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For THE CANADIAN ENGINEER.

THE NEW PHOTOGRAPHY.

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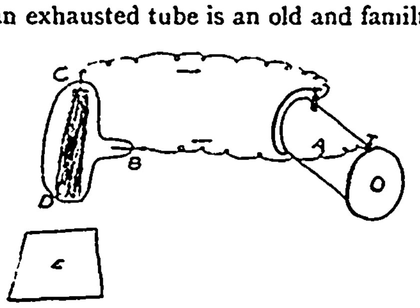
The new process of picture-making is the remarkable discovery of W. C. Roentgen, Professor of Physics in the University of Wurzburg, Germany; and though the original account of the method was first published in December, 1895, it is now known everywhere. For the reason of this we do not have to seek far. The apparatus used is very simple, and is possessed by almost every reputable institution of higher education; also, the results are so striking and sensational that even the daily newspapers have found it a very fertile source for paragraphs.

The apparatus required consists of a good-sized induction coil, a well-exhausted glass tube and the ubiquitous photographic dry-plate.

The experiment of discharging an induction coil through an exhausted tube is an old and familiar one.



By way of illustration, let us consider the tube *BCD* (Fig. 1), which is one of the many shapes in which they are made. The induction coil is shown at *A*. The platinum wire *B* fused into the glass, whereby the current enters, is known as the *anode*; that where the exit takes place, *C*, is the *cathode*. It will, of course, be remembered that the use of these terms is not confined to vacuum tubes. Perhaps some one may think that as the coil gives an alternating electromotive force, there can be no fixed anode and cathode, but that the current will first enter at *B*, then at the next alternation at *C*, returning to *B*, and so on. But the electromotive force generated at *break* of the primary is much greater than at *make*, and only the former gives an effective discharge. This fact can be easily proved by receiving the shock from a small coil as the primary is slowly interrupted by hand; the effect at "break" will be much stronger than at "make." This effective discharge then enters at *B* and comes out at *C*. Anode means the *path up to* and cathode the *path away from*.

If the air in *BCD* is at ordinary atmospheric pressure, the discharge from *B* to *C* will be of the ordinary jagged, noisy kind. However, as the gas is removed, the character rapidly changes. The crackling noise is absent, and between the electrodes beautiful colored ribbons or striæ occur. These vary with the gas as well as with the pressure, and for exhibiting them, the tube is very generally a cylinder quite long in proportion to its diameter, with electrodes at each end. Such tubes are usually called after Geissler, of Bonn, who first constructed them. For different gases, the pressures at which the discharge takes place most easily, or for which the striations are most beautiful, are by no means uniform; but usually they are a few millimetres of mercury. Frequently the glass is of a sort which will fluoresce when the discharge strikes it.

Dr. William Crookes, the editor of the *Chemical News*, London, made a series of remarkable experiments on these vacuum tubes. On pushing the exhaustion beyond the point at which the best effects of stratification are produced, he found the nature of the phenomena changed entirely. When the rarefaction is very great, about a millionth of an atmosphere, rays are shot out from the cathode, in a direction approximately at right angles to it. In figure 1, the cathode is a small platinum disc, from which the rays are projected against the opposite end *D*. These rays can be focused by a concave mirror within the tube, and can produce intense heating effects—great enough to fuse platinum or melt the tube. On striking the glass they produce brilliant fluorescence. The position of the anode is immaterial, the discharge being always in straight lines from the cathode, with no deviation to suit the shape of the tube. The exhaustion has been reduced, in some cases, to one-twentieth of a millionth of an atmosphere.

Crookes stated his belief that these rays consisted of molecules charged with electricity and shot off at great velocity. This view has not been accepted by all physicists, Hertz amongst others disagreeing, but recent evidence has appeared to support it. The researches of Prof J. J. Thomson,* of Cambridge, lead him to think that these rays are charged *atoms*; and to the French Academy of Sciences on Dec. 30, 1895, M. Jean Perrin†

* See J. J. Thomson—*Recent Researches in Electricity and Magnetism*, chap. 2 Oxford, 1893.

† Translation of paper in *Nature*, January 30, 1896.