Meteor-Showers.

	R.A.	Decl.		
Near β Serpentis	232°	17° N.	Very swift.	
From Hercules...	255	37 N.	April 12–25	Very swift.
	268	33 N.	*Lyrids*, April 18–20	
	272	20 N.	April 18–24	
From Vulpecula	300	24 N.	April 19–20. Swift.	

GEOGRAPHICAL NOTES.

THE Russian Geographical Society elaborated at its last meeting the following programme of work for the next summer. M. Kuznetsoff will continue his geo-botanical work on the northern slope of Caucasus, and M. Rossikoff will continue his survey of the Caucasian glaciers on the little-known southern slope of West Caucasus. M. Listoff will also resume his exploration of the caves containing layers of ice in Crimea. Pendulum measurements will be done by Prof. Sokoloff in Poland and West Russia; and an Expedition of three persons will be sent out for the exploration of the Kola peninsula.

THE following details of the Brazilian Expedition, headed by Dr. von Steinen, have been received from Dr. Ehrenreich, one of the members of the Expedition. Their object was to investigate the Kuluene River, a tributary of the Xingu. Dr. Ehrenreich gives the following as the chief results of the Expedition: (1) the discovery of great Caribbean races in the centre of South America, named respectively the Bakairi and the Nahugua; (2) the discovery of the Kanayura and Anite tribes, who still speak the ancient Tupi language, and use remarkable weapons, amongst which is the very peculiar arrow fling. Surveys of the Kuluene were made and many ethnographical specimens have been collected, forming a complete picture of the original culture of these Indians, who, even to-day, do not know the use of metal, but are still in the period of implements made of flint, bone, and fish teeth.

OUR ELECTRICAL COLUMN.

J. T. BOTTOMLEY showed that the temperature of a wire conveying electric currents varied with the air-pressures surrounding it, and that a wire which remained dull at ordinary atmospheric pressure incandesced when a moderate vacuum was obtained. M. Cailletet has been working in the opposite direction. He has shown that a current which would fuse a wire under ordinary pressure will scarcely raise it to redness when the pressure is sufficiently great. These experiments show how essential free convection as well as radiation is to the incandescence of filaments in glow-lamps, as well as to the heating of conductors.

LECHER (*Rep. der Physik*, xxiii. p. 795) has experimented on the much-vexed question of the counter-electromotive force of arc lamps, and he finds that its existence is not proved, that the observed difference of potential which is expressed by the formula $a + bl$ varies with temperature, and that it is probably due to discontinuity in the current.

CONSIDERABLE attention has lately been devoted to the potential difference between the various constituents of a voltaic cell by direct measurement, an operation facilitated by Helmholtz's capital observation that this difference between an electrode of mercury flowing in drops through a capillary tube and an electrolyte is *nothing*. The mercury thus acquires the potential of the electrolyte, and can be measured. Moser (*Beiblätter*, xi. p. 788) has thus measured the Daniell and Clark cells, and Miesler has been following it up. Thus in the Daniell cell—

$Zn \mid ZnSO_4$	= + 1·06 volt
$ZnSO_4 \mid CuSO_4$	= + ·22 ,,
$CuSO_4 \mid Cu$	= − ·22 ,,
Total PD ...	1·06 ,,

In the Grove cell—

$Zn \mid H_2SO_4$	= + 1·06 volt
$H_2SO_4 \mid HNO_3$	= + ·36 ,,
$HNO_3 \mid Pt$	= + ·20 ,,
Total PD ...	1·62 ,,

He makes the PD—

$C \mid HNO_3$	= + ·38 volt
$C \mid H_2CrO_4$	= + ·62 ,,
$H_2SO_4 \mid H_2CrO_4$	= + ·5 ,,
$PbO_2 \mid H_2SO_4$	= + 1·3 ,,
$H_2SO_4 \mid Pb$	= + ·9 ,,

all the measurements, except that of the Grove cell, according fairly well with known and accepted measurements.

HERTZ, WIEDEMANN, AND EBERT have been experimenting on the influence of rays of high refrangibility on electrical discharges, and M. Hallwachs has been verifying their results. He finds that a well-insulated disk of zinc charged with electricity rapidly loses its charge when the rays of an arc lamp fall upon it. It is more rapid with negative than with positive charges.

PENDULUM SEISMOMETERS.

