BUOY COLORISTS.		
Jennie H. Fitch.....	Four months seven days.....	\$252'34
STENOGRAPHER.		
Harry J. Van Der Beek.....	Eight months nineteen days.....	514'00
WRITERS.		
Lily A. Mapes.....	One year.....	900'00
Virginia Harrison.....	do.....	900'00
Kate Lawn.....	do.....	800'00
Alice G. Reville.....	Four months ten days.....	258'21
Florence Brower.....	One month.....	60'60
John Dale.....	One year.....	720'00
Florence B. Burlingame.....	Five months twenty-three days.....	345'40
John Hobgood.....	do.....	290'00
Deane S. Bliss.....	Two months four days.....	130'59
Mary L. Godwin.....	Two months three days.....	128'61
Marie L. Fout.....	One month twenty-five days.....	110'73
Daniel Hurley.....	One year.....	600'00
DRAFTSMEN.		
Adolph Lindenkohl.....	One year.....	2 400'00
Henry Lindenkohl.....	do.....	2 200'00
Edwin H. Fowler.....	do.....	2 000'00
William C. Willenbucher.....	do.....	2 000'00
Ferdinand Westdahl.....	do.....	1 800'00
Ernest J. Sommer.....	do.....	1 800'00
Frank C. Donn.....	do.....	1 800'00
David M. Hildreth.....	do.....	1 400'00
Charles H. Deetz.....	do.....	1 400'00
George F. Pohlers.....	Two months.....	202'20
Edmund P. Ellis.....	One year.....	1 200'00
Charles Mahon.....	do.....	1 000'00
Paul Erichsen.....	do.....	1 000'00
William R. Doores.....	do.....	900'00
Francis W. Clay.....	do.....	900'00
COMPUTERS.		
Edward H. Courtenay.....	One year.....	2 000'00
Myrick H. Doolittle.....	do.....	2 000'00
John H. Boutelle.....	do.....	1 600'00
Leland P. Shidy.....	do.....	1 600'00
Frank M. Little.....	do.....	1 532'60
Henry Farquhar.....	Seven months eight days.....	851'71
Daniel L. Hazard.....	One year.....	1 400'00
Rollin A. Harris.....	do.....	1 267'30
Charles H. Kummel.....	do.....	1 200'00
Harry F. Flynn.....	do.....	1 067'20
Lilian Pike.....	do.....	1 000'00
Jesse Pawling, jr.....	Three months two days.....	258'33
COPPERPLATE ENGRAVERS.		
William A. Thompson.....	One year.....	2 000'00
Henry M. Knight.....	do.....	2 000'00
Theodore Wasserbach.....	Two months.....	337'00
August Peterson.....	Three months nineteen days.....	542'90
Edward J. Enthoffer.....	Four months eighteen days.....	639'64
William H. Davis.....	One year.....	1 800'00
Edward H. Sipe.....	do.....	1 663'87
William Mackenzie.....	Two months eleven days.....	361'04
William F. Peabody.....	One year.....	1 600'00
Henry L. Thompson.....	do.....	1 327'81
William A. Van Doren.....	do.....	1 063'87
Alfred H. Sefton.....	do.....	931'93

Statement of the expenditures of the United States Coast and Geodetic Survey, etc.—Continued.

SALARIES—PAY OF OFFICE FORCE, 1895—Continued.

To whom paid.	Time employed.	Amount.
COPPERPLATE ENGRAVERS—cont'd.		
George Hergesheimer.....	One year.....	\$900'00
Frank G. Wurdemann.....	do.....	855'97
Harry R. McCabe.....	do.....	833'94
Gilbert F. Dawson.....	Two months.....	109'40
Peter H. Geddes.....	Three months twenty-three days.....	287'50
Rowland H. Ford.....	Six months twenty-one days.....	145'20
ELECTROTYPYER AND PHOTOGRAPHER.		
Daniel C. Chapman.....	Six months.....	900'00
Louis P. Keyser.....	Five months.....	620'80
ELECTROTYPYER.		
Louis P. Keyser.....	Seven months.....	527'50
ASSISTANT ELECTROTYPYER AND PHOTOGRAPHER.		
Roy Thomas.....	Four months sixteen days.....	262'52
PLATE PRINTERS.		
Frank Moore.....	Eleven months.....	1 468'10
D. N. Hoover.....	Eleven days.....	48'35
Charles J. Harlow.....	One year.....	1 000'00
Richard S. Bright.....	do.....	1 000'00
Eberhard Fordan.....	do.....	1 000'00
Abraham D. Levi.....	Nine months.....	750'00
Neil Bryant.....	One year.....	1 000'00
George B. Crawford.....	Three months.....	250'00
PLATE PRINTERS' HELPERS.		
William H. Waddington.....	One year.....	700'00
Charles F. Locraft.....	do.....	700'00
Louis L. Williams.....	Eleven months thirty days.....	698'10
Paul Dexter.....	One year.....	700'00
Frank C. Gohre.....	do.....	700'00
INSTRUMENT MAKERS.		
Ernest G. Fischer.....	One year.....	1 800'00
Clement Jacomini.....	do.....	1 200'00
William R. Whitman.....	do.....	1 000'00
Stephen A. Kearney.....	do.....	1 000'00
Clarence B. Regennas.....	do.....	1 000'00
Jacob Schwarz.....	Nine months twenty-two days.....	810'44
Michael Lauxmann, jr.....	One year.....	775'02
CARPENTERS.		
Horace O. French.....	One year.....	1 267'40
George W. Clarvoe.....	do.....	917'88
Charles N. Darnall.....	do.....	700'00
ENGINEERS.		
John A. Watts.....	One month, nine days.....	108'66
P. J. Mullen.....	Ten months eighteen days.....	883'23
JANITOR.		
Walter P. Ramsey.....	Two months.....	202'20

Statement of the expenditures of the United States Coast and Geodetic Survey, etc.—Continued.

SALARIES—PAY OF OFFICE FORCE, 1895—Continued.

To whom paid.	Time employed.	Amount.
WATCHMEN.		
David Parker	One year	\$880'00
John W. Drum	do	880'00
FIREMEN.		
Horace Dyer	One year	630'00
William H. Butler	do	550'00
MESSENGERS.		
Edward D. Scott	One year	880'00
Charles Over	do	820'00
Charles H. Jones	do	820'00
William R. McLane	do	820'00
Vicente Denis	do	820'00
Thomas McGoines	do	820'00
J. A. Dorsey	Eleven months twenty-three days	802'17
J. W. Reed	One year	700'00
George Newman	do	700'00
William West	One month	53'90
Josef K. Hagmann	Eleven days	19'13
John W. Miner	One year	640'00
Preston Boisseau	Eleven months eight days	600'01
John W. Hunter	Eleven months eighteen days	565'24
Attrell Richardson	One year	630'00
Dennis E. White	do	550'00
LABORERS.		
John H. Brown	One year	630'00
Baylor Crutchfield	do	630'00
Hans Bowdwin	do	550'00
Boston Brown	do	550'00
Sarah E. Flynn	Fifteen days	14'88
John H. Mason	One year	365'00
Virginia McGlincey	Eleven months thirteen days	348'14
Expenditures		130 136'77
Appropriation		135 000'00
Expenditures		130 136'77
Unexpended balance		4 863'23

RECAPITULATION.

Pay of field officers	\$98 748'75
Pay of office force	130 136'77
Total expenditures	228 885'52
Total sum appropriated for salaries	236 956'40
Total sum expended for salaries	228 885'52
Unexpended balance	8 070'88

Statement of the expenditures of the United States Coast and Geodetic Survey, etc.—Continued.

PARTY EXPENSES, 1895.

ATLANTIC COAST.

To whom paid.	On what account.	Amount.
R. M. Bache	Topography	\$1 482.28
C. H. Boyd	do	730.55
John W. Donn	do	1 846.81
J. A. Flemer	do	77.79
Stehman Forney	do	59.90
L. M. Garrett	Hydrography, steamer Endeavor	1 667.76
G. C. Hanus	Hydrography, schooner Eagre	1 222.94
W. C. Hodgkins	Topography	54.50
C. T. Iardella	do	1 390.75
W. F. Low	Hydrography, schooner Eagre	972.94
Herbert G. Ogden	Topography	1 908.05
Robert G. Peck	Hydrography, steamer Bache	2 232.74
C. S. Ripley	Hydrography, schooner Eagre	92.07
O. H. Tittmann	Topography	682.11
W. Irving Vinal	do	1 484.16
D. B. Wainwright	do	2 183.82
S. F. Whitmarsh	Storage	40.00
Henry L. Whiting	Topography	30.70
Expenditures		18 159.87
Appropriation		17 700.00
Add 10 per cent from objects not named		470.00
Total		18 170.00
Expenditures		18 159.87
Unexpended balance		10.13

GULF COAST, ETC.

To whom paid.	On what account.	Amount.
McKinzie, Oerting & Co	Stores for schooners Quick and Transit	\$149.59
Robert G. Peck	Hydrography, steamer Bache	2 419.41
F. Walley Perkins	Triangulation	2 319.16
P. A. Welker	Topography	1 809.94
Expenditures		6 698.10
Appropriation		7 400.00
Less 25 per cent transferred to Navy travel, etc.	\$370.00	
Expenditures	6 698.10	7 068.10
Unexpended balance		331.90

OFFSHORE WORK, ETC.

To whom paid.	On what account.	Amount.
L. M. Garrett	Hydrography, steamer Endeavor	\$1 868.17
Inspector Sixth light-house district	Oil for steamer Endeavor	13.05
George W. Mentz	Hydrography, steamer Blake	2 765.05
G. B. Reynolds & Co	Coal for steamer Blake	180.00
Expenditures		4 826.27
Appropriation		5 000.00
Expenditures		4 826.27
Unexpended balance		173.73

Statement of the expenditures of the United States Coast and Geodetic Survey, etc.—Continued.

PARTY EXPENSES, 1895—Continued.

