Aug. 27, 1929. S. LOEWE 1,726,111

METHOD AND ARRANGEMENT FOR OBTAINING PERFECT HIGH VACUUMS

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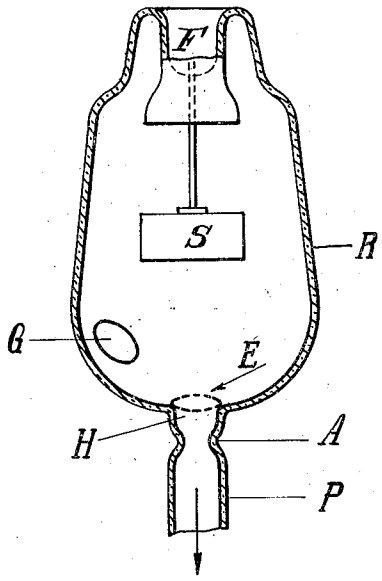


Fig. 1.

Fig. 2.

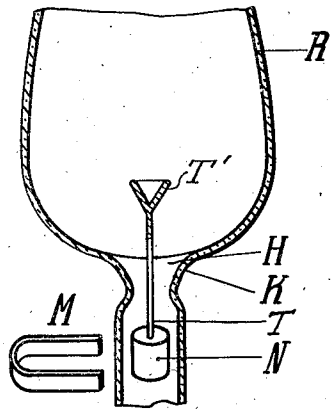
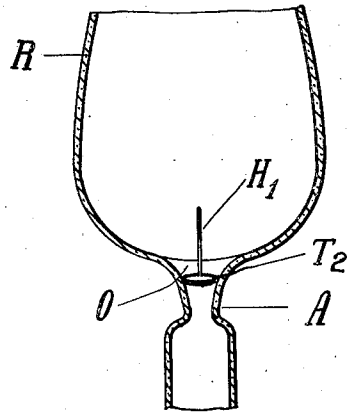


Fig. 3.



Inventor

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UNITED STATES PATENT OFFICE.

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METHOD AND ARRANGEMENT FOR OBTAINING PERFECT HIGH VACUUMS.

Application filed November 14, 1927, Serial No. 233,280, and in Germany November 11, 1926.

This invention relates to a method of evacuating hollow glass vessels, such, for example, as thermionic valves or vacuum tubes for radio transmission and reception.

With the present methods and devices employed for evacuating such vessels, very good results can be obtained and a high vacuum produced, but, owing to certain difficulties present during the sealing of the tube, gases are evolved and a certain proportion of these gases pass into the vessel and reduce the vacuum to an undesirable extent.

The object of the present invention is to provide a method whereby, after the usual exhausting action is completed, but before disconnection of the vessel from the exhausting device, and while the latter is still acting, communication between the vessel and the exhausting device may be cut off so as to prevent passage of any residual gases remaining in the exhaust tube, or of any gases evolved during the sealing process, from passing in any material amount into the vessel.

The principle underlying my invention will be more fully understood by reference to the accompanying drawing, in which:—

Fig. 1 is a sectional view through a thermionic valve, showing the bulb as it appears prior to evacuation and sealing and illustrating one mode of closing communication between the bulb and exhaust pump prior to the bulb sealing action.

Figs. 2 and 3 are views showing other ways of carrying the invention into practical effect.

The hollow glass vessel illustrated comprises a thermionic bulb R having at one end a pedestal F to support a system of electrodes S. P is the exhaust tube integral with the other end of the bulb and provided for the connection therewith of the exhaust pump or device. It may be assumed that the bulb and the system of electrodes have been completely freed from air and evacuated by the well known process. The degree of vacuum is, however, reduced by gas freed and evolved during the operation of heating and contracting the tube at point A to seal the bulb. Some of this gas thus set free will under present processes pass into the bulb R, and the object of the present invention is to prevent this or to reduce to a material extent the quantity of gas which may unavoidably enter the bulb R. Merely for illustrating the principle of my invention it may be assumed that inside the bulb a round disc G of mica or other suitable material is placed which, under normal conditions, is arranged adjacent to but out of alinement with the exhaust port E communicating with the tube P. When the extraction of gas has been completed, then according to my invention this port is closed by moving disc G so that it will be drawn into the port to tightly fit the same by the suction of the pump. Although this sealing may not be absolutely tight, it serves, in view of the comparatively small differences of pressure occurring during the fusing operation, to sufficiently seal the bulb against the entrance of gas during the fusing and sealing of the tube at the sealing point A. There is then left only the small hollow space H filled with the gas set free during the fusing under the steam pressure which has prevailed during the fusing. This gas will gradually pass into the bulb R, but such amount of gas is inconsiderable owing to the small area of the space H.

