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TO THE

MISCELLANEOUS DOCUMENTS

OF THE

SENATE OF THE UNITED STATES

FOR THE

FIRST SESSION OF THE FORTY-NINTH CONGRESS.

COLLEGE

IN THIRTEEN VOLUMES.

- Volume 1.—Nos. 1 to 46, inclusive.
- Volume 2.—Nos. 47 to 98, inclusive, except Nos. 71 and 82.
- Volume 3.—No. 71.
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- Volume 5.—Nos. 99 to 170, inclusive, except Nos. 104, 120, 145, 152, 154, 155, 156, and 162.
- Volume 6.—Nos. 104, 120, and 145.
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WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1886.

different conditions to be satisfied. Besides, the large operations of line and azimuth measures (of which the Coast Survey has many examples on the coast of Florida and Louisiana), it principally makes use of two methods differing little in principle but more in the choice of instruments. They may be characterized as (1) traverse (or telemeter) work, consisting mainly of direct linear and angular measures of connected lines joining the objects whose relative positions are to be determined, and starting from and returning to a point trigonometrically fixed, the instrument employed (known as a tachymeter) combines the horizontal and vertical circles of the theodolite with the optical telemeter and the spirit-level; and (2) plane-table work, a kind of graphical triangulation, combined with telemeter measures, produces the delineations of the natural and artificial features of the country directly. Relative to the first method, its progress in the field is slow. On the other hand, traverse surveying demands extra office-work for plotting and copying the topographical hand sketches made in the field. Contour lines or curves of equal level form an essential feature of topography. With comparatively few objects to locate, and on ground of much sameness and broad natural features, plane-table surveying would be out of place. Traverse or tachymetric surveying has a large range of applicability, due to its ready powers of adaptation to the features of the ground and to any degree of accuracy that may be proposed for the survey.

With the above exposition of the work of geodesy premised, the accompanying chart will need no farther comment or explanation beyond what is given in its legend.

I remain, sir, yours, very respectfully,

CHAS. A. SCHIOTT,
Assistant.

J. E. HILGARD,
Superintendent United States Coast and Geodetic Survey.

Mr. CHARLES S. PEIRCE, an assistant in the Coast Survey, appeared and made a statement, as follows:

By Mr. LYMAN:

Question. What position do you hold under the Government?

Answer. I am an assistant in the Coast Survey, and have charge of the office of weights and measures under the Coast Survey. I have charge, also, of the gravimetric survey.

Q. Will you, if you please, give the Commission a short sketch in your own language of your work as the person in charge of the office of weights and measures?

Answer. The office of weights and measures at present is a very slight affair, I am sorry to say. It only exists by law, because Congress many years ago directed the Secretary of the Treasury to supply the different States and Territories and so forth with standard weights and measures, and that provision was afterwards extended to the agricultural schools, so that for that purpose it has been necessary to have standards and balances made and the States and schools have been supplied with these articles. We have our office there to keep up the supply of these various things and we take occasion to verify any standard that is referred to us.

But an office of weights and measures in the sense in which it exists in every other country, namely, an office which should be prepared to make exact verifications of all sorts of standards and to certify officially to them, does not exist in the United States. We have had within a week or so an application from a surveyor who sent on a couple of yards which he wanted verified better than that could be done at any private institution. We have had standard gauges to verify. We have had micrometrical scales, whose errors were to be determined. So far as we can do those things we do them, and if any work involving expense is required we have that done outside. In far too many instances we want the means of executing the verifications asked of us. Thus what we do

Book

in the office of weights and measures is to supply the different persons whom we are directed to supply, and then in addition do as much of the usual work of an office of weights and measures as our very narrow circumstances will permit. But we are not prepared to fulfill the real functions of such an office and we do not do what the public demands of us, or what we are constantly asked to do.

Q. Will you tell us what your idea is of what an office of weights and measures should be—such an organization as would fulfill reasonably the public demands for such work. Supposing you had *carte blanche* for such an organization, how would you proceed?

