Ice Planed.

PERHAPS it will interest some of those who are investigating the structure of different kinds of ice to know how blocks of it may, with ease and certainty, be shaped into bars and plates of any required dimensions. Some time ago I had occasion to prepare some specimens for experimental purposes. At first my success in working the ice into the required form was not very great, for it cracked in all directions under the action of a saw or chisel. After trying many devices, I at last resorted to a joiner's plane; a tool which may have been tried for the purpose before, though I do not remember having seen its use suggested. With it ice may be planed with greater ease than wood, the shavings coming away in powder, and leaving the ice with a clean, bright, sound surface. R. M. DEELEY.

39 Caversham Road, Kentish Town, N.W., February 16.

REPETITION OF HERTZ'S EXPERIMENTS, AND DETERMINATION OF THE DIRECTION OF THE VIBRATION OF LIGHT.

SINCE last October, Prof. Fitzgerald and I have been repeating some of Prof. Hertz's experiments, as occasion allowed; and it may not be without interest at the present time to give a short account of our work.

The first experiment tried was the interference of direct electro-magnetic radiation with that reflected from a metallic sheet. This experiment is analogous to that known in optics as "Lloyd's experiment."

The radiation was produced by disturbances caused in the surrounding space by electrical oscillations in a conductor. It was arranged in this wise. Two thin brass plates, about 40 centimetres square, were suspended by silk threads at about 60 centimetres apart, so as to be in the same plane. Each plate carried a stiff wire furnished at the end with a brass knob. The knobs were about 3

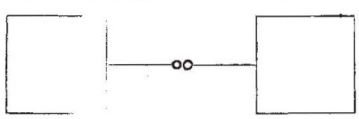

FIG. 1.

millimetres apart, so that on electrifying one plate a spark could easily pass to the other. This spark, as is well known, consists not simply of a transference of half the electricity of the first plate to the second—though this, which is the final state, is all that is observable by ordinary experimental methods—but the whole charge passes across to the second plate, then returns, and so on, pendulum-fashion, the moving part of the charge becoming less each time, till finally brought to rest, the energy set free at sparking being converted partly into heat in the wire and air break, partly into radiation into space, or in terms of action at a distance in inducing currents in other bodies.

The time taken by the charge to pass over to the second plate and to return, is a definite thing for a given sized arrangement, and depends on the connection between them. If C be the capacity of the plates, and I the self-induction of the connection, the time of each complete oscillation equals $2\pi\sqrt{CI}$. The time in the case of the particular arrangement used is, speaking roughly, about the 1/30,000,000 of a second.

If there be conductors in the neighbourhood of this "vibrator," currents will as usual be induced in each on every passage of the charge between the plates, each passage serving simply as a primary current.

Now, speaking briefly, the whole object of the experiment is to find out if these induced currents take place simultaneously in conductors situated at various distances from the primary current, and if not, to determine the delay. In order to do this we must, in the first place, be possessed of some means of even ascertaining that these currents occur, all ordinary methods being inadequate for detecting currents lasting only for such exceedingly short periods as these do. By devising how to determine the existence of these currents, Hertz made the experiment possible.

His method depends on the principle of resonance, previously suggested by Fitzgerald, and his current-observing apparatus is simply a conductor, generally a wire bent into an unclosed circle, which is of such a length that if a current be induced in it by a passage of a charge across the "vibrator" the return current or rush back of the electricity thus produced in the ends of the wire occurs simultaneously with the next impulse, due to the passage back across the "vibrator."

In this way the current in the "resonator" increases every time, so that at last the end charges, which are always of opposite sign, grow to be so great that sparks will actually occur if the ends of the wire are brought near together. Thus, Hertz surmounted the difficulty previously experienced by Fitzgerald when proposing electro-magnetic interference experiments.

The time of vibration in this circle is, as before, $2\pi\sqrt{CI}$, but on account of difficulties in calculating these quantities themselves, the length of the wire is most readily found by trial. To suit the "vibrator" we used, it was about 210 centimetres of wire No. 17. The ends of the wire were furnished with small brass knobs, which could be adjusted, as to distance between them, by a screw arrangement, the whole being mounted on a cross of wood for convenience in carrying about.

At first sight the simplest "resonator" to adopt would seem to be two more plates arranged similarly to the "vibrator," but it will be seen on consideration that it would not do, because no break for seeing the sparking could be put between the plates, for, if it were, the first induced current would be too feeble to jump the break, so that the reinforcement stage could never begin.[1]

The charging of the "vibrator" was effected by connecting the terminals of an induction-coil with the plates. In this way a continuous shower of sparks could be obtained in the resonating circle.

The circle in the interference experiment was held in the horizontal plane containing the axis of the "vibrator," the ends of the circle of wire being in such a position that a line joining the knobs was at right angles to the "vibrator." In this position only the magnetic part of

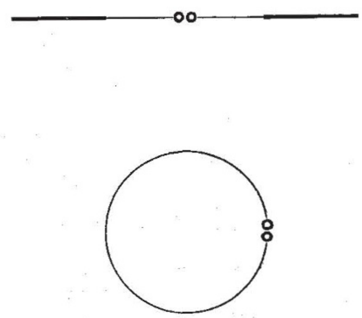

FIG. 2.

the disturbance could affect the circle, the "magnetic lines of force," which are concentric circles about the axis of the "vibrator," passing through the "resonator" circles.

When the knobs of the circle are brought round through 90°, so as to be parallel to the "vibrator," the electric part of the disturbance comes into play, the electric lines of force being, on the whole, parallel to the axis of the "vibrator." The electric action alone can cause a forced vibration in the knobs, even when the connecting wire is removed, if placed fairly close to the "vibrator."

[1] However, two pairs arranged in line, the pairs connected by a wire, could probably be got to spark between the centre plates.