

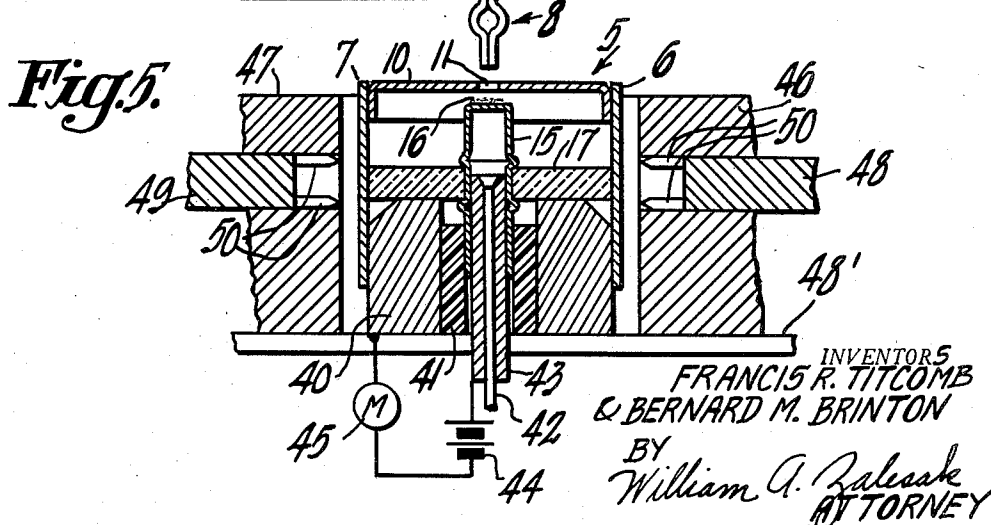
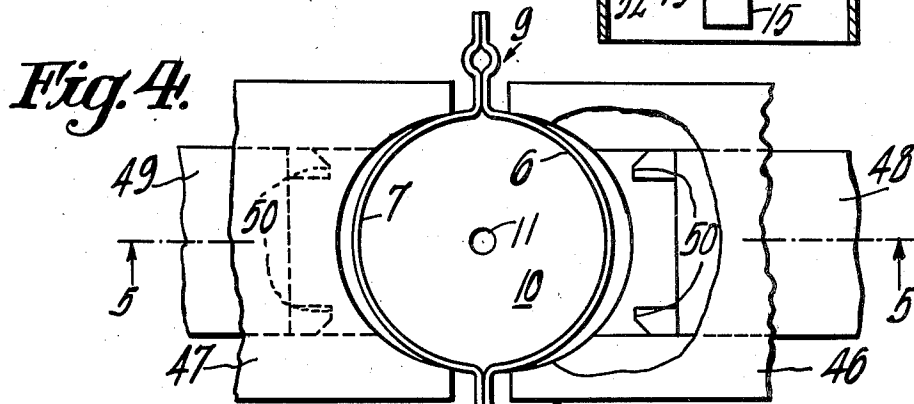
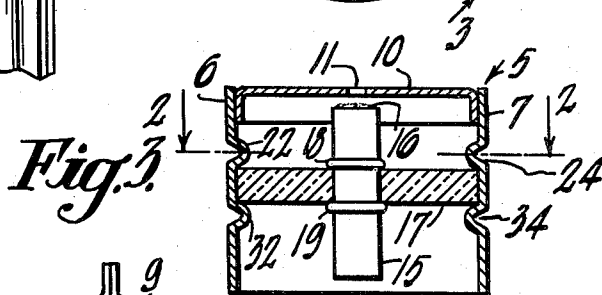
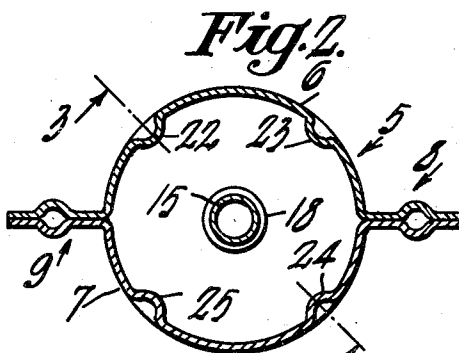
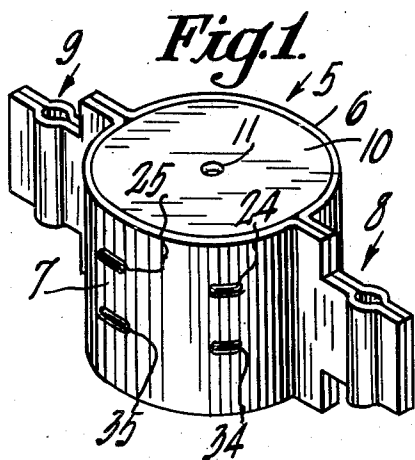
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CATHODE GRID ASSEMBLY

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2,842,702

CATHODE GRID ASSEMBLY

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2 Claims. (Cl. 315—1)

This invention relates to the electron gun portion of cathode ray tubes, and more particularly, to the cathode grid structure at which the electron beam is originated.