A. I think the proper functions of weights and measures in this country are these: In the first place the legal units of length and of weight, say the yard, the meter, the pound, and kilogram, we should be prepared to verify. That is, if anybody sends in copies of those weights and measures and wishes to have them compared with our standards, we should be authorized to send them back an official certificate as to the length or weight of the copies sent and that certificate should be valid in the courts. We now do these things, but our certificate has no legal value of a different nature from that of any expert testimony. In the second place, we should be prepared to speedily verify, for people making proper application, the multiples and submultiples of the units of mass and length. Messrs. Pratt & Whitney, of Hartford, Messrs. Brown & Sharp, of Providence, Messrs. Sellers & Co., of Philadelphia, and others are engaged in making gauges of great precision, and it is highly important and to the interest of all parties that their gauges should exactly correspond. This exact uniformity can only be secured by all their gauges measuring precisely what they purport to measure in inches. It is therefore desirable that our office should be prepared to speedily ascertain for such parties whether a given gauge is really, say an inch and a half, or what its true measure is. And to this we should certify officially.

The same thing is true with regard to weights about which we have constant applications; and, so with the capacity measures.

In the third place, there was a conference of electricians in Philadelphia last summer, under the auspices of the Government, and those gentlemen passed a unanimous resolution that the Government ought to supply units for electrical measurements. I think that that was a proper demand, because there exists precisely the same reason why Congress should establish electrical units, as why Congress should establish units of weight and measures of length, namely, important and very numerous contracts are made about electricity. Electricity is an article of sale, it is something offered in the market, and the interpretation of these contracts depends upon the units of electrical quantities. Now you must define how much you have got of such an article any more than how much you have of any material substance which is to be weighed, except by reference to some arbitrary standard, some particular body, which is to be its equivalent; and the only way of producing any uniformity in regard to an arbitrary unit is for the Government to intervene and declare what the standard shall be. That is, Government must declare, that whatever bears the stamp or certificate of a certain office shall be respected in the courts as being entitled to the designation, say of an ohm or a weber. This is what the electricians wish to have done, and it appears that Congress is authorized to do it under the terms of the Constitution, and that it is a reasonable demand that the office of weights and measures shall be put in a condition to give those people the ohms, &c., that they require.

Another function that I think the office should fulfill is that we should have a scientific control over all operations of weighing and measuring in the different bureaus of the Treasury. I do not mean that we should be constantly interfering, but rather that the fact should be recognized that those offices may throw upon the office of weights and measures the responsibility of regulating their methods of procedure. Take the Mint, for instance; the Mint is not, in a narrow use of the term, a scientific office; and yet, it carries on one operation at least, that of weighing the gold and silver, where scientific exactitude is highly desirable, if not necessary. In weighing gold it makes a very considerable difference if all your coins turned out of a certain mint are even a little too heavy or too light; and it appears to me that it would be better for the mints and better for the country, if there were a scientific control of the operation of weighing, more than the annual inspection gives, if there were somebody who was responsible for the methods they use being correct.

Congress has declared a certain brass weight, which is deposited in the Philadelphia mint, to be the pound of the United States for purposes of coinage. Copies of that brass weight are made and sent to the different mints in the United States, and a piece of gold is there put upon one side of an ordinary balance and this brass weight on the other side, and they are balanced, the one against the other. But, owing to the buoyancy of the air, which affects brass rather considerably, but gold hardly any at all, gold being so dense, the piece of gold which is put on the pan of the balance will really not weigh quite so much as the brass. That is, it would not balance quite so much brass *in vacuo* as it does in air. The brass is slightly buoyed up. If this buoyancy were equal at all times it would be a matter of indifference, but when they take that brass weight up to the Carson or Denver mints a considerable part of the atmosphere is left below the level of those places, and they get too much metal into their gold coins.

By the CHAIRMAN:

Q. Too much at those points?

A. More than is in the coins coined at the Philadelphia mint. You will see that that is the necessary result of the thing.

