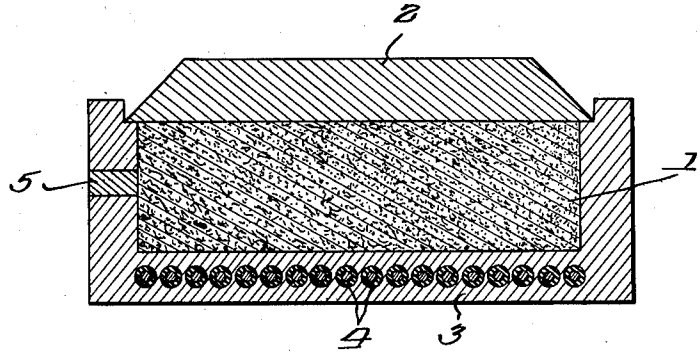
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DISPENSER CATHODE HAVING HEATER EMBEDDED IN DENSELY SINTERED RECEPTACLE WALL

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DISPENSER CATHODE HAVING HEATER EMBEDDED IN DENSELY SINTERED RECEPTACLE WALL

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This invention relates to electrical discharge devices, and is particularly concerned with a dispenser type cathode comprising a body forming the emitting surface and wall means secured thereto forming a receptacle therewith containing a supply of an emissive material which migrates at operating temperature through fine passages in said body to the emitting surface thereof, said receptacle wall being made of densely sintered material which is impermeable to the emissive material, and a heater element embedded in said wall means.

Cathodes provided with a supply of emissive material, which migrates through fine passages in a cathode body forming a retaining wall therefor, are known. The cathode body forming the retaining wall may be a sintered tungsten or molybdenum body. The emissive material may be a thorium or barium substance or corresponding alloy.

The object of the invention is to produce a cathode of this kind which is easy to manufacture, reliable in operation, and which has a long life. This object is realized by the provision of a receptacle wall joined with a cathode body and forming a receptacle therewith from which the emissive material can migrate to the emitting surface of the cathode body, but which is so densely sintered that it is impermeable to the emissive material so as to prevent escape thereof through the receptacle wall. The material of the receptacle wall is of a kind that can be easily secured to or connected with the associated cathode body which is a porous sintered body permeable to the emissive material. The two parts may be connected, for example, by sintering. The receptacle wall may be made of sintered molybdenum or of molybdenum-tungsten and the associated cathode body may be a sintered tungsten body.

The heating of cathodes of the general kind as indicated before often presents difficulties due to the required relatively high operating temperatures. In known indirectly heated cathode structures there is employed a heater which is by spraying covered with aluminum oxide and thereafter sintered. The heater temperature may be very high, because heat has to be transferred by radiation from the heater to the emissive material and to the emitting cathode body, involving heat loss across the vacuum space which separates the heater from the other parts. The high heating of the heater introduces the danger of deterioration of the aluminum oxide.

In order to avoid this danger, the invention proposes, in accordance with another object, to embed in the densely sintered receptacle wall the heater element which may be wire covered with aluminum oxide. The advantage is that the heat is transferred from heater element to the various parts not by radiation but by direct thermal conduction. The heater element which is then throughout its entire extent in intimate heat-exchange contact with the receptacle wall and thus also in heat-exchange contact with the associated porous sintered cathode body, will not assume a temperature appreciably higher than that of these parts, thereby preventing deterioration of the aluminum oxide coating.

The structure also provides for a very favorable temperature distribution, because the temperature of the emissive material can always be maintained higher than that of the emitting surface of the porous cathode body. The heater may be embedded in the densely sintered receptacle wall at a desired depth, relative to the emissive material, so as to obtain favorable temperature conditions for the volatilization or reduction thereof for the purpose of providing for optimal conditions for the spreading of the emissive material upon the emitting cathode surface.

The heating wire is in the production of the cathode provided with an aluminum oxide coating, for example, by spraying, and is then pressure-molded into and with the receptacle wall, and thereafter highly sintered therewith. The porous cathode body forming the retaining wall for the emissive material and also forming the emitting surface is a sintered tungsten body which is tightly connected with the densely sintered receptacle wall by sintering. The emissive material is introduced into the receptacle through a suitable hole in its densely sintered wall thereof after such wall has been joined with the cathode body, and the hole is then tightly plugged.

An example of the invention is in diagrammatic and simplified manner shown in the accompanying drawing, which illustrates only essential parts of a flat cathode.

The emissive material is indicated at 1. The retaining wall 2, which constitutes the cathode body is a relatively thin, flat, porous sintered tungsten member forming an emitting surface which extends over an area several times the thickness thereof. The potlike sintered portion 3 which may be made of molybdenum powder or of a mixture of tungsten and molybdenum powder forms with the cathode body 2 a receptacle for the emissive material 1. The wall portion 3 is so highly sintered that it is impermeable to the emissive material. The interior cavity formed by the receptacle accommodates an amount of emissive material 1 which is several times the volumetric size of the cathode body 2. The heater, which is embedded in the receptacle wall 3 and sintered therewith, is a spirally wound wire 4 coated with aluminum oxide. It may be embedded only in the bottom wall of the receptacle, as shown, but it is of course entirely possible, and contemplated by the invention, to provide it instead of or in addition thereto in the side wall of the receptacle. The heater may be embedded in the receptacle wall at a desired depth so as to produce in any given case desired differentiated temperature conditions for the emissive material and for the emitting surface of the cathode body 2, respectively. The receptacle is provided with a hole at a suitable place for introducing the emissive material. This hole is thereafter tightly plugged, as indicated at 5.

The discharge device in which the cathode is used comprises of course an evacuated envelope and parts, such as grid and anode means, as well as suitable mounting provisions and terminal conductors which extend in vacuumtight manner to the outside. These parts are well known and therefore have been omitted from the drawing, to keep it simple. The emission is confined to the operationally effective emitting surface of the cathode body.

Changes may be made within the scope and spirit of the appended claims.

I claim:

1. A heated dispenser type cathode for use in an electrical discharge device comprising a receptacle having wall means made of sintered material which is so highly sintered that it is substantially impermeable to vaporized emissive material, a porous vapor-permeable sintered cover member tightly substantially vapor-impermeably sintered to said vapor-impermeable wall means of said receptacle and forming a cavity therewith containing emis-

sive material, the outside of said vapor-permeable cover member forming the emitting surface of said cathode, and an electrically insulated heater element completely embedded in part of said receptacle wall in heat conductive relationship thereto, means for heating the receptacle formed thereby and the emissive material contained therein and the cover member sintered thereto solely be thermal conduction to cause migration of said emissive material substantially solely through said porous vapor-permeable cover member to the emitting surface formed thereby.

2. A cathode according to claim 1, wherein said vapor-impermeable wall means of said receptacle is made of

sintered molybdenum and said vapor-permeable cover member of sintered tungsten.

3. A cathode according to claim 1, wherein said heater element is embedded in a wall of said retaining member at a depth which provides predominantly for direct heat transfer through the corresponding wall to the emissive material contained in said cavity.

References Cited in the file of this patent

UNITED STATES PATENTS

2,121,589	Espe	June 21, 1938
2,543,728	Lemmens et al.	Feb. 27, 1951
2,673,277	Lemmens et al.	Mar. 23, 1954