After the explanation of the principle made by reference to Fig. 1, Figs. 2 and 3 may illustrate two practical embodiments of the principle underlying my invention. The portion of the exhaust tube which is to be hermetically sealed to close bulb R has in this case been given a conical shape at K. Inside the bulb is a movable closure member which may consist of a thin-walled small glass stem T which at its upper end has been blown to form a funnel-shaped stopper T'. After completion of the pumping operation the stopper T' is allowed to drop down so that it fits loosely into the conical part K of the bulb. It then closes communication between the bulb R and the pump P, leaving only a very small hollow space remaining in the tube between the stopper and the bulb. In the operation of fusing and sealing the tube the stem T and stopper T' are fused to the sealed portion of the tube, and the excess portion of the stem is severed with the excess portion of the tube beyond the sealing point A. In order to prevent the stopper T' from moving from open position to closed position during the pumping operation, the outer end of the stem T may be provided with a part N of nickel, iron or other metal capable of being attracted by a magnet M held during the pumping opera-

tion at a level to support the closure member so as to keep the stopper in open position, as shown in Fig. 2. Upon the completion of such operation the magnet M is lowered to allow the closure member or moved away from the tube to break the magnetic attraction and drop and the stopper T′ to seat and close communication between the bulb and tube. The fusing of the stopper T′ to the sealed nub of the tube increases the strength of the tube at this point.

A further and in practice particularly simple embodiment is illustrated in Fig. 3. In this case a glass stopper disc T_2 is carried by a stem H_1, and this disc is firmly held in the exhaust tube in the proximity of its fusing point in such manner that during the pumping operation a sufficiently wide intervening space or aperture O exists. After completion of the pumping operation, the glass wall of the exhaust tube is heated and contracted to close it to such an extent that only a very small aperture remains. During this operation the wall of the exhaust tube may be fused to the stopper T_2 except at a point alining with such small aperture. This manipulation having been performed, the fusing point proper A is heated and drawn together, thus sealing the tube and the aperture referred to, but, if desired, the aperture may be closed prior to the second heating of the tube by allowing the tube to contract by cooling about the stopper, as will be readily understood.

Having thus described my invention, I claim:—

1. The method of evacuating hollow glass vessels of that type in which the vessel is primarily provided with an exhaust tube for connection with the exhauster during the evacuating period and designed to be sealed by fusion on completion of the evacuating action, which consists in closing communication between the vessel and the tube when the vessel is exhausted to the desired degree but while the tube is connected with the exhauster and the exhauster is still in action, and then sealing the tube.

2. The method of evacuating hollow glass vessels of that type in which the vessel is primarily provided with an exhaust tube for connection with the exhauster during the evacuating period and designed to be sealed by fusion on completion of the evacuating action, which consists in bringing means into position for closing communication between the vessel and the tube when the vessel is exhausted to the desired degree but while the tube is connected with the exhauster and the exhauster is still in action, and then sealing the tube and simultaneously fusing the closing means thereto.

3. The method of evacuating hollow glass vessels of that type in which the vessel is primarily provided with an exhaust tube for connection with the exhauster during the evacuating period and designed to be sealed by fusion on completion of the evacuating action, which consists in preliminarily contracting the exhaust tube between the exhauster and vessel and adjacent to the latter, bringing means into position to close the tube between the vessel and the said contracted portion when the vessel is exhausted to the desired degree but while the tube is connected with the exhauster and the exhauster is still in action, and then further contracting and fusing the contracted portion of the tube and simultaneously fusing the closing means thereto.

In testimony whereof I have affixed my signature.

SIEGMUND LOEWE.