Sept. 2, 1941. J. E. BEGGS 2,254,726

DISCHARGE DEVICE

Filed Feb. 9, 1940

Fig. 1.

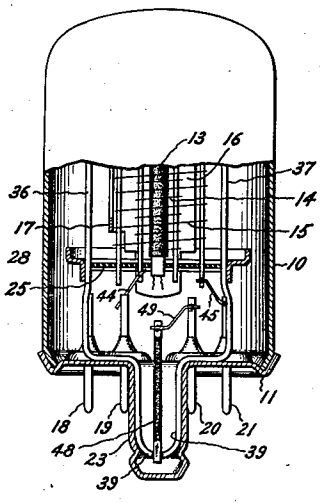



Fig. 2.

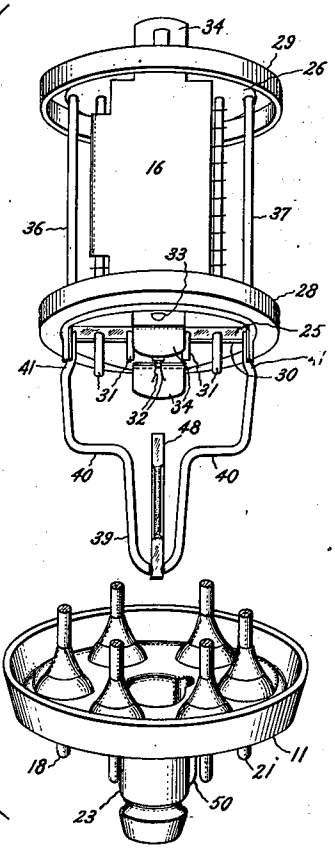



Fig. 4.

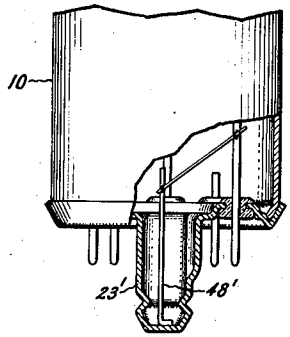



Fig. 5.

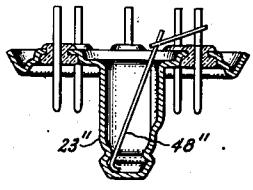
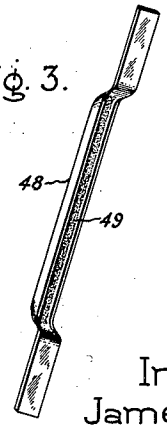



Fig. 3.




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James E. Beggs,
by Harry E. Dunham
His Attorney.

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2,254,726

# UNITED STATES PATENT OFFICE

2,254,726

## DISCHARGE DEVICE

James E. Beggs, Scotia, N. Y., assignor to General Electric Company, a corporation of New York

Application February 9, 1940, Serial No. 318,061

5 Claims. (Cl. 250—27.5)

This application is a continuation-in-part of my prior application Serial No. 266,558, filed April 7, 1939, and assigned to the General Electric Company.

The invention claimed herein relates to structural improvements in enclosed electrical devices such as radio receiving tubes.

It is one object of the invention to provide an improved method and means for mounting electrode elements within an enclosing envelope of the type which includes a hollow tubulation projecting from the main body of the envelope for facilitating the engagement of the envelope with a cooperating socket. To this end, the tubulation is used as a guide and retainer for a portion of the framework on which the electrode parts are supported. By making the said framework portion of such dimensions that it frictionally engages the interior of the tubulation it proves feasible to use the same as a temporary aligning means during the initial assembly of the parts, to be reinforced subsequently by the formation of appropriate permanent connections.

A further important aspect of the invention consists in the utilization of the tubulation above referred to as an enclosure for a getter substance to be used during the fabrication of the tube as an aid in exhausting the same.

The features which I desire to protect herein are pointed out with particularity in the appended claims. The invention itself, together with further objects and advantages thereof, may best be understood by reference to the following description taken in connection with the drawing, in which Fig. 1 is a view in partial section of a discharge device suitably embodying the invention; Fig. 2 is an exploded view showing the relationship of certain parts of the device of Fig. 1 prior to assembly thereof; Fig. 3 is an enlarged detail view of one feature of Fig. 1, and Figs. 4 and 5 respectively illustrate alternative variations of one aspect of the invention.

Referring particularly to Fig. 1 there is shown a discharge envelope comprising a seamless dome-like portion 10 and a basing header 11, both of these parts being constituted of metal, for example, iron. Within the envelope there are provided a cathode 13, a control grid 14, a screen grid 15, and an anode 16, these elements being arranged concentrically in the order named. (The anode, which is incompletely illustrated in the drawing, comprises a pair of parallel plate members which are joined at one edge by narrow metal strips such as the strip which is indicated at 17 in Fig. 1.) The various electrodes are respectively connected to lead-in conductors which are insulatingly sealed into the header 11 by means of individual glass-to-metal seals and of which the particular conductors shown are numbered 18 to 21 inclusive. Also, the header 11 is provided with an outwardly projecting protuberance or tubulation 23 which serves to assist in orienting the device as a whole in a cooperating socket and which provides electrostatic shielding between certain of the lead-in conductors.