Now that is an example of how it is needful that scientific operations, like weighing and measuring, when they are performed in bureaus that have not otherwise a scientific organization, should be controlled by an office of weights and measures. We ought to have such an office to fulfill these functions toward the public and towards the other bureaus of the Government. It need not enter upon the business of inspecting commercial standards, because that is done already by the States in a satisfactory way. They come to us, too. For instance, it was only the other day that the city of New York applied to our office to see that the office in the City Hall had the proper weights and measures for the verifications of the weights and measures used in the markets of the city. And that is a satisfactory way of dealing with ordinary commercial interests; but when it comes to exact verifications, the ordinary State officers of inspection are not prepared to do the work. The national office lacks both authority and means. Neither does it fulfill the reasonable demand of the electricians, that we should supply them with physical units.

By Mr. LYMAN:

Q. Has this brass weight, that you mentioned as being in the Philadelphia mint, ever been weighed *in vacuo* in this country?

A. No, sir; it has never been weighed *in vacuo* at all. It was obtained in 1827 under the presidency of John Quincy Adams. Mr. Galatia was our minister at London, and it was made by Captain Kater, who was at that time a great authority on the subject; but it is a weight which would now be deemed badly made, because it is hollow, and we do not use hollow weights for measures of precision, because their buoyancy cannot be accurately ascertained. The mint pound was not weighed *in vacuo* by Kater and it has never been weighed since. The Government has, in point of fact, never had any balance that could weigh the pound *in vacuo*.

Q. So that, as I understand you, the pound used in the determination of all our balances is one whose weight we do not know?

A. We do not know it, sir, though it is held that that pound is the pound of the United States. Yet we at our office cannot tell how much that pound is. We do not know, and, consequently, when a person comes to us and asks us to verify a pound weight, and to tell what the correction of it is, we tell them what the correction of it is in terms of the British pound.

Now, the British pound is a pound which was made about 1855, in consequence of the destruction of the old pound and after the system of weights in England had been reformed and modified in 1818. This weight is supposed to be nearly a copy of the old avoirdupois pound. As a standard it has never had any authority conferred upon it by our Congress, and it could not have had any authority at the time when we separated from the mother country; so that I cannot see how that can be legally our pound, except upon the belief that it is of just the same weight as the old pound which was destroyed. Yet our office gives the people the pound in terms of that pound. We verify pounds brought to us and give the errors in terms of that pound. We do so, because that is a pound, the true weight of which we can ascertain, while the weight of the one in the Philadelphia mint we cannot.

Q. When you say "that pound" you mean the British pound which you have imported from England, do you?

A. I was speaking, not of the pound we have imported from England, but of the pound that is deposited there in England; for, once in a while, our pound gets sent over there for reverification; and there is no doubt about that pound and its relation to our copies of it.

By the CHAIRMAN:

Q. You have a copy of that pound in your office here?

A. Yes; an excellent copy.

Q. Is a copy of that pound in the mint, or is that in the mint a different pound?

A. At the time when the pound in the mint was constructed the standard pound of England was the old troy pound of 1758, which was afterwards destroyed at the burning of the houses of Parliament. After that, when new standards were made in consequence of the destruction of those old standards, the English ceased to take the troy pound as their standard. They established the avoirdupois pound, which avoirdupois pound was assumed to have a certain relation to the troy pound, that is, to weigh 7,000 grains, of which the troy pound contained 5,760. The pound at the mint at Philadelphia is a troy pound, a copy of that old pound; yet when people bring us avoirdupois pounds and ask us what their errors are we are compelled to tell them in terms of the present British pound.

Q. Of the avoirdupois and not the troy?

A. Yes; but that is not quite the point. You might convert it from the avoirdupois to the troy by multiplying by $\frac{12}{14.7}$. But the question is about the grain, or fraction of a grain by which the British avoirdupois pound differs from $\frac{5}{16}$ of the Philadelphia pound.

