Feb. 11, 1936. B. SALZBERG 2,030,187

SHORT WAVE TUBE

Filed June 23, 1934

Fig. 1

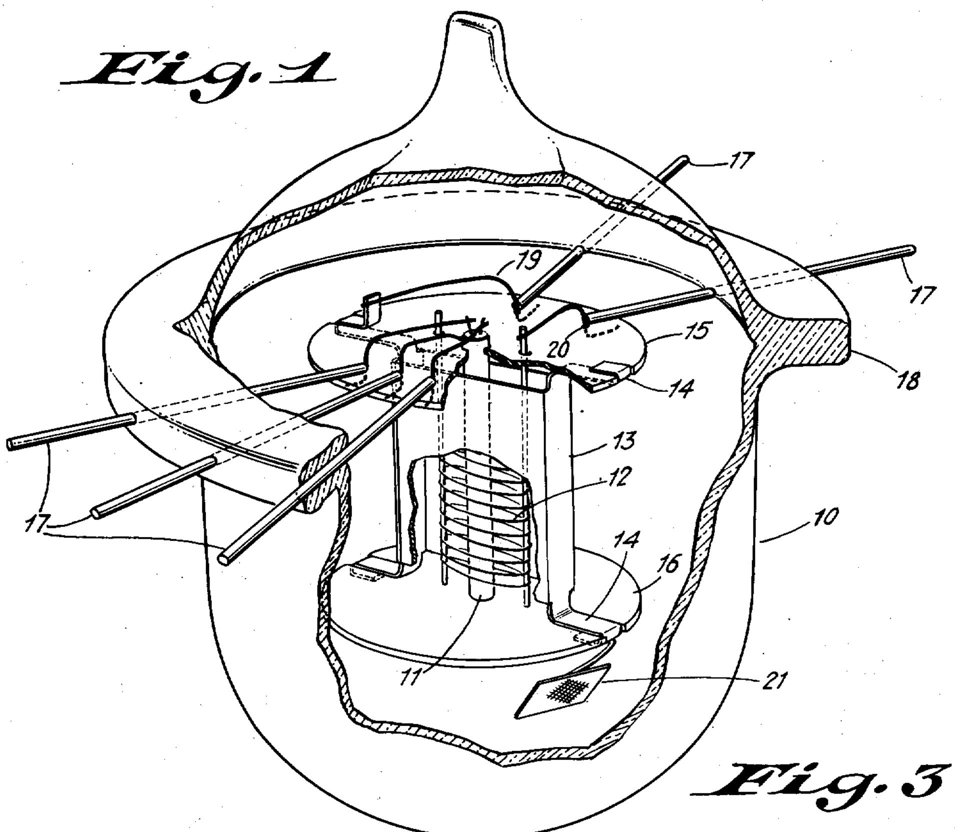


Fig. 3

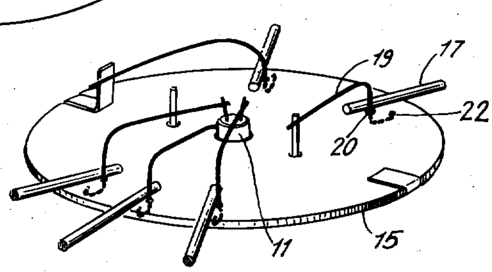


Fig. 2

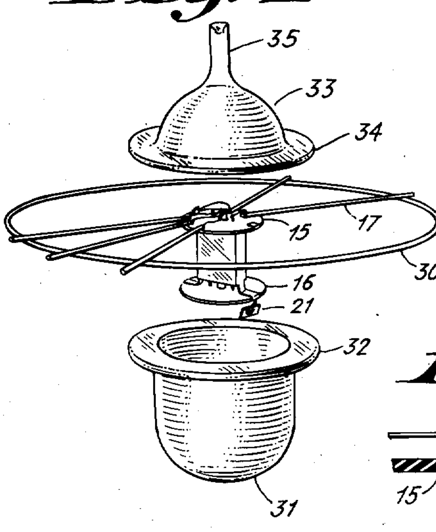


Fig. 4

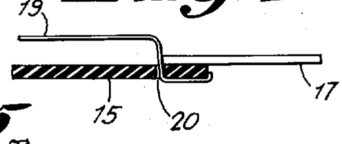
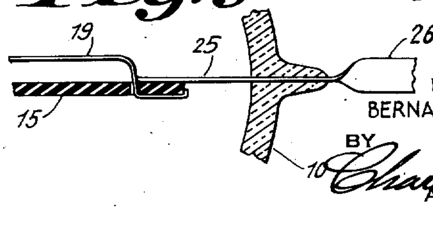


Fig. 5



INVENTOR
BERNARD SALZBERG
BY Charles McClair
ATTORNEY

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UNITED STATES PATENT OFFICE

2,030,187

SHORT WAVE TUBE

Bernard Salzberg, New York, N. Y., assignor to Radio Corporation of America, a corporation of Delaware

Application June 23, 1934, Serial No. 732,028

7 Claims. (Cl. 250—27.5)

My invention relates to electron discharge devices, more particularly to electron discharge devices for use at ultra high frequencies and to the method of making the same.