PACIFIC COAST.

To whom paid.	On what account.	Amount.
F. H. Crosby	Hydrography, steamer McArthur	\$452'53
E. F. Dickins.....	Storage.....	30'00
C. P. Eaton.....	Hydrography, steamer McArthur	251'94
Lucian Flynne.....	Hydrography, steamer Gedney.....	5 183'83
J. J. Gilbert.....	Combined operations	419'31
J. F. Pratt.....	Storage.....	42'00
Aug. F. Rodgers.....	Triangulation and topography	3 441'66
J. H. Sears.....	Hydrography, steamer McArthur	4 766'13
Amount disbursed		14 587'40
Railroad accounts referred for settlement		95'72
Expenditures		14 683'12
Appropriation		15 000'00
Expenditures		14 683'12
Unexpended balance		316'88

ALASKA.

To whom paid.	On what account.	Amount.
A. C. Almy.....	Hydrography, steamer Hassler.....	\$427'90
Bureau of Equipment, Navy.....	Coal for steamer Patterson.....	590'96
G. B. Harber.....	Hydrography, steamer Hassler	1 995'67
E. K. Moore.....	Hydrography, steamer Patterson	1 908'39
W. I. Moore.....	do	4 131'95
Expenditures.....		9 053'97
Appropriation		8 400'00
Add 7 per cent from tides, etc.....		735'00
Total		9 135'00
Expenditures.....		9 053'97
Unexpended balance.....		81'03

TIDES, ETC.

To whom paid.	On what account.	Amount.
George Davidson.....	Sausalito and San Francisco tidal	\$1 166'64
David Hamilton.....	Newport tidal.....	120'50
Henry L. Marindin.....	Physical hydrography.....	3 104'16
F. V. Moss.....	Washington tidal.....	29'03
Homer P. Ritter.....	Physical hydrography.....	1 800'00
L. P. Shidy.....	Washington tidal	18'16
J. G. Spaulding.....	Fort Hamilton tidal	1 056'69
Expenditures.....		7 295'18
Appropriation		10 500'00
Less 7 per cent transferred to Alaska.....	\$735'00	
Expenditures.....	7 295'18	
		8 030'10
Unexpended balance		2 469'82

Statement of the expenditures of the United States Coast and Geodetic Survey, etc.—Continued.

PARTY EXPENSES, 1895—Continued.

COAST PILOT, ETC.

To whom paid.	On what account.	Amount.
Talbot Pulizzi.....	Services.....	\$900'00
John Ross.....	do.....	1 500'00
Expenditures.....		2 400'00
Appropriation.....		2 500'00
Expenditures.....		2 400'00
Unexpended balance.....		100'00

MAGNETICS.

To whom paid.	On what account.	Amount.
James B. Baylor.....	Magnetics.....	\$230'55
George Davidson.....	do.....	13'97
J. J. Gilbert.....	do.....	131'35
L. G. Schultz.....	do.....	1 508'25
Stephenson's express.....	do.....	76'31
Expenditures.....		1 960'43
Appropriation.....		2 000'00
Expenditures.....		1 960'43
Unexpended balance.....		39'57

LEVELING.

To whom paid.	On what account.	Amount.
Isaac Winston.....	Precise leveling.....	\$2 470'59
Appropriation.....		2 500'00
Expenditures.....		2 470'59
Unexpended balance.....		29'41

STATE SURVEYS.

To whom paid.	On what account.	Amount.
E. A. Bowser.....	Triangulation.....	\$1 188'68
A. H. Buchanan.....	do.....	1 933'86
H. C. Dangberg.....	Care and feed of animals.....	308'90
Stehman Forney.....	Reconnaissances.....	2 602'00
W. C. Hodgkins.....	Triangulation.....	608'65
L. C. Persons.....	Storage.....	13'25
C. H. Sinclair.....	California and Nevada boundary.....	5 927'43
Amount disbursed.....		12 582'77
Railroad accounts referred for settlement.....		118'27
Expenditures.....		12 701'04
Appropriation.....		13 500'00
Less 5 per cent transferred to transcontinental work.....	\$675'00	
Expenditures.....	12 701'04	13 376'04
Unexpended balance.....		123'96

Statement of the expenditures of the United States Coast and Geodetic Survey, etc.—Continued.

PARTY EXPENSES, 1895—Continued.

GRAVITY, ETC.

To whom paid.	On what account.	Amount.
G. R. Putnam	Gravity experiments (\$1 200'47) and longitudes (\$279'94).	\$1 480'41
C. H. Sinclair	Longitudes	532'07
Edwin Smith	do	1 090'01
Samuel Springman	Drayage	'25
Amount disbursed		3 102'94
Railroad accounts referred for settlement		66'20
Expenditures		3 168'94
Appropriation		3 500'00
Expenditures		3 168'94
Unexpended balance		331'06

TRANSCONTINENTAL WORK.

To whom paid.	On what account.	Amount.
William Eimbeck	Triangulation	\$6 411'58
F. D. Granger	do	2 682'75
F. Walley Perkins	do	1 895'90
P. A. Welker	do	2 084'49
Amount disbursed		13 074'72
Railroad accounts referred for settlement		165'76
Expenditures		13 240'48
Appropriation		12 600'00
Received from F. D. Granger, repayment to credit of appropriation		10'75
Add 5 per cent from State surveys		675'00
Total		13 285'75
Expenditures		13 240'48
Unexpended balance		45'27

NAVY TRAVEL, ETC.

To whom paid.	On what account.	Amount.
A. C. Almy, U. S. N.	Mileage	\$78'80
C. Churchill, U. S. N.	do	253'36
A. H. Davis, U. S. N.	do	13'20
W. A. Edgar, U. S. N.	do	28'40
J. J. Gilbert	Special survey	76'93
G. C. Hanus, U. S. N.	Mileage	17'52
H. K. Hines, U. S. N.	do	28'56
J. Q. Lovell, U. S. N.	do	16'08
C. W. McCormick, U. S. N.	do	15'04
N. A. McCully, U. S. N.	do	269'84
E. K. Moore, U. S. N.	do	292'48
Jeff. F. Moser, U. S. N.	do	1 097'52
E. D. Preston	Special survey	160'75
J. C. Richards, U. S. N.	Mileage	9'35
A. G. Rogers, U. S. N.	do	257'76
F. M. Russell, U. S. N.	do	13'20
James H. Sears, U. S. N.	do	14'48

Statement of the expenditures of the United States Coast and Geodetic Survey, etc.—Continued.

PARTY EXPENSES, 1895—Continued.

NAVY TRAVEL, ETC.—Continued.

To whom paid.	On what account.	Amount.
F. Swift, U. S. N	Mileage	\$35.60
E. H. Tillman, U. S. N	do	27.76
Expenditures		2 706.63
Appropriation		2 500.00
Received from E. K. Moore, repayment to credit of appropriation		4.64
Add 5 per cent from Gulf Coast, etc.		370.00
Total		2 874.64
Expenditures		2 706.63
Unexpended balance		168.01

OBJECTS NOT NAMED.

To whom paid.	On what account.	Amount.
John Brown	Services	\$333.87
George Davidson	Astronomical observations	136.15
Charles Johnson	Services	59.68
P. Looby	Detective service	87.95
W. O. Luscombe	Storage	20.00
George Olsen	Services	504.84
J. F. Pratt	Traveling expenses	129.80
Carl F. Schiodt	Services	600.00
C. H. Van Orden	Leveling	867.06
P. A. Welker	Traveling expenses	22.75
H. L. Whiting	do	82.20
Amount disbursed		2 844.30
Annual contribution to the International Geodetic Association		313.90
Expenditures		3 158.20
Appropriation		4 700.00
Less 10 per cent transferred to Atlantic Coast	\$470.00	
Expenditures	3 158.20	
		3 628.20
Unexpended balance		1 071.80

RECAPITULATION.

[Showing expenditures in gross (by subitems) on account of the appropriations for party expenses, 1895.]

Subitems.	Amount.
Atlantic Coast	\$18 159.87
Gulf Coast, etc	6 698.10
Offshore work, etc	4 826.27
Pacific Coast	14 587.40
Alaska	9 953.97
Tides, etc	7 295.18
Coast Pilot, etc	2 400.00
Magnetics	1 960.43
Leveling	2 470.59
State surveys	12 582.77
Gravity, etc	3 102.74
Transcontinental work	13 074.72

UNITED STATES COAST AND GEODETIC SURVEY.

Statement of the expenditures of the United States Coast and Geodetic Survey, etc.—Continued.

PARTY EXPENSES, 1895—Continued.

RECAPITULATION—Continued.

Subitems.	Amount.
Navy travel, etc	\$2 706'63
Objects not named.....	2 844'30
Amount disbursed	101 762'97
Railroad accounts referred for settlement.....	445'95
Annual contribution to the International Geodetic Association.....	313'90
Total expenditures.....	102 522'82
Total amount appropriated for party expenses, 1895.....	107 800'00
Repayment by F. D. Granger to credit of transcontinental work.....	10'75
Repayment by E. K. Moore to credit of navy travel, etc	4'64
Total	107 815'39
Total amount expended for party expenses, 1895.....	102 522'82
Unexpended balance.....	5 292'57

CLASSIFICATION OF EXPENDITURES FOR PARTY EXPENSES, 1895.

On what account.	Amount.
Triangulation.....	\$4 271'30
Topography	11 521'87
Hydrography	42 087'93
Transcontinental geodetic work.....	13 240'48
Points for State surveys	12 701'04
Coast Pilot	2 400'00
Leveling	3 337'65
Magnetics.....	2 048'38
Physical hydrography.....	1 800'00
Geographical positions.....	2 038'42
Tidal operations	5 495'18
Gravity experiments.....	1 266'67
Contribution to International Geodetic Association.....	313'90
Total	102 522'82

PARTY EXPENSES, 1895 AND 1896.

ALASKA.