Q. How does the mint in Philadelphia give an exact copy to the mint in Denver?

A. Although our office is in this state of nonentity, having hardly any legal existence, the mints and other bureaus are in the habit of coming to us and asking us to make copies of the pound and to verify them, and we have sent to Philadelphia and have placed the mint pound upon one beam of a balance and another troy pound upon the other side, and have ascertained that the former balances a certain piece of brass in the air; but, inasmuch as the mint pound is hollow, and we cannot tell whether the air leaks in and leaks out with the changes of the barometer or not, the whole proceeding is very unsatisfactory. The question asked brings me to another desideratum to put this office upon a proper footing. As I say, the English reformed and modified their system of weights and measures in 1818, so that ours no longer coincides with theirs. For instance, a gallon and a quart are very different in the two countries, about in the ratio of 4 to 5, and apothecaries' weights are so different—about 10 per cent.—that one who had got a prescription from an English physician in Montreal and then came and got it put up in New York, would get an appreciably different dose.

Q. We get more, or less?

A. More in this country; for everything in England now goes by avoirdupois weight, while we have retained the old weights and measures. It is highly desirable, it appears to me, that England, and America, and Russia, which are the three countries which use the English system of weights and measures, should establish the weights and measures they do use on an international basis, and at present there is no international basis.

By Mr. HERBERT:

Q. Have you ever compared the pound which you have verified with the mint pound in Philadelphia?

A. That comparison was made by Mr. Lane in 1876.

Q. Was there any difference, and if so, how much?

A. It is believed that there is quite a considerable difference, so great a difference that we are a little in a quandary when people come to us for verifications. The city of New York sent to us recently for avoirdupois and troy weights both, and they send weights to us which are in true relation between troy and avoirdupois weights, and yet our practice has been to verify the avoirdupois weights by the English avoirdupois pound and the troy weights by the pound at Philadelphia, and there is an appreciable difference between those two.

Q. You have a standard troy pound here, have you not?

A. We have no standard troy pound except one derived from that pound at the mint. We can also ascertain what a troy pound would be if obtained from the avoirdupois pound by multiplying by the necessary fraction—a theoretical fraction.

Q. Without regard to the mode of obtaining it, my question is, What is the difference, if any, between the troy pound in the mint at Philadelphia and what you understand as the true troy pound—however you may obtain it? What is the difference between that troy pound at the mint in Philadelphia and the true troy pound?

* 1 British gallon = 1.201 American gallon; 1 British fluid ounce = 0.960 American fluid ounce; 1 British ounce = 0.911 apothecaries' ounce

A. The mint pound is declared by Congress to be the true troy pound.

Q. Well, what is the value of a troy pound?

A. It would be a fraction of a grain, between four and five hundredths of a grain, in air different from $\frac{5}{16}$ of the British pound.

Q. Is that more or less?

A. That I do not remember. I cannot carry the figures in my mind.

By the CHAIRMAN:

Q. I take it that the troy pound of the mint in Philadelphia having been copied by your office and verified, they are exactly equal in air, are they not? That is, if you have taken a true copy of the Philadelphia brass piece, they must be exactly equal when put upon the scale, or else they would not be equal.

A. They are undoubtedly exactly equal when weighed at that point of air.

Q. But you think if you were to reduce the difference of the Troy pound from the avoirdupois pound which you have that they would not coincide with the mint pound at Philadelphia?

A. Precisely.

By Mr. HERBERT:

Q. Is there any metal other than brass that you would suggest, which would avoid this difficulty about the difference in weight resulting from the buoyancy of the atmosphere according to the altitude?

A. Yes.

Q. What metal would be the same *in vacuo* as in air?

A. A different set of weights should be employed to weigh silver and weigh gold. In weighing silver nothing could be made better than a weight made of sterling silver, and in weighing gold, since a gold weight would be rather too soft so that it might wear down, I would prefer an alloy of platinum and iridium, which is considerably used for weights in other countries.

Q. Would that obviate the difficulty?

A. That would obviate the difficulty after we had once ascertained how much to call a pound; but it seems to me as one of the things greatly wanted that the English system of weights and measures should be put upon an international basis, and it is plain that a bureau having a distinct legal standing would be in a better condition to make the necessary *pour parler* than ours in its present state can be. I think a reorganization of the office might bring about an international understanding. Those who are opposed to the metric system certainly ought to desire that the English system should be brought into as perfect a condition as possible, so as to give it every chance in the struggle for existence which intrinsically belongs to it. The reasons scientific men oppose the English system of weights and measures are capable of being in great measure obviated by some slight modifications of that system.

