

Aug. 6, 1963

M. W. HUSE

3,100,273

CATHODE SUPPORT

Filed July 5, 1960

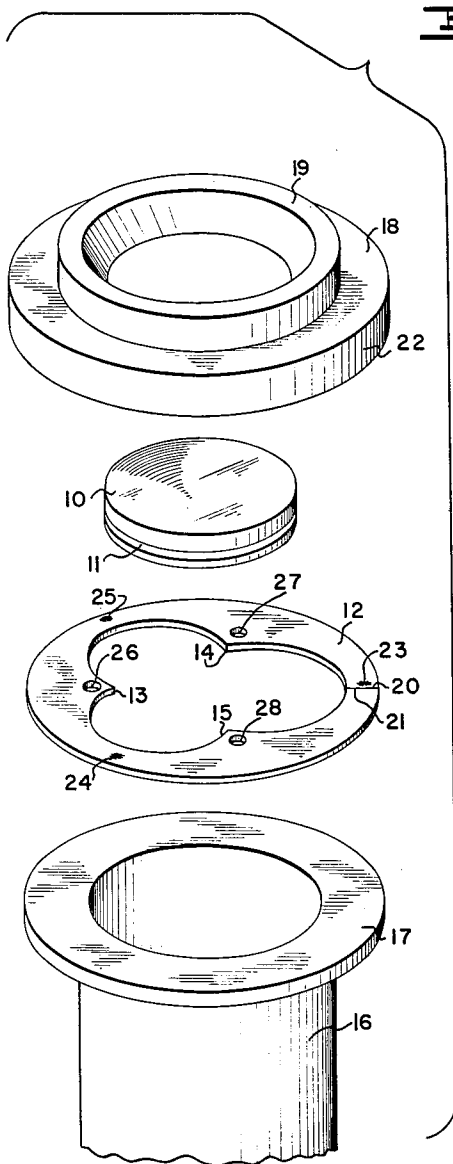


FIG. 2.

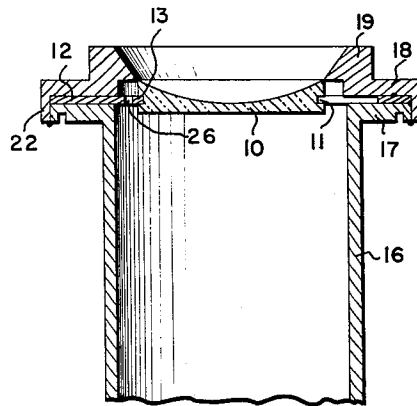


FIG. 1.

INVENTOR

MASON W. HUSE

BY

Joseph D. Pannone

ATTORNEY

1

3,100,273

CATHODE SUPPORT

Mason W. Huse, Sudbury, Mass., assignor to Raytheon Company, Lexington, Mass., a corporation of Delaware
Filed July 5, 1960, Ser. No. 40,646
9 Claims. (Cl. 313-82)

This invention relates generally to charged particle emitters, and more specifically to an improved emitter or cathode support structure for use in various types of beam tubes.

The primary object of this invention is to provide an improved support for a cathode whereby precise alignment of the cathode may be maintained within a tube in spite of varying heat conditions in and surrounding the cathode.

A more specific object of the invention is to provide a support structure for a cathode of a beam tube wherein the utilization of the cathode under high heat conditions will not affect the mounting and cause it to loosen or warp, resulting in misalignment of the cathode within the tube.

A still further object of this invention is to provide a simplified cathode support structure which is efficient in operation and economical to manufacture.

Another object of this invention is to provide a cathode support structure wherein the cathode is supported at a minimum number of points by structure including heat chokes to prevent damage to the mounting structure for the cathode and to restrict the amount of cathode heat dissipation through the mounting structure.

With the foregoing and other objects in view, the invention resides in the following specification and appended claims, certain embodiments and details of construction of which are illustrated in the accompanying drawings in which:

FIGURE 1 is a vertical section taken through the cathode and cathode support structure of a beam tube, and FIGURE 2 is an exploded view of the various parts of the structure illustrated in FIGURE 1.

Referring more particularly to the drawings, a cathode element 10 is illustrated as being provided with a peripheral groove 11. Engaging the peripheral groove 11 at three spaced points is a support disc 12 having inwardly directed pointed projections 13, 14 and 15. These projections during assembly of the cathode engage upon the grooved area to support the cathode 10 in axial, concentric alignment within a support cup 16 which carries the entire cathode assembly.

