Oct. 4, 1927. 1,644,002

J. S. VAN HORNE

MEANS AND METHOD OF EXHAUSTING ELECTRICAL BULBS

Filed July 25, 1922

Fig. 1

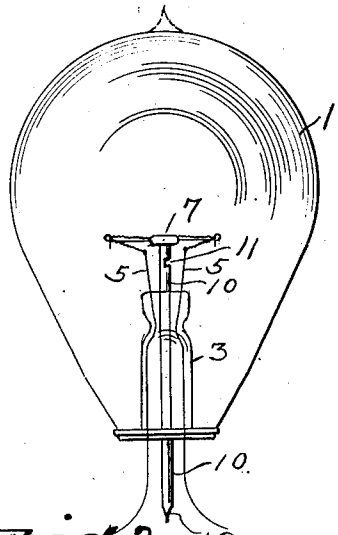


Fig 2

Fig 3

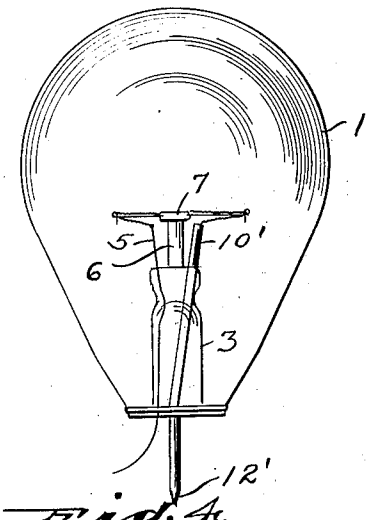
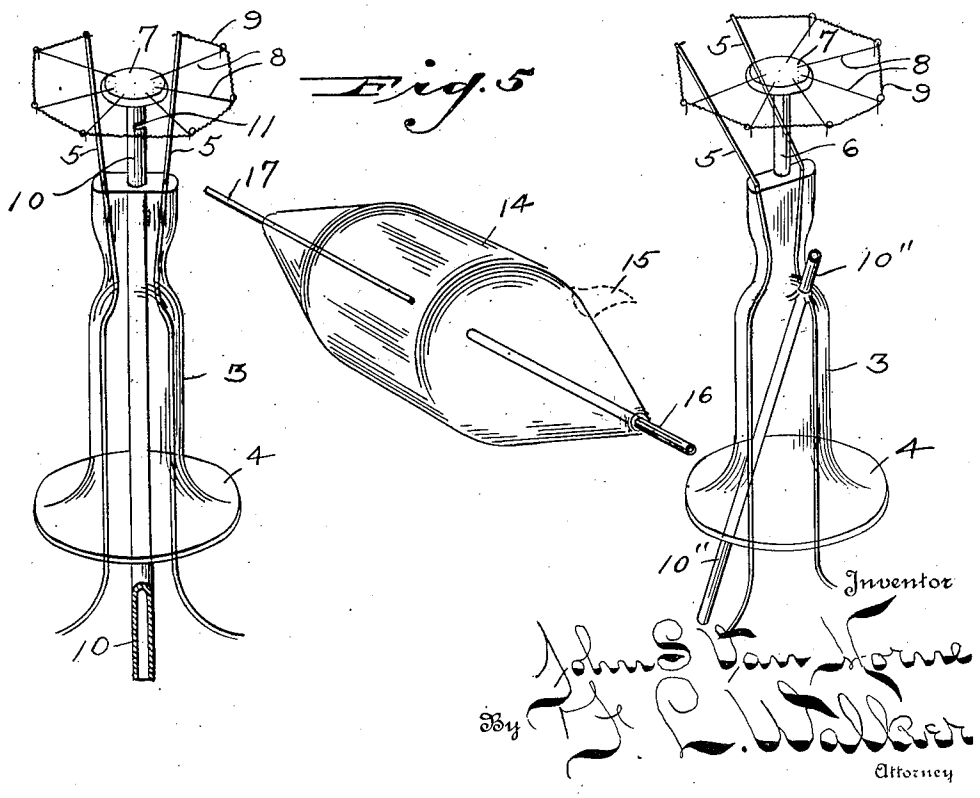


Fig. 4.

