been made at Saarbrück and Karwin. The Austrian inquiry showed that "where after a rapid rise of the barometer it continued to rise slightly, or remained stationary for some time at its maximum, a gradual increase in the volume of gas in the air would set in; or if, after a rapid fall in the barometer, it continued to fall gradually, or remained stationary at its lowest point, a decrease in the quantity of gas would become apparent."

Evidently, therefore, from these researches the greatest danger is not, as a rule, to be apprehended when the barometer is low or falling, and this is supported by actual disasters, the majority taking place under anticyclonic conditions of pressure. While Mardy, Pendlebury, Penygraig, Seaham, and many others add to the verdict, it will suffice to deal with some explosions of the present year, and see if they do not bring home to us a new view of the natural forces at work far down below the surface of the earth.

From the simultaneous observations made at 6 p.m. on Friday, February 18, the Meteorological Office reported:—"The barometer is now rising in all parts of the United Kingdom, and an anticyclone is apparently advancing from the westward." An hour later thirty-nine lives were lost in an explosion in the Rhondda Valley. The anticyclone continued on its course to the Continent, and by the morning of Wednesday, February 23, when so much damage was wrought by the earthquake, the centre had reached Southern Europe. On March 1 the anticyclone was a little further north, and over the neighbourhood of the Chatelus Mine, near St. Etienne, where ninety lives were sacrificed. Still moving northward, the night of March 4–5 found the highest barometer readings over Belgium and the Netherlands, when 144 miners perished at Quaregnon, near Mons.

In the last week of May another anticyclone moving from south to north was marked by the loss of one life at Darcy Lever on the 25th, three lives near Wigan on the 26th, and seventy lives at Udston, near Glasgow, on the 28th.

An anticyclone over Western Germany on the night of June 7–8 marked about sixty deaths at Gelsenkirchen. As this area moved to the westward, a slight earthquake was felt near Strasburg on the 11th, and a severe one in La Vendée on the 15th.

Clearly Mr. Buddle's strong opinion is not applicable to the second half of the century. The knowledge that gas is found escaping with a rising barometer, and that so many explosions take place as indicated, has led mining officials to blame the mercury for not falling even before the gas begins to escape, their idea being that pressure has actually decreased, but that barometers are many hours before taking up the changes. The idea may be dismissed as an erroneous one. The cause must be sought for in another direction, not the direct action of variations of atmospheric pressure on the gas as it leaves the coal, but the effect on the earth's crust and indirectly on the occluded gas. Whatever be the true cause of earthquakes, there seems to be no reason to doubt that fluctuations of atmospheric pressure cause undulations of the earth's crust. Prof. Darwin, taking a probable estimate for the elasticity of rocks, has calculated that with a range of two inches of the barometer we are at least three or four inches nearer the earth's centre when the instrument stands very high than when it is very low, and concludes: "It may be that the incessant straining and unstraining of the earth's surface is partly the cause of earth-tremors, and we can at least understand that these strains may well play the part of the trigger for precipitating the explosion of the internal seismic forces." The seismological records of Japan show that earthquake shocks are twice as numerous under the predominant anticyclone of the winter months, as they are in the summer with lower pressure. As a result of the discussion of earthquakes in Jamaica, Mr. Maxwell Hall concludes that "at the time of an average earthquake shock the barometer is a little above its average height. This is due to the circumstance that the winter months, December, January, and February, when the barometer is above its monthly average, are more liable to shocks than other months of the year; and that the hours from 8 p.m. to 2 a.m., when the barometer is above its diurnal average, are similarly more liable to shocks than other hours of the day." Explosions of fire-damp follow a similar rule; they are most numerous in the winter months, when the range of pressure is greatest, and usually when the barometer is very high. Allowing for the flexure of the earth's surface, we can conceive that with the downward movement under increasing pressure the pent-up gases are forced into the workings of our deep mines; it may be indeed these movements cause infinitesimal fissures in the coal-seams through which the gas passes into the workings at a time when it has been customary to believe there was least danger. There is some degree of probability in this from the fact, so frequently noted in great explosions, that there is a suddenness in the appearance of the gas which is not a common experience in shallow workings.