The support disc 12, as illustrated in FIGURE 1, is confined between the flanges 17 and 18 of support cup 16 and focusing electrode 19 respectively. As illustrated, the support disc 12 is a split ring and is provided with a pair of substantially terminal edges 20 and 21 whereby the disc has an inherent amount of radial resilience for assembly within the downwardly depending lip 22 of the flange 18. Upon assembly within the lip 22 the disc 12 is spot welded at points 23, 24 and 25 after first pressing cathode 10 into disc 12 so that the disc is axially fixed relative to the cathode 10 and is concentric therewith. Once the disc 12 is secured to the electrode 19, the cathode 10 may be pressed into position over the projections 13, 14 and 15 until such pointed projections engage the surface of the peripheral groove 11 of the cathode member. It will be readily obvious to one skilled in the art therefore that the cathode 10 is supported at spaced points approximately 120° apart by a minimum amount of metal contact area. The disc 12 is further preferably provided, adjacent the projections 13, 14 and 15, with a plurality of holes 26, 27 and 28 which provide sufficient air gaps in the metal adjacent such projections as to func-

2

tion as heat chokes to minimize the amount of cathode heat draining off into the mounting means, thereby efficiently preserving the cathode emitter temperature level while guarding against excessive temperatures in the mounting structure.

After the cathode has been inserted into its fixed aligned position relative to the electrode 19, the support cup 16 is moved into the assembled position within the housing formed by the members 16 and 19 as illustrated in FIGURE 1 and the abutting faces of lip 22 and flange 17 are sealed together throughout the contact area by means of a continuous welding process.

In consideration of the principles of the invention, it is well to mention that the electrode 19 and the support cup 16 are preferably made of Monel metal chosen for the purpose of thermal compensation. The support disc 12 is preferably of molybdenum although it is not necessarily limited to this metal since the choice of material is dictated by temperature and emission problems.

With the molybdenum disc 12 welded to the Monel electrode 19 at the three narrow points 23, 24 and 25 about its perimeter, any differential expansion between the molybdenum and the Monel parts causes the circle described by the points of the three projections 13, 14 and 15 of disc 12 to contract during any heating of the cathode. The heating of the cathode therefore cannot cause the mounting to loosen. On the contrary, the cathode will always experience a radial compression at the points of support during a heating operation.

It should thus be apparent to one skilled in the art that the support structure provided for the cathode element 10 will not permit any play in the support assembly at elevated temperatures of the cathode. The axial position of the cathode with respect to the focusing electrode 19 is determined only by the position of the groove in the emitter 10. The original concentricity of the cathode 10 with respect to the focusing electrode 19 and the support cup 16 may be derived during manufacturing procedures by simple jiggling processes. It should be further apparent to one skilled in the art that the utilization of the preferred form of heat chokes, as provided by the holes 26, 27 and 28 adjacent the contact points between the disc 12 and the cathode element 10, will reduce the amount of cathode temperature drain while at the same time will block a good deal of the temperature from the securing portions of the disc 12 to the electrode 19. Furthermore the close proximity of the cathode 10 to its ultimate connection through the weld spots 23, 24 and 25 to the electrode 19 reduces possible misalignment due to thermal expansion to a negligible amount. Another feature which should be obvious to one skilled in the art is that the inherent strength of the support disc 12 relative to the cathode 10 is so great that it will withstand severe shock and vibration tests which might otherwise cause misalignment and breakage of the unit.

Obvious modifications to the precise structure as illustrated and described herein are deemed to be well within the purview of the appended claims.

I claim:

1. A cathode assembly comprising a support cup, a focusing electrode fixedly secured to said support cup in substantially concentric alignment therewith, an electrically conductive support disc secured between said support cup and said focusing electrode and having an interior peripheral edge of an undulating contour, and a cathode element supported by three spaced portions of said interior peripheral edge of said support disc in axial alignment with said support cup and said electrode.
2. A cathode assembly for beam tubes comprising a supporting two part housing assembly made of metal, a cathode element axially aligned within said housing, and

3

metallic means fixed to said housing and extending inwardly therefrom to engage and support said cathode at three spaced points in rigid relationship to the housing and in axial alignment therewith, the metal of the cathode engaging means having a coefficient of expansion different and less than the metal of the housing, whereby any differential expansion between the housing and the cathode engaging means will cause a compressive reaction of the engaging means on the cathode.

