bulb for a distance of half an inch or more, so as to cool this part of the thermometer as well as the bulb. It must be wrapped close and tight for not more than one and a half turns around the bulb. The free end below the bulb must be tied in closely and left projecting for an eighth of an inch or more. The psychrometric formula and tables are computed for this sort of covering. Failure to wash out the sizing in new muslin or a wrinkling of the covering so that it fails to fit the bulb closely, is likely to give erroneous readings.

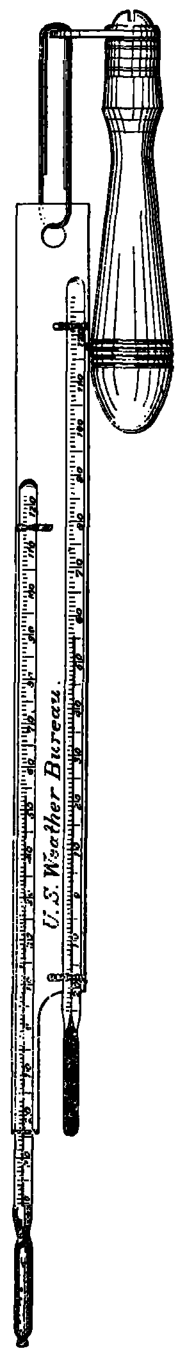

FIG. 20.—Sling psychrometer (Marvin).

METEOROLOGICAL OBSERVATORY AT TENERIFFE.

We are pleased to announce that the Spanish authorities are cordially cooperating with the International Aeronautical Commission and the German Government in supporting the high-level meteorological observatory on Teneriffe. It has been decided to open the doors of the observatory to qualified investigators of all nationalities.—*C. A., jr.*

THE RELATIONS OF THE INVERSIONS IN THE VERTICAL GRADIENT OF TEMPERATURE IN THE ATMOSPHERE TO AREAS OF HEAT AND COLD.

By HENRY HELM CLAYTON. Dated Readville, Mass., March 2, 1909.

When recording instruments are sent aloft on kites or balloons they show that, at least in the lower air, the temperature usually falls with increasing height above the ground; but there are belts or regions where the temperature rises with increasing height above the ground. These regions of rising temperature have received the name of inverted gradients. The belts of inverted gradient play an important part in atmospheric phenomena. They separate the air into strata with marked contrasts in humidity, wind velocity, and cloud formation. Usually the maximum of humidity and the clouds are immediately below the inverted gradient, but sometimes this condition is reversed. Usually there is a maximum of wind velocity within or very near each inverted gradient which occurs within 4,000 meters of the earth's surface. There are undoubtedly many other important relations to meteorological phenomena which remain to be disclosed.

Studies of these inversions have been made by Rykachev,[1] Assmann,[2] A. J. Henry,[3] and myself.[4] The conclusion which I reached[4] from a study of the data at Blue Hill was that "*the belts of inverted gradient reached their greatest distance from the ground about the time of minimum temperature, and were nearest the ground about the time of maximum temperature.*"

In a recent study of the records obtained with kites and sounding balloons on the expedition of M. Teisserenc de Bort and Professor Rotch in the trade wind region, I found that the inverted strata dipped from about 40° north to the heat equator and then rose again in southern latitudes. Hence, I am led to conclude that it is a general law for the inverted gradients of temperature to incline upward from regions of warmth toward regions of cold, and vice versa.

The reason of this rule is probably because air flowing from regions of cold towards regions of warmth has a descending component of motion and the inclination of the inverted gradient indicates the angle of descent. On the other hand air moving from regions of warmth toward regions of cold is ascending and the inclination of the inverted gradient indicates the rate of ascent. But ascending air is expanding and cooling so that in time the moisture in such inclined ascending currents becomes condensed into cloud and in this way is undoubtedly to be explained the presence of stratiform clouds such as nimbus, alto-stratus, cirro-stratus, which are found immediately beneath these inverted gradients.

How the inverted gradients dip downward as the temperature of the air in which they occur rises and how they ascend as the temperature falls is here illustrated by some examples taken from my discussion of the observations at Blue Hill in Bulletins No. 1, 1899, and No. 1, 1900, of the Blue Hill Meteorological Observatory. Figs. 1 and 2, in the accompanying diagrams, show plots of the temperatures recorded at different heights on September 21 and 22, 1898, when the temperature was rising. Dots connected by a continuous line show the points where the temperature was read from the records made during the ascent of the kite and crosses connected by a broken line show the temperatures during the descent of the kite. It is seen from fig. 1 that the inverted gradient was between 1,200 and 1,700 meters during the ascent on September 21. By the morning of September 22, see fig. 2, the temperature had risen some 10° to 15° F., and the inverted gradient had descended several hundred meters. During the descent of the kites on the afternoon of the same day the inverted gradient had descended to within 650 meters of sea-level.

[1] Meteorol. Zeitschr., Hann-Band., p. 174.
[2] R. Assmann, Beiträge z. Physik d. f. Atmosph., 1:39.
[3] Bul. Mount Weather Observ., 1908, 1, pt. 3:143.
[4] Bul. Blue Hill Meteor. Obs., 1900, No. 1:7, 11.