FRIDAY, APRIL 6, 1883.

DISTRIBUTION OF PUBLIC DOCUMENTS.

THE report regarding the publication and distribution of public documents, prepared by a special committee of experts, Messrs. Ames, Spofford, and Baird, and recently issued from the Government printing-office, is the fruit of one of those spasms of virtue that is apt to overtake spendthrifts, individual or corporate, at the end of a period of peculiarly unreasonable waste and folly. In any well-managed government, the conditions which this report shows to exist would be a matter for chagrin and for immediate remedy; but, as the remediable waste probably does not exceed a million of dollars at the most, it will be perhaps too trifling an evil for attention.

The committee report that they "are very deeply impressed with the number of documents printed by authority of Congress, aggregating, for the forty-sixth Congress, 2,324,254, and, for the first session of the forty-seventh Congress, 1,354,947. . . . They are no less deeply impressed with the lack of system and economy in the distribution of these documents. . . . Under the practice now prevailing, nearly all documents, whatever may be their cost and value, are distributed by from two to four agencies, each in ignorance of what the others are doing."

They recommend a single agency for all the distribution, that the public libraries have the first care, and that discretion be shown in the choice of libraries which are to receive the full sets of congressional documents. They print twenty-four pages of tables, giving, in fine type, a list of the 'documents' printed by the forty-sixth Congress, — a wonderful list, in which the transit of Venus comes against the Fitz John Porter case, and the eulogies on Z. Chandler succeed the nautical almanac. Congress assumed that twelve thousand persons needed to hear what Congress said on the death of the above-named statesman, while only half that number needed information on the chinch-bug; three thousand required information on the flags of maritime nations, while only twelve hundred wanted the third volume of the geological survey.

No. 9. — 1883.

The number of scientific books is surprising. There are about fifty volumes upon such topics, not including reports that are partly scientific, nor the census publications, many of which should be placed in this category.

One of the results of this deluge of free scientific books is, that any private publication of works of this nature is well nigh impossible in this country. Our people have been brought to the state of mind where they assume that any large, well-printed, elaborately illustrated work was, of course, made to be given away.

There are good reasons for the publication of most of the public scientific works. Many of them are an honor to the government, and of great value to science; but the system of distribution has been to the last degree absurd, and not a little damaging to the best interests of scientific men. The publication of this document, and the recent action of Congress, are steps towards the reform of the evil. If the government will heed the sagacious recommendations of their committee, the worst of these evils will be cured.

THE VARIATION OF TEMPERATURE UNDER CONDITIONS PRESUMABLY THE SAME.

IN all comparisons of standards of length, the accurate ascertainment of the temperature is a matter of the utmost importance. A neglect of proper precautions in regard to this point will frequently, if not generally, introduce greater uncertainty into the results than all other sources of error combined. The importance of knowing the temperature will be readily admitted by all, but the difficulty of ascertaining it is by no means fully appreciated. The writer has himself seen costly and elaborate comparators which were used in the open air of a room without any provision for protecting the bars under comparison from the influence of heat radiated from the observer's body. He has also read letters of persons whose ideas of accuracy were far beyond their ability to achieve, and who wished for the standards they would send for comparison a refinement of determination that would be instantly lost in the uncertainty of the temperature under the conditions to which they would be subjected in use. It is this difficulty of accurately knowing the temperature, that has demanded the expenditure of so much time, talent, and money, in the construction of compensating bars for base measurement. Were it possible for a thermometer to accurately register the temperature of a metallic bar beside which it was laid, a simple rod or bar would form the most accurate base-measuring apparatus, as there would be no risk of any parts getting out of order.

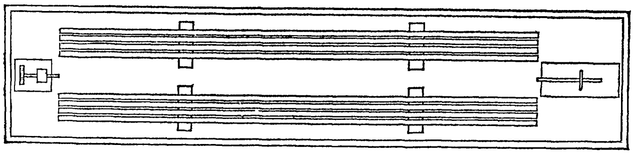

FIG. 1.

