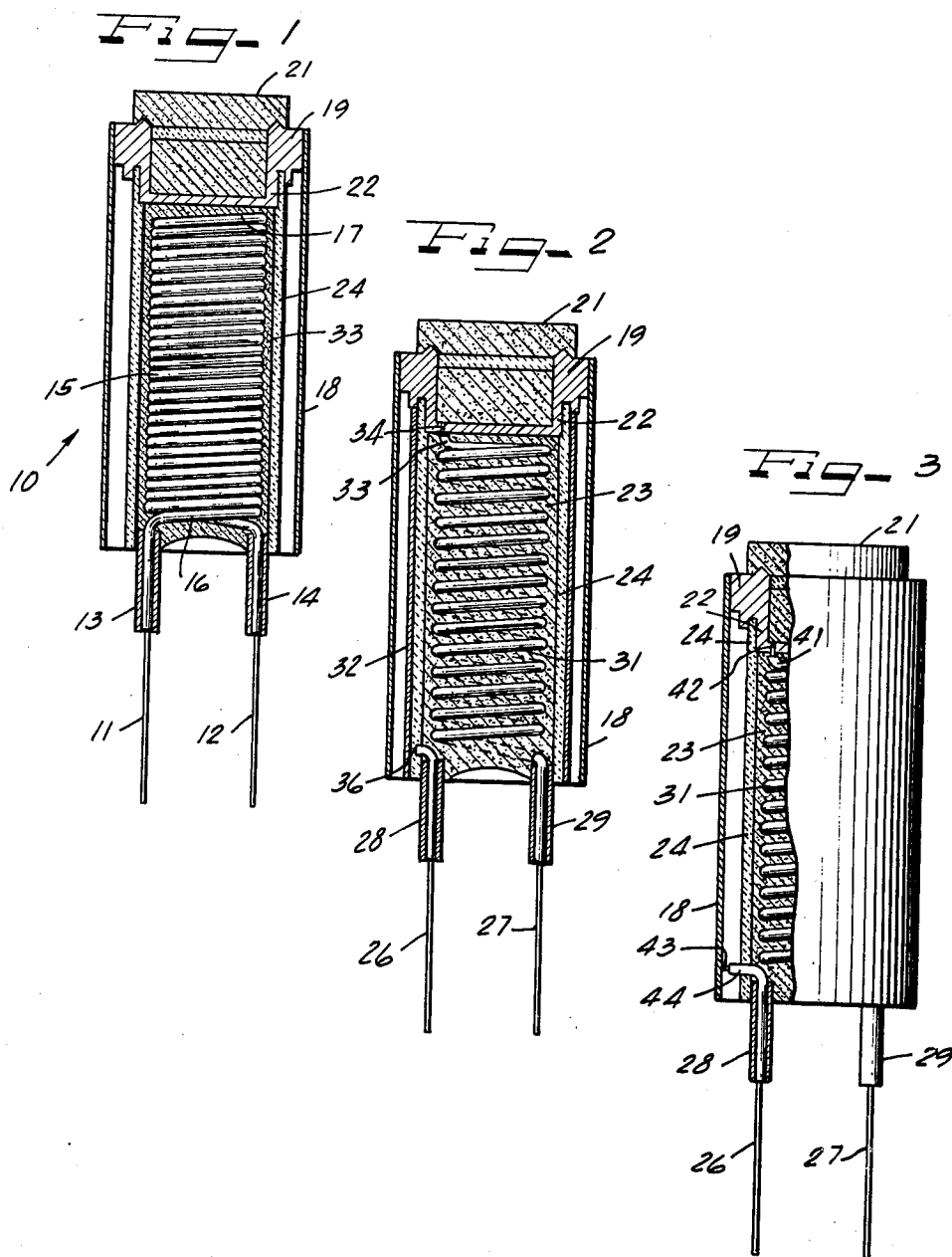


Feb. 10, 1970

H. KATZ
INDIRECTLY HEATED DISPENSER CATHODE FOR
ELECTRICAL DISCHARGE VESSELS
Filed April 3, 1968

3,495,121



INVENTOR.

HELMUT KATZ

BY

Hill, Sherman, Merani, Ross & Simpson

ATTORNEYS

1

3,495,121

INDIRECTLY HEATED DISPENSER CATHODE FOR ELECTRICAL DISCHARGE VESSELS

Helmut Katz, Munich, Germany, assignor to Siemens
Aktiengesellschaft, a corporation of Germany

Filed Apr. 3, 1968, Ser. No. 718,410

Claims priority, application Germany, Apr. 10, 1967,
S 109,263

Int. Cl. H01j 1/14, 19/06

U.S. Cl. 313—346

7 Claims

ABSTRACT OF THE DISCLOSURE

An indirectly heated dispenser cathode comprising a heater coated with an insulation layer which is enclosed by a shell of insulating material as for example, a ceramic of aluminum or beryllium oxide, which is connected to a pot-shaped supply chamber filled with emissive material to provide a new and novel indirectly heated dispenser cathode in which leakage current between the heater and cathode shell is eliminated when connected to a DC source.

BACKGROUND OF THE INVENTION

Field of the invention

The invention relates to an indirectly heated dispenser cathode in which a heater is energized by a DC source.

