U. S. ~~Department of Agriculture,~~
WEATHER BUREAU.

INSTRUCTIONS

FOR USE OF

THE RAIN-GAUGE.

CIRCULAR C, INSTRUMENT ROOM.

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INSTRUCTIONS FOR USE OF THE RAIN GAUGE.

DESCRIPTION OF GAUGE.

1. The rain gauge consists of the following parts—

The receiver, *A*;
The overflow attachment, *B*;
The measuring tube, *C*.

The top cylindrical portion of the receiver, marked *a* in Fig. 1, is exactly 8 inches in diameter, inside, and is provided with a funnel-shaped bottom, which conducts any precipitation falling into the receiver into the tall cylindrical measuring tube, *C*, the total height of which, inside, is exactly 20 inches. The diameter of this tube is much smaller than the large receiving tube, *a*, being only 2.53 inches. In

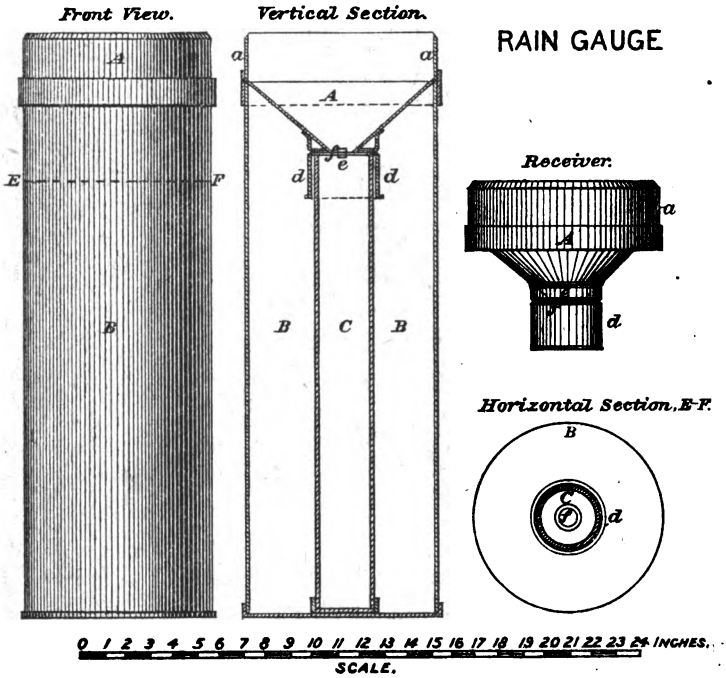

FIG. 1.

consequence of this a small amount of rain falling into the receiver and flowing into *C* fills the latter to a depth greater than the actual rainfall in proportion as the area of the receiver is greater than the area of the measuring tube. In the standard gauges of the Weather Bureau the depth of the rainfall, in accordance with this principle, is

magnified just ten times. The receiver, *A*, has a sleeve, *d*, Fig. 1, which slips over the tube, *C*, and very effectually prevents any loss of rainfall. Again, when the rainfall is very heavy the tube, *C*, may be more than filled. In this case to still prevent loss a little opening, shown at *e*, Fig. 1, is made in the sleeve, *d*, just on a level with the top of the tube, *C*. The excess of rainfall escapes through this opening, and is retained in the large overflow attachment, *B*, and can be measured afterwards, as will be described below. The diameter of the overflow attachment in the latest style gauges is now made just 8 inches inside diameter. The object of this is to be able to use this portion of the instrument as a snow gauge, as will be explained hereafter.

Rain Gauge and Support.

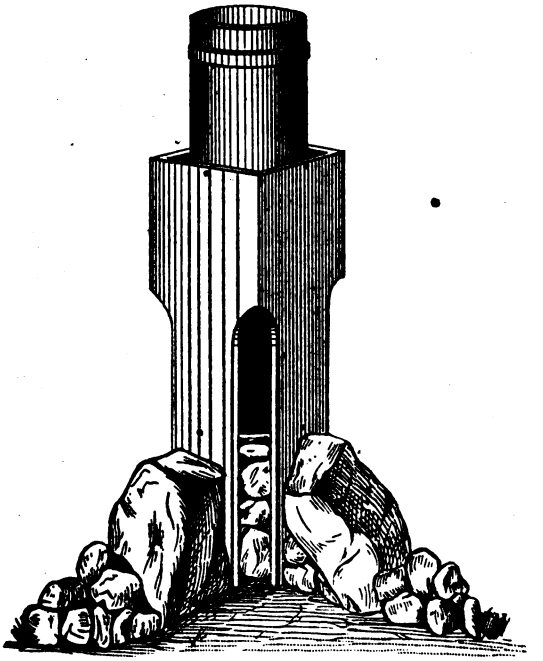

FIG. 2.

EXPOSURE OF RAIN GAUGES.

