

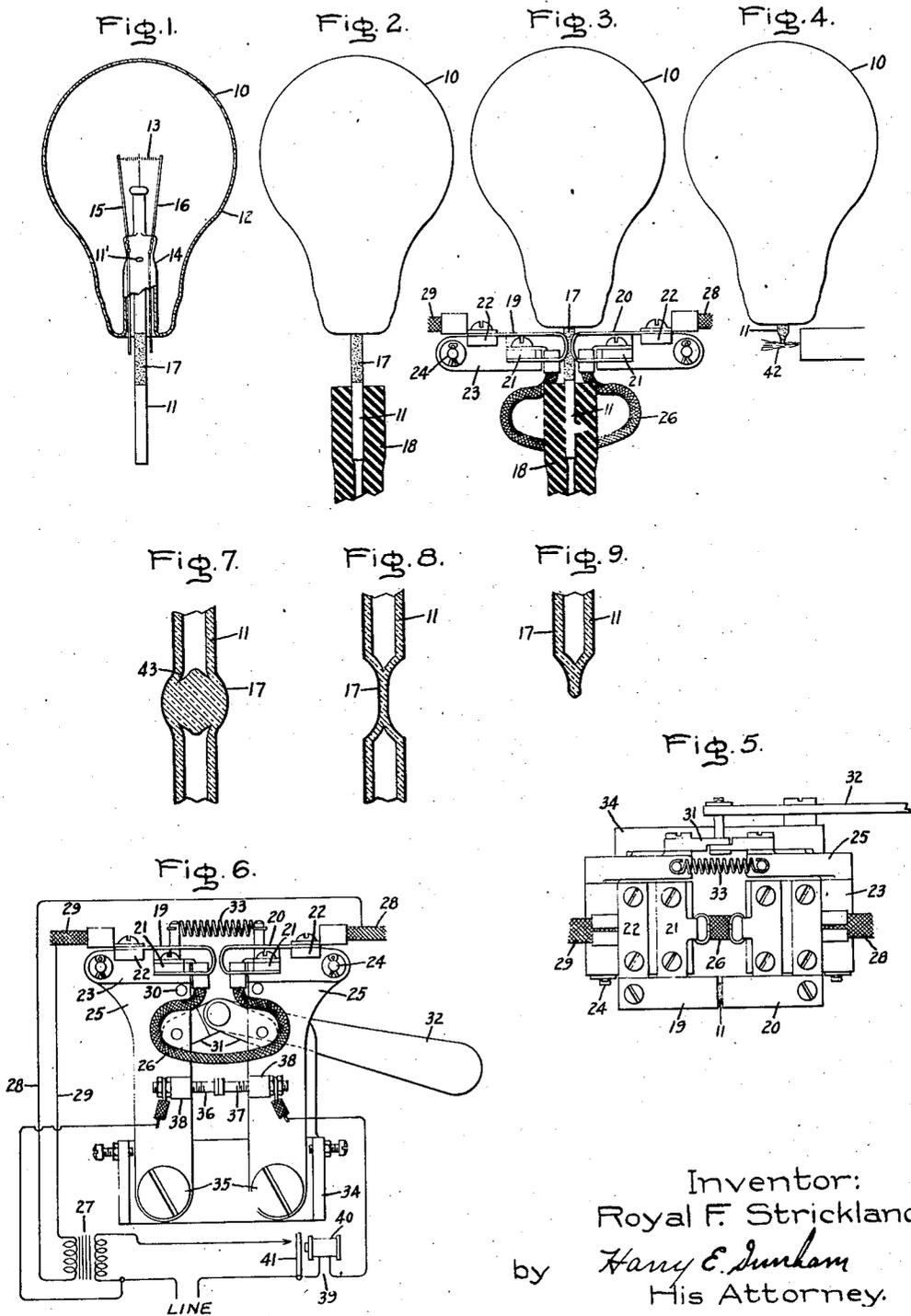
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METHOD AND APPARATUS FOR SEALING ENVELOPES

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METHOD AND APPARATUS FOR SEALING ENVELOPES

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My invention relates to the manufacture of electric lamps and other similar electric devices enclosed within a sealed bulb or envelope and more particularly to a method and apparatus for sealing or tipping off a vitreous tube through which the device is exhausted and then gas filled.

