with a drop of turpentine, to act as an insulator, between them. On this was laid a thin cover-glass, as used for covering objects when mounted for the microscope. Unintentionally the potential between the two tinfoil strips rose high enough to permit a spark to pass through the oil between them, and when this occurred a small piece was blown out of the centre of the cover-glass, being about $1/16$ in. in diameter on the upper side and about half this on the lower, the piece of glass having the appearance of a small truncated cone. The cover-glass was only held down by the film of oil separating it from the strips of tinfoil; yet the fragment of glass was ejected with considerable force.

The cause of the effect may be explained as follows: the energy liberated from the spark was sufficient to cause the pressure to rise rapidly to a high value in the confined space, either by decomposing the oil and heating the liberated gas, or by forcing away the oil along its path, and so compressing it. (We are, however, not concerned here with the question as to whether the pressure on the glass cover had its seat in the oil alone or in the gas liberated from the oil, but only with the fact that the passage of the spark through the oil gave rise to a series of events which culminated in the forcing out of a plug of glass from the cover.) As the time during which the spark lasted was almost negligible, the rate at which the pressure rose near the spark was great enough to send out a pulse of pressure through the oil. This pulse striking the thin cover-glass had sufficient energy stored in it to cause the small piece of glass to be removed from it.

This effect is the converse of that noted by Mr. J. Y. Buchanan during the voyage of the *Challenger* in 1873, and repeated by him while on board the yacht of H.S.H. the Prince of Monaco, the *Princesse Alice*, in the summer of 1902 (see Proc. Roy. Soc., 1903, vol. lxxii., p. 88; or NATURE, 1903, vol. lxxviii., p. 334). I will quote from Mr. Buchanan's paper:—"The brass tube (Figs. 1 and 2, plate i.) above referred to was the case for holding a piezometer which was accidentally broken. With it I repeated the experiment which I had made in the *Challenger*, with this difference, that I used only one sealed glass tube. It was an ordinary pipette of 50 c.c., sealed up at both ends close to the body. It was wrapped in a piece of muslin and loosely packed with cotton waste so as to occupy the middle of the brass tube.

"The length of the brass tube was 33 cm., and its diameter $4\frac{1}{3}$ cm. Its weight without the cover was 350 grams. Both the top and the bottom are pierced with many holes so as to allow passage to the water.

"Thus charged, it descended on the sounding line to a depth of 3000 metres, and when it came up it was evident from its appearance that the experiment had succeeded. As in the experiment on board the *Challenger*, the glass had been converted into a snow-white powder. The external effect also was confined entirely to that part of the brass tube which had been occupied by the sealed glass tube. Above and below it there was no disfiguration."

In this case it was easier for the water outside to distort the brass tube than to flow through the perforated caps covering the ends, and so fill the space lately occupied by the glass bulb. In the case of the punctured cover-glass the pressure rose so suddenly on the spark passing through the oil that there was not sufficient time to raise the glass as a whole, or to push away the film of oil lying between it and the glass slide, with the result that a minute piece of glass was forcibly blown out. Had the cover-glass possessed the ductility of brass, there would perhaps

have been a bulge formed instead of a piece being bodily removed.

On another occasion I had a practical demonstration of the power given out by a spark. It was in the early days of wireless telegraphy, and I had constructed an oscillator of a simple type, consisting of a pair of brass balls immersed in paraffin oil, the oil and balls being contained in an inverted bottle from which the bottom had been removed. The bottle was about $2\frac{1}{2}$ in. in diameter, and about 4 in. deep, and the balls were situated at the centre, one above the other, and $\frac{1}{8}$ in. apart. I had not passed more than about a dozen sparks between the balls when suddenly the glass was shattered. The large end of the bottle was open, and the free surface of the oil was about $2\frac{1}{2}$ in. in diameter. We have in this case direct evidence of a pressure being transmitted in the form of a pulse, or single wave, to the glass containing vessel of an intensity sufficient to cause it to break. The cause of this pressure was the spark passing from ball to ball through the oil, and while passing pushing away the oil on all sides with a rapidity which gave rise to a pulse of pressure. This pulse travelled outwards with great velocity, and contained such a store of energy that on striking the sides of the vessel it was sufficient to rupture the glass. The potential energy of the original electric charge was converted into the kinetic energy of the spark, and this in turn was transformed into the energy of the pulse, which was finally transferred to the glass. As the amount of energy was too great for the glass to hold, it found an outlet in shattering the vessel.