In the manufacture of cathode grid assemblies, the distance between the thermo-emissive coating on the cathode and the grid aperture must be very accurately fixed at a predetermined value in the order of 0.005 inch. It has been the practice to use a mechanical spacer to determine the distance between the cathode and the grid aperture. However, the necessary tolerances are such that, in practice, the mechanical spacers and the cathode and grid elements cannot be made accurately enough to avoid the necessity of measuring and sorting the parts which will satisfactorily go together. It is therefore a general object of this invention to provide an improved cathode grid assembly wherein the spacing of the cathode and the grid is fixed without the use of a separate mechanical spacer.

It is another object to provide an improved cathode grid assembly which is simpler and less expensive to manufacture by reason of including a minimum number of elements.

It is a further object to provide an improved method of manufacturing cathode grid assemblies.

In one aspect, the invention comprises a hollow cylindrical metallic cathode, closed on one end, and fixed in a central aperture in a ceramic insulating disc. The closed end of the cathode is coated with a thermo-emissive material. A cup-shaped metallic grid has a central aperture in the closed end thereof and has an inner diameter to snugly receive the peripheral edge of the ceramic disc. The disc is fixed in the grid, at the position providing the desired distance between the coated end of the cathode and the grid aperture, by means of a plurality of inwardly extending deformations at circumferentially and axially spaced points on the cylindrical wall of the grid.

These and other objects and aspects of the invention will be apparent to those skilled in the art from the following more detailed description taken in conjunction with the appended drawings, wherein:

Figure 1 is a perspective view of a cathode grid assembly constructed according to the teachings of this invention;

Figure 2 is a transverse sectional view of the assembly of Figure 1;

Figure 3 is a longitudinal sectional view taken on the line 3—3 of Figure 2.

Figure 4 is a top view of the parts of a cathode grid assembly in a fixture used for positioning the parts and fixing them together; and

Figure 5 is a sectional view taken on the line 5—5 of Figure 4.

Referring to Figures 1, 2 and 3 of the drawings, the grid is a cup-shaped structure made of two metallic pieces 6 and 7 which are formed to together constitute a cylindrical wall having two radially extending ears 8 and 9. The ears 8 and 9 are used for mounting the cathode grid

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assembly in alignment with other electrodes of a cathode ray gun. An end cap 10 provided with a central aperture 11 is welded to the cylindrical wall formed by members 6 and 7.

The cathode consists of a hollow metallic cylinder 15 having one end closed and coated with thermo-emissive material 16. The cathode 15 is fixed in a central aperture in a ceramic insulating disc 17 by means of beads 18 and 19 formed on the cathode 15 to tightly engage the ceramic disc 17.

The inner diameter of the cylindrical wall of the grid 5 is dimensioned to snugly receive the peripheral edge of the ceramic disc 17. The disc 17 is fixed in place in the grid 5 by means of a plurality of inwardly extending deformations or projections in the cylindrical walls of the grid. A first plurality of inwardly extending deformations 22, 23, 24 and 25 are arranged in spaced relation circumferentially around the cylindrical wall of the grid 5. These deformations fix the ceramic disc 17 against axial movement towards the end cap 10 of the grid 5. A second plurality of deformations 32, 33, 34 and 35 are similarly arranged in spaced relation circumferentially around the cylindrical wall, but axially spaced from the first plurality of deformations. The deformations 32 thru 35 fix the ceramic disc 17 against axial movement away from the end cap 10 of the grid 5. The first and second plurality of deformations are axially spaced by an amount according to the thickness of the ceramic disc 17 so that the disc is rigidly fixed in position in the grid 5. It will be noted from the drawings that deformations 22 and 32 are aligned with each other so as to grip the peripheral edge of ceramic disc 17 at adjacent opposite sides thereof. Deformations 23 and 33, 24 and 34, and 25 and 35 are similarly aligned.

Preferably, all of the deformations are simultaneously formed after the ceramic disc 17 has been positioned to provide the desired spacing between the thermo-emissive coating 16 of the cathode 15 and the aperture 11 in the end cap 10 of grid 5. The desired position of the cathode 15 and ceramic disc 17 may be determined by any desired method such as the electric spark method, an optical method, or any other suitable method. In the electric spark method, the cathode 15 and ceramic disc 17 are moved axially in the grid 5 toward the end cap 10 until a point is reached at which a predetermined potential applied between the cathode 15 and grid 5 causes an electric spark from the closed end of cathode 15 to the end cap 10. The cathode 15 and grid 5 are clamped in the position at the point while the deformations are simultaneously formed to permanently and rigidly fix the position of the cathode 15 and the disc 17 within the grid 5. This construction thus eliminates the use of a spacer element between the ceramic 17 and inner surface of grid cap 10. Also, the use of a locking ring between ceramic 17 and welded grid cap members 6 and 7 is eliminated.

