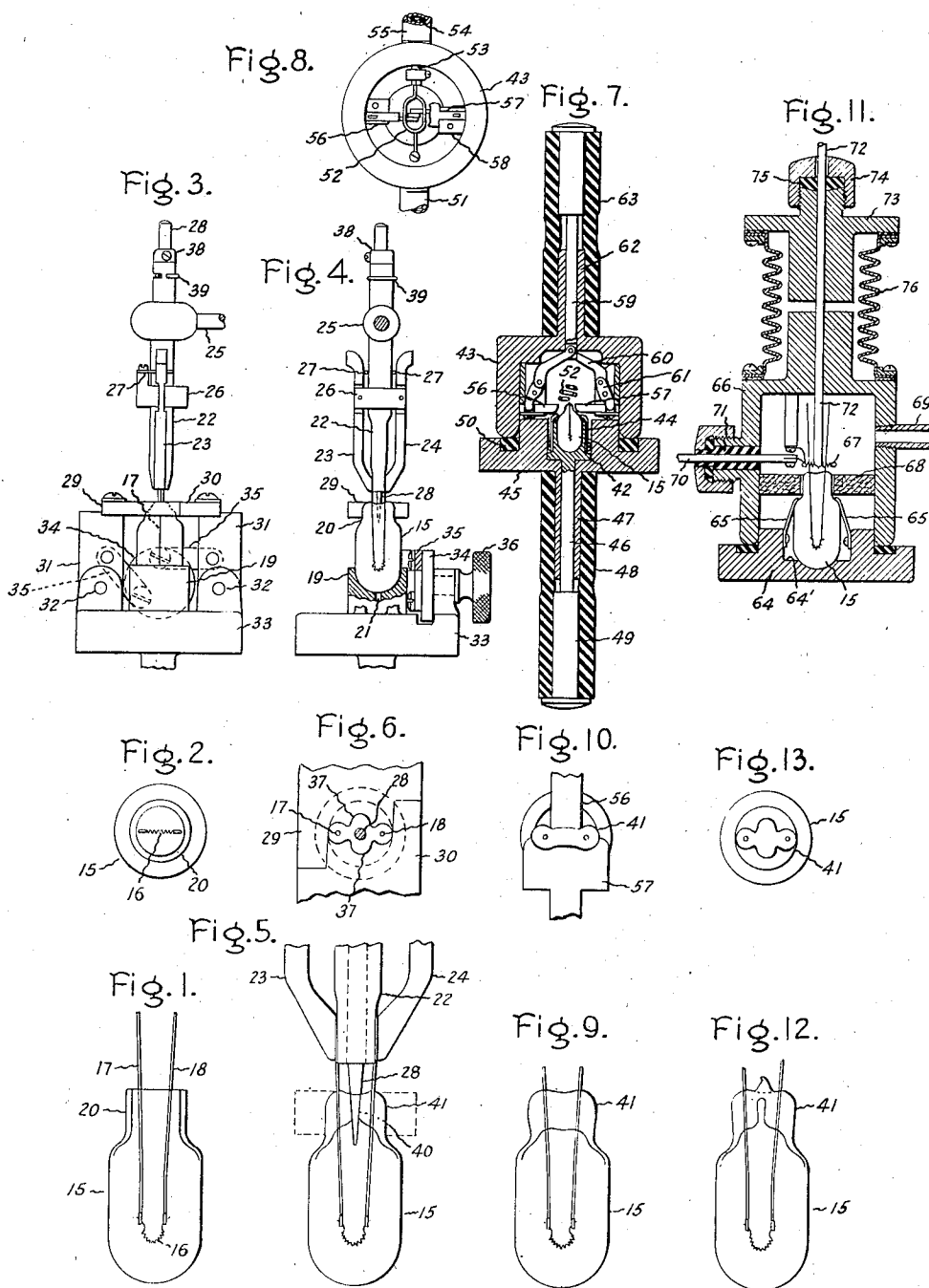


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METHOD AND APPARATUS FOR MANUFACTURING
ELECTRIC LAMPS AND SIMILAR ARTICLES
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METHOD AND APPARATUS FOR MANUFACTURING ELECTRIC LAMPS AND SIMILAR ARTICLES

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My invention relates to methods and apparatus for manufacturing electric incandescent lamps and similar devices and more particularly to methods and apparatus for sealing and evacuating such devices. Still more particularly, my invention relates to the manufacture of miniature incandescent lamps.

Heretofore, miniature incandescent lamps have been made by the butt-seal method. The mounts for these lamps consist of a pair of lead wires held in spaced relationship by a bead of vitreous material and carrying a filament at their ends. Portions of the lead wires are sealed in the glass of the joint formed by butt-sealing an exhaust tube to the neck of a bulb. The lamp is then evacuated through the exhaust tube which is subsequently tipped off.

One of the objects of my invention is to eliminate the use of an exhaust tube as well as the bead for holding the leads spaced apart and to positively position the filament in the bulb. Another object is to provide a more economical process of manufacture by means of simplified equipment and a greater rate of production.

