Hanging pens 36 mm. long are suspended obliquely at the end of the pen-arms, and glide along a perpendicular rod of rhombic cross section, being held against it by their own weight. This system has not as yet been tested in the open. The recording drum is held in place on the clockwork by friction only. It is protected from moisture by a square tin case whose front and left side are hinged, door-like, to the rigidly fastened back and right side, and can be swung open when the cover is lifted. The clockwork within the recording drum is further protected by a waterproof case. To change the record-sheet the fresh strip is stretched over a duplicate drum in the house; then the board upon which the apparatus stands is turned round, the case opened, the old drum lifted out and replaced by the new one, and the two pens charged with ink if necessary. The clock is wound without a key, while the case is closed, by means of a ratchet wheel whose lever sticks out from beneath the case and is moved back and forth. Thus the instrument need not be moved from its place in the shelter for any of these operations. The elements are a hair hygrometer and a bimetallic thermometer, built by C. Schneider himself, who has had much experience in making them for the kite and balloon instruments of the Hamburg kite station. The transmission mechanism of the hair hygrometer is adopted from the Richard kite meteorograph. It has the advantage of permitting a fairly uniform scale, but also the disadvantage that the transmission consumes a large amount of the little force available. The entire frame of the apparatus is made of nickel aluminum.

Figure 4 shows the thermohygrograph open. In later examples the hygrometer hairs will be longer and placed under the base-plate beside the thermometric element.

For second-order stations without registering apparatus, the dimensions of the louvered shelter are so chosen that the bulbs of the psychrometer and of the maximum and minimum thermometers stand off about 5 cm. from the louvers. Accurate observations are needed to determine whether, as some contend, the louver walls at this distance can affect the temperature readings. If the inner louvers have a temperature noticeably different from that of the air outside the shelter, then the temperature of the air in the shelter also will be incorrect. I believe that this danger is avoided by the arrangement here proposed whereby no strong radiation can fall upon even the outer louvers. The thermometers lie with their upper ends in wire rests which are inserted in notches cut in the inner louvers of the west side of the shelter; near the bulb-ends stands a vertical wooden rod carrying strong wire hooks as supports which permit the shifting[11] of the maximum and the minimum thermometers according to the change of season, in conformity with the instructions of the Prussian Meteorological Institute. * * *

If it is desired to place also a hair hygrometer in the shelter, then the space above and to the right should be chosen for it, in order to affect all four thermometers as little as possible. According to its mounting, it may either be hung behind the thermometers, or placed on a thin board. The inner louver in this place can be omitted.

D. Artificial ventilation.—The question of artificial ventilation comes up, primarily, in connection with the wet-bulb thermometer, because it there has a double task, viz, both to protect against radiation—as in the case of the dry-bulb—and particularly to make possible the use of a uniform psychrometric constant, because under the varying ventilation of nature that constant, strictly speaking, should be changed as the ventilation varies. For this purpose, the Assmann "Psychroaspirator" (price 45 marks) is already in wide use in Germany. In applying this aspirator to louvered-shelter exposures it is advisable to lengthen the originally short tube between the wet bulb and aspirator[12] until it passes out through the lateral louvers, in order that the shelter may be kept closed from the time aspiration begins to the time of reading.

With such a powerful air current at hand (in present psychroaspirators it amounts to about 3 m/sec.) it is but a step to extend its use to the ventilation of the dry-thermometer in those cases of calm weather and strong radiation where natural ventilation is insufficient; and simply by bringing both bulbs into the same current. I have experimented in this line; but since a similar modification of Assmann's aspiration apparatus will shortly be described by Assmann himself, I shall not go further into this matter.

Since a convincing test of the new thermometer screen must be made in a climate of strong radiation, Dr. C. Dorno in Davos has most kindly undertaken to compare it over a long period with the Assmann aspirated thermometer and the English shelter. The instruments and also the screens were contributed for this purpose by the Prussian Meteorological Institute and the German Seewarte. Similar comparisons will be instituted at the Hamburg kite station, whose predominantly cloudy and windy weather makes, indeed, much less demands upon protection from radiation, although not less than does the native weather of the English screen itself.

WEATHER BUREAU TERMS USED TO DESIGNATE STORMS.

[Dated: Weather Bureau, Sept. 25, 1915.]

Cyclone.—As used by the Weather Bureau the term "cyclone" is the name of any atmospheric system in which the barometric pressure diminishes progressively to a minimum value at the center, and toward which the winds blow spirally inward from all sides. The system overspreads an approximately circular or elliptical area at least 50 miles, generally several hundred miles, and often over one thousand miles in diameter. A cyclone is any such system of winds, except a tornado which is rarely greater than a mile in diameter, or a whirlwind which is seldom more than a few yards across. North of the Equator the inflowing winds move in a counter-clockwise direction. South of the Equator the spiral inflow is clockwise in direction of motion. The name does not signify any degree of intensity, and is applied to storms of little as well as to those of great intensity. On weather maps cyclones appear as systems of a few or many closed concentric isobars of elliptical or nearly circular form, and indicate a progressive decrease in the atmospheric pressure to a minimum at the center. Arrows showing the direction of the wind indicate a gyratory inflow from all sides.

Classification.—For purposes of analysis and technical discussion cyclones may be divided into a great many classes. For the purposes of forecasting, non-technical

[11] The maximum and minimum thermometers of the Prussian Institute lack the metal backs of the United States Weather Bureau instruments, and they lie horizontally in metal brackets in front of the vertical wet- and dry-bulb thermometers hanging behind them. The bracket with the maximum and minimum is shifted with the seasons, to avoid interfering with readings of the wet- and dry-bulb thermometers.—C. A., jr.

