

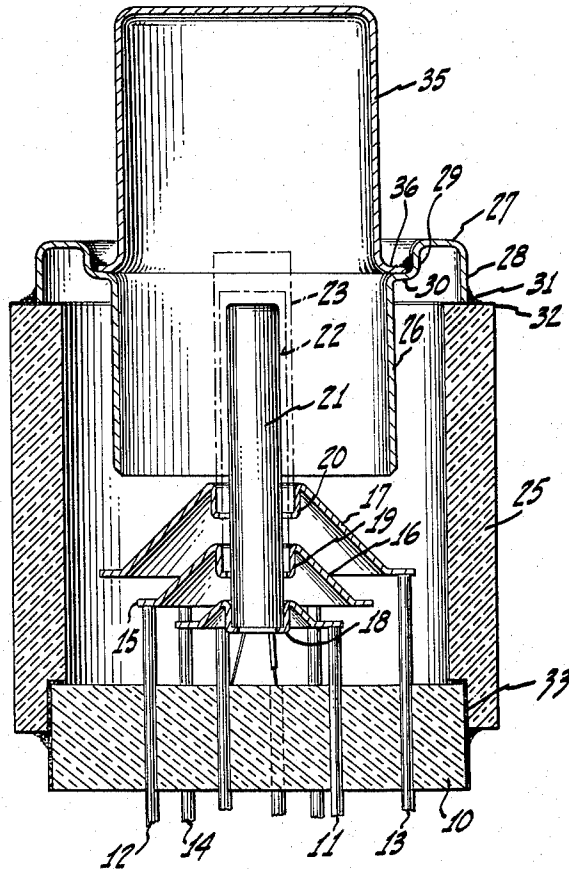
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ANODE TOP-CAP ASSEMBLY FOR ELECTRON DISCHARGE DEVICES

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ANODE TOP-CAP ASSEMBLY FOR ELECTRON DISCHARGE DEVICES

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My invention relates to electron discharge devices of novel construction and more particularly to an improved anode and top-cap assembly useful in tubes utilizing ceramic envelopes.

Tubes utilizing ceramic envelopes have advantages over those utilizing glass but have introduced other problems in manufacturing and in tube construction. Tubes having ceramic envelopes may be processed at very high temperatures thereby improving out-gassing. Also, it is possible with such tubes to, in one step, fix all of the electrode elements and their supporting members within the envelope except for a closure member by brazing done at very high temperatures. Techniques have been developed which permit the assembly of all of the elements within a jig. After such assembly, the jig and all of the parts may be inserted into a furnace for degassing and for brazing simultaneously.

In tubes of this kind employing ceramic envelopes and processed at relatively high temperatures, the problem exists in simultaneously meeting the requirements of proper anode electronic design, proper mechanical design to provide strain free seals and for maximum strength and ease of brazing to the ceramic envelope and providing a pumping port through which the tubes can be evacuated and which can be brazed shut after completion of the pumping operation. Further, it is desirable to provide a construction which is easy and economical to fabricate.

Further, I have found that attempts to seal a flat, radially extending flange supporting an anode to a flat surface of a ceramic envelope are not satisfactory for providing vacuum tight seals. Heat developed in the anode during operation induces stresses which cause seal failure in this type of construction.

It is therefore an object of my invention to provide an electron discharge device of the type described which structurally meets all of the requirements pointed out above.

The single figure of the drawing shows a longitudinal section of an electron discharge device of the type described and utilizing my invention.

The electron discharge device shown in Fig. 1 includes a ceramic header member 10. Extending through and sealed vacuum tight to this header member are a plurality of terminal leads and supports 11, 12, 13, 14. These leads and supports have mounted at their upper ends flange-like elements 15, 16 and 17 provided with the well portions 18, 19 and 20. Each of these flanges is preferably connected to and supported on three equally spaced leads and support elements. Supported in coaxial arrangement by means of the flange members 15, 16 and 17 are the indirectly heated cathode 21, control grid 22, shown schematically, and screen grid 23, also shown schematically.

The envelope includes the cylindrical ceramic portion 25 sealed at 33 to the header member 10. The surfaces to be sealed vacuum tight are first metallized. The seal

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is made by brazing using a brazing ring at the joint between the parts to be brazed. The upper end of the tubular member 25 is also metallized at 32 to provide a seal which will be discussed below. The end surface of the comparatively thick cylindrical portion 25 lies in a plane transverse to the axis of the envelope.

In accordance with my invention, I provide a tubular anode 26 which is coaxial with and surrounds the electrodes 21, 22 and 23. The upper end of the anode electrode terminates in a radially outwardly directed step portion 30. The anode support which is integral with the step portion 30 includes an annular flange-like member 27 of U-shaped cross-section having an outer leg 28 of cylindrical shape and an inner leg 29 of shorter dimensions. The outer leg 28 is brazed vacuum tight to the upper end of the ceramic cylinder 25 using a brazing ring. The upper end of this cylinder is metallized at 32 whereby the lower or free end of the leg portion 28 of flange 27 may be sealed vacuum tight thereto at 31 by brazing. The step or shelf portion 30 provides a support for the anode cap 35 having a flange 36 subsequently sealed vacuum tight to the step 30, also by brazing using a brazing ring.

In assembly, all of the parts including the anode are assembled in a jig and subjected to a temperature sufficiently high to braze all of the parts together, the parts having previously been coated on the proper surfaces with brazing material. After the brazing has been effected, the top-cap and anode terminal 35 is placed in the position shown with a ring of brazing material (not shown) placed between the rim 36 and the step portion 30 of the anode.

