United States Patent

[11] **3,633,062**

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[21] Appl. No. **827,590**
[22] Filed **May 26, 1969**
[45] Patented **Jan. 4, 1972**

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[32] Priority **May 28, 1968**
[33] **Japan**
[31] **43/43526**

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[54] **DIRECT-HEATED CATHODE ELECTRODES WITH CATHODE SHIELD FOR ELECTRON GUNS**
3 Claims, 5 Drawing Figs.

[52] **U.S. Cl.** **313/341,** 313/346
[51] **Int. Cl.** **H01j 1/15,** H01j 19/08
[50] **Field of Search** 313/336, 337, 340, 345, 341, 346, 326

[56] **References Cited**

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ABSTRACT: In a direct-heated cathode electrode for use in electron guns wherein a heating element is mounted on a base to heat a cathode pellet which emits thermoions, a cathode shield maintained at the same potential as the heating element is disposed between the same and the base.

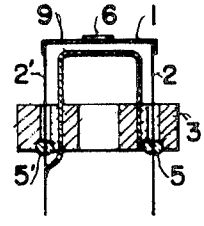


FIG. 1

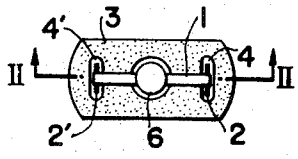


FIG. 4

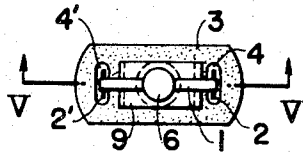


FIG. 2

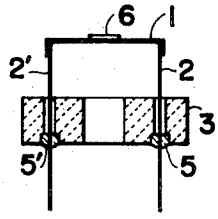


FIG. 5

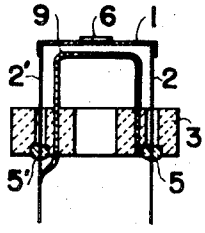
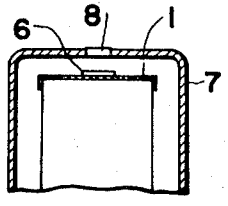


FIG. 3



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DIRECT-HEATED CATHODE ELECTRODES WITH CATHODE SHIELD FOR ELECTRON GUNS

BACKGROUND OF THE INVENTION

This invention relates to a novel direct-heated cathode electrode for use in electron guns.

The conventional direct-heated cathode electrode for use in electron guns is generally constructed as shown in FIGS. 1 and 2. Thus, a heating element 1 is welded to a pair of heater leads 2 and 2' at its opposite ends and the heater leads extend through perforations 4 and 4' through a ceramic base 3 and are secured in position by means of glass beads 5 and 5'. A cathode pellet 6 coated with an oxide is welded to the upper surface of the heating element 1 so that the cathode pellet 6 emits electrons when a suitable voltage is impressed across heater leads 2 and 2', as is well known in the art. The direct-heated cathode structure fabricated in this manner is then surrounded by a grid cup 7 having an perforation 8 opposing the cathode pellet 6, as shown in FIG. 3.

The prior art direct-heated cathode of the type described just above has following disadvantages. First, the cathode is subjected to a voltage higher than its normal operating voltage during exhaust step or operation test with the result that volatile materials are driven off from the cathode pellet 6 and come to deposit upon the surface of the ceramic base 3. Consequently, leakage current flows between grid and cathode electrodes. Second, in the direct-heated type cathode electrode of the type described above as the diameter of the cathode pellet 6 is made smaller than that of the perforation 8 of the grid cup 7 for the purpose of decreasing the power required for operating the heating element, eccentric disposition of the cathode electrode results in nonuniform electric field in front of the cathode electrode, thus affecting focusing.

BACKGROUND OF THE INVENTION

It is therefore an object of this invention to provide a new and improved direct-heated cathode electrode which can obviate above mentioned disadvantages.

Another object off this invention is to provide a novel direct-heated cathode electrode which can improve the heating efficiency of the cathode electrode.

According to a preferred embodiment of this invention there is provided a direct-heated cathode electrode comprising an insulator base, a pair of leads extending through the base, a heating element connected between the upper ends of the leads, a cathode pellet coated with an oxide and secured to the heating element, an inverted U-shaped cathode shield mounted upon the base beneath the heating element and between the leads and means to apply the same potential to the cathode shield as the heating element.

BRIEF DESCRIPTION OF THE DRAWING

The invention can be more fully understood from the following detailed description when taken in connection with the accompanying drawing in which:

FIG. 1 is a top plan view of one type of a prior art direct-heated cathode electrode with a grid electrode removed;

FIG. 2 is a sectional view of the cathode electrode shown in FIG. 1 taken along a line II—II;

FIG. 3 is a portion of the cross-sectional view shown in FIG. 2 with the grid electrode assembled;

FIG. 4 shows a top plan view of a direct-heated cathode electrode embodying this invention and

FIG. 5 is a sectional view of the embodiment shown in FIG. 4 taken along a line V—V.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIGS. 4 and 5 there is shown a cathode electrode embodying this invention wherein corresponding parts are designated by the same reference numerals as in FIGS. 1 and 2. According to this invention, beneath and close to the heater element 1 is mounted a generally inverted U-shaped cathode shield 9 having a upper surface area larger than that of the cathode pellet 6. The cathode shield 9 is made of a suitable electroconductive material, supported by the ceramic base 3 and one end of the shield is electrically connected to one of the heater leads, e.g. 2'. Thus the cathode shield 9 is maintained at the same potential as the cathode electrode.

There are many methods of holding the cathode shield 9 other than that illustrated in the drawing. Thus, for example, the cathode shield may be welded to terminals embedded in the ceramic base 3, one of the terminals being connected to one of the leads.

Thus, most of the volatile substances evaporated from the heater pellet 6 deposits on the surface of the cathode shield 9 thus effectively preventing such substances from depositing upon the surface of the ceramic base 3, whereby it is possible to prevent leakage between grid and cathode electrodes. Although not shown in FIGS. 4 and 5, it is to be understood that a grid electrode, such as 7 shown in FIG. 3 is to be provided around the cathode electrode. Further, as the cathode shield 9 having large surface area adjacent the cathode pellet 6 is impressed with the same potential as the cathode electrode it is possible to render substantially uniform the field distribution near the cathode pellet thus assuring satisfactory focusing irrespective of slight misalignment of the center of the cathode electrode.

Thus, according to this invention, it is not only possible to eliminate above-described disadvantages of the prior art cathode electrode but also the surface of the cathode shield 9 operates to reflect the radiant heat and infrared rays from the heating element back thereto, thus saving the power consumed by the heating element.

While the invention has been explained by describing a particular embodiment thereof, it will be apparent that improvements and modifications may be made without departing from the scope of the invention as defined in the appended claims.

What is claimed is

1. In a direct-heated cathode electrode for use in electron guns comprising a heating element and a cathode pellet heated by said heating element to emit thermoions, the improvement which comprises a cathode shield mounted adjacent said heating element and means to maintain said cathode shield at the same potential as said heater element and cathode pellet.

2. The direct-heated cathode electrode according to claim 1 wherein said cathode pellet is coated with an oxide and welded to said heating element.

3. The direct-heated cathode electrode according to claim 1 wherein said heating element is supported by a pair of spaced apart leads extending through an insulator base and said cathode shield has an inverted U-shaped configuration and is mounted on said base beneath said heating element and between said pair of leads.

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