

[54] **DEGASSING ARRANGEMENT FOR ELECTRON BEAM TUBE INCLUDING AN MK DISPENSER CATHODE**

[72] Inventor: **Manfred Wintzer**, Munich, Germany

[73] Assignee: **Siemens Aktiengesellschaft**, Berlin and Munich, Germany

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[58] Field of Search.....313/106, 107, 179, 178, 217, 313/311, 346, 346 R, 346 DC

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Primary Examiner—Roy Lake

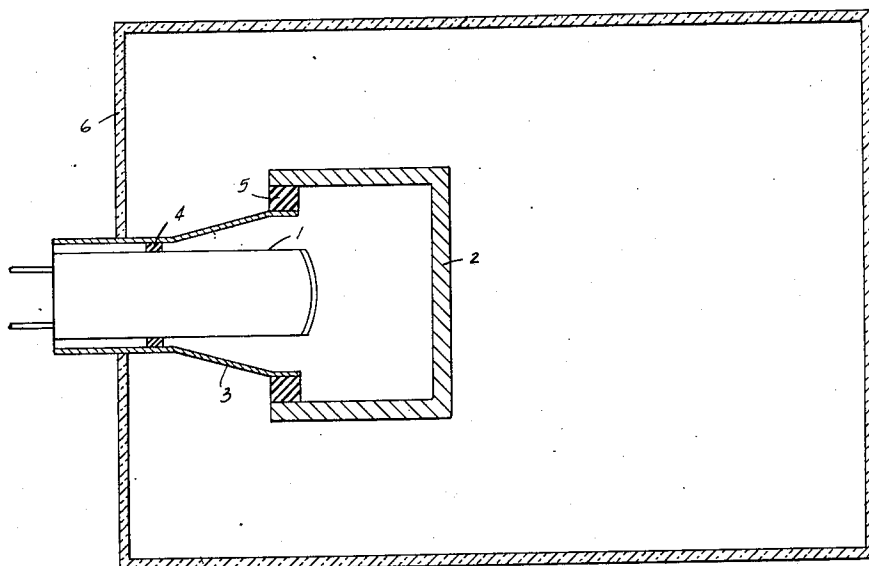
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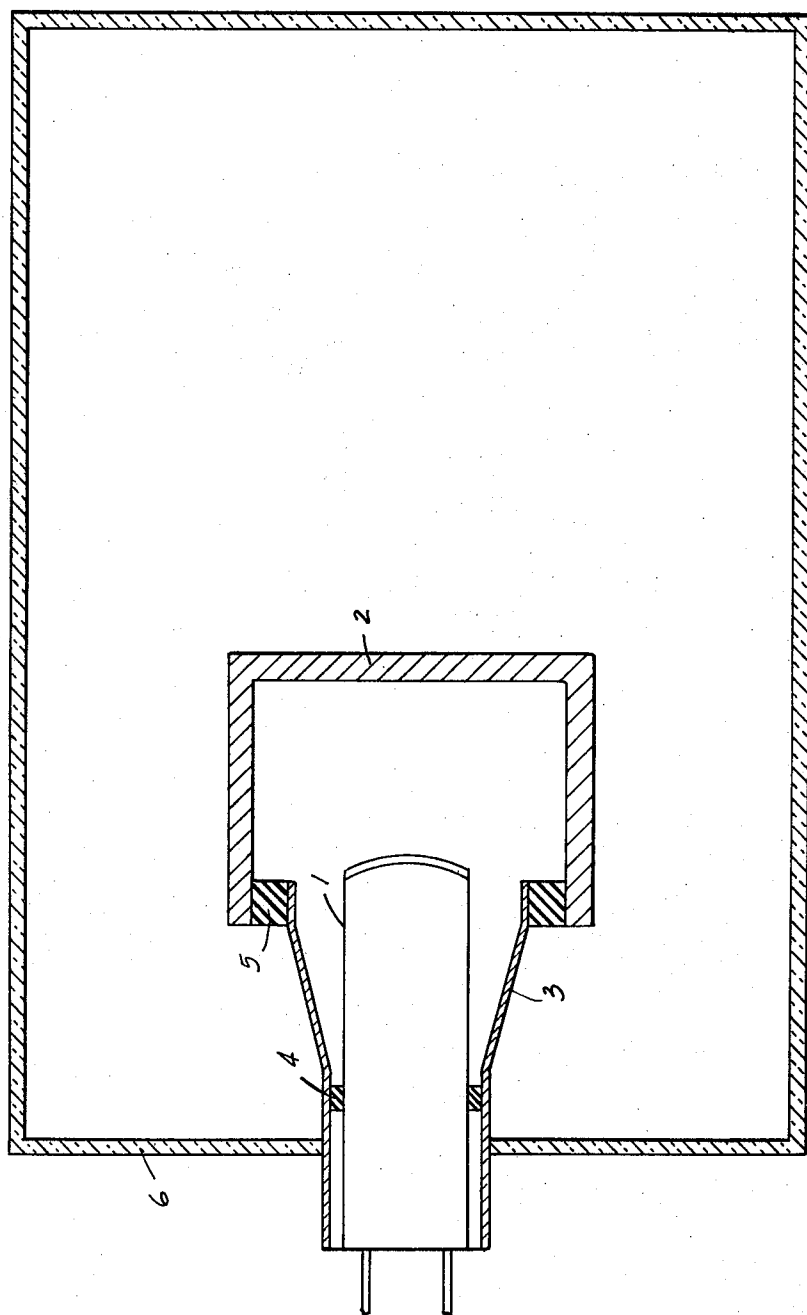
Attorney—Hill, Sherman, Meroni, Gross & Simpson