By the CHAIRMAN:

Q. It is claimed that the metric system is more accurate, is it not? What is the scientific view of that point?

A. Well, sir, I do not myself believe that the metric system is so accurate. What I mean to say is this: that a yard is capable of being ascertained and known more accurately than a meter. When you speak of a yard you know exactly what length that is, better than you do now when you speak of a meter, because the yard means the distance between two lines drawn upon a certain bar in London, when that bar is at the tem-

perature of 62° Fahrenheit, which is about the temperature at which measurements are generally made. Therefore there is usually but a small correction to be applied to the length of a yard bar to bring it to its standard temperature. But the meter is the distance between the ends of a certain bar at the freezing point of water. It is forbidden to touch those ends or abut up against them, and therefore it is next to impossible to ascertain what is the true distance between them. That difficulty will be obviated in a few years because the International Commission is making new meters which will be defined by lines. But another difficulty will still remain that the standard of temperature of the bar is the freezing point. Now you may ascertain that another bar is of just the same length as that at the freezing point, but then you have got to correct all the way from the temperature of the freezing point to the temperature at which measures are made; and this will always be a subject of very great difficulty; and, therefore, in my opinion, if you come to a question of exactitude the yard is susceptible of being determined with greater exactitude than the meter, and the balance of utility is, therefore, if anything, upon the side of the yard.

I must say this in regard to the metric system: That before I was appointed to the office of weights and measures I was very strongly in favor of that system, and I thought people who were opposed to it were standing in the way of the progress of the world. But since I have been in a more responsible and more practical relation to the subject my opinion has changed very much, and I now think that it is worth while to see whether opinion could not be united upon a reformed English system, which, with slight changes, could have substantially all the advantages of the metrical system; because, if opinion could be united upon such a system in England and in this country, then I think it would be perfectly feasible for us, considering that we are the nations which perform the accurate measurements on a great scale, that we are the ones that have the accurate machine-shops (there being very few, comparatively, in other countries), and that we are, too, the commercial peoples, I think that even at this date it would not be too late to bring about the universal adoption of such a reformed English system.

Q. Then you think an international arrangement between the United States, Russia, and England very desirable?

A. Yes, sir; but that could not be brought about until some one could go to the English and say, "Now, we have a certain authority and influence here, and we feel confident that certain things could be done if you could do certain other preliminary things." The preliminaries cannot be effected unless we have some existence as an office of weights and measures.

By Mr. HERBERT:

Q. Will you state definitely what authority you think Congress ought to confer on your office in addition to what it possesses now?

A. I think we ought to be authorized to give certificates. We are not authorized at present to give any certificates. The weight of authority in courts ought to be given to our certificates, and those certificates ought to relate to the units of weight and units of length, together with their multiples and submultiples, and also to the units derived from the units of weight, length, and time. That would include the electrical and other physical units.

Q. In addition to giving those certificates, what power is necessary or proper, in your opinion, to be conferred upon your office?

A. We should exercise certain authority, which is now exercised by the Commissioner of Internal Revenue, with reference to methods of gauging and weighing in the internal revenue, and we should have similar responsibility for the methods of gauging and weighing in the custom-houses and in the mints.

By the CHAIRMAN:

Q. Do you not verify the gauges and other instrumentalities used by the Internal Revenue Bureau now, or are they actually independent of you?

A. They are independent of us, but the methods of gauging were, I believe, settled by a commission established some years ago.

Q. In 1868?

A. Yes.

By Mr. LYMAN:

Q. Would you extend it to such things as the test of sugar by the spectroscope?

A. No; I had not intended that we should do anything further than weighing and measuring. That is a matter of chemical analysis. Yet I would not object to being called upon for such a thing as that.

