garding the mean distances, mean paths, &c., of molecules on rarefying gases. For the relations computed depend on known mathematical principles. The only possible ground for question would be the particular data of mean distance, &c., taken as a basis for the calculations. But it should be noticed that these rest on an experimental basis : having been deduced from observed facts by investigators of admitted competence, and by means of several *diverse* lines of argument which are found to accord in a remarkable manner as to the results,—which is therefore strong confirming evidence of their substantial accuracy. Also the above inferences regarding a mechanism for the fundamental purposes of carrying energy, storing energy in equilibrium, and producing effects of approach (such as gravity, &c.), cannot as mechanical facts admit of any question. For mechanical principles (like mathematical truths) hold independently of any inquiry as to whether they actually find practical *application* in nature or not. The best argument for their practical application in nature is the incomprehensibility of observed facts without them. We can at least say with certainty that under such conditions, effects (phenomena of approach,[1] transferences of motion, &c.) of the character observed would be produced,—and which effects have not hitherto found any explanation that appeals to our reason. The certainty of simple and automatic mechanical conditions being conceivable which are capable of producing such important effects, should lend a legitimate interest to these inquiries, and the mechanical beauty of the "radiant" adjustment of moving particles of matter which adapts them to so many noteworthy purposes at once, should surely itself be an argument in favour of the practical application of the scheme in nature,—as a simple means to great and important ends.

S. TOLVER PRESTON

[1] It would not be difficult substantially to imitate what occurs in gravitation (according to the dynamical theory), by cooling down the opposed faces of two metal disks freely suspended in a moderately large vessel of rarefied gas, at a less distance apart than the mean length of path of the gaseous particles,—when from known principles (already experimented on by Mr. Crookes) the two disks would approach. Here the diminished velocity of rebound of the gaseous particles from the cooled inner surfaces of the disks (which entails the approach), is imitated in gravitation by a similar diminished velocity of rebound of the gravific particles from gross matter, owing to their translatory motion being partly shivered into vibration (and rotation) at the shock of impact against gross matter (in a manner elucidated by Sir W. Thomson, *Phil. Mag.*, May, 1873). On a large scale, a similar diminution of translatory motion at impact is universally illustrated by the known retarded rebound of elastic masses at collision,—when part of the translatory motion is (in a somewhat analogous way) converted into a vibratory or rotatory motion of the colliding body at the encounter. It becomes interesting in a dynamical phenomenon of the nature of gravitation to contemplate the possibility of doing something towards illustrating it experimentally, and to acquire the certainty of the existence of the streams of particles which produce the effect,—by almost visualising them, through the means employed in the recent researches by Mr. Crookes.

DEEP-SEA OPHIURANS

IN the anniversary *Memoirs* of the Boston Society of Natural History, Prof. Theodore Lyman gives an account of a structural feature hitherto unknown among Echinodermata which he has discovered in deep-sea Ophiurans. The remarkable structures described appear under the microscope as little tufts resembling bunches of simple Hydroids on the sides of the arms of certain Ophiurans. On careful examination these tufts are found to be bunches of minute spines, each inclosed in a thick skin-bag, and in form resembling agarics, or parasols with small shades. They are arranged in two or even three parallel vertical rows, and in this respect the animals on which they occur differ from all other Ophiuridæ known, for all others possess a single row only of articulated spines. The peculiar tufts, which are apparently homologous with pedicellariæ, are attached to the outer joints of the arms, near the margins of the side arm-plates. Two new genera, Ophiotholia and Ophiohelus, closely allied to Ophiomyces, are described in which these curious appendages occur. The species of the genera are soft with imperfect calcification. Examples of Ophiotholia were dredged off Juan Fernandez, in 1825 fathoms, and of Ophiohelus off Barbadoes in 82 fathoms, and off Fiji in 1350 fathoms.

Prof. Lyman states that among the Ophiuridæ and Astrophytidæ of the *Challenger* Expedition the entire number of new genera brought home is 20; that of species 167.

AN ELECTRICAL THERMOMETER FOR DETERMINING TEMPERATURES AT A DISTANCE

THE success of many industrial operations depends upon the steady maintenance or proper variation of certain temperatures, and it is often of the highest importance that the person in charge of these operations should be able readily to ascertain by means of the thermometer if the workmen are performing their duties correctly. It sometimes happens that thermometers have to be placed in positions which are difficult of access, or removed some distance from the centre of the manufactory, and that considerable time has to be expended in visiting the different stations. It was in order to meet the requirements of such a case as this that the electro-thermometric apparatus here described was constructed.

