plate the leaf system has lost a definite quantity of electricity, and the times between such contacts under different conditions are a measure of the corresponding ionizations. When the whole is projected upon a screen the effects are readily followed by a class.

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A VARIABLE HIGH RESISTANCE OF INDIA INK ON PAPER.¹

BY FRANZ A. AUST.

INDIA ink rulings on a strip of paper make a convenient form of resistance for regulating the voltage or current from a static machine and for other small current high potential work. The maximum resistance is limited by that of the paper used. A range from .01 megohm to 20,000 megohms is readily obtained on a single strip of paper 3 by 45 cm. The paper strip is stretched between two insulating supports at one of which the high potential terminal is attached. A slide giving a metallic contact with the paper strip forms the second terminal. When the strip is made of drawing paper the current which may be passed through it is limited to about .2 milliampere, but if asbestos paper is used currents as high as 25 milliamperes may be employed with strips only 3 cm. wide.

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EFFECT OF WAVE FORM UPON INCANDESCENT LAMPS.¹

BY M. G. LLOYD.

IT is shown on theoretical grounds that the power consumption, the candlepower and the life of incandescent lamps depends upon the wave form of the current or voltage used to operate them. The magnitude of the effect depends upon the heat capacity of the filament and upon the frequency, as well as upon the wave form. A typical case chosen for illustration was between sinusoidal current and continuous current. With metal filaments the power consumed is less with alternating current, while with carbon it is greater. In both cases, however, the candlepower is greater with alternating current, and the life is shorter. Experimental investigation indicates that at frequencies of sixty cycles or higher the effects will not be appreciable with commercial lamps, and even at twenty-five cycles the heat capacity of carbon is sufficiently high to prevent observable effects. With a twenty-five watt, 120-volt tungsten lamp at twenty-five cycles the power consumption was found to be 0.16 per cent. less with alternating current than with direct current, whereas the candlepower was 1.6 per cent. greater.

¹Abstract of a paper presented at the Minneapolis meeting of the Physical Society, December 27-30, 1910.