To whom paid.	On what account.	Amount.
E. K. Moore.....	Hydrography, steamer Patterson.....	\$2 354'00
Appropriation		15 000'00
Expenditures.....		2 354'00
Unexpended balance.....		12 646'00

STATE SURVEYS.

To whom paid.	On what account.	Amount.
C. H. Sinclair.....	California and Nevada boundary.....	\$875'11
Appropriation		12 000'00
Expenditures.....		875'11
Unexpended balance.....		11 124'89

Statement of the expenditures of the United States Coast and Geodetic Survey, etc.—Continued.

PARTY EXPENSES, 1895 AND 1896—Continued.

RECAPITULATION.

[Showing expenditures in gross (by subitems) on account of the appropriation for party expenses, 1895 and 1896.]

Subitems.	Amount.
Alaska	\$2 354'00
State surveys	875'11
Expenditures	3 229'11
Total amount appropriated for party expenses, 1895 and 1896	40 000'00
Total amount expended for party expenses, 1895 and 1896	3 229'11
Unexpended balance	36 770'89

ALASKA BOUNDARY SURVEY.

[From February 1, 1895, to December 31, 1895.]

To whom paid.	On what account.	Amount.
George Davidson	Boundary survey	\$111'36
E. F. Dickins	do	3 455'08
W. W. Duffield	Traveling expenses	35'25
John E. McGrath	Boundary survey	887'36
E. K. Moore, U. S. N.	do	300'00
Fremont Morse	do	280'56
J. F. Pratt	do	25'67
P. A. Welker	do	5 598'96
Expenditures		10 694'24
Unexpended balance on hand Feb. 1, 1895		11 343'61
Expenditures		10 694.24
Present unexpended balance		649'37

REPAIRS OF VESSELS, 1895.

To whom paid.	On what account.	Amount.
American Ship Windlass Co	Steamer Hassler	\$64'00
Clay & Torbensen	Steamer McArthur	60'00
Lucian Flynne, U. S. N.	Steamer Gedney	1 853'38
L. M. Garrett, U. S. N.	Steamer Endeavor	881'36
J. J. Gilbert	Steam launch Tarry Not	17'92
G. C. Hanus, U. S. N.	Schooner Eagre	3 637'12
G. B. Harber, U. S. N.	Steamers Hassler and Inca	774'83
John Hoodless	Schooners Quick and Transit	3 243'25
James Reilly Repair & Supply Co.	Steamer Blake	2 563'30
Journal of Commerce and Commercial Bulletin	Advertising	10'00
W. F. Low, U. S. N.	Schooner Eagre	29'20
McKenzie, Oerting & Co.	Schooner Quick	40'23
G. W. Mentz, U. S. N.	Steamer Blake	942'72
Mercury Publishing Co.	Advertising	9'60
E. K. Moore, U. S. N.	Steamer Patterson	211'59
W. I. Moore, U. S. N.	do	2 757'63
New Yorker Staats Zeitung	Advertising	2'60
Robert G. Peck, U. S. N.	Steamer Bache	101'48
C. S. Ripley, U. S. N.	Schooner Eagre	1'60
James H. Sears, U. S. N.	Steamer McArthur	3 447'10
Wm. E. Woodall & Co	Schooner Matchless	3 700'00
Expenditures		24 348'91
Appropriation		25 000'00
Expenditures		24 348'91
Unexpended balance		651'09

Statement of the expenditures of the United States Coast and Geodetic Survey, etc.—Continued.

REPAIRS OF VESSELS, 1895—Continued.

CLASSIFICATION OF EXPENDITURES FOR REPAIRS OF VESSELS.

Name of vessel.	Amount.
Steamer Bache	\$101'48
Steamer Blake	3 520'82
Schooner Eagre	3 667'92
Steamer Endeavor	881'36
Steamer Fuca	746'31
Steamer Gedney	1 853'38
Steamer Hassler	92'52
Schooner Matchless	3 707'40
Steamer McArthur	3 507'10
Steamer Patterson	2 969'22
Schooner Quick	3 035'23
Steam launch Tarry Not	17'92
Schooner Transit	248'25
Total	24 348'91

PUBLISHING OBSERVATIONS, 1895.

To whom paid.	On what account.	Amount.
Gertrude Harrison	Services	\$270'97
F. L. Kendrick	do	72'58
L. G. Schultz	do	125'00
Charles C. Yates	do	373'54
Expenditures		842'09
Appropriation		1 000'00
Expenditures		842'09
Unexpended balance		157'91

GENERAL EXPENSES, 1895.

INSTRUMENTS, INSTRUMENT SHOP, CARPENTER SHOP, DRAWING DIVISION, BOOKS, MAPS, CHARTS, AND SUBSCRIPTIONS.

To whom paid.	On what account.	Amount.
D. Ballauf	Instrument shop	\$14'00
Robert Beall	Books	3'00
Charles Becker	Instrument and carpenter shops	10'93
Benedict & Burnham Manufacturing Co.	Instrument shop	4'55
Hugo Bilgram	Instruments	10'90
Andrew W. Boyd	Books	25'00
John A. Brashear	Instruments	25'00
Brown & Sharpe Manufacturing Co.	Instrument shop	7'20
J. H. Bunnell & Co	do	24'10
The Calvert Co.	Books	3'75
J. B. Chamberlain	Instrument shop	2'04
J. H. Chesley & Co	Carpenter shop	12'17
Church & Stephenson	do	46'13
The Cushman Chuck Co.	do	6'00
George Davidson	Instrument shop, subscriptions, etc.	25'95
Doremus & Just	Instruments	2'00
J. W. Drew & Co	Instrument shop	29'75
Alfred Ely & Co	do	54'01
E. Morrison Paper Co	Carpenter shop	9'90
The Engineering Magazine Co	Subscriptions	3'00
George T. Ennis	Instrument shop	99'25

Statement of the expenditures of the United States Coast and Geodetic Survey, etc.—Continued.

GENERAL EXPENSES, 1895—Continued.

INSTRUMENTS, INSTRUMENT SHOP, CARPENTER SHOP, DRAWING DIVISION, BOOKS, MAPS, CHARTS, AND SUBSCRIPTIONS—Continued.

To whom paid.	On what account.	Amount.
Lucian Flynne.....	Instruments.....	\$7'00
M. N. Forney.....	Subscriptions.....	3'00
Richard Gasch.....	Instrument shop.....	14'16
The Geological Publishing Co.....	Subscriptions.....	1'75
General Electric Co.....	Instrument shop.....	27'49
Z. D. Gilman.....	Instrument and carpenter shops.....	36'14
Henry J. Green.....	Instruments.....	27'00
W. & L. E. Gurley.....	do.....	60'00
H. Hoffa.....	Instrument shop.....	6'00
Jones & Laughlin, Limited.....	do.....	26'09
M. E. Kahler.....	do.....	41'75
J. Karr.....	Instruments.....	84'50
Jas. B. Lambie.....	Carpenter shop.....	10'00
Frank Libbey & Co.....	do.....	195'45
Melville Lindsay.....	do.....	6'57
W. H. Lowdermilk & Co.....	Subscriptions.....	9'50
Lutz & Bro.....	Instrument shop.....	1'00
Mackall Bros. & Flemer.....	Instrument and carpenter shops.....	41'05
McMillan & Co.....	Subscriptions.....	3'00
F. P. May & Co.....	Carpenter shop.....	68'82
McFadden & Co.....	Instrument shop.....	47'55
W. H. Mehler.....	do.....	66'10
Merchant & Co.....	do.....	16'94
Edward Miller.....	Subscriptions.....	6'00
John Milne.....	Books.....	12'50
E. K. Moore.....	Instrument shop.....	105'00
W. B. Moses & Sons.....	Carpenter shop.....	10'87
Munn & Co.....	Subscriptions.....	7'00
George F. Muth & Co.....	Instrument and carpenter shops.....	76'67
N. Murray.....	Subscriptions.....	5'00
J. B. Nalle.....	Instrument and carpenter shops.....	85'88
T. S. & J. D. Negus.....	Instrument shop.....	125'00
John C. Parker.....	Subscriptions.....	5'00
W. W. Payne.....	do.....	1'60
F. W. Perkins.....	Instruments.....	1'50
Charles S. Platt.....	Instrument shop.....	7'50
Charles A. Pleasants.....	Carpenter shop.....	3'80
Publishers of Science.....	Subscriptions.....	2'50
Publishers' Weekly.....	do.....	5'00
E. J. Pullman.....	Instrument shop.....	7'52
Rand, McNally & Co.....	Books.....	47'00
F. J. Reutlinger.....	Instrument shop.....	10'98
E. S. Ritchie & Sons.....	Instruments.....	55'00
Arthur W. Robson.....	Books.....	1'00
Aug. F. Rodgers.....	Instrument shop.....	7'00
Royce & Marean.....	do.....	21'49
Scheller & Stevens.....	do.....	17'51
Fred A. Schmidt.....	Instruments.....	100'18
L. H. Schneider's Son.....	Instrument and carpenter shops.....	94'73
Seth Thomas Clock Co.....	Instruments.....	136'80
C. G. Sloan & Co.....	Books.....	5'35
M. Silverberg & Co.....	Carpenter shop.....	8'76
Thomas W. Smith.....	do.....	109'08
Thomas Somerville & Sons.....	Instrument shop.....	8'45
L. S. Starrett.....	Carpenter shop.....	8'65
C. T. Starke.....	Instrument shop.....	11'86
Gustav E. Stechert.....	Books.....	88'46
Ormond Stone.....	do.....	2'00
M. A. Tappan.....	Instruments.....	1'50
Tice & Lynch.....	do.....	5'00
C. H. Townsend.....	Instrument shop.....	90'00
University of Chicago.....	Subscriptions.....	2'00
United States Naval Institute.....	do.....	3'50
D. B. Wainwright.....	Instrument shop.....	'65
C. W. Walker.....	do.....	9'00
B. Westermann & Co.....	Books.....	39'07
H. T. Whitman.....	Maps.....	25'00

Statement of the expenditures of the United States Coast and Geodetic Survey, etc.—Continued.