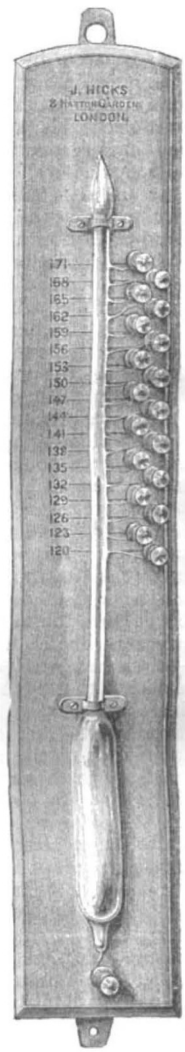

FIG. 1.

I had for some time been much in need of an instrument which would admit of the temperature of a series of malt-drying kilns being determined at a considerable distance from the kilns themselves, and, not being able to meet with a description of a suitable instrument, I was led, after several trials, to contrive this apparatus, which, although it does not embody any new principle, and is not perhaps adapted to accurate meteorological work, is nevertheless very suitable for the technical purpose for which it was originally designed, and is doubtless capable of extended application in many industries.

The apparatus consists essentially of two parts, a mercurial electro-thermometer, and a combination of apparatus which constitutes an automatic receiver and transmitter of signals from the thermometer.

The thermometer, which is shown in Fig. 1, was constructed for me by Mr. J. Hicks of Hatton Garden. It is an ordinary thermometer about nine inches in height, with a large bulb and a stem of wide bore. Through the side of the stem, and fused into the glass, are inserted a series of short platinum wires, the free end of each being connected with a binding screw. These wires, which project slightly into the bore of the thermometer, are, in my instrument, inserted at intervals of 3° F. between 120° and 171°, the range of temperature required in this case. The constructor of this part of the apparatus informs me that, if necessary, there is no practical difficulty in inserting wires at intervals of a single degree, or even less, without interfering with the calibration of the tube. The upper part of the bore of the tube is expanded into a small bulb which is partly filled with glycerine, this

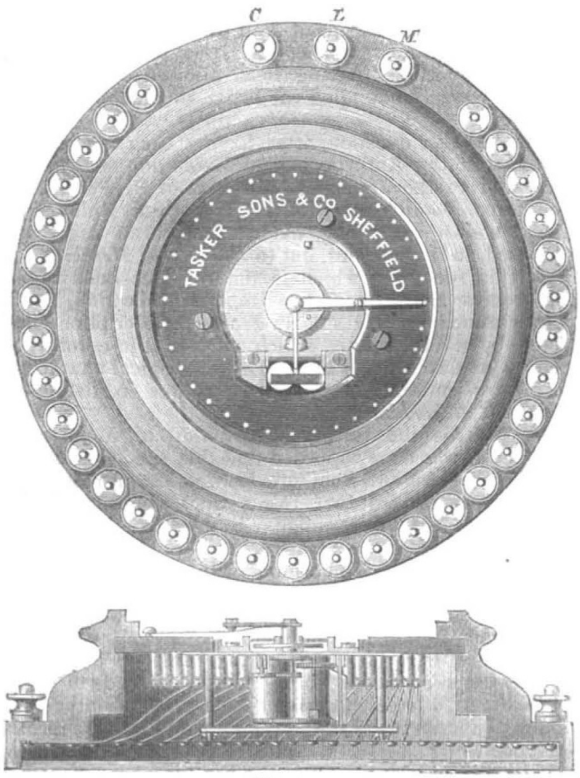

FIG. 2.

liquid of course also filling the bore of the tube above the mercury column. A wire fused into the main bulb of the thermometer is connected with a binding-screw from which a wire leads to one pole of a battery of two Leclanché cells, the opposite pole of the battery being placed permanently to earth.

If the free end of a wire, put to earth through a galvanometer or bell, is brought successively in contact with the binding-screws at the side of the thermometer, commencing at the lowest, a signal will be given from each wire in contact with the mercurial column, but not from the wires above it. By carrying a conducting wire from each of the binding-screws to a series of ordinary electrical bell-pushes arranged on a key-board, the main bar of which is put to earth through a signalling apparatus, it is evidently possible to ascertain at any distance from the thermometer the height of the mercury column, and consequently the temperature, the mean error of observation depending upon the intervals between the wires inserted in the bore of the thermometer. Such a form of apparatus is however inconvenient, as it necessitates carrying a large number of insulated wires to the observing station.