Description of the prior art

Presently indirectly heated dispenser cathodes such as used in travelling wave tubes and disk seal tube work satisfactory with alternating current, but upon the application of a direct current voltage, electrolytic decomposition occurs during the operation in the insulating material such as aluminum oxide which will result in leakage current between the heater and the cathode shell, thus leading to short circuits between the heater and the cathode.

SUMMARY OF THE INVENTION

The present invention abrogates the disadvantages of the prior art by surrounding the indirectly heated cathode with a ceramic cylinder which is spaced between insulation material around the heater and the thin metallic shield which forms the outer shell of the cathode. The ceramic shielding cylinder which is placed around the indirectly heated cathode eliminates the electrolytic decomposition which occurs conventionally in such structures when energized by a DC source. Various modifications of the invention are also disclosed which eliminate electrolytic decomposition effects.

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 drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a sectional view of the indirectly heated dispenser cathode of this invention;

FIGURE 2 is a modification of the dispenser cathode; and

FIGURE 3 is a further modification of the dispenser cathode.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIGURE 1 illustrates an indirectly heated dispenser cathode 10 which has a pair of electrical input leads 11 and 12 which pass through insulating cylinders 13 and 14 that extend outwardly from the dispenser cathode 10. Within the cathode structure the leads 11 and 12 are cov-

2

ered with a suitable insulation material 16 which might, for example, be aluminum oxide and are formed into a bifilar coil 15. A pot-shaped supply container 19 holds the emissive material 21 which when heated emits electrons. A ceramic cylinder 24 which might, for example, be made of an oxide ceramic such as aluminum oxide or beryllium oxide is connected to the supply container 19 by press-fitting over a collar 22 or by using conventional soldering technique. The heater coil 15 is mounted within the ceramic cylinder 24 and is encapsulated by an oxide material 23 that might be aluminum or beryllium oxide which fills the space between the ceramic cylinder 24 and the heater coil 15. A thin foil cylinder 18 is also attached to the supply container 19 and extends around the ceramic shell 24 but is spaced away from it.

The ceramic shell 24 which is spaced between the metallic shell 18 and the heater 15 allows either alternating or direct current voltage to be applied to the leads 11 and 12 to heat the heater 15 and undesirable electrolytic decomposition effects are prevented because of the isolating qualities of the shell 24. As a result, the potential differences normally present with direct current between the heater and the cathode shell 18 are eliminated.

Even the potentials which at most amount to the heater voltage which might still occur between adjacent turns of the customary bifilar heater winding 15 can be eliminated by the modifications shown in FIGURES 2 and 3.

FIGURE 2, for example, illustrates a single turn coil heater 31 which has a first input lead 27 which passes through an insulating cylinder 29. The other end 33 of the heater end 34 is electrically connected to supply container 19 which is in turn connected to a foil cylinder 32 which is spaced closely adjacent the ceramic cylinder 24 but is spaced from shell 18. A second lead 26 passes through an insulating sleeve 28 and through the wall of the ceramic cylinder 24 and is electrically connected to the end of the foil cylinder 32 adjacent the lead 27 at 36. The foil cylinder 32 in combination with the ceramic cylinder 24 improves heat economy of the cathode and eliminates radiation losses.

It is to be particularly noted that the heaters in FIGURES 2 and 3 are single turn heaters wherein the winding extends within the cylinder 24 from one end to the other and the return is through either the shell 32 in FIGURE 2 or as shown in FIGURE 3 through the outer conductive shell 18. FIGURE 3 illustrates the input leads 26 and 27 which pass through the insulating cylinders 28 and 29 which extend from the cathode. The upper end 41 of the heater 31 has its end 42 connected to the supply container 19. The lead 26 passes through the wall of the ceramic cylinder 24 at 44 and has its end 43 electrically connected to the cylinder 18 of the cathode.

The structure of FIGURE 3 allows the return current to pass through the foil cylinder 18 between points 42 and 43. Likewise in FIGURE 2 the return current passes from points 34 to 36 through the cylinder 32.

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

I claim as my invention:

1. An indirectly heated cathode for an electrical discharge vessel that has a heater and a supply chamber for the supply of emission and which is sealed by a porous emission material carrier disk and which is attached to a supporting cylinder of metal foil comprising, a ceramic cylinder attached to the supply chamber and contained within said supporting cylinder.

2. A cathode as claimed in claim 1 wherein said heater is a bifilar spiral heater.

3

3. A cathode as claimed in claim 1 wherein said heater is a single filament spiral having one end connected to said supply chamber.

4. A cathode as claimed in claim 3 in which an additional metal cylinder is attached to said supply chamber and is mounted between said ceramic cylinder and said supporting cylinder and said additional metal cylinder serves as a supply lead for said heater.

5. A cathode as claimed in claim 1 wherein said ceramic cylinder is formed of aluminum oxide.

6. A cathode as claimed in claim 1 wherein said ceramic cylinder is formed of beryllium oxide.

7. A cathode as claimed in claim 3 wherein said supporting cylinder serves as a supply lead for said heater.

4

References Cited

UNITED STATES PATENTS

2,870,366	1/1959	Vantol	-----	313—346	X
3,056,061	9/1962	Melsert	-----	313—346	
3,421,039	1/1969	Knauer et al.	-----	313—346	X

FOREIGN PATENTS

1,225,314	2/1960	France.
-----------	--------	---------

10 JOHN W. HUCKERT, Primary Examiner

ANDREW J. JAMES, Assistant Examiner

U.S. Cl. X.R.

313—337, 345