PENDULUM SEISMOMETERS are among the oldest forms of instruments employed to record earthquake motion upon a stationary plate. In 1841 crude forms of such seismometers were used to record shocks at Comrie in Scotland. The objections to the older forms of these instruments are that they are not provided with any arrangement to magnify the motion of the earth, the writing indices are not sufficiently frictionless, and the value of the records are destroyed because the pendulums almost invariably swing (see "Experiments in Observational Seismology," by J. Milne, Trans. Seis. Soc., vol. iii. p. 12). The first pendulum seismometer with which I am acquainted which has a multiplying index is the one described, constructed, and successfully employed by Dr. G. Wagener (see Trans. Seis. Soc., vol. i. p. 55). From Dr. Wagener's account of this instrument it was the inventor's intention to counteract any tendency of the pendulum bob to swing by the inertia of the multiplying index, and from his experience with the instrument, owing to frictional resistance or otherwise, it seems that even if the pendulum was set in motion it quickly came to rest.

The multiplying arrangement, or "indicating pendulum," in Wagener's instrument was a lever, which we will call *a b c*, 25 inches in length (Fig. 1); the upper end of this at *a* geared

FIG. 1.

in the base of the main pendulum bob W by a ball-and-socket joint. One inch below, at *b*, a second ball-and-socket joint connected the lever with the earth. Now if *a* remained at rest, and *b*, being connected with the earth, moved backwards and forwards, a multiplied representation of this movement was produced at *c*, 24 inches lower down. The question which arises is whether W tends to remain at rest, and what effect the jointed system *a b c* exerts upon it.

Imagine that an impulse is received towards the right, so that the point of suspension of W at *o*, and the point *b*, move to the right. The tendency of W is therefore to move to the right. If the centre of oscillation of *a b c* relatively to *b* as a centre of percussion is *below* *b*, then *a* will move to the right and assist W in its swing; if, however, the centre of oscillation is *above* *b* then W will be retarded in its motion. In Dr. Wagener's instruments the centre of oscillation was below *b*, and hence the index retarded W by its inertia and friction only. Still, the instrument was the first one where there was an attempt to use an "indicating pendulum," first as a multiplying index, and secondly as a means to check the motion of a large pendulum. In pendulum seismographs, which I have largely used in Japan (see Trans. Seis. Soc., vol. iv. p. 91), *a b* was loaded with a brass ball, and thus the centre of oscillation raised above *b*. The moment that *a b* exerted on W was not, however, sufficient to prevent W from swinging, and its movements were retarded and rendered "dead beat" by frictional resistance directly applied to the surface of W, which was a disk of lead suspended horizontally. During the last two years I have had several seismographs constructed in which *a b* was long; and, as near to *a* as possible, a weight sufficiently large to render W feebly stable was placed. This important suggestion of loading *a b* originated with Mr. T. Gray. Later, Mr. Gray drew attention to the necessity of rendering an ordinary pendulum, for small displacements, absolutely astatic, and he suggested various means by which this might be accomplished (Trans. Seis. Soc., vol. iii. p. 145).

In the same publication, vol. v. p. 89, Prof. Ewing, attacking the same problem, described a duplex pendulum, a modified form of which he described in vol. vi. p. 19. In vol. viii. p. 83, Prof. Sekiya described an improved form of Prof. Ewing's instrument (see also NATURE, vol. xxxiv. p. 343). In the duplex pendulum seismograph an ordinary pendulum is rendered astatic for small displacements by placing an inverted pendulum beneath it, and so uniting the bobs of the two pendulums that any horizontal motion is common to both, and the jointed system so proportioned that neutral or feebly stable equilibrium is obtained. Although these instruments are, for seismometrical work, theoretically good, in practice such of them as I have had, which are the best to be obtained in this country, present many serious objections. Among these objections I may mention the following: (1) the difficulty of adjustment; (2) the difficulty of inserting and removing smoked glass plates; (3) the fact that the pointer being cranked at its upper end it does not give so satisfactory a record in directions at right angles to the plane of the crank as is desired; (4) their incapability of recording an earthquake of greater amplitude than 5 mm.

By introducing arrangements for adjustment, alteration in the form of the recording index, &c., these instruments might be improved. Possibly in the instrument recommended by Prof. Ewing for use in Observatories (see NATURE, vol. xxxiv. p. 343), although it appears to be practically similar to those I have in Tokio, the objections may not be so serious.