According to my invention, miniature incandescent lamps are made by disposing a mount, comprising a pair of lead wires having a filament attached thereto, within a bulb with the said lead wires extending longitudinally through the open neck of said bulb. The lead wires are preferably held by a pair of jaws with the filament definitely positioned with respect to the bulb. The bulb neck is then heated to cause it to be fused and sealed to the lead wires but an opening is maintained through said bulb neck. The said fused neck portion of the bulb is preferably compressed around the lead wires by a pair of jaws and the opening is preferably maintained by means of a mandrel or rod located within said bulb neck. The bulb is then evacuated within an exhaust chamber and the said opening is closed and sealed, for example by heating the said bulb neck and then compressing it within the exhaust chamber or by sealing molten glass thereto on the said opening.

Further features and advantages of my invention will appear from the following detailed description of species thereof and from the drawing.

In the drawing, Figs. 1 and 2 are side and plan views of the lamp parts to be sealed together according to my invention; Figs. 3 and 4 are side elevations at 90° to each other of apparatus used in sealing the lamp parts together; Figs. 5 and 6 are side and plan views of the lamp parts in the

final sealing step; Fig. 7 is a longitudinal section through one form of exhausting apparatus of my invention; Fig. 8 is a plan view looking upward into the chamber of said exhausting apparatus; Figs. 9 and 10 are side and plan views of a lamp produced by said apparatus; Fig. 11 is a longitudinal section through a modified exhausting apparatus of my invention; and Figs. 12 and 13 are side and plan views of a lamp produced by said modified apparatus.

The first step in the method of manufacture according to my invention consists in inserting the lamp bulb 15 and the mount, comprising the filament 16 and the leading-in wires 17 and 18 shown in Figs. 1 and 2, into the sealing apparatus shown in Figs. 3 and 4. The bulb 15 is placed in the cup 19 with neck 20 thereof uppermost and is held in place therein by the suction conducted to said cup 19 through an aperture 21. The mount is placed in the apparatus by insertion of the leading-in wires 17 and 18 between opposite sides of a spindle 22 and the jaws 23 and 24 which are at this time located some distance above the lamp bulb 15. The spindle 22 is held by apparatus (not shown) to which it is connected by an arm 25, and it supports the jaws 23 and 24 which are pivotally mounted in a block 26 attached thereto. To permit insertion of the leading-in wires 17 and 18 into the apparatus, the jaws 23 and 24 are opened by squeezing the upper ends thereof against the action of a wire spring 27. The said leading-in wires 17 and 18 are placed in longitudinal grooves in the spindle 22 which serve to locate them properly and are gripped by the jaws 23 and 24 by the pressure produced by the spring 27 which is attached to the block 26.

The spindle 22 is then lowered so as to carry the filament 16 into the bulb 15 and the leading-in wires 17 and 18 into proper relation to the neck 20 of said bulb 15 whereupon heat is applied to said neck 20 to cause it to soften. The heating is preferably done by fires from burners (not shown) located about the spindle 22 which are directed on the upper half of the bulb neck 20 and the tapered end of a rod or mandrel 28 extending down into said neck 20 from the spindle 22. As the bulb neck 20 softens, it collapses around the leading-in wires 17 and 18 and the rod 28, and then the jaws 29 and 30 are closed on the softened neck 20 to press it around said leads and rod. The jaws 29 and 30 are mounted each on an arm 31, which is pivoted on a pin 32 in a stationary block 33, and which is turned thereabout to actuate the jaw by rotation of a

disc 34 to which it is connected through a link 35. The disc 34 is pivoted on the block 33 and, in this case, is rotated manually by means of the knurled knob 36 connected thereto. The shape of the faces of the jaws 29 and 30 is such that the bulb neck 20 is pressed tightly around all sides of the leading-in wires 17 and 18 and the end of rod 28, and two lobes 37 are formed on opposite sides of the said rod 28. The rod 28 is mounted slidably in a central opening in the spindle 22 and is held in position by a collar 38 attached to the upper end thereof and by the frictional engagement of a spring 39. The spring 39 lies in a slot in spindle 22 and extends therearound. It is preferred that the tapered end of the rod 28 be so dimensioned that a passage 40 about .02 to .06 inch in diameter is left in the seal or press portion 41 of the lamp bulb 15.

The next step consists in evacuating the lamp bulb 15 and closing the passage 40 either by compressing the seal portion 41 thereof or by sealing additional material thereto over the end of said passage 40. In the former instance, the apparatus shown in Figs. 7 and 8 is used and the lamp bulb 15 is inserted in the aperture in the cup 42 as shown after the upper bell housing 43 has been removed. The bulb 15 is held upright by the cup 42 and is held therein by the spring fingers 44 which are attached thereto and which engage the shoulder of said bulb 15 adjoining the neck 20. The cup 42 is located within an aperture in the circular block 45 and is held in position by the rod 46 to which it is attached and which extends through the tubular extension 47 of said block. The rod 46 is held, in turn, by the rubber tubing 48 which is tightly stretched about the tubular extension 47 and a cylindrical extension 49 at the end of said rod, thereby sealing the connection between the said rod 46 and the circular block 45. The outer ends of the leading-in wires 17 and 18 are bent down onto the top surface of the block 45 so as to clear the other parts of my apparatus in the bell housing 43 which is now placed over the bulb 15 in engagement with the circular rubber washer 50 located within a groove in block 45. The lamp 15 is now located within a completely sealed chamber from which the air is exhausted through pipe 51 (Fig. 8) which is screwed into an aperture in the wall of the bell housing 43. In some instances, it may be desirable to evacuate and flush the chamber several times to produce the desired conditions within the bulb 15.