Fig. 5



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Patented Oct. 4, 1927. 1,644,002

UNITED STATES PATENT OFFICE.

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MEANS AND METHOD OF EXHAUSTING ELECTRICAL BULBS.

Application filed July 25, 1922. Serial No. 577,454.

My invention relates to the manufacture of vacuum tubes, electrical bulbs and the like, and more particularly to the provision of means and an improved mode or process for exhausting such bulbs and tubes, and if the occasion requires refilling them with an inert gas or the like without the necessity of leaving a projecting sprue or teat upon the exterior of the bulb or tube.

In the manufacture of electric light bulbs, vacuum tubes, radio protectors and the like, it is quite the common practice to use a small exhaust hole in the wall of the bulb or tube to which is fused the end of a glass exhaust tube, through which the bulb or tube is exhausted by suitable vacuum or suction. When the proper degree of vacuum is attained, the bulb or tube is sealed by "burning off" or fusing the exhaust tube at its juncture with the bulb to close the outlet port and separate the exhaust conduit. This process, however, leaves an objectionable point or sprue such as is ordinarily found at the apex of incandescent electric lamp bulbs. The present invention is intended to overcome the objectionable features of this method of exhausting such bulbs and tubes and the elimination of such points or sprues thereby leaving the exterior of the glass bulb or tube uniformly smooth, or continuous. Attempts have been made to exhaust incandescent lamp bulbs by a glass tube introduced through the base of bulb. However, due to the fragile nature of the glass and difficulties of manufacture, the breakage due to the use of such glass eduction means, has been so great as to render such process uneconomical and impractical for commercial purposes.

The invention contemplates embedding or sealing into the wall or structure of the bulb or tube a non-fragile eduction conduit of heat resistant material, preferably, though not necessarily metallic in character, which will afford an intercommunicating passage between the interior and exterior of the bulb or vacuum-tube. When of electro-conductive material, this eduction conduit may further serve as one of the electrical conductors. That is to say, a hollow electrical conductor is employed in such embodiment for the double purpose of carrying current and of exhausting the bulb or tube. In other embodiments, such non-fragile or non-glass eduction conduit may form the supporting staff for the filament anchor in addition to its function in exhausting the bulb or tube or it may be embodied to perform solely and independently the exhausting function.

The object of the invention is to simplify the means and mode of manufacturing vacuum tubes and electric bulbs, whereby they will not only be cheapened in construction, but will be uniform in exterior contour, devoid of the usual projecting points or sprue teats, provided with a permanently embodied eduction or exhaust passage and unlikely to get out of repair.

A further object of the invention is to provide means for facilitating the exhaustion of such vacuum tubes and bulbs, and to reduce the incidental breakage, to a minimum.

With the above primary and other incidental objects in view as will more fully appear in the specification, the invention consists of the features of construction, the parts and combinations thereof and the mode of operation or their equivalents as hereinafter described and set forth in the claims.

Referring to the drawings, wherein are shown several preferred embodiments of the invention, Fig. 1 is a side elevation of an incandescent electric light bulb, minus the base cap or screw, to which the present invention has been applied. Fig. 2 is an enlarged perspective view of the filament support and electrical connection, the eduction tube forming the subject matter hereof being utilized as the supporting staff for the filament anchor. Fig. 3 is a side elevation of an incandescent light bulb wherein the non-fragile, eduction tube forms one of the electrical conductors. Fig. 4 is an enlarged perspective view of the filament support, showing a non-fragile eduction tube introduced therethrough wholly independent of the electrical circuit and filament. Fig. 5 is an enlarged perspective view approximately quadruple size, of a vacuum tube protector for radio apparatus and the like installation wherein a hollow electrical conductor is employed to exhaust the tube.

Like parts are indicated by similar characters of reference throughout the several views.

In the accompanying drawings, 1 is an ordinary glass incandescent light bulb, upon which is shown by dotted lines at 2, the pointed teat or sprue wholly eliminated by the present process, leaving the bulb of a uni-

form and continuous peariform shape. This projecting point or sprue on the end of the bulb as usually manufactured at the present time, is the remains of the glass exhaust tube temporarily connected at this point during the manufacture and subsequently removed by "burning off" or fusing to such extent that it is separated and at the same time sealing the orifice into the bulb.

