came close to the house and into the yard where the poultry feed. I have not seen it for some months, nor heard of it in any other garden. A. S. MATHEWS

Edgbaston

Curious Phenomenon in Cephalonia

MR. LEDGER (p. 246) need not have had any doubt about the correctness of the information sent him by his friend about currents running from the sea *into* Cephalonia. It is a well-known fact, and the following account of it is from Dr. John Davy's "Ionian Islands," published in 1842, vol. i. 164 :—

"The next phenomenon I have to mention is very extraordinary, and apparently contrary to the order of nature: it is the flowing of the water of the sea into the land in currents or rivulets which descend and are lost in the bowels of the earth. This occurs in Cephalonia, about a mile and a half from the town of Argostoli, near the entrance of the harbour, where the shore is composed of freestone, and is low and cavernous, from the action of the waves.

"The descending streams of salt water are four in number; they flow with such rapidity that an enterprising Englishman has erected a grist-mill on one of them with great success. I have been informed that it produces him 300*l.* a year. The flow is constant unless the mouths through which the water enters are obstructed by sea-weed. No noise is produced by the descent of the sea-water, and rarely is any air disengaged; the streams have been watched during earthquakes, and have not been found affected by them. It is stated that fresh-water is perpetually flowing through fissures in the rock from the land in the trench which has been dug for the reception of the mill-wheel, and that, when the sea-water is prevented rushing in, then the water in the trench rises higher by several inches than usual, and the water is brackish to the taste. The phenomenon has been long known to the natives. The little information I have obtained respecting these extraordinary currents I owe to my friend Dr. White, surgeon of the Second Battalion of the Rifle Brigade, collected by him when stationed in the Ionian Islands about 1840."

If Mr. Ledger's friend could give us more information it would be most desirable. I am sorry I had not an opportunity of examining the mill when I was amongst the islands in 1857.

Gateshead, January 17 R. S. NEWALL

After-Images

CAN any reader account for the following interesting phenomenon :—If I close my eyes in the presence of a strong light, so close that not a ray of light can penetrate the lids—in fact, I may generally place my hands firmly over my eyes—I can see pictures of great splendour, more beautiful than any decoration I have ever beheld, sometimes in the form of some splendid architectural design, most elaborately worked out; at others, beautiful landscapes; again, fine geometrical and other designs, as well as every conceivable form of conventional treatment, such as might be applied to carpets, or other floor decorations, iron-work, &c. I would add that all this is seen without any apparent preconceived action of the will, as sometimes, if I close my eyes with the deliberate intention of seeing any particular object, I am disappointed, though not so frequently now as when I first noticed the phenomenon a few years ago. I have sometimes seen designs positively ugly, but as a rule they are most beautiful in form and colour.

I have visited but few grand and noble buildings, and seen but little of beautiful landscapes, as I am only a humble mechanic, but I take great delight in reading descriptions of such buildings and scenes, and am a true lover of sound, substantial, and elaborate workmanship. J. C. S.

PROFESSOR TAIT ON THE PARTITION OF ENERGY BETWEEN TWO SYSTEMS OF COLLIDING SPHERES[1]

SINCE Clerk-Maxwell published, in 1860, his first grand investigation on the subject, it seems to have been taken for granted, rather than proved, that in a mixture of great numbers of colliding spherical particles of two kinds, the ultimate state would be one in which the average energy of translation is the same for a sphere of either kind. Also that his Corollary, which extends the proposition to a mixture of many systems, is true. Further extensions have been made, the results of which have been considered as irreconcilable with the kinetic theory of gases, at least in its present form.

So far as I am aware, no really *convincing* proof of this theorem has yet been given. Maxwell's first proof is so sketchy, and involves so many inadmissible assumptions, that it cannot be looked on as more than an illustration of a truth which his deep insight had enabled him intuitively to perceive. More recent proofs depend so much on a species of analytical verbiage (under cover of which any amount of assumptions may be tacitly introduced), that, besides being totally unintelligible to any but specialists, they do not bring full conviction even to specialists themselves. What is required is plain, clear statement, and justification of every step about to be taken, such as will commend it to the careful reader, and leave no doubt on his mind as to *what* is about to be done, and *why*; though the mere details of the subsequent necessary calculation may be beyond him. Nothing does greater harm to the average reader, in the way of shaking his belief in the results of an investigation, than the use of analysis instead of, or so as to mask, thought. One may make a mistake in evaluating a definite integral, just as one may make a mistake in adding a column of figures. But when the process of forming the expression to be integrated, or of obtaining the items of the column of figures to be added, is not made fully intelligible, incredulity is very justly aroused, however we may be inclined to trust the special skill of the mere analyst or of the arithmetician in his proper sphere.

In seeking such a convincing proof, I have become from time to time suddenly aware of specially dangerous traps which (some almost obvious, others extremely difficult to detect) abound in this particular region of inquiry. Some of these will appear in what follows. Hence I determined not to be content with anything short of absolutely pointing out the nature of, and the reason for, every step; so that even those who cannot follow the step itself may fully understand *why* it has been taken, and be in a position to judge of its legitimateness.

Limits of space forbid my giving all this in an abstract, so that I must confine myself to a very condensed statement.

For reasons given, we assume the truth of the "error-law" distribution of speeds in any one system of spheres. This will be called the "special" state.

When two systems are mixed, we assume the mixture to be complete; and, on account of the small fraction of the whole number of particles (one from each, or one from either, system), which are at any time in collision, *and of the perfect freedom of collision between any two assigned particles* (this is a point of special importance), we assume that each system, by its internal collisions, maintains its own "special" state. Hence in our investigations the collisions of two particles of the same system need not be attended to. Their sole function has been assigned, and we assume that they accomplish it.

But it is most distinctly to be understood that the above assumptions are absolutely necessary to the prosecution of the inquiry in the manner adopted; and, therefore, to whatever result it may legitimately lead, that result is not to be held as accurate if any of them be departed from. Thus the extensions of Maxwell's Theorem, given by Boltzmann and others, must not be considered as legitimate extensions of that Theorem and its corollaries unless, in the collisions between complex particles, the mechanism of each degree of freedom of any one such particle has perfectly free access for collision with that of the corresponding as well as with that of the non-cor-

[1] Abstract of Paper read to the Royal Society of Edinburgh, January 18. Communicated by permission of the Council.