Considerable difficulty has heretofore been experienced in sealing off the exhaust tube of such devices when the pressure of the gas therein is greater than atmospheric, principally because the gas pressure causes a hole to be blown out in the tube when it is heated sufficiently to be fused and sealed. Heretofore, it has been proposed to heat the exhaust tube until it becomes workable but still not soft enough to blow out, and then to pinch it until the walls are brought together and sealed. The operation of heating the exhaust tube is very critical and, together with the pinching operation which tends to close the opening in said tube except for two very small threadlike openings or passages at both sides of the pinched portion, is very difficult to perform on a commercial scale. The pinching jaws also stick to the vitreous exhaust tube in many instances.

One object of my invention is to provide a satisfactory method of pinching and sealing the exhaust tube of a vessel, particularly one containing a gas at superatmospheric pressure. Another object of my invention is to prevent the pinching jaws from sticking to the exhaust tube during the tipping thereof by the application of a coating to said exhaust tube that will not stick to said jaws. Still another object of my invention is to provide pinching apparatus for closing the exhaust tube satisfactorily and causing an appreciable area therealong to be closed and sealed. Other features of my invention will appear from the following detailed description and from the accompanying drawing.

In the drawing, Figs. 1, 2, 3 and 4 are similar side elevations of an incandescent lamp in the various steps of the tipping operation; Figs. 5 and 6 are plan and side views respectively of apparatus for tipping the exhaust tube with the wiring diagram therefor incorporated in the latter figure; Figs. 7 and 8 are longitudinal sections at right angles to each other and on an enlarged scale through the pinched and sealed portion of the exhaust tube; and Fig. 9 is a similar section of said exhaust tube after the tipped off end has been removed and the tip glazed.

In the instance shown in the drawing, an incandescent lamp 10 of the so-called tipless type

having an inert gas filling at a pressure greater than atmospheric is sealed by the tipping off of the glass exhaust tube 11 extending therefrom. The lamp 10 at the start of the tipping operation, as shown in Fig. 1, comprises a bulb 12, filament 13, stem 14, leading-in wires 15 and 16 which extend through the stem 14 and are connected to the end of said filament 13, and the exhaust tube 11 which extends from the stem 14 and communicates with the interior of the lamp 10 through an aperture 11'. The first step in the tipping operation is the application of the coating 17 to a portion of the exhaust tube 11 adjacent the bulb 12 by means of a brush, spray gun or any other convenient means. The coating 17 is provided for the purpose of preventing the pinching jaws or other tool used in closing the exhaust tube 11 from sticking thereto during the tipping operation and preferably consists of a coating material, such as graphite or mica flakes, which does not become sticky at the softening temperature of the exhaust tube, and a binder such as a solution of nitro-cellulose or shellac, the former of which is burned away before the softening temperature is reached. It is preferred that the graphite be the flat flake type known as electro-platers' graphite. The coating 17 can be relatively thin but must flow sufficiently during the pinching of the exhaust tube 11 to keep between the pinching tool and said exhaust tube 11. The coating 17 can, if desired, be applied to the exhaust tube 11 at some other time during the manufacture of the device, for instance, before the said tube is fused into the stem 14 or, where no stem is employed, before or after the exhaust tube is united to the bulb or envelope.

The incandescent lamp 10 is exhausted as shown in Fig. 2 in the usual manner through the rubber tube 18 and is then filled with a gas, such as argon and nitrogen, to a pressure greater than atmospheric. The pressure of the gas within the lamp 10 in this instance is only limited by the strength of the bulb 12 and other parts of the enclosure.

While still connected to the exhaust and gas-filling means, the exhaust tube 11 is heated and pinched at a point between the rubber tube 18 and the bulb 12 so that the passage therethrough is closed and sealed. These operations are preferably brought about as shown in Fig. 3 by apparatus shown in full in Figs. 5 and 6, and occurs as the heated jaws 19 and 20 are closed on the tube 11. Each of the jaws 19 and 20 is formed from a ribbon of metal mounted on the arms 21

and 22 extending from the block 23 which in turn is pivotally mounted on the pin 24 extending from the arm 25. In this instance, the jaws 19 and 20 are made of nickel-chromium-steel alloy having sufficient resistance to be heated by the current passed therethrough, although they could as well be heated by a flame directed onto the inner surfaces thereof opposite those engaging the exhaust tube. The jaws 19 and 20 are electrically connected in series by the flexible wire 26 which engages the metal arms 21 of the respective jaws, and are connected to the transformer 27 which supplies the low voltage current therefor through the wires 28 and 29 which engage the metal arms 22 of the respective jaws 19 and 20. The blocks 23 are made from an insulating material and are held in position, so as to engage the exhaust tube 11 properly, by the pins 30 extending from the arms 25. The closing of the jaws 19 and 20 is brought about through the toggle links 31 which are pivotally attached to the arms 25 and are moved upward into the position shown by manual adjustment of the lever 32. Normally, the toggle links 31 are in alignment and keep the arms 25 separated but when they are moved to the position shown, the contraction of the spring 33, which extends between a post in each arm, draws the said arms together.

