The Energy of Cyclones.

IN NATURE for December 2, p. 436, Sir Napier Shaw remarks: "There can be no doubt, I suppose, that solar and terrestrial radiation are ultimately responsible for the kinetic energy of the winds." If we include other possible radiations from space and the effects of high-velocity cosmic matter striking the upper limits of the atmosphere, few will fail to agree. Not many years ago the theory mentioned by Mr. J. R. Cotter (NATURE, November 25, p. 407), 'that the energy of a cyclone is derived from the heat-energy of the earth's surface," would have been considered as most probably correct. However, Mr. W. H. Dines, with the aid of about 250 soundings of the upper air with self-registering balloons, proved that the lower central parts of cyclones are actually cooler and denser than the surrounding parts. That his conclusion is of general application so far as western Europe is concerned the daily Upper-Air Temperature Charts issued by the Meteorological Office show.

Fig. 1 shows the distribution of temperature in cyclones found by Mr. W. H. Dines, and in the face of such a distribution it appears to be impossible to attribute their growth and disappearance to the heat-

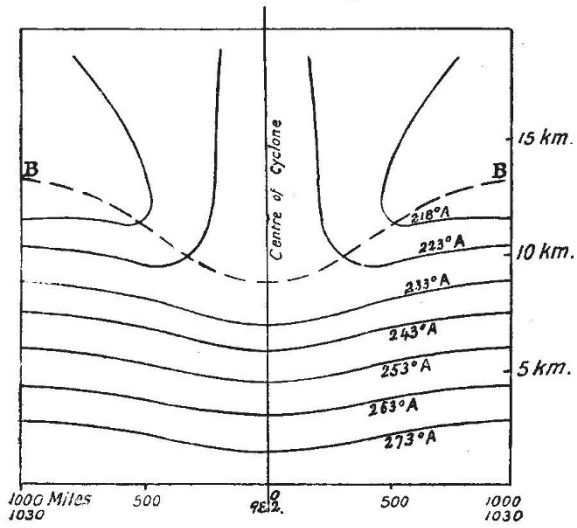

FIG. 1.

ing and cooling of the troposphere. Local heating of the atmosphere near the earth's surface does cause up-rushes of air, resulting in thunderstorms, etc., but they never seem to result in cyclones.

In view of the actually determined distribution of temperature in cyclones being as shown in Fig. 1, I suggested (*Phil. Mag.*, July, 1915, April, 1916, and March, 1918) that the upper, as well as the lower, limits of the atmosphere become irregularly heated, and that the general and local winds of the earth result from the interaction of the movements set up by these two layers of heated air. Referring to Fig. 1, it will be noticed that the line of division BB between the stratosphere and the troposphere is lower at the centre of the cyclone than at its margins, and that the temperature at the centre of the depression is lower than near the margins. So marked is this lowering of temperature that, in spite of the lower pressure, the central air is denser than that surrounding it, and there is, consequently, no tendency for the column of air to rise. On the other hand, above BB the temperature of the stratosphere at the cyclonic centre is higher than it is at the margins at similar levels, and the pressure at the centre being lower as well, there is a strong lifting power exerted upon the troposphere by the stratosphere. So long as such lifting action is in operation the cyclone persists.

With regard to the general circulation upon which the travelling cyclones are superimposed, all the registering balloon ascents yet made indicate that the temperature conditions of the greater cyclonic circulations of the polar areas are similar in nature to those of the smaller ones; nor is there as yet any evidence suggesting that the conditions of decay in cyclones differ in anything but degree from their conditions of growth.

Sir Napier Shaw has pointed out that rain and many other weather conditions are very often due to the "embroidery" of the cyclone rather than to the rising air in the centre of the cyclone itself. The Daily Weather Charts show that, especially near the margins, the effect of the oncoming or growing cyclone, impressing its circulation upon already existing winds, is often to cause damp, warm air-currents to mount over dry ones, and thus to produce rain and cloud. Mr. W. H. Dines (NATURE, November 18, p. 375) may be quite correct, therefore, in holding that cyclones do not result from warm air of the troposphere flowing over cold air near the earth's surface; and Lt.-Col. Gold (*ibid.*, November 11, p. 345) may be equally correct in believing that rain is often due to such conditions obtaining in cyclones. However, such movements are secondary phenomena, and may add some energy to an already existing cyclone, for the reasons given by Sir Oliver Lodge (*ibid.*, November 25, p. 407).

The formation of a cyclone, as Sir Napier Shaw (*ibid.*, December 2, p. 437) states, shows that "the region covered by a cyclone has simply lost a certain part of the air which it normally possesses. In one example I estimated the loss as equivalent to 40,000 cubic km. at sea-level. Beyond all doubt or question air had gone; it was not piled up in anticyclones fore and aft, as we used to think the convected air of our cyclones must be; it was gone clean away." According to my conception, the upper limit of the atmosphere is often heated locally by radiant energy or high-velocity matter from without. Heated protuberances are thus formed at the upper effective limit of the atmosphere. The air of these protuberances then flows away in all directions, leaving cyclonic conditions below the area where the protuberance was formed.

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December 4.

Name for the Positive Nucleus.

MAY I ask in what way "the hydrogen nucleus or unit of positive charge," for which Sir Oliver Lodge (NATURE, December 9, p. 467) provides us with a choice of brand-new names, "proton, ambron, merron, uron, prime, centron, and hylon," differs from our very old friend "hydrion," the familiar hydrogen ion of the physical chemist? The point occurred to me when Sir Ernest Rutherford suggested the new name "proton" for it in Section A of the British Association this year. Its new hypothetical *rôle* as "the brick of which all atoms are built up, electrons acting as cement," although probably more acceptable to chemists than the curious inversion of this which afforded to a past generation of physicists such peculiar æsthetic and intellectual gratification, ought not to be allowed to obscure the fact that there is nothing hypothetical or protonic about the particle itself. In 1920 hydrogen ion, as the common constituent of that very common class of