The "pressure in an electric spark" is a term by no means uncommon in scientific literature, yet but little attention is paid to the effects which this pressure exerts on surrounding objects, as, for example, when a tree or house is struck by lightning. They all belong to the type mentioned above.

In conclusion, I would recommend a careful study of the paper by Mr. J. Y. Buchanan referred to above to those interested in the subject of the sudden relief of great pressure.

W. G. ROYAL-DAWSON.

17 Pembridge Gardens, London, W.

January 8.

The Halo in the Ricefield and the Spectre of the Brocken.

IN connection with the curious Japanese phenomenon of the halo seen around the head of the shadow of a person standing in a ricefield in early morning (NATURE, p. 419, December 12, 1912), it may be of interest to recall that some recent balloon voyagers have reported observations of a bright halo surrounding the shadow of the car thrown upon a horizontal cloudfield by oblique solar rays. Coloured diffraction rings are sometimes seen surrounding the head of the "spectre of the Brocken," but for these to be visible theory requires that the drops constituting the mist should be of uniform size. In an article in the *Meteorologische Zeitschrift* (p. 282, June, 1912; see also *Science Abstracts*, p. 574, December, 1912), by Prof. F. Richarz, discussing the theory of the subject, reference is made to an observation by Dr. Bieber from the balloon *Marburg* of a halo around the shadow, and also to other verbal communications of a similar character. Prof. Richarz's article is followed by another describing a photograph taken by Dr. Wegener of a series of three diffraction rings seen around the shadow of the same balloon, the *Marburg*, on another voyage. The centre of the rings was the point corresponding to the shadow of the eye, or of the camera objective. On calculating the

radius r of the cloud drops from the angular radius of a ring, a divergence from theory was found on this, and other, occasions. Theoretically all the rings should give the same value for r , but the calculated value of r was found to diminish with the order of the ring outwards.

The Japanese observers are stated in the note to attribute the halo to reflected light from sun-images formed on the green blades by rays refracted through dewdrops. In the case of the cloud observations it seems necessary to assume reflection from portions of the cloud itself.

The difficult point, however, is to explain why the light thus reflected should be maximum in the direction of the sun, or, what is the same thing, in the direction of the observer. The fact that the ring surrounds the shadow of the observer's head seems to render such an assumption necessary. A single drop, as Prof. Richarz points out, does not give maximum intensity of reflection in the direction of the incident light. Dr. Richarz's explanation why the cloud as a whole should do so is simple and ingenious, and is applicable whether the sun's rays fall normally or obliquely to the surface of the cloud. Direct light only penetrates into the cloud (or assemblage of drops) when it finds a clear path, for if it strikes any drops on the way it will be scattered or diverted by refraction and reflection at their walls. If light which has so penetrated should then fall on the surface of a drop in the interior, it will be reflected in various directions, but only that portion of the reflected beam which returns the same way it came can find a clear path out again. Portions of the beam reflected in other directions will generally find their way blocked by intervening drops and be scattered. Hence the intensity of the reflected light will be maximum in the direction of the source of light, and the intensity will fall off rapidly with departure from that direction. The observer's head (or the balloon) cuts off the central portion of the sheaf of rays which he would see most brightly reflected, leaving only the peripheral portion visible.

To digress, I have a vivid recollection of one very foggy winter evening when I was wintering in a cottage on a wild part of the Cornish coast. Chancing to throw open the casement window of the sitting-room, I was for the moment quite taken aback to find myself confronted by a tall sinister figure looming up before the window. It was my own shadow thrown on the fog by a lamp left unshaded on a table in the room.

