

June 24, 1958

E. J. LESOVICZ

2,840,739

CATHODE RAY TUBE GUN ASSEMBLY

Filed Oct. 12, 1956

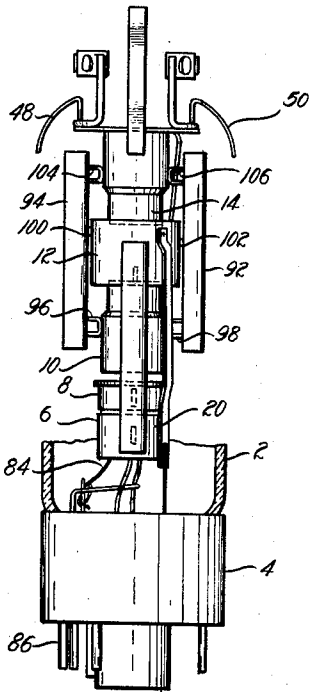


Fig. 1

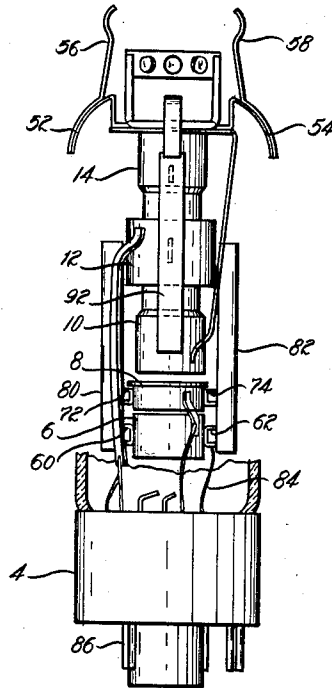


Fig. 2

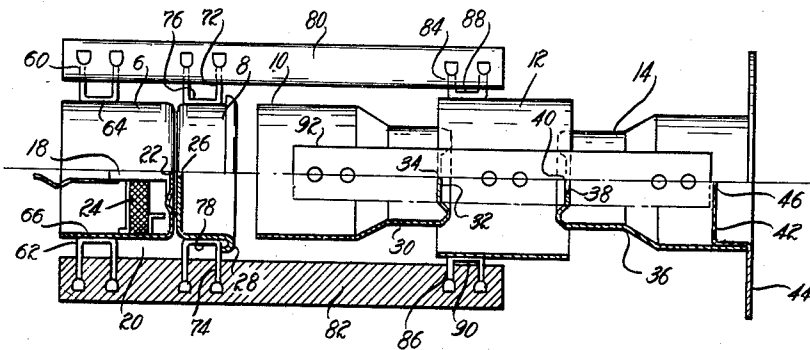


Fig. 3

INVENTOR
EDWARD J. LESOVICZ

BY

Riggins & LeBlanc

ATTORNEYS

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2,840,739

CATHODE RAY TUBE GUN ASSEMBLY

Edward Joseph Lesovicz, Wallington, N. J., assignor to Thomas Electronics, Inc., Passaic, N. J., a corporation of New Jersey

Application October 12, 1956, Serial No. 615,673

6 Claims. (Cl. 313—82)

This invention relates to cathode ray tubes and more particularly to an improvement in electron gun structures.

While many different electrode configurations have been devised heretofore to provide electrostatic focusing for the electron beams in cathode ray or other charged particle tubes and while many different types of guns, such as bent guns, straight guns, slashed field guns, offset guns, have been used, the various elements in the guns have normally been connected together and properly positioned by means of insulating rods extending along the sides of the assembled electrodes and attached thereto by means of studs projecting from such electrodes into the rods. In the gun structures of which I am aware, a first group of rods is connected to the first grid, second grid and anode to assemble these elements together. A second group of rods is connected to the anode, focusing ring, and field defining electrode and accelerating anode.

While this type of construction is widely used at the present time and is quite satisfactory, I have now found that the insulating characteristics of the gun may be materially improved if the first mentioned set of rods is connected to the first grid, second grid and then to the focusing ring rather than the anode, and by so doing the gun may also be materially shortened whilst maintaining the insulation level achieved in longer guns of the former design. With this latter construction the first set of insulating rods is connected only to electrodes which are at substantially the same voltage so that no large potential gradient is created in these rods. This makes it possible to materially shorten the length of the anode.

