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No. 17.

REPORT OF THE SUPERINTENDENT

OF THE

U. S. COAST AND GEODETIC SURVEY

SHOWING

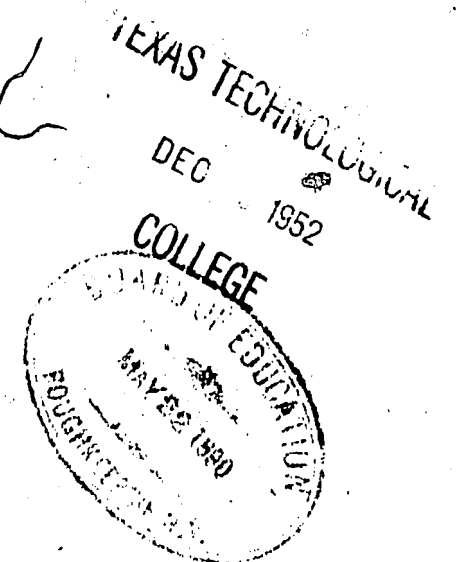
THE PROGRESS OF THE WORK

DURING THE

FISCAL YEAR ENDING WITH

JUNE, 1887.

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1889.



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foregone any extended leave of absence and remained almost daily at his post. I wish especially to acknowledge the skillful assistance of Miss S. C. Ayres in Office correspondence and the care of the records of leave of absence. Mr. R. M. Harvey has attended to the filing of letters, registering mail, and receiving and forwarding express matter. Miss S. B. Harvie and Miss Kate Lawn have contributed much to facilitate the work of my part of the Office by promptly furnishing accurate copies, by hand and by type-writer, of material intrusted to them from all Divisions of the Office. On the 6th of January, 1887, the office of the Assistant in Charge lost the valued services of Miss F. Cadel by transfer to the Tidal Division. Up to that date she had given faithful attention to the preparation of descriptions and sketches of stations and to miscellaneous copying. The Survey lost the service of an accomplished clerk when Miss M. L. Oliver was promoted and transferred to the Treasury Department. It is hardly necessary that I should allude here to the valuable service rendered by your especial clerk, Mr. William B. Chilton, but it is proper that I should extend my thanks to him for his earnest efforts to facilitate the work of the Office generally.

Mr. Silas E. Parsons, a trustworthy and honest man, died suddenly October 11, 1886. Mr. William J. McMahon, who had served as plate-printer's helper in the Office but a short time, died January 23, 1887; and Mr. F. Courtenay, an accomplished engraver, died March 23, 1887.

I feel that after two years of service as Assistant in charge of the Office and Topography, I am beginning to understand its many complexities. I am also more than ever convinced that whoever manages such a work must rely for success mainly upon the earnest support of the Chiefs of Division and their skilled helpers. I have had this, and beg here to express to them my high appreciation of their untiring patience and industry.

In public as well as in private business a judicious division of labor is indispensable to the highest excellence in results. Such a division of labor is illustrated in the present distribution of their respective special duties between the Hydrographic Office of the Navy, the U. S. Geological Survey, and the U. S. Coast and Geodetic Survey, whose fields of operation are sufficiently distinct to prevent mutual encroachment, while their methods are in some particulars sufficiently similar to promote the earnest emulation which is a condition of the highest efficiency.

Believing that the U. S. Coast and Geodetic Survey has a future of great usefulness and promise before it, and looking with pride upon its previous performance, I shall not cease to devote my best efforts to its continued success and welfare.

Yours, respectfully,

B. A. COLONNA,

Assistant in charge of Office and Topography.

To Mr. FRANK M. THORN,
Superintendent U. S. Coast and Geodetic Survey.

REPORT OF THE COMPUTING DIVISION, COAST AND GEODETIC SURVEY OFFICE, FOR THE FISCAL YEAR ENDING JUNE 30, 1887.

COMPUTING DIVISION, COAST AND GEODETIC SURVEY OFFICE,
June 30, 1887.

