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MOUNTING MEANS FOR A VACUUM TUBE ELECTRODE ASSEMBLY

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Fig. 1

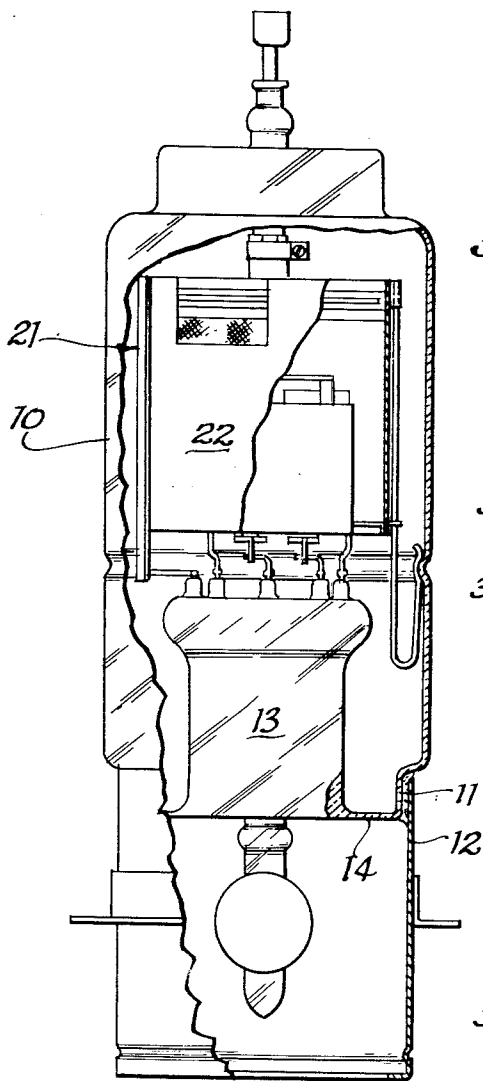


Fig. 2

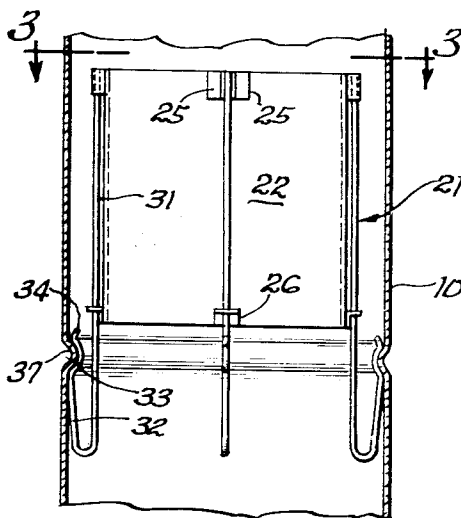


Fig. 3

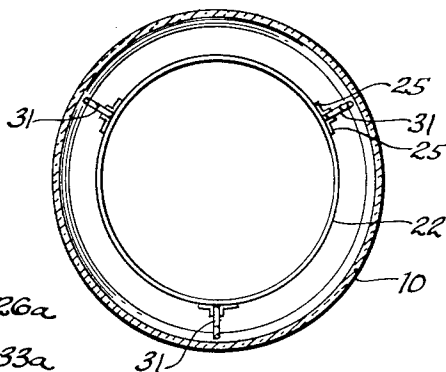
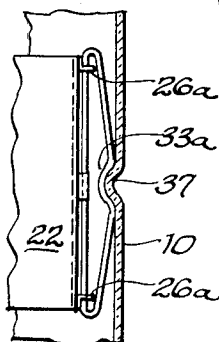


Fig. 4



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MOUNTING MEANS FOR A VACUUM TUBE ELECTRODE ASSEMBLY

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6 Claims. (Cl. 313—254)

This invention relates to improvements in electron tubes. In general it has relation to a tube comprising an envelope and an electrode structure supported there-within, the envelope defining an evacuated space or one into which a gas may have been admitted following evacuation, e. g. a glow discharge tube employing hydrogen as the gaseous medium. However it will be understood from what follows that the invention is of broad application to devices wherein an assemblage of elements on the order of the electrodes of a glow discharge tube is to be semi-rigidly supported in a predetermined position within a confining envelope.

One type of glow discharge tube, of which the "thyatron" is exemplificative, employed in radar, includes a somewhat massive electrode structure which, while supportable to a substantial degree upon axially disposed elements secured to the tube envelope, must also be provided with lateral support capable of maintaining the electrode assembly in a predetermined position in the envelope. Furthermore, it is desirable that such support be of semi-rigid character, for otherwise dimensional changes due to heating of the metal parts and glass during operation may readily set up stresses of a hazardous character. Additionally a semi-rigid mounting enables the electrode structure capable of absorbing shock without damage to itself or to the parts upon which it is carried.

