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E. J. WALSH

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ELECTRODE ASSEMBLY FOR ELECTRON DISCHARGE DEVICES

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2 Sheets-Sheet 1

FIG. 1

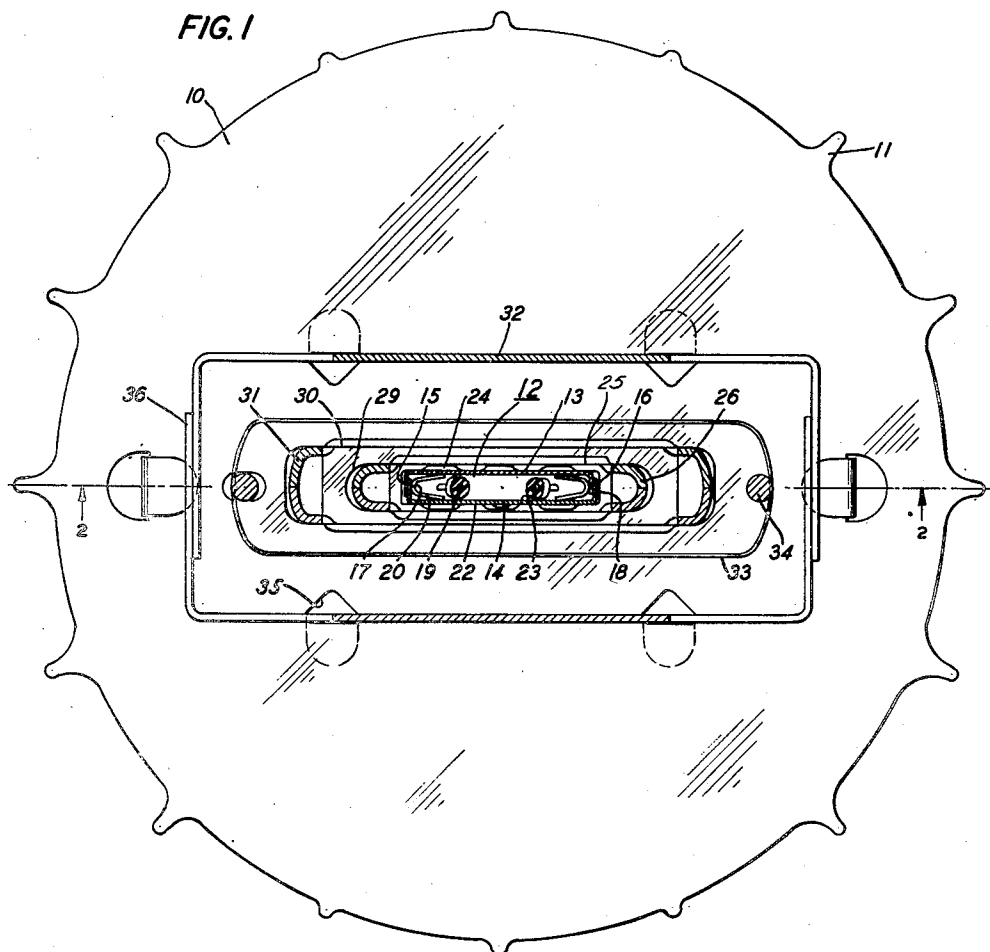
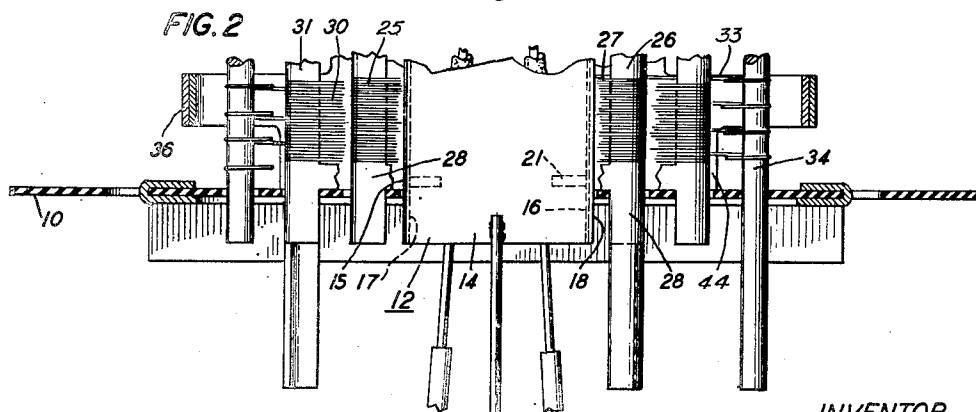