The heated jaws 19 and 20 force the side walls of the exhaust tube 11 toward each other as rapidly as said walls soften, and finally squeeze them tightly together and cause an outward and upward displacement of the glass thereof as the operation is completed. The displacement of the glass is caused by the squeezing out of the excess glass between the jaws 19 and 20 and results in an upward movement thereof which is allowed for by the turning of blocks 23 about the pins 24.

The arms 25 supporting the jaws 19 and 20 are pivotally mounted on the base 34 of the device by means of the screws 35 and carry the respective contacts 36 and 37 which are brought into engagement with each other when the exhaust tube has been squeezed to the required thinness. These contacts 36 and 37 are mounted on insulating blocks 38 carried by the arms 25 and make or break the line circuit to a relay 39 which in turn controls the line circuit to the primary of the transformer 27. As shown in Fig. 6, contact 36 is connected directly to the line and contact 37 is connected to the coil 40 of the relay 39 which is connected to the opposite side of the line. The primary of the transformer 27 is connected directly to one side of the line and through the contact and the armature 41 of the relay 39 to the other side of the line. Before the contacts 36 and 37 engage each other, the circuit through the relay 39 to the transformer 27 is complete and the necessary electrical energy is supplied to the jaws 19 and 20 to heat and fuse the exhaust tube 11, but the making of the circuit through said contacts 36 and 37 causes the coil 40 to shift the armature 41 so that the circuit is broken and all danger of heating the exhaust tube 11 so that it blows out is eliminated. After a short interval during which the exhaust tube 11 is permitted to cool, the jaws 19 and 20 are separated and the lamp 10 is removed from the exhausting apparatus. Due to the slight weight of the lamp 10, no additional means is normally required for its support and no effect due thereto is noticeable in the displacement of exhaust tube 11. The pinching operation may be brought about more rapidly when the exhaust tube 11 is preheated by a gas

flame directed thereagainst during the exhausting and gas-filling operation.

That portion of the exhaust tube 11 extending beyond the pinch is of no further use and the application of a slight sideward pressure to the end thereof causes said exhaust tube 11 to separate midway in the pinched area. The end of the exhaust tube 11 then has sharp edges and it is preferred that said end be glazed by the application of a flame 42 thereto as shown in Fig. 4. The breaking point of the exhaust tube 11 can be determined more exactly by providing pinching jaws of another form which reduce the thickness of the pinch more at the point it is desired the tube 11 should break. Such jaws are not necessary, however, as the apparatus shown produces a seal of considerable length as shown in Figs. 7 and 8 and there is little chance that the break will extend beyond this zone. The length of the pinched portion of the exhaust tube 11 is largely due to the upward movement thereof during the pinching which is allowed by the movement of the jaws 19 and 20. This movement of the jaws 19 and 20 also shortens the side pockets or horns 43 which extend into the pinched area. The glazed end of the pinched exhaust tube 11 is shown in Fig. 9.

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

1. The method of sealing an envelope having a vitreous exhaust tube extending therefrom which consists in applying a powdered graphite coating to a portion of the exhaust tube, holding heated jaws in engagement with the said coated portion of the exhaust tube until the said tube is softened and then compressing said jaws to pinch the tube and seal it while causing a relative longitudinal separation of the parts of the exhaust tube on opposite sides of the pinched portion and a corresponding movement of the said jaws longitudinally of said exhaust tube.

2. Apparatus for sealing an envelope having a vitreous exhaust tube extending therefrom comprising means for supporting the tube and envelope so as to permit a small longitudinal elongation of the tube, means for heating a portion of the exhaust tube, a pair of jaws arranged to engage opposite sides of said tube, means for causing said jaws to engage and pinch said exhaust tube to seal it, said jaws being arranged for a small amount of movement longitudinally of the exhaust tube to permit the longitudinal displacement of the tube and jaws during the pinching operation.

3. Apparatus for sealing an envelope having a vitreous exhaust tube extending therefrom comprising means for supporting the tube and envelope so as to permit a small longitudinal elongation of the tube, means for heating a portion of the exhaust tube, a pair of jaws arranged to engage opposite sides of said exhaust tube, a pair of arms for supporting said jaws, said jaws being pivotally mounted on said arms to allow them to move longitudinally of the exhaust tube, and means for moving said arms to cause said jaws to engage and pinch said exhaust tube to seal it whereby the tube and jaws are longitudinally displaced a small amount during the pinching operation.

