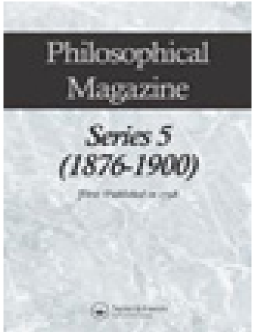

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On a kind of electrical current produced by ultra-violet rays

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surface of the mirror from the effects of the spark, a thin plate of quartz was placed in front of it. It was found that the copper mirror showed no limit of selective absorption by reflexion for wave-lengths of light produced by burning copper at the limits of the copper-spectrum, that is, at wave-length 2100. The photographic plate taken by this method showed all the lines that the plates showed which were taken by the direct light of the spark unreflected and unabsorbed by any medium. The palladium mirror was substituted for the copper mirror, and also showed no limit of selective absorption above wave-length 2100. We are led to conclude, therefore, that the metallic surface of the speculum metal upon which the lines are ruled which form the diffraction-grating does not fix by selective absorption the limit of metallic spectra at 1800 to 2100. This limit more likely resides in the materials forming the sensitive emulsion with which the sensitive plates are coated. We have found that a marked difference exists in different emulsions in regard to sensitiveness to ultra-violet light. The various staining processes, which enhance to such a marked degree the sensitiveness of photographic plates to wave-lengths of greater length, do not seem to affect the limit of metallic spectra in the ultra-violet. Thus, plates stained with erythrosine, which are extremely sensitive to yellow and green light, continue to give the same limit in the ultra-violet after staining as they did before they were submitted to the staining process.

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ON A KIND OF ELECTRICAL CURRENT PRODUCED BY ULTRA-VIOLET RAYS. BY M. A. STOLETOW.

The researches of Hertz, E. Wiedemann and Ebert, and Hallwachs having demonstrated the influence of the ultra-violet rays on electrical discharges of high potential, I conceived the idea of trying if a similar effect could be obtained with electricity of low potential.

Two metal disks, 22 centim. in diameter, are placed vertically opposite each other in front of a lantern with a voltaic arc fed by a dynamo (12 amperes, 70 volts). The disk turned towards the lamp is of wire gauze, the other is solid; the two form a kind of condenser, of which one armature may be illuminated on its internal face through the meshes of the other.

I take any battery, and connect its negative pole to the solid disk and the gauze disk is connected with the positive pole. A Thomson's astatic galvanometer is introduced into the circuit, which is broken by an air-space.

When the lamp is lighted the galvanometer is deflected and remains so; a kind of current traverses the circuit. Any opaque screen, or any kind of glass, placed between the arc and the gauze cause the deflections to disappear; a quartz plate only enfeebles it to a slight extent. The deflection is constant as long as the lamp acts; any irregularity is at once apparent in the changes of current.

If the poles of the battery are reversed there is only a small deflection; it seems that the illumination of the positive armature is not effective.

It is clearly the action of the ultra-violet radiation which produces here the flow of negative electricity, as in the experiments cited, the layer of air acquires a kind of unipolar conductivity.

I have repeated these experiments with batteries of 1 to 100 elements. For two Daniells, the distance of the disks being 2 to 3 millim., the deflections are 30 to 50 divisions, 1 division corresponding to 9×10^{-11} amperes. With 100 zinc-water-copper elements traces of a current are obtained even with disks separated by 10 centim.

Cleaning the solid disk increases the effect. The intensity of the arc has great influence. In order to investigate the laws of the phenomenon the arc must be kept constant and the comparisons be made as quickly as possible.

By observing these precautions I arrive at the following conclusions;—

(1) If the surface illuminated is diminished (by covering $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$ of the gauze with a screen) the current diminishes in proportion.

(2) When the distance l of the disk is varied the current varies also; but it is not inversely proportional to l, and it seems rather to follow the law $i = \frac{E}{a+bl}$.

(3) When the electromotive force E which charges the disk is increased the current constantly increases; so long as E is small (to two Daniells) it is proportional to it, and then increases more slowly. The apparent resistance of the layer of air seems thus to increase with the electromotive force.

If the two disks are of different metals, their electrical difference must be allowed for in estimating the electromotive force. The proportionality of i to the *external* electromotive force is then masked by the difference in question. If the *total* electromotive force makes the solid disk positive there is no effect.

This suggested to me the idea that a current might be obtained in any circuit even *without a battery*, provided the gauze be of a metal more positive than that of the solid disk. Thus, with a disk of perforated zinc as gauze, and a solid disk of silvered copper, I obtained a current. This is a kind of element where the illuminated air takes the place of liquid, and which acts as long as the illumination lasts, the current being maintained at the cost of the radiant energy. When the two disks are brought closer until they finally touch, the current increases to a certain limit, it then passes through zero, and changes its sign (thermoelectric effect).

By comparing the current in the condenser zinc-silver with that which one Daniell produces, I have arrived at a value of 0·97 to 1·06 volt for the difference Zn/Ag. This is accordingly a *galvanometric* method, for comparing the electric differences of metals, which seems to give results agreeing with those of ordinary methods.

It would be interesting to extend this research to different gases and at various pressures. The method started enables us to investigate the electrical effects of radiation under conditions which are much simpler, and more accessible to measurement, than in the experiments of the authors cited above*.

The effect of the voltaic arc is enormously increased by introducing certain metals; among those which I have tried, aluminium is the most effective; then come zinc and lead. These, I think, are the metals of which the ultra-violet spectrum is richest; it is also to be observed that they are the most positive metals in Volta's series.

I have made some experiments by another method. Having charged my gauze condenser by a battery, I leave it insulated under the action of the rays for some time, and I then measure the discharge-current. In order to increase the charge and retard the loss due to the rays, a large and known capacity (standard mica condenser) is joined to the illuminated condenser. In this way the resistance of the layer of air may be calculated; the results are in agreement with those obtained by the first method. If the disks are of different metals, the effect of the rays tends to equalize their potentials; and by connecting the two armatures by the galvanometer, after a sufficient time a charge-current is obtained corresponding to the electrical difference of the metals.—*Comptes Rendus*, April 16, 1888.

INVESTIGATIONS ON THE INFLUENCE OF MOISTURE ON THE LENGTH OF CERTAIN WOODS, AND IVORY. BY RUDOLFF HILDEBRAND.

The results of this research are summed up by the author as follows:—

(1) Within certain limits, the length of woods in the direction of their fibres depends on the proportions of water in the cell-wall, and with an absorption of water amounting to 20–30 per cent. the increase of length may amount to 0·1 to 2 per cent., according to the kind of wood.

(2) The woods are shortest when all water is withdrawn from them.

(3) Dry woods are highly hygroscopic.

(4) Woods attain their greatest length by absorbing water from air charged with it, or by complete soaking with water.

* This Note was written before I knew of a recent research of M. Arrhenius (Wiedemann's *Annalen*, No. 4, 1888), who obtains analogous results by working either with *phosphorescent air*, which forms part of an electrical discharge-tube, or with rarefied air illuminated from the outside. The method of M. Arrhenius is not delicate enough for pressures above 20 millim., and it does not bring out the difference in the function between the two electrodes of the current in air.

Compare also Phil. Mag. [5] vol. xxv. p. 314 (Ed. Phil. Mag.).