Nov. 7, 1950 A. L. BUTTINO 2,529,134

SUPPORT FOR ELECTRON GUNS

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FIG. 1.

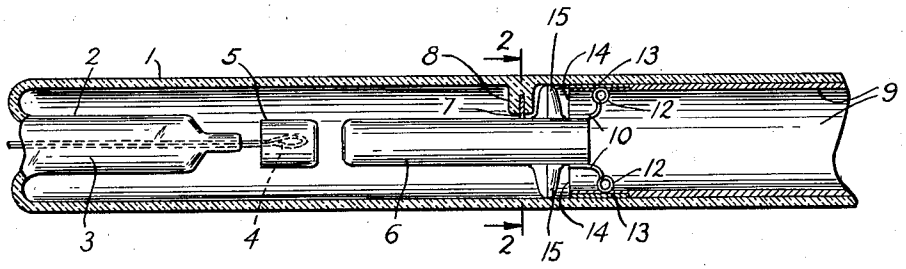


FIG. 2.

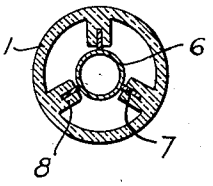
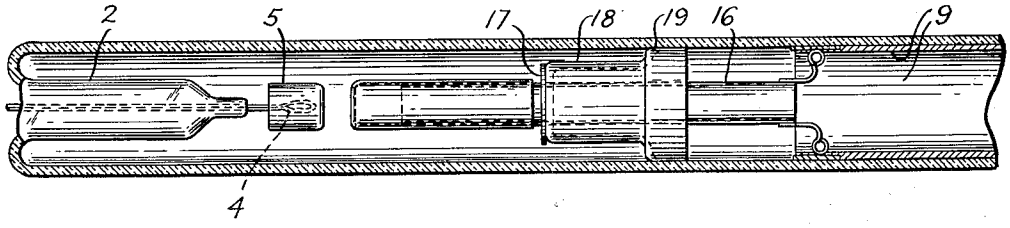


FIG. 3.



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SUPPORT FOR ELECTRON GUNS

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9 Claims. (Cl. 250—155)

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This invention relates to cathode ray tubes and more particularly to cathode ray tubes of the high accelerating voltage type suitable for use in large screen television receivers.

A typical electron gun of the magnetic focusing type has a cathode, a grid and a cylindrical anode aligned in that order in the neck of a tube. For these elements to be properly supported it has been found that the following requirements must be met:

1. The electrical breakdown resistance must be high to withstand the high voltage across the space between the grid and the anode.

2. There must be a long leakage path between the support of the parts (cathode and grid) to which negative and the part (anode) to which high positive potential is applied.

3. Electron bombardment of insulating parts near the metal electrodes must be avoided in order to prevent secondary emission and charging up of the insulating parts.

4. The structure must be rigid and lend itself to accurate alignment.

5. The construction of the electron gun must not impede the assembling and fabricating of the rest of the tube.

The problem of properly supporting an electron gun has been a long standing one.

In one attempt to solve this problem the cathode and grid were mounted on a glass stem which had two long glass pillars projecting for supporting the anode by wires extending from the ends of the pillars. These wires were also connected to the conductive wall coating inside the neck of the tube to which high positive potential was applied. This structure was unsatisfactory because the long glass pillars made it fragile and the elements were apt to spring out of alignment. Also, since the pillars passed close to the metal electrodes, bombardment by stray electrons of the pillars occurred.

According to another attempt, the cathode and grid were held by the stem but the anode, instead of being held by pillars from the stem, was supported directly from the neck by a glass collar which was sealed to a kovar flange on the end of the anode cylinder. The wall coating was extended from the neck onto the collar to the point where it touched the kovar flange. One disadvantage of this construction was that the rest of the tube could not be easily assembled after the electron gun was in place. If the wall coating was applied after the electron gun was assembled, it had to be applied by a brush through the relatively small opening in the anode

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cylinder because the glass collar was in the way. If the coating was applied beforehand, it oxidized during the subsequent heating when the glass collar was fastened to the kovar flange.

In order to overcome these and other disadvantages of the prior art, I provide means for supporting the anode of an electron gun in the neck of a cathode ray tube which satisfy all five of the above-mentioned requirements.

This will be more clearly seen from the following detailed description read in conjunction with the appended claims and the drawings, in which:

Fig. 1 is a side view, partly in section, of a portion of the neck of a cathode ray tube;

Fig. 2 is a cross section on the lines 2—2 of Fig. 1;

Fig. 3 is a modification of Fig. 1 showing a side view, partly in section, of a portion of the neck of a cathode ray tube.

The cathode ray tube has a restricted or neck portion 1 into which a glass stem 2 has been sealed. The stem supports a lead-in wire 3, a cathode 4 and a grid 5 in a conventional manner. The center of hollow anode cylinder 6 is aligned with the cathode and grid and supported by three metal pins 7 radially projecting from it towards the wall of neck 1. Pins 7 are sealed to the neck by glass beads 8 at a considerable distance from cathode 4 to insure a long leakage path. Charging up of the beads is avoided because the beads are not at a place where they can be bombarded by stray electrons, i. e. removed from the unshielded place between grid and anode.