It is accordingly a primary object of the present invention to provide an improved electron gun for cathode ray tubes.

It is another object of the invention to provide an improved electron gun for cathode ray tubes having improved insulation characteristics.

It is a further object of the invention to provide an improved straight electron gun for cathode ray tubes which is shorter in length than currently available guns.

It is still a further object of the invention to provide an improved electron gun for cathode ray tubes which is easily manufacturable and compact in size.

These and further objects and advantages of the invention will become apparent upon reference to the following specification and claims and appended drawings wherein:

Figure 1 is a vertical elevation of an electron gun constructed according to the invention and having the tube envelope broken away;

Figure 2 is a vertical elevation of the electron gun of Figure 1 taken from a position 90° removed from Figure 1; and

Figure 3 is an enlarged vertical elevation of the electrode assembly of the electron gun which is sectioned below the center line.

Referring now to the figures of the drawing, there is

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illustrated the neck 2 and base 4 of a cathode ray tube, the enlarged bulb and screen supporting face of which are not shown. Supported within the neck 2 is an electron gun of the type commonly known as a straight gun.

5 This electron gun comprises a cathode grid assembly 6, a second grid 8, an anode 10, a focusing ring 12 and an accelerating anode 14.

As shown in Figure 3, the cathode grid assembly 6 includes a tubular cathode member 18 supported co-axially within a thimble shaped grid member 20 having a coaxially aligned aperture 22. The cathode member 18 is supported within the first grid thimble 20 by means of an insulating disc 24.

15 The second grid 8 is a cup shaped member having an axially aligned aperture 26 and an outwardly extending rolled flange 28. The accelerating anode focusing assembly which forms the remaining unit of the electron gun comprises an anode 10, a focusing ring 12 and an accelerating anode 14.

20 The anode 10 is formed of a tubular metal member having a reduced diameter end portion 30 and a concave end 32 having an axially aligned aperture 34. The accelerating anode 14 is likewise a tubular metal member having a reduced diameter end portion 36 and also having a concave end 38 and axially aligned aperture 40.

25 An aperture cup 42 fits within the end of accelerating anode 14 and is provided with a skirt or rim 44 by which the gun may be centered in the neck of the tube. A central opening 46 in the aperture cup assists in the determination of the size of the electron beam.

30 The gun assembly may be centered in the tube neck by means of resilient spring members 48, 50, 52 and 54 and contact may be made with the conductive tube coating by means of fingers 56 and 58 which are welded to spring members 52 and 54. A preferred method of centering the gun and making such contact is shown in assignee's copending application Serial No. 607,945, filed September 4, 1956, in the name of Alfred P. Johansen. The gun is supported in the tube by means of conductors 35 40 44 which are connected to external prongs 86.

According to the invention the first grid 6, second grid 8 and focusing ring 12 are made structurally unitary by means of insulating rods 80 and 82. The rods 80 and 82 are attached to the first grid 6 by means of U-shaped studs 60 and 62 having bights 64 and 66 spot welded to the wall of thimble shaped grid member 20.

Second grid 8 is attached to the rods 80 and 82 by U-shaped studs 72 and 74 having bights 76 and 78 spot welded to the second grid. Focusing ring 12 is attached to the rods 80 and 82 by U-shaped studs 84 and 86 having bights 88 and 90 spot welded to the focusing ring. The studs 84 and 86 are shorter than studs 60, 62, 72 and 74 so as to keep rods 80 and 82 parallel, although 45 50 55 parallelism is not necessary.

It will be noted that the first grid, second grid and focusing electrode are at substantially the same voltage thereby preventing the large voltage gradient which would exist in the rods if they were connected to the anode as is customarily the case. This permits a substantially shorter straight gun assembly.

60 The anode 10 and accelerating anode 14 are assembled to the gun by insulating rods 92 and 94. These rods are attached to anode 10 by U-shaped studs 96 and 98, to the focusing ring by U-shaped studs 100 and 102, and to the accelerating anode by U-shaped studs 104 and 106.