FIG. 2



INVENTOR
BY E. J. WALSH
Walter C. Kiesel
ATTORNEY

Oct. 24, 1950

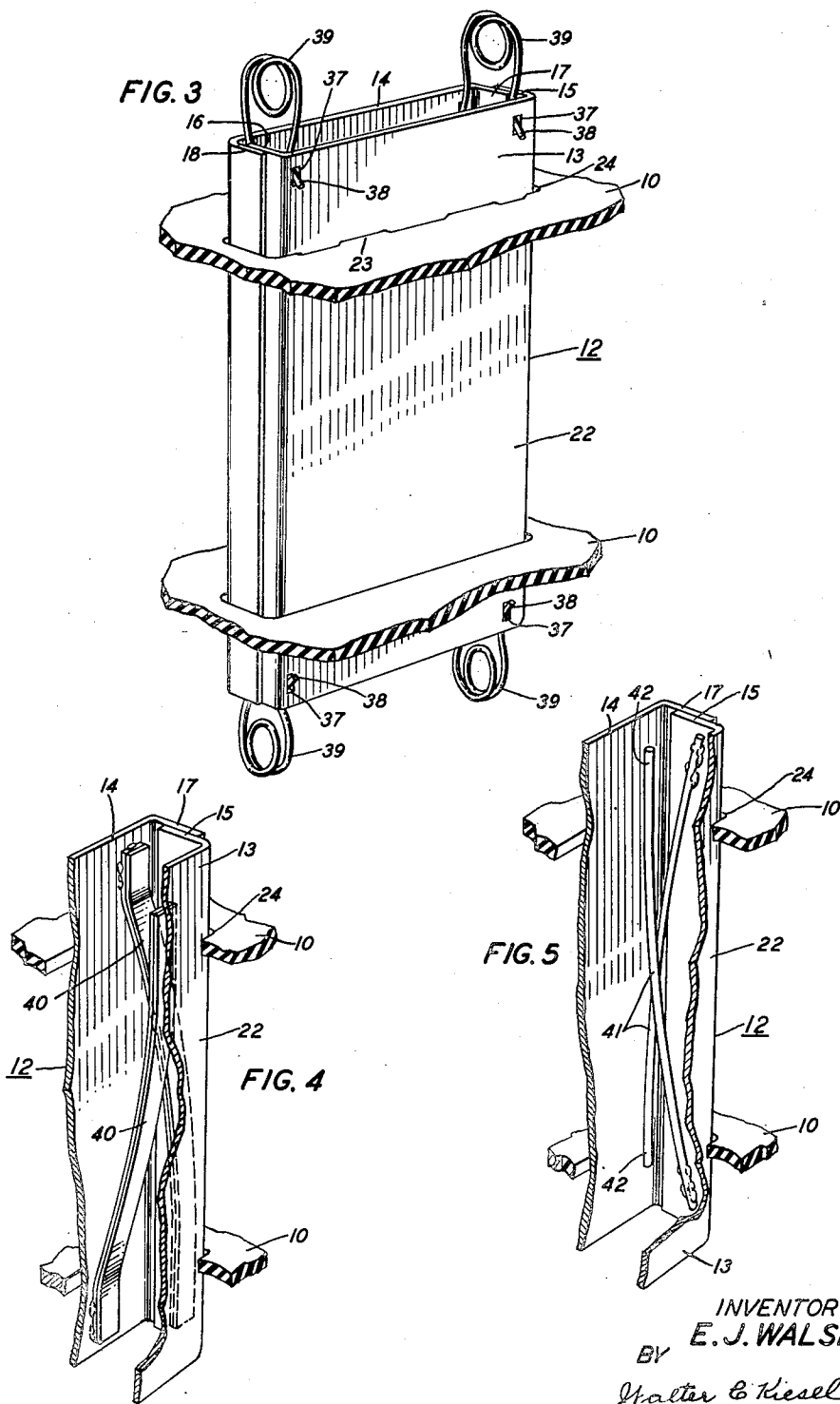
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ELECTRODE ASSEMBLY FOR ELECTRON
DISCHARGE DEVICESEdward J. Walsh, Tenaflly, N. J., assignor to Bell
Telephone Laboratories, Incorporated, New
York, N. Y., a corporation of New York

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7 Claims. (Cl. 250-27.5)

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This invention relates to electron discharge devices and more particularly to the construction and arrangement of electrodes for such a device.

