United States Patent [19]

Held et al.

[11] **3,758,808**

[45] **Sept. 11, 1973**

[54] **DISPENSER CATHODE AND METHOD FOR MAKING SAME**

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[73] Assignee: **Licentia Patent-Verwaltung S-GmbH**, Frankfurt, Germany

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[21] Appl. No.: **166,453**

[30] **Foreign Application Priority Data**

July 30, 1970 Germany ..... P 20 37 874.9

[52] **U.S. Cl.** ..... **313/346**, 313/341, 313/346 DC

[51] **Int. Cl.** **H01j 1/14**, H01j 19/06

[58] **Field of Search** ..... 313/346 R, 346 DC, 313/341

[56] **References Cited**

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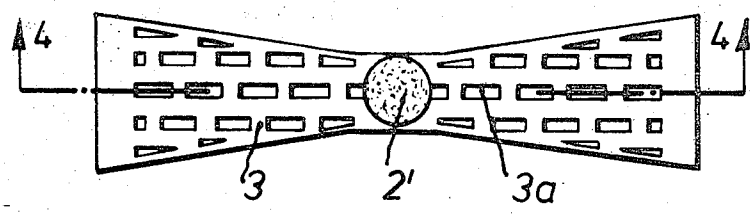
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Primary Examiner—Rudolph V. Rolinec
Assistant Examiner—Saxfield Chatmon, Jr.
Attorney—Spencer & Kaye

[57] **ABSTRACT**

A dispenser cathode composed of a cathode carrier forming an electrical heating element and presenting means, such as perforations, for effecting an intimate meshing between the cathode carrier and a cathode body, and a pressed cathode body meshed in a portion of the cathode carrier and formed from a moldable material. The dispenser cathode is constructed by forming a cathode carrier as an electrical heating element, and pressing a moldable material into the form of a cathode body and simultaneously fastening the material to the cathode carrier to cause it to mesh intimately therewith.