[12] Meteorol. Ztschr., Wien, Jan., 1891, 8:18.

bulletins and the like publications, seemingly the most satisfactory basis of classification is that of geographic origin, according to which two main groups suffice, "Tropical" and "Extratropical."

Tropical cyclones of greater or less intensity possess characteristics which differentiate them, in a measure, from cyclones of extratropical origin having approximately equal intensities, yet the essentials of both groups are practically the same.

Hurricane; Typhoon.—Special terms have been employed to designate tropical cyclones in various parts of the world, especially when fully developed and exhibiting destructive intensity. The word "cyclone" was first applied to violent disturbances of cyclonic character in the Bay of Bengal; but to a similar disturbance originating 1,000 to 2,000 miles to the eastward, as in the China Sea or the region of the Philippines, the name "typhoon" is frequently applied. In the tropical seas to the southeastward of the North American Continent the name "hurricane" is applied, and this disturbance is given the additional qualifying words "West Indian," evidently to indicate its location or place of origin.

In Weather Bureau usage, therefore, the name "West Indian Hurricane" is specifically applied to fully-developed tropical cyclones which originate and exhibit destructive violence in the West Indies or adjacent regions. A West Indian hurricane can cause great damage because of wind effects, because of great volumes of precipitation, by unusual tidal conditions, or by combinations of these and other accompanying characteristics. The word "hurricane" is also used in other combinations, and then has a different signification. For example "hurricane" is the highest force on the Beaufort wind scale. Winds of "hurricane force" are considered to have actual velocity of 75 miles per hour or more, and winds attaining such speed are said to blow with hurricane force, irrespective of geographic locality or whether the winds are associated with a cyclone of West Indian origin.

Tropical cyclones of the West Indies, as well as of other portions of the Tropics, occasionally pass into extratropical regions. The question may then be asked, "How shall a tropical cyclone or a West Indian hurricane or a typhoon be classed after it has passed into extratropical latitudes"? Tropical cyclones change in important particulars when they leave the warm, humid equatorial regions and come under the influence of conditions prevailing in the Temperate Zone. Such changes, however, take place gradually, and a tropical cyclone may show great intensity even several degrees north of the Tropic of Cancer, especially when traveling over water. While moving inland over the North American Continent, however, they show marked signs of waning intensity and soon become indistinguishable from cyclones of actual extratropical origin.

In a bulletin issued by the Weather Bureau, entitled "The West Indian Hurricane of August 13–23, 1915," the track of that great storm is shown from its first appearance in the vicinity of Martinique to its practical dissipation in the Gulf of St. Lawrence.[1] While in a connection of this character the term "West Indian hurricane" may be appropriately applied to this great storm at any point of its course, nevertheless to do so does not in that case necessarily imply that at every point of its path the storm exhibited destructive violence. Similarly, throughout its course the storm may properly be designated a "tropical cyclone," as the observations available show its tropical origin. In the absence of such knowledge the same storm in temperate latitudes would be named an "extratropical cyclone."

Tornado.—This name is applied to certain storms of well-known characteristics. While they occur in connection with certain cyclonic systems and exhibit great intensity, they are, nevertheless, of extremely local geographic extent and of very short duration.

[1] Also on chart XLIII—92 of the present issue of this issue of the REVIEW—C. A., jr.

NOTE ON THE CRUSHING OF A COPPER TUBE BY LIGHTNING.

By W. J. HUMPHREYS, Professor of Meteorological Physics.

[Dated: Weather Bureau, Washington, D. C., Sept. 1, 1915.]

Introduction.—Although the collapse of a hollow lightning rod under the stress of a heavy discharge has already been described and explained,[1] the phenomenon appears to be of unusual occurrence and not very generally known. It may, therefore, be worth while to discuss in some detail an excellent example of a crushed lightning conductor kindly furnished for this purpose by Mr. West Dodd, of Des Moines, Iowa.

In a letter dated April 5, 1915, Mr. Dodd, referring to the conductor in question, says:

> The crushed tube was 5 feet long. It constituted the entire part that stands on top of the house for the point.
>
> The rest of the rod was copper cable and about 50 to 100 feet of that was crushed into smaller volume or made smaller in diameter, as it was loosely woven.
>
> This happened in Michigan about six years ago, and the house was not damaged any—not even a splinter taken off.
>
> Similar phenomena of this kind have occurred in four or five instances to my knowledge, but in the great majority of cases where a point is melted the tube is not damaged.

An additional reason for discussing this particular example of the effect of the "pinch phenomenon"[2] is the fact that it offers data sufficient for making a rough estimate of the current strength of the discharge, and even a crude estimate of the quantity of electricity involved.

Description of conductor.—Figure 1 shows two originally duplicate (so reported), hollow, copper lightning rods, one uninjured (never in use), the other crushed by a discharge. The uninjured rod consists of two parts, shown assembled in figure 1 and separate in figure 2. The conical cap, nickel plated to avoid corrosion, telescopes snugly over the top of the cylindrical section, and when in place, where it is left loose or unsoldered, becomes the ordinary discharge point.

The dimensions are:

Section.	Outside diameter.	Inside diameter.
	Millimeters.	*Millimeters.*
Cylinder	16.0	14.65
Cone shank	17.4	16.0

Length of conical cap, cylindrical portion, 7 cm., total, 19 cm.

Both the cylindrical and the conical portions of the rod are securely brazed along square joints.

Effects of discharge.—The general effects of the discharge, most of which are obvious from the illustrations, were:

1. One or two centimeters of the point were melted off.

[1] *Pollock & Barraclough.* Jour.-Proc., Roy. soc., N. S. Wales, 1905, **39:** 131.

[2] For the origin of this term, now widely used, and a general discussion of the phenomenon, see *Northrup*, Phys. Rev., 1907, **24:** 474; Trans., Amer. electrochem. soc., 1909, **15:** 303.