May 30, 1944. Z. J. ATLEE 2,350,270

CATHODE ASSEMBLY STRUCTURE

Filed Oct. 2, 1943

Fig. 1

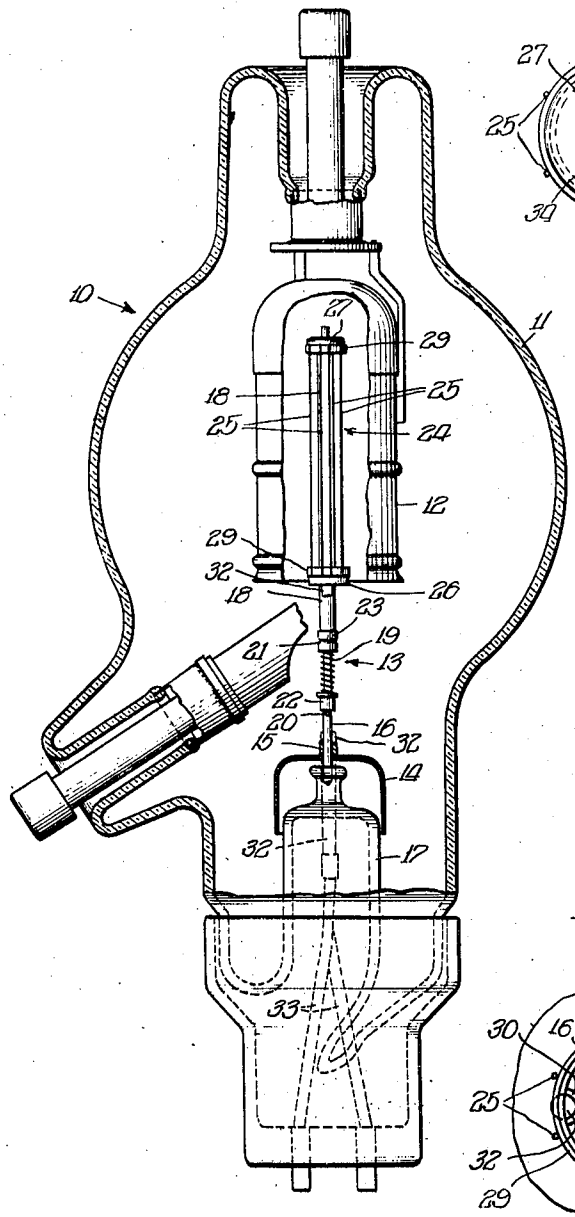


Fig. 3

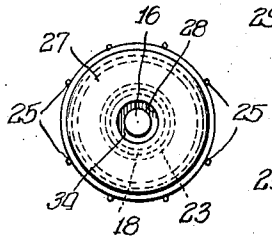


Fig. 2

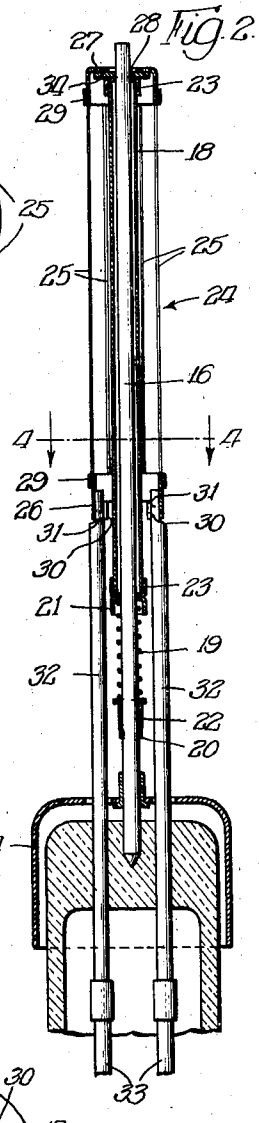
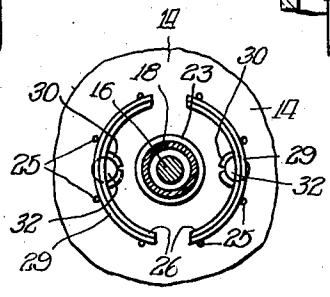


Fig. 4



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CATHODE ASSEMBLY STRUCTURE

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10 Claims. (Cl. 250—27.5)

The present invention relates to a cathode assembly structure for electron tubes, particularly tubes used in high voltage operations such as radar, X-ray and other operations conducted with high voltage.

An important object of the present invention is to provide a cathode assembly structure for tubes used for such purposes, including particularly an improved filament assembly structure that will withstand the high temperature conditions attending such operations. Some of the difficulties experienced with previous structures and attempts to remedy them are recited in United States Letters Patent No. 2,314,037, granted March 16, 1943.

