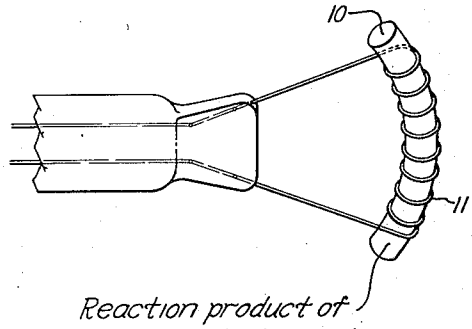
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CATHODE FOR DISCHARGE DEVICES

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Reaction product of alkali earth chromate or aluminate and reducing agent.

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## CATHODE FOR DISCHARGE DEVICES

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7 Claims. (Cl. 250—27.5)

My invention relates to cathodes of electric discharge devices and especially of devices wherein, in full operation, the discharge is an unconstricted low-pressure arc discharge and not a high-pressure arc discharge with a constricted column. However, since a high-pressure discharge usually starts as a low-pressure discharge, the use of the invention in high-pressure discharge devices is not excluded. A cathode means, as usual, an electrode which acts as cathode during some part of the operation of the device. If the device is operated from an alternating supply, the cathode will usually act as anode during some part of the cycle.

Low-pressure arc discharge devices, for example commercial lamps coated on their interior surface with luminescent materials and operating on ordinary supply voltages, are usually provided with activated cathodes heated independently of the discharge during the starting period, though they may be heated by the discharge alone when in full operation. It is necessary to heat the cathodes independently during the starting period, because otherwise the glow discharge, which first passes, does not transform itself into an arc unless the applied voltage is undesirably high. An object of this invention is to provide a cathode which permits this transformation to occur with lower applied voltages than must be used with the cathodes used hitherto.

The drawing shows in perspective one form of electrode embodying the present invention.

According to the invention the cathode of an electric discharge device consists of a pellet, shown at 10 in the drawing having considerable electrical conductivity, prepared by heating, within the discharge envelope and during the manufacture of the device, a mixture of a not too easily reducible compound of an alkali earth metal like strontium, or preferably barium, with a not too easily volatile reducing agent and, preferably, a binder.

The compounds preferred are barium aluminate ($BaAl_2O_4$) or barium chromate ($BaCrO_4$). The reducing agents preferred are silicon, zirconium, or commercial ferro-titanium containing some 12 per cent of aluminum. Aluminum alone is usually less suitable on account of its volatility.

The reducing agent should be in considerable excess, so that after the reduction the remainder of it makes the pellet highly conducting. If the reducing agent does not react readily with water (e. g. silicon) potassium waterglass may be used as a binder. If (like zirconium) it does react with water, an organic binder may be used, for example a solution of ethyl cellulose. A pellet 10 prepared from the mixture is preferably placed within a tungsten helix 11 which serves as its support and can be heated during the manufacture of the device so as to cause the compound and the reducing reagent to react. The pellets, before they are heated, are perfectly stable and may be preserved for long periods in a stoppered bottle. If zirconium is the reducing agent, the pellet must not be heated above 300° C. in the sealing-in of the cathode in order that it may not burn in air. The other reducing agents named are less liable to burn.

The merit of cathodes according to the invention appears to arise largely from the roughness of their surface, which leads to the concentration of the glow discharge on one or a few spots and avoids its spreading over a large area, and from their high electrical conductivity.

One method of preparing a cathode according to the invention will now be described by way of example. Powdered barium aluminate is mixed with an equal weight of zirconium powder; to the mixture is added 15 per cent by weight of a binder consisting of 17 gm. of ethyl cellulose, 3 gm. of castor oil, and 140 ml. of toluene. The resulting paste is formed into a pellet which is dried, placed within a tungsten spiral and introduced into the discharge device. At a suitable stage in the pumping of the device, the tungsten spiral is heated to a temperature (about 1000° C.) high enough to cause the zirconium and barium aluminate to react, but not much higher than is necessary for this purpose.

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

1. The method of manufacturing cathodes for electric arc discharge devices which comprises mixing together the powders of a difficultly reducible compound selected from the group consisting of the aluminate and the chromate of an alkali earth metal and an excess of a difficultly volatile metallic reducing agent, and then heating the mixture to cause a reaction of the ingredients whereby, after the reduction, the remainder of the metallic reducing agent makes the mass highly conductive.

2. The method of manufacturing cathodes for electric arc discharge devices which comprises mixing together the powders of a difficultly reducible compound selected from the group consisting of the aluminate and the chromate of an alkali earth metal and a difficultly volatile metallic reducing agent selected from the group

consisting of silicon, zirconium and ferro-titanium containing about 12 per cent of aluminum, and then heating the mixture to cause a reaction of the ingredients.

3. The method of manufacturing cathodes for electric arc discharge devices which comprises mixing together approximately equal weights of powdered barium aluminate and zirconium powder with a binder, and then heating the mixture to a temperature of approximately 1000° C. to cause the zirconium and barium aluminate to react.

4. A cathode for electric arc discharge devices comprising the reaction product of the powders of a difficultly reducible compound selected from the group consisting of the aluminate and the chromate of an alkali earth metal and a difficultly volatile metallic reducing agent, the metallic reducing agent being present in an amount appreciably in excess of that required to reduce the difficultly reducible compound so that the cathode is highly conductive.

5. A cathode for electric arc discharge devices comprising the reaction product of the powders of a difficultly reducible compound selected from the group consisting of the aluminate and the chromate of an alkali earth metal and a difficultly volatile metallic reducing agent selected from the group consisting of silicon, zirconium and ferro-titanium containing about 12 per cent of aluminum.

6. A cathode for electric arc discharge devices comprising the reaction product of approximately equal weights of powdered barium aluminate and zirconium powder.

7. A cathode for electric arc discharge devices comprising a coil of refractory metal wire containing and supporting a coherent and substantially homogeneous electron-emissive pellet consisting of the reaction product of a powdered compound selected from the group consisting of the aluminate and the chromate of an alkali earth metal and a powdered difficultly volatile metallic reducing agent.

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