Wyoming.—The weather for the month was mild and pleasant over nearly all sections of the State, and unusually favorable for the stock interests. All stock have kept in good condition, and practically no losses have occurred. The deficient snowfall over most of the State gave some apprehension of a deficient supply of irrigation water for the coming season.—*W. S. Palmer.*

SPECIAL ARTICLES.

RECENT PAPERS BEARING ON METEOROLOGY.

Dr. W. F. R. PHILLIPS, Librarian, etc.

The subjoined titles have been selected from the contents of the periodicals and serials recently received in the Library of the Weather Bureau. The titles selected are of papers or other communications bearing on meteorology or cognate branches of science. This is not a complete index of the meteorological contents of all the journals from which it has been compiled; it shows only the articles that appear to the compiler likely to be of particular interest in connection with the work of the Weather Bureau. Unsigned articles are indicated by a ——.

Scientific American. New York. Vol. 90.
—— Dispersion of Fogs by Electricity. P. 115.
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—— Electrons and Atmospheric Electricity. P. 23522.
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Bryan, G. H. and Williams, W. E. The Longitudinal Stability of Aeroplane Gliders. Pp. 12-19.
Marriott, William. The Balloon Ascents made by James Glaisher, F. R. S., for Scientific Purposes, 1862-69. Pp. 19-23.
Symons's Meteorological Magazine. London. Vol. 38.
C., R. H. An Unexpected Use for Sunshine Recorders. Pp. 210-211.
Smith, C. Michie. The Climate of Kodaikánal. Pp. 215-217.
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Abbot, C. G. Recent Studies of the Solar Constant of Radiation. Pp. 74-83.
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Allan, S. J. Radioactivity of the Atmosphere. Pp. 140-150.
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Blythswood, Lord and Allen, H. S. Radio-active Gas in Mineral Springs. P. 247.
Stoney, G. Johnstone Stoney. Escape of Gases from Atmospheres. Pp. 247-248.
—— Atmospheric Absorption and Emission of the Extreme Ultra-Violet Radiation. P. 262.
Simpson, George. A Theory of the Cause of Atmospheric Electricity. P. 270.
Clayton, Henry Helm. The Diminishing Size of the New Bishop's Ring around the Sun. Pp. 270-271.
Lodge, Oliver. Atmospheric Electricity. P. 294.
Warner, H. M. Curious Shadow Effects. P. 296.
—— Observations of Glaciers and Avalanches. P. 299-300.
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Nordmann, Ch. Le rayonnement hertzien du soleil et l'influence de l'activité solaire sur le magnétisme terrestre. Pp. 97-120.
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Brunhes, Bernard and Brunhes, Jean. Les analogies des tourbillons atmosphériques et des tourbillons des cours d'eau et la question de la déviation des rivières vers la droite. Pp. 1-20.
Sorre, Maximilian. Régime pluviométrique de la Vendée. Pp. 56-63.
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—— Constitution physique de l'atmosphère. Pp. 515-516.
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Elias, H. Der Zustand der Atmosphäre an Nebeltagen. Pp. 1-11.
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PROBLEMS OF THE ATMOSPHERE.

By Prof. JAMES DEWAR.

In the Proceedings of the Royal Institution of Great Britain, vol. 17, part 1, No. 96, November, 1903, p. 223, Prof. James Dewar, after describing his method for removing the more condensable constituents of the atmosphere and his process of analyzing the resulting mixture of rare gases, continues as follows:

These experiments prove that air[1] contains as a minimum 1/362,000 of its volume of helium, about 1/70,000 of neon, and not more than 1/100,000 of free hydrogen. * * *

The spectroscopic examination of these gases throws new light upon the question of the aurora and the nature of the upper air. On passing electric discharges through tubes containing the most volatile of the atmospheric gases, they glow with a bright orange light, which is especially marked at the negative pole. The spectroscope shows that this light consists, in the visible part of the spectrum, chiefly of a succession of strong rays in the red, orange, and yellow, attributed to hydrogen, helium, and neon. Besides these a vast number of rays, generally less brilliant, are distributed through the whole length of the visible spectrum. The greater part of these rays are as yet of unknown origin. The violet and ultra-violet part of the spectrum rivals in strength that of the red and yellow rays. As these gases probably include some of the gases that pervade interplanetary space, search was made for the prominent nebular, coronal, and auroral lines.