In the comparisons upon which he has been engaged in the Bureau of U. S. standard weights and measures, the writer has had frequent occasion to notice the variations of temperature under conditions which would ordinarily be presumed to be the same; and he has had forcible evidence of the fact, that no matter how well the conditions are controlled, or how carefully the bars may be protected, we can never rely upon two bars having the same temperature. No doubt they often have the same temperature; or, when a difference exists, its effect is inappreciable. Still, there is an uncertainty in the matter which can be eliminated only by a careful interchange of relative positions.

A marked illustration of what is said above is given in the following case. The comparisons were made by the writer. The circumstances of comparison were as follows: seven steel end-metres were to be compared with a standard metre. The comparisons were made in a room about 20×16 feet in size. This room was at the north-east corner of the building, so that two of its sides were outer walls. They were about two feet thick. The room was below the level of the street in front, but had free circulation of air around the outer sides, the building being separated from the coal-vaults in front by an area five or six feet wide. The comparator was parallel to the eastern (longer) side of the room, and about three feet from it. The doors of the room were kept closed, and the daily range of the temperature seldom exceeded three degrees. Two windows in the eastern wall were closed with a double glass sash and a solid wooden frame; and, to more effectually close them against passage of air, heavy manila paper was closely pasted over the entire frames. The eight bars were supported on racks, in two groups of four each, on both sides of the position that a bar would have when lying between the abutting-screw and contact-slide of the comparator. As the bars lay in the rack, they were about three-quarters of an inch apart from centre to centre. The extreme bars were about seven inches apart. The arrangement is shown in Fig. 1.

The bed-plate of the comparator was a framework of solid wood several inches thick. The bars and comparator were covered by a framework of wood and heavy plate-glass. The manipulation of the bars was effected by long pliers working through two narrow slits in the top of the case. As an extra precaution, a covering of heavy paper was placed over the whole. In manipulating the bars, the observer stood between them and the wall; so that, if the heat from his body succeeded in penetrating the casing, the effect would be to *diminish* the variations observed, and not to increase or to produce them. Numbering the notches in the rack from 1 to 8, the former being the nearest to the wall, the order of arrangement and change was as follows: the

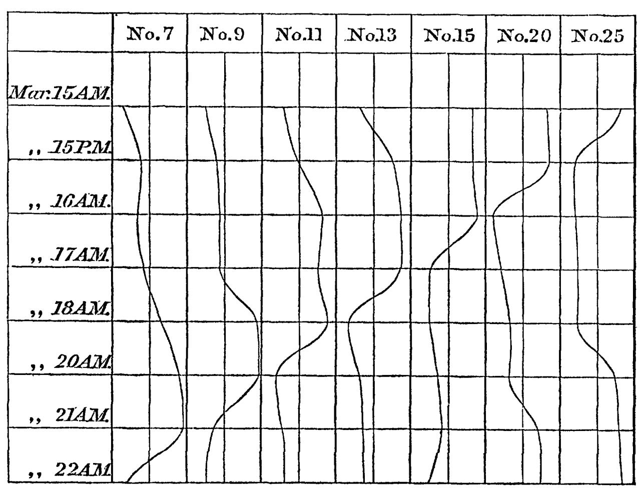

FIG. 2.

standard remained constantly in No. 5; after each set of comparisons, the bar in No. 8 was put in No. 1; each other bar being moved forward one space, except that in No. 4, which was moved to No. 6. Now, it will be seen from the comparisons, that the influence of the cold wall was such, that despite the care with which the bars were protected, and their nearness together, each one had a different length for each position that it occupied.

When the comparisons had continued for two or three days, it was seen that the range of individual results was greater than should be from mere errors of comparison. The true cause was not, however, suspected until the set had been completed by running the bars through each position of the rack, returning to the arrangement with which the set started. The following table gives the relation of the standard to the steel metres, the differences being expressed in microns (one micron equals one-thousandth of a millimetre).