Located in the base of the bulb is the usual filament support 3, comprising a tube of glass flared at its lower end as at 4 to agree with the base of the bulb 1 to which it is integrally united by fusing. Extending through this tubular support are the circuit leads or electrical conductors 5. After the introduction of these lead wires or conductors 5 the upper end of the tubular support 3 is compressed, while in a plastic or semi-fluid condition, thereby embedding the lead wires 5 therein. As ordinarily constructed at the present time, commercial incandescent bulbs are provided with an anchor staff 6 of glass united with the upper end of the support 3 by fusing. Such staff 6 carries a head or button 7 in which are embedded the radial supporting arms 8 for the lighting filament 9, the terminals of which are connected to the conductors or leads 5. In the structure shown in Figs. 1 and 2, there has been substituted for the anchor staff 6 a tube 10, of nonfragile heat resistant material. That is to say, material which will resist the degree of heat necessary for the semi-fusing of the glass tube 3 sufficient to render it plastic, that it may be compressed and solidified about the inserted tubular conduit 10 and circuit leads 5. The glass anchor button 7 is carried upon the upper end of this nonfragile hollow staff 10. This staff 10 is preferably, though not in the present instance necessarily of metal. The tube 10 forming this staff extends downwardly beyond the base of the bulb 1 and near its upper end is provided with a lateral orifice or notch 11, opening into the interior of the bulb 1. Thus after the assembly of the parts, this conduit 10 embedded in the filament support 3 forms an intercommunicating passage between the interior and exterior of the bulb, extending through the base thereof through which the bulb may be exhausted, and if the bulb is of that type known as the gas bulb, the inert gas may be subsequently introduced through the same tube. The outer end of this access tube or passageway is subsequently sealed by "burning off" or fusing the end of the tube in a hot flame or by other means as is indicated at 12. In the construction shown in Figs. 1 and 2, the eduction tube is thus made to serve a double function, that of supporting the filament in lieu of the usual glass anchor staff and that of an exhaust conduit through which the bulb is exhausted and if so desired filled with an inert gas.

In Fig. 3 the general construction of the bulb is identical with that heretofore described except that in lieu of employing the eduction tube as an anchor staff, the ordinary glass staff as is usual in bulbs of commerce is employed, and the eduction tube or exhaust conduit 10′, which in this case is of electro-conductive material is employed as one of the circuit leads in lieu of one of the leads 5 and to which one end of the filament 9 is connected. Thus in the construction shown in Fig. 3 the eduction tube 10′ is in effect a hollow or tubular electrical conductor, which not only carries current to the filament, but also affords an exhaust passage through which the bulb may be exhausted, or filled. This eduction tube or hollow electrical conductor is likewise sealed by any suitable sealing plug or material, or is closed by fusing or "burning off" as at 12′.

In Fig. 4 there is shown a modification, wherein the exhaust conduit 10″ is introduced by thrusting the same through the side of the support tube 3, while the latter is in a plastic condition and fusing the glass of the tube 3 into adherence with the conduit. In this instance the exhaust conduit is uno-functional.

The invention is not only applicable to the manufacture of incandescent lamp bulbs, but is equally as important in the production of vacuum tubes for other purposes, as for instance protector tubes for radio purposes, as shown in Fig. 5. These tubes ordinarily comprise a glass bulb 14, through each end of which is inserted an electrical conductor. These conductors extend into spaced relation one with the other. The interior of the bulb 14 is partially exhausted, the degree of exhaustion depending upon the condition of use and service required. Current does not ordinarily pass through the protector, but in the event of excessive voltage the excess current will leak through the intervening gap from one terminal to the other. In the ordinary process of manufacture of such protector tubes for commercial purposes, an external sprue or pointed teat 15 shown by dotted lines in Fig. 5 is left as the remains of the glass exhaust tube severed by fusing or "burning off" in closing the exhaust port, after the tube has been exhausted to the desired degree. In order to simplify the manufacture, economize and reduce the number of operations, and above all to minimize the breakage, the present invention is applied to such vacuum tube by making one of the electrical conductors 16 of tubular form. The other conductor 17 may be an ordinary solid wire conductor. These conductors 16 and 17 are sealed into the ends of the tube 14 by fusing the glass into adherence to the conductor. The conductor 16 in this case, of electro-conductive or metallic material forms an intercommunicating pas-

sage between the interior and exterior of the tube, through which the tube may be exhausted. After exhaustion, this conductor is closed or sealed either by the introduction of a body of sealing material, or by fusing or "burning off", the conductor.