The electrode elements above referred to are insulatingly supported by means of an appropriate framework. The particular arrangement shown for this purpose comprises a pair of insulating spacers indicated respectively at 25 and 26 in Fig. 2. These spacers are in turn supported and given a greater degree of rigidity by being positioned in metallic cup-like members 28 and 29. The members 28 and 29 are both provided with transversely extending slots (such as that shown at 30 in Fig. 2), in order to permit the passage through the members of metal rods 31 for supporting the various grid electrodes and for providing terminal connections therefor. Corresponding terminal connections for the cathode are indicated at 32, and a connection tab for the anode is shown at 33. A flap 34 bent out of the member 28 permits the anode tab to pass through member 28 without danger of contact therewith. This flap and the other similarly numbered flaps which are shown in the drawing serve the additional function of shielding the anode tabs from the extremities of the control grid support rods and from the control grid connector 44.

In order to position the electrode assembly within the envelope, the supporting framework is provided with a part which is adapted to interfit with the hollow tubulation 23 of the header 11. In the particular embodiment shown, this part is formed by the provision of wire uprights 36 and 37 which respectively extend through the insulators 25 and 26 so as to engage the same and which terminate at their lower ends in a common V-shaped connecting portion 39. This connecting part is slightly tapered as indicated in Fig. 2 and is of such dimensions as to fit resiliently within the tubulation 23. It is furthermore provided with outwardly extending shoulders 40 which determine the degree of its penetration into the tubulation. Additional shoulders or offset portions, indicated at 41, serve to facilitate the exact positioning of the up-

rights 36 and 37 with respect to the transverse members 28 and 29.

In the process of fabricating tubes the arrangement above described is of outstanding value in that it affords a ready means of assembling the parts in their desired relationship prior to connecting the electrode terminals 31, 32 and 33 to the various lead-in conductors. The procedure which is preferred in this connection involves first bringing the electrode assembly and the basing header 11 to the state of completion indicated in Fig. 2. For reasons shortly to be explained, the surfaces of the header are preliminarily covered with a readily fusible metal or solder such as tin. Subsequent to the foregoing, the electrode framework and the basing header are forced into mutual engagement so that the portion 39 of the framework is caused to slide into the tubulation 23. The resilience of the part 39 causes it to engage the interior walls of the tubulation and thus to hold the parts more or less rigidly in a temporary assembly. Thereafter, the various electrode terminals are connected to the lead-in conductors by appropriate wires or jumpers which are welded or otherwise secured in place as indicated at 44 and 45 in Fig. 1. The completion of these connections serves to increase the rigidity of the assembly and to lessen the danger of relative movement of the parts during subsequent operations.

Following the above, the main body of the envelope (that is, the part 10) is placed loosely over the electrode assembly and the parts are exhausted—for example, by being placed in an evacuated chamber in accordance with the method described in my aforesaid prior application Serial No. 266,558. After the exhaust has proceeded to a desired point, the envelope is brought into abutting engagement with the header 11, as shown in Fig. 1, the assembly being sufficiently heated at this time as a result of the exhaust operation to melt the fusible metal previously applied to the surfaces of the header. This operation results in joining the header to the main body of the envelope in hermetically sealed relation and assures the vacuum-tight character of the tube. Moreover, the fluxing of the fusible metal at the contact surfaces which exist between the header and the parts 39 and 40 will produce adhesion of these parts. Consequently, relative motion between them will thereafter be positively prevented and the assembly will remain rigidly fused during the subsequent handling and use of the tube.

Numerous minor changes may obviously be made in the procedure just outlined. For example, it has been found advantageous in most cases to apply the soldering coating not only to the header 11 but also to the main body of the envelope and to the electrode-supporting framework, including particularly the part 39. Moreover, although such an expedient is not essential to the successful use of the invention, it will prove useful in some cases to provide the extremity of the part 39 with a lateral projection or extension for slipping over and locking to the embossment which exists at the lower end of the tubulation 23. Also, the tubulation itself may, if desired, be provided with a longitudinally extending indentation or keyway (in addition to the socket-engaging key 50) for preventing the introduction of the part 39 into the tubulation in any except a desired orientation. Finally, the shape of the part 39 may be altered in various ways, all within the scope of the invention.

It has further been found advantageous to use the tubulation engaging part 39 as a support for a gettering device to be used during the exhaust of the discharge envelope. Such a device may comprise, for example, a strip of metal ribbon 48 which is of channel-shaped cross-section so as to accommodate a quantity of an appropriate reactive substance 49. In this connection one may use a ribbon which is constituted of tantalum in combination with a substance which, in reaction with the tantalum, is adapted to evolve a gas absorbing element. Such a substance may comprise, for example, barium oxide, or a mixture of this material with strontium oxide.