The instrument of this class which I have in all respects found the most satisfactory is, in its essential features, shown in Fig. 2,

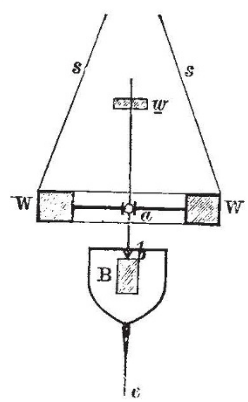

FIG. 2.

in which W represents a lead ring about 7 inches in diameter, with a small tube, *a*, fixed in a plate at its centre. W is supported by three strings or wires, *s*. The indicating pointer is *w a b c*, prolonged downwards, at the lower end there being a needle as a writing-point sliding in a small tube. *w a b* is a light steel rod with a ball forming a universal joint on the tube at *a*, and a point, *b*, pivoting in the fixed steel bar B. The stability of the system is readily altered by raising or lowering the *small* weight *w*. For small displacements neutrality is obtained when $\frac{w}{W} = \frac{p^2}{Ll}$ where $p = ab$, L the length of the main pendulum, and l the length of the inverted pendulum.

The whole is carried on a tripod about 2 feet 3 inches high, stiffened in the centre by a small transverse table which carries the bar B. W is so suspended that it can be readily shifted laterally or vertically. Below there is a small shaft which carries the smoked plate. By means of a wedge this can be raised or lowered, and the plate brought to any degree of contact with the sliding pointer. This portion of the apparatus is so simple that a record-receiving surface is instantly adjusted or removed by the movement of a handle connected with the wedge. The instrument is an outcome of instruments which have preceded it, and it may be regarded as a modification of an old type where *a b c* has been prolonged upwards and the balance load placed above *a* instead of being between *a* and *b*. Its chief recommendations are: (1) its smallness; (2) the simplicity and fewness of its parts; (3) the ease with which it may be used; (4) its large range of motion; (5) the accuracy of its diagrams. The test for accuracy has been made by placing the instrument upon a specially designed shaking table, the absolute movements of which are recorded by a multiplying lever.

Comparing the diagrams given by the machine with those given by the table, it is found that for all small displacements, whether in right lines or complicated curves, the diagrams, 20 or 30 mm. in length, are practically identical. For diagrams 50 mm. in their greatest dimensions, composed of a complication of curves if anything greater in complexity than those yielded by ordinary earthquakes, some differences occur, the extent of which may be judged of by the accompanying diagram, Fig. 3. Figs. 4

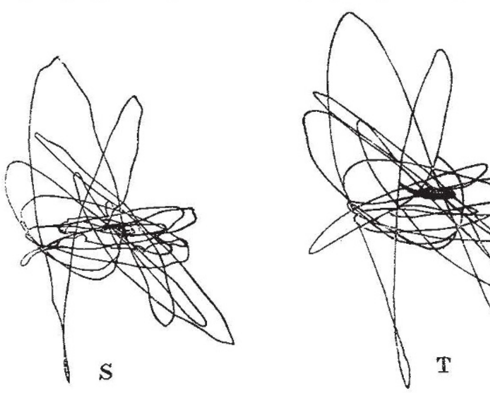

FIG. 3.

and 5 are examples of the diagrams obtained for small displacements. These diagrams are fair specimens, but have not been selected as particularly good examples. The multiplication of the table diagram, marked T, is 6·3, while that of the seismograph, marked S, is slightly over 6.

Diagrams of the old type of seismograph with the weight on *a b* have also compared favourably with the table motion. I regret, however, to say that the diagrams given by one of Prof.

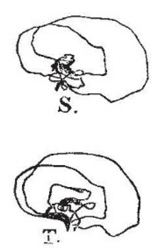

FIG. 4.

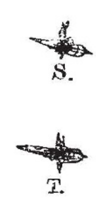

FIG. 5.

Ewing's duplex pendulums, with the exception of their amplitude, in no way resembled the table motion. This instrument was adjusted to have extremely feeble stability. With a second of Prof. Ewing's instruments, which was adjusted by Prof. Sekiya's assistant, who understood the machine, the distortion was not so great, but the diagrams were complicated by the swinging of the pendulum after the shaking had ceased. The pendulum in this instance had a period of about two seconds, which was much too short.

JOHN MILNE.