on observations extending over a period of six consecutive months; with soil temperatures, a series of observations embracing a similar period; with the normal condition of vegetable structure with reference to cell contents; and with "peach yellows," a disease attacking peach trees. To do justice to any one of these memoirs would really require a separate notice, but the mere mention of them will serve to indicate some of the channels into which the energies of this new centre of research are being directed. In connection with the meteorological work, however, it is worth noting that daily bulletins were issued, the predictions being made for twenty-four hours from noon to noon. The whole number of predictions made was 210, of which only 1·9 per cent. proved incorrect, so that the bulletins came to be depended upon and served a most important purpose for the time during which they were issued. All the reports are printed in an attractive form, and special pains appear to have been bestowed upon the diagrams and coloured plates.

To the names that have already been mentioned it is necessary to add that of Mr. Henry E. Alvord, who has undertaken the duties of general manager. Mr. Alvord's name is already familiar to agriculturists on this side of the Atlantic, particularly in connection with American dairy farming, and his association with Houghton Farm is another guarantee, if one were needed, of the thoroughly business-like manner in which the new experiment station is to be conducted.

From this brief sketch it will be seen that there exist at Houghton Farm potentialities whose development can hardly fail to exercise considerable influence on the agricultural practice of the future. Those who have studied the Rothamsted results will be glad to compare with them the results deduced from the Houghton Farm experiments, and each station will be benefited by comparing notes with its friendly rival, while the valuable work which English agriculturists associate with the names of Lawes, Gilbert, Pugh, Masters, and Warington will, it is to be hoped, find a parallel in the discoveries we shall confidently look for from the transatlantic station. Intentionally planned, in many details, upon the same lines as Rothamsted, there is one point in which the new station specially resembles its English prototype, and it is contained in the words, "Visitors are always welcome at Houghton Farm." W. FREAM

EDELMANN'S ELECTROMETER

AMONGST the many forms of electrometer that derive their origin from the quadrant electrometer of Sir William Thomson is that of Edelmann, which is very extensively used in the physical laboratories of the Continent. Dr. Edelmann, whose name it bears, is not only proprietor of workshops in Munich, which are rapidly winning renown for the excellence of the instruments which they turn out, but also holds the post of *privat-docent* in the Polytechnicum of Munich.

In the parent instrument of Sir W. Thomson, and in most of the modifications of that instrument which go by the names of Branly, Kirchoff, Mascart, &c, the quadrants are literally four quadrants cut from one plane circle; and in most of these instruments the *needle* is of the flat dumb-bell or lemniscate form which Sir W. Thomson himself gave to it. Dr. Edelmann has, however, taken a departure in quite another line, his instrument being very appropriately named the "cylinder-quadrant" electrometer. The three accompanying figures show the essential parts of the instrument. The quadrants, marked G in Fig. 1, and *a*, *b*, *c*, *d* in Fig. 2, are formed by taking a metal tube, furnished with flanges above and below, and slitting it into four parts by four equidistant cuts parallel to the axis of the tube; the four pieces being then set in their proper places by being screwed to two rings, R and S, of ebonite. This arrangement has some advantages over those of the ordinary quadrant electrometers. In these, when the quadrants consist of four pieces of flat brass borne each on an insulating pillar, it is difficult to set them so that they shall be all exactly in one plane; and when, as in some of the more delicate instruments, the quadrants are made of a hollow box slit into four parts, there is found the further difficulty of arranging the quadrants so that the needle can be taken out and replaced. These difficulties are, to a large extent, obviated in Dr. Edelmann's form of instrument; for the inner surface of the cylinder, which constitutes the four quadrants, can be turned perfectly true after the quadrants have been screwed to the ebonite rings; and there is no difficulty at all in lowering the needle into the cylindrical cavity within the quadrants, or in lifting it out. The needle itself is of the form shown in Figs. 2 and 3, and