Another important object of the present invention is to provide an improved filament assembly structure comprising parts mainly of tungsten and molybdenum, thereby largely avoiding the breakage and distortion experienced with structures previously available. This is accomplished in the present invention by employing a weld flux of tantalum, platinum or other metal of similar characteristics, in connecting molybdenum parts and tungsten parts by means of a weld. It is a further object of the invention to provide improved means for supporting and tensioning a filament assembly structure.

This invention further resides in the combination, construction and arrangement of parts illustrated in the accompanying drawing, and while there is shown therein preferred embodiments of the invention, it is to be understood that the same are susceptible of modification and change without departing from the spirit of the invention.

The accompanying drawing illustrates a selected embodiment of the invention, and the views therein are as follows:

Fig. 1 is a side elevation of a tube including an illustrative embodiment of the invention, partially broken away;

Fig. 2 is an enlarged, central vertical section of the cathode assembly structure shown in Fig. 1;

Fig. 3 is a plan view of the structure shown in Fig. 2;

Fig. 4 is a sectional view along the line 4—4 of Fig. 2.

The particular embodiment of the invention illustrated in the drawing comprises an electron tube, generally designated by the numeral 10, including an evacuated glass envelope 11, an anode 12 and a cathode assembly structure generally designated by the numeral 13, with suitable leads thereto arranged in glass-to-metal sealed relation with said tube.

The cathode assembly structure 13 comprises a cathode support shell 14 of inverted cup shape having a central sleeve portion 15 adapted to receive a supporting stem 16, which is mounted in the re-entrant portion 17 of the envelope 11, the shell being arranged generally to cover said re-entrant portion. The stem 16 is adapted to extend in a generally axial direction well within the anode 12, which is in the form of a cup shaped shell. A tensioning member or tube 18 is slidably mounted on the stem and its ends are normally maintained in spaced relation with the respectively adjacent ends of the stem 16 by means of a tension spring 19, which is arranged on the stem 16 intermediate one end of the tube and a stop 20 provided on the stem. The opposite ends of the spring 19 preferably abut, respectively, a guide 21 and a collar 22 which are slidably mounted on the stem 16. The opposite ends of the tube 18 are preferably received in guides 23 which are also slidably mounted on the stem 16.

The filament assembly 24 is generally tubular in form and comprises a plurality of filamentary tungsten wires 25 having their opposite ends respectively secured to supporting members 26 and 27. The members 26 are in the form of spaced arcuate molybdenum strips. The member 27 is in the form of a molybdenum hat having a central opening 28 adapted to receive the stem 16. As the tungsten wires 25 cannot readily be welded to the molybdenum members 26 and 27, a strip of tantalum is arranged intermediate the ends of the wires and the adjacent portions of each of the members 26 and 27, as indicated at 29 in Figs. 1, 2 and 4. The tantalum is welded with the tungsten and the molybdenum and the filamentary wires are thus secured to the members 26 and 27.

The members 26 have depending sleeves 30 which are welded to the end portions 31 of supporting wires 32. The wires 32 are operatively connected with lead wires 33.

The filament assembly 24 is arranged on the stem 16 adjacent the end of the tube 18 remote from the spring 19 with the upper end of the stem 16 projecting through the opening 28.

A molybdenum washer 34 may be provided on the stem 16 intermediate the guide 23 and the hat 27. The conformation and arrangement of the parts is such that the spring 19 will cooperate with the tube 18 and the stop 20 to tension the filament assembly 24.

The straps 29 may be made of platinum or

other metal having welding flux characteristics similar to tantalum or platinum.

Changes may be made in the form, construction and arrangement of the parts without departing from the spirit of the invention, and the right is hereby reserved to make all such changes as fairly fall within the scope of the following claims.

The invention is hereby claimed as follows:

1. A cathode assembly structure comprising a plurality of fixed supporting members, a filament assembly structure mounted on said supporting members, and means for tensioning said filament assembly structure, said filament assembly structure comprising spaced metallic supporting members and a plurality of filamentary wires having their opposite ends respectively secured to said last mentioned supporting members by a metallic welding flux.

2. A cathode assembly structure comprising a pair of fixed supporting members, a filament assembly structure, and means for tensioning said filament assembly structure, each of said members being connected with an electrical conductor, said filament assembly structure comprising spaced metallic supporting members and a plurality of filamentary wires having their opposite ends respectively secured to said last mentioned supporting members by a metallic welding flux, and said last mentioned supporting members including a pair of generally arcuate members arranged at one end of said wires and mounted respectively upon said fixed supporting members.

3. A cathode assembly structure comprising a pair of fixed tungsten supporting members, a filament assembly structure, and means for tensioning said filament assembly structure, each of said members being connected with an electrical conductor, said filament assembly structure comprising spaced molybdenum supporting members and a plurality of filamentary tungsten wires having their opposite ends respectively secured to said last mentioned supporting members by a tantalum weld, and said last mentioned supporting members including a pair of generally arcuate members arranged at one end of said wires and mounted respectively by a tantalum weld upon said fixed supporting members.

