SMITHSONIAN MISCELLANEOUS COLLECTIONS.

DIRECTIONS

FOR

METEOROLOGICAL OBSERVATIONS,

AND THE

REGISTRY OF

PERIODICAL PHENOMENA.

WASHINGTON:
SMITHSONIAN INSTITUTION.
1860.

GREEN'S STANDARD BAROMETER.

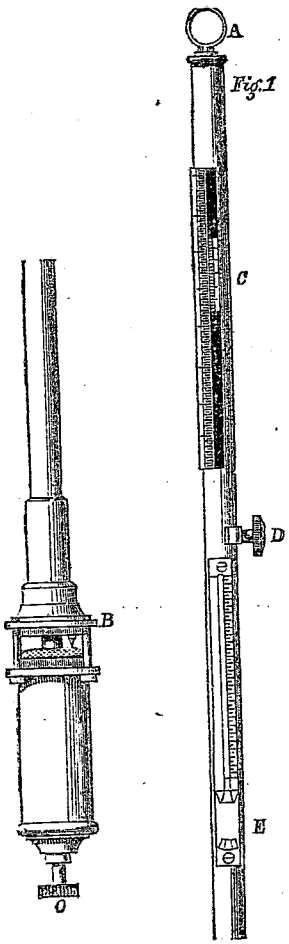


Fig. 1

THE following is an account of Green's improved standard barometer, adopted by the Smithsonian Institution, for observers of the first class.

The barometer consists of a brass tube, (Fig. 1) terminating at top in a ring A, for suspension, and at bottom in a flange B, to which the several parts forming the cistern are attached.

The upper part of this tube is cut through so as to expose the glass tube and mercurial column within, seen in Fig. 5. Attached at one side of this opening is a scale, graduated in inches and parts; and inside this slides a short tube *c*, connected to a rack-work arrangement, moved by a milled head D: this sliding tube carries a vernier in contact with the scale, which reads off to $\frac{1}{500}$ (.002) of an inch.

In the middle of the brass tube is fixed the thermometer E, the bulb of which being externally covered, but inwardly open, and nearly in contact

Fig. 5

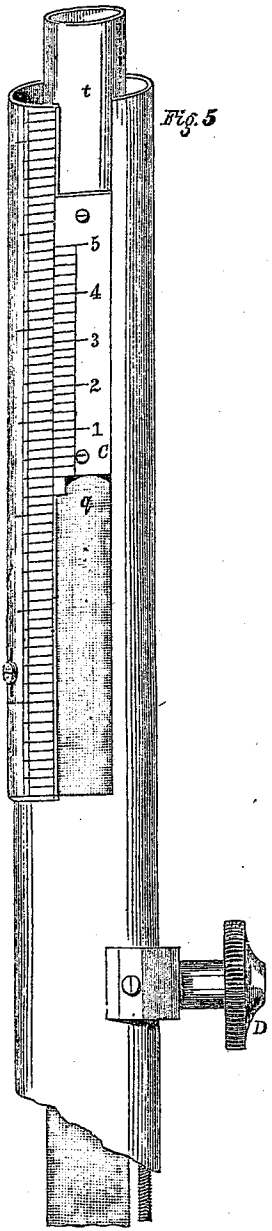
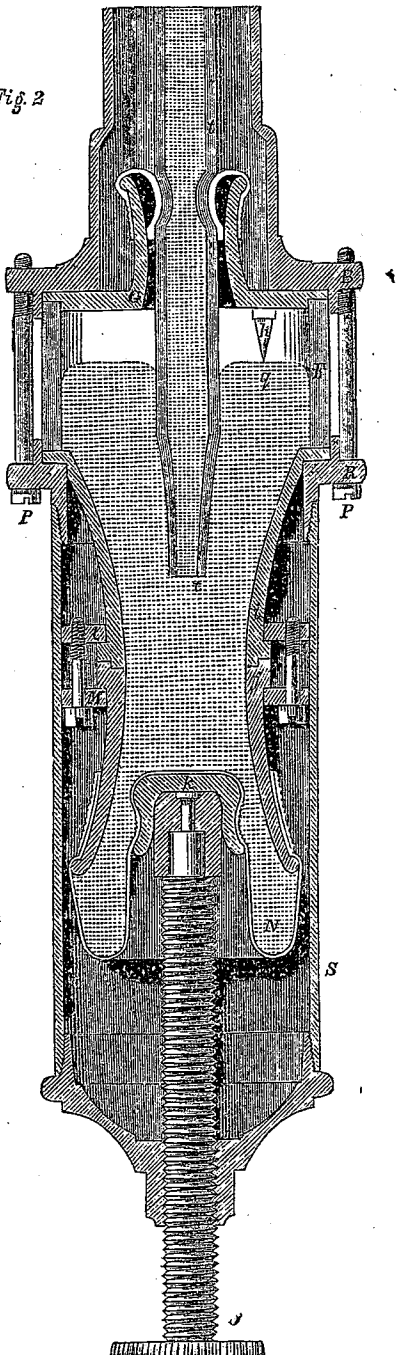


Fig. 2



the amount of correction for the repaired or the new tube being estimated until a good comparison can be made directly or intermediately with the Smithsonian standard.