The ribbon 48, which constitutes an electrical resistance element, is terminally connected at one end to the part 39 as by being welded thereto. At its other end it is connected to the lead-in conductor 20 by means of a jumper connection 49 (see Fig. 1). In utilizing the getter it is only necessary to impress a sufficient voltage between the conductor 20 and the header to raise the ribbon to a temperature at which it is effective to cause reaction of the getter substances.

A particular advantage of the getter arrangement described in the foregoing lies in the possibility of using the resistance element 48 as a heating means for expediting the operation of joining the header 11 to the envelope shell 10. To this end the ribbon is preferably made of sufficient heat producing capacity so that it will serve to heat the header 11 substantially to the melting temperature of the solder applied thereto without becoming hot enough to cause reaction of the getter applied to the ribbon. I have found it advantageous in the particular case to use a resistance member which is capable of dissipating about seven watts without causing flashing of the getter substance. By this means it is possible to heat the header at a controlled rate so as to avoid cracking of the glass seals associated with the lead-in conductors. Additional heating of the envelope and header may, of course, be produced by conventional induction methods.

The enclosure of the gettering means within the tubulation 23 tends to avoid deposition of the getter material on the insulating parts of the electrode mounting structure. This advantage is one which may be made use of even where the particular construction of Figs. 1 and 2 is not employed. For example, one alternative arrangement is shown in Fig. 4 in which the getter ribbon is indicatedat 48' and is shown to have its lower extremity connected directly to the bottom of a tubulation 23'.

In case it is desirable to take further precautions to prevent escape of excess getter substance through the opening of the tubulation, one may utilize an arrangement of parts such as that shown in Fig. 5. In this case the resistance ribbon, which is indicated at 48'' is inclined to the axis of the tubulation 23'' so that its lower surface is directed away from the opening of the tubulation. If the getter material is then applied exclusively to this surface, its vapors will have little tendency to escape into the discharge space, but will, on the contrary, be projected mainly into the lower portion of the tubulation 23''.

The gettering arrangements described in the foregoing are fully claimed in my copending application Serial No. 362,263, filed October 22, 1940, and assigned to the same assignee as the present invention.

While the invention has been described by ref-

erence to particular structural embodiments thereof, it will be understood that numerous modifications thereof may be made by those skilled in the art without departing from the invention. I, therefore, aim in the appended claims to cover all such equivalent variations as come within the true spirit and scope of the foregoing disclosure.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. An enclosed electrical discharge device including an envelope, a terminal-supporting base forming part of the envelope and having a hollow tubulation extending outwardly therefrom for the purpose of orienting the device in a cooperating socket, electrode structure within the envelope and a framework for supporting the electrode structure, said framework including a pair of wire uprights terminating in a U-shaped connecting part which extends within the said tubulation and which engages the same to maintain the framework and electrode structure in a desired orientation within the envelope.

2. An enclosed electrical discharge device including an envelope, a terminal-supporting base forming part of the envelope and having a hollow tubulation extending outwardly therefrom, electrode structure within the envelope, transverse members for insulatingly supporting the electrode structure, a pair of wire uprights extending perpendicular to the said transverse members and forming therewith a supporting framework, and a U-shaped part extending between and forming a continuation of the said wire uprights, said U-shaped part extending within the said tubulation and resiliently engaging the same to maintain the said framework and electrode structure in a desired orientation with respect to the said base.

3. A method of assembling a discharge device of the type which employs a separately formed base having a hollow tubulation and lead-in conductors extending therefrom, which method includes the steps of supporting the electrodes of the device on a framework having a projecting part adapted to interfit with the said tubulation, forcing the said projecting part into the tubulation to effect a desired orientation of the base portion and the electrodes, and thereafter connecting the electrodes to the lead-in conductors to produce a rigid assembly.

4. A method of assembling a discharge device of the type which employs a metal envelope and a metal header bearing lead-in conductors and a hollow tubulation extending outwardly therefrom, which method includes applying a fusible metal to the surface of the said header, supporting the electrodes of the device on a framework having a projecting metallic part adapted to interfit with the said tubulation, introducing the said projecting part into the tubulation, connecting the electrodes to the lead-in conductors, placing the envelope about the electrodes and in abutting contact with the said header, and heating the assembly to cause the said fusible metal to seal the header to the contacting surfaces of the said envelope and framework.

5. An enclosed electrical discharge device, including an envelope, a terminal-supporting base forming a part of the envelope and having a hollow tubulation extending outwardly therefrom for the purpose of orienting the device in a cooperating socket, the said tubulation being provided internally with a longitudinally extending indentation adapted to serve as a keyway, electrode structure within the envelope, a pair of wire uprights forming a framework for supporting the electrode structure and a U-shaped part extending between and forming a continuation of the said wire uprights, said U-shaped part extending within the said tubulation and interfitting with the said longitudinally extending indentation therein, thereby to maintain the said framework and electrode structure in a desired orientation with respect to the said base.

JAMES E. BEGGS.