GENERAL EXPENSES, 1895—Continued.

INSTRUMENTS, INSTRUMENT SHOP, CARPENTER SHOP, DRAWING DIVISION, BOOKS, MAPS, CHARTS, AND SUBSCRIPTIONS—Continued.

To whom paid.	On what account.	Amount.
John Wiley & Son	Books	\$1'50
Williams & Hanks	Instrument shop	3'64
Amount disbursed		2 602'99
Appropriation		8 000'00
Received from F. V. Abbot, Corps of Engineers, in payment for one sextant furnished by this Bureau		64'00
Total		8 064'00
Expenditures		2 602'99
Unexpended balance		5 461'01

COPPER PLATES, CHART PAPER, PRINTING INK, COPPER, ZINC, AND CHEMICALS FOR ELECTROTYPING AND PHOTOGRAPHING; ENGRAVING, PRINTING, PHOTOGRAPHING, AND ELECTROTYPING SUPPLIES; EXTRA ENGRAVING AND DRAWING; PHOTOLITHOGRAPHING AND PRINTING FROM STONE AND COPPER FOR IMMEDIATE USE.

To whom paid.	On what account.	Amount.
D. Ballauf	Printing supplies	\$17'30
Charles E. Barrick	Electrotyping and photographing supplies	4'50
R. F. Bartle & Co.	Extra engraving	1 363'85
Charles Becker	Printing supplies	29'74
Henry J. Brown	Electrotyping and photographing supplies	3'50
N. Bunch	Printing supplies	45'50
Bureau Engraving and Printing	do	653'21
Clendenin Bros.	Electrotyping and photographing supplies	499'40
George Davidson	do	7'40
E. Morrison Paper Co.	Printing supplies	40'20
Peter H. Geddes	Extra engraving	702'45
C. D. Gildersleeve's Son	Printing supplies	110'00
Z. D. Gilman	Electrotyping, photographing supplies, etc.	373'29
E. N. Gray & Co.	Printing supplies	143'60
W. H. Harrover	Electrotyping and photographing supplies	1'40
A. Hoen & Co.	Photolithographing	29'80
H. Hoffa	Engraving supplies	16'98
J. E. Hurley	Printing supplies	3'63
Charles Eneu Johnson & Co.	do	15'00
Jones & Laughlin, Limited	do	'96
Ernest Kubel	Copper plates	462'00
Melville Lindsay	Electrotyping and photographing supplies, etc.	58'59
Mackall Bros. & Flemer	do	74'15
William Mackenzie	Extra engraving	677'29
Mackey Print Paper Co.	Electrotyping and photographing supplies	35'72
F. P. May & Co.	Printing supplies, etc.	4'23
Robert Mayer & Co.	do	23'00
William H. Mehler	do	3'75
Edwin H. Morsell	Printing supplies	3'50
David Morris	Extra engraving	600'00
George F. Muth & Co.	Printing supplies, etc.	52'30
J. B. Nalle	do	89'74
The Norris Peters Co.	Photolithographing	231'25
Peter Adams Co.	Chart paper	3 696'94
E. J. Pullman	Electrotyping and photographing supplies	53'67

Statement of the expenditures of the United States Coast and Geodetic Survey, etc.—Continued.

GENERAL EXPENSES, 1895—Continued.

COPPER PLATES, CHART PAPER, PRINTING INK, COPPER, ZINC, AND CHEMICALS FOR ELECTROTYPING AND PHOTOGRAPHING; ENGRAVING, PRINTING, PHOTOGRAPHING, AND ELECTROTYPING SUPPLIES, ETC.—Continued.

To whom paid.	On what account.	Amount.
Randolph & Clowes.....	Copper plates.....	\$4.06
Edgar S. Ryder.....	Printing supplies.....	15.00
Schiller & Stevens.....	Electrotyping and photographing supplies.	5.16
F. H. Schneider's Son.....	.....do.....	5.06
Sharp & Sons.....	Copper plates.....	11.20
The Strobridge Lithographing Co..	Photolithographing.....	872.45
Francis Whiteley.....	Copper plates.....	885.82
Williams, Brown & Earle.....	Electrotyping and photographing supplies.	14.75
Williams & Hanks.....	Plate printing supplies.....	3.90
Amount disbursed.....		11 945.24
Appropriation.....		18 000.00
Expenditures.....		11 945.24
Unexpended balance.....		6 054.76

STATIONERY, TRANSPORTATION OF INSTRUMENTS AND SUPPLIES, OFFICE WAGON AND HORSES, FUEL, GAS, TELEGRAMS, ICE, AND WASHING.

To whom paid.	On what account.	Amount.
Adams Express Co.....	Transportation.....	\$89.65
Herman Baumgarten.....	Stationery.....	12.40
James Connor.....	Office horse.....	31.50
George Davidson.....	Stationery.....	14.60
Annie L. Foley.....	Washing.....	139.33
George W. Knox Express Co.....	Transportation.....	15.34
Holmes & Co.....	Stationery.....	8.78
Independent Ice Co.....	Ice.....	161.82
Minnie Kelly.....	Washing.....	8.25
Library Bureau.....	Stationery.....	26.94
Lutz Bros.....	Office wagon and horse.....	14.50
McDermott Carriage Co.....	.....do.....	47.25
George F. Muth & Co.....	Stationery.....	13.65
John C. Parker.....	.....do.....	62.35
Postal Telegraph Cable Co.....	Telegrams.....	1.25
Fred. A. Schmidt.....	Stationery.....	103.54
B. F. Shaw.....	Office horse.....	240.00
Smithsonian Institution.....	Transportation.....	38.35
Stephenson's Express.....	.....do.....	8.82
Tice & Lynch.....	.....do.....	9.68
United States Express Co.....	.....do.....	56.75
Washington Gaslight Co.....	Gas.....	1 508.25
Charles Werner.....	Fuel.....	1 102.90
Western Union Telegraph Co.....	Telegrams.....	63.77
Wyckoff, Seamans & Benedict.....	Stationery.....	.20
Expenditures.....		3 799.87
Deposited with Treasurer United States in payment for stationery furnished by Treasury Department.....		494.62
		4 274.49
Appropriation.....		6 000.00
Expenditures.....		4 274.49
Unexpended balance.....		1 725.51

Statement of the expenditures of the United States Coast and Geodetic Survey, etc.—Continued.

GENERAL EXPENSES, 1895—Continued.

MISCELLANEOUS EXPENSES, CONTINGENCIES OF ALL KINDS, OFFICE FURNITURE, REPAIRS, EXTRA LABOR, AND TRAVELING EXPENSES (OFFICE).

To whom paid.	On what account.	Amount.
George F. Muth & Co.	Contingencies.	\$1'20
The National Democrat.	Advertising.	5'10
M. Newmeyer	Contingencies.	8'48
New York Soap Works	do	12'00
John J. O'Roke	do	6'00
William C. Peake	Repairs and contingencies.	8'80
W. P. Ramsey	Traveling, office.	17'00
John F. Renfro	Extra labor.	548'48
The Republic.	Advertising.	11'28
L. H. Schneider's Son.	Contingencies.	4'04
Shoemaker & Busche.	do	2'18
Marshall Smith	Extra labor.	5'81
Thomas W. Smith.	Contingencies.	15'67
Thomas Somerville & Sons	do	6'15
Edw. S. Spear & Co.	do	47'17
Standard Oil Co.	do	4'32
J. C. Thompson & Co.	Advertising.	5'60
The Townsend Leader Co.	do	7'83
The Volkes Tribune.	do	8'25
John Walsh.	Repairs	15'00
Washington City post-office.	Contingencies.	15'00
Washington News Publishing Co.	Advertising.	43'08
The Washington Post Co.	do	55'00
The Washington Sentinel.	do	27'83
Washington Times Co.	do	8'48
Somerset R. Waters	Contingencies.	10'26
Edw. J. Watts.	do	2'70
John W. Wiedo	do	1'50
William West	do	22'75
Jos. P. Willett	do	5'00
Wyckoff, Seamans & Benedict.	do	207'75
William Young	Extra labor.	89'00
James L. Barbour & Son.	Contingencies.	2'13
Charles E. Barrick.	Repairs.	99'00
Andrew Braid	Travel, office.	8'50
The Capitol Express.	Advertising.	14'70
The Capitol Press.	do	5'10
Charles T. Carter & Co.	Contingencies.	10'80
J. H. Chesley & Co.	do	3'18
Chesapeake and Potomac Telephone Co.	Exchange rental	100'50
Walter Y. Clark.	Extra labor	96'77
Colonist Printing and Publishing Co.	Advertising.	7'05
M. G. Copeland & Co.	Contingencies.	28'21
Daily News Publishing Co.	Advertising.	7'73
Daily Olympian Publishing Co.	do	3'53
George Davidson.	Traveling and contingent expenses.	61'00
J. C. Ergood & Co.	Advertising.	34'44
Evening Star Newspaper Co.	do	9'90
The Evening Telegram	do	7'80
The Examiner	do	17'10
A. M. Fite.	Contingencies.	2'88
Frank Freeman	do	3'50
Alfred Gilbert.	Extra labor.	2'40
Z. D. Gilman.	Contingencies.	14'04
Hanlan & Goodman	do	8'40
James Holleran.	do	12'00
Julius Lansburgh Carpet Co.	do	249'28
H. Sidney King.	Extra labor.	164'52
Lansburgh Bros.	Contingencies.	65'17
Mackall Bros. & Flemer.	do	1'14
Henry McShane Manufacturing Co.	do	14'91
W. H. Mehler.	Repairs and contingencies.	23'00
Edward Miller	Contingencies.	6'00

Statement of the expenditures of the United States Coast and Geodetic Survey, etc.—Continued.

GENERAL EXPENSES, 1895—Continued.

