Aug. 16, 1949. L. THIBIEROZ 2,479,032

EXHAUST TUBE STRUCTURE FOR ELECTRON DISCHARGE TUBES

Filed Aug. 9, 1946

Fig. 1

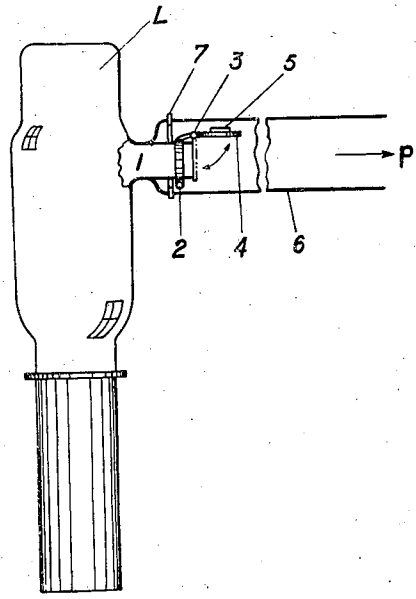
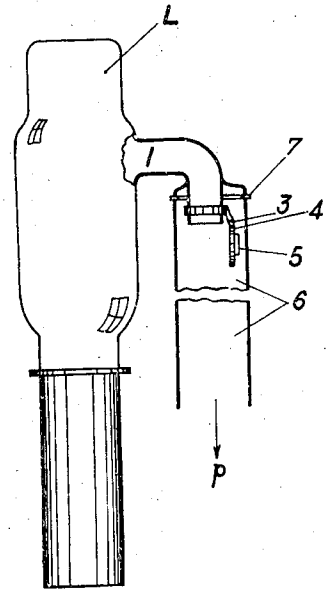


Fig. 2



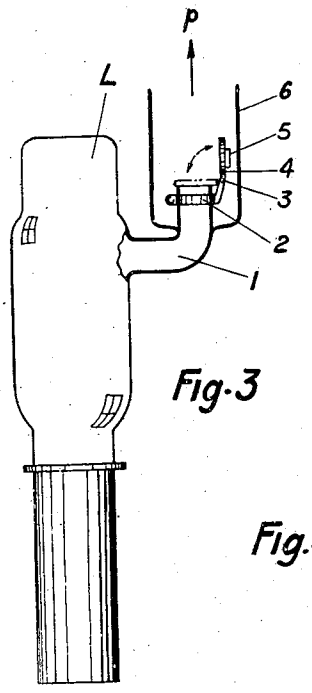


Fig. 3

Fig. 4a

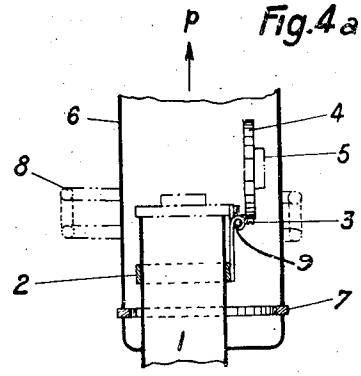
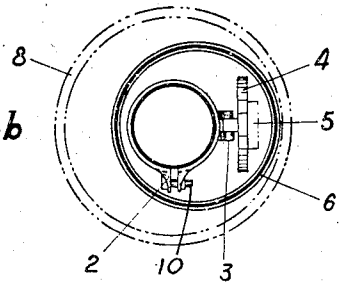


Fig. 4b



INVENTOR
LAURENT THIBIEROZ
By John B. Brady
attorney.

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EXHAUST TUBE STRUCTURE FOR ELECTRON DISCHARGE TUBES

Laurent Thibieroz, Paris, France, assignor to Societe Francaise Radio Electrique, a corporation of France

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5 Claims. (Cl. 250—27.5)

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The present invention relates to an improved manufacturing process for discharge tubes.

One of the objects of my invention is to provide an improved process of manufacturing electron discharge tubes for facilitating the exhausting and sealing-off operation of such tubes.

Another object of my invention is to provide an improved method of expediting the exhaust time in the manufacture of electron discharge tubes for reducing the cost of tube manufacture.

A further object of my invention is to provide an improved construction of sealing-off means for electron discharge tubes.

Other and further objects of my invention reside in the improved method of producing electron discharge tubes and construction of electron discharge tubes as set forth more fully in the specification hereinafter following by reference to the accompanying drawing, in which:

Figure 1 schematically illustrates one form of sealing-off means employed in the process of my invention;

Fig. 2 illustrates a modified form of structure of electron discharge tube utilizing the sealing-off method of my invention;

Fig. 3 shows a further modified arrangement of sealing-off means for electron discharge tubes embodying the principle of my invention;

Fig. 4*a* is a fragmentary longitudinal sectional view showing the sealing-off means of my invention for electron discharge tubes on a larger scale; and

Fig. 4*b* is a transverse sectional view of the structure illustrated in Fig. 4*a*.

