June 13, 1944. M. E. McGOWAN 2,351,530

METHOD OF SEALING-IN AND MOLDING LAMP BULBS

Original Filed Dec. 21, 1935

Fig. 1.

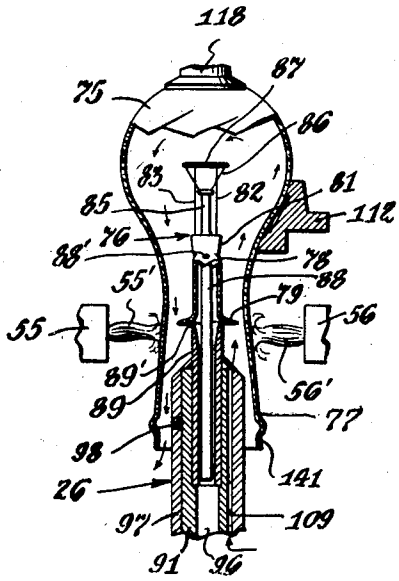


Fig. 2.

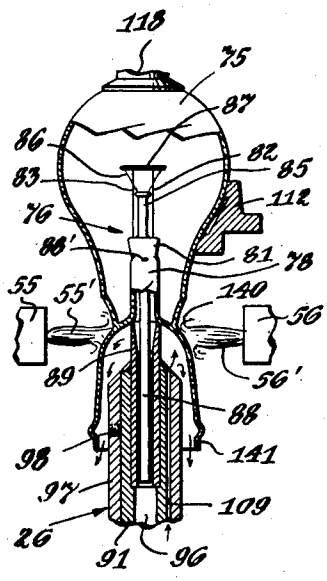


Fig. 3.

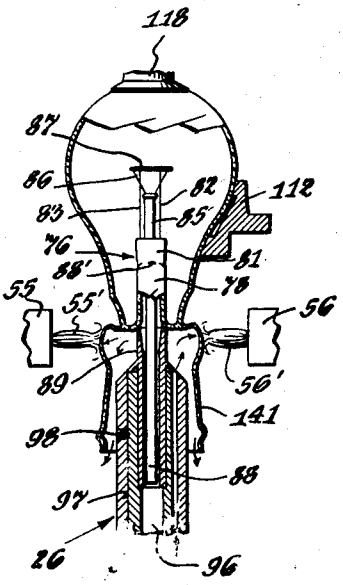


Fig. 4.

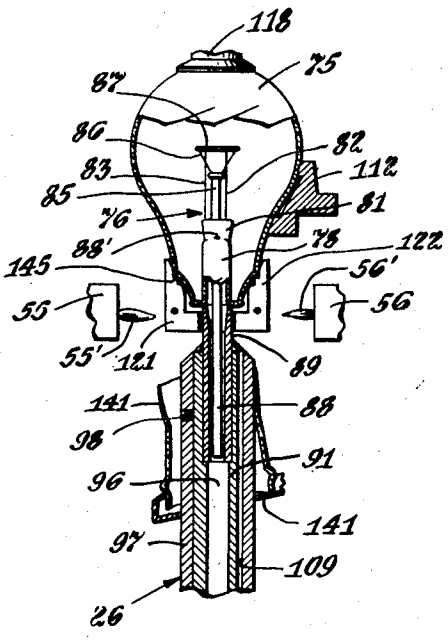
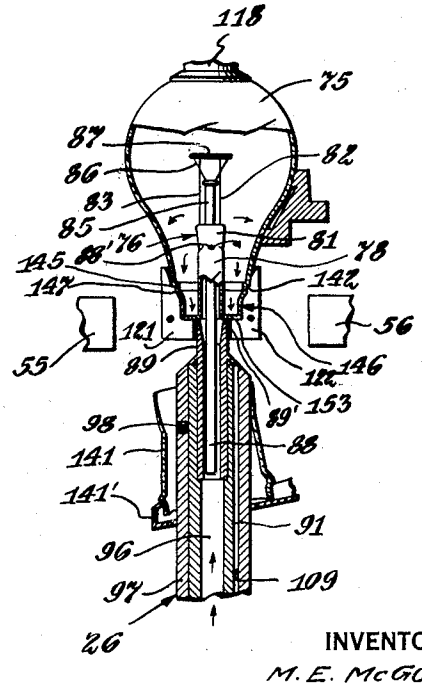


Fig. 5.