Accordingly a relatively rigid but yet yieldable form of support is dictated, and in consequence of which the principal object of our invention is to provide, in an electron tube, means for supporting the electrode assembly, which is not only capable of radial flexibility to accommodate movement of the assembly due to dimensional changes, but such shifting thereof as might result from shock or vibration.

Another object is to provide supporting means as aforesaid which is capable of locating the electrode structure coaxially of the tube as well as in a predetermined longitudinal location.

A further object is to provide electrode structure supporting means, characterized as aforesaid, which may be assembled with the envelope without the use of tools, and easily disassembled without hazard to the envelope or the electrode assembly.

Still another object is to provide supporting means, in accordance with the foregoing objects, which may be assembled with the envelope without regard to the maintenance of a particular angular relation between such means and the envelope.

In general the invention contemplates the securement, in any convenient manner, to the exterior portions of the electrode assembly of a plurality of members comprising resilient wire each of which is bent upon itself to form a hairpin-like element imparting transverse flexibility. The bent-over portion of the member is positioned adjacent the inner wall of the envelope and is provided with a deformed arcuate zone or concavity for engagement over a rib formed peripherally of the inner wall of the

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envelope, whereby upon mutual engagement of the concavity with the rib axial retention of the electrode structure is effected. Radial support of a yieldable character is provided by the hairpin spring action of the member.

By way of example the invention will be described with reference to a so-called hydrogen thyatron, although the actual type of tube is immaterial insofar as practice of the invention is concerned. Such tube has been chosen as exemplificative because of the relatively heavy electrode structure employed and the relatively high operating temperature, both of which factors provide a suitable environment for realizing in substantial measure the advantages of the invention.

In the drawing which depicts the invention embodied in a hydrogen thyatron of a recently developed design:

Fig. 1 is a side elevational view, partly in section, showing the supporting means of the invention:

Fig. 2 is a combined longitudinal elevational and cross-sectional view to show the mode of affixing the supporting wires to the electrode assembly;

Fig. 3 is a transverse cross-section taken on the line 3—3 of Fig. 2; and

Fig. 4 is a detail of an alternative form of the invention.

Referring to this drawing there is shown a glass envelope 10 of generally cylindrical form having a neck 11 to which the metal supporting base 12 is cemented or otherwise secured. It will be apparent from what follows that the envelope is not necessarily glass, but may be of metal, in which case the invention possesses a further distinctive advantage in that the supporting members are capable of finding a proper seat upon the rib in the envelope to be described, and visibility need not be relied upon to determine if accurate assembly has been accomplished.

It will be understood that the basic tube envelope will be left open at one end for insertion of the electrode assembly. In the present instance such opening will be defined by the neck 11; the press 13 and flange 14 being thereafter assembled by fusion in the well-known manner. With the use of the invention any minor variation in positioning of the press 13 is immaterial, as compared to those other arrangements wherein the principal support for the electrode assembly was the press, and any mislocation of the latter resulted in mispositioning of the electrode structure.

The electrode structure 21 illustrated incorporates various cathode, grid and plate elements the details of which are not material to this description, other than to point out that the outermost element, in this case a cylindrical so-called grid can electrode 22 is utilized particularly in practicing the invention. It will be understood that the several electrodes are assembled in a definite arrangement. The conductors for these several electrodes are brought out through the press 13 in a manner well understood in this art, except that, for the purposes of this invention, it is not necessary that these conductors be relied upon to support the electrode assembly as is the case in certain prior constructions. As a matter of preferred practice these leads may have some flexibility in order to allow the electrode assembly to be supported solely upon the members constituting part of the invention, and to occupy a position centrally of the envelope. Stated otherwise, by the use of the invention, a self-centering action of the electrode assembly may be readily achieved.

Referring particularly to Figs. 2 and 3 the electrode 22 is provided with a circumferentially spaced plurality of pairs of ears 25 spot welded or otherwise secured to the plate 22, and disposed adjacent one end of the electrode, in this case, the upper end. At the other end there is provided a correspondingly spaced plurality of ears 26

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which may also be spot welded or otherwise secured. A plurality of resilient rods or wire members 31 are secured to the ears 25 and 26, as by interposing one end of the member between a pair of ears 25 and spot welding the parts together, and by passing the other end of the member through an aperture in the outstanding leg of the ear 26. Preferably the wire members are formed from a metal having low relaxation at high temperature, for example, Inconel X, available from the International Nickel Company. By securing the member 31 to the electrode 22 by one end only, change in the respective longitudinal dimensions of the plate and members under heating or cooling need not be of the same order of magnitude. Thus transmission of stress from one to the other is avoided, together with any separation of welded or otherwise fabricated joints as might otherwise result when parts having differing coefficients of expansion are rigidly joined. In essence the ear 26 provides lateral positioning for the intended purpose as well as the action of a slip or expansion joint. In the foregoing connection it is pointed out that in certain types of electron discharge devices the plate may operate at red heat. While three equally spaced members 31 are shown it will be obvious that some other plurality may be used equally effectively.

