LETTERS TO THE EDITOR.

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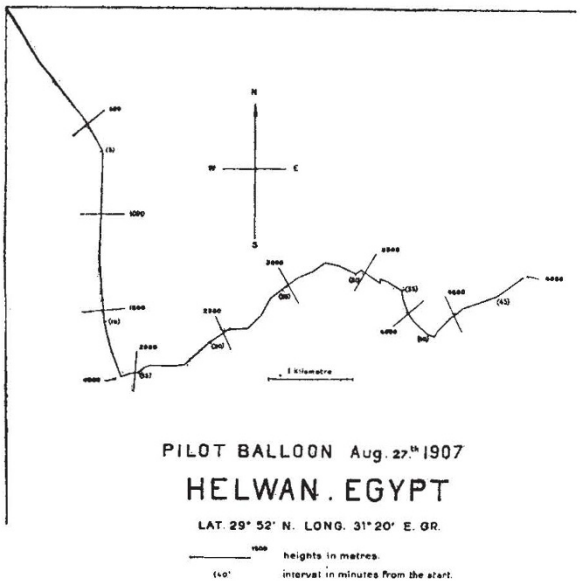
Upper Air Research in Egypt.

THE Helwan Observatory (under the Survey Department of Egypt) has recently acquired apparatus to enable it to join in the study of the upper regions of the atmosphere. As a commencement, some fifteen ascents of small "pilot" balloons were made during the month of August. On three occasions the balloons were watched to a height of 5000 metres, but rather a large percentage of the balloons used burst at much lower altitudes. A better type of balloon has been ordered, and it is hoped that observations may be regularly made with them up to 5000 metres or 6000 metres. The balloons are of 2 feet nominal diameter, and are filled with dry hydrogen made from zinc and sulphuric acid. They are observed as they ascend by two observers at the ends of a base line 1 kilometre in length. The theodolites are of the very convenient type made by S. and A. Bosch, of Strassburg, specially for this work. The result of a month's work shows that at this season the surface wind (N. to N.W. as a rule) is from



1000 metres to 2000 metres thick. Above this there is a layer of varying thickness of winds from W. to W.S.W., whilst above 4000 metres other winds are reached, but the number of observations is at present too few to generalise about this region. An interesting ascent is shown in the figure, which represents the horizontal projection of the flight of a balloon on August 27, with contours showing the position of the balloon at intervals of 500 metres. In this case, above the stratum of S.W. wind there was a layer of N.W. winds, whilst above this a S.W. current was again entered.

Besides this study of the winds, kite ascents will very shortly be commenced. The apparatus acquired for these consists of a winch of the pattern designed by Mr. W. H. Dines, F.R.S., driven by a Crossley petrol engine of 4 horse-power. The observatory is indebted to Mr. Dines and also to Mr. J. E. Petavel, F.R.S., who watched the manufacture of the winch and introduced many minor alterations which use of a similar machine at Glossop had suggested. The machines are housed in an iron building on the flat desert plateau behind the observatory.

During the September international days (September 4, 5, and 6) five ascents of pilot balloons were made. The height to which they were followed varied between 2500 metres and 3300 metres.

Helwan. B. F. E. KEELING.

Newton's Rings in Polarised Light.

AN erroneous statement regarding the above-mentioned subject is made in Preston's "Theory of Light" (p. 363, 1901 edition) and also in Edser's "Light" (p. 519, 1902 edition). As the error is a rather serious one, it seems worth while to point it out.

When the rings are seen between two lenses of the same substance, by light polarised perpendicularly to the plane of incidence, reflected at an angle greater than the polarising angle of the substance, it is stated that the centre of the rings is bright. That this is wrong can be seen. For :—

(1) Stokes has shown from the principle of reversibility that, whatever be the nature of light, the centre of the rings seen between lenses of identical refractive indices is black at all incidences of the light.

(2) Since the centre of the rings is black *at all incidences* for common light and for light polarised in the plane of incidence, it follows by resolution that it is also black when the light is polarised in a perpendicular plane.

(3) When the angle of incidence is less than the polarising angle, the coefficients of reflection *in glass* and *in air* at the bounding surfaces of the two media are opposite in sign. It is argued that, on increasing the incidence, the coefficient of reflection *in air* changes sign as the polarising angle is passed, and therefore at such incidences the two coefficients agree in sign, and destructive interference no longer takes place. Really, however, it appears from Fresnel's formula (coefficient $= -\tan(i-r)/\tan(i+r)$ that both the coefficients change sign as the incidence passes through the polarising angle, and therefore continue to differ in sign, as can be directly shown from the principle of reversibility. Destructive interference does, therefore, take place.

(4) I have shown by experiment that the statement is not true.

(5) Airy has shown (Lloyd's "Wave Theory," p. 178, and Jamin's "Optique Physique," p. 503) that when the two lenses differ in refractive index, the centre of the rings seen in light polarised perpendicularly to the plane of incidence is white only when the incidence lies between the angles of polarisation of the two media. Outside these limits the centre is dark.

C. V. RAMAN.

Science Association Laboratory, Calcutta, September 12.

MR. RAMAN'S criticism of the statement made on p. 519 of my "Light for Students" is quite justified. Some time ago I noticed the error myself, and devised the following experiment, to which the same objections cannot be raised, while at the same time it is more easily performed than that in which two lenses of different refractive indices are used.

An ordinary black tea-tray is filled with tap water, and the surface is then touched by the end of a glass rod which has been dipped in oil (I find that the heavy paraffin oil used for engine lubrication answers well). The oil spreads over a fairly large area, Newton's rings being exhibited round the edge of this. On viewing the colours through a Nicol at an angle slightly greater than 45° no change is produced when the light transmitted is polarised in the plane of incidence, but on turning the Nicol through a right angle the colours change to their complementaries. In this case the light is reflected from the lower surface of the film at an angle slightly greater than the angle of polarisation for that surface, while it is reflected from the upper surface of the film at an angle less than the polarising angle. I presume that if Lloyd's single mirror fringes were observed through a Nicol, a similar change would occur on rotating the Nicol; I should be obliged if anyone who has tried this experiment would let me know whether this actually occurs. EDWIN EDSER.

Thermodynamics of Diffusion.

IN his review of "Thermodynamics" (NATURE, July 25) and again in the *Philosophical Magazine* for July, Mr. Burbury directs attention to a result stated by me regarding the gain of entropy resulting from slow diffusion of gases at constant pressure and temperature.

May I direct attention to the context in connection with