The entire assembly with the anode cap in place is then placed in a vacuum chamber and heat treated for out-gassing at a very high temperature but somewhat below the flow temperature of the brazing ring. The gasses which are released by the heat treatment are pumped out through the small gap between the flange portion 36 to the top-cap and the step 30 of the anode. This gap is not shown but exists simply as a poor seating contact between the two parts. Finally, the tube assembly is raised in temperature for a short time to cause melting of the brazing ring so that it flows into the region of contact between the rim 36 of top-cap and the step 30 of the anode effecting a vacuum tight joint. The step 30 supports the anode cap during this process and the inner leg 29 insures proper positioning and registration of the top-cap during this process.

The U-shaped portion of 27 integral with the anode provides a sufficient degree of flexibility so that thermal strains or small mechanical deformations of the anode proper or of the top-cap are effectively isolated from the metal-to-ceramic seal region.

A tube incorporating my invention has the advantages of ease of fabrication and use, an adequate degree of strain isolation between the metal-ceramic anode bulb seal region and the rest of the anode top-cap structure for practical application, provision of a convenient pumping port for tube exhaust together with a means for closing this port, provision of an electrical contact terminal which can also serve as a heat radiator if needed, and flexibility of design so that various diameters of anode and bulb cylinders can be used without departing from the overall concept.

What is claimed is:

1. An electron discharge device having a ceramic envelope including a cylindrical portion one end of which has an annular surface lying in a plane transverse to the longitudinal axis of said cylindrical portion, a tubular anode provided at one end with an outwardly extending annular portion of U-shaped cross-section the outer leg

of which provides a cylindrical structure which extends parallel to the surface of the anode and toward the other end of said anode, the free end of said outer leg being sealed vacuum tight to the annular surface of the cylindrical portion of said envelope, said anode being provided with a step portion between the anode proper and said annular portion and providing a supporting surface, a cup-shaped member extending outwardly from said anode and having a flange sealed to said step portion, the inner leg of said U-shaped portion providing a guide for the flange on said cup-shaped member to properly position said cup-shaped member during assembly, the U-shaped portion serving to absorb strains induced in said electron discharge device, and electrode means supported within said anode member.

2. An electron discharge device having a ceramic envelope including a cylindrical portion, a tubular anode positioned within said envelope and provided at one end with an outwardly extending annular portion of U-shaped cross-section the outer leg of which extends back toward the other of said anode, the free end of said outer leg being sealed to one end of the cylindrical portion of said envelope, said anode having a step portion between the anode proper and the inner leg of said annular portion and providing a supporting surface, a cup-shaped closure member extending outwardly from said anode and having a flange sealed to said step portion, the inner leg of said U-shaped portion providing a guide for the flange on said cup-shaped member to properly position said cup-shaped member during assembly, the U-shaped portion serving to absorb strains, and electrode means supported within said anode member.

3. An electron discharge device having a ceramic envelope including a cylindrical portion, a tubular anode provided at one end with an outwardly extending annular portion of U-shaped cross-section, the free end of said outer leg being sealed vacuum tight to one end of the cylindrical portion of said envelope, said anode being provided with a radially directed step portion providing a supporting surface, a cup-shaped closure member having a flange sealed to said step portion, the U-shaped portion serving to absorb strain in said electron discharge device.

4. An electron discharge device having a ceramic envelope including a cylindrical portion, a tubular anode positioned within said envelope and provided at one end with an outwardly extending annular portion having oppositely disposed legs, the outer leg of which is longer than the inner leg and which extends back toward the other end of said anode, the free end of said outer leg being sealed vacuum tight to one end of the cylindrical portion of said envelope, said anode having a step portion

between the anode proper and the inner leg of said annular portion and providing a supporting surface, a cup-shaped member extending away from said anode and having a flange sealed to said step portion, the inner leg of said U-shaped portion providing a guide for the flange on said cup-shaped member to properly position said cup-shaped member during assembly, the U-shaped portion serving to absorb strain in said electron discharge device.

5. An electron discharge device having a ceramic envelope including a cylindrical portion one end of which has an annular surface lying in a plane transverse to the longitudinal axis of said cylindrical portion, a ceramic header member closing the other end of said cylindrical portion, a tubular anode provided at one end with an integral outwardly extending annular portion of U-shaped cross-section the outer leg of which is longer than the inner leg, said outer leg being parallel to the surface of the anode and extending toward the other end of said anode, the free end of said outer leg being sealed to the annular surface of said cylindrical portion, said anode having a step portion connecting the anode proper and the inner leg of said annular portion of U-shaped cross-section and providing a supporting surface, a cup-shaped closure member extending away from said anode and having a flange sealed to said step portion, the inner leg of said U-shaped portion providing a guide for the flange on said cup-shaped member to properly position said cup-shaped member during assembly, the U-shaped portion serving to absorb strains induced in said electron discharge device, and electrode means supported by said header member coaxial and within said anode member.

6. An electron discharge device having an envelope including a cylindrical ceramic portion, a tubular anode positioned within said cylindrical ceramic portion and provided with an outwardly extending annular portion sealed to one end of the cylindrical ceramic portion of said envelope, said anode having a step portion between the anode proper and the annular portion and providing a supporting surface, a cup-shaped closure member extending outwardly from said envelope and having its lip sealed to said step portion, said annular portion providing a guide for said cup-shaped closure member to properly position said cup-shaped member during assembly on said step portion, said annular portion serving to absorb strains, and electrode means supported within said anode.

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