persevering efforts we succeeded in sending up, even in bad weather, paper balloons carrying self-registers to altitudes of 13 and 14 kilometers. Notable improvements in the instruments have enabled us to isolate the sensitive portion of the thermometer from the mass of the self-register, whose calorific sluggishness is quite large.

The records of much higher precision obtained under these conditions have fully confirmed that which we had at first noticed, and we have been able to separately consider the curves of the self-registers for different conditions, or types, of weather.

The following table is a résumé of this classification as arranged in two groups both of which indicate the same result.

Résumé of temperature measurements by means of sounding balloons.

	Years.	Location of center of high pressures.					Location of station relative to low pressures.			
		East of Europe.	Over France and Gulf of Gascony.	Over France.	West of Europe.	South and southwest of the low.†	In front.	At the side.	In path.	In central part.
		Kilo.	*Kilo.*	*Kilo.*	*Kilo.*	*Kilo.*	*Kilo.*	*Kilo.*	*Kilo.*	*Kilo.*
Altitude of isothermal zone.*	1899–0	11.3	12.1	11.7	11.2	12.2	11.4	11.3	9.9	10.4
	1901–2	11.3	12.8	11.4	11.1	12.5	11.5	11.3	11.9	9.7
Altitude of zone of less than 0.4° temperature decrease per 100 meters.	1899–0	10.0	10.7	10.8	10.1	11.0	10.5	10.5	9.1	9.6
	1901–2	10.0	11.5	10.8	10.7	10.5	10.4	10.5	9.6	8.6
Altitude of zone of maximum rate of temperature decrease.	1899–0	8.0	8.7	8.8	7.7	9.2	8.2	8.3	7.4	8.1
	1901–2	8.0	8.8	8.4	8.5	8.6	8.1	8.3	8.1	7.1
Mean value of maximum rate of decrease.	1899–0	0.93	0.95	0.92	0.87	0.89	0.89	.....	0.93	0.92
	1901–2	0.93	0.88	0.91	0.90	0.95	0.88	0.90	0.89	0.92

*That is, no vertical gradients.—ED.
†So in original, but may be a misprint for "the station."—ED.

As is shown by this table, the altitude of the isothermal zone is in the neighborhood of 12.5 kilometers in the central portions of the areas of high pressure and north of these, but descends to 10 kilometers in the centers of areas of low pressure. Hereafter we shall see the correlation of this altitude above sea level with the temperature of the air under these opposing atmospheric conditions.

HALOS, PARHELIC CIRCLES AND CONTACT CIRCLES.

Mr. J. A. Warren, Voluntary Observer, Santee, Nebr., sends us the following:

To-day (June 23) at 1:15 p. m., my attention was called to a peculiar halo which my informant called a rainbow, but it was no rainbow. It was a broad band of rainbow colors below the sun, and perhaps a little nearer to the horizon than to the sun. It appeared perfectly horizontal with no curvature toward or from the sun, and extended about one-ninth of the distance around the sky. It was very wide, perhaps 7°, and the colors all very distinct, the red being toward the sun. The halo continued about thirty minutes after I first saw it. The sky was overcast with a thin layer of stratus clouds and one of cirrus also. Soon after the disappearance of this halo the 22° halo appeared. Can you tell what this was? I should think it the 45° ring, except that it did not curve toward the sun and was so very wide.

A great variety of circles have been observed about the sun; they may be divided into the three following classes:

1. Halos, having the sun at the center;
2. Parhelic circles, passing through the sun;
3. Contact circles, tangent to the halos.

At least three varieties of halos have been observed: *a*, the most common of all having a radius of 22°; *b*, a halo of 46° radius; *c*, the great circle of Hevelius, having a radius of 90°. The first two of these are red on the inner side, or the side nearest the sun, and blue on the outer side, while the third is nearly white.

Four parhelic circles have been described; one parallel to the horizon, one perpendicular to it, and two very faint ones about 30° on either side of the latter. These four circles are white.

A great number of contact circles have been observed tangent to the halos, most commonly occurring at the highest and lowest points of the 22° and 46° circles. The one tangent at the highest point of the 46° circle, and both those tangent to the 22° circle, have been described as horizontal, or circumzenithal, circles, but I have been unable to find a description of a horizontal circle tangent to the lowest point of the 46° circle previous to that here given by Mr. Warren. It frequently happens, as was the case at Santee, that the tangent circle alone is observed, the halo itself being invisible.

At the numerous intersections of these various circles, parhelia, or mock suns, or sundogs, are formed, often of great brilliancy.

A more complete description of these phenomena may be found on pages 216 to 225 of Loomis's Treatise on Meteorology; pages 422–440 of Kämtz's Meteorology, translated by C. V. Walker, London, 1845; and on pages 295 and 305 of the MONTHLY WEATHER REVIEW for July, 1897, Vol. XXV.

In fig. 1 is reproduced a sketch of a brilliant solar halo observed at Fort Egbert, Alaska, transmitted by Mr. C. C. Georgeson, special agent in charge of the Experiment Station of the United States Department of Agriculture, at Sitka, Alaska.

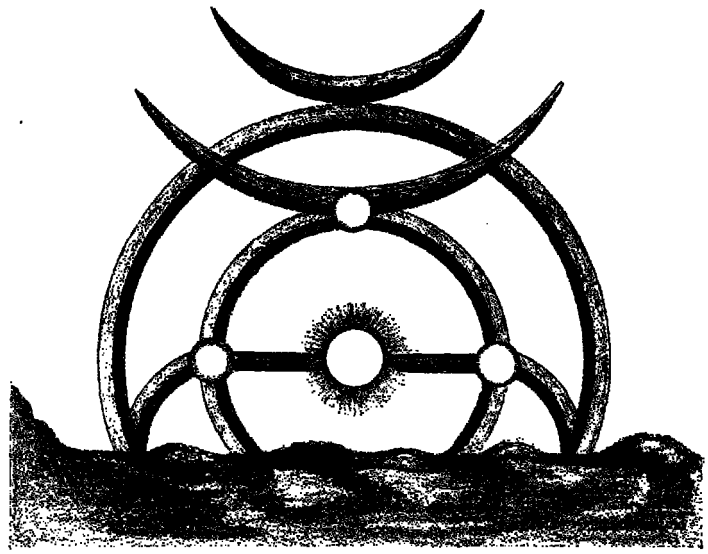

FIG. 1.—A brilliant solar halo.

No description accompanied the sketch, but apparently there were observed the halos of 22° and 46° radius, contact circles at the highest point of each of these, a horizontal parhelic circle, three parhelia on the 22° circle, with prolongations from those at the intersection of the 22° circle with the parhelic circle. In the original sketch the horizontal circle is made to appear red on the lower and blue on the upper side, but this could hardly be the case, since this circle is supposed to be caused by the reflection of light from the vertical faces of snow crystals, while the halos and the contact circles are produced by the refraction of light that passes through the snow crystals.

These phenomena are seen at their best in high latitudes when the sun is near the horizon, as was the case at Fort Egbert on March 21, 1902.—*H. H. K.*

ERRATA.

MONTHLY WEATHER REVIEW, August, 1901, page 365, column 1, equation (*a*), for "*W*" read "log *W*."

MONTHLY WEATHER REVIEW, May, 1902, page 250, column 1, line 5 from the bottom, for "produces" read "maintains"; page 255, Table 19, column 8, line 7, for "8125" read "3125"; page 257, column 2, line 8 from bottom, for "expected" read "anticipated"; page 258, column 1, line 12, for "the tornado tube" read "the half of a tornado tube".