After the bulb 15 is evacuated and, if desired, gas filled, the cup 42 is raised to bring the seal portion 41 of said bulb within the electrically heated resistance coil 52 by upward pressure on the end of cylinder 49. The resiliency of the rubber tubing 48 permits the cylinder 49 to be moved the desired amount. One end of the resistance coil 52 is attached directly to the bell housing 43 which conducts electricity thereto and the other end of said coil 52 is attached to a rod 53 which extends through an insulating bushing 54 extending through the bell housing 43 and the tube 55. The seal portion 41 of the lamp bulb 15 is softened very quickly by the heat from the resistance coil 52, after which the pressure is withdrawn from the cylinder 49 causing the rubber tubing 48 to expand and the bulb 15 to be returned to its formed position. The jaws 56 and 57 are then moved in against the lobes 37 on the bulb neck, thereby compressing them and closing off the passage 40, as shown in Figs. 9 and 10. The jaws 56 and 57 are each located

within a slideway in a block 58 attached to the bell housing 43 and are actuated by longitudinal movement of rod 59 which is connected to each of said jaws through the link 60 and the lever 61 which is pivoted on said block 58. The rod 59 is located within a tubular extension 62 of the bell housing and is held in position by the rubber tubing 63 surrounding the end of said rod and said tubular extension 62. Pressure on the end of the rod 59 closes the jaws 56 and 57 and compresses the rubber tubing 63 whereas the expansion of the tubing 63 opens the jaws 56 and 57 when the pressure is withdrawn. The rubber tubing 63 prevents gas leakage between the rod 59 and the tubular extension 62. Air is now allowed to pass into the bell housing 43, whereupon it is separated from the remainder of the apparatus and the lamp is removed therefrom. The evacuated bulb 15 made by this method consists of a single piece of glass, inasmuch as no exhaust tube has been used.

In an alternative method of evacuating the bulb 15, the apparatus shown in Fig. 11 is employed. In this case, the bulb 15 is placed in the cavity 64' in the plate 64 between the spring fingers 65 after the bell housing 66 has been removed. After said bell housing 66 has been replaced, the neck of the bulb is located in operative relation to the heating coil 67. The bulb 15 is held upright by a partition or gasket 68 within the bell housing 66 which is provided with a hole into which the neck 20 thereof extends and which is preferably made of asbestos because of its close proximity to the heating coil 67. The bulb 15 is now located within a completely sealed chamber from which the air is removed through the pipe 69 and is heated by the passage of electricity through the heating coil 67. The heating coil 67 is fastened to the bell housing 66 and to the rod 70 extending through the insulating bushing 71 and soon softens the seal portion 41 of the lamp 15 as well as the end of a glass rod 72 whereupon said rod 72 is moved down into contact with said seal portion 41 and is fused thereto. The molten portion of the rod 72 completely closes off the passage 40 in the lamp 15, which appears as shown in Figs. 12 and 13 after the rod 72 has been raised and the unfused portion thereof separated from said lamp 15. The rod 72, which is preferably of the same vitreous composition as the bulb of the lamp 15, extends through an opening in the top of the bell housing 66 and is attached to and tightly sealed to the block 73 by the nut 74 and resilient washer 75. The block 73 is attached to the flexible bellows 76 extending from the bell housing 66 and moves the rod 72 down as desired when pressure is applied to the end thereof. The bellows 76 permits this motion and effectively seals the block 73 to the bell housing 66. After the bulb 15 has been sealed, air is allowed to enter the bell housing 66, and after separation of it from the block 64, the lamp is removed.

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

1. The method of manufacturing electric incandescent lamps and similar articles without the use of an exhaust tube which comprises disposing a mount within a glass bulb with the lead wires of said mount extending longitudinally through the open neck of said bulb, heating said bulb neck to cause it to be fused and sealed around said lead wires and maintaining an opening through said neck, evacuating said bulb within an exhaust chamber and then hermetically seal-

ing said opening by fusing and compressing said bulb neck within said chamber.

2. The method of manufacturing electric incandescent lamps and similar articles without the use of an exhaust tube which comprises disposing a mount within a glass bulb with the lead wires of said mount extending longitudinally through the open neck of said bulb, heating said bulb neck to cause it to be fused and sealed around

said lead wires and around a mandrel located within said neck for maintaining an opening through said neck, withdrawing said mandrel, evacuating said bulb within an exhaust chamber and then hermetically sealing said opening by fusing and compressing said bulb neck within said chamber.

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