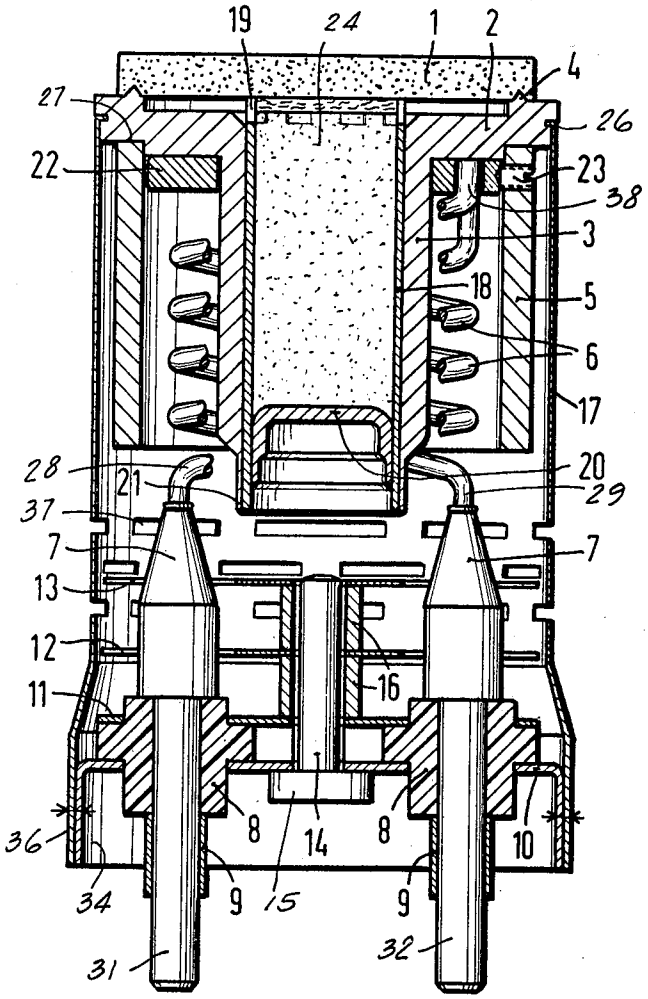
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INDIRECTLY HEATED SUPPLY CATHODE

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INVENTOR
ERWIN HÜBNER
ARNO HINCKELDEY

BY Hill, Sherman, Meroni, Gross & Simpson ATTORNEYS

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INDIRECTLY HEATED SUPPLY CATHODE

Erwin Hübner and Arno Hinckeldey, Munich, Germany, assignors to Siemens Aktiengesellschaft, a corporation of Germany

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U.S. Cl. 313—346 8 Claims

ABSTRACT OF THE DISCLOSURE

An indirectly heated dispenser cathode which is not subject to electrolysis deterioration which has a pair of coaxially mounted thick wall cylinders of good heat-conductive material and between which is mounted a cylindrical heating coil. A wide flange is connected to the heating coil and is in engagement with a connected portion between the two coaxial cylinders to obtain good heat conduction between the coil and the coaxial cylinders. A thin foil cylinder supports the cathode structure and is formed with slots for keeping the heat in the active portion of the cathode. A porous carrier disk upon which is formed an emission layer is connected to the front end of the cathode and is attached to a supply emitting element which extends into the inner coaxial heating cylinder.

Field of the invention

This invention relates in general to indirectly heated dispenser cathodes and particularly to an MK cathode for electrical discharge vessels.

Description of the prior art

Prior art indirectly heated dispenser cathodes have comprised heating elements which are covered with an insulating coating and which are then encapsulated into the cathode body with a plastic material which has a good heat transfer characteristic. Such cathodes are widely used in traveling wave and disk tubes. They operate satisfactorily when the heater is energized with AC voltage; however, DC voltage between the heating element and the cathode causes electrolysis in the plastic insulating material and can result in breakdown of the cathode. The plastic encapsulating material commonly used in the prior art dispenser cathodes is aluminum oxide. The disintegration of this material may lead to a complete short circuit between the heater and the cathode to cause tube failure. The rate of electrolysis within the plastic insulating material varies as an exponential function of temperature, and if the cathode temperature is operated at 20° C. above its conventional operating temperature, the insulation may break down and the tube will not last for its guaranteed period.

For detailed discussion of Metal Capillary Cathodes of the MK type reference may be made to the article entitled Metal Capillary Cathodes in the Journal of Applied Physics, vol. 24, No. 5, pages 597–603 of May 1953.

SUMMARY OF THE INVENTION

The present invention comprises an indirectly heated dispenser cathode particularly of the MK type in which the heating coil is not coated with insulation material nor is the heating coil encapsulated into a plastic such as aluminum oxide as is done with conventional indirectly heated supply cathodes. A pair of coaxial concentric thick-walled cylinders of high heat conductivity such as molybdenum are joined together at one end with a wide flange

to which the heater is attached to provide uniform heat distribution. The porous emission carrier disk is attrached to the end of the coaxial cylinders and the inner coaxial cylinder is hollow and receives the supply receptacle of the mushroom-shaped cathode carrier. A thin foil cylinder is connected to the thick-walled coaxial cylinders and supports the cathode. The thin-walled cylinder is formed with slots which extend concentrially about its surface to prevent heat from traveling away from the cathode-emitting area.