At its lower end each member 31 is of hairpin form including a portion 32 returned upon the main part of the member, and such portion is provided with a concave deformity or hump 33 terminating in an inwardly bent tail 34 for a purpose to be described. Initially, that is prior to assembly of the envelope and electrode assembly, the spacing between the body of the member 31 and the portion 32 will be greater than in the assembled condition in order that, upon assembly, the leg 32 will be compressed and enabled to exert outward pressure and consequent firm engagement with the envelope.

Formed around the periphery of the envelope is an indented zone or projection 37 preferably in the form of a toroidal convexity or rib adapted for engagement by the hump 33 of each of the several members 31, and whereby longitudinal positioning of the electrode assembly is accomplished. If desired, the convexity 37 may be interrupted to provide a plurality of separated indentations, although circumferential continuity is preferred for the reason that no specific angular relation between the envelope and electrode assembly need be observed.

From the foregoing it will have become apparent that incorporation of the electrode assembly with the envelope in a specific longitudinal relation merely involves inserting the assembly through the neck 11, and sliding the same to within the envelope until the humps 33 snap over the convexity 37. Such engagement is facilitated by the tail portions 34 sliding over the convexity 37 and camming the portions 32 inwardly until proper engagement is effected, as shown.

It is a simple matter, following such engagement, to rotate the electrode assembly to a desired angular position within the envelope, and without disturbing the engagement.

Following positioning of the electrode structure the press 13 may be located and fused into position, the several conductors having previously been threaded through the press in the customary manner.

In Fig. 4 there is shown an alternative form of the invention in which the spring members are of loop formation, secured to the electrode 22 at the center, and aligned and supported by ears 26a near the bights thereof. The concavity or hump 33a engages the rib 37 in the same manner as previously explained for the principal form of the invention.

While we have shown particular embodiments of our invention, it will be understood, of course, that we do not wish to be limited thereto, since other modifications may be made, and we therefore contemplate by the appended claims to cover any such modifications as fall within the true spirit and scope of our invention.

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Having thus described our invention, what we claim and desire to secure by Letters Patent is:

1. An electron tube comprising an envelope, an electrode assembly, and means supporting said assembly within said envelope including a peripheral convexity on the interior face of the envelope and a plurality of hairpin springs secured to and spaced apart about said assembly, each said spring having a concavity engaging over said convexity and positioning said assembly longitudinally and transversely of said envelope.

2. An electron tube comprising an envelope, an electrode assembly including an outermost element, and means supporting said assembly within said envelope including a peripheral convexity interiorly of the envelope and a plurality of hairpin springs spaced apart on said assembly, one arm of each of said springs being affixed to said element at at least one point of the arm, said element having an apertured ear slidably receiving said arm, the other arm of each of said springs including a concave deformity frictionally engaging over said convexity.

3. An electron tube comprising a substantially cylindrical envelope; an electrode assembly including an outermost cylindrical element; and means supporting said assembly in said envelope including a plurality of hairpin springs spaced apart circumferentially on said assembly, means securing one leg of each of said springs to said element, means constituting an expansion joint between said element and a portion of said leg, said envelope having a circumferentially disposed inwardly convex narrow zone, and the other leg of each of said springs having a concave deformity engaging with said zone.

4. An electron tube comprising an envelope, an electrode assembly disposed within said envelope and including an outermost element, said envelope having an inward projection peripherally of the interior face of the wall thereof which is humped in transverse cross-section, and a plurality of resilient U-shaped members secured to said outermost element by one leg, the other leg thereof having a deformed portion substantially congruent with the cross-sectional contour of said projection and engaged therewith, said members having resiliency principally in a direction normal to said wall for mounting said assembly with respect to said envelope principally for resistance to shock transversely of the envelope.

5. An electron tube comprising an envelope, an electrode assembly disposed within said envelope, said envelope having an inward projection on the interior face of the wall thereof and extending substantially uninterruptedly peripherally of said wall, the cross section of said projection in a plane normal to the principal direction thereof being substantially convex, and a plurality of U-shaped resilient elements supporting said assembly on said envelope, one leg of each element being secured to said assembly and the other leg thereof having a deformed portion substantially congruent with the cross-sectional configuration of said projection and engaged thereover, said elements having resiliency principally in a direction normal to said wall for mounting said assembly with respect to said envelope principally for resistance to shock transversely of the envelope.

6. An electron tube comprising an envelope, an electrode assembly disposed within said envelope, said envelope having an inward projection on the interior face of the wall thereof and extending substantially uninterruptedly peripherally of said wall, the cross-section of said projection in a plane normal to the principal direction thereof being substantially convex, and a plurality of loop-shaped resilient elements supporting said assembly on said envelope, one leg of each element being secured to said assembly and the other leg thereof having a deformed portion substantially congruent with the cross-sectional configuration of said projection and engaged thereover, said elements having resiliency principally in a direction

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normal to said wall for mounting said assembly with respect to said envelope principally for resistance to shock transversely of the envelope.

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