6 Claims, 11 Drawing Figures



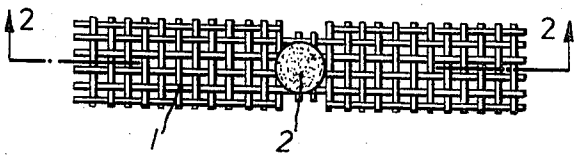


FIG.1

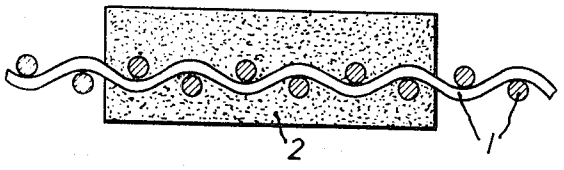


FIG.2

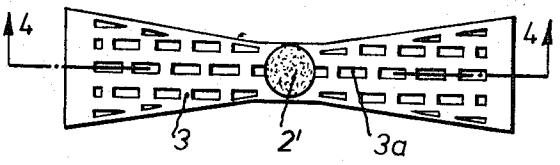


FIG.3

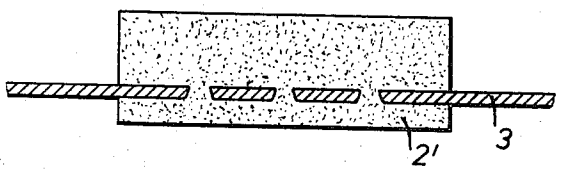


FIG.4

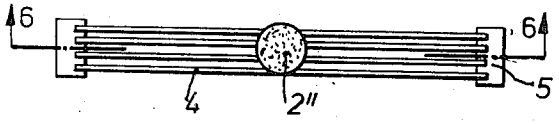


FIG.5

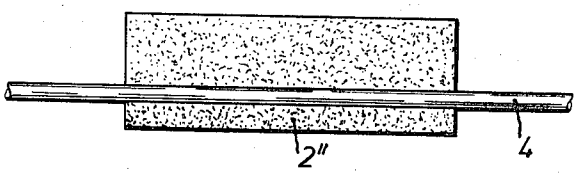


FIG.6

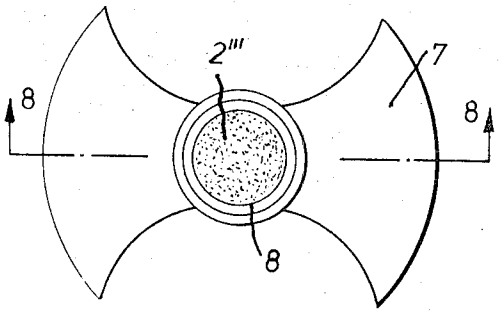


FIG. 7

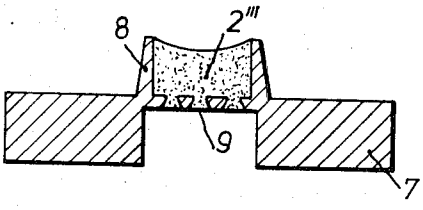


FIG. 8

FIG. 9

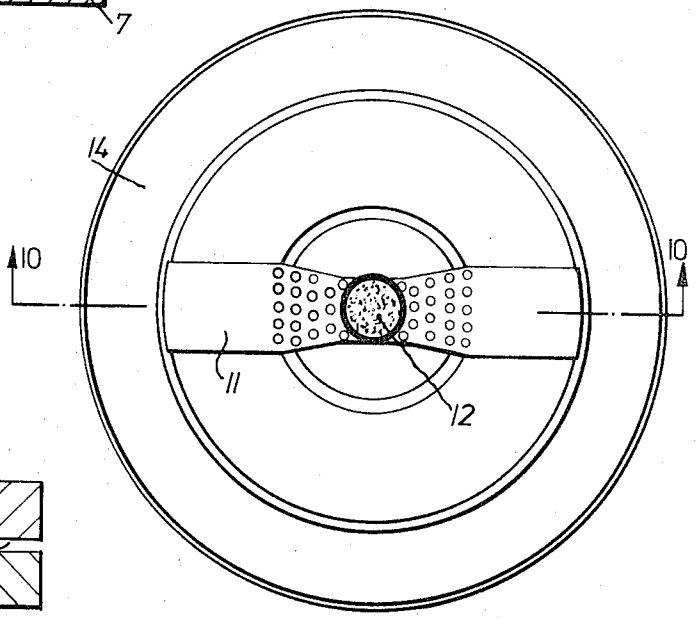


FIG. 11

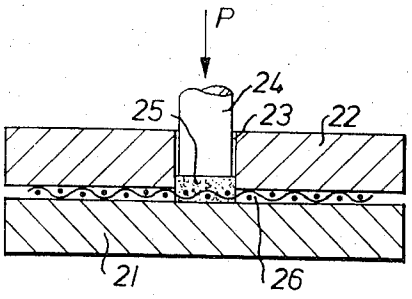
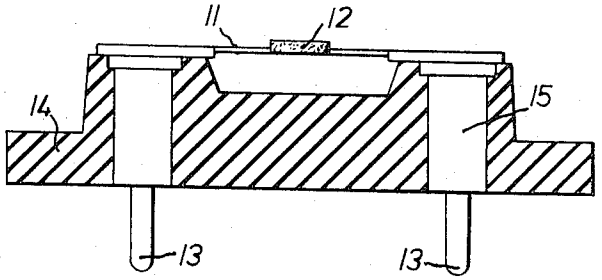


FIG. 10



DISPENSER CATHODE AND METHOD FOR MAKING SAME

BACKGROUND OF THE INVENTION

The present invention relates to a method for producing a dispenser cathode whose cathode body is formed from moldable material, such as a powder or paste, by a pressing process, and is simultaneously fastened to a cathode carrier, and to directly heated dispenser cathodes produced according to this method.

Dispenser cathodes are known whose sintered dispenser body is fastened to a cathode carrier which is usually of the sleeve type. A heating element is disposed in one opening of this cathode carrier. Thus, these are indirectly heated dispenser cathodes.

Directly heated cathodes are also known in which an emission material is applied in layers directly on the heating element. Compared to the indirectly heated cathodes, directly heated cathodes have the advantage that they require a shorter heating period and, thus, are ready for operation after the onset of the heating process more quickly than are the indirectly heated cathodes.

SUMMARY OF THE INVENTION

It is among the objects of the present invention to provide a method for producing a novel dispenser cathode whose heating time is reduced, and to provide cathodes of the type produced according to this method.