The structure of the cathode is such that the heater and its related structure can be installed and tested before installing the carrier disk and the carrier.

Other objects, features and advantages of the present invention will be readily apparent from the following detailed description of certain preferred embodiments thereof taken in conjunction with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

The figure illustrates an indirectly heated supply cathode according to the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The figure illustrates the indirectly heated supply cathode and comprises an outer thin-walled foil cylinder **17** into which is mounted at one end thereof, **36**, a supporting disk **10** that has a flange **34** which is connected to the portion **3** of the foil cylinder **17**. The disk or base plate **10** supports a pair of insulating bushings **8** through which extend leads **31** and **32** for supplying electricity to the heater. The conductive pins **31** and **32** are formed with enlarged portions **7** and are surrounded by metal bushings **9** adjacent the bushings **8**.

Radiation panels **11**, **12** and **13** are spaced from each other by spacers **16** and are supported from the base plate **10** by a pin **14** which has a head **15**.

Concentric slots **37** are formed in the foil cylinder **17** to improve the heat efficiency of the cathode.

The pins **7** are connected to the ends **28** and **29** of a heater coil **6** which extends upwardly from the pins **7** relative to the figure. The upper portion **38** of the heater coil **6** is attached to a clamping ring **22**. The heating element **6** is mounted between a pair of thick-walled heat-conducting cylinders **3** and **5** that might be made of molybdenum, for example. The cylinders **3** and **5** are joined at the upper ends relative to the figure by portion **2**, and a set screw **23** is mounted in the wall of the cylinder **5** and engages the clamping ring **22**.

A groove **26** is formed in the portion **2** and the thin foil cylinder **17** is received in the groove **26** to support the cathode structure.

A ridge **4** is formed about the portion **2** and the emission material carrier disk **1** is attached to the ridge **4**.

A supply receptacle which is formed into a mushroom-shaped thin-walled cylinder **18** is mounted within the central opening of the cylinder **3** and is formed with an end cup **20** which is attached to the walls of the cylinder **18**. The supply receptacle cylinder **18** is filled with a suitable active substance **24** for electron emission which supplies the carrier disk **1**. The upper end of the cylinder **18** is flared outwardly, as indicated by numeral **19** and is attached to the emission material carrier disk **1**.

It is seen that the cathode is formed in two parts comprising the actual emission source comprising the mushroom-shaped carrier disk and the thin-walled cylinder **18**. This construction allows the heater element to be constructed and tested before inserting into the mushroom-shaped cathode body and disk **1**. Thus, the cathode may be economically and reliably constructed.

The slots **37** formed in the carrier foil cylindrical jacket **17** in its lower area below the heating coil serve as heat barriers to keep the heat in the electron emitting portion of the cathode. The radiation panels **11**, **12** and **13** aid in keeping the heat in the electron emitting portion also.

In operation an emission-boosting substance like barium for example passes from the supply receptacle through the pores of the porous emission material carrier disk to its surface, and this substance forms the variable emission layer from which the electrons then are emitted. the supply substance thus forms the emission layer.

Although minor modifications might be suggested by those versed in the art, it should be understood that we wish to embody within the scope of the patent warranted hereon all such modifications as reasonably and properly come within the scope of our contribution to the art.

The invention claimed is:

1. An indirectly heated dispenser cathode for electrical discharge vessels comprising

a supporting foil cylinder,

a pair of relatively thick-walled coaxial cylinders of heat-conductive material attached together and to the supporting cylinder,

a self-supporting heater mounted between the pair of coaxial cylinders,

an emission material-carrier of porous high melting metal and a wide emitting area, and

a carrier disk and supply receptacle of mushroom shape containing an emission-boosting substance attached to said coaxial cylinders.

2. An indirectly heated dispenser cathode according to claim **1** comprising a clamping ring attached to the coaxial cylinders and to the heater.

3. An indirectly heated dispenser cathode according to claim **1** comprising a base plate mounted in the supporting foil cylinder at the end away from the carrier

disk, a pair of insulated electrical leads supported by the base plate and connected to said heater, and radiation shielding means mounted in the supporting foil cylinder adjacent the base plate.

4. An indirectly heated dispenser cathode according to claim **3** comprising insulating bushings mounted in said base plate through which said electrical leads extend.

5. An indirectly heated dispenser cathode according to claim **4** wherein said shielding means comprises a shielding disk into which said bushings are mounted.

6. An indirectly heated dispenser cathode according to claim **1** wherein said supporting foil cylinder is formed with slots which extend in the circumferential direction below the heater.

7. An indirectly heated dispenser cathode according to claim **1** wherein said heater is formed into a helical.

8. An indirectly heated dispenser cathode according to claim **1** wherein the supply receptacle comprises a sheet metal cylinder with its end away from the carrier disk sealed and attached to the inner coaxial cylinder.

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JOHN W. HUCKERT, Primary Examiner

A. J. JAMES, Assistant Examiner

U.S. Cl. X.R.

313—337, 345

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,495,122 Dated February 10, 1970

Inventor(s) ERWIN HUBNER and ARNO HINCKELDEY

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 2, line 31, "3" should read --36--.

SIGNED AND
SEALED
NOV 17 1970

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents

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