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H. JANCKE ET AL

2,291,965

ELECTRICAL DISCHARGE DEVICE

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Fig. 1.

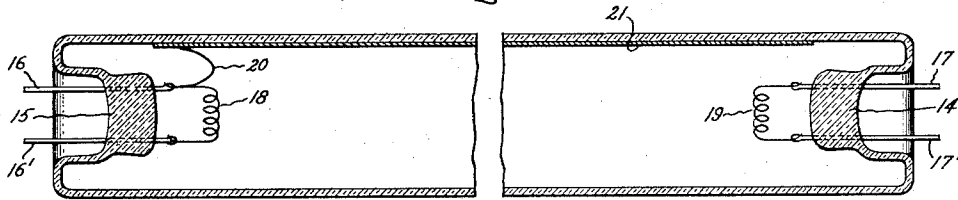


Fig. 2.

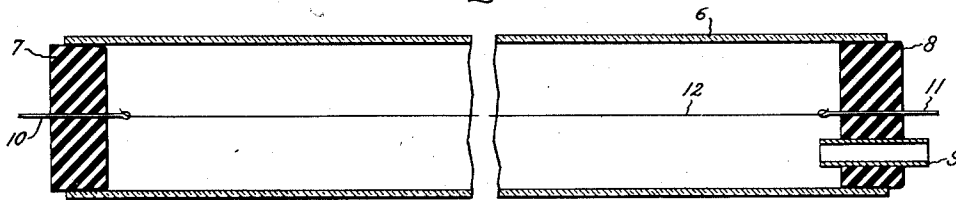


Fig. 3.

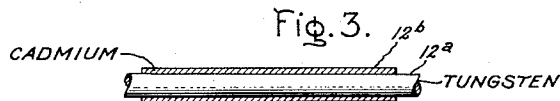


Fig. 4.

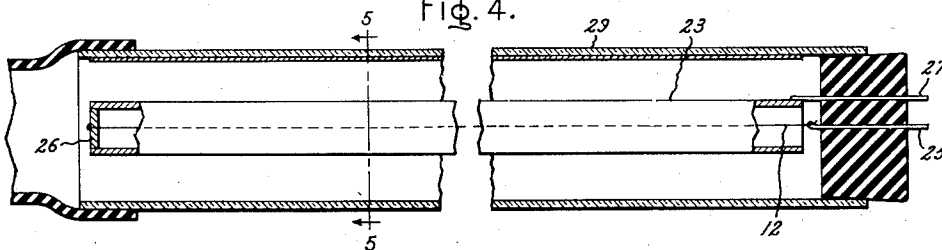
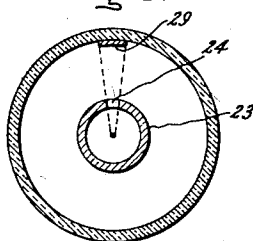


Fig. 5.



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UNITED STATES PATENT OFFICE

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ELECTRICAL DISCHARGE DEVICE

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5 Claims. (Cl. 176—122)

The present invention comprises an improved electrical discharge device which is provided with a novel conductive coating for facilitating starting and also a method of providing such device with such coating.

It is known to facilitate the ignition of electrical discharge devices, such, for example, as lamps and rectifiers, by means of conducting coatings which may be connected to one or both electrodes or which may extend over a considerable part of the envelope wall even without being connected to an electrode. In order that the light emission should not be reduced, it has been suggested to employ thin, transparent coatings of metallic or metalloidal materials. Transparent metallic coatings are difficult to produce because of the unusual thinness required, and the required uniformity, especially as to resistance values. Furthermore, the tendency of alloy formation of metal coatings with the vapor-forming metal in such devices interferes with functioning of such devices. In the case of metalloidal coatings, it is impracticable to produce the required continuity throughout the length of the coatings. For these reasons these suggestions have not been of practical significance.

In accordance with our invention, these disadvantages are avoided by constituting such ignition-facilitating coatings of cadmium oxide, which possesses good electric conductivity at room temperature, forms readily in thin layers free from discontinuities, and alloys with mercury or other vapor-forming metals. A marked advantage of transparent cadmium oxide coatings is ascribable to the fact that cadmium oxide, because of its high work function, obviates any deleterious short-circuiting of the discharge.

In the accompanying drawing, Fig. 1 is a longitudinal section of an embodiment of our invention in a discharge device containing thermionic electrodes; Fig. 2 is a longitudinal section of an apparatus for producing a coating by vaporization from wire which is shown greatly enlarged in Fig. 3; Fig. 4 is a longitudinal section of a modification for producing a coating over a restricted part of the container, and Fig. 5 is a cross-sectional taken on lines 5—5 of Fig. 4.