It is proposed, according to the method of the present invention, to form a cathode carrier as an electrical heating element, to provide the cathode carrier with means such as perforations, extensions, and the like, for effecting an intimate meshing between the cathode carrier and a cathode body, and to press a moldable material, such as a powder or paste into the form of a cathode body while simultaneously fastening the material to a portion of the cathode carrier to cause it to mesh intimately with the carrier due to the means for effecting an intimate meshing of the cathode body with the cathode carrier.

The method according to the present invention is particularly suited for the production of rapidly-heatable directly-heated dispenser cathodes, and has the advantage that it is particularly suited for mass production because of the small number of simple production steps involved. The above-described method has the further advantage that very good meshing, and thus good heat transfer, between the heat-producing portion of the cathode and the emitting portion of the cathode is attained.

The dispenser cathodes according to the present invention have a cathode carrier forming an electrical heating element and constituting means for effecting an intimate meshing between the cathode carrier and a cathode body and a pressed cathode body meshed in a portion of the cathode carrier and formed from a moldable material.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top plan view of a first embodiment of a dispenser cathode according to the present invention.

FIG. 2 is a cross-sectional view taken generally along the line 2—2 of FIG. 1.

FIG. 3 is a top plan view of a second embodiment of a dispenser cathode according to the present invention.

FIG. 4 is a cross-sectional view taken generally along the line 4—4 of FIG. 3.

FIG. 5 is a top plan view of a third embodiment of a dispenser cathode according to the present invention.

FIG. 6 is a cross-sectional view taken generally along the line 6—6 of FIG. 5.

FIG. 7 is a top plan view of an embodiment of a dispenser cathode according to the present invention which is particularly suited for delivering high outputs.

FIG. 8 is a cross-sectional view taken generally along line 8—8 of FIG. 7.

FIG. 9 is a top plan view of yet another embodiment of a dispenser cathode according to the present invention.

FIG. 10 is a cross-sectional view taken generally along line 10—10 of FIG. 9.

FIG. 11 shows a step in manufacturing a dispenser cathode according to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 shows a directly heated dispenser cathode according to the present invention whose cathode carrier is a woven band 1 composed of a plurality of interlaced wires and into which a dispenser cathode material is pressed to form a cathode body 2. FIG. 2 shows the cathode of FIG. 1 in cross section. The cathode body 2 may be a porous material which is pressed in a known manner from a powder or a paste in a mold press to produce the cathode body 2 of the desired shape. Hereafter, the term "moldable material" is used to designate generally powders and pastes. Subsequent to the pressing step, there advisably takes place a sintering process which produces a further solidification of the cathode body 3, and improved fastening of the dispenser body to the cathode carrier. The emission material may be pressed into the cathode body during its manufacture, or it may be applied thereto after the cathode body 2 has been completed. As a moldable material for the cathode body for example a mixture of powders of barium, calcium, aluminiumoxyde, molybdenum and tungsten may be used and pressed in the desired shape of a pressing tool. A preferred material for the carrier is an alloy of tungsten and rhenium having 1 to 10 percent rhenium.

The cathode shown in FIG. 1 of the drawings is heated by the application of an electrical heating voltage to the two ends of the woven metal band 1, which is constructed from an electrical resistance material. Such metals as, for example, molybdenum, manganese, tungsten, or alloys of those and similar metals may be used to construct band 1. A concentration of heat in the area of the cathode body 2 occurs in the embodiment of FIGS. 1 and 2 because in this area the cross section band 1 is reduced. Such a woven metal band 1 is, for example, a braid of wires having a diameter of 5 to 100μ.

A second embodiment of a dispenser cathode produced according to the method of the present invention is shown in FIG. 3. This embodiment has a cathode body 2' pressed into a cathode carrier in the form of a heating element 3 constructed from, for example, a foil in which perforations 3*a* are formed. The formation of such perforations in the foil is preferably done by a suitable, known photoetching process. Here, as in the embodiment of FIGS. 1 and 2, a concentration of heat is effected by a reduction of the cross section of element

3 in the area of the cathode body 2'. Such a cathode is shown in cross section in FIG. 4, and it can be seen that pressing cathode body 2 into the foil-shaped heating element 3 produces a strong, intimate mechanical and highly heat-conductive connection between the two parts.

