hours thereafter the wind was comparatively light, but from 8 o'clock till midnight the hourly movement exceeded 40 miles.

The greatest damage occurred in the vicinity of Cheyenne, principally to roofs, chimneys, spouting, window glass, small garages, street signs and wires. At Fort Frances E. Warren the damage exceeded $12,000 and in Cheyenne more than $10,000. In the immediate vicinity of Cheyenne the damage to buildings amounted to about $3,000. In the rest of the State the damage is placed at $20,000 to $40,000.

For more than a month prior to this storm there had been very little precipitation and the wind, being abnormally high, had removed moisture from the soil to a considerable depth. Hence, in addition to the wind damage, there occurred also the most severe dust storm ever known to this part of the country. The small particles of the soil, consisting largely of decomposed granite, were caught up and some of it carried to great heights. The air near the surface was so completely filled with the sand that at times objects were invisible beyond 50 feet and headlights were used on automobiles. The larger particles, up to the size of walnuts, sent bouncing along the ground, caused large stock, some of which was injured, to stampede to shelter. Sheep could not stand up in the gale. The surfacing was removed from gravel roads and streets to the foundation. The soil in many plowed fields, in cases a foot deep, was removed to the gravel. Large windrows of sand were formed and many ditches filled. Great damage occurred to winter grain; much was blown out or covered with sand. Alfalfa also suffered in a similar manner. It is stated that the per cent of abandoned winter grain will be the greatest ever known in the State.

In some cases the sand blast stripped every particle of paint from the exposed parts of automobiles and so pitted the glass that not a piece could be seen through. All insulated objects became amazingly charged electrically. The ignition systems of automobiles were completely disrupted and hundreds of cars were stranded. The city engineer of Cheyenne states that the induced current was sufficient to start small electric motors. The anemometer pole at the city office became so charged that the triple register could not be touched without receiving a severe shock and it was necessary to ground the instrument.

## UNUSUAL LUNAR HALOS

M. R. Hovde, assistant meteorologist, and Mac A. Emerson, senior observer, St. Paul, Minn., noted at 11:30 p. m., Februray 7, 1933, the halo of 22°, complete; the halo of 46°, large arc; and the paraselenic circle, complete.

Harry V. Myers, observer, Moline, Ill., noted at 5 a. m., February 8, 1933, both paraselenae of 22°; the 22° halo, a portion of the 46° halo, the circumzenithal halo, a portion of the paraselenic circle, the moon pillar, and a cross through the moon.

C. G. Andrus, meteorologist, Cleveland, Ohio, recorded at 6:45 p. m., February 8, 1933, both paraselenae of 22°; the halo of 22°; the upper tangent arc of the halo of 22°; the upper portion of the halo of 46°; the circumzenithal circle; half of the paraselenic circle; a lunar pillar, vertical through the moon, and a cross, produced by the lunar pillar and the adjacent portions of the paraselenic circle.

J. H. Spencer, senior meteorologist, and A. P. Keller, junior meteorologist, Buffalo, N. Y., observed from 8 p. m., February 8, 1933, to after midnight (brightest from 9:30 p. m. to 10:30 p. m.) the halo of 22°; the paraselenic circle, complete; and a portion of the halo of 46°.

NOTE.—On these dates the moon was nearly full, that is, at about its brightest, and the halo-producing cirrus so thin that the brighter stars were clearly visible through it. In short, both the moon and the cirrus haze were in their optiumum states for producing visible halos. Similar solar halos were observed on this date, February 8, by Joseph J. Eigenmann, assistant observer, at Springfield, Ill., by Berlin Pugh, at Royal Center, Ind., and, doubtless, by many others. Evidently, therefore, the thin cloud that produced these solar and lunar halos was both extensive and persistent.—EDITOR.

## THE DUST STORM OF JANUARY 22, 1933, OVER SECTIONS OF ILLINOIS, INDIANA, AND MICHIGAN

By C. G. ANDRUS

[Weather Bureau Airport Station, Cleveland, Ohio]

On January 22, 1933, a rather well-defined dust storm that began and ended abruptly was reported by aviators and observers in sections of Illinois, Indiana, and Michigan. At some stations the visibility was reduced to less than 1 mile, causing a real hazard to flight. An aviator on passing through sudden dashes of rain about 3 p. m. on this date, in the northwestern corner of Ohio, found his windshield streaked with reddish-yellow "mud." The rain he encountered farther east was clear. On the next day, according to the Canadian press, about an inch of grayish-yellow snow fell at Chicoutimi, in Quebec.

This dust presumably was caught up in the dry southeastern sector of a low centered, at 8 p. m., January 21, in middle Kansas.

## SOLAR HALO, DECEMBER 14, 1932, AT MOORHEAD, MINN.

Mr. C. A. Olsen, junior observer at Moorhead, Minn., reports an interesting solar halo complex observed at that station on December 14, 1932. This consisted of (1) both the parhelia of 22°, (2) both the parehlia of 46°, (3) both the parhelia of 120°, (4) a short section of the parehlic arc through each parhelion of 120°, (5) the anthelion, (6) a short section of one or more of the anthelic arcs, (7) the parhelic circle, complete, (8) a sun pillar, vertical through the sun, (9) a cross (combination of pillar and adjacent portions of the parhelic circle, (10) the halo of 22°, (11) the upper tangent arc of the halo of 22°, (12) the halo of 46°, (13) the circumzenithal arc very brilliant over 20° to 30° on side nearest the sun; faint over the rest of the circle, but complete all the way around.

NOTE.—It is unusual, but not unknown, for the circumzenithal arc and Kern's arc (the arc farthest from the sun on the same circle as the circumzenithal arc) to blend into a complete circle.—EDITOR.