The maximum frequency at which the conventional tube will operate is limited principally by inter-electrode and inter-lead capacity and by the inductance of the leads to the electrodes, because the inductance and capacity of the electrodes and leads form an electrical system which determines the upper limit of frequency at which the tube will operate. While the inter-electrode capacity may be decreased and thus the upper frequency limit at which a tube will operate increased by making electrodes small, making them short, and bringing out leads at different points of the bulb, such a tube is difficult and expensive to make, because of special constructions and methods required for assembling such tubes.

An object of my invention is to provide an electron discharge device which may be made commercially even in very small sizes and in which the inter-lead capacity and the inductance of the leads are considerably less than the conventional type.

Another object of my invention is to provide an electron discharge tube in which the overall dimensions and inter-electrode spacing are much less than is feasible in tubes constructed in the usual way.

A further object of my invention is to provide a simple and novel method for facilitating the assembly particularly of very small tubes intended for ultra high frequency use.

The novel features which I believe to be characteristic of my invention are set forth with particularity in the appended claims, but the invention itself will best be understood by reference to the following description taken in connection with the accompanying drawing in which Figure 1 is a perspective view, with parts broken away, of an electron discharge device embodying my invention; Figure 2 is a perspective exploded view illustrating the method of assembling an electron discharge device in accordance with my invention; Figures 3, 4 and 5 are views showing modifications of details of construction of the electron discharge device shown in Figure 1.

Referring to Figure 1, the envelope 10 of the tube encloses and supports a unitary electrode mount assembly comprising an indirectly heated cathode 11 with the usual heater, a grid 12, and an anode 13, which may be a box-like structure made from sheet metal. The anode 13 has at each end extensions 14 which form shoulders for supporting electrode spacers 15 and 16 of insulation, such as mica and preferably in the form of plates or discs transverse to the longitudinal axis of the tube. The extensions 14 are bent over against the mica plate members and may lie in slots in the edges of the plate members as shown to rigidly secure the spacers to the anode so as to provide a rigid unitary electrode assembly.

In accordance with my invention radially positioned stiff conductors 17 which serve as lead-in and mount support wires extend thru an exterior annular press 18 in the wall of the bulb 10 and have secured to their inner ends, preferably by welding, conductors 19 having one end threaded thru apertures 20 in the insulating disc or plate member 15 to secure the conductors 17 to the plate member as best shown in Figure 4 and the other end electrically connected to one of the electrodes mounted between the plates 15 and 16. The outer ends of conductors 17 serve as tube contacts to be received in a properly designed socket. This construction eliminates the need of the usual reentrant stem press and materially reduces the overall dimensions of the tube. It will be observed that the grid and anode lead-ins are positioned on the opposite side of the envelope from the heater and cathode leads to reduce inter-lead capacity and inductance. A getter tab 21 is preferably fastened to an extension 14 of the anode at the opposite end of the mount from the lead-in conductors.

A modification of the lead-in construction is shown in Figure 3. Here the conductor 19 is first threaded thru and secured at one end to the insulating mica spacer or plate member 15 near its periphery in any suitable manner, for example as indicated at 22, and electrically connected at its other ends to an electrode. The lead-in conductors 17 are then secured and electrically connected to the conductors 19 preferably by welding, the conductors 17 being positioned so that the mica is securely clamped between the inner ends of conductors 17 and the ends of the conductors 19 secured to the mica.

While the round type of lead-in conductors 17, such as shown in Figures 1, 3 and 4, serve very well as tube contacts to be received in sockets, the lead-in conductor shown in Figure 5 possesses the advantage of providing a large surface area and of facilitating sealing. In this modification the lead-in conductor 25 is in the form of a flat strip welded at its inner end to the electrode conductor 19 with its flat side in contact with the mica disc spacer 15 and extends thru the annular press in a plane parallel to the spacer. On the exterior of the envelope the lead is twisted thru a 90° angle as shown at 26 to provide a knife blade contact which can be received by appropriate clip type socket contacts.

While various methods may be used for assembling a tube of the type described in accordance with my invention I use the novel method illustrated in Figure 2. After the electrodes have been assembled between the insulating mica discs 15 and 16 to provide a unitary mount structure, the combined lead-ins and tube contacts 17 are secured to the mica disc spacer 15 and connected to the electrodes by means of conductors 19. The outer ends of conductors 17 are secured to a spacer ring 30 which acts as a mount jig, or the leads may be first connected to the ring and then secured to the insulating plate member 15. This assembly is then positioned so that the mount extends downwardly within the cup shaped portion 31 of the envelope 10 provided with an annular lip 32, the lead-in conductors resting on the lip. A second cup shaped portion 33 of the envelope 10 provided with the lip 34 is positioned over the leads so that the lips 32 and 34 register with each other. Fires are then played on the lips until the glass flows around the leads to seal the lips. The lips may then be pressed together in a die, for example, to provide the outwardly extending annular seal or press 18 as shown in Figure 1, thru which the leads 17 extend. The ring 30 is then cut from the leads by severing the leads, preferably in a single operation, a predetermined distance from the edge of the press. The tube is then exhausted thru the exhaust tubing 35 after which it is tipped off. This method of construction permits easy handling of the mount without injury during assembly and promotes speed in the assembly operation while decreasing shrinkage in the finished tubes.