Reference will now be made to Figures 4 and 5 for a description of a method by which the cathode 15 may be precisely and permanently fixed in position in the grid 5. The cathode 15 with the ceramic disc 17 attached thereto, is positioned in an aperture in a member 40. The aperture in the member 40 is lined with an insulating sleeve 41 to electrically insulate the cathode 15 from the member 40. An expander pin 42 is drawn downwardly causing an expanding collet 43 to grip the interior of the cathode 15 and draw it downwardly so that the ceramic disc 17 seats on the top surface of the member 40.

The grid 5 is then placed over the ceramic disc 17 and over the outside surface of member 40. The grid 5 makes electrical contact with the member 40. A battery 44 and a meter 45 (or any suitable equivalents) are connected in series from the expanding collet 43 to the:

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member 40. The grid 5 is moved slowly downward until a spark discharge occurs between the coating 16 on the cathode 15 and the end cap 10 of the grid 5. The potential of the battery 44 is predetermined at a value which permits the spark discharge when the spacing of the cathode and the grid are at the desired value.

When the desired position of the grid 5 is reached, the grid is clamped in position by means of jaws 46 and 47 which move toward the grid 5 on a platform 48'. The platform 48' also supports the member 40 so that the jaws 46 and 47 and the member 40 are fixed against relative up and down movement. The jaws 46 and 47 have horizontal guides therein in which plungers 48 and 49, respectively, are free to slide towards the grid 5.

Figures 4 and 5 show the jaws 46 and 47 in the unclamped position. The jaws are moved toward the grid 5 to rigidly clamp it in position with relation to the cathode 15, and then the plungers 48 and 49 are simultaneously urged toward the grid 5. The plungers 48 and 49 are provided with a plurality of pointed prongs 50 which engage the cylindrical wall of the grid 5 to produce inwardly extending deformations therein at circumferentially and axially spaced points. The distribution of the deformations is such as to rigidly confine the ceramic disc 17 in the grid 5, and consequently to fix the distance between the thermo-emissive coating 16 and the end cap 10.

After the deformations are formed, the jaws 46 and 47 are opened to release the grid 5, and the collet 43 is contracted to release the cathode 15. The cathode grid assembly is then free to be removed from the fixture.

For normal operation, helical insulated heating wire (not shown) is positioned within the hollow cylindrical cathode 15, and the cathode and grid assembly is mounted within a cathode ray tube bulb in appropriate relationship with other electrodes. Electric current passed thru the heater wire raises the temperature of the thermo-emissive coating 16 to the extent necessary to cause electrons to be emitted therefrom. By properly biasing the cathode 15 and the grid 5 with respect to each other, and with respect to other electrodes of the gun, a stream of electrons is made to emerge from the aperture 11 in the grid 5.

It is apparent that the cathode grid assembly constructed according to the teachings of this invention provides for the rigid fixing of the space between the thermo-emissive cathode and the aperture in the grid without

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employing a separate spacing element disposed between the ceramic disc 17 and the end cap 10. The assembly is simpler and less expensive to manufacture by reason of omission of the previously necessary spacing and welding member which had to be constructed to extremely close tolerances.

What is claimed is:

1. The method of fixing a metallic cathode in insulated predetermined spaced relation inside a cup-shaped metallic grid member, said method comprising the steps of, fixing said cathode within an aperture in a ceramic disc having an outer diameter fitting within said grid, applying a predetermined electric potential between said cathode and said grid, moving said cathode and said disc in said grid towards the closed end thereof until said cathode reaches a point at which an electric discharge occurs between said cathode and said grid, and locking said cathode and said grid together by forming inwardly extending projections in the tubular wall of said grid at a plurality of circumferential and axially spaced points with said projections contacting the peripheral edge of said disc on both sides thereof.

2. The method of fixing a metallic cathode in insulated predetermined spaced relation inside a cup-shaped metallic grid member, said method comprising the steps of, fixing said cathode within an aperture in a ceramic disc having an outer diameter fitting within said grid, placing said cathode and grid in a circuit with a potential source, moving said cathode and disc in said grid towards the closed end thereof, clamping said cathode and said grid in position when a current flow occurs in said circuit, forming inwardly extending projections in the tubular wall of said grid at a plurality of circumferential and axially spaced points with said projections contacting the peripheral edge of said disc on both sides thereof to lock said disc to said grid.

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