Taking into consideration all the recorded facts, they point to the conclusion that far greater weight should be attached to a period of high atmospheric pressure than has hitherto been deemed necessary. In any future discussion of this important subject it is to be hoped further evidence will be forthcoming, and that instead of endeavouring to connect every disaster with a low barometer, the distribution of pressure as a whole be taken into account.

The influence of coal-dust upon explosions has not been touched upon, but it may be remarked that the dry atmosphere of an anticyclone renders the dust more inflammable than the dampness of a low-pressure system, so that there is a double reason for giving closer attention to mines under anticyclonic conditions.

HY. HARRIES.

MEASUREMENT OF SPECIFIC HEAT.

HAVING regard to the comparatively large experimental error introduced by thermometers into specific heat measurements, a null method appeared to be desirable. The following method occurred to me about two months ago, but not having access to a physical laboratory, I have not been able to practically test its accuracy.

Two exactly similar calorimeters (A and B) are taken, each containing a coil of thin Pt wire of resistance R, so arranged as to be completely immersed in the liquid. A contains a mass, M (including water equivalent), of water; B the same mass of substance the specific heat of which is being measured. The wires are arranged in bridge fashion, so that the ratio of the currents flowing through the two wires may be made to take any value.

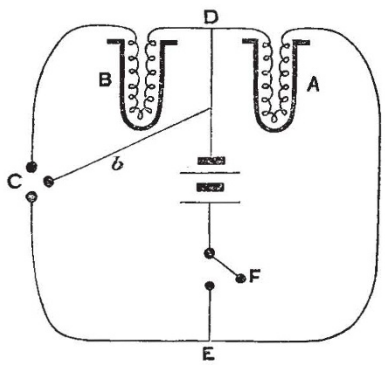

FIG. 1.

A differential thermometer (not indicated in the sketch, for sake of clearness) shows the least difference of temperature between A and B. Probably the most delicate and convenient arrangement is to use two thin Pt wires balanced in the arms of a bridge, using a very sensitive galvanometer.

First consider the calorimeter B containing the substance. It receives a quantity of heat, H, from a current, C, flowing through a resistance, R, for a time, t. Hence

$$H = \frac{C^2Rt}{J} = \theta MS$$

(where θ is the rise of temperature, and S the mean specific heat for that interval).

Similarly in A, containing water,

$$H^1 = \frac{C_1^2Rt}{J} = \theta M.$$

For by the conditions obtained θ is the same in both A and B. Hence $S = \left(\frac{C}{C_1}\right)^2 = \left(\frac{r_1}{r}\right)^2$, where r_1 and r are the resistances of the two circuits. It is obviously unnecessary to make the resistances, and the masses of liquids, equal, but the equation is thus simplified. If a smaller mass of water, m, be taken, then $S = \frac{m}{M} \cdot \left(\frac{r_1}{r}\right)^2$, thus increasing the delicacy of the method.

Since in the adjustments a considerable amount of time would be necessary to allow the calorimeters to attain thermal equilibrium after each trial, the following modification may prove more simple and more practical :—

The calorimeter B is arranged so that by a switch-key, C, the current can be diverted through a wire of exactly equal resistance, b, so that the current is the same by either path. The resistance from D to E is the same either way. The key F is pressed down for a time, t,

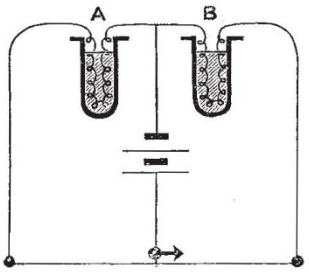

FIG. 2.

until the needle is largely deflected; then the current is switched from B and passed through A alone, until the needle is just brought back to zero, in total time, T. Then, neglecting for the present the slight error due to cooling, in A . . . $\theta M = \frac{C^2RT}{J}$, in B . . . $\theta MS = \frac{C^2Rt}{J}$, $\therefore S = \frac{t}{T}$.

