United States Patent [19]

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[11] 3,895,249

Andre et al.

[45] **July 15, 1975**

[54] **INSTANT WARM-UP HEATER CATHODE**

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[73] Assignee: **International Standard Electric Corporation,** New York, N.Y.

[22] Filed: **Nov. 23, 1973**

[21] Appl. No.: **418,644**

[30] **Foreign Application Priority Data**

Mar. 20, 1973 Germany 2313911

[52] **U.S. Cl.** **313/37;** 313/340

[51] **Int. Cl.** **H01j 61/52;** H01j 1/24

[58] **Field of Search** 313/337, 340, 37

[56] **References Cited**

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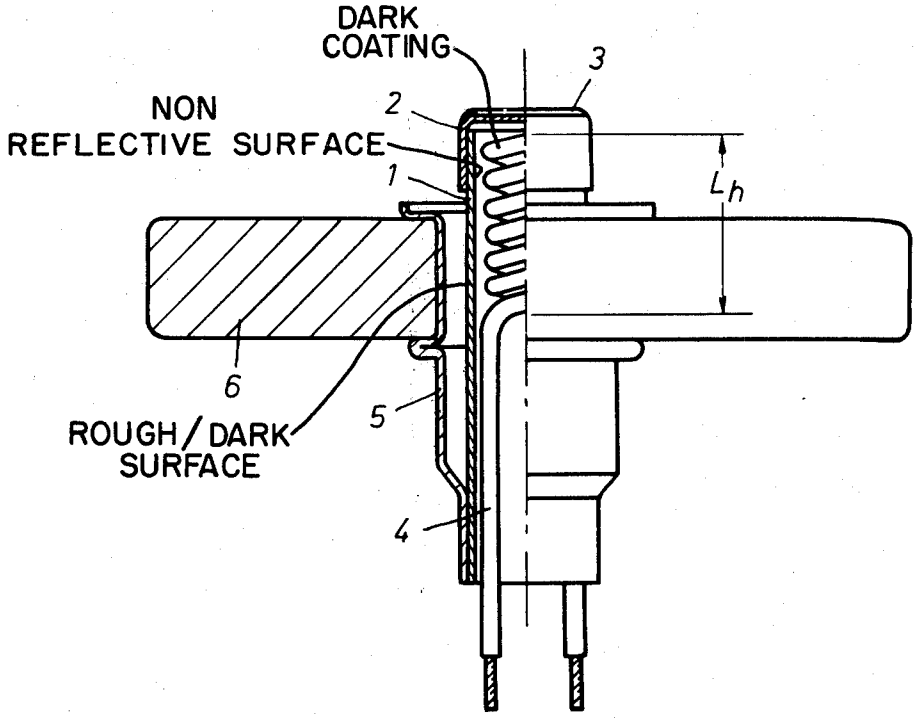
[57] **ABSTRACT**

A fast warm-up cathode for an electron tube is provided by having the major portion of the coiled heater element close to the emitting layer end within the cathode tubing. The heater is also coated with a dark layer of insulation, the inner cathode tubing around the heater is made non-reflective and the outer surface of the cathode is roughened and/or provided with a dark color coating to concentrate the heat at the end.