MISCELLANEOUS EXPENSES, CONTINGENCIES OF ALL KINDS, OFFICE FURNITURE, REPAIRS, EXTRA LABOR, AND TRAVELING EXPENSES (OFFICE)—Continued.

To whom paid.	On what account.	Amount.
John T. Mockabic.....	Contingencies.....	\$5'00
Morning Herald.....	Advertising.....	56'77
Amount disbursed.....		2 612'76
Deposited with Treasurer United States in payment for furniture and towels furnished by Treasury Department.....		86'87
Expenditures.....		2 699'63
Appropriation.....		\$4 500'00
Repayment from account of William Young.....		21'00
Total.....		4 521'00
Expenditures.....		2 699'63
Unexpended balance.....		1 821'37

RECAPITULATION.

[Showing expenditures in gross (by subitems) on account of appropriation for general expenses, 1895.]

Subitems.	Amount.
Instruments, instrument shop, carpenter shop, drawing division, books, maps, charts, and subscriptions.....	\$2 602'99
Copper plates, chart paper, printing ink, copper, zinc, and chemicals for electrotyping and photographing; engraving, printing, photographing, and electrotyping supplies; extra engraving and drawing; photolithographing and printing from stone and copper for immediate use.....	11 945'24
Stationery, transportation of instruments and supplies, office wagon and horses, fuel, gas, telegrams, ice, and washing.....	3 779'87
Miscellaneous expenses, contingencies of all kinds, office furniture, repairs, extra labor, and traveling expenses (office).....	2 612'76
Total disbursements.....	20 940'86
Deposited in payment for stationery, furniture, etc., furnished by the Treasury Department.....	581'49
Total expenditures.....	21 522'35
Total amount appropriated for general expenses, 1895.....	36 500'00
Received from F. B. Abbot, Corps of Engineers, in payment for sextant.....	64'00
Repayment from account of William Young.....	21'00
Total.....	36 585'00
Total amount expended for general expenses, 1895.....	21 522'35
Unexpended balance.....	15 062'65

CLASSIFICATION OF EXPENDITURES FOR GENERAL EXPENSES, 1895.

On what account.	Amount.	On what account.	Amount.
Instruments.....	\$516'38	Transportation of instruments and supplies.....	\$233'19
Instrument shop.....	1 093'26	Office wagon and horse.....	333'25
Carpenter shop.....	681'87	Fuel.....	1 102'90
Books, maps, and charts.....	253'63	Gas.....	1 508'25
Subscriptions.....	57'85	Telegrams.....	65'02
Copper plates.....	1 363'08	Ice.....	161'82
Chart paper.....	3 696'94	Washing.....	147'58
Engraving, printing, photographing, and electrotyping supplies.....	2 408'13	Miscellaneous expenses and contingencies of all kinds.....	1 235'88
Extra engraving.....	3 343'59	Extra labor.....	1 144'58
Photolithographing and printing from stone and copper for immediate use.....	1 133'50	Repairs.....	145'80
Stationery.....	227'86	Traveling expenses (office).....	86'50
		Total.....	20 940'86

UNITED STATES COAST AND GEODETIC SURVEY.

Statement of the expenditures of the United States Coast and Geodetic Survey, etc.—Continued.

SALARIES—STANDARD WEIGHTS AND MEASURES, 1895.

To whom paid.	Time employed.	Amount.
ADJUSTER.		
Louis A. Fischer	One year	\$1 500'00
MECHANICIAN.		
Otto Storm	One year	1 250'00
ASSISTANT MESSENGER.		
Charles A. Harbaugh	Eleven months nineteen days	696'52
WATCHMAN.		
J. A. McDowell	One year	720'00
Expenditures		4 166'52
Appropriation		4 190'00
Expenditures		4 166'52
Unexpended balance		23'48

CONTINGENT EXPENSES—STANDARD WEIGHTS AND MEASURES, 1895.

MATERIALS, APPARATUS, AND INCIDENTAL EXPENSES.

To whom paid.	On what account.	Amount.
Eimer & Amend	Apparatus and supplies	\$271'53
Z. D. Gilman	Supplies	6'40
Henry J. Green	Apparatus and supplies	139'65
H. Hoffa	Supplies	'70
Mackall Bros. & Flemer	do	11'20
W. H. Mehler	do	1'00
George F. Muth & Co	do	13'65
J. B. Nalle	do	9'75
John C. Parker	do	2'50
Sylv. A. Schmidt, jr., & Co	do	'42
Henry Troemner	do	3'00
United States Mint (Philadelphia)	do	4'37
John W. Weide	do	2'75
Expenditures		466'92
Appropriation		500'00
Expenditures		466'92
Unexpended balance		33'08

EXPENSES AMERICAN MEMBER INTERNATIONAL COMMITTEE.

To whom paid.	On what account.	Amount.
B. A. Gould	Traveling expenses	\$475'00
Appropriation		475'00
Expenditures		475'00

Statement of the expenditures of the United States Coast and Geodetic Survey, etc.—Continued.

CONTINGENT EXPENSES—STANDARD WEIGHTS AND MEASURES, 1895—Continued.

RECAPITULATION.

[Showing expenditures in gross by subitems on account of the appropriation for contingent expenses, Standard Weights and Measures, 1895.]

Subitems.	Amount.
Materials and apparatus and incidental expenses.	\$466'92
Expenses American member International Committee.	475'00
Total expenditures.	941'92
Total amount appropriated.	975'00
Total amount expended.	941'92
Unexpended balance.	33'08

GENERAL RECAPITULATION.

[Showing appropriations, expenditures, and balances for the fiscal year ending June 30, 1895; also unexpended balances on Alaska boundary survey, and amounts received from other Government bureaus.]

Name of appropriation.	Appropriated.	Expended.	Balances.
Salaries:			
Pay of field officers.	\$101 956'40	\$98 748'75	\$3 207'65
Pay of office force.	135 000'00	130 136'77	4 863'23
Party expenses:			
Sundry civil act of August 18, 1894.	\$107 800'00		
Repayment from F. D. Granger.	10'75		
Repayment from E. K. Moore.	4'64		
Alaskan boundary survey—balance from last report.			
Repairs of vessels.	11 343'61	10 694'24	649'37
Publishing observations.	25 000'00	24 348'91	651'09
Party expenses, 1895 and 1896.	1 000'00	842'09	157'91
General expenses:	40 000'00	3 229'11	36 770'89
Sundry civil act of August 18, 1894.	\$36 500'00		
Received from F. V. Abbot.	64'00		
Repayment from account of William Young.	21'00		
Salaries—Weights and measures.	4 190'00	4 166'52	23'48
Contingent expenses—Weights and measures.	975'00	941'92	33'08
Total.	463 865'40	397 153'48	66 711'92
Appropriations and expenses.			Amount.
Amounts appropriated and available as follows:			
Appropriation for Coast and Geodetic Survey proper for fiscal year ending June 30, 1895, sundry civil act, August 18, 1894.			\$447 256'40
Appropriations for Office of Standard Weights and Measures, legislative act, July 21, 1894.			5 165'00
Balance from last report on account of Alaskan boundary survey.			11 343'61
Repayment from F. D. Granger on account of party expenses.			10'75
Repayment from E. K. Moore on account of party expenses.			4'64
Repayment from F. V. Abbot on account of general expenses.			64'00
Repayment from account William Young.			21'00
			463 865'40
Amount expended as follows:			
For Coast and Geodetic Survey.			\$381 350'80
For Office of Standard Weights and Measures.			5 108'44
For Alaskan boundary survey.			10 694'24
			397 153'48
Total unexpended balance.			66 711'92

Expenditures since last report on account of the appropriations for the service of the fiscal year ending June 30, 1894.

PARTY EXPENSES, 1894.

PACIFIC COAST.

Subitems.	Amount.
Balance on hand, report for 1894.....	\$1 189'09
Railroad accounts referred for settlement.....	86'89
Present unexpended balance.....	1 102'20

ALASKA.

Balance on hand, report for 1894.....	\$157'59
Railroad accounts referred for settlement.....	3'97
Present unexpended balance.....	153'62

TRANSCONTINENTAL WORK.

To whom paid.	On what account.	Amount.
William Eimbeck.....	Triangulation.....	\$5'00
Expenditures.....		5'00
Balance on hand, report for 1894.....		219'83
Expended since, as above.....		5'00
Present unexpended balance.....		214'83

OBJECTS NOT NAMED.

Subitems.	Amount.
Balance on hand, report for 1894.....	\$904'84
Annual contribution to International Geodetic Association.....	313'90
Present unexpended balance.....	590'94

RECAPITULATION.

[Showing expenditures in gross by subitems.]

Subitems.	Amount.
Transcontinental work.....	\$5'00
Railroad accounts referred for settlement.....	90'86
Annual contribution to International Geodetic Association.....	313'90
Expenditures.....	409'76
Balance on hand, report for 1894.....	7 373'37
Expended since last annual report, as above.....	409'76
Present unexpended balance.....	6 963'61

Expenditures since last report on account of the appropriations for the service of the fiscal year ending June 30, 1894—Continued.

GENERAL EXPENSES, 1894.

INSTRUMENTS, INSTRUMENT SHOP, CARPENTER SHOP, DRAWING DIVISION, BOOKS, MAPS, CHARTS, AND SUBSCRIPTIONS.

To whom paid.	On what account.	Amount.
W. H. Lowdermilk & Co.	Subscriptions	\$9.75
Edward P. North.	Books	10.00
J. L. Shaw.	do	18.00
American Institute of Electrical Engineers.	do	45.50
Publishers of Science.	Subscriptions	2.60
Expenditures.		85.85
Balance on hand, report for 1894.		269.90
Expended since, as above.		85.85
Present unexpended balance.		184.05

COPPER PLATES, CHART PAPER, ETC.

To whom paid.	On what account.	Amount.
Evans & Bartle	Extra engraving	\$1 090.00
Expenditures.		1 090.00
Balance on hand, report for 1894.		1 860.16
Expended since, as above.		1 090.00
Present unexpended balance.		770.16

STATIONERY, TRANSPORTATION OF INSTRUMENTS, ETC.