3. A cathode assembly comprising a pair of housing members, one portion thereof acting as a focusing electrode, a flat metal disc secured to the focusing electrode of said housing in axial alignment therewith, said disc including a substantially open central area having three inwardly directed spaced projections, and a cathode element supported by said disc, said cathode element being provided with a peripheral groove into which the projections of said disc may extend to thereby engage and support the cathode in axial alignment within the housing members.

4. A cathode assembly comprising a pair of cylindrical, flanged housing members at least one of which is electrically conductive, said members being joined together along their abutting flanges, a flat metal disc secured to at least one of the housing members between the flanges and being in axial alignment therewith, said disc including an open central area having three inwardly directed spaced projections, and a cathode element supported by the projections of said disc, said cathode element being provided with a peripheral groove into which the projections of said discs may extend to thereby engage and support the cathode in axial alignment within the housing members.

5. A cathode assembly comprising a pair of metal housing members, one portion thereof acting as a focusing electrode, a flat metal disc secured to the focusing electrode of said housing in axial alignment therewith, said disc including a substantially open central area having three inwardly directed spaced projections, and a cathode element supported by said disc, said cathode element being provided with a peripheral groove into which the projections of said disc may extend to thereby engage and support the cathode in axial alignment within the housing members, the metal of the disc having a coefficient of expansion different and less than the metal of the housing members, whereby any differential expansion between the housing members and the disc will cause a compressive reaction of the disc on the cathode.

6. A cathode assembly comprising a pair of housing members, one portion thereof acting as a focusing electrode, a flat metal disc secured to the focusing electrode of said housing in axial alignment therewith, said disc including a substantially open central area having three inwardly directed spaced projections, and a cathode element supported by said projections of said disc, said disc being provided with a plurality of openings at least one

4

of which is positioned closely adjacent to the apex of each projection, said cathode element being provided with a peripheral groove into which the projections of said disc may extend to thereby engage and support the cathode in axial alignment within the housing members.

7. A cathode assembly comprising a pair of cylindrical flanged housing members at least one of which is electrically conductive, said members being joined together along their abutting flanges, a flat metal disc secured to at least one of the housing members between the flanges and being in axial alignment therewith, said disc including an open central area having three pointed inwardly directed spaced projections, said disc being further provided with a plurality of openings at least one of which is positioned closely adjacent to the apex of each pointed projection, and a cathode element supported by the pointed projections of said disc, said cathode element being provided with a peripheral groove into which the projections of said disc may extend to thereby engage and support the cathode in axial alignment within the housing members.

8. The invention according to claim 8, wherein the housing members are made of a metal having a certain coefficient of expansion and wherein the flat metal disc is made of a different metal having a different coefficient of expansion less than the metal of said housing members whereby any differential expansion between the housing members and the disc under varying temperature conditions will cause a compressive reaction of the disc on the cathode.

9. A cathode assembly comprising a pair of cylindrical housing members, said members being made of metal and being joined together along their abutting flanges, a flat metal disc secured to at least one of the housing members between the flanges and being in axial alignment therewith, said disc including an open central area having inwardly directed spaced projections, and a cathode element supported by the projections of said disc, said cathode element being provided with a peripheral groove into which the projections of said disc may extend to thereby engage and support the cathode in axial alignment within the housing members, the metal of the disc having a coefficient of expansion different and less than the metal of the housing, whereby any differential expansion between the housing and the cathode supporting disc will cause a compressive reaction of the disc engaging projections on the cathode.

References Cited in the file of this patent

UNITED STATES PATENTS

2,421,767	Varian	June 10, 1947
2,455,381	Morton et al.	Dec. 7, 1948
2,888,591	Schmidt et al.	May 26, 1959
2,941,109	Senior et al.	June 14, 1960
2,978,606	Kahl	Apr. 4, 1961

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,100,273

August 6, 1963

Mason W. Huse

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, line 37, before "inwardly" insert -- three --.

Signed and sealed this 25th day of February 1964.

(SEAL)
Attest:

ERNEST W. SWIDER

Attesting Officer

EDWIN L. REYNOLDS

Acting Commissioner of Patents