Since T and t can both be made large, this should give very accurate results. It is evidently especially applicable to the measurement of the rate of increase of specific heat with temperature, since the liquids may have any initial temperature.

In conclusion, I may say that I should not have published this method in such an incomplete state, and unsupported by experiment, but I noticed to-day (September 5) that Profs. Stroud and Gee intend to read a paper before the British Association on "A Null Method in Electro-Calorimetry," and it is possible this may refer to a similar method.

GEORGE N. HUNTLY.

THE HESSIAN FLY.

I AM sorry to say that reports from correspondents acquainted with the attack of the Hessian fly show its presence now in an almost continuous line along the northern and eastern coast from Cromarty on the Moray Firth in Scotland down to Kent.

I have this morning received specimens of the *puparia* from the parish of Urquhart, in Morayshire, the most northerly locality from which I have at present received the so-called "flax-seeds."

The amount of presence varies very much. In the locality above mentioned (that is, the district from Aberdeen to Cromarty), the traces of attack are reported as to be found from 25 to 30 miles inland, but the injury slight, not more than one straw in fifty being affected, and the grain of fair quality. It is severe in some parts of Perthshire, and is found also in the eastern counties adjacent.

In East Lothian, Haddington, and Berwickshire attack is only reported from a few places at present, and in Northumberland from one locality.

Beginning again on the two sides of the Humber the attack widens much in area as it is traced south. It passes through Lincolnshire and Cambridgeshire, touching an easterly part of Northamptonshire, till it extends over the district commonly known as the eastern counties, including besides great attack in Hertfordshire, and some in Bedfordshire; and it also occurs in Kent.

In the southerly or westerly parts of England it occurs at Lymington and Petersfield in Hampshire, and to a considerable extent near the College of Agriculture, Downton, near Salisbury; and I have one report of it from near Bridgwater, and it also occurs at Goring Heath, Oxfordshire.

The above localities are where I know of its presence from specimens sent to myself, or, in a few cases, from information given me by correspondents whom I know to be acquainted with the appearance of the *puparium*, and the characteristics of the attack.

It very likely may occur elsewhere, but I am only just giving a general sketch of extent of infested area from personal knowledge.

It strikes me as a very curious point that the attack should so markedly cling to the sea-side, excepting in a few isolated instances, or where the inland area is continuous with the sea-side district.

It is very satisfactory to observe that although the season has been so altogether *extraordinarily* favourable to various kinds of insects affecting corn-stems, yet that in very many instances reported to me the injury caused to wheat by Hessian fly has been slight

On this fact I venture to think we may ground a hope that, either from the varieties of wheat which we use being kinds suited to do what is called "resist" attack, or from circumstances of our cultivation, we may find that our wheat at least does not suffer as much as in some other countries.

Also the enormous prevalence of the two stem attacks caused respectively by the corn sawfly (*Cephus pygmæus*), and by the dipterous fly, the *Chlorops tæniopus* (attacks which far exceed in amount any which have been brought under my notice as caused by these insects), give a hope that the climatal circumstances which usually prevail here will have an effect in checking the attack of the *Cecidomyia destructor*, as well as the above-named crop pests, as we see that all three kinds have been exceptionally thriving in the exceptional heat and drought.

It is unnecessary to point out to your highly informed and thinking readers that the statements now appearing of the *Cecidomyia destructor* having been a corn pest in this country for many years have not the slightest foundation.

ELEANOR A. ORMEROD.

THE BRITISH ASSOCIATION.

MANCHESTER, *Tuesday Evening*.

ABOUT the success of the Manchester meeting there seems to be only one opinion. In mere numbers—the most popular gauge of success—it has by several hundreds surpassed all former meetings; the number of tickets sold very closely approaches 4000. As a natural result, the amount of money collected and available for the purposes of research is unprecedentedly great, as will be seen by the list of grants which have been allotted to the various Committees. The great increase in attendance over all former years is to a considerable extent due to the large number of foreign visitors, who have formed a marked and prominent feature of the present meeting. In the proceedings of nearly every Section the representatives of foreign science have taken an active