To avoid this difficulty I have devised the *transmitting* portion of the instrument, an apparatus which, placed as near as is convenient to the source of heat, is capable of collecting the various signals from as many different thermometers as may be desired, and of transmitting all these signals down a *single* wire to an observing station at any required distance. This part of the apparatus, shown in Fig. 2, was constructed for me by Messrs. Tasker and Sons of Sheffield. It consists essentially of an ebonite ring, through the thickness of which are inserted, at even distances, a series of small platinum studs, terminating level with the surface of the ebonite ring, and connected at the lower side with a series of binding-screws arranged round the circumference of the circular wooden frame enclosing the instrument. Within the case of the instrument is an ordinary clockwork

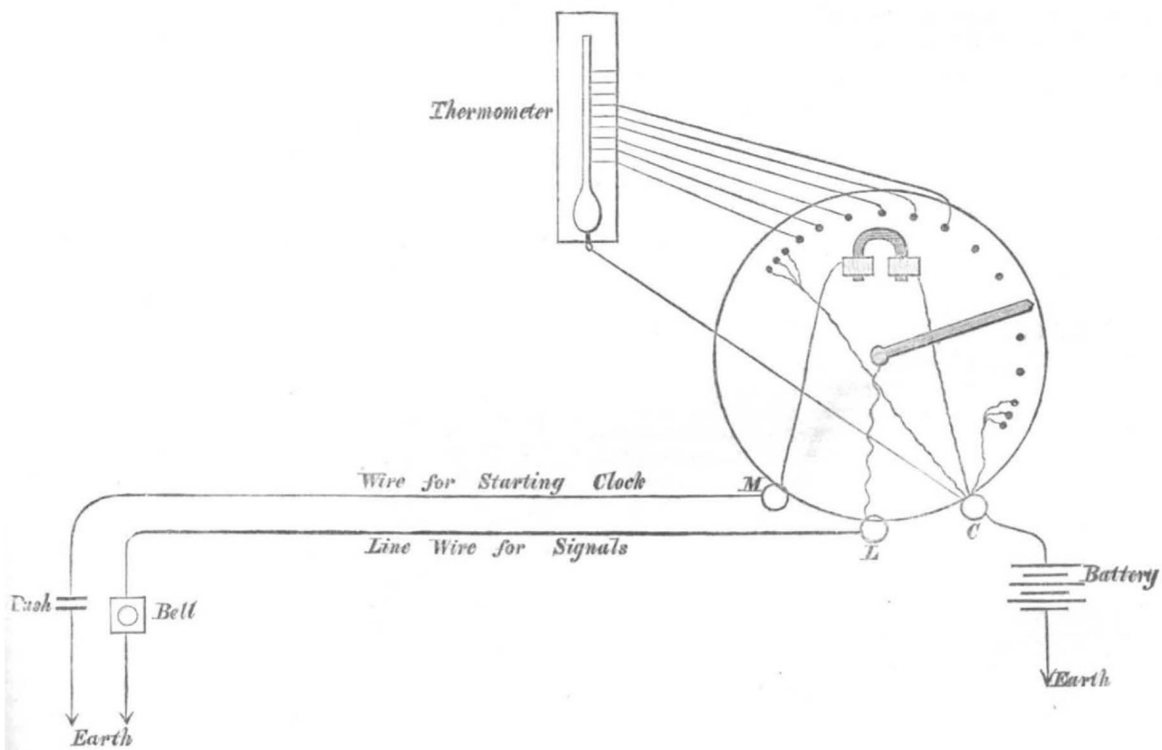

FIG. 3.

motion driving a small metallic traverser, which is capable of a somewhat rapid movement similar to that of the hand of a watch. This traverser, furnished at its extremity with a small piece of platinum, is caused, by means of an adjusting screw, to press lightly against the face of the ebonite ring, and to produce metallic contact with the studs when passing over them. The binding screws around the case of the instrument are connected in serial order with the wires inserted in the bore of the thermometer, and the traverser is in permanent electrical contact with the binding screw L, to which is attached the line-wire.

If the transmitter is intended to convey the signals from more than one thermometer, there are inserted in the ebonite ring, at suitable intervals, three small platinum studs very close together. These studs are not in connection with the thermometers, but with the binding-screw C, which is in permanent connection, through the battery, with earth. By this arrangement the current is short-circuited whenever the traverser passes over these extra studs, and the three signals sent down the wire in quick succession serve to show that the transmitter has commenced to send signals from another thermometer.

The axis which drives the traverser carries round with it a metallic disk, which is drilled with a hole into which fits, when the clockwork is at rest, a small plug. This plug, which acts as a detent, is attached to the heavier side of a light lever, the opposite end of which is furnished with an iron armature in close proximity to the poles of a very small electro-magnet. One end of the magnet coil is connected with the binding-screw C, and so through the battery with earth, whilst the other end of the coil is connected through the binding-screw M (Figs. 2 and 3) with another line-wire which is carried to the observing station, and is capable of being put to earth through an ordinary electric bell-push.

