effect is principally confined to a layer of gas near the surface (John S. Townsend, *Camb. Phil. Proc.*, vol. x. Part iv.), but when the pressure is low the secondary rays are not so rapidly absorbed by the gas, and the ionisation (n_0) between the plates is nearly uniform.

The ratios of $\frac{c}{c_0}$ were determined for different forces, the air being at a pressure of two millimetres. When the strength of the rays was reduced to $\frac{1}{3}$ of its original value it was found that the ratios $\frac{c}{c_0}$ were unaltered. This shows that α is independent of n_0 and is some function of X and p.

The plates were then set at one centimetre apart, and the values of c were determined for different forces. The results, corresponding to a pressure 2 and ·8 mm., are given in the second columns of the accompanying tables. The numbers given are the mean between the currents in opposite directions. With this form of apparatus, however, there were only very small differences found in the conductivity when the electromotive forces were reversed. The plates were then set at two centimetres apart, and the currents found in this case for pressures 2·14 and ·8 mm. are given in the third columns of the tables.

The force X is given in volts per centimetre.

TABLE I.—*Air at pressure 2 mm.*

X	$c(d=1)$	$c(d=2)$	Calculated values of $c(d=1)$
20	28	49·5	28
40	28·2	51	28·4
80	29·5	55	29·5
120	36	81	35·5
160	51	173	50
180	64·5	293	63

TABLE II.—*Air at pressure ·8 mm.*

X	$c(d=1)$	$c(d=2)$	Calculated values of $c(d=1)$
10	10	17·7	10
20	10·5	19	10·5
40	12	24·5	12
80	17	53·5	17
120	31	190	29
165	61	990	62·5
186	82	2180	84

The tables show that the current increases more rapidly with X when the plates are two centimetres apart than when they are one centimetre apart. This effect cannot be attributed to a surface action which would be independent of d when X remains constant.

From the formula $\frac{c}{c_0}=\frac{1}{\alpha d}\left(E^{\alpha d}-1\right)$ we can deduce the values of α from the third columns of the tables, by making $d=2$ and c_0 the smallest value of c. From values of α thus obtained, the ratios $\frac{c}{c_0}$ for the different forces corresponding to plates 1 centimetre ($d=1$) were calculated. The values of c found in this manner are given in the fourth columns, and they show a good agreement with the experimental determinations.

Other experiments for different pressures have also been made, and they all show an agreement with the present theory.

For the purpose of deciding whether it is the positive or negative ions which produce other ions by their rapid motion through the gas, we may mention the following experimental results. When the lines of force in the gas are not parallel, large differences in current were obtained on reversing the electromotive force. Thus, when the conductivity takes place between two electrodes one inside the other, it was found that for high electromotive forces the current is much greater when the ions go towards the inner electrode.

Thus, with an apparatus consisting of a small spherical electrode surrounded by a large electrode made of thin aluminium, the currents, when the outside electrode was positive, were 14 for a potential difference of 40 volts, and 34 for a potential difference of 300 volts; when the outside electrode was negative the currents were 14 and 174 for the same voltages. In these experiments the pressure was about 2 mm. The positive and negative ions produced by the rays are generated nearly uniformly throughout the area between the electrodes. When the large electrode is positive only a few of the negative ions pass through the region round the small electrode where the force is big, and the current only increases from 14 to 34. When the electromotive force is reversed all the negative ions produced by the rays come into the region where the force is big, and the current is thereby increased from 14 to 174. It is therefore evident that the increase of conductivity must be attributed to the rapid motion of the negative ions.

I hope in a future paper to give a fuller account of the above experiments, and also to point out some of the applications of this theory to the passage of electricity through gases. I may mention that the high conductivities obtained with ultra-violet light (Stoletow, *Journal de Physique* (2), 9, pp. 463-473, 1890), at pressures of about 1 millimetre, may be explained by this theory.

Approximate values of the energy of translation of the negative ion when producing another ion by a collision can also be obtained from the coefficients α. J. S. TOWNSEND.

Trinity College, Cambridge.

A Remarkable Hailstorm.

I HEREWITH enclose you prints, from untouched negatives, of hailstones which fell at Northampton on Friday, July 20.

The drawing board measures 19½″ by 17″, and the average circumference of the hailstones upwards of five inches. These are by no means the largest that fell, according to the statements of trustworthy persons, but were typical of what fell in my garden.

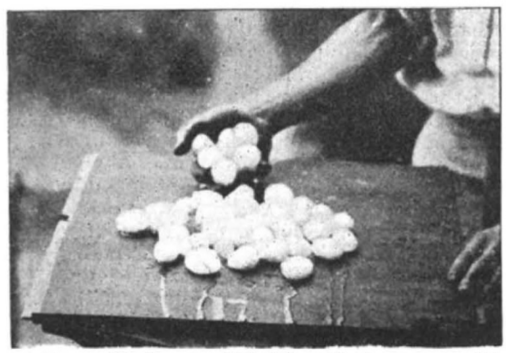

FIG. 1.—Group of hailstones which fell at Northampton on July 20. Size of board 19½ in. by 17 in.

The majority of the stones were somewhat flattened, as shown in the front of the photograph, but many were nearly spherical like those in my hand (Fig. 1).

The stones were extremely dense and well frozen, and buried themselves in the garden soil. Where they fell on hard surfaces, they usually broke into fragments which rebounded to considerable heights, while glass roofs suffered enormous damage all over

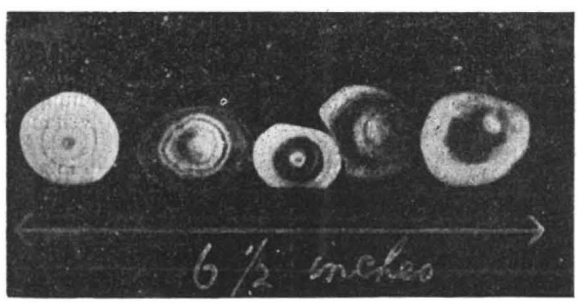

FIG. 2.—Sections of hailstones (Northampton, July 20).

the area, some twelve miles by six, covered by the storm. I have a piece of glass 5/16ths of an inch in thickness many hundred square feet of which were broken at the various factories in the town.

The sections (Fig. 2) were an afterthought and show the structure exceptionally well in two instances.

J. G. ROBERTS.

Northampton and County School, July 30.