2. It is desired observers use particular care in selecting a good place of observation, as the value of the records is sometimes greatly impaired by improper exposure. It is scarcely necessary to say that every precaution should be taken to protect gauges from the interference of animals and unauthorized persons. Select, if possible, a position in some open lot as unobstructed as possible by trees, buildings, or fences. Such a place in general affords the best exposure, though sometimes difficult to find. Gauges should be exposed upon roofs of

buildings only when necessary, and then the roof should be flat, or nearly so, if possible. The middle portion of a flat unobstructed roof generally gives the best results.

RAIN-GAUGE SUPPORT.

3. The box in which the gauge is shipped to the observer is expressly designed as a stand for the instrument, and should be opened at the head, which is fastened by screws. Set the box up as nearly vertical as possible at the place selected for the exposure and ballast by filling the lower portion with several inches of stone or broken brick. Slip in the head and lower to the level of the screw holes in the sides of the box about 10 inches from the bottom, where the head is securely fastened with the screws taken out in opening the box. The support is further secured and fixed in its position by piling up a few stones around the outside. The gauge can now be placed inside, and appears as shown in Fig. 2.

4. Three iron braces are supplied to regular Weather Bureau stations to accompany the above-described box support, in order that the latter may be erected upon roofs. These will be attached as shown in Fig. 3, and the false bottom will be placed at a lower point *so that the top edge of the receiver is just four* (4) *inches above the box support.*

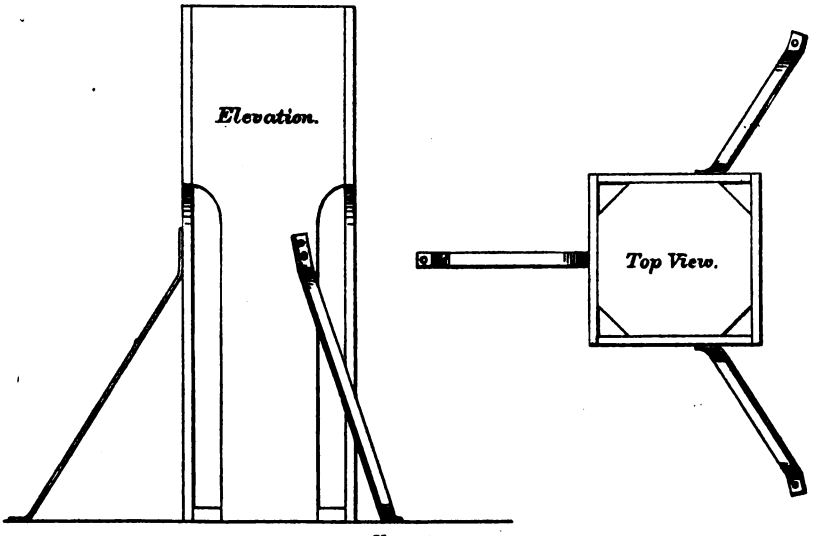

FIG. 3.

TO MEASURE RAINFALL AND SNOWFALL.

RAINFALL.

5. The rain-gauge measuring stick is graduated into inches and tenths of inches. Remembering that the actual depth of the rainfall is magnified ten times, as explained above, it is plain that if we find the water 10 inches deep in the measuring tube, then the real rainfall must have been only one inch deep, or, if the water in the tube is only

one-tenth inch (or written as a decimal .1 inch) deep, then the rainfall must have been only one one-hundredth inch (or written as a decimal .01 inch).

6. To save observers the trouble of always thinking about the magnification, and to avoid possible errors in reports, the numbers on the graduations of the measuring sticks are not actual inches, but in the latest pattern of measuring sticks have all been divided by 10, and thus represent the actual rainfall. Moreover, these numbers are expressed in hundredths of inches of rainfall, and are written as decimal fractions. Thus the ten-inch line is numbered 1.00 (read one and zero hundredths), which is the depth of rainfall in inches corresponding to 10 inches of water in the measuring tube; similarly the one-inch line is numbered .10 (read ten one-hundredths), which again is the depth of rainfall in inches corresponding to one inch of water in the tube.

7. The depth of the water is measured by inserting the measuring stick into the gauge through the small hole in the funnel. When the stick reaches the bottom of the measuring tube it should be held for one or two seconds and then quickly withdrawn and examined to see at what division of the graduation the top of the wetted portion comes. The numbering of this division, *as stamped on the stick*, gives, as has just been explained, the actual depth of rainfall, and in making out records and reports observers should *always use the decimal expressions*. Of course, it will rarely happen that the top of the wetted portion will fall exactly upon one of the numbered lines—it will generally be on or near one of the shortest lines. Thus, for example, suppose the water-mark comes to the sixth short line beyond the line numbered .80, the proper record to make in this case would be .86 inch rainfall. The number of short lines, reckoned from the numbered line next lower, are always to be inserted in place of the 0 in the stamped numbers.