The general arrangement of the whole apparatus is shown in the diagram, Fig. 3. The action of the instrument is as follows:—The line-wire connected with M is momentarily put to earth at the observing station by depressing the bell-push; this causes a current to circulate round the coils of the electro-magnet, which, attracting its armature, liberates the detent, and starts the clock. The number of signals now passed down the line-wire by the passage of the traverser over the platinum studs will be a measure of the height of the mercury column in each thermometer. The traverser, having made one complete revolution, is arrested by the falling of the plug into the disk.

It is evident that any number of observing stations can be established along the line-wire, and also that, if desired, the apparatus may be made automatically to register the temperature at any required interval of time.

HORACE T. BROWN

THE RECENT DISCOVERY OF THE BODY OF RHINOCEROS MERCKII IN SIBERIA

IT is a well-known fact that carcases of extinct animals, such as the Mammoth (*Elephas primigenius*) and Tichorhine Rhinoceros (*Rhinoceros tichorhinus*) are obtained in a more or less perfect state of preservation in the frozen tundras of Siberia. A memoir recently presented by Dr. Leopold von Schrenck to the Imperial Academy of Sciences of St. Petersburg,[1] informs us that the most recent discovery of this nature (which took place in 1877) is of a specially interesting character. The remains found upon this occasion turn out, not to belong to either of the above-named animals, but to a distinct species of Rhinoceros, *Rhinoceros Merckii* (better known in England as *Rhinoceros leptorhinus* of Owen), which had never been known previously to occur in such a condition. Unfortunately full advantage has not been taken of this extraordinary discovery. Although the carcase, as already mentioned, was found in 1877, it was not until March, 1879, that it came to the knowledge of the Imperial Academy. At the same time the sad fact was communicated that only the head and one foot of the whole body of this extinct monster had been preserved, all the remaining portions having been allowed to drift away into the River Yana, upon the banks of which it had first come to light.

[1] "Das erste Fund einer Leiche, *Rhinoceros Merckii*, Jaeg." Von Dr. Leop. v. Schrenck (Mém. Ac. Imp. Sc. St. Pet., viie série, vol. xxvii. No. 7, 1880).

The head in question, after having been exhibited in Moscow, at the Anthropological Exhibition of 1879, was presented to the Zoological Museum of St. Petersburg, where upon comparison with the Tichorhine Rhinoceros, it was shown to belong, not as had been previously supposed, to that species, but to *Rhinoceros Merckii*.

Of this specimen, which is naturally reckoned among the greatest treasures of the Imperial collection, Dr. L. von Schrenck now gives us an excellent description, illustrated by several figures, which show that in external as well as (as now already known) in osteological characters, *R. Merckii* presents many salient features to distinguish it from *R. tichorhinus*.

As regards the former distribution of *R. Merckii*, although it was once supposed that this species was confined to Western and Southern Europe, recent researches had already proved that this extinct rhinoceros had a much more extensive range. Besides being found in several localities in Eastern Europe, Brandt, in his excellent Memoir on the Tichorhine Rhinoceroses, has shown that this species formerly existed in Eastern Siberia. It is therefore not now so remarkable that a whole frozen body of this former inhabitant of the Steppes of Siberia should have been discovered on the banks of one of the rivers, preserved frozen during many thousands of years, as we know to have been also the case in the previously obtained specimens of the Mammoth and the Tichorhine Rhinoceros.

NOTES

WE give on another page an abstract of the revised edition of the proposed statutes on the professoriate promulgated by the Oxford University Commissioners. It is, to say the least, hopeful to find the Commissioners so amenable to criticism and suggestions, and the proposed revised statutes, it will be found, obviate most of the objections which came from all quarters to the harassing and humiliating nature of the first draft. Occupying the position we do in relation to science, we could not but condemn the statutes in their first form. Were we the mouthpiece of the College of Preceptors, then possibly we might not have objected to the Oxford professors being legislated for as if they were merely elementary school-teachers; but as we are bound to consider the interests of science and its advancement, and as we believe one of the chief duties of an Oxford professor, as of a German or a French professor, to be original research, we could not but consider the statutes in their first form as a serious blunder.

ON Monday, March 15, the Paris Academy of Sciences held its annual sitting, when the prizes for 1880 were delivered. M. Ed. Becquerel was in the chair. He opened the sitting by an *éloge* of M. Michel Chasles, who died quite recently, and who was one of the most popular members of the Academy. At the end of his address he reminded his fellow members of the completion of the great work of M. Milne-Edwards, which has lasted for a quarter of a century. The great prize for mathematics was awarded to M. Halphen, with honourable mention to M. Poincarre; the Poncelet Prize to M. Leonte, engineer of the machinery constructed by the Government. A sum of 3000 francs was awarded to M. Ader for having advanced in an essential manner phonetic telegraphy (also telephony). The Trémont Prize was awarded to M. Vinot, the editor of the only astronomical paper published in France, and the founder of the only astronomical society. M. Dumas, with