By Mr. HERBERT:

Q. Do you think you ought to verify the polariscope?

A. My definition, I suppose, would not include it. My definition would take in length and units derived from units of weight, length, and time, thus including units of force, velocity, electrical resistance, &c.

Q. The custom-houses throughout the country ought to put themselves in communication with you, ought they not?

A. They ought to do so.

Q. Do they?

A. I do not know what methods of gauging are employed in the custom-houses; they may, from time to time, have consulted our office.

Q. Do you mean to say that your Bureau ought to have power to go into these other different departments of the Government and say to them, "Your weights and measures are incorrect and ought to be corrected;" or do you mean to say, simply, that you ought to have the power to give certificates to them when they make application to you?

A. Well, I think the latter would be satisfactory enough; still I think it would be better to require us to report, at stated periods, to the Secretary of the Treasury upon the methods of weighing and measuring used in those different Bureaus.

By the CHAIRMAN:

Q. As to whether their methods are proper?

A. Proper.

By Mr. LYMAN:

Q. What force do you think would be required for an efficient and economical administration of such a Bureau? Of course you cannot tell exactly, but give us an estimate.

A. I should think a dozen persons would be sufficient.

Q. At present about how many can you command in case of necessity?

A. At present we have three persons who could be used in verifications.

Q. With a dozen persons you think you could cover the ground of the electrical ohm and other measures, do you?

A. With regard to the electrical measurements, I think a great deal of that work ought to be done outside. I think a bureau of the Government cannot very properly be expected to be doing original scientific work. Its natural functions are to do routine work. It can rise above that to a certain extent now and then, but you cannot expect the highest kind of scientific work to result from any mere work of organization. That can only come from individual genius.

If you find that the head of a bureau is disposed to take up scientific questions and treat the business of his office with a little unnecessary scientific thoroughness, I should not think it was advisable to come down upon him and say, "You are to work simply for the \$4,500 or \$5,000 that you are receiving, and are to take no interest in the scientific perfection of your work beyond the point at which it saves money." I would not frown upon scientific aspirations; and yet it is hardly to be expected that scientific investigation undertaken incidentally by a Bureau of the Government, should, in the long run, be of the very highest character.

By the CHAIRMAN:

Q. Here is the original provision [reading]: "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, District of Columbia," &c. So it seems to contemplate, at least if called upon, that you are bound to furnish the custom-houses with verifications of weights?

A. You are undoubtedly right about that. Since I have been in charge of the office we have not happened to be called upon to supply custom-houses.

Adjourned to meet at the call of the chair.

FURTHER STATEMENT BY THE DIRECTOR OF THE GEOLOGICAL SURVEY.

DEPARTMENT OF THE INTERIOR,
UNITED STATES GEOLOGICAL SURVEY,
Washington, February 6, 1885.

Hon. W. B. ALLISON,
Chairman Congressional Joint Commission, &c.:

SIR: I have the honor to acknowledge the receipt of the following letter of inquiry:

SENATE OF THE UNITED STATES,
COMMITTEE ON APPROPRIATIONS,
Washington, January 27, 1885.

DEAR SIR: Will you kindly send to the Commission for its use a short summary of the methods adopted in other countries for conducting topographical surveys; also geologic surveys; and also, in a general way, inform us how cadastral and geodetic surveys are made in the various countries? The Commission is of opinion that this information will be of value.

Respectfully yours,

W. B. ALLISON,
Chairman.

Maj. J. W. POWELL,
Director, Geological Survey.

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ORGANIZATIONS OF CERTAIN BUREAUS.

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GRAVITY EXPERIMENTS.

To whom paid.	On what	Amount.
Adams Express Company.....	Expressage.....	
Geo. W. Knox.....	Freight, &c.....	\$42 75
Francis H. Parsons.....	Subsistence.....	35 84
C. S. Peirce.....	Gravitation.....	44 00
John Shea.....	Cablegram.....	2,945 79
		2 60
Expenditures.....		3,070 98
Appropriation.....		3,000 00
Add 1 per cent from Coast of Maine.....		32 50
Add 2 per cent. from Coast Pilot.....		40 00
Expenditures, as shown above.....		3,072 50
Unexpended balance.....		3,070 98
		1 52
<i>Approximate supplementary statement.—Gravity Experiments.</i>		
Party expenses.....		\$3,070 98
Salary paid to normal force.....		3,199 17
Total.....		6,270 15

COAST PILOT.