4. A cathode assembly structure comprising a plurality of fixed electrical conductors, a filament assembly structure, and means for tensioning said filament assembly structure, said filament assembly structure comprising a molybdenum supporting hat, a plurality of generally arcuate, opposed molybdenum supporting members arranged in spaced relation with said hat, and a plurality of spaced filamentary tungsten wires having opposite ends connected by means of a tantalum weld with said hat and one of said supporting members, respectively, and said supporting members being respectively mounted upon said conductors.

5. A cathode assembly structure comprising a plurality of fixed electrical conductors, a filament assembly structure, and means for tensioning said filament assembly structure, said filament assembly structure comprising a molybdenum supporting hat, a plurality of generally arcuate, opposed molybdenum supporting members arranged in spaced relation with said hat, and a plurality of spaced filamentary tungsten wires having opposite ends connected by means of a tantalum weld with said hat and one of said supporting members, respectively, said supporting members being respectively mounted upon said conductors, said tensioning means comprising a fixed support, a stop on said support adjacent one end thereof, a tension member slidably mounted on said support, spring means mounted on said support intermediate said stop and said tension member, and guides for said tension member slidably mounted on said support, said hat having a central opening adapted slidably to receive said support and said hat being arranged on said support in cooperative relation with said tension member.

6. A cathode assembly structure comprising a plurality of fixed electrical conductors, a filament assembly structure, and means for tensioning said filament assembly structure, said filament assembly structure comprising a molybdenum supporting hat, a plurality of generally arcuate, opposed molybdenum supporting members arranged in spaced relation with said hat and with each other, and a plurality of spaced filamentary tungsten wires having opposite ends connected by means of a tantalum weld with said hat and one of said supporting members, respectively, and said supporting members being respectively mounted upon said conductors.

7. A cathode assembly structure comprising a fixed support, a filament assembly structure movably mounted on said support, and means on said support for tensioning said filament assembly structure, said filament assembly structure comprising a molybdenum supporting hat, opposed molybdenum supporting members arranged in spaced relation with said hat, a plurality of filamentary tungsten wires connecting said hat and said supporting members, respectively, the opposite ends of said wires being connected to said hat and one or the other of said supporting members, respectively, by means of a tantalum weld, and a plurality of electrical conductors respectively connected with said supporting members.

8. A cathode assembly structure comprising a fixed support, a filament assembly structure movably mounted on said support, and means on said support for tensioning said filament assembly structure, said filament assembly structure comprising a molybdenum supporting hat, opposed molybdenum supporting members arranged in spaced relation with said hat, a plurality of filamentary tungsten wires connecting said hat and said supporting members, respectively, the opposite ends of said wires being connected to said hat and one or the other of said supporting members, respectively, by means of a tantalum weld, and a plurality of fixed electrical conductors respectively connected with and arranged to support said supporting members independently of said fixed support.

9. An electron tube comprising an evacuated glass envelope having a re-entrant portion, a metal supporting stem mounted in said re-entrant portion centrally thereof and in glass-to-metal sealed relation therewith, a plurality of opposed tungsten leads mounted in said re-entrant portion in glass-to-metal sealed relation therewith and in spaced relation with each other and with said stem, a metal shield mounted on said stem in spaced relation with said re-entrant portion and having spaced openings adapted to receive said leads, a filament assembly structure movably mounted on said stem, and means on said stem for tensioning said filament assembly structure, said filament assembly structure comprising a metal supporting hat having a central opening therein and arranged slidably to receive said

stem, opposed metal supporting members respectively mounted on said leads and arranged in spaced relation with said hat, and a plurality of filamentary tungsten wires connecting each of said supporting members with said hat, the said wires having opposite ends connected to said hat and said supporting members, respectively, by a tantalum weld.

10. An electron tube comprising an evacuated glass envelope having an axially extending re-entrant portion, a metal supporting stem mounted in said re-entrant portion centrally thereof and in glass-to-metal sealed relation therewith, a plurality of opposed tungsten leads mounted in said re-entrant portion in glass-to-metal sealed relation therewith and in spaced relation with each other and with said stem, a nickel plated steel shield mounted on said stem in spaced relation with said re-entrant portion and having spaced openings adapted to receive said leads, a filament assembly structure movably mounted on said stem, and means on said stem for tensioning said filament assembly structure, said filament assembly structure comprising a molybdenum supporting hat having a central opening therein and arranged slidably to receive said stem, opposed molybdenum supporting members respectively mounted on said leads and arranged in spaced relation with said hat and a plurality of filamentary tungsten wires connecting each of said supporting members with said hat, the said wires having opposite ends connected to said hat and said supporting members, respectively, by a tantalum weld.

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