FIG. 5 shows a third embodiment of a dispenser cathode according to the present invention in which a cathode body 2 is pressed around a plurality of parallel wires 4 which define a cathode carrier that serves as the heating element. In this embodiment, four wires 4 are arranged between current inputs 5 which, as can be seen in the cross-sectional view of FIG. 6, are embedded in a cathode body 2''.

FIGS. 7 and 8 show a dispenser cathode according to the invention suited for delivering high outputs. A cathode carrier 7, which simultaneously acts as the heating element, is formed as a shaped part and is constructed of, for example, molybdenum. A portion 8 bearing the cathode body 2 is so formed by a reduction in cross section in that portion of cathode carrier where cathode body 2 is meshed, and perforations 9 that the strongest heat is developed in this area when current flows through carrier 7. The particular shape of the cathode of FIGS. 7 and 8 and the perforations 9, permit easy pressing in of the cathode body 2''', and the realization of a good mechanical and heat-conductive meshing between the cathode body 2''' and the heating element 7. The cathode of FIGS. 7 and 8 is particularly suited as a rapid-heating cathode for higher-output electron tubes, as are required, for example, for microwave tubes.

FIGS. 9 and 10 show the total structure of yet another cathode according to the present invention, in which a cathode carrier 11 is formed in foil form similar to the cathode shown in FIGS. 3 and 4. Carrier 11 bears a cathode body 12 in its center region. This cathode carrier 11 is mounted on an insulating member 14 by means of contacts 15 and input pins 13. Any suitable, known electrical insulating material may be used for constructing member 14. The cathode carrier 11 is connected with the contacts 15 by, for example, welding or soldering. Such a cathode may be inserted, for example, in a known manner into a cup-shaped control electrode.

FIG. 11 shows a preferred method of manufacturing a dispenser cathode as shown in FIG. 1. A mixture of powders, for example as described before is filled into a boring 23 of the part 22 of a pressing tool. A carrier 26 is inserted between the basic part 21 and the part 22 of the tool. The mixture of powders then is pressed into the opening of the carrier 26 lying under the boring 23 and into the form of a tablet-like cathode body 25 by pressing down the stamper 24 as indicated by arrow P with a pressure of about 7 to 15 tons per square-cm for some seconds. The carrier 26 together with the cathode body 25 then is taken out of the pressing tool and preferably sintered at temperatures of about 1,700° C to 2,200° C for some minutes for example in an oven.

It will be understood that the above description of the present invention is susceptible to various modifications, changes and adaptations, and the same are intended to be comprehended within the meaning and range of equivalents of the appended claims.

We claim:

1. A dispenser cathode comprising: a cathode carrier forming an electrical heating element and having openings constituted by perforations formed in said cathode carrier for effecting an intimate meshing between said cathode carrier and a cathode body, and a solid pressed cathode body extending into said openings in a portion of said cathode carrier to mesh intimately therewith and formed from a moldable material.

2. A dispenser cathode as defined in claim 1, wherein said cathode carrier has a reduced cross-section in that portion thereof where said cathode body is meshed.

3. A dispenser cathode as defined in claim 1, wherein the cathode carrier is constructed of an electrical resistance material.

4. A dispencer cathode as defined in claim 1 wherein said cathode carrier consists of a tungsten rhenium alloy.

5. A dispenser cathode comprising: a cathode carrier forming an electrical heating element and presenting openings for effecting an intimate meshing between said cathode carrier and a cathode body, said cathode carrier being constituted by a band of woven metal wires forming a grid array enclosing the openings, and a solid pressed cathode body extending into said openings in a portion of said cathode carrier to mesh intimately therewith and formed from a moldable material.

6. A dispenser cathode comprising: a cathode carrier forming an electrical heating element and having openings constituted by perforations formed in said cathode carrier for effecting an intimate meshing between said cathode carrier and a cathode body, and a solid pressed and sintered cathode body extending into said openings in a portion of said cathode carrier to mesh intimately therewith and formed from a moldable material.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,758,808 Dated September 11th, 1973

Inventor(s) Walter Held and Rolf Lerch

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

In the heading of the patent, line 5, change "Verwaltung S-" to --Verwaltungs- --.

Signed and sealed this 5th day of March 1974.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334.

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