DEAR SIR: In conformity with regulations I have the honor to submit the usual report of work done by the several computers and others temporarily attached to this Division of the Office during the fiscal year ending June 30, 1887.

The charge of the Computing Division was continued with the undersigned, and no change occurred during the year in the personnel of the regular computing force, which remained the same as in the previous year, and thus demanded its utmost exertion in order to keep up the current work and make some impression on older work now capable of being placed on standard data. Mr. A. D. Risteen was transferred to the Computing Division October 1, 1886, taking a place which had become free by Mr. A. S. Christie's appointment to the Tidal Division. On October 26, 1886, Mr. M. Farquhar was temporarily transferred to the pendulum party under Assistant

C. S. Peirce; he reported for duty in the Computing Division February 1, 1887; between April 22 and May 11, he was again engaged on pendulum work; in consequence of these transfers the amount of astronomical work has suffered to some extent; besides the only telegraphic longitude work that could be attempted during the year had to be placed in the hands of Subassistant Preston, who was attached to the Division for less than two and one-half months. Mr. P. R. Stansbury, clerk to the Computing Division, resigned on account of ill health some time in August, 1886; his place has not been filled, but between August 20, 1886, and January 31, 1887, Miss P. E. Smith acted as writer, and in the same capacity Mr. W. C. Maupin was engaged between February 14, 1887, and the close of the fiscal year; technical and scientific papers are copied by one of the computers. Of temporary help the following computers were attached to this Division during the fiscal year: Subassistant F. H. Parsons from July 1, 1886, to August 20; Mr. W. B. Fairfield from July 1, 1886, to August 9; Subassistant J. E. McGrath from July 22 to 29, 1886; Subassistant E. D. Preston from September 18, 1886, to November 30; Assistant F. Smith from October 4, 1886, to March 22, 1887; Subassistant R. A. Marr from October 15, 1886, to April 7, 1887; Subassistant C. H. Van Orden from October 21, 1886, to March 31, 1887. Mr. J. M. Duesberry acted as writer between February 1 and 12 inclusive.

The increased general correspondence of the Office, relating to matter technical and scientific, makes occasionally heavy demands on the computing force, and is frequently a source of unavoidable interference with the regular computing work; the information called for is furnished as promptly as practicable. Besides directing, distributing, supervising, and reporting the work performed in this Division, special attention was given by me to the following discussions and reports: During July, August, September, October, and part of November, 1886, I gave all my spare time to the computations, the discussion, and the report for the press of the magnetic and corresponding astronomical work of the Fort Conger Polar Expedition under command of Lieut. A. W. Greely, U. S. A., 1881-'84; this work forms part of the International Polar Research, and will be published by the office of the United States Signal Corps. I have also brought out a new edition (the sixth) of the Discussion of the Secular Variation of the Magnetic Declination, which now comprises one thousand and seventy-one observations at ninety-four stations; this paper forms Appendix No. 12 in the Report for 1886. Considerable attention, also, was given to proof-reading of certain scientific appendices in the 1885 Report. Among a large number of reports made, one on the construction of a new primary-base apparatus and one on astronomical, geodetic, and magnetic field-work proposed for the next fiscal year may be specially mentioned. I also made the usual magnetic observations in this city at the close of the year.

The work performed by each computer during the year is herewith enumerated in detail.

Edward H. Courtenay was engaged in the least square adjustment of the old and new triangulations of Long Island Sound and adjacent coasts, bringing the results up to the standard astronomical and geodetic data of the Survey. He also chiefly supplied the required geodetic information for field and office parties; had full charge of the geodetic registers containing the geographical positions, and took care of the duplicate records deposited with the Computing Division. He also prepared manuscript computations for binding making in all one hundred large volumes; assisted in getting up certain statistics bearing on the efficiency of the service for the years 1884-'85-'86-'87, and made satisfactory progress with the computation and adjustment of the triangulation about Baltimore, 1886.