One of the essential operations in the manufacturing of discharge tubes involves the evacuation and subsequent sealing of the tubes.

It is an expensive operation because it entails the use of costly material and the utilization of skilled labor; its cost is approximately in proportion to the time required for the operation.

It is a long operation: when treating discharge tubes of a high power, the necessary time for obtaining a sufficient vacuum varies, with the present technique, between a few hours and several days.

The duration of this operation, every other condition remaining alike, depends on the speed with which the vacuum is obtained in the valve.

For a representative system employing vacuum pumps, this speed is a function of the section of the pipe connecting the valve to the system of pumping. This section is generally at its smallest in the part which is nearest to the valve, that

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is the so-called exhaust tube. For, actually, in the state of the present practices, it is necessary to have an exhaust tube of only a few millimeters of interior diameter, so that it is possible to cut it off and close it when the exhausting operation is ended, for it is known that it is not possible to cut off an exhaust tube of a too great diameter without being subject to the danger of cracking.

For a group of vacuum pumps of a given power, the speed of the operation of exhaustion is thus limited by the admissible value of the diameter of this exhaust tube.

The present invention allows the use of exhaust tubes of great diameter, which may be of several centimeters. The speed with which the vacuum is obtained is thus considerably increased. The arrangement results then in a very important reduction of the time necessary for evacuating the valve, and an increase of the capacity of production of discharge tubes and a reduction in the cost price thereof.

By way of non limitative example, Fig. 1 shows one form of my invention illustrating the principle of operation by which large diameter exhaust tubes may be employed. L designates a valve of a great power arranged for an exhaust operation. The connection between the valve and the pumping system P is effected near the valve by an exhaust tube made of two conduits, one of which is interior to the other. These two conduits may be made of glass or any other insulating material, the interior conduit may be made also of a metallic alloy which it is possible to solder to the glass.

The interior conduit 1 may have a diameter of several centimeters; it bears a collar 2 on which there is fixed, through a pivotal connection formed by pin 9 (Fig. 4*a*) on axis 3, a disc 4 of a metallic alloy, which is weldable to itself or to glass. The collar 2 is fastened around interior conduit 1 by screw-threaded bolt and nut connection 10. The interior conduit 1 terminates in an annular peripheral seat against which disc 4 may seat in a vacuum-tight manner. This disc 4 may also be of glass when the conduit 1 is of a metallic alloy which is weldable to glass. This disc is maintained in the open position through the intervention of an external magnetic field, the source of which is not illustrated but the action of which may be exerted upon a piece 5 of a magnetic metal fixed to the disc 4, in the case where the disc is not itself of a magnetic material.

The exterior conduit 6 is connected to the pumping system P.

When the evacuation of the valve is ended, the disc 4 is applied in the closing position, through a magnetic action against the rim of the interior conduit 1 which rim has been previously suitably prepared.

It is then possible, for instance by means of a high frequency oven with localized field, to effect the welding of this disc 4 on to the end of the interior conduit 1 and thus hermetically close this conduit 1 in an absolutely tight manner. During this operation it is possible, if necessary, to cool the conduit 1.

Conduit 6 is disconnectible or severable with respect to conduit 1 and may be broken away from tube 1, that is, after the exhausting and sealing operation, it is possible to cut off the exterior conduit 6 for separating it from the valve. If this conduit 6 has been fixed to the exhaust tube or conduit 1 of the valve, for instance through the intermediary of a piece of metallic alloy 7, it will be possible to achieve this separation by means of a high frequency oven which is analogous to the preceding one.

Figs. 2 and 3 show other embodiments of my invention which differ from the structure of Fig. 1 by the arrangement and directivity of bends of the exhaust tube. Figs. 2 and 3 respectively show the exhaust tube 1 directed downwards and upwards. As the several figures of the drawings make use of the same reference characters as in Fig. 1, no other explanation is needed. The embodiment of Fig. 3 permits, for instance, of outgassing disc 4, by means of a high frequency oven having a horizontal axis, a few seconds before turning it down against the interior conduit 1.

Figs. 4*a* and 4*b* show longitudinal and transverse sections of a detail of one of the embodiments of the exhaust tube 1 where the exhaust tube 1 extends in a vertically upward direction. At 8 there is indicated the high frequency oven.

In the various embodiments of my invention, the disc 4, instead of being fixed by collar 2 and axis 3, may also be maintained and guided in any other manner.

My invention also permits of opening a valve while shielding it from the air and effecting successively the same operations in the reverse order of that previously described.

