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THE ULTRA-VIOLET RAYS.

The engineering profession at large, and persons who have had no occasion to investigate the subject, appear to regard the rays of light as the only manifestation of the disturbance in the ether which causes the human eye to perceive and distinguish colors; this is not correct, as of late many other varieties of "rays" have been isolated and found to possess qualities vastly different from light rays. Among the latter to be isolated and examined are the ultra violet rays which have their sphere of motion at the extreme violet end of the spectrum.

The rays which are commonly called "light" are composite, being formed of seven rays which move with a sufficient relaxation to affect the optic nerves; these seven are red, orange, yellow, green, blue, indigo and violet.

The first important manifestation of these auxiliary rays were noticed by Professor Roentgen. This gentleman, not understanding their characteristics, gave them the now familiar name of X rays. As is well known, the feature of these rays which causes them to be so useful, is that of piercing many substances opaque to ordinary light rays. The X ray, however, moves at such an astounding speed as to be entirely unnoticed by the optic nerves, and in order to retard this enormous speed a screen of basium platinocyanide is placed between the object pierced and the human eye. These rays, in common with ordinary light, cast well defined shadows.

Prof. Roentgen, in his original memoir on "A New Kind of Rays," remarks that a kind of relationship between the X rays and light rays appears to exist; at least the formation of shadows, florescence, and the production of chemical action point in this direction. It has been known for some years that, in addition to the transverse vibrations which account for the phenomena of light, it appears that longitudinal vibrations may exist in the ether, and, according to the view of certain physicists, must exist. It is granted that their existence has not yet been made clear, and their properties are not experimentally demonstrated. It is a question if the new rays should not be ascribed to longitudinal waves in the ether.

The next discovery of importance in this direction was made by the Curies when they reached the source of certain radiations in discovering and isolating radium. Although these persons are justly credited with discovering and isolating the salts of radium, they cannot be credited with the prior discovery of the radiations. This honor must go to Prof. Henri Becquerel, who was following up the work of Prof. Roentgen when he became aware, accidentally, that certain inorganic substances, supposedly uranium, were capable of evolving emanations which conducted themselves in a degree, similar to the X rays. Subsequent investigation by Prof. and Madame Curie disclosed the fact that these emanations proceeded from certain impurities previously unknown, which were regarded as a residue in the distillation processes to which the uranium and salts of that element were subjected. These impurities were later found to be three undiscovered elements, and were given the name of polonium, actinium, and radium. Of these radium is by far the most active.

Professor and Madame Curie have determined the atomic weight of radium and find it to be 225. Radium, although considered an element, has not, up to recently, been isolated in the elementary condition; all experiments are carried out with the chloride or bromide.

The radiations from radium appear to possess the property of disintegrating organic tissue. A small quantity of radium introduced beneath the skin of a mouse near the spinal column, produced speedy death from paralysis. However, although this action is known, it is safe to say that no definite concise understanding of the destructive or medicinial properties of this element have been acquired.

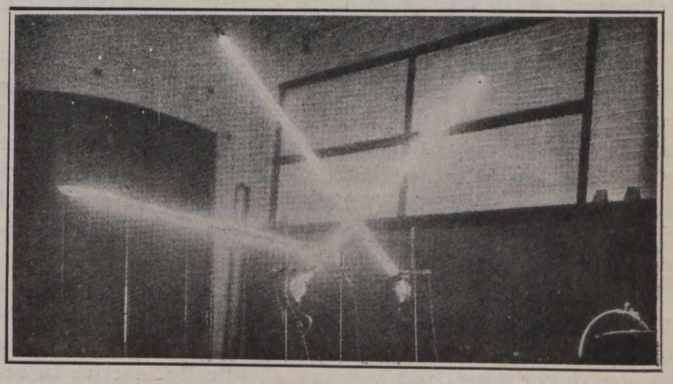

Fig. 1.

Through the development of the mercury vapor lamp it was found possible to produce ultra-violet rays in such a form that they could be experimented with. The lamp which is generally used in a modification of the Copper Hewitt lamp illustrated in Fig. 1. In this apparatus a small quantity of mercury is confined in a glass tube, which is exhausted of air to a considerable extent. Metal electrodes protrude at the extremities, and when the current is led to the lamp the tube is tilted, allowing the mercury to strike an arc, the heat and flash which follows vaporizes the mercury or a portion of it. From the mercury in the vaporous condition come the ultra violet rays, so deadly to bacteriological and low forms of organic life.

The light is deficient in the longer wave lengths, or red. The lack of the longer wave lengths results in an unpleasant distortion of color. The ordinary glass tube allows the blue and violet rays to pass, but is entirely absorbent of the extreme violet (ultra violet) rays. To bring these rays outside, the tube must be constructed of quartz.

To construct a piece of physical apparatus of fused quartz is an extremely difficult operation, owing primarily to the enormous heat necessary—2,000° C. (3630° F.)—and the difficulty of procuring a substance that will manufacture into a suitable crucible.