them the placenta has no claim to be a primary index of affinity. And if we only seek for the most practically convenient way of arranging Mammalia, it is to the bones and teeth, rather than to the maternal organs of generation, that we must look.

P. H. PYE-SMITH

Potential Energy

WHILE on the subject of Thomson and Tait's Natural Philosophy, I should like to call attention to the definition of Potential Energy, given in Art. 273, p. 189.

I think it will be found that this definition gives the wrong sign, because the potential energy in any configuration is the amount of work the forces of the system perform in *returning* to the zero configuration, the ideal position of stable equilibrium.

Thus when a spring is stretched or compressed the potential energy is measured by the kinetic energy which is generated by the work done by the elastic force of the spring by the time the spring has returned to its unstretched condition. With this change of sign the definition now agrees with that given in Art. 484.

Infinite distance being taken as the zero configuration, the potential energy is a positive quantity for such forces as electric and magnetic forces.

With this zero the potential energy for gravitating particles is negative, which is expressed by saying that the exhaustion of potential energy is positive, because as the particles approach their kinetic energy increases, and their potential energy suffers exhaustion and diminishes.

In Art. 485 we read, "The potential at any point, due to any attracting or repelling body or distribution of matter, is the mutual potential energy between it and a unit of matter placed at that point. But in the case of gravitation, to avoid defining the potential as a negative quantity, it is convenient to change the sign. Thus the gravitation potential at any point, due to any mass, is the quantity of work required to remove a unit of matter from that point to an infinite distance."

Although the gravitation potential has had its sign changed, nevertheless the potential at any point P for gravitation and for electric and magnetic forces, is defined in the same way as the sum of the quotients of every portion of the mass divided by its distance from P.

This is the Potential Function of Green, usually called by the name given by Gauss, the Potential, and is the function which satisfies Laplace's equation.

The gravitation potential is the old force function of Sir W. Hamilton and Jacobi, such that its rate of increase in any direction is the resolved part of the force in that direction on the unit of mass.

The potential, defined as the potential energy in the unit of mass is of opposite sign to the free function; its rate of decrease in any direction is the component force in that direction.

These perplexing changes of sign arise from the fact that in gravitation we have only one kind of matter, the particles of which naturally attract; hence the potential energy is negative, or it diminishes as the particles approach; it is, therefore, convenient to make a change of sign.

In the general case of which electrical and magnetical phenomena may be taken as the type, like particles repel, unlike attract, and the potential energy increases as the particles approach.

These definitions and conventions of signs are, of course, in accordance with those given by Thomson and Tait; the proper signs and names are given also in Briot's "Théorie Mécanique de la Chaleur," but in all the other French books there is great confusion; for instance, in the "Théorie Mécanique de la Chaleur" of Verdet, the potential goes by Green's name, the potential function, but has its sign changed, while the potential energy is called the potential, after Clausius. This also seems to be the nomenclature adopted by the Germans.

It is very necessary that all doubt as to the meaning and value of these important functions should be set at rest; the system adopted in Thomson and Tait's "Natural Philosophy" leaves nothing to be desired.

A. G. GREENHILL

St. John's College, Cambridge, March 6

Development of Barometric Depressions

I LEAVE to those who are equal to it the task of reconciling and discussing "J. K. L.'s" propositions in reference to Indian meteorology, which appear to be these:—1, "The rainfall in the Himalayas" (instanced by him in proof that rainfall is not the cause of depression), "probably causes a very great depression" (meaning, I now suppose, the great Asiatic depression really due to the rarefaction of the air in Central Asia); 2, "but certainly not any currents such as I have described" (viz., currents in accordance with Buys Ballot's Law, having the lowest pressure on their left); 3, "the circuit of the wind in the region of the Himalayas is, so far as we know, in exact accordance with Ballot's Law."

My complaint was that the critic had ignored, not, of course, Part II. of my book, but certain propositions in Part I., as "distinctly enunciated" as those on which he comments, and inseparable from them, though not yet fully discussed.

I will now close, as far as my part is concerned, a discussion, for the opening of which I was responsible, but which has, contrary to my intention, become rather personal than scientific. The question, however, really at issue between us I believe to be one of some interest in meteorology. "Does the fact that precipitation in certain cases, and especially in the warmer regions of the globe, fails to produce baric depression, disprove, or render improbable, the theory (based on substantial evidence) that the depressions which occur in Western Europe are results of precipitation?"

March 10 W. CLEMENT LEY

A Safety Lamp

THE article in this week's NATURE on "Foul Air in Mines, and how to live in it" calls to mind a contrivance made use of by the watchmen of Paris in all magazines where explosive or inflammable materials are stored, and suggests the idea that the same may possibly be of service to our miners.

The Paris *Figaro* says, "Take an oblong vial of the whitest and clearest glass, put in it a piece of phosphorus about the size of a pea, upon which pour some olive oil, heated to the boiling point, filling the vial about one-third full, and then seal the vial hermetically. To use it, remove the cork, and allow the air to enter the vial, and then re-cork it. The whole empty space in the bottle will then become luminous, and the light obtained will be equal to that of a lamp. As soon as the light grows weak its power can be increased by opening the vial and allowing a fresh supply of air to enter. Thus prepared the vial may be used for six months."

4, Moreton Place, S.W. B. G. JENKINS

Beautiful Meteor

I ENCLOSE a description of meteor, apparently of unusual brilliancy, recently seen by my assistant at Parsonstown, thinking that it may perhaps be interesting to some of your readers.

Carlton Club, London, March 12 ROSSE

"Observed an intensely brilliant meteor. It was first seen in the region about Lepus, whence it moved with a slow and steady motion across the heavens to the S.E. horizon, where it gradually disappeared in a bank of cloud at about $9^h\ 5^m\ 19^s$, Greenwich mean time, having occupied seven or eight seconds in moving over 50° of a great circle. The time given may be a few seconds wrong, as it was noted by an ordinary watch. The head was intensely brilliant, of a bluish white colour, and lighted up the whole sky.

"Its brightness was maintained during its entire visibility, and may have been as great as the moon at quadrature. Apparent diameter of the head 42′. It was followed by a very narrow tail about 3° in length and of a reddish hue. It did not leave any phosphorescent train behind it, but at the latter part of its course it threw out some reddish luminous masses, that gradually faded away. Its apparent course was in a great circle through β Canis Majoris to a point near the S.E. horizon, in azimuth S. 28½° E., and altitude 8½°. For β Canis Majoris the azimuth was S. 20° 52′·4 W., and altitude 16° 43′·3.

"Observatory, Birr Castle, March 8"

WHILE travelling last night, at about twenty minutes to nine o'clock, as we were descending a tolerably high hill, about 5 miles from this city, our road leading S.S.W., I found myself very favourably circumstanced for seeing a beautiful meteor which was