The connecting the parts *i* and *j* by rings and screws, Figs. 2, 3, and 4, rather than by a single screw cut on the edge, is an improvement, as the single wood-screw is apt, after a time, to adhere so firmly that it is often difficult, and sometimes impossible, with safety to the parts, to separate it.

It is not advisable to disturb the cistern, unless it becomes difficult, from the oxide of mercury which gradually forms, to make the adjustment of the mercury to the ivory point, as there is more or less risk in doing so. Any one accustomed to such mechanical affairs, with due attention to the plan, can, however, take out the mercury from the cistern, refilter, clear the parts of adhering oxide, and replace them; the instrument all the time being kept vertical, with the cistern at top, as the mercury must not be allowed to come from the tube.

To insure a good vacuum by the complete expulsion of all air and moisture, the boiling of the mercury in the tube is done in vacuo; and care should be taken to preserve it in good condition.

To put up the barometer for observation, suspend the barometer by the ring A in a good light, near to and at the left side of a window, and, when practicable, in a room not liable to sudden variations of temperature. Record the temperature, and then, by the screw O, lower the mercury in the cistern until the surface is in the same plane with the extremity of the ivory point. As this extremity of the point is the zero of the scale, it is necessary, at each observation, to perfect this adjustment. It is perfect when the mercury just makes visible contact. If the surface is lowered a little, it is below the point; and if raised a small amount, a distinct depression is seen around the point. This depression is reduced to the least visible degree. A few trials will show that this adjustment can always be made to a thousandth of an inch.

The adjustment effected, bring the lower edge of the vernier C, Fig. 5, by means of the milled head D, into the same plane with the convex summit of the mercury in the tube. Looking through the opening, with the eye on a level with the top of the mercury in the tube, when the vernier tube is too low, the light

dent. This was removed by the substitution of iron in the place of wood; but it was soon found impracticable, in this form of cistern, to prevent damage from rust. These objections led to the present plan of construction, which effectually secures the joints without the use of any cement. The surfaces concerned are all made of a true figure, and simply clamped together by the screws, a very thin leather washer being interposed at the joints. This would not be permanent, however, but for the especial care taken in preparing the boxwood. The boxwood rings are all made from the centres of the wood, and concentric with its growth. They are worked thin and then toughened, as well as made impervious to moisture, by complete saturation with shellac. This is effected by immersing them in a suitable solution in vacuo. The air being withdrawn from the pores of the wood, is replaced by the lac. This, however, with the after-drying or baking, requires care; but when properly done, the wood is rendered all but unchangeable.

Another peculiarity consists in making the scale adjustable to correct for capillarity, so that the barometer may read exactly with the adopted standard, without the application of any correction; and this, too, without destroying the character of the barometer as an original and standard instrument. Near the 30 inches line, Figure 6, is a line *v*, on the main tube; this last line is distant exactly thirty inches from the tip of the ivory point; therefore, when these lines coincide, or make one line, the scale is in true measurement position; or the 30 mark is exactly thirty inches from the tip of the ivory point in the cistern. In this position, the amount of correction due to capillarity being ascertained, the scale is then moved that quantity and clamped firm. The barometer will now give the readings corrected for capillarity, and thus avoid at once the labor of applying a correction, and the risk of error from an accidental neglect of it.

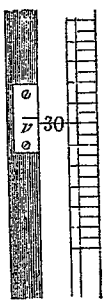


Fig. 6

It must be borne in mind that this correction applies only to the particular tube, and while preserved in good condition.

If this tube is injured and again used, or another tube put in its place, the scale should then be moved until the lines coincide,

the amount of correction for the repaired or the new tube being estimated until a good comparison can be made directly or intermediately with the Smithsonian standard.

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is cut off; when too high, the light is seen above the top of the mercury. It is right when the light is just cut off from the summit, the edge making a tangent to the curve. A piece of white paper placed behind, and also at the cistern, will be found to give a more agreeable light by day, and is, besides, necessary for night observations; the lamp being placed before the instrument and above the eye, to reflect the light.

Fig 4.

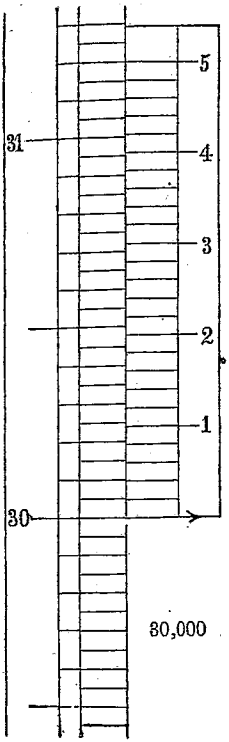
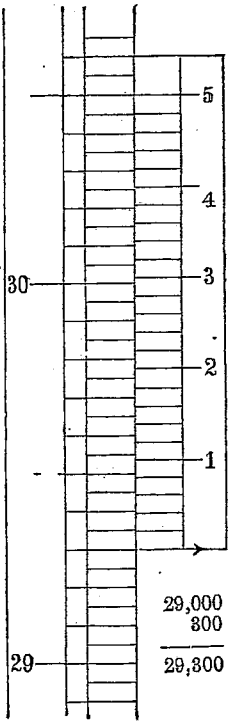


Fig. 5.