A tube constructed in accordance with the above description may be easily made of very small dimensions, is sturdy and reduces interlead capacity and inductance to a very small value.

While I have indicated the preferred embodiments of my invention of which I am now aware and have also indicated only one specific application for which my invention may be employed, it will be apparent that my invention is by no means limited to the exact forms illustrated or the use indicated, but that many variations may be made in the particular structure used and the purpose for which it is employed without departing from the scope of my invention as set forth in the appended claims.

What I claim as new is—

1. An electron discharge device including an envelope, a unitary electrode mount assembly positioned within the envelope and comprising a pair of insulating plate members and electrodes positioned between and secured to said members, radially positioned stiff lead-in conductors extending thru the wall of said envelope, means on the inner ends of the radially positioned conductors securing the conductors to one of said insulating members for supporting the mount within the envelope and for electrically connecting the conductors to the electrodes positioned between the insulating plate members.

2. An electron discharge device including a glass envelope, a unitary electrode mount assembly within said envelope comprising an insulating plate member and electrodes secured to said plate member, stiff lead-in conductors sealed into and extending radially thru the wall of the envelope toward said mount assembly and having a second conductor secured intermediate its ends to the inner ends of said lead-in conductors, said second conductors having one end secured to the insulating member and the other end electrically connected to an electrode in said electrode mount assembly whereby said mount is supported within said tube by said radially positioned lead-in conductors.

3. An electron discharge device including an envelope, a unitary electrode mount assembly positioned within said envelope and comprising a transverse insulating plate member and a plurality of electrodes secured to said plate member, flat conductors extending radially thru the wall of the envelope with a flat side in contact with the insulating plate member, the outer end of each of said flat conductors being twisted thru 90° with respect to the inner end to provide a knife blade contact, conductors secured intermediate their ends to the inner ends of said flat conductors and having one end extending thru and secured to the insulating plate member and the other end electrically connected to one of the electrodes in the mount to provide a support for the mount and a lead-in for the electrodes.

4. An electron discharge device comprising an envelope, an electrode mount assembly positioned in the envelope, flat lead-in conductors extending radially thru the wall of the envelope with a flat side lying in a plane transverse to the longitudinal axis of said electron discharge device, the outer ends of said flat lead-in conductors being twisted thru 90° to provide knife blade contacts and means for connecting the inner ends of said lead-in conductors to said mount assembly.

5. The method of assembling an electron discharge device comprising assembling the electrodes into a unitary mount structure having an insulating member at one end, securing radially positioned lead-in conductors at their inner ends to said insulating member and electrically connecting each conductor to one of the electrodes in the mount assembly, and connecting the outer ends of said lead-in conductors to a ring positioning the mount structure within a cup-shaped member provided with a glass lip, positioning a second cup-shaped member provided with a glass lip over the open end of said first cup-shaped member with the lips in registry with each other, applying heat to the lips of said cup-shaped members to provide an annular seal thru which the radially positioned lead-in conductors extend, and severing the ring from said lead-in conductors adjacent their outer ends exhausting the electron discharge device thru an exhaust tube extending outwardly thru a closed end of one of the cup-shaped members and tipping off said exhaust tube.

6. The method of assembling an electron discharge device comprising assembling the electrode into a unitary mount structure having an insulating member at one end, securing radially positioned lead-in conductors connected to a ring at their outer ends to said insulating member and electrically connecting each conductor to one of the electrodes in the mount assembly, positioning the mount structure within a glass cup-shaped member provided with a lip, positioning a second glass cup-shaped member provided with a lip over the open end of said first cup-shaped member with the lips in registry with each other, and sealing the lips of said cup-shaped members

to provide an annular seal thru which the lead-in conductors extend and severing the ring from said lead-in conductors adjacent their ends.

7. An electron discharge device including an envelope, a unitary electrode mount assembly positioned within said envelope and comprising a pair of insulating plate members and electrodes positioned between and secured to said plate members, stiff lead-in conductors sealed into and extending thru the wall of the envelope toward said unitary electrode mount assembly with the inner ends of the lead-in conductors positioned around one of said insulating plate members, each of said lead-in conductors having a second conductor secured intermediate its ends to the inner end of the stiff lead-in conductor, said second conductors having one end secured to said one of said insulating plate members and its other end electrically connected to an electrode in said electrode mount assembly, whereby said mount assembly is supported within said envelope by said stiff lead-in conductors, the outer ends of said stiff lead-in conductors being external contacts to make connections to a socket.

BERNARD SALZBERG.