An object of this invention is to maintain the spacing of the effective portions of the electrodes of an electron discharge device constant.

One feature of this invention is the provision of means to bias the effective surface of an electrode towards an associated electrode and against an intermediate stationary support, whereby the thermal expansion of the electrode is taken up by the biasing means and the effective surface remains stationary.

The invention is more completely set forth in the following detailed description and the accompanying drawings, in which:

Fig. 1 represents a plane view of an electrode assembly of a typical electron discharge device employing an electrode and biasing member in accordance with this invention;

Fig. 2 is a partial elevation of an electrode assembly showing the lower portion of the electrode shown in Fig. 1; and

Figs. 3, 4 and 5 are perspectives of various forms of biasing means showing their manner of cooperation with an electrode of this invention.

Referring now to the drawings which disclose a typical electrode structure for an electron discharge device in which an electrode of this invention might be employed, 10 represents an insulating spacer formed from a sheet of some material having a low temperature coefficient of expansion such as mica. The electrode assembly is supported by a pair of these spacers 10, one at its top and one at its bottom. Each spacer is secured in frictional grip with the wall of the envelope (not shown) in which the assembly is mounted by the projections 11 spaced about its periphery.

The embodiment shown in the drawings is a pentode electrode assembly employing an indirectly heated cathode 12 made up of two longitudinal half sections in the form of channel members 13 and 14 having overlapping flanges 15, 16, 17 and 18. Within the cathode is a filamentary heater 19 and two pairs of flat spring biasing members 20 and 21, one pair adjacent the upper spacer and the other adjacent the lower spacer. These biasing members maintain a constant outward pressure on the inner faces of the cathode section whereby the outer emissive surfaces 22 of the cathode are biased towards the adjacent electrode, the ends of channels 13 and 14 which pass through the spacer

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serving as supports which are forced against the edges 23 of the cathode aperture 24 in the spacer 10.

A control grid 25 is positioned adjacent the cathode and mounted upon a sheet metal frame 26 having an opened center portion across which the grid laterals 27 are supported. The frame is mounted on the spacer 10 by means of the projections 28 which extend through the apertures 29 in the spacer. A screen grid 30 is supported next to the control grid 25 on a frame 31 in the same manner as the frame 26. Intermediate the screen 30 and the anode 32 is a suppressor grid 33 having its grid laterals mounted on the side rods 34 extending through the spacer 10. The anode 32 is made up of two sheets each having arms 44 extending through apertures 35 in the spacer 10 and being interconnected by the transverse members 36.

Several preferred types of biasing members which may be employed to maintain the cathode to control grid spacing are disclosed in Figs. 3, 4 and 5. Fig. 3 shows an entire cathode structure wherein each corner of both half sections contains an aperture 37 which is adapted to receive the end 38 of an outwardly biased spiral spring 39. In Fig. 4 at bi-metallic strips 40 are shown secured in a convenient manner to the inner face of each of the cathode half sections 13 and 14, so that they exert an outward pressure on the inner face of the section which increases with temperature to force the cathode into a positive spaced relationship with the other electrodes before the tube reaches its operating condition. A longitudinal cantilever mounted wire spring 41 is secured in a suitable manner, as by brazing or welding, to either end of the innermost flange on each side of the cathode of Fig. 5, a portion of its length 42 at its free end bearing against the inner cathode face to provide the necessary outward bias.