4. Apparatus for sealing an envelope having a vitreous exhaust tube extending therefrom comprising means for supporting the tube and envelope so as to permit a small longitudinal elongation of the tube, a pair of jaws arranged to en-

gage opposite sides of said exhaust tube and each formed of a ribbon of metal, means for passing an electrical current through said jaws to cause them to be heated, means for causing said jaws to engage said tube to heat it and thereafter pinch said tube to seal it, said jaws being arranged for a small amount of movement longitudinally of the exhaust tube to permit longitudinal displacement of the tube and jaws during the pinching operation.

5. Apparatus for sealing an envelope having a vitreous exhaust tube extending therefrom comprising means for supporting the tube and envelope so as to permit a small longitudinal elongation of the tube, a pair of jaws arranged to engage opposite sides of said exhaust tube and each formed of a ribbon of metal, means for passing an electrical current through said jaws to cause them to be heated, means for causing said jaws to engage said tube to heat it and thereafter pinch said tube to seal it, said jaws being arranged for a small amount of movement longitudinally of the exhaust tube to permit the longitudinal displacement of the tube and jaws during the pinching operation, and means for interrupting the passage of the electrical current through said jaws after they have closed upon the tube a predetermined amount.

6. Apparatus for sealing an envelope having a vitreous exhaust tube extending therefrom comprising means for supporting the tube and envelope so as to permit a small longitudinal elongation of the tube, a pair of jaws arranged to engage opposite sides of said exhaust tube and each formed of a ribbon of metal, a pair of arms for supporting said jaws, said jaws being pivotally mounted on said arms to allow them to move longitudinally of the exhaust tube, means for passing an electrical current through said jaws to cause them to be heated, and means for moving said arms to cause said jaws to engage said tube to heat it and thereafter pinch said tube to seal it whereby the tube and jaws are longitudinally displaced a small amount during the pinching operation.

7. Apparatus for sealing an envelope having a vitreous exhaust tube extending therefrom comprising means for supporting the tube and envelope so as to permit a small longitudinal elongation of the tube, a pair of jaws arranged to engage opposite sides of said exhaust tube and each formed of a ribbon of metal, a pair of arms for supporting said jaws, said jaws being pivotally mounted on said arms to allow them to move longitudinally of the exhaust tube, means for passing an electrical current through said jaws to cause them to be heated, means for moving said arms to cause said jaws to engage said tube to

heat it and thereafter pinch said tube to seal it whereby the tube and jaws are longitudinally displaced a small amount during the pinching operation, and means for interrupting the passage of the electrical current through said jaws after they have closed upon the tube a predetermined amount.

8. Apparatus for sealing an envelope containing a gas filling at a pressure above atmospheric and having a vitreous exhaust tube depending therefrom comprising a pair of jaws arranged to engage opposite sides of said exhaust tube, means for electrically heating said jaws, means for causing said jaws to engage said tube to heat it and thereafter pinch said tube to seal it, and means for interrupting the electrical heating of said jaws after they have closed upon the tube a predetermined amount and before the adjacent portions of the tube have been softened sufficiently to cause the internal pressure to blow a hole therethrough.

9. Apparatus for sealing an envelope containing a gas filling at a pressure above atmospheric and having a vitreous exhaust tube depending therefrom comprising a pair of jaws of electrically conductive material arranged to engage opposite sides of said exhaust tube, means for passing an electrical current through said jaws to heat them, means for causing said jaws to engage said tube to heat it and thereafter pinch said tube to seal it, and means for interrupting the passage of the electrical current through said jaws after they have closed upon the tube a predetermined amount and before the adjacent portions of the tube have been softened sufficiently to cause the internal pressure to blow a hole therethrough.

10. Apparatus for sealing an envelope having an exhaust tube extending therefrom comprising a pair of jaws arranged to engage opposite sides of said exhaust tube and each formed of a ribbon of metal, a pair of pivotally mounted arms for supporting said jaws, said jaws being pivotally mounted on said arms to allow them to move longitudinally with respect to the exhaust tube, means for passing an electrical current through said jaws to cause them to be heated, means for pivoting said arms to cause said jaws to engage said tube to heat it and thereafter pinch said tube to seal it, a pair of contact members mounted on said arms in opposed relationship so as to be brought into engagement after said jaws have closed upon the tube a predetermined amount to prevent further closing of said jaws, and means controlled by the engagement of said contact members for interrupting the passage of the electrical current through said jaws.

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