Perhaps I may take this opportunity to record another little optical observation of different character. Once—I think it was towards the close of the hot summer of 1908—watching, from the top of a cliff some 800 ft. high, the sun setting over the sea, I saw the upper half of the disc look like a double staircase; there were three or four distinct, almost rectangular, steps cut out of the limb symmetrically on either side. When most of the disc had sunk out of sight, the small portion remaining was suggestive of the lid of a teapot with a knob on top. Some lines of light cloud about the horizon showed the existence of horizontal stratification in the atmosphere, and the strange distortion of the solar limb was evidently due to refraction through horizontal strata with extraordinary sharpness of boundary and difference of density.

Alice EVERETT.

Milbourne Lane, Esher, January 6.

"*Rosa stellata*."

IN 1898 Prof. E. O. Wooton described a remarkable new rose from southern New Mexico, giving

NO. 2256, VOL. 90]

it the name *Rosa stellata* on account of the stellate trichomes. The peculiar, mostly trifoliate leaves, the leaflets with cuneiform bases and more or less truncate, sharply toothed apices, gave the plant an unusual appearance; while even the flowers, described as "large and showy . . . deep rose-purple," were not at all like those of the ordinary wild roses of the Rocky Mountains. Through the kindness of my friend, Prof. Fabian Garcia, I obtained some living plants of *R. stellata* from the original locality in the Organ Mountains. Some of these were sent to Dr. A. R. Wallace, who has grown them in England successfully; the others have been growing in Boulder, Colorado. Last year the plants in my garden grew exceedingly well, and were most attractive. Certainly if *R. stellata* can be generally used in gardens, it will be a valuable addition to horticulture, but it probably will do its best only in relatively dry climates. My wife attempted crosses with several other roses, and in one case was successful in getting good seed; what will result remains to be seen.

The fruit of *R. stellata*, as indicated by Wooton, is large, beset with strong slender prickles. Quite unlike the usual types of rose fruits, its walls are dense, not at all fleshy or brilliantly coloured, but corky. The orifice is very broad, with a diameter of 8 mm. The bright chestnut-red seeds, about 4 mm. long, are long-oval, not compressed, and therefore not at all angular. All this differs conspicuously from the fruit of typical *Rosa*.

R. stellata, however, is not the only plant of this type. Years before, Engelmann described *R. minutifolia* from Lower California, a plant with the same general characters. In recent times, Dr. Greene has separated part of Wooton's *R. stellata* as *R. mirifica*, and has added a fourth species, *R. vernonii*. Thus we have a compact group, which should, I think, form a distinct subgenus or genus *Hesperhodos*, with *stellata* as the type. All the species are of extremely restricted distribution, which may probably be explained by the fact that the fruits are not adapted to be eaten by birds.

The wide-open prickly fruit suggests that this may be a primitive form, as compared with true *Rosa*; but it is to be noted that the roses found fossil in the Miocene beds of Florissant, Colorado, belong to the true genus *Rosa*, not at all to *Hesperhodos*.

T. D. A. COCKERELL.

Boulder, Colorado, December 30, 1912.

A Lens or a Burning Glass?

IN the latest edition of Carpenter on the microscope at p. 119 occurs the following, evidently from the pen of the late Dr. Dallinger:—"There is in the British Museum a remarkable piece of rock crystal, which is oval in shape and ground to a plano-convex form, which was found by Mr. Layard during the excavations of Sargon's Palace at Nimroud, and which Sir David Brewster believed was a lens designed for the purpose of magnifying. If this could be established it would, of course, be of great interest, for it has been found possible to fix the date of its production with great probability as not later than 721-705 B.C. . . . we spent some hours in the careful examination of this piece of worked rock crystal, which, by the courtesy of the officials, we were permitted to photograph in various positions, and we are convinced that its lenticular character as a dioptric instrument cannot be made out. There are cloudy striæ in it, which would prove fatal for optical purposes, but would be even sought for if it had been intended as a decorative boss; while the grinding of the 'convex' surface is