It is inherent in the structure of an indirectly heated cathode that considerable expansion and contraction will occur over the range of operating temperatures. Since the control grid to cathode spacing is one of the critical factors determining the transconductance of the tube, it is essential that this distance remain constant throughout tube operation. This result is obtained in the structure shown by supporting the control grid 25 on a relatively stationary member such as the frame 26 mounted upon the spacer 10 by the extensions 28 which pass through suitable apertures 29 in the spacer. The cathode, being mounted with its effective

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surface biased against the edges of the cathode aperture in the spacer 10 and having the flanges on each section overlap so that in expanding they slide over each other, will not have its emitting surface forced outward by the expansion of its transverse portions. Since the grid frame is spaced from the heater its temperature varies only slightly compared to the cathode, hence its thermal expansion is negligible. Further the intermediate mutual supporting member is of a material having a low temperature coefficient of expansion and therefore the effective surfaces of the control grid and the cathode remain relatively fixed.

Another advantage attained from the split electrode construction of this invention lies in the convenience of manufacture. In many tubes employing electrodes of the type disclosed the allowable tolerances are very limited and hence it is difficult and costly to maintain such tolerances in volume manufacture. Since the dimensions of this type of electrode are determined only by the spacer aperture, the tolerances necessary in the manufacture of the channel members 13 and 14 can be increased and the accuracy of the punched aperture relied upon to produce a satisfactory structure.

In operation the cathode is necessarily heated to high temperatures relative to the temperatures of the remainder of the electrodes and therefore has a much greater tendency to change the position of its effective surface, hence the expansion take-up means of this invention has been shown incorporated in a cathode construction. However, it is to be understood that the same general construction might be employed in the control grid, screen grid or anode shown in order to make the spacing of the effective portions in the electron path constant. For example, the grid frames might be made with overlapping transverse flanges and an internal biasing means similar to those employed in the cathode mounted within the solid portions of the grid frame to force the sections against the edges of suitable apertures within the spacer 10. Another modification might be the use of biasing members to force the anode sections inward towards the screen grid and against the edges of suitable spacer apertures thereby permitting expansion of the overlapping cross-straps at the ends of the anode sections without producing undesirable spacing changes in the assembly.

As indicated in the preceding paragraph many possible embodiments might be made of the above invention hence it is to be understood that all matter hereinbefore set forth is to be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. An electrode assembly comprising a plurality of electrodes having effective surfaces the generatrices of which are straight lines which are constantly parallel to a fixed straight line, a spacer transverse said electrodes and having an aperture receiving a portion of one of said electrodes, and means biasing the effective surface of said one electrode against an edge of said aperture and towards the effective surface of an adjacent electrode.

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2. An electrode assembly comprising a plurality of electrodes having effective surfaces the generatrices of which are straight lines which are constantly parallel to a fixed straight line, spacer means for said electrodes, and means biasing the effective surface of one of said electrodes against said spacer means and towards the effective surface of an adjacent electrode.

3. An electrode assembly comprising a first electrode, a hollow electrode comprising a pair of longitudinal sections movable towards and away from each other, a transverse spacer supporting said first electrode and having an aperture receiving the ends of said sections, and means biasing said sections against the edge of said aperture.

4. An indirectly heated tubular cathode comprising a plurality of strips having flanged edges, said strips being interrelated each with its flanges overlapping the flanges of the adjacent strips to form a closed tube, a spacer member apertured to receive the ends of said interrelated strips, and a biasing member within said tube biasing said strips against the edges of said spacer aperture.

5. An electron discharge device comprising a tubular cathode, a pair of channel members having their flanged edges overlapping to form said tubular cathode, a transverse non-conducting spacer having an aperture receiving a portion of and determining the outer dimensions of said cathode, and a resilient member within said cathode and said channel members to maintain the portions of their outer surface extending through said spacer in contact with the edge of said spacer aperture.

6. An electrode assembly comprising a plurality of electrodes, one of said electrodes having a pair of cooperating support portions, a member having spacer means thereon engaging said portions, a second electrode supported on said member, and a resilient member extending between said support portions of said first electrode mechanically biasing them against said spacer means and towards the effective surface of said second electrode.

7. An electrode assembly comprising a plurality of electrodes, one of said electrodes comprising a longitudinally split sleeve, a spacer transverse to said electrodes and having an aperture receiving a portion of said sleeve electrode, and resilient means biasing portions of the wall of said sleeve against the edge of said aperture.

EDWARD J. WALSH.

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