photo-ionization ; transition to an arc takes place when the conditions *at the cathode* are such as to initiate a much more copious source of electrons, namely thermionic emission or auto-electronic emission.

The propagation of a leader stroke depends on ionization processes in the gas. There seems no reason to suppose that a sudden transition will take place in the leader channel at a value of current which relates to the glow-to-arc transition between metal electrodes, where all evidence points to the importance of cathode mechanisms. Thus I consider that the experimental data on glow-to-arc transition are not directly applicable to the leader stroke, which is a gas-dependent phenomenon.

A feature of the propagation of leader strokes is their development in fields of relatively low gradient. The leader stroke must therefore carry forward as it advances a localized intense field about its tip in order that its progress may be maintained. To create such a field an excess charge of the appropriate sign is required in the channel. I would then suggest that one of the criteria relating to the propagation of a leader stroke is that the gradient along the ionized channel should be such that the electron drift speed is sufficient to ensure the continuous creation of this excess charge as the leader advances. The manner in which this excess charge is produced is probably as follows :

(1) *The negative leader stroke.* The average electron drift speed u cm. per sec. along the leader channel is in the same direction as the average speed v of advance of the channel tip. If n is the number of ion pairs created per cm. advance of the leader stroke, the number of electrons in the channel is $\dfrac{n\,v}{v-u}$ per cm., while the number of positive ions is n per cm. (the positive ions may be considered as virtually stationary in comparison with the more mobile electrons). There is then an excess of electrons in the channel, namely, $\dfrac{n\,u}{v-u}$ per cm., which maintains the negative character of the advancing leader.

(2) *The positive leader stroke.* The direction of electron drift in the leader channel is in the reverse direction to that of advance of the leader. The number of electrons in the channel is $\dfrac{n\,v}{v+u}$ per cm., while the number of positive ions is n per cm., so that there is a resultant excess $\dfrac{n\,u}{v+u}$ positive ions per cm. of channel.

Further details relating to the amount of excess charge required in a leader channel will be published in due course.

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Magnetization of Matter by Ultra-violet Radiation

I HAVE attempted to repeat the interesting experiments reported by Ehrenhaft and Banet[1] on the effect of ultra-violet radiation on "non-magnetic" and annealed pieces of iron. They stated that, with the simplest apparatus (for example, a cheap compass needle), they showed that poles were induced in various pieces of annealed iron, the poles being mainly north magnetic. The specimens were placed perpendicularly to the geomagnetic field and irradiated for periods varying from minutes to several hours. The poles, they state, were present in many specimens after several days.

My experiments were carried out under similar conditions, and, within the limits of sensitivity of the magnetometer used, they were entirely negative. This sensitivity was about 9,000 mm. at 1 metre per œrsted, and was such that a pole strength of 0·01 c.g.s. unit (or a magnetic moment of 0·05 c.g.s. unit) on the specimen tested could be detected clearly. A small compass needle was found to be less sensitive and reliable. In the various tests I used two types of ultra-violet source, direct exposures to within 10 cm. of the source and also at the focus of a quartz lens, exposure times ranging from minutes to several hours, various angles from 0° to 90° between radiation beam and specimen, and many specimens of the kind mentioned by Ehrenhaft and Banet. In no case was there a significant increase in magnetization. An occasional specimen, accidentally dropped, became magnetized by the earth's field.

It was shown that the weak poles (of order 0·01–0·1 c.g.s. unit) induced by placing a specimen in the earth's field and tapping it could be detected with certainty by the magnetometer, and often by the compass needle.

The first ultra-violet lamp used by me was an Osira, 125-watt, high-pressure type (General Electric Co.). Its glass globe had been removed, and the ultra-violet flux density in the region 3132 A. and less had been determined in previous work[2] (39 microwatts per cm.[2] at 61 cm. horizontally from the source). The second source was a Mercra lamp, 125-watt, with ultra-violet filter bulb (British Thomson-Houston Co.).

I would like to know if anyone else has tried these experiments, and their results.

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July 16.

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Distillation 'Constants'

WE have become interested in the relationships existing between some of the older 'distillation constants' and the more recent concept of relative volatility (α of Walker, Lewis *et al.*[1]). To find the rate of change with composition of total vapour pressure (P) of a binary mixture Rosanoff, Bacon and Schulze[2] put forward the general equation (deduced empirically)

$$\frac{dP}{dx} = \frac{1}{K} \log \left[p_1(1-x)/p_2 x \right]. \qquad . \quad . \quad . \quad . \quad (1)$$

p_1 and p_2 were the partial vapour pressures (at a particular temperature) of the components, the