2 Claims, 3 Drawing Figures



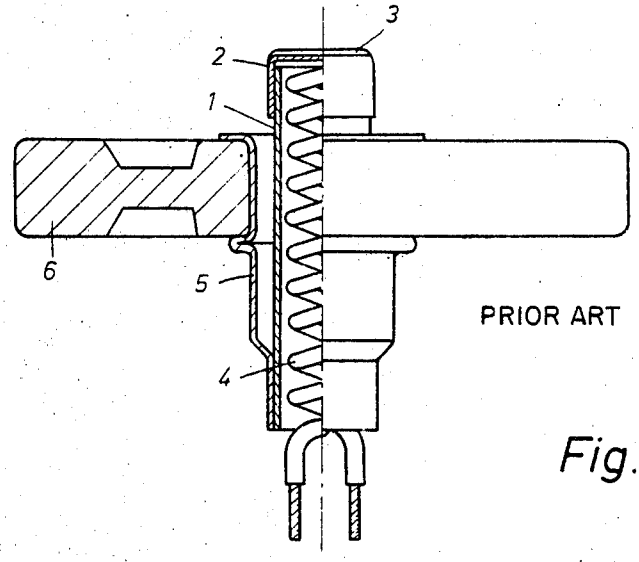

3
2
1
6
5
4
PRIOR ART

Fig.1

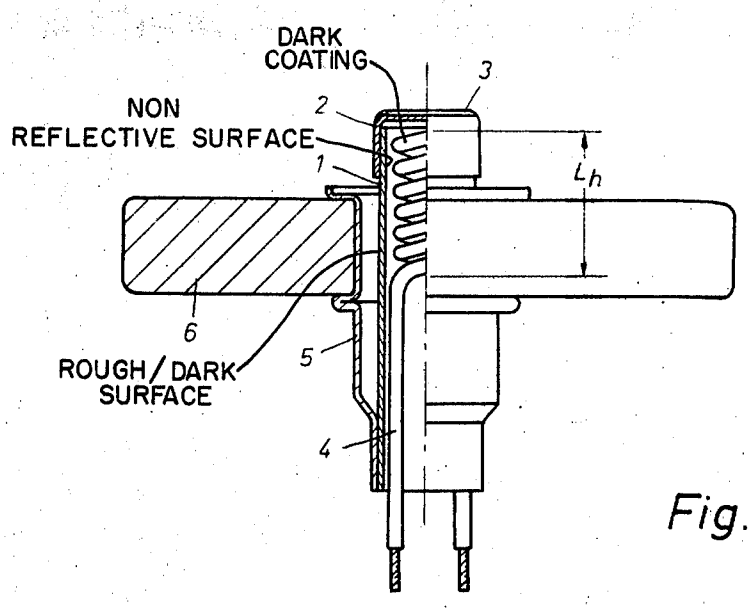

DARK COATING
3
NON REFLECTIVE SURFACE
2
1
L_h
6
ROUGH / DARK SURFACE
5
4

Fig.2

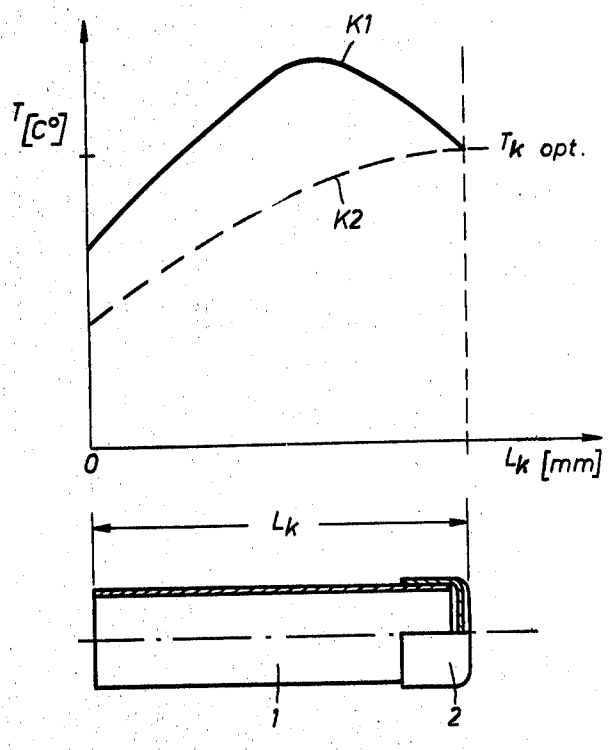


Fig. 3

INSTANT WARM-UP HEATER CATHODE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an instant heat cathode for electron tubes such as television picture tubes and to an improved indirectly heated cathode construction therefore.

2. Description of the Prior Art

The usual cathode for a television picture tube includes a cylindrical tubing one end of which is closed with a cap carrying the emitting layer and the other end of which is open. The heater element is inserted into the open end of the tubing which is mounted on a supporting disc and additional holding element.

In order to permit rapid use of television sets it has proven necessary to make television picture tubes ready to operate within a few seconds. For this purpose, attempts have been made with indirectly heated cathodes to reduce the warm-up time either by applying an increased filament power during the warm-up period, or by permanently pre-heating the cathode. Both methods, however, involve increased circuitry and, in the case of an increased filament power, a stronger thermal loading of the cathode is required.

