a house, but they have also seemed to fall, as would a stone,[103] like a meteor, from the storm cloud, and along the approximate path of both previous and subsequent lightning flashes. Others appeared to start from a cloud and then quickly return, and so on through an endless variety of places and conditions.

Doubtless many reported cases of ball lightning, probably the great majority, are entirely spurious, being either fixed or wandering brush discharges or else nothing other than optical illusions, due, presumably, to persistence of vision. But here, too, as in the case of rocket lightning, the amount and excellence of observational evidence forbid the assumption that all such phenomena are merely subjective. Possibly in some instances, especially those in which it is seen to fall from the clouds, ball lightning may be only extreme cases of rocket lightning, cases in which the discharge for a time just sustains itself. A closely similar idea has been developed in detail by Toepler.[104] It might either disappear wholly and noiselessly, as often reported, or it could, perhaps, suddenly gain in strength and instantly disappear as sometimes observed, with a sharp, abrupt clap of thunder.

To say that all genuine cases of ball lightning, those that are neither brush discharges nor mere optical illusions, are stalled thunderbolts, certainly may sound very strange. But that, indeed, is just what they are, according to the above speculation, a speculation that recognizes no difference in kind between streak, rocket, and ball lightning; only differences in the amounts of ionization, quantities of available electricity and steepness of potential gradients.—*W. J. Humphreys.**

[103] Violle, *Comptes rendus*, Paris, 1901, **132**, 1537.
[104] *Annalen d. Physik*, 1900, **22**, 623.
**Jour. Franklin Inst.*, Aug., 1918, p. 218 (part of "Physics of the Air").

MISCELLANEOUS METEOROLOGICAL NOTES.

[Submitted by A. H. Palmer.]

As a result of damage done by hail during a severe thunder storm on July 2, 1920, the Eastern Iowa Mutual Hail Association has paid $3,317 insurance to individuals residing in the vicinity of Postville, Iowa.

The city of Oakland, California, maintains a meteorological and astronomical observatory known as Chabot Observatory, and located in the suburbs of that city. It is maintained under the direction of the Board of Education as a part of the school system, and is open to the public during certain hours of the day and evening. At the present time complete meteorological apparatus similar to that of a first class station is being installed. On the east side of San Francisco Bay there are four cities, Oakland, Berkeley, Alameda and Richmond, with a combined population of approximately 350,000 people. In litigation involving weather data, records from Chabot Observatory and those kept by the University of California, in Berkley, are frequently consulted.

As there are approximately 150 aeroplanes in commercial use in California at present, and the number is increasing from month to month, the demand for aerological data continues to grow in proportion.

The South San Joaquin District maintains a large dam known as Woodward Reservoir, and located about 8 miles north of Oakdale, California. In order to determine the loss of stored water through evaporation, the Weather Bureau and the Irrigation District are coöperating in the measurement of evaporation. For the past two years a standard evaporation station has been maintained on the bank of the reservoir, and at the present time a supplementary evaporation pan is being installed on a float in the dam. A similar floating pan is maintained on Lake Tahoe, in the Sierra Nevada Mountains.

During the past few months there have been large railroad shipments of Casinghead Gasolene from Texas to California. Because of its high specific gravity, this gasolene expands greatly with increase of temperature. In making arrangements for these shipments, the Bureau of Explosives, maintained by the railroad companies, found it necessary to fill the tank cars only to a certain capacity, owing to the high temperatures encountered by those cars in passing through the hot deserts, under the cloudless skies of the Southwest.

At Greenland Ranch, in Death Valley, California, the air temperature, as recorded by a tested maximum thermometer exposed in a standard instrument shelter, rose to 100° or higher on 23 days during June, and on every day during July, 1920. The extreme maximum was 125°, recorded on the last day of July.—

On July 10, 1913, the temperature there reached 134° F., the highest officially recorded air temperature in the world.[1]—*A. H. Palmer.*

MONTHLY WEATHER REVIEW, JUNE, 1920 (ISSUED AUG. 30, 1920).

The June issue of *The Monthly Weather Review* contains 20 contributions and 11 notes and abstracts, in addition to the usual material—bibliography, special (solar) observations, and weather, river and earthquake phenomena of the month. A third of the contributions are of appreciable length. The contributions are as follows:

***Relation between the annual precipitation and the number of head of stock grazed per square mile.** J. WARREN SMITH. Pp. 311–317.

(See this BULLETIN, May, 1920, p. 55.)

***New aerological apparatus.** S. P. FERGUSSON. Pp. 317–322, 20 figs.

(See this BULLETIN, May, 1920, p. 52.)

***A general theory of halos.** C. S. HASTINGS. Pp. 322–330, 8 figs.

[The general theory of halos developed in this paper rests on the assumption that two kinds of simple ice-crystals—elongated hexagonal rods and hexagonal plates—are occasionally present in a tolerably transparent atmosphere; moreover, that these crystals subsiding in quiescent air would necessarily fall into four groups.

The first portion of the paper establishes the validity of the assumption by reference to well-recorded observations.

The second portion is devoted to a development of the consequences from the presence of each of these groups for various altitudes of the sun. It is there shown that all the authenticated features of complex halos are naturally explained (excepting certain rare multiple concentric circles) as inevitable consequences of the hypothesis. In addition, this portion gives a new means of classifying the various phenomena, showing unsuspected relationships as well as essential diversity in certain other cases where common origin was formerly assured.—*Author's synopsis.*]

A beautiful halo display observed at Ellendale, N. Dak. F. J. BAVENDICK. Pp. 330–331, fig.

The Boulder halo of January 10, 1918. E. W. WOOLARD. Pp. 331–332, 3 figs.

The Grand Junction halo of March 3, 1906. E. W. WOOLARD. P. 332, fig.

Outline showing the formation of the elements of a halo complex. E. W. WOOLARD. P. 332.

*[These four short papers are included in the separate of Professor Hasting's article, as they are largely descriptive of actual occurrences of halo complexes covered by his theoretical discussion.]

[1] See *Mo. Weather Rev.*, June, 1915, Vol. 43, pp. 278–280.