[57] **ABSTRACT**

Method and apparatus for producing electrodes capable of receiving considerable cathode bombardment and which are formed so as to remove gas from an electron tube, are disclosed. The electrodes are formed by powdered metallurgy by mixing getter material powders such as zirconium, titanium or other getter material powders with carbon powder such as graphite and then forming the electrodes by pressing the mixture into a mold with a small amount of pressure and sintering in the range, for example, of 800° to 1,400° centigrade to produce the electrodes which have good gas absorption capability and which can be worked with little difficulty.

5 Claims, 1 Drawing Figure





INVENTOR.

MANFRED WINTZER

BY *Hill, Sherman, Mann, Chase & Smith* ATTORNEYS

DEGASSING ARRANGEMENT FOR ELECTRON BEAM TUBE INCLUDING AN MK DISPENSER CATHODE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates in general to electrodes for electron tubes and in particular to electrodes which have high gas absorption capacity.

2. Description of the Prior Art

In the prior art it has been known to use molybdenum for constructing electron tube electrodes. Electrodes covered with getter material and consisting of one or more carbon discs have also been known. However, in actual practice, it has become evident that carbon bodies cannot be covered with getter material such as zirconium of arbitrary thickness which would be necessary for attaining higher rates of evacuation and larger gas absorption capabilities. On the other hand, working electrodes constructed of pure zirconium which are produced by pressing and sintering zirconium powder, have a high evacuation rate and large gas absorption capacity at temperatures above 600° centigrade, but at room temperature the gas absorption capacity was small because gas diffusion into the zirconium interior did not take place and only the small surface absorption of the zirconium electrode was effective. However, an increase in the gas absorption capacity of a working electrode at room temperatures is absolutely necessary in order to maintain the necessary vacuum of larger electron tubes while being stored.

SUMMARY OF THE INVENTION

The present invention relates to electrodes for electron tubes for high performance such as, for example, in tubes using a dispenser cathode, in particular an MK-cathode, and which provides mixing a powder of getter materials such as zirconium, titanium, or similar substances, with powdered carbon such as graphite and in which the distributed carbon may amount to up to about 30 percent by weight. The mixture is then pressed in molds with a small amount of pressure into electrodes with the pressure being up to 3 kp/cm² and the resulting electrodes sintered in the temperature range from 800° to 1,400° centigrade. The electrodes thus formed are still capable of being mechanically machined without difficulty.

