In this form it is easy to see that each term may be graphically represented by an area, and the equation simply expresses the fact that the rectangular area xu is equal to the algebraic sum of the areas $\int_0^t udx$ and $\int_0^t xdu$. It is obvious that for periodic motion the rectangle xu will vanish when a suitable value is given to t; but so also will the areas $\int_0^t udx$ and $\int_0^t xdu$. So that when $xu = 0$ we get, either

$$\int_0^t udx = 0 \text{ and } \int_0^t xdu = 0; \text{ or } \int_0^t udx = -\int_0^t xdu.$$

Again, in what Clausius calls "stationary motion" when xu does not vanish periodically, although we can make the expression $\frac{m}{2t}ux$ vanishingly small, by taking t very great, it is obvious that if the areas $\int_0^t udx$ and $-\int_0^t xdu$ are not equal before multiplying them by $\frac{m}{2t}$, the expressions so obtained are not so afterwards. Moreover, and finally, it should be observed that the expression $m\int_0^t udx$ *does not represent kinetic energy;* to represent which the expression should be $m\int_0^t udu$. The above considerations seem to me to entirely upset Clausius' demonstration.

In the tenth edition of Maxwell's "Heat" (p. 323), Lord Rayleigh has given an illustration of the manner in which he supposes the "virial" to act in opposition to kinetic energy, and we may take his illustration as a simple test of the theorem. He supposes two bodies, each of mass m, to revolve in a circular path with a constant velocity about their centre of gravity. Here, as there is no pressure, the so-called virial equation takes the form

$$\Sigma\tfrac{1}{2}mv^2 = \tfrac{1}{2}\Sigma Rr.$$

In the above equation v, the velocity, is constant, and $R = mf$. If we take ρ as the radius of the circle, then $r = 2\rho$, and the equation becomes

$$\tfrac{1}{2}v^2\Sigma m = \tfrac{1}{2} \times 2\rho f\Sigma m.$$

Hence

$$\tfrac{1}{2}v^2 = \rho f;$$

which equation *does not represent the ordinary law of centrifugal force.* Lord Rayleigh omitted to notice that

$$\Sigma R = \Sigma mf = f\Sigma m = 2mf.$$

When, however, we throw overboard all ideas of "virial," and look upon the term $\frac{1}{2}\Sigma Rr$ in the so-called "virial equation" as simply representing work and equal to $\frac{3}{2}pV$, also an expression for work, then the equation

$$\Sigma\tfrac{1}{2}mv^2 = \tfrac{3}{2}pV + \tfrac{1}{2}\Sigma Rr$$

is certainly true. But there seems no possible advantage to be obtained in splitting the right-hand member into two equal terms, instead of writing the equation

$$\Sigma\tfrac{1}{2}mv^2 = 3pV; \text{ or } \Sigma\tfrac{1}{2}mv^2 = \Sigma Rr;$$

in either of which forms—the first for preference—it is applicable to ideal gases. For natural permanent gases the equations become, either

$$\Sigma\tfrac{1}{2}\beta mv^2 = 3pV; \text{ or } \Sigma\tfrac{1}{2}\beta mv^2 = \Sigma Rr,$$

and not

$$\Sigma\tfrac{1}{2}\beta mv^2 = \Sigma\beta Rr,$$

as given in my letter (p. 221) on "Argon and the Kinetic Theory."

C. E. BASEVI.

London, W., August 14.

Incubation among the Egyptians.

ARTIFICIAL incubation, like many another practice supposed to be peculiar to modern civilisation, is but a revival from very ancient times. Diodorus, an author who wrote about forty years before the commencement of the Christian era, tells how the Egyptians of his time, with their own hands, bring eggs to maturity, and how the young chickens thus produced are not inferior in any way to those hatched by the usual means.

The practice, probably with methods differing little from those of ancient times, survives to the present day among the fellahs of Egypt. In suitable places ovens are erected, and the proprietors go round the neighbouring villages collecting eggs. A sufficient number having been collected, they are placed on mats strewed with bran, in a room about 11 feet square, with a flat roof. Over this chamber, which is about 4 feet high, there is another built about 9 feet in height. The roof, which is vaulted, has a small aperture in the centre to admit light during the warm weather; below it another opening of larger dimensions communicates with the oven below. In the cold weather both are kept closed, and a lamp is kept burning within. Entrance is then obtained from the front of the lower chamber. In the upper room fires are made in troughs along the sides, and the eggs are placed on the mats below in two lines, corresponding to and immediately below the fires. The fires are lighted twice a day, the first time to die about midday, the second to last from about 3 p.m. to 8 p.m. The first batch of eggs are left for about half a day in the warmest situation, after which they are moved to make room for others, until the whole number in hand have had the benefit of the position. This is repeated for six days. Each egg is then examined by a strong light. All eggs that at this stage are clear are rejected, but those that are cloudy or opaque are restored to the oven for another four days. Then they are removed to another chamber, where there are no fires, but the air is excluded. Here they lie for five days, after which they are placed separately, about one or two inches apart, and continually turned. This last stage generally takes six or seven days. During this time a constant examination is made by placing each egg to the upper eyelid, when a warmth greater than that of the human skin is a favourable sign. The duration of the process generally extends over twenty-one days, but thin-shelled eggs often take only eighteen days. The average heat required is 86° F. Excessive heat is prejudicial. In Egypt the best time is from February 23 to April 24.

J. TYRRELL BAYLEE.

Mountain Sickness.

I HAVE just come back from a journey in the region of the Andes, and in looking over the numbers of NATURE, which had accumulated during my absence, I came across the extract, which you make in your notes of February 21, from the *Revue Scientifique*, on the subject of mountain sickness. I cannot agree with M. Kronecker's statement that beyond three thousand metres mountain sickness attacks all persons as soon as they indulge in the least muscular effort, as I made the acquaintance of many people, mostly railway men, living and working at altitudes of fourteen or fifteen thousand feet on the Oroya line and the Southern Railway of Peru, who had never experienced *soroche*, or mountain sickness. As far as my own experience goes, in three journeys across the Andes and several mountain ascents, including one to the top of the crater of the Misti, 19,300 feet above sea level, I had only one attack of *soroche*, and that was at the end of a ride on an oil engine from sea level to fourteen thousand feet in nine hours. But this was so complicated with suffocation by the oil fumes and scorching by the heat of the furnace while running through the fifty-seven tunnels on the line, that I cannot say how much was mountain sickness and how much was not. At any rate, I was perfectly well the next morning, and rode over a pass nearly seventeen thousand feet high without the slightest inconvenience. As regards the danger of a prolonged sojourn, my experience teaches me that it is almost entirely due to personal idiosyncrasy and unwise eating and drinking. A healthy person whose lungs and heart are all right, who does not over-eat and is very moderate in the use of stimulants, will not suffer from mountain sickness after the first few hours, and in many cases will not suffer at all if the ascent is sufficiently gradual. Of course very violent exertion produces distress by reason of the deficiency of oxygen. I do not think that there need be any difficulty about the officials of the proposed Jungfrau railway, if steady men, not of a full habit of body, are selected. I never heard of any trouble from mountain sickness among the Peruvian railway men unless they over-stimulated, and yet they are accustomed to go in a day from sea level to 15,764 feet on the Oroya line, and to 14,666 feet on the Southern line, and return to sea level on the following day. I may add that I have made both these journeys myself without the slightest inconvenience, and have been able to walk and ride without any trouble at the end of them.

London, August 20. GEORGE GRIFFITH.