However, we did not find any difference between the two opposite directions of the current. The current followed the illumination without measurable time lag and was equal in both directions. Up to 2,000 volts, it was proportional to the potential applied. At 5,000 volts, saturation was nearly reached. We therefore conclude that: (1) The mean time lag τ between the appearance of a photoelectron and its transition into a bound state is of the order 10^{-6} sec., assuming a normal mobility of electrons of 300 cm./sec. in a field of 1 volt/cm. at $-180°$ C. (2) The equality of saturation currents in both directions shows that the number of free electrons and of free holes ('positive electrons') produced by light are also equal. (3) The equality of the currents in the region where Ohm's law holds is a proof of the equality of the mobilities of electrons and holes.

Without any external electric field, the movement of electrons and holes leads to a diffusion of photo-conductivity from the illuminated spot in all directions. In fact, illuminating a section at one end of a cuprous oxide plate, we found at the other end that the conductivity rose gradually during one hour from the initial small value of about 10^{-12} ohm^{-1}

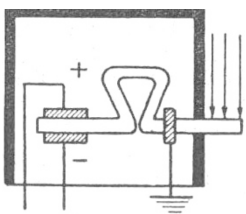

FIG. 2.

at $-180°$ C. to a value about hundred times as large. Cutting off the light, we gradually reduced the conductivity to its initial value.

In order to be sure that the measured conductivity was not due to diffusion of light inside the plate or to the spreading out of the field, we gave to the cuprous oxide plate the form shown in Fig. 2 and illuminated one end through a yellow-green filter by light which was strongly absorbed. The remaining part of the plate was put in a closed black box. The opposite end of the plate was provided with two electrodes. Just as in the case of a plane plate, we observed an increasing current, 'transmitted' from the illuminated section.

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Impulse Corona in Water

IN order to obtain accurate data concerning the mechanism of breakdown phenomena in liquid dielectrics, we have investigated the impulse corona in liquids by means of the spectrograph. The liquid dielectric used in this case was distilled water. The impulse corona was produced by applying an impulse voltage between the aluminium needle N and the plate electrode P (Fig. 1); M, C, C, and W denote the impulse generator, which produces impulse voltage of $10^{-4} \sim 10^{-5}$ sec. in duration.

When the gap-length of F, in Fig. 1, is sufficiently large, the full impulse voltage is applied between electrodes N and P. If, in this case, an impulse voltage of adequate intensity is applied, a pink-coloured corona is produced on the end of the needle

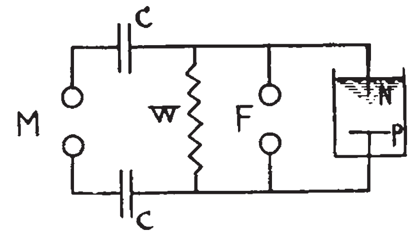

FIG. 1.

electrode N, and, at the same time, many very small bubbles of water vapour. The spectrum of this corona is very similar to that of a water vapour electric discharge tube as shown in Fig. 2.

When the impulse voltage is reduced by shortening the gap-length of F, the corona disappears. If the crest value, however, of the impulse voltage is increased by widening the gap at M, a white corona is produced. The spectrum of the corona, also shown in Fig. 2, is quite different from the pink one mentioned above. The duration of the impulse voltage was less than 10^{-7} sec.

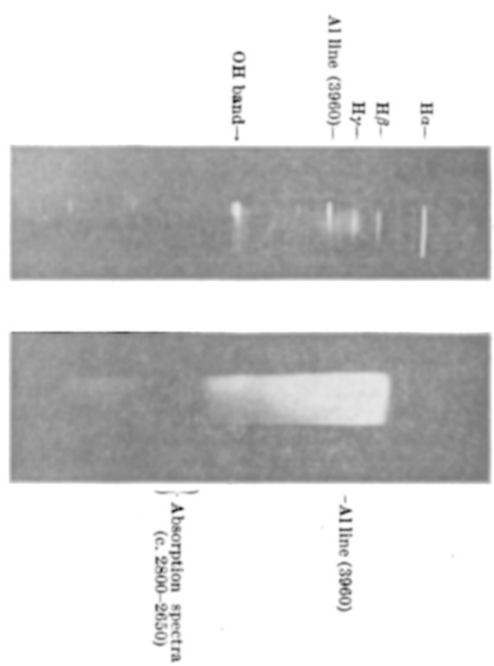

Fig. 2. Above, spectrum of corona of water vapour electric discharge tube; below, spectrum of white corona produced by increasing the crest value of the impulse voltage.

In short, there are two types of impulse corona in water; one pink in colour, obtained in the case of a rather longer impulse voltage, and the other white, in the case of a shorter impulse.

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