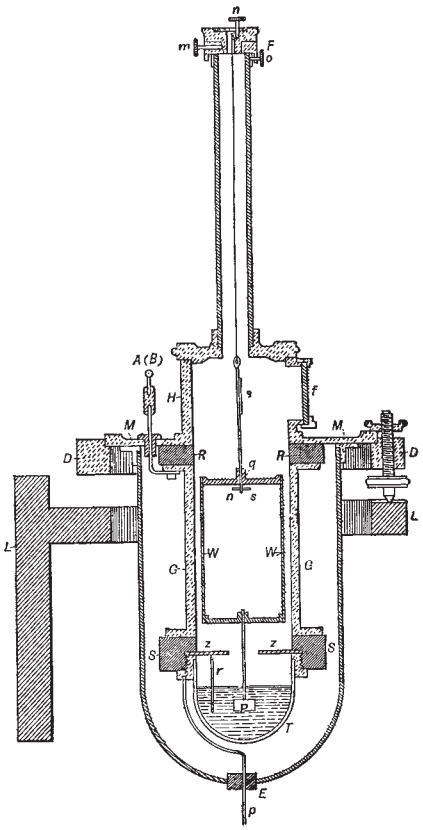

FIG. 1.

consists of two portions of metal (W W) cut from a cylinder, united above and below, and hung by a single fibre of small torsion from an adjustable head, F, above. A mirror, *s*, is attached above the needle, and a platinum vane, P, below it dips into a vessel, T, containing sulphuric acid. To give directive force to the "needle" a small magnetic needle, *n s*, is attached to it. This device was indeed used in some of Sir W. Thomson's early instruments, though subsequently abandoned in favour of the bifilar suspension usually adopted. It is of course understood that the opposite pairs of quadrants are, as usual, connected together. Electrodes, A, B, pass through the metal plate, M, which covers the instrument, and are connected with the quadrants as shown in Fig. 1. An outer jar of glass surrounds the instrument and is fixed to the under side of the plate M by a bayonet point. The plate M itself is very substantial, and is provided with three levelling screws which rest in V-grooves in a strong ring-

shaped support of cast zinc, L L, which is screwed to the laboratory wall like a bracket.

It will be seen that Dr. Edelmann has discarded the Leyden jar, replenisher, and gauge, which play so important a part in Sir W. Thomson's electrometers. Instead of these a Zamboni pile, or a battery of 200 small well insulated voltaic elements, is used. These are made of test-tubes filled with common water, and having small zinc-copper pairs placed from cell to cell. It is difficult to believe that either of these dispositions is an improvement on the replenisher-jar-gauge arrangement, though either may be somewhat cheaper. Nor is it likely that the presence of the ebonite rings R and S will add, in the

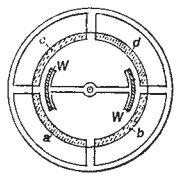

FIG. 2.

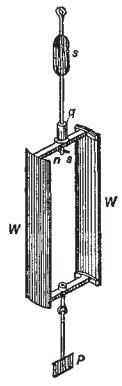

FIG. 3.

long run, to the satisfactory working of the instrument; for, as is well known, this substance when exposed to light decomposes at the surface, and becomes covered with a conducting-film of acid. The insulation of the quadrants ought not to be risked by such a doubtful device. It ought to be mentioned that a cylindrical arrangement of quadrants had been previously employed by Silow in an instrument for investigating the dielectric capacity of liquids: but to Dr. Edelmann is due the credit of having applied this arrangement for the construction of these electrometers, which in consequence of their many good points are becoming so popular for laboratory work both in Germany and elsewhere.

GLEANINGS FROM THE REPORTS CONCERNING THE ERUPTION OF KRAKATOA

I DO not propose to give here an abstract of all the reports which I have gathered, but I only wish to state some important data which might be useful to those who wish to become acquainted with the full particulars concerning the eruption. Therefore I have mentioned the authorities from which I have taken the following statements, in order that the reader who wishes for more circumstantial reports may find them easily.

I regret to say that I have not been able to find any reports from Tjiringin and the lighthouse-keepers of Java's First Point and Vlakke Hoek. In the beginning of October an engineer of the mine-service was sent to Krakatoa to examine the island, and he is expected now to bring in a scientific report about the eruption; it is to be hoped he has insisted that everything referring to the catastrophe should be circumstantially recorded.