To whom paid.	On what account.	Amount.
J. W. G. Atkins.....	Services, subsistence, &c.....	\$223 60
Marcus Baker.....	Subsistence.....	294 00
J. S. Bradford.....	do.....	6 00
George Davidson.....	Examination.....	277 90
John B. Goode.....	Traveling expenses.....	10 20
G. C. Hanns.....	Hydrography.....	228 17
E. J. Leiper.....	do.....	232 73
W. C. Moler & Sons.....	Supplies.....	1 50
J. E. Pillsbury.....	Hydrography.....	84 79
Expenditures.....		1,958 89
Appropriation.....		2,200 00
Less 2 per cent. transferred to Gravity Experiments.....		\$40 00
Expenditures as shown above.....		1,958 89
Unexpended balance.....		1,998 89
		1 11
<i>Approximate supplementary statement.—Coast Pilot.</i>		
Party expenses.....		\$1,958 89
Salary paid to normal force.....		2,923 00
Navy pay and rations.....		2,474 76
Total.....		7,356 65

MAP OF UNITED STATES.

To whom paid.	On what account.	Amount.
J. B. Boutelle.....	Services, extra observer.....	\$200 00
John W. Donn.....	Topography.....	920 00
H. F. Walling.....	Maps, &c.....	621 35
Expenditures.....		1,741 35
Appropriation.....		2,000 00
Less 3 per cent. transferred to Washington Territory.....		\$60 00
Less 4 per cent. transferred to Tides, Pacific.....		80 00
Less 3 per cent. transferred to Magnetica, Pacific.....		60 00
Expenditures, as shown above.....		1,741 35
Unexpended balance.....		1,941 35
		58 65
<i>Approximate supplementary statement.—Map of the United States.</i>		
Party expenses.....		\$1,741 35
Salary paid to normal force.....		363 00
Total.....		2,104 85

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ORGANIZATIONS OF CERTAIN BUREAUS.

MAGNETICS—ATLANTIC.

To whom paid.	On what account.	Amount.
James B. Baylor.....	Magnetics.....	\$530 50
Appropriation.....		500 00
Excess*.....		30 50

*To be covered by transfer under 10 per cent. clause.

Approximate supplementary statement.—Magnetics, Atlantic.

Party expenses for magnetics.....	\$530 50
Salary paid to normal force.....	467 90
Total.....	998 40

GRAVITY EXPERIMENTS.

To whom paid.	On what account.	Amount.
C. S. Peirce.....	Gravitation.....	\$1,352 87
Appropriation.....		3,500 00
Unexpended balance.....		2,147 13

Approximate supplementary statement.—Gravity Experiments.

Party expenses.....	\$1,352 87
Salary paid to normal force.....	1,002 70
Total.....	\$2,355 57

COAST PILOT.

To whom paid.	On what account.	Amount.
George Davidson.....	Coast-pilot examinations.....	\$96 15
G. H. Peters.....	Mileage and subsistence.....	129 04
Expenditures.....		225 19
Appropriation.....		2,500 00
Unexpended balance.....		2,274 91

Approximate supplementary statement.—Coast Pilot.

Party expenses.....	\$225 19
Salary paid to normal force.....	918 90
Total.....	1,044 09

TOPOGRAPHY—CALIFORNIA.

To whom paid.	On what account.	Amount.
George Davidson.....	Topography.....	\$6 00
Stehman Forney.....	do.....	2,006 05
Aug. F. Rodgers.....	do.....	2,155 32
Expenditures.....		4,227 37
Appropriation.....		8,500 00
Unexpended balance.....		4,272 63

Approximate supplementary statement.—Topography, California.

Party expenses for topography.....	\$4,227 37
Salary paid to normal force.....	1,905 20
Total.....	6,132 57

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