No definite lines agreeing with the nebular spectrum could be found, but many lines occurred closely coincident with the coronal and auroral spectrum. But before discussing the spectroscopic problem, it will be necessary to consider the nature and condition of the upper air.

According to the old law of Dalton, supported by the modern dynamical theory of gases, each constituent of the atmosphere while acted upon by the force of gravity forms a separate atmosphere, completely independent, except as to temperature, of the others, and the relations between the common temperature and the pressure and altitude for each specific atmosphere can be definitely expressed.

If we assume the altitude and temperature known, then the pressure can be ascertained for the same height in the case of each of the gaseous constituents, and in this way the percentage composition of the atmosphere at that place may be deduced.

Suppose we start with a surface atmosphere having the composition of our air, only containing 2/10,000 of hydrogen; then, at 37 miles, if a sample could be procured for analysis, we believe that it would be found to contain 12 per cent of hydrogen, and only 10 per cent of oxygen. The carbonic acid practically disappears; and by the time we reach 47 miles, where the temperature is minus 132°, assuming a gradient of 3.2° per mile, the nitrogen and oxygen have so thinned out that the only constituent of the upper air which is left is hydrogen. If the gradient of temperature were doubled the elimination of the nitrogen and oxygen would take place by the time 37 miles was reached, with a temperature of minus 220°.

The theoretical distribution of the chief components of our atmosphere, on the assumption of steady equilibrium, is graphically represented in figs. 1 and 2. In these diagrams nitrogen is represented by the horizontal hachure, oxygen by the diagonal hachure, hydrogen by the stippling, argon by the blank white space, and carbonic acid by black. A horizontal line drawn across the diagram at any height marked in kilometers (0.62 mile) shows the percentage by volume of the constituents at that elevation, by the respective lengths within the hachures of the individual constituents. The results of Hinrich's calculations which involve no consideration of the effects of temperature, are represented in fig. 1, and those of Ferrel, who assumes a temperature gradient of 4° per kilometer throughout the upper air, in fig. 2. The higher the assumed temperature gradient the lower the elevation at which the nitrogen and oxygen are eliminated and the true hydrogen atmosphere begins. The elevations marked *A*, *B*, *C*, *D*, in fig. 2, refer to the respective gradients of 4°, 3°, 2°, and 1°, per kilometer, and mark the end of the nitrogen and the beginning of the true hydrogen atmosphere. The position *A* corresponds to 60 kilometers and a temperature of —220°; *B*, to 67 kilometers and —181° C.; *C*, to 76 kilometers and —132°; and *D*, to 87 kilometers and —67°.

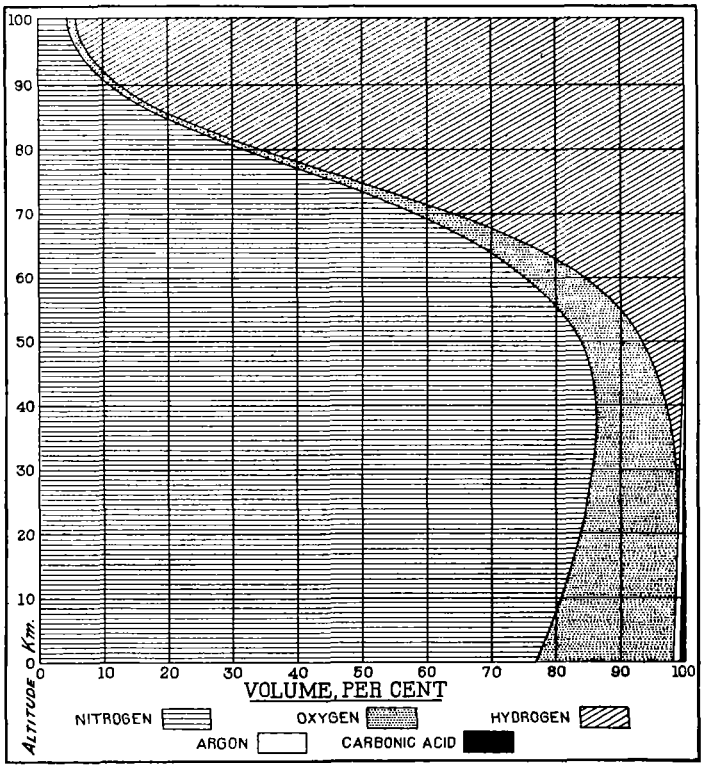

FIG. 1.—Distribution of the atmospheric gases, Hinrich's formula.

[1] We ought rather to say the air of London.—ED.