SUMMARY OF THE INVENTION

It is therefore the object of the present invention to provide an improved cathode construction which reduces the warm-up time of the cathode and makes the television picture tube ready for operation more rapidly. This is accomplished by arranging the major portion of the heat source adjacent the emitting layer of the cap, with the ratio of the cathode tubing length to the effective heater coil element length substantially 2:1 or greater. In addition, the heater element is coated with a dark layer of insulating material, the inner surface of the cathode tubing around the heater element is made non-reflective and the entire outer surface of the cathode tubing is roughened and/or of dark color.

The details of the invention will become apparent from the following description taken with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** shows a conventional cathode construction of an indirectly heated cathode,

FIG. **2** shows the novel cathode construction according to the present invention, and

FIG. **3** is a diagram showing the temperature distribution of the cathodes of FIGS. **1** and **2.**

DESCRIPTION OF THE PREFERRED EMBODIMENT

The known prior art type of cathode shown in FIG. **1** consists of a cylindrical cathode tubing **1** with a cap **2** including a suitable specially doped nickel coating welded to one end of the tubing. The face side of the cap is coated with the actual electron emitting layer **3.** Positioned inside the cathode tubing is the coiled heater element **4** which occupies almost the entire length of the tubing.

The assembly including the cathode tubing with the cap and the heater element is mounted on a disc **6** with an additional holding element **5** which may be of a suitable type having a single or multi-part construction.

This known cathode construction, when plotted with temperature versus distance along the longitudinal dimension of the cathode tube, has a temperature distribution corresponding to curve K1 in FIG. **3.**

It is clearly evident that the maximum temperature in the steady operating condition does not occur at the emitting layer end. It is therefore actually necessary that the cathode tubing be heated to a far greater extent at other points than is required to achieve optimum emission on the layer. It will be readily apparent that for such a spatially determined temperature distribution, and also when considering a similar temperature curve in terms of time, it is not the emitting surface which first reaches its operating value.

In designing the cathode construction according to FIG. **2,** the geometry of the cathode tubing with the cap and the emitting layer has been maintained. The coiled heater element, whose effective length is L*h*, is positioned inside the cathode tubing. The length L*h* is close to one half or less than the length L*k* of the cathode tubing (FIG. **3**). As a result, the effective major part of the heat source, or coiled portion of the heater element, lies very close to the emitting layer.

In addition, the heater element is coated with a layer of a suitable dark insulating material and the inside of the cathode tubing, at least within the area of the heater element, is designed to be substantially non-reflective. This causes good transfer of heat towards the emitting layer. An example of such a insulating material that can be used is a porous sintered mixture of aluminum oxide and a refractory metal such as tungsten, as described in copending application Ser. No. 415,256, filed Nov. 12, 1973, and assigned to the same assignee as the instant application.

A corresponding suitable dark colored coating and/or roughening of the outer surface of the cathode tubing aids in concentrating the heat and attaining the desired final temperature. This is the operating temperature of the emitting layer which will not exceed the desired value.

This combination provides a temperature distribution having a curve as indicated by dashed line K2 in FIG. **3.** The present heater element requires no higher filament power than the previous conventional one according to FIG. **1.** The final temperature of the emitting layer, however, is reached within a few seconds. In addition, as seen from curve K2 in FIG. **3,** there is also no occurrence of any excessive temperatures, as in the case of curve K1.

What is claimed is:

1. A fast warm-up cathode for an electron tube comprising a hollow tubular enclosure having a closed end, an electron emissive layer on the outer surface of said end, a coiled heater element extending within said enclosure adjacent said end so that the ratio of the length of the tubular enclosure to the effective length of the coiled portion of the heater is at least 2:1, a supporting disc, a holding element securing said tubular enclosure to said disc, said tubular enclosure being mounted within said holding element and disc and an insulating coating of a layer of dark colored material on said heater, the inner and outer surfaces adjacent said end of said tubular enclosure around said heating element being substantially non-reflective and the entire said outer surface of said tubular enclosure being roughened.

2. The device of claim **1** wherein the entire said outer surface of said tubular enclosure has a dark colored coating.

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