Myrick H. Doolittle prepared final abstracts of horizontal directions at the eastern stations in Nevada, 1882-'83, and in western Utah, 1884-'85, and completed the computation of the primary and secondary triangulations; adjusted the primary triangulations, coast of California, south of Monterey Bay, 1884-'85-'86; computed the secondary and tertiary triangulations in the vicinity of San Simeon of 1871-'72-'73-'74 and of 1884-'85; solved a number of normal equations; computed the length of a set of four-meter base bars; adjusted the triangulation between Hereford Inlet and Absecon Light-house, New Jersey, 1881-'84-'86; computed the geodetic operations on the coast between Cape Fear River and the South Carolina boundary, 1886; computed the supplementary triangulation of Core Sound and of Beaufort Harbor, North Carolina, 1886; computed the heights of Mount Hamilton and surrounding stations, California, and prepared abstracts of vertical angles at all primary stations in Nevada and Utah.

Verification and adjustment at the United States Mint, Philadelphia, of certain weights intended for use as standards in the San Francisco Mint.—Recomparison of the Star Troy Pound of the Office of Construction of Standards of Weight and Measure with the Standard Troy Pound of the Philadelphia Mint.—A request having been made by the Director of the Mint for the services of the Office of Construction of Standards of Weight and Measure in the verification and adjustment at the United States Mint, Philadelphia, of certain weights intended for use as standards in the Mint at San Francisco, Assistant Andrew Braid was detailed by the Superintendent for this duty with the approval of the Secretary of the Treasury. On August 3 Mr. Braid proceeded to Philadelphia, accompanied by Dr. J. J. Clark, Adjuster of Weights and Measures. Dr. W. P. Lawver, Assayer of the Mint, was in attendance under the instructions of the Director, as the representative of the Mint, to witness the tests and verifications.

Mr. Braid's elaborate report shows that the closest attention was paid to every detail that would insure accuracy. Means were taken to remedy slight defects found to exist in the large Standard Balance of the Mint, and to obtain an additional balance of a greater degree of sensitiveness; the methods of weighing were so arranged as to eliminate any slight inequalities that might exist in the weights of the right and left parts of each balance; to eliminate also any inaccuracy of adjustment of the balances or any progressive change in the beams during weighings, due to expansion or contraction, and also any constant error due to unequal flexure of the two arms of the beam.

The weighings were made in the room known as the Cabinet, and the standard pound of the Mint and the weights to be tested were always left together in the balance case over night so as to insure equality of condition as to temperature, etc.

No comparisons were made between the new weights and the Mint Standards of like denomination, as no record could be found showing the precise value of these standards. The Kater Pound (the Standard Troy Pound of the Mint) was therefore made the sole basis of comparison for the determination of the values of the new weights and their subsequent adjustment and verification.

The weighings were made by Dr. J. J. Clark and the reductions and computations by Mr. Braid. From four to six repetitions of the weighings were made in each instance, and the value of one division of the balance scale was determined for each set.

Upon the completion of the weighings and the computation of their results, the adjustments were then made by Dr. Clark by taking off from the bottom of each weight the amount necessary to bring it within the allowable limit of error. Re-weighings were then made and the results placed on record.

Advantage was taken of the present opportunity to make a re-comparison of the Star Troy Pound of this Office with the Mint Standard, the last comparison having been made in 1876. The result of a large number of weighings of the Star Pound with the Mint Standard indicated a less discrepancy between the two weights than in 1876 by about 0.012 gr.

Determinations of latitude and gravity at stations on the Hawaiian Islands for the Hawaiian Government.—From the results of observations for latitude and gravity made in June, 1883, at Honolulu, Oahu, and at Lahaina, Maui (Freyinet's station of 1819), by Subassistant E. D. Preston, on his detachment from the Eclipse Expedition, and from a comparison of these results with those of Captain Tupman, of the English Transit of Venus party, who had determined latitude in 1874, it appeared very desirable, both from a scientific and practical point of view, to determine a number of astronomical latitudes at different points on these islands, where the great depth of the sea, the volcanic formation of the high mountains, and their distance from continental masses, furnished conditions presented by no other locality on earth for the study of the effects of gravity upon the direction of the vertical.

