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SUPPORTING STRUCTURES FOR THE ELECTRODES OF ELECTRON DISCHARGE DEVICES

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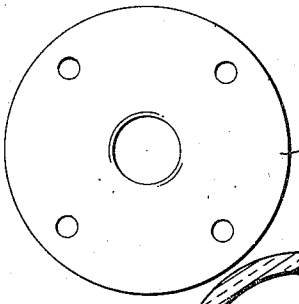

Fig. 2

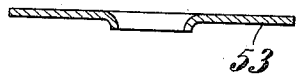

Fig. 3

Fig. 1

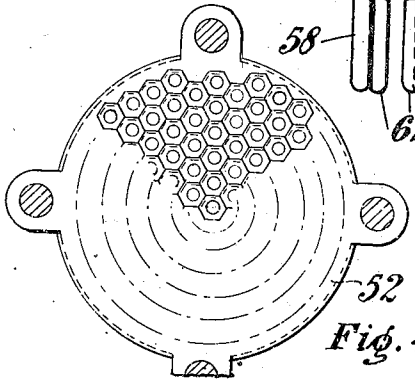

Fig. 4

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SUPPORTING STRUCTURES FOR THE ELECTRODES OF ELECTRON DISCHARGE DEVICES

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3 Claims. (Cl. 250—27.5)

1

This invention relates to electron discharge devices and is especially applicable to electron multipliers having one or more secondary cathodes and a collector or anode.

According to this invention an electron discharge device is characterised in that the electrodes or their carriers are assembled on a number of rods of insulating material and are spaced apart by washers of insulating material which encircle said rods. The insulating material and washers which carry the electrodes is a refractory insulating material such as steatite, and the expression "refractory insulating material" used in the claims is defined as meaning material of this type.

Each said rod may be provided with a shoulder at one end and a screw-threaded portion at the other end for receiving clamping nuts formed also of insulating material.

The aforesaid rods may be carried by metal legs which are inset in the ends of the rods and extend through and are sealed in the glass envelope of the discharge device.

Certain of the electrodes may be electrically connected to said metal legs thereby avoiding the necessity of providing additional lead-in wires.

In applying the invention to an electron multiplier the aforesaid electrodes may be disc-like and are provided with holes therein for accommodating said rods. Thus, in assembling the construction the electrodes are threaded on the rods with the intervening washers of insulating material, one of the electrodes resting on the shoulders of the rods at one end, while the whole assemblage is clamped together by means of the clamping nuts at the other ends of the rods.

The following is a description of the invention as applied to an electron multiplier, reference being made to the accompanying drawing, in which:

Figure 1 is a side elevation of the multiplier with certain parts shown in section,

Fig. 2 is a plan view of an accelerator plate, on a smaller scale,

Fig. 3 is a cross section through the accelerator plate of Fig. 2, and

Fig. 4 is a plan view on a larger scale of a secondary cathode.

The primary cathode and its heater, together with a control grid, are mounted between two steatite plates 13 and 14 which are provided with suitable recesses for this purpose and with locating faces against which the cathode and control grid are respectively pressed by resilient means as described in our U. S. Patent No. 2,378,164 of

2

June 12, 1945. The plates are approximately rectangular in configuration and provided at each of their corners with hollow bosses 50 through which four steatite assembly rods 9 pass. As will be seen, each rod has an enlarged end 54 to provide a shoulder. The opposite end of each rod is screw-threaded to receive a clamping nut 57 also formed of steatite. The various electrodes are disc-shaped and are provided with lugs having holes therein for engaging the aforesaid rods. These electrodes comprise the final secondary electron-emitting cathode 55, a collector or anode 51, a number of secondary electron-emitting cathodes 52 (Fig. 4) and an accelerator 53 (Figs. 2 and 3). Each of the secondary cathodes and the collector has a perforated plate 61 spaced away from and electrically connected with the preceding cathode. All the electrodes are spaced an appropriate distance apart by means of the insulating washers 56 which are also formed from steatite. Inset in each of the enlarged ends of the rods is a wire leg 58 which extends through a glass sealing disc 59 secured to the envelope 60 of circular cross section. Lead-in wires 65 and 66 also extend through the envelope 60 at the other end of the container and are inset in the upper plate; they are also connected by leads 27 and 32 to the primary cathode and grid respectively. The heating wire for the primary cathode is connected to leads 21 and 22 which in their turn are connected by metal clips such as 63 to two conductors 64. Various lead-in wires 62 pass through the disc-seal 59 and are connected by clips 63 to the various conductors 64 which in their turn are connected to the different electrodes. The secondary cathodes plates are preferably constructed in the manner described in the specification of British Patent No. 543,106 and as shown in Fig. 4. In front of each of the perforated secondary cathodes 52, except the first one, there is an auxiliary disc-like electrode 61 consisting of a plate with plain perforations, that is to say, perforations without extending tapering walls, as have the perforations of the secondary cathode. The auxiliary electrode is in each case arranged with its perforations out of line with the perforations in the secondary cathode immediately behind it. The secondary cathodes also have their perforations out of line and the perforations of the auxiliary electrodes are also out of line. This result may be obtained in the manner described in the said patent by employing electrodes with supporting lugs so arranged that by twisting the electrodes in relation to one another during assembly the required disposition of the perfora-

tions is achieved. As indicated above, the electrode assembly is mounted in an envelope 60 comprising a pinch or disc-seal 59. As will be seen, the disc-seal is of slightly domed form and the lead-in wires pass through it. The conductors 64 are connected to the lead-in wires 62 by means of metal clips 63 welded at one end around the conductors and the other end around their appropriate lead-in wires. The electrode assembly is mounted on the convex side of the disc-seal and the main part of the envelope is formed with a flange overlying the peripheral margin of the disc-seal to which it is joined.

It will be appreciated that the invention is applicable to thermionic devices other than electron multipliers, for example to thermionic valves, especially those of the beam type, and also to cathode-ray tubes.

We claim:

1. An electron discharge device comprising a glass envelope containing a plurality of spaced supporting rods formed from high fusing point refractory insulating material, electrodes having holes therein encircling said rods, washers formed from high fusing point refractory insulating material encircling said rods and spacing the electrodes apart, and metal legs secured in the ends of said rods and sealed in said envelope.

2. An electron discharge device comprising a glass envelope, a plurality of spaced supporting rods formed from high fusing point refractory insulating material threaded at one end and having a shoulder at the other, a plurality of electrodes formed with holes encircling said rods, and having an end electrode resting on said shoulders, washers formed from high fusing point refractory insulating material encircling said rods and spacing said electrodes apart, and nuts formed from high fusing point refractory insulating material engaging said screw-threaded portions of the rods and clamping the electrodes and washers together, metal legs secured in the ends of said rods, and sealed in said envelope.

3. An electron discharge device comprising a glass envelope, a plurality of spaced supporting rods formed from high fusing point refractory insulating material threaded at one end and having a shoulder at the other, a plurality of electrodes formed with holes encircling said rods, and having an end electrode resting on said shoulders, washers formed from high fusing point refractory insulating material encircling said rods and spacing said electrodes apart, and nuts formed from high fusing point refractory insulating material engaging said screw-threaded portion of the rods and clamping the electrodes and washers together, metal legs secured in the ends of said rods, and sealed in said envelope, and connections between certain of said electrodes and said metal legs.

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