Other objects, features and advantages of the present invention will be readily apparent from the following detailed description of certain preferred embodiments.

BRIEF DESCRIPTION OF THE DRAWING

The FIG. illustrates an electrode according to the invention mounted in a suitable electron tube.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The invention comprises forming working electrodes especially constructed for considerable cathode bombardment and which are completely or partially covered with getter material such as zirconium, titanium, or other suitable getter material. Such electrodes may be, for example, anodes used in electron tubes having indirectly heated cathodes of high performance

such as, for example, with tubes having cathodes in the form of dispenser cathodes, in particular of an MK-cathode.

The working electrodes are constructed by powdered metallurgy in that the getter material such as zirconium, titanium, or other suitable getter material substances are formed into a powder and mixed with a powder of carbon, in particular of electrographite, and with the powders being of approximately the same granulation and with the carbon being up to 30 percent by weight. After the powders have been suitably mixed to form a homogenous mixture, it is then pressed in molds with small pressure into electrodes. The pressure may be up to approximately 3 kp/cm², (kp means kilopounds).

The electrodes are then sintered in a temperature range between 800° to 1,400° centigrade. Electrodes thus formed may be easily worked and machined.

The invention is based upon the discovery that with porous unpressed zirconium bodies, an increase of gas absorption capacity at room temperature of tenfold can be attained. However, heating of the electrodes by the electron beams cause the zirconium electrodes to be deformed and cracks form in the electrodes, thus decreasing the getter qualities of such zirconium bodies. The present invention, which mixes the getter powder with the carbon powder and pressing the mixture into suitable molds and then sintering between 800° to 1,400° C, produces electrodes that can be easily worked and which has great gas absorption capability.

It has also been discovered that the carbon particles in the pressed electrodes result in a higher porosity than obtainable with ductile molybdenum or tungsten powder. Also, it has been discovered that the gas emission of carbon particles is considerably smaller than the gas emission of molybdenum or tungsten powder.

The fact that the pressed zirconium-carbon body continues to be easily workable, even after the use of relatively high sintering temperatures, as, for example, at 1,300° C, is a great advantage.

It is possible that an alloy forms at the contact surfaces of the carbon-zirconium which is advantageous because zirconium carbide is a strongly pyrophoric material, which comprises an active getter material.

The FIG. illustrates a cathode according to the present invention comprising an envelope 6 in which the electrode of the present invention is mounted so as to be sealed from the atmosphere. Generally, such envelope will be evacuated as is well known. The envelope is connected to a support member 3 of cylindrical form, for example, which supports a cathode 1 by suitable insulating ring 4. An impact electrode 2 according to the invention is supported adjacent the cathode 1. Electrode 2 is supported from the support member 3 by insulating ring 5.

The impact electrode 2 is constructed according to the present invention and in a preferred form may be constructed as a disc with cylindrical sides extending toward the cathode 1. It is to be realized, of course, that the electrode 2 may also be disc-shaped, if desired. The electrode 2 is formed by the process described above and includes the getter powder mixed with carbon powder which has been pressed and sintered between 800° C. and 1,400° C. so as to produce electrodes that may be easily machined and which have the ability to

absorb large quantities of gas. Thus, the electrode 2, while providing an excellent working electrode, also serves to reduce and remove gas which is present in the envelope 6 and thus comprises a substantial improvement over working electrodes of prior art.

Although various 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. A degassing arrangement for an electron-beam tube having an envelope comprising:
an MK-type dispenser cathode mounted in said tube
within said envelope; and
an electron emitting member forming a part of said

dispenser cathode and an impact electrode insulatingly mounted adjacent said cathode within said envelope and formed of a mixture of getter material and carbon with said carbon being up to 30 percent by weight.

2. A degassing arrangement according to claim 1 wherein said getter material is zirconium.

3. A degassing arrangement according to claim 1 wherein said getter material is titanium.

4. A degassing arrangement according to claim 1 wherein said carbon is in the range of 15 to 30 percent by weight.

5. A degassing arrangement according to claim 1 wherein said getter material and said carbon have powder particle sizes.

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