70 While the gun illustrated and described here utilizes two insulating rods connecting the first grid, second grid and focusing ring together it will be recognized that more rods could be used if desired. The arrangement illustrated is to be preferred, however, since the symmetrical arrangement of the rods supporting the electrostatic lens

electrodes with respect to the rods supporting the low voltage electrodes permits a compact arrangement without a congestion of insulating rods. Thus it will be seen on reference to the drawings that the studs on which rods 92 and 94 are mounted lie in a plane approximately 90° removed from the plane in which the studs supporting rods 80 and 82 lie.

It will be apparent from the foregoing that by utilizing a gun construction wherein one set of support rods is connected only to the low voltage electrodes and a second set of rods is connected to the electrostatic lens electrodes a compact arrangement can be obtained with an improvement in leakage characteristics.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

1. An electron gun comprising a cathode for emitting electrons along an electron beam path, an electron beam creating and focusing structure through which said path passes, said structure comprising in order along said beam from said cathode, a first grid, a second grid, an anode, a focusing electrode and an accelerating anode, first insulating means supporting said anode, focusing electrode and accelerating anode, and second insulating means connected to and supporting said first grid, second grid and focusing electrode.

2. An electron gun comprising a cathode for emitting electrons along an electron beam path, an electron beam creating and focusing structure through which said path passes, said structure comprising in order along said beam from said cathode, a first grid, a second grid, an anode, a focusing electrode and an accelerating anode, a first set of insulating rods connected to and supporting said anode, focusing electrode and accelerating anode, and a second set of insulating rods connected to and supporting said first grid, second grid and focusing electrode.

3. An electron gun comprising a cathode for emitting electrons along an electron beam path, an electron beam creating and focusing structure through which said path passes, said structure comprising in order along said beam from said cathode, a first grid, a second grid, an anode, a focusing electrode and an accelerating anode, a first set of generally parallel insulating rods connected to said anode, focusing electrode and accelerating anode by means of studs projecting radially from said anode, focusing electrode and accelerating anode, and a second set of

generally parallel insulating rods connected to said first grid, second grid and focusing electrode by means of studs projecting radially from said first grid, second grid and focusing electrode.

4. An electron gun as set out in claim 3 wherein said first set of rods comprises two rods mounted on diametrically opposite studs, and wherein said second set of rods comprises two rods mounted on diametrically opposite studs approximately 90° removed from said studs mounting said first set of rods.

5. An electron gun comprising a cathode for emitting electrons along an electron beam path, an electron beam creating and focusing structure through which said path passes, said structure comprising in order along said beam from said cathode, a thimble shaped first grid, a cup shaped second grid, a cylindrical anode having a reduced diameter portion, a cylindrical focusing electrode overlapping the reduced diameter portion of said anode, and a cylindrical accelerating anode having a reduced diameter portion overlapped by said focusing electrode, a first set of generally parallel insulating rods connected to said anode, said focusing electrode and said accelerating electrode, said rods being connected by being impaled upon radially outwardly extending studs on said anode, said focusing electrode and said accelerating electrode, and a second set of generally parallel insulating rods connected to said first grid, said second grid and said focusing electrode, said rods being connected by being impaled upon radially outwardly extending studs on said first grid, said second grid and said focusing electrode.

6. An electron discharge device comprising a bulb having a neck and a target opposite said neck, an electron gun mounted within said neck, said electron gun comprising in order along the path of said electrons, a thimble shaped first grid, a cup shaped second grid, a cylindrical anode having a reduced diameter portion, a cylindrical focusing electrode overlapping the reduced diameter portion of said anode, and a cylindrical accelerating anode having a reduced diameter portion overlapped by said focusing electrode, a first set of generally parallel insulating rods connected to said anode, said focusing electrode and said accelerating electrode, said rods being connected by being impaled upon radially outwardly extending studs on said anode, said focusing electrode and said accelerating electrode, and a second set of generally parallel insulating rods connected to said first grid, said second grid and said focusing electrode, said rods being connected by being impaled upon radially outwardly extending studs on said first grid, said second grid and said focusing electrode.

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