I have found in a given tube that by connecting the beads to the neck a distance of about 2⅜ inches from the cathode, secondary emissions and charging-up of the insulating parts are negligible. Also by placing pins 7 about one inch from the end of anode cylinder 6, good support and balancing of the anode were achieved.

A conductive wall coating 9 of aquadag or other suitable material is applied to the inside wall of the neck slightly beyond the point to which the anode projects into the neck. A high positive potential is applied to the coating at another point (not shown) in any well known manner. Coating 9 is connected to anode 6 by metal springs 10 which may be made of any material retaining its springiness after heating, such as tungsten or nichrome wire. Springs 10 are conventionally fastened to the end of the anode nearest the wall coating. Loops 12 formed in the free ends of springs 10 contact wall coat-

ing 9 covering platinum strips 13 which rest directly on the wall of neck 1.

As seen from Fig. 2, if the heat of the sealing operation of the beads to the neck should damage the wall coating, particularly around loops 12, the space between the neck and the anode permits easy access with a brush and touching-up of the damaged portions, or the wall coating may be applied to the neck only after the electron gun has been completely assembled.

Since the end of the wall coating 9 in the neck may be in the form of a sharp edge, as at 14, and the coating is on high potential, I recommend placing an electrostatic shield 15, such as a conventional corona shield, between the anode and edge 14.

In the modifications shown in Fig. 3 cathode 4 and grid 5 are supported by stem 2 in the same manner as in Fig. 1. A cylindrical metal extension 16 is attached to the right-hand end of the anode cylinder. One convenient manner of doing this is to make extension 16 of a slightly smaller diameter than anode 6 and slipping the extension within the anode cylinder.

A kovar flange 17 is provided around extension 16 near the point where it enters the anode. A glass collar 18 sealed to the neck at 19 is attached to flange 17 by a conventional glass-to-metal seal. Collar 18 thus surrounds and supports anode 6 and its extension. Conductive wall coating 9 extends up to the free end of extension 16 and is electrically connected to the extension in the same way as anode 6 in Fig. 1.

I have found that in a given cathode ray tube by adding approximately three inches to the length of the anode, it was well supported and properly balanced. According to this construction it is possible to apply the wall coating prior to assembly of the electron gun and, since it is at a distance from the seals at 17 and 19, the coating will not be damaged by the heat used in the sealing operations.

What is claimed is:

1. In a cathode ray tube, an envelope having a restricted portion enclosing an electron gun comprising a cathode, a grid and an anode, means for supporting the cathode and grid, means rigidly fastened to and wholly contained within the inner wall of the restricted portion for supporting the anode in linear alignment with the cathode and grid, a conductive coating on the inside wall of the restricted portion, and means for electrically connecting the anode to said coating.

2. The device according to claim 1, and in which the means for supporting the cathode and grid is a glass stem fastened to the restricted portion and projecting therein.

3. The device according to claim 1, and in which the means for electrically connecting the anode and coating comprise at least one projection from the anode, at least one conductive strip fastened to the restricted portion under said coating so that each projection rests on the coating above a strip.

4. The device according to claim 1, and in which the means for supporting the anode are a plurality of pins projecting from the anode and glass beads sealing the pins to the restricted portion.

5. The device according to claim 4, and in which the pins radially project from the anode towards the restricted portion and are a substantial linear distance away from the grid.

6. The device according to claim 1, and in which the anode is extended in length and the means for supporting it is an insulating collar.

7. The device according to claim 6, and in which an extension of substantial length projects from one end of the anode so that the points where the collar are fastened to the restricted portion are remote from the end of the wall coating.

8. In a cathode ray tube, an envelope having a neck portion enclosing an electron gun for passing voltages of the order of 50 to 100,000 volts and comprising a cathode, a grid and an anode cylinder, a glass stem fastened to the neck and projecting therein, a plurality of metal pins projecting from the anode cylinder towards the wall of the neck but a substantial linear distance away from the grid, a glass bead sealing each pin to the inside of the neck wall thereby rigidly supporting the anode in linear alignment with the cathode and grid, a conductive coating partially covering the inside of the neck wall, two metal springs projecting from the end of the anode furthest from the grid and bent towards the neck wall, two metal strips fastened to the neck under said coating, a loop in the free end of each spring for contacting said coating above a corresponding strip, and an electrostatic shield for shielding the anode from the edge of the coating in the neck.

9. In a cathode ray tube, an envelope having a neck portion enclosing an electron gun for passing voltages of the order of 50 to 100,000 volts and comprising a cathode, a grid and an anode cylinder, a glass stem fastened to the neck and projecting therein, a cylindrical metal extension supported by the anode, a glass collar fastened to the inside of the neck wall and to the extension near the point where it joins the anode thereby supporting the anode and its extension in linear alignment with the cathode and grid, a conductive coating partially covering the inside of the neck wall, said collar being fastened to the neck at a substantial linear distance from the edge of the coating in the neck, two metal springs projecting from the free end of the projection and bent towards the wall of the neck, two metal strips fastened to the neck under said coating, and a loop in the free end of each spring for contacting said coating above a corresponding strip.

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