The method of reading off will perhaps be best explained by a few examples. Suppose, after completing the adjustments, the scale and vernier to be in the position shown in Fig. 4, on this page, it will be seen that the lowest or index line of the vernier coincides exactly with the line marked 30 on the scale. The reading, therefore, is 30.000 inches.

If, as in Fig. 5, we find the line of the vernier coinciding with the third line of the tenths above 29, we read 29.300.

If, as in Fig. 6, on this page, we find the index at 29 inches 3 tenths and 5 hundredths, we read 29.350.

If, as in Fig. 7, we find the index at 30 inches no tenths 5 hundredths and something more, this additional quantity we

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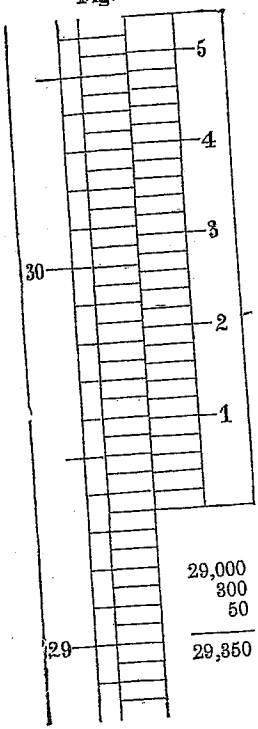
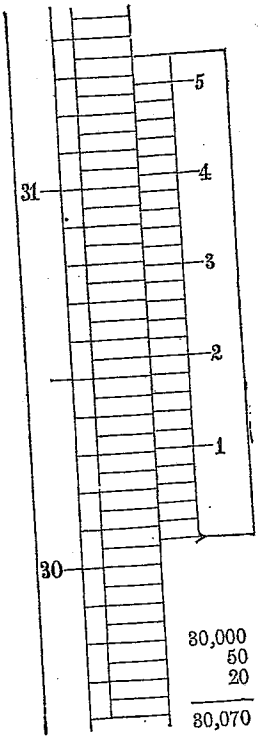


Fig. 7.



shall find by looking up the vernier scale, until we come to some one line on it, coinciding with a line on the other scale. In this instance it is the line marked 2, and indicates 2 hundredths, to be added to the other numbers, making 30.070.

If, as in Fig. 8, we find 29 inches no tenths 5 hundredths, and on the vernier the second line above that marked 2, is found to coincide with the scale, each of these short lines indicates 2

thousandths—consequently, are so counted; the reading s therefore 29.074.

Fig. 8.

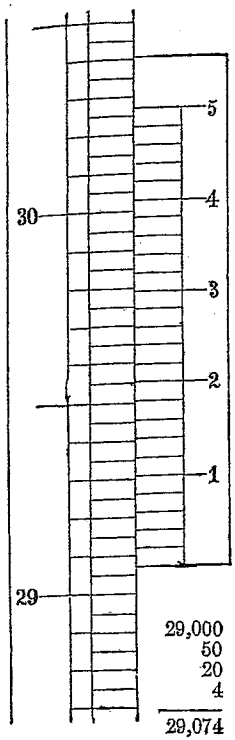
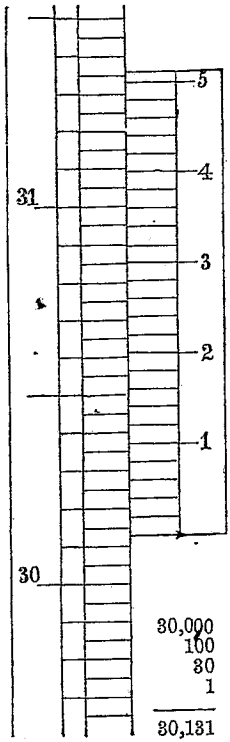


Fig. 9.



Or it may be, as in Fig. 9, where we have 30 inches 1 tenth, and the line on the vernier mark 3 coinciding nearly, but not perfectly, with a line on the scale, it is a little too high; the 2 thousandth short line next above is, however, a like quantity too low; so the true reading must be the number between them—that is, 1 thousandth, making together 30.131.

These examples include all the combinations the scale allows. A little practice with the barometer, with reference to the examples, will soon enable the learner to read off the scale with facility. At first it will be best to write down the inches and

parts in full, as in the diagrams, not trusting the memory with the whole, until experience shall have given confidence.

Be careful never to lower the mercury in the cistern much below the necessary quantity, as it increases the risk of air entering the tube.

When the barometer is to be removed for transportation, or change of position, before taking it down, the mercury is to be screwed up until the cistern and tube are just full. If it is screwed more than this, the mercury may be forced through the joints of the cistern. It should then be inverted, and carried cistern-end upwards.

This instrument is well adapted for service as a mountain barometer, and when used as such, is packed in a leather case, with suitable straps for convenient carriage.