Subsequent correspondence on the subject between W. D. Alexander, esq., Superintendent of the Hawaiian Government Survey, and Mr. Preston, and a personal conference between Mr. Alexander and the Superintendent of the Survey in October, 1884, led ultimately to a request from the Hawaiian Government, received through its minister, Hon. H. A. P. Carter, to the Superintendent of the Survey, for the detail of Mr. Preston to make the observations for latitude and determinations of gravity required.

Mr. Preston's application for six months' leave of absence without pay having been approved by the Department, he left Washington in December, 1886, and arrived in Honolulu January 12, 1887, having with him the two-yard and meter Peirce pendulums Nos. 3 and 4. Pendulum No. 3 had been swung in 1883 at stations on the Caroline Islands, on the Hawaiian Islands, and at San Francisco, and final computations of results made by Mr. Preston. Before leaving Washington he had prepared and tested this pendulum so that it should be ready for immediate transportation. The plan of his work contemplated a thorough study of the plumb-line deflections in the Hawaiian Islands for the Hawaiian Government, and to this were added later, determinations of gravity at the base and summit of Haleakala, the largest extinct volcano in the world, and also at Honolulu, for the sake of a better determination of the correction for elevation above sea-level, and also to connect the gravity work of the United States Eclipse Expedition of 1883 with that of the present year. For the latitude determinations he had with him meridian telescope No. 1.

Between the 22d of January, when the work was begun, and the end of May, all of the stations occupied were for observations of latitude. The first was Ewa station, Puuloa, near the mouth of Pearl River. The second was at Kahuku, on the windward side of Oahu. Observations here were completed February 13. A preliminary reduction of results at this station showed a difference between the astronomical and geodetic latitudes of nearly a minute of arc, one of the most striking examples in the world of deflection of the plumb-line from mountain attraction.

The time from February 22 to April 2 was devoted to the island of Kauai, situated about eighty miles to the northwest of Oahu. On Kauai three latitude stations were occupied, two on the south and one on the north side. For the safe transportation of the instruments between the two southern stations, Waimea and Koloa, it was necessary to remove the eye-piece micrometer and latitude level from the telescope and carry them separately, the road being exceedingly rough and the cart of the most primitive kind.

Honolulu was occupied for latitude between April 3 and April 12. Three stations on the island of Hawaii occupied the party till May 29. Kohala consumed a week only. But here the wind was the whole time so violent that living in a tent was out of the question, and the party found lodging in an old sugar-shed. The station at Hilo, where the rain-fall is over sixteen feet a year, required nearly a month, and during that time only one good night for observations could be obtained. Observations were obtained on two other nights, partly clear, but it was not deemed advisable to wait for more favorable weather, as Mr. Preston was informed that the weather had been better than might be expected much of the time in Hilo.

At Ka Lae the weather was passably favorable. The difficulties of obtaining water for cooking and drinking were great. It had all to be carried on donkey back a distance of eight miles, part of the road being over the rough lava known as aa.

Gravity was determined at Honolulu between June 1 and June 14.

Owing to bad weather and inaccessibility of stations, it was found impossible to finish the work originally contemplated within the time at first assigned; hence an extension of furlough for three months was granted to Mr. Preston, in order that the entire programme might be completed. This extended his leave to September 15, 1887.

From June 14 to 22 Kailua, on Hawaii, was occupied for latitude, and from that date till June 30 the party was occupying station Haiku, on the island of Maui, for determinations of latitude and gravity.

Further account of the progress of this work will be given in the next annual report.

COAST AND GEODETIC SURVEY OFFICE.

The assignment of Assistant B. A. Colonna to duty in charge of the Office and Topography was continued throughout the year. Mr. Colonna's report of the Office operations, accompanied by the detailed reports of the chiefs of the several Office divisions, appears in Appendix No. 4 to this volume.

In his summary of progress made during the year Mr. Colonna refers to important information furnished in response to official requests from the National and State Governments; mentions improvements introduced in various branches of office and field-work; urges the great need of an