LETTERS TO THE EDITOR.

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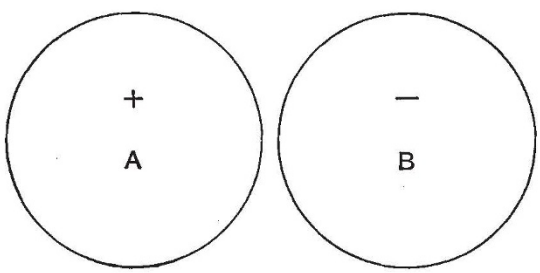
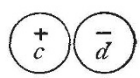
Velocity of Propagation of Electrostatic Force.

DR. BOTTOMLEY'S note published in NATURE of January 23, quotes an extract from my Baltimore Lectures of October 1884, in which this subject is spoken of, with an illustration consisting of two metal spheres at a great distance asunder, having periodically varying opposite electrifications maintained in them by a wire connecting them through an alternate current dynamo.

For an illustration absolutely freed from connecting wire and all complications, consider four metal spheres, A, B, *c*, *d*, with their centres all in one straight line;—their relative magnitudes and positions being such as shown in the accompanying diagram. Let each of the four be initially electrified, A and *c*, positively, B and *d*, negatively. Let the charges on *c* and *d* be so strong that a spark is only just prevented from passing between them by the influence of B and A. Let A be gradually brought nearer to B till a spark passes between them. Will the consequent spark between *c* and *d* take place at the same instant or a little later? It is not easy to see how this question could be answered experimentally; but remembering the wonderful ingenuity shown by Hertz in finding how to answer questions related to it, we need not perhaps despair to see *it* also answered by experiment.

The elastic solid theory restricted to the supposition of incompressibility (which is expressed by Maxwell's formulas) makes the difference of times between the two sparks infinitely small.





The unrestricted elastic solid theory gives for the difference of times the amount calculated according to the velocity of the condensational-rarefactional wave.

But I feel that it is an abuse of words to speak of the "elastic solid theory of electricity and magnetism" when no one hitherto has shown how to find in an elastic solid anything analogous to the attraction between rubbed sealing-wax and a little fragment of paper; or between a loadstone or steel magnet and a piece of iron; or between two wires conveying electric currents. Elastic solid, however, we must have, or a definite mechanical analogue of it, for the undulatory theory of light and of magnetic waves and of electric waves. And consideration of the definite knowledge we have of the properties of a real elastic solid, which we have learned from observation and experiment, aided by mathematics, is exceedingly valuable in suggesting and guiding ideas towards a general theory which shall include light (Old and New), old and new knowledge of electricity, and the whole of electro-magnetism. KELVIN.

The New Actinic Rays.

MAY I point out that an unnecessary amount of energy is being expended on Röntgen's photographs—I mean electrical energy.

I have succeeded in obtaining perfectly sharp and fully-exposed negatives from an action of four minutes' duration, even when a thin aluminium plate is placed in front of the sensitive film, and the rays are excited in a Crookes' bulb connected direct (*i.e.* with no Leydens inserted) with the secondary terminals of an Apps' induction coil, which gives (in its present condition) a three-inch spark in air when worked, as in the present experiments, by three small accumulator cells. This is much smaller, however, than that used in the published experiments of others who have been doing similar work.

University College, London. ALFRED W. PORTER.

THE accompanying photograph may perhaps interest those who are engaged in the photography of invisible objects. It was taken in the following way. Upon a piece of board I placed a sensitive plate, on this a penny-piece with the obverse side downwards, and on the top of the penny-piece a $\frac{1}{16}$-inch cedar board. The whole was exposed to the light emitted by the burning of sixteen inches of magnesium ribbon at a distance of six inches. I developed with pyro-ammonia. An inspection of the photograph will show a distinct image of the Queen's head.

On repeating the experiment with fifteen inches of magnesium ribbon at six inches, but without the use of the cedar board, the part of the plate surrounding the coin was solarised, whilst the part underneath was over-exposed, so that no trace of the image was visible.

I then repeated the last experiment, using a slow lantern-plate, and burning four inches of ribbon at nine inches distance; on development a faint image of the Queen's head was visible. Hence it is only a matter of exposure and development to produce a much better result than the one presented.

The phenomenon does not appear to be due to the varying thickness of the coin, since the impression of the reverse side has not modified the result, but rather to the different *directions* in which the penetrating rays are refracted from the irregular refracting surface on to the sensitive plate. W. SAUNDERS.

[A FAINT image of the Queen's head is quite visible upon the print received from Mr. Saunders, but it will not bear reproduction.—ED. NATURE.]

A STORY was current at Cambridge some forty years ago that an aspirant to mathematical honours replied to the question, "Construct a prism through which no ray can pass," in the terms following:—

"Take a prism of *wood*: then if no ray passes through, what was required is done. But if a ray does pass through, *paint it*."

Surely a marvellous anticipation of Röntgen's X-rays!

R. B. H.

The Stress in Magnetised Iron.

I AM glad that Dr. Chree, in his letter published in NATURE of January 23, has raised a discussion of this matter, regarding which, as he says, the most contradictory statements are to be found. For some time I have been aware that the passage referred to in my book on "Magnetic Induction in Iron" requires correction. The magnetic stress, $B^2/8\pi$, in a long rod or ring uniformly magnetised, is there spoken of as if it were of the same nature as a simple longitudinal stress of compression, producing a contraction of the length in consequence of the elasticity of the metal. Dr. Chree, if I understand him rightly, would treat it as of the same nature as a simple longitudinal stress of tension, producing an elongation of the iron.

But it now seems clear to me that both of these views are equally wrong. There is no proper comparison, in the general state of magnetised iron, with the stress in a loaded pillar or the stress in a stretched rope.

Take the case of a uniformly magnetised ring, where we have no complications due to end effects. Imagine a plane of section, and call the halves of the ring A and B. According to the first view, A is, as a consequence of the magnetisation of the ring, pushing against B, and B against A. According to the other view, A is pulling B, and B is pulling A. But if A is either pushing or pulling B, the equilibrium of B demands that some other force must act on it to balance this push or pull. No such