8. Observers should always be careful to put the stick into the gauge so that the end at which the numbering begins goes to the bottom, and the stick passes through the middle of the tube; for if the stick is placed near the sides the water is sometimes drawn up by capillary action in the narrow space between the stick and the tube, so as to wet the former entirely too high and give very erroneous records.

9. After measuring and recording in this way the precipitation found in the gauge the top should be removed, the measuring tube emptied and drained, and the gauge put in position again. Observers should be careful after emptying the gauge to replace the measuring tube so that the bottom stands within the ring in the middle of the bottom of the overflow, and in putting on the receiver that it passes over the measuring tube and rests squarely down upon the overflow.

10. When the amount of rain that has fallen more than fills the measuring tube, some care is required to determine the total rainfall. First carefully remove the receiver so as not to spill any of the water in the measuring tube, which should be exactly full. If some water has been

slopped out and the measuring tube is not exactly full the amount of water remaining must be accurately measured with the stick as already described. The tube is then lifted out slowly and carefully, if full, so as not to spill any of the water into the overflow, emptied and allowed to drain a moment or so. The water remaining in the overflow is now poured into the measuring tube, being careful not to lose any, and measured in the usual way. Suppose we find this to be .47 inch rainfall, then, remembering that the measuring tube is just 20 inches high, the total rainfall will be 2 inches plus .47 inch = 2.47 inches. Or, in case some water was spilled from the measuring tube, the .47 inch should be simply added to the first measured amount to give the total rainfall.

SNOWFALL.

11. During the winter season, especially in those climates where the precipitation is nearly all in the form of snow, it is necessary to expose only the overflow attachment in the support as a snow-gauge, removing the receiver and measuring tube to the house as these parts cannot be used for measuring snow, and even if rain should occur it is very apt to be frozen while in the measuring tube, generally bursting it and rendering it worthless or highly inaccurate.

12. *First method.*—The snowfall collected in the overflow attachment is measured by first placing the vessel in a warm room until the snow is melted. The water is then carefully poured into the measuring tube and measured just as though it were rainfall.

13. *Second method.*—The above method is objectionable because it often requires considerable time, and is liable to be inaccurate owing to the loss of the snow or water by evaporation. The following plan is much better unless clumsily conducted so as to spill and waste the water:

Take the overflow into the room and pour into it, carefully, *one measuring tube full to the brim* with water, preferably warm water. This in general will mostly melt, or at least reduce to a very fluid slush a considerable snowfall.

The measuring tube should be again carefully filled to the brim from the melted contents of the overflow and emptied, whereupon the remaining water in the overflow should be carefully measured in the measuring tube, thus giving quickly and easily the depth of melted snow.

14. In addition to this measurement by the gauge a measurement will be made of the actual depth in inches of the snow on the ground. Select a level place of some extent where the drifting is least pronounced and measure the snow in at least three places. The mean of these measurements will give the snowfall which is to be entered in the fourth column of the report, and whenever it is impracticable to melt the snow as described in the preceding paragraphs, one-tenth of this mean will give an approximate value, in water, for the snow which

ould not be melted. This value must be set down in the third column f the report in precisely the same manner as rainfall, or snow melted n the gauge. After having once made a measurement of the snowfall ; is not desired that the same snow be measured at each succeeding bservation until it shall finally disappear. Any fresh snow, however, hould be measured and recorded as it falls. If there be any snow on he ground at the middle and at the end of the month that fact and he depth in inches should be noted.

15. Observations should be made every evening, also at the close of very storm, and the gauge should be emptied of all the water it may ontain as soon as it has been measured.

16. The form supplied for these records will be found self-explana-ory. Rainfall observers will disregard the columns headed "Tem-erature," but should confine their attention to those headed "Pre-ipitation." The first and second columns have to do with the time of beginning and ending of the storm and together measure its dura-ion. In the third column is to be entered the reading of the gauge, as described in sections 5 to 10 of these instructions. If no rain, snow, or hail has fallen during the period of observation make the entry .00, or "No precipitation," in this column. If the amount is too small to measure make the entry "Trace." The fourth column is provided for the record of snow measurements made by the method described in sections 12 and 13. In the "Monthly summary" all matters indicated are proper subjects of the rainfall observer's record, with the exception of the three lines which deal with temperature.

17. It is particularly important in the interests of accuracy that the observations be recorded as soon as made, and that the daily entries be made day by day. The forms for each month should be mailed on the first day of the succeeding month. Even if no rain has fallen the observer should bear in mind that his official record of that fact is as important as though it were a month of rain.

18. Requisition for blank forms or envelopes may be made at any time, and will receive immediate attention. It is not necessary to write a letter asking for them, a simple note on the margin of the monthly report will be sufficient.