To whom paid.	On what account.	Amount.
Samuel Springman	Transportation	\$0.50
Expenditures. ....		.50
Balance on hand, report for 1894.		136.46
Expended since, as above. ....		.50
Present unexpended balance.		135.96

RECAPITULATION.

[Showing expenditures in gross, by subitems, on account of the appropriation for general expenses, 1894.]

Subitems.	Amount.
Instruments, instrument shop, etc.	\$85.85
Copper plates, chart paper, etc.	1 090.00
Stationery, transportation of instruments, etc. ....	.50
Total expenditures	1 176.35
Balance on hand, report for 1894	2 311.27
Expended since, as above.	1 176.35
Present unexpended balance	1 134.92

Expenditures since last report on account of the appropriations for the service of the fiscal year ending June 30, 1894—Continued.

CONTINGENT EXPENSES, STANDARD WEIGHTS AND MEASURES, 1894.

MATERIALS AND APPARATUS AND INCIDENTAL EXPENSES.

To whom paid.	On what account.	Amount.
Arthur Burkhardt.....	Reckoning machine.....	\$122'33
Expenditures.....		122'33
Balance on hand, report for 1894.....		624'68
Expended since, as above.....		122'33
Present unexpended balance.....		502'35

UNITED STATES COAST AND GEODETIC SURVEY,
OFFICE OF THE DISBURSING AGENT,
Washington, D. C., January 1, 1896.

I certify that the foregoing statement is a correct exhibit of all expenditures for the United States Coast and Geodetic Survey, and for the Office of Standard Weights and Measures, for the fiscal year ending June 30, 1895, and for all preceding years embraced within the limits of the law for making such expenditures, including all accounts rendered up to the close of business on December 31, 1895.

R. J. GRIFFIN,
Disbursing Agent, United States Coast and Geodetic Survey.

Approved:

W. W. DUFFIELD,
Superintendent United States Coast and Geodetic Survey.

OFFICE REPORT NO. 4—1895.

REPORT OF THE ASSISTANT IN CHARGE OF THE OFFICE OF STANDARD WEIGHTS AND MEASURES FOR THE FISCAL YEAR ENDING JUNE 30, 1895.

UNITED STATES COAST AND GEODETIC SURVEY,
OFFICE OF STANDARD WEIGHTS AND MEASURES,
Washington, D. C., June 30, 1895.

SIR: I have the honor to transmit the annual report on the conduct of the Office of Standard Weights and Measures for the fiscal year ending June 30, 1895.

During my absence in the field, from the beginning of the year until September 10, the Office was in charge of Mr. L. A. Fischer, adjuster, and from September 10 to the end of the year, it was in my charge.

The regular force of the Office remained the same, and consisted of Mr. L. A. Fischer, adjuster, and Charles A. Harbaugh, assistant messenger. In addition to this force, however, Mr. John F. Hayford, Assistant, was detailed for duty on September 8, 1894, where he remained until June 14, 1895, when he was granted leave of absence until June 30, his resignation having been tendered to take effect on that date. Mr. Hayford's resignation was tendered in order that he might accept a position as instructor at Cornell University. While in the Office Mr. Hayford determined the densities and masses of the new X set of gramme weights; made a redetermination of the errors of the foot graduation of the United States bench standard, and investigated the behavior of the balance of precision recently acquired by this Office. The peculiar value of this balance arises partly from the high grade of workmanship upon it, but largely from two special auxiliary devices which enable the observer not only to note the oscillations of the beam from a distance, but also to interchange the weights upon the scale pans without approaching the balance. The balance was in January, 1895, mounted on a brick pier in an old coal vault in the southern part of the Butler Building. This, while not suitable for the purpose on account of the dampness, is the only place available, and the result of the investigation made by Mr. Hayford shows that the Office is now in a position to make weighings of the highest precision, the probable error of a single weighing with a load of 1 kilogramme being ± 0.0236 milligramme. A report on the balance has been prepared by Mr. Hayford for publication.

It gives me great pleasure to report that the laborious and tedious preparation of the State sets of weights and measures for North and South Dakota was finally completed, and they were forwarded to their destination in June. All the work of adjustment and verification of these standards devolved upon Mr. Fischer. He also gilded and adjusted the X set of gramme weights, and made four groups of direct comparisons between the Committee Metre and Prototype No. 21, with a view to settling their relation. While the results secured are remarkably accordant, it was deemed advisable to make some observations by a method which did not depend upon viewing a point, or thread, and its reflection, in the ends of the Committee Metre, and accordingly two auxiliary abutting pieces were made, and will be used as soon as the current work of the Office will permit.

Mr. C. A. Harbaugh's duties are of a miscellaneous character, and are performed with ability and dispatch. He compared alcoholometers, etched inscriptions on tapes, indexed records, and by his expeditious use of the typewriter assisted me in preparing copy of the United States Coast and Geodetic Survey Report for 1894, for the printer.

STANDARDS OF MASS.

The X set of gramme weights were made of Muntz metal, in the instrument shop of the United States Coast and Geodetic Survey, from drawings furnished by this Office. They are cylindrical in form, surmounted with knobs for handling. In order to show the uniformity in

density which may be expected where weights are made of commercially rolled metal of this composition, the densities and masses of the set are given as follows:

Densities and masses of the X set of metric weights.

Designation.	Density at 0°.0 C.	Masses.	
		Grammes.	Milligrammes.
(10 000 gm.) ^x	8.4079	10 000	-12.99 ±0.80
(5 000 gm.) ^x	8.4118	5 000	+ 2.34 ±0.60
(2 000 gm.) ^{1x}	8.4214	2 000	+ 0.24 ±0.14
(2 000 gm.) ^{2x}	8.4207	2 000	- 0.39 ±0.08
(1 000 gm.) ^x	8.4108	1 000	- 0.69 ±0.01
(500 gm.) ^x	8.4083	500	- 0.050 ±0.038
(200 gm.) ^{1x}	8.4374	200	+ 0.186 ±0.016
(200 gm.) ^{2x}	8.4328	200	+ 0.298 ±0.016
(100 gm.) ^x	8.4338	100	- 0.064 ±0.009
(50 gm.) ^x	8.443	50	+ 0.067 ±0.010
(20 gm.) ^{1x}	8.464	20	0.000 ±0.004
(20 gm.) ^{2x}	8.462	20	+ 0.068 ±0.004
(10 gm.) ^x	8.460	10	- 0.027 ±0.004
(5 gm.) ^x	8.445	5	+ 0.0260 ±0.0032
(2 gm.) ^{1x}	8.379	2	+ 0.0287 ±0.0022
(2 gm.) ^{2x}	8.319	2	+ 0.0116 ±0.0022
(1 gm.) ^x	8.410	1	+ 0.0092 ±0.0021

In anticipation of being called upon to make tests of electric standards, an effort was made to provide the Office with suitable standards, in accord with specifications adopted by the National Academy of Sciences, but beyond purchasing the necessary cells and material, nothing could be done, owing to the smallness of the force and the demands upon the Office.

Yours, respectfully,

O. H. TITTMANN,

*Assistant, Coast and Geodetic Survey, in Charge of
Office of Standard Weights and Measures.*

Gen. W. W. DUFFIELD,

*Superintendent United States Coast and Geodetic Survey,
and of Office of Standard Weights and Measures.*

Abstract of verifications of weights and measures made during the fiscal year 1895.

Date.	Name.	Service.
1894.		
July.....	Woodward, Prof. R. S., Montclair, N. J.....	Tape compared.
	Foss, Wm. E., Brighton, Mass.....	Two tapes compared.
	Troemner, Henry, Philadelphia, Pa.....	Information furnished.
	Fauth & Co., Washington, D. C.....	Two tapes compared.
	Blake, Prof. Eli, Brown University.....	Metre bar compared.
August.....	Coblentz, Dr. V., Ocean Grove, N. J.....	Information furnished.
	State of Rhode Island.....	Weights and balance read-justed.
September....	Baltimore Topographical Survey, Baltimore, Md.	Two tapes compared.
	Preston, E. D., Assistant U. S. C. & G. S.....	Tape compared.
	Stixrud & Nasten, Seattle, Wash.....	Tape compared.
	Roe, J. N., Valparaiso, Ind.....	Information furnished.
	Internal Revenue Bureau.....	Ullage table prepared.
	Taylor, S. S., Cairo, Ill.....	Two tapes compared.
	Internal Revenue Bureau.....	One hundred and twenty alcoholometers compared.
October.....	Gibson, W. F., Tilton, N. H.....	Information furnished.
	State sealer weights and measures, Iowa.....	Information furnished.
	Darling, C. P., Huntington, N. Y.....	Information furnished.
	Eimer & Amend, New York.....	Quartz plate compared.

Abstract of verifications of weights and measures made during the fiscal year 1895—Continued.