To this end, the exterior conduit 6 may be for instance re-formed by soldering, by means of a high frequency oven, a glass or insulating tubing to the exhaust tube 1 of the valve; then this exterior conduit 6 may be connected to the system of vacuum pumps. When the vacuum in this conduit is high enough, the connection between disc 4 and the interior conduit 1 will be unsoldered by means of a high frequency oven analogous to the oven 8 hereinbefore referred to. The opening of this disc and its maintenance in the open position is effected through the action of a magnetic field.

The invention may also be applied where several exhaust tubes for one valve are employed.

It is also applicable to rectifiers, oscillograph tubes, vacuum tubes, etc.

Finally, in a more general manner, my invention aims at achieving the assembling through soldering by means of a high frequency oven, at the interior of a chamber with non metallic walls, of two metallic parts, or of one part of a metallic alloy with an insulating material which is not weldable to the latter.

While I have described my invention in certain of its preferred embodiments I realize that modifications may be made and I desire that it be understood that no limitations upon my invention are intended other than may be imposed by the scope of the appended claims.

What I claim is:

1. An electron discharge device comprising a vessel terminating in an exhaust tube of non-magnetic material, an annular peripheral seat on the terminus of said exhaust tube, a disc of non-magnetic material pivotally mounted with respect to said exhaust tube and operative to hingedly cover or uncover the end of said exhaust tube, a second tube of insulation material surrounding the aforesaid tube and severably connected thereto and forming a connection for establishing a vacuum through said tubes in said vessel and magnetic means carried by said disc and responsive to the control of an external magnetic field for effecting the closing or opening of the end of said exhaust tube, the material of said disc being fusible with the peripheral seat on said terminus under conditions of induced high temperatures.

2. An electron discharge device comprising a vessel terminating in an exhaust tube of non-magnetic material, an annular peripheral seat on the terminus of said exhaust tube, a disc of non-magnetic material, a collar member enveloping said exhaust tube, a bracket member extending therefrom, a hinge member extending from said disc of non-magnetic material, pin means for pivotally connecting said hinge member with said bracket whereby said disc may move to either of two limiting positions for covering or uncovering the end of said exhaust tube, a second tube of insulation material surrounding the aforesaid tube, said collar and said pivotally mounted disc, and forming a connection for establishing a vacuum through said tubes in said vessel, and magnetic means carried by said disc and responsive to the control of an external magnetic field for effecting the closing or opening of the end of said exhaust tube, the material of said disc being fusible with the peripheral seat on said terminus under conditions of induced high temperatures.

3. An electron discharge device comprising a vessel terminating in an exhaust tube of non-magnetic material, an annular peripheral seat on the terminus of said exhaust tube, a disc of non-magnetic material, a collar member enveloping said exhaust tube, a bracket member extending therefrom, a hinge member extending from said disc of insulation material, pin means for pivotally connecting said hinge member with said bracket whereby said disc may move to either of two limiting positions for covering or uncovering the end of said exhaust tube, a second tube of insulation material surrounding the aforesaid tube, said collar and said pivotally mounted disc and forming a connection for establishing a vacuum through said tubes in said vessel, magnetic means carried by said disc and responsive to the control of an external magnetic field for effecting the closing or opening of the end of said exhaust tube, the material of said disc being fusible with the peripheral seat on said terminus under conditions of induced high temperatures, and a metallic and non-magnetic connecting means between said second tube of insulation material and said exhaust tube for facilitating removal of said second tube from said exhaust tube when said disc is sealed in a position covering the end of said exhaust tube.

4. An electron discharge device comprising a vessel terminating in an exhaust tube of non-

magnetic material, an annular peripheral seat on the terminus of said exhaust tube, a disc of non-magnetic material pivotally mounted with respect to said exhaust tube and operative to hingedly cover or uncover the end of said exhaust tube, a second tube of insulation material surrounding the aforesaid tube and severably connected thereto and forming a connection for establishing a vacuum through said tubes in said vessel and magnetic means carried by said disc and responsive to the control of an external magnetic field for effecting the closing or opening of the end of said exhaust tube, the material of said disc being fusible with the peripheral seat on said terminus under conditions of induced high temperatures, the plane of said disc when in a position covering the end of said exhaust tube being substantially normal to the axis of said vessel.

5. An electron discharge device comprising a vessel terminating in an exhaust tube of non-magnetic material, an annular peripheral seat on the terminus of said exhaust tube, a disc of non-magnetic material pivotally mounted with respect to said exhaust tube and operative to hingedly

cover or uncover the end of said exhaust tube, a second tube of insulation material surrounding the aforesaid tube and severably connected thereto and forming a connection for establishing a vacuum through said tubes in said vessel and magnetic means carried by said disc and responsive to the control of an external magnetic field for effecting the closing or opening of the end of said exhaust tube, the material of said disc being fusible with the peripheral seat on said terminus under conditions of induced high temperatures, the plane of said disc when in a position covering the end of said exhaust tube extending in a direction substantially parallel to the axis of said vessel.

LAURENT THIBIEROZ.

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