material nature of the rays, and the only novel point in the paper referred to seems to me to be that the rays owe their greater or less penetrative power to the fact that they are particles less or more free from electric charges. If this were the case, it seems scarcely possible that the particles could pass as freely through, and in the neighbourhood of, a conductor when charged as when uncharged. If the particles were completely without charge, it is true they should be equally affected by a conductor first charged positively, and then with an equal negative charge. On the other hand, if the particles were positively charged, they would experience stronger attraction to a conductor negatively electrified than to the same conductor equally positively charged; and the same, *mutatis mutandis*, may be said if they are negatively charged.

The effect one might expect is that the uncharged particles would at first be attracted by a charged conductor, and then repelled from it, if they acquired part of its charge, in which case the photographic image of the uncharged conductor produced by the X-rays would be modified in intensity if not in form [1]—probably in both.

If, as Messrs. Vosmaer and Ortt suppose, the "rays" are diselectrified by striking against the charged anode inside the tube, it is difficult to see why they should not be re-charged, and therefore act like other charged particles, if they strike against an electrified conductor *outside* the tube, especially if the potential of the external conductor be as great or greater than the potential of the internal. Indeed, the authors of the paper admit this; and if it is true, one might reasonably expect some such action as I have sought for.

I therefore thought it would be, at any rate, worth trying experiments to see if the X-ray photograph of a conductor, such as of a small plate of aluminium (with carefully rounded edges), differs according to (1) whether it be charged or not, and (2) whether it be charged positively or negatively.

According to the paper the X-ray particles are to be considered free from charge when they completely discharge a charged insulated plate, without afterwards imparting to it a charge, and the focus tube I used in all these experiments was one which gave rays of this description.

In the first set of experiments two small squares (A and B) with rounded edges, cut from the same piece of sheet aluminium, and one-thirtieth of an inch in thickness, were arranged in the same horizontal plane beneath the focus tube placed symmetrically with respect to the anode of the tube, so that the line joining the centres of the squares was in a direction at right angles to the line joining the centre of the anode and the centre of the kathode mirror. Below these small squares, and resting on a thick block of paraffin, was placed the photographic plate (all the plates used belonged to the same batch—the Ilford special rapid, and all the plates of each set of experiments were developed together in the same dish). The tube was worked by a large coil, giving six-inch sparks, and A and B were electrified when necessary by wires from the poles of a Wimshurst machine with leydens giving seven-inch sparks between the nobs when used in the ordinary way. The duration of each exposure was timed by a stop-watch in each case, and was as nearly as possible the same for each set of experiments.

A blank experiment in each set, in which the plate, wrapped in dark paper (the same number of folds in every case), was exposed to the radiation from A and B without the Röntgen rays, proved that no photographic effect was produced by their electrification by the Wimshurst.

Exposures were then made as follows:—

(1) A and B both earthed by a wire soldered to a gas-pipe.
(2) A positively, B negatively electrified.
(3) A negatively, B positively electrified.
(4) A positively, B to earth.
(5) A negatively, B to earth.
(6) A and B both earthed.

Development showed that the electrification of A and B was without effect, either absolute or comparative.

Since in the above experiments sparks passed between A and B when their difference of potential exceeded an amount far less than that which could be given by the Wimshurst, and it seemed possible that a stronger charge might still yield some indication of a difference, one of the aluminium squares was removed, and the other shifted till it was immediately beneath the anode, and a second set of experiments was made in a rather different way. In each pair of exposures the same plate was used, each half of the plate being protected, whilst the other half was exposed by a thick slab of plate glass—proved by experiment to allow no developable action of the X-rays to pass through it during the time of exposure used. The experiments were as follows:—

(1) A blank experiment without the X-rays in which one-half of the plate was exposed, first to A charged positively to the full power of the Wimshurst, and then the other half to A charged negatively in the same way. The result showed there was no developable action.

(2) 1st half X-rays only, then an interval of rest (the same interval being allowed between every experiment), then the 2nd half to the X-rays only; this was done to see how the emission of the tube varied.

(3) 1st half A positively charged, 2nd half X-rays only: A to earth.

(4) 1st A negatively. 2nd A to earth.
(5) 1st A positively. 2nd A negatively.
(6) 1st A insulated. 2nd A to earth.
(7) Same as (2).
(8) Same as (1).

The whole of this series was repeated, using the contents of one box of Edwards's isochromatic plates. Development showed no action which could be attributed to the electrification of A.

In a third series of experiments A was connected by a wire first to the kathode loop and then to the anode loop of the focus tube, and radiographs were taken comparing the effects of this treatment with that of earthing A; but these, too, gave no indication of any increase or decrease of the X-rays reaching the plate, nor of any re-distribution of the rays.

In a fourth set the photographic plate was placed on an ordinary discharging table, and brush discharges, and afterwards thick sparks were passed between the poles of the discharger, and the radiographs developed; but they showed no traces whatever of any effect of the sparks.

I, therefore, conclude that the radiograph of a conductor (though it is true I have only tried aluminium and brass) is not sensibly altered by even powerful electrification, nor are the rays altered in force or direction in passing through air in the neighbourhood of a powerfully-charged conductor, nor even through air which is being subjected to a powerful disruptive discharge.

This seems to me to make it more difficult to believe that the X-rays are due to particles, whether totally or partly devoid of charges of positive or negative electricity. T. C. PORTER.

Eton College, July 5.

[1] The alteration in form, and to a certain extent intensity, would depend partly on the velocity with which the particles were travelling. I do not remember reading of any determinations of the velocity of propagation of the X-rays; but if this remains very high over great distances, as it seems to do, it would appear very unlikely that the rays consist of material particles.

Primitive Methods of Drilling.

IN NATURE for June 10 (p. 140) there was an abstract of a monograph upon drills, dealing, among others, with those used in ancient Egypt. May I be permitted to point out that the object shown in Fig. 3 is not, as the author suggests, a drill bow, but a censer.

Again, the meaning of the sign *sam* (explained by Mr. McGuire as a disc drill), when used as a phonetic hieroglyph, is perfectly certain. It means "joining" or "union," and when accompanied by the lotus and papyrus (called "strings" by the author), "union of Upper and Lower Egypt." The figures accompanying it are most certainly gods, and not captives. At the same time, the sign *sam* occurs as a determinative to the word *casanet*, usually translated chisel, but which may well mean a drill such as Mr. McGuire indicates.

Constantinople, July 10. FRANZ CALICE.

Meteor of July 29.

IN case it may be of any interest to you, I beg to inform you that at 7.45 p.m., yesterday (Thursday, July 29), when standing 0° 29′ 40″ W., by 51° 10′ 12″ N. (Sparelands or Willinghurst on 1-inch Ordnance Map, Sheet 285, near Cranleigh) I saw a meteor fall in a direction bearing 46° east of north, as near as I could tell by a bearing subsequently taken. Its appearance was that of a falling magnesium star rocket. It did not appear to explode, but left a long trail of fragments.

Willinghurst, Guildford, July 30. J. V. RAMSDEN.