	No. 7.	No. 9.	No. 11.	No. 13.	No. 15.	No. 20.	No. 25.
March 15, A.M.	−8.9	−4.0	−9.4	+2.1	+0.1	−5.3	−10.9
" 15, P.M.	7.4	3.2	8.2	4.7	0.1	5.1	14.6
" 16, A.M.	7.7	2.9	6.3	5.4	+0.5	9.7	14.6
" 17, A.M.	7.2	−2.9	6.6	5.4	−3.3	8.9	14.4
" 18, A.M.	5.8	+0.1	5.8	1.2	3.4	8.3	14.4
" 20, A.M.	4.3	+0.4	10.0	2.0	2.7	8.3	11.4
" 21, A.M.	4.0	−3.4	9.4	2.3	2.3	6.0	11.1
" 22, A.M.	−8.6	−3.9	−9.3	+2.4	−3.4	−5.8	−10.8
	−6.74	−2.48	−8.13	+3.19	−1.80	−7.18	−12.77

While the regularity of the change is apparent in this table, it is much more readily

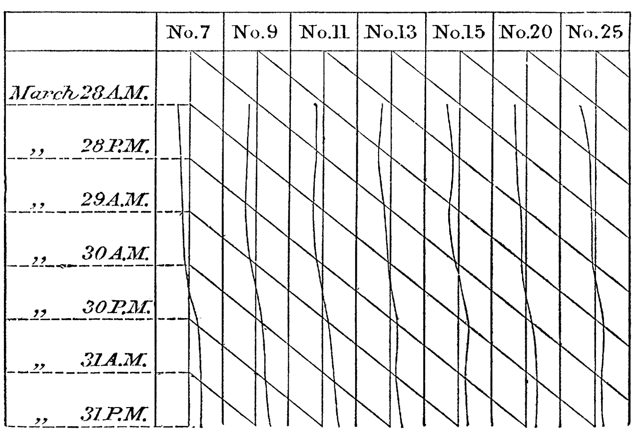

FIG. 4.

seen in a graphic projection. This is shown in Fig. 2.

The variations from the mean are magnified sixteen hundred times.

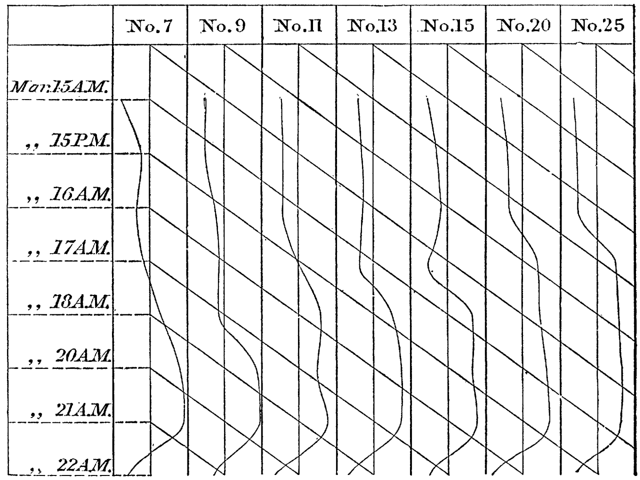

FIG. 3.

In this diagram the vertical lines represent the mean values; and the points in the curves are obtained by using the *differences* from the means as offsets to the right or left, for positive and negative differences. The greatest length of each bar is found when the bar is farthest from the outer wall, and the least length when nearest it. If the differences be shown graphically in parallel projection, the similarity of the curves is still more forcibly shown. This form is given in Fig. 3.

That the variation of temperature within so small a space so carefully protected should have shown so marked an effect, was entirely unexpected. It is susceptible of much more accurate determination through the bars themselves than by the use of thermometers. In the case under consideration, the difference between the extreme positions corresponds to a difference of temperature of about 0.7° F.

To lessen the effect of the influence of the outer wall, other piers were built at double the distance from the wall, and a large screen was placed between the comparator and the wall. The screen was made of a framework of wood, covered on each side with heavy paper. Another series of observations upon the same bars was then begun. The results show the same influence to have been at work; but the effect is very much reduced. A graphic representation is given in Fig. 4.