By the use of metallic eduction tubes, or in any event a tube or conduit of non-fragile material, which may or may not form one of the circuit leads or electrical conductors, the quantity of breakage is not only materially reduced, but the bulb or tube is left in such condition that in the event that the bulb is not properly exhausted, or if at any subsequent time the degree of vacuum is to be modified, such conduit or eduction tube may be reopened and the tube or bulb again subjected to exhaustion, or a suitable inert gas or other fluid may be admitted thereto, without endangering the bulb or involving any intricate operation. By employing the eduction tube as an anchor staff as shown in Figs. 1 and 2, the danger of breakage at this point is entirely eliminated.

The tube when of electroconductive character, as in Figs. 2 and 5 is preferably of metal having low resistance and a coefficient of expansion and contraction approximating that of glass, such as is possessed by various "platinum substitute" alloys commonly employed at the present time for the circuit leads 5 of incandescent lamps. In the event that non-metallic or non-conductive material is employed, as in Figs. 1, 2 and 4 the material must be one to which the glass will adhere, possessing a fairly high degree of resistance to heat, and likewise having a coefficient of expansion and contraction approximating that of glass and to which the glass will adhere, in order that perfect union may be maintained between the tube and the glass. Such non-metallic tubes having the requisite characteristics may be composed of various phenolic condensation materials and compositions, or asbestos fiber composition and the like. These materials and platinum substitute alloys are suggested merely for the purpose of illustration and with no intent to so limit the invention.

While the invention has been shown applied to an incandescent lamp having a ring type of filament, it is to be understood that the invention is equally applicable to other types and forms of lamp bulbs, and either gas filled or vacuum tubes of whatever shape or character.

I am aware that heretofore incandescent lamp bulbs have been exhausted through a port provided in the tubular support 3. However, the parts being wholly of glass and of small dimensions and extremely fragile, such process has not been generally adopted for commercial production, due to the high percentage of breakage. By the use of non-fragile or metallic tubes as herein described, the exhaustion of lamp bulbs through the base as well as other forms of vacuum tubes without leaving the objectionable point or sprue is made entirely practical and a commercial reality.

From the above description it will be apparent that there is thus provided a device of the character described, possessing the particular features of advantage before enumerated as desirable, but which obviously is susceptible of modification in its form, proportions, detail construction and arrangement of parts without departing from the principle involved or sacrificing any of its advantages.

While in order to comply with the statute the invention has been described in language more or less specific as to structural features, it is to be understood that the invention is not limited to the specific details shown, but that the means and construction herein disclosed comprises the preferred form of several modes of putting the invention into effect and the invention is therefore claimed in any of its forms or modifications within the legitimate and valid scope of the appended claims.

Having thus described my invention, I claim:

1. As an article of manufacture, an electric bulb having a hollow electrical conductor extending from the exterior to the interior of the bulb through which the bulb is exhausted or filled.

2. As an article of manufacture, a vacuum protector comprising a glass bulb having electrical conductors extending thereinto in spaced relation one with the other, one of said conductors being hollow and through which the bulb is exhausted.

3. As an article of manufacture an electrical bulb, of glass, and a tubular electrical conductor leading therefrom through which the bulb is exhausted or filled.

4. The herein described method of exhausting glass bulbs and the like consisting in sealing a metallic tubular electrical conductor into the wall of the bulb, exhausting the bulb through such tubular metallic duct and closing the conductor.

5. The herein described method of tubulating lamp bulbs and the like comprising embedding a non-fragile tube in the wall of the bulb, exhausting the bulb through such tube and subsequently closing the tube and employing same as an electrical conductor.

In testimony whereof I have hereunto set my hand this 10th day of July, A. D. 1922.

JOHN S. VAN HORNE.