1. *Data referring to the time anterior to the Eruption.*—In a report which was published in the *Java Courant* (the paper of the Dutch Government), which was brought from Batavia by the mail of August 25, it was said: "There are now two craters on Krakatoa, 3 km. distant from each other, which are continually working. The western crater is at the foot of Mount Perbuatan (working since May 20); the eastern crater working since a more recent date (which is unknown to me) at the foot of Mount Dannan. The outlines of the top of Mount Perbuatan are changed; the outlines of the beach are also altered by some increase of land along the shore. The trees which covered the island are burnt for the greater part."

As to what occurred before and during the eruption of August 26 and 27 I particularly took the data:—

(1) From the report of the *Berbice*, Capt. Logan, from New York (*Nieuws van den Dag*, October 11): August 26 at 2 p.m. she was off Vlakke Hoek, 20 miles to the south; she got sight of the light of Java's First Point August 28 at 12 p.m. Since August 26 at 4 p.m. she had only little sail; 28, at 4 a.m., maintopsail was set; afterwards at noon she set full sail and made for First Point. Therefore she was during the eruption near a line which joins Java Head and the point where she was August 26 at 2 p.m.

(2) From the report of the *Charles Bal* (NATURE, Dec. 6, p. 140): She passed Prince's Island August 26, at 9 a.m.; Krakatoa seen at 4.15 p.m., north half east, 10 miles distant. At 11 p.m. the island became more visible, west-north-west, 11 miles distant; August 27 at 6 a.m. she set sail, passed lighthouse Fourth Point at 8 o'clock, Anjer at 8.30; passed Button Island at 10.15.

(3) From the report of eye-witnesses, who were at Anjer during the catastrophe (*Nieuws van den Dag*, October 11 and 14).

(4) From a report written by a passenger (an engineer) of the *Gouverneur Loudon* (Dutch Indian steamer, 761 reg. tons, 190 h.p.) (*Nieuw. Rotterdam. Court.*, October 23, by Mr. van Sandick): She was off Anjer August 26 at 3 p.m.; went to Telok Betong, where she arrived at 7 p.m.; remained there till next morning at 7 o'clock. After a wave had destroyed Telok Betong she made for Anjer, but before she had left the bay darkness came on, and she was compelled to lie there till August 28 in the morning.

(5) From the report of eye-witnesses at Telok Betong (*Nieuws van den Dag*, November 3 and 13).

Moreover, I took a few particulars from the reports of Katimbang (*Nieuws van den Dag*, October 16) (Lampongs, at the foot of the Radjah Bassa), Binuangan (*Nieuw. Rotterdam. Court.*, October 23) (at the bottom of the Semangka Bay), and Pulu Merak (*Nieuws van den Dag*, October 10).

Though *e.g.* on the Island Bali strong detonations were heard in the morning of August 26, the reports of Telok Betong and Anjer say: Fine weather, no extraordinary detonations in the afternoon. *Berbice* reports: Sky dark at 2 o'clock, threatening at 4 o'clock; at 6 p.m. thunder and lightning. On board the *Charles Bal* at 4.15 an eruption at the east of Krakatoa was observed; the masses which were driven forth to the east had the appearance of a furious squall. Anjer reported: At 6 o'clock quite dark; at Telok Betong at 6 p.m. slight rain of ashes; at the same time *Berbice* experienced ashes pouring down at once; it was quite dark. Fall of ashes and darkness continued the whole evening. About this time the commotion of the sea began also. At Anjer, between 6 and 7 p.m., several vessels were carried by the wave to and fro in the harbour (canal), but the sea did not flow over. From Merak is reported, August 26, at 7 p.m. or 7.30 p.m.: Heavy detonations, violent shocks (but no earthquake). Waves swept away the Chinese camp; caused much damage. In the night (I could not find out at what o'clock) fiery phenomena were seen in the direction of Krakatoa, shocks of earthquake, waves. The Controleur, who was at Katimbang, related: "August 26, 7 p.m., several prows thrown on the beach, waves, but the sea did not flow over, nor did the waves grow higher."

The *Loudon* came to anchor off Telok Betong at 7 p.m. Rough sea, boats could not communicate. They observed that there was something wrong, but could not make out what it was. The Dutch bark *Marie*, which was there