This illustration presents in a forcible manner the importance of giving the closest attention to the protection of the standards, where refined accuracy is sought. The influence of the heat from the observer's body is frequently less than that of other causes against which protection is supposed to have been made. With a micrometer capable of measuring with certainty a hundred-thousandth of an inch, we can repeat observations again and again with a range not exceeding this amount, and yet the result will differ from that obtained on another day by a quantity several times larger than the extreme range during a set taken all at once. Any one who has made careful linear or other comparisons will have noticed this. The fact that the bars, while subjected to apparently the same influences, are yet differently affected, is the principal cause of this trouble; and the only way of eliminating the effects from the final result is to so change and alternate the bars in position as that the disturbing influences may operate in turn on the one or the other of the standards under consideration. H. W. Blair.

HISTORY OF THE APPLICATION OF THE ELECTRIC LIGHT TO LIGHTING THE COASTS OF FRANCE.[1]

V.

It only remains now to describe the de Meritens machine to complete the description of the electric appliances for light-houses.

M. de Meritens has devised several types of machines. The one adapted for light-house purposes, shown in Fig. 16, has the permanent magnets of horseshoe form arranged radially around the axis in a precisely similar manner to the disposition of the field-magnets of the old Alliance machine, which in general appearance it at first sight much resembles.

Fig. 17 is a transverse section of the machine, and Fig. 18 a longitudinal section taken through the axis, so as to show, in both views, the armature ring, and the position of the field-magnets with respect to it.

Figs. 19, 20, and 21 show the details of the armature bobbins marked H, the iron core-pieces, *h h*, and the projecting pole-pieces, which form enlarged ends to the latter, and are marked *g*. In Fig. 19, which represents a

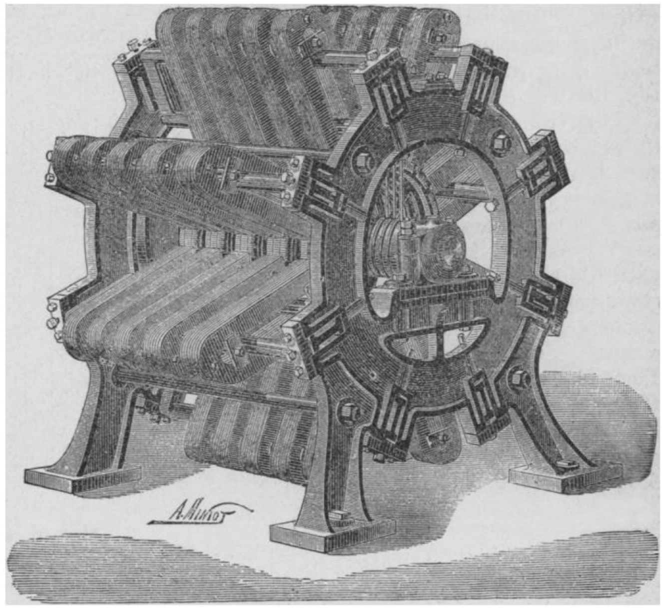

Fig. 16.

section through half the ring, the method of attachment and of coupling up is clearly shown. On reference to Fig. 17, it will be seen that each armature ring, G, is built up of sixteen flattened oval bobbins, H, separated from one

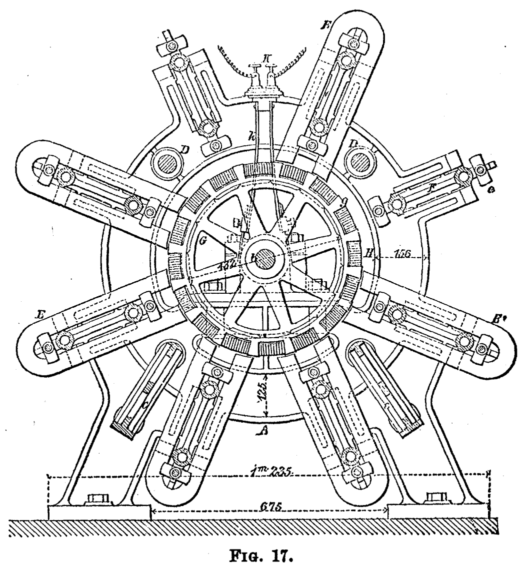

Fig. 17.

another by the projecting pole-pieces, *g;* and around each ring are fixed, radially to the

[1] Concluded from No. 8.