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Patented June 13, 1944

2,351,530

UNITED STATES PATENT OFFICE

2,351,530

METHOD OF SEALING-IN AND MOLDING LAMP BULBS

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Original application December 21, 1935, Serial No. 55,519, now Patent No. 2,212,842, dated August 27, 1940. Divided and this application July 13, 1940, Serial No. 345,310

11 Claims. (Cl. 49—78)

This application is a division of my copending application, Ser. No. 55,519, filed December 21, 1935, now patent No. 2,212,842, dated August 27, 1940, and owned by the assignee of the present application.

This invention relates to the manufacture of incandescent electric lamps and similar devices, and more particularly to a method for sealing together two glass parts of said devices and for shaping the seals, also for shaping the bulb neck to form an annular abutment to seat the edge of a lamp base, and the product of said method.

The manufacture of devices of the above character, such as incandescent electric lamps, includes the operation of uniting what is termed a stem or mount, including a glass flare tube, to the neck portion of a bulb. In addition to the sealing operation it is desirable to shape the united parts while still plastic so that when completing the lamp another part termed the base may more readily be applied and held in fixed relation to the bulb.

Machines for performing a sealing-in operation have long been used in the lamp making industry and it has been the practice to first prepare the assembled parts by slowly heating to a conditioning temperature. This preliminary heating was considered necessary before subjecting the parts to the hot sealing fires. The preheating step retarded the speed of manufacture, particularly in connection with machines which operated continuously to give the maximum speed in production.

Developments in the lamp industry, especially those relating to high-speed production, include machines which will function to perform the required operations without the necessity of stopping for time-consuming operations. In machines as heretofore employed the conveyor which carried the lamp parts was indexed to provide a given number of stationary periods and obviously the rate of production was determined and dependent on the time required to perform the longest operation.

In my Patent No. 2,132,538, dated October 11, 1938, and owned by the assignee of the present application, a machine is shown for performing the operation of sealing the bulb after exhaust. Obviously such a machine, which operates continuously at relatively high speed, would lose a great deal of its value if the preceding operation of sealing-in failed to perform with the necessary rapidity.

As above mentioned, it was believed that bulbs required preheating before being passed to the sealing fires; whereas, in accordance with the present invention, no preheating is employed but the lamp parts, while cold or at room temperature, are inserted into the high temperature sealing fires. This is possible by reason of the present method of circulating air or other gas into the bulb during the sealing operation. The air which passes the bulb surface directly in contact with the fires is slightly warmed and the bulb immediately absorbs some heat from the air. As the temperature of the bulb is raised, the circulating air dissipates or carries away sufficient heat to prevent the formation of internal stresses in the glass which might result in cracks as would ordinarily be expected when a cold glass body is subjected to a quick temperature change.

The present invention also includes the operation of forming or shaping the bulb neck to receive a base. The formation of the bulb neck is important and has been accomplished heretofore by molding members, such as shown in Patent No. 2,006,231, issued June 25, 1935. This patent shows a bulb neck formed to receive a base but, as will be noted, the contour of the bulb neck in cross section is made with rounded surfaces. This follows the practice of avoiding sharp corners although it is of great advantage to provide a straight or flat shoulder to hold a base, particularly when used with what is termed a mechanical base, where the base is held mechanically instead of by cement.

The present invention provides molding means which is formed so as to furnish the bulb neck with a sharp or substantially right angle shoulder or annulus, to provide a flat face or contact surface which cooperates with other mechanical means to hold a base against relative movement when attached to a bulb neck. Although a sharp-cornered shoulder is contrary to previous teachings and practice, bulbs shaped in accordance with the present method were subjected to the usual tests, including the storage of lamps over a period of months, for the determination of developed cracks. It was found that the present method gave a satisfactory and commercial lamp free from internal stress and an extremely low percentage of cracked or leaky lamps.

It is, therefore, an object of the present invention to provide a simple and effective method for performing a high-speed sealing-in operation.

Another object of the invention is to provide a method which may be practiced using a continuously operating sealing-in machine.

A further object of the invention is to provide

a method wherein a plurality of lamp parts, including a bulb, are directly positioned in a high temperature zone for a sealing-in operation without preheating.

A still further object of the invention is to provide a method for fusing a plurality of glass lamp parts together, and shaping the fused portion during the movement of the parts on a conveyor.

Another object of the invention is to provide a method of applying high temperature flames to unheated lamp parts, and in performing a sealing-in operation in the absence of detrimental strains or cracks.

A further object of the invention is to provide a lamp bulb having the neck portion thereof formed with a shoulder of substantially right angular form in transverse cross section, free from detrimental stresses or cracks.

Other objects and advantages of the invention will be more clearly understood from