Date.	Name.	Service.
1894. October	Crew, Prof. H., Evanston, Ill. Krause, Albert, Buffalo, N. Y. Thies, C. P., Hoboken, N. J. Harrington, Son & Co., Philadelphia, Pa. Harrington, C. L., New York. Saegmuller, G. N., Washington, D. C. U. S. Coast and Geodetic Survey.	Information furnished. Tape compared. Quartz plate compared. Information furnished. Information furnished. Tape compared. Five thermometers compared.
November	U. S. Coast and Geodetic Survey. Trautwine, J. C., Philadelphia, Pa. National Brewing Company, Baltimore, Md. Fimer & Amend, New York. Kuhnemann, Emil, Brooklyn, N. Y. Bodenstab, Henry, Stapleton, N. Y. North Dakota Agricultural College. Murrey, W. P., Des Moines, Iowa.	Tape compared. Information furnished. Three saccharometers compared. Quartz plate compared. Quartz plate compared. Quartz plate compared. Information furnished. Information furnished. Tape compared.
December	Engineer Commissioner, D. C. U. S. Geological Survey. Case School of Applied Science, Cleveland, Ohio. Elgin Smelting Co., The, Leadville, Colo.	Tape compared. Tape compared. Kilogramme compared. Fourteen weights compared.
1895. January	Greeley, Frederick, Chicago, Ill. Denison & Perfler, Columbus, Ohio. French & Bryant, Brookline, Mass. Eakins, L. G., Pueblo, Colo. Towne, P. A., Edmeston, N. Y. Baldwin, Prof. Ward, Cincinnati, Ohio. Superior Scale Works, Council Bluffs, Iowa.	Information furnished. Tape compared. Tape compared. Information furnished. Information furnished. Tape compared. Weights compared.
February	McCowell, John, Caldwell, Tex. Joseph, Antonio, Washington, D. C. Denver Fire Clay Co., Denver, Colo. Pueblo Smelting and Refining Co., Pueblo, Colo. Howe Scale Co., Rutland, Vt. Case School of Applied Science, Cleveland, Ohio. Case School of Applied Science, Cleveland, Ohio.	Information furnished. Information furnished. Weights compared. Information furnished. Information furnished. Kilogramme compared. Metre compared.
March	Baldwin, Prof. Ward, Cincinnati, Ohio. Whitney, Prof. N. O., University of Wisconsin. Harkness, Prof. Wm., Washington, D. C. Governor of Kentucky. Buff & Berger, Boston, Mass. Smith, Chas. H., Middletown, N. Y. Department Public Works, Buffalo, N. Y. Pueblo Smelting and Refining Co., Pueblo, Colo. Denison & Perfler, Columbus, Ohio. Whitney, Prof. N. O., University of Wisconsin. U. S. Geological Survey. Whitaker, E. H., La Salle, Ill. Internal Revenue Bureau.	Tape compared. Thermometers compared. Tape compared. Information furnished. Two tapes compared. Tape compared. Tape compared. Weight compared. Tape compared. Tape compared. Two tapes compared. Tape compared. Ullage table furnished.
April	Goodwin Metre Company, Philadelphia, Pa. Darling, C. P., Huntington, N. Y. Seelig & Kandler, Chicago, Ill. City of Newark, N. J.	Cubic-foot bottle compared. Information furnished. Weights and measures adjusted.
May	U. S. Geological Survey. Rose, Hon. A. J., Austin, Tex. Baker, E. B., Gloversville, N. Y. Buff & Berger, Boston, Mass. Treasury Department. Mendenhall, T. C., Worcester, Mass. Denison & Perfler, Columbus, Ohio. Treasury Department. U. S. S. Gen. Geo. W. Snow, Salt Lake City. Lutz, H. R., Guttenberg, N. Y. Denison & Perfler, Columbus, Ohio.	Tape compared. Information furnished. Two tapes compared. Information furnished. Information furnished. Information furnished. Information furnished. Information furnished. Information furnished. Information furnished. Information furnished. Three tapes compared.
June	Mendenhall, T. C., Worcester, Mass. U. S. Weights and Measures Association, San Francisco. Osborn, W. B., Clarksburg, W. Va. U. S. Internal Revenue Bureau.	Tape compared. Weights compared. Information furnished. Alcoholometer compared.

U. S. COAST AND GEODETIC SURVEY REPORT FOR 1895.

PART I.

PROGRESS SKETCHES.

1. Sketch of general progress (eastern sheet).
2. Sketch of general progress (western sheet).
3. General chart of Alaska.
4. Progress of surveys for locating the boundary line between Alaska and the British Possessions in North America.
5. Map showing longitude stations and connections determined by the electric telegraph between 1846 and June 30, 1895.
6. Map showing positions of magnetic stations occupied between 1844 and June 30, 1895.
7. Map showing lines of geodetic leveling run, and positions of gravity stations to June 30, 1895.
8. Progress of surveys and resurveys between the St. Croix and Hudson rivers, with subsketch showing the surveys of the Northeast boundary lakes.
9. Triangulation between the Atlantic Coast and West Virginia, with subsketch showing progress of surveys near Charleston, S. C.
10. Triangulation between western Kansas and eastern Utah along or near the thirty-ninth parallel.
11. Boundary survey between California and Nevada; scale 1-400 000.
12. Progress of the surveys on the coasts of Oregon and Washington from Tillamook Bay to the boundary, with subsketch of progress in San Francisco Bay.
13. Sketch showing the extension of triangulation from Atlantic Base to the Gulf of Mexico, with subsketch showing triangulation in eastern Tennessee.
14. Progress of surveys and resurveys of the Gulf coasts of Florida and Alabama.
15. Reconnaissance for triangulation along Rio Grande, from El Paso to the Gulf of Mexico.
16. Map showing the distribution of the principal astronomic stations occupied by the Coast and Geodetic Survey for latitude, longitude, and azimuth to June 30, 1895.
17. Sketch of Porcupine River, from the boundary to Fort Yukon, Alaska; scale 1-400 000. From a reconnaissance by J. H. Turner, Subassistant in 1890.
18. Progress sketch of vicinity of St. Michaels, Alaska; scale 1-200 000. From surveys in 1890 and 1891.
19. Progress sketch of vicinity of Yakutat Bay and Mount St. Elias, Alaska; scale 1-400 000. From surveys in 1892 and 1894.
20. Progress sketch of Lituya Bay and Fairweather mountains, Alaska; scale 1-200 000. From surveys in 1894.
21. Progress sketch of Chilkat and Chilkoot rivers, Alaska; scale 1-200 000. From surveys in 1890 and 1894.
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23. Progress sketch of Stikine River, Alaska; scale 1-200 000. From surveys in 1886 and 1893.
24. Progress sketch of Yukon River and Fortymile Creek, at the crossing of the one hundred and forty-first meridian; scale 1-200 000. From surveys in 1889 and 1891.

UNITED STATES COAST AND GEODETIC SURVEY SKETCH OF GENERAL PROGRESS

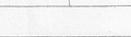
JUNE 30 1895

Eastern Sheet

Scale 5000000



EXPLANATION OF SYMBOLS

- Primary Triangulation 
- Secondary Triangulation 
- Tertiary Triangulation 
- Reconnaissance 
- Surveyed Topography 
- do. In-shore Hydrography 
- do. Off-shore do. 
- Lines of Deep Sea Soundings 
- do. Geodesic Levelling 

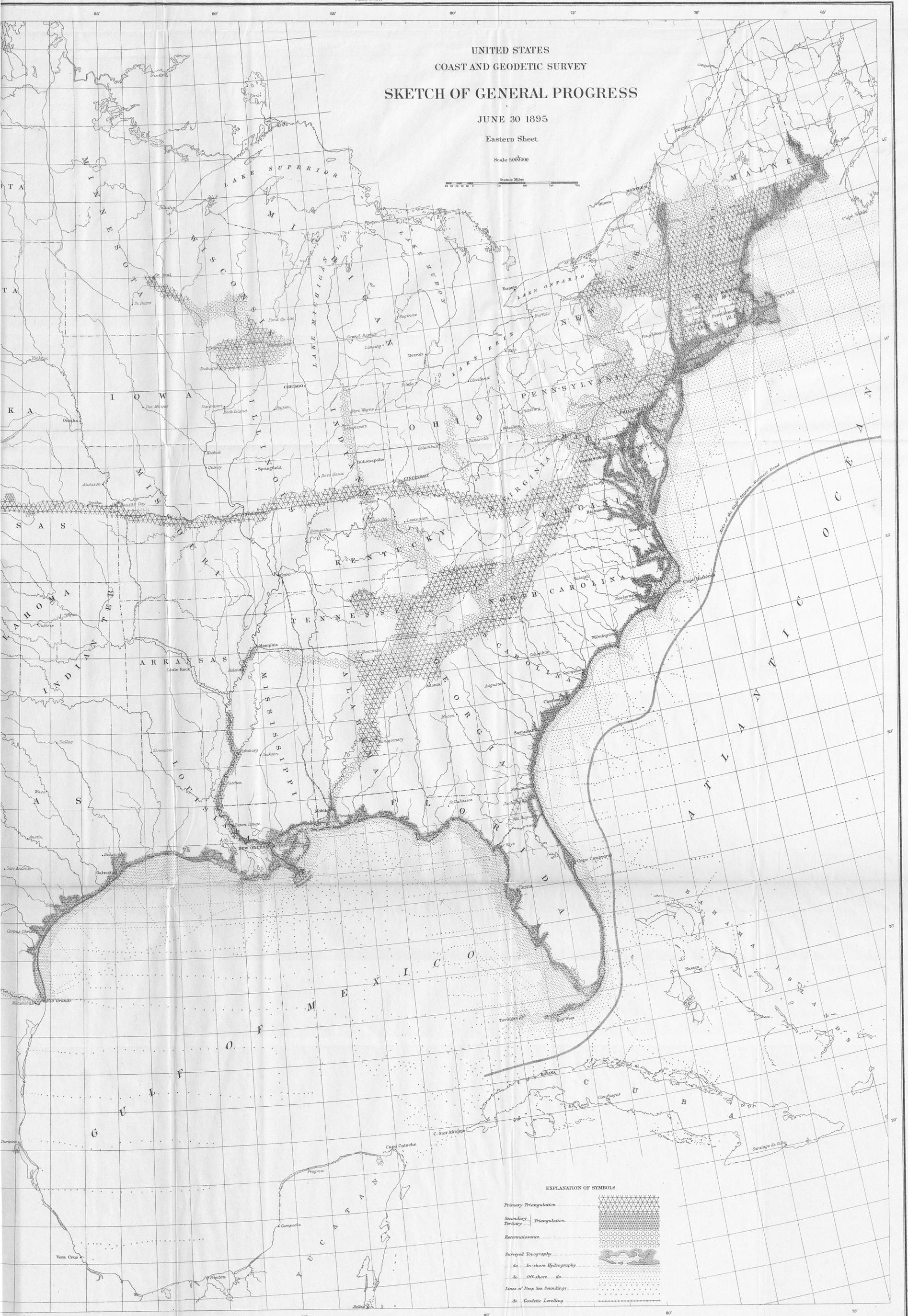
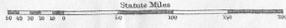
UNITED STATES
COAST AND GEODETIC SURVEY