The coating of cadmium oxide on a device such as shown in Fig. 1 may be produced as follows:

Metallic cadmium first is vaporized in the envelope and caused to be deposited uniformly on the interior surface of the envelope forming a thin cadmium mirror. This metal layer is subsequently oxidized to form a transparent cadmium oxide coating. For example, a very thin

coating of metallic cadmium can be produced on the interior of tubing which is to be used for the fabrication of electrical discharge devices. The metallic cadmium subsequently is oxidized to form cadmium oxide.

Fig. 2 shows a tube 6 of glass quartz or other vitreous material into which are inserted temporary sealing plugs 7, 8 of rubber or other suitable material as well known in the art. The plug 8 contains a tube 9 which can be used for exhaust purposes. Plugs 7, 8 are provided with electrical conductors 10, 11 between which is mounted a wire 12 consisting of a suitable refractory metal upon which a layer of cadmium has been deposited. The wire 12, as shown in Fig. 3, includes a core 12a, which may conveniently consist of tungsten, and which has been provided with a layer 12b of metallic cadmium, the latter being deposited in any convenient way, for example, by electrolysis.

The interior of the tube 6 is thoroughly exhausted and then the wire 12 is heated to a temperature at which the cadmium is vaporized and deposited as an exceedingly thin layer on the interior of the tube 6. If desired, the vaporization of the cadmium may occur in an inert gas as, for example, a mixture of argon and nitrogen. Upon the deposition of the cadmium, the interior of the tube 6 is filled with an oxidizing gas such as oxygen or a gas containing oxygen, and is then heated, causing oxidation of the cadmium deposit to cadmium oxide, which is substantially transparent. The faint yellowish color of the coating does not substantially reduce the light emission of the lamp and the coating need not cover the entire interior surface of the lamp. Part of the coating may be removed mechanically or chemically or its deposition may be restricted as will be shown.

As shown in Fig. 1, tubing thus provided with a coating of cadmium oxide can be fabricated into an electrical discharge device. Stems 14, 15, respectively containing leading-in wires 16, 16' and 17, 17' are sealed into the ends of the coated tubing. Mounted upon the leading-in wires are thermionic cathodes 18 and 19, which may be of the activated type, that is, being coated with a material suitable for enhancing electron emission. A conductor 20 makes contacts respectively from the electrodes 18 to the conductive interior coating 21 consisting of cadmium oxide.

If it is desired that the coating of cadmium oxide should be deposited only as a restricted strip upon the interior of the tubing then, as shown in Fig. 4, the wire 12 is surrounded by a

shield 23 of metal or other suitable material which (as shown in Fig. 5) is provided with a longitudinal opening 24. The wire 12 is connected at one end to the leading-in wire 25 and at the opposite end to the end wall 26 of the shield 23 which is also connected at the opposite end to a leading-in wire 27. When a current of sufficiently high amperage is conducted through the wire 12 to heat the same to the vaporizing temperature of the cadmium coating therein, then a narrow sector or strip of cadmium is deposited as indicated at 29. This strip of cadmium is oxidized to form the oxide of cadmium as described in connection with Fig. 2.

Tubing thus coated upon the interior with cadmium oxide may be fabricated into lamps or other devices and provided with suitable electrodes; one of which may be connected to the strip. Usually it is preferable to have only one of the electrodes connected to the strip. As already indicated, beneficial results can be obtained by the conductive strip even though it is unconnected to the electrodes of the device. The discharge devices, embodying our invention, for example, electric lamps, such as shown in U. S. Patents 2,030,805 and 2,103,093, may contain the usual gas and vapor fillings and may be operated at low or high pressures.

What we claim as new and desire to secure by Letters Patent of the United States is:

1. An electrical discharge device which is provided with electrodes and having a thin continuous coating of cadmium oxide deposited upon the interior thereof to facilitate starting of a discharge between said electrodes.

2. An electrical discharge device which comprises the combination of a tubular container,

electrodes sealed therein and a thin continuous coating of cadmium oxide on the interior of the container extending from one of said electrodes to the vicinity of another electrode to facilitate starting of a discharge between said electrodes.

3. An electrical discharge device comprising an elongated tubular container, electrodes therefor sealed into opposite ends of the container, a thin continuous conductive strip of cadmium oxide deposited upon the interior wall of the container and extending longitudinally from the vicinity of one electrode to the vicinity of another electrode to facilitate starting of a discharge between said electrodes.

4. An electrical discharge device comprising an elongated tubular container of vitreous material, electrodes at opposite ends of said container, and a thin continuous conductive strip of cadmium oxide on the interior wall of said container, said strip being electrically connected to one of said electrodes and extending longitudinally to the vicinity of the other electrode to facilitate starting of a discharge between said electrodes.

5. An electrical discharge device comprising an elongated tubular container containing a discharge supporting atmosphere comprising a metallic vapor, electrodes therefor sealed into opposite ends of the container, a thin continuous conductive strip of cadmium oxide deposited upon the interior wall of the container and extending longitudinally from the vicinity of one electrode to the vicinity of another electrode to facilitate starting of a discharge between said electrodes.

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