SKETCH OF GENERAL PROGRESS

JUNE 30 1895

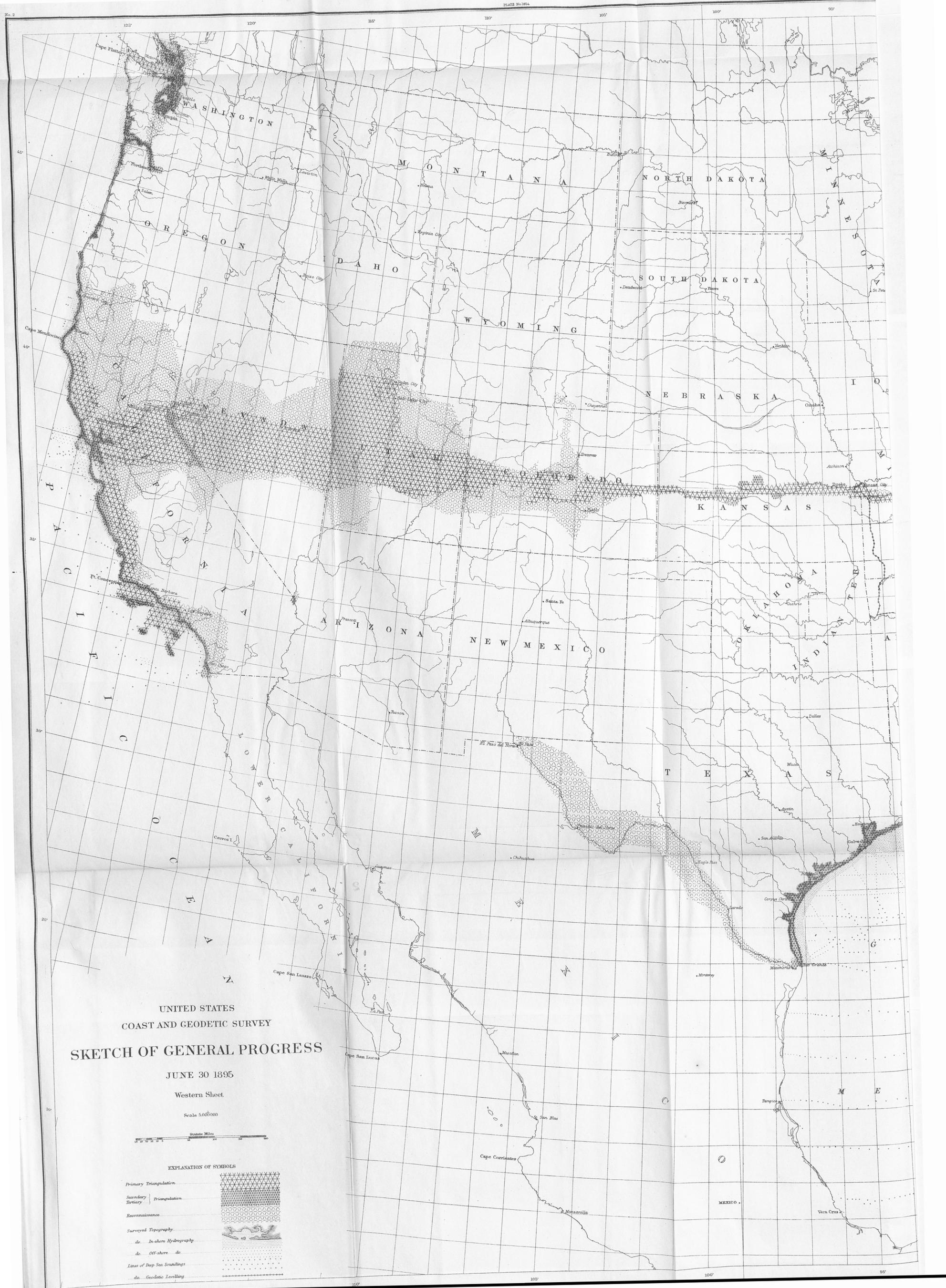
Eastern Sheet

Scale 5000000

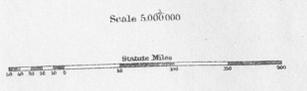


EXPLANATION OF SYMBOLS

- Primary Triangulation..... [Cross-hatch pattern]
- Secondary Triangulation..... [Diagonal line pattern]
- Tertiary Triangulation..... [Dotted pattern]
- Reconnaissance..... [Dotted pattern]
- Surveyed Topography..... [Shaded area]
- do. In-shore Hydrography..... [Dotted pattern]
- do. Off-shore do..... [Dotted pattern]
- Lines of Deep Sea Soundings..... [Dotted pattern]
- do. Geodetic Levelling..... [Dotted pattern]

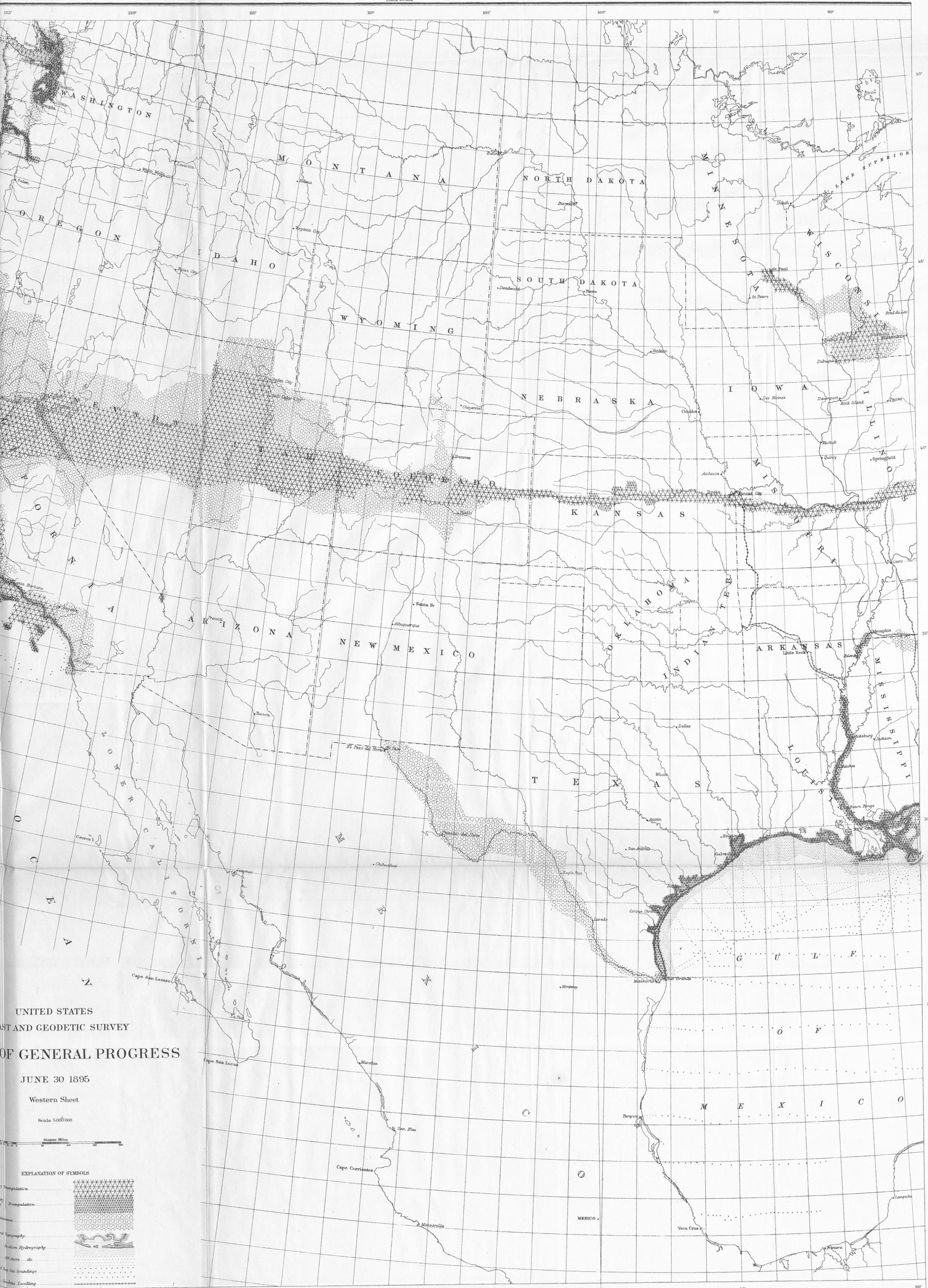


UNITED STATES
 COAST AND GEODETIC SURVEY
SKETCH OF GENERAL PROGRESS
 JUNE 30 1895
 Western Sheet.



EXPLANATION OF SYMBOLS

Primary Triangulation	
Secondary Triangulation	
Tertiary Triangulation	
Reconnaissance	
Surveyed Topography	
do. In-shore Hydrography	
do. Off-shore do.	
Lines of Deep Sea Soundings	
do. Geodetic Levelling	



UNITED STATES
AST AND GEODETIC SURVEY
OF GENERAL PROGRESS

JUNE 30 1895

Western Sheet

Scale 5000000



EXPLANATION OF SYMBOLS

- Triangulation
- Topography
- Hydrography
- do
- do
- do
- do
- do



GENERAL CHART OF ALASKA

Scale 3600000

Compiled from United States and Russian Authorities

ALL SOUNDINGS IN FATHOMS, HEIGHTS IN FEET

Published Dec. 1895, W.W. DUFFIELD, Superintendent
Venkov, O.H. Hillman, Assistant in charge of the Office
J.E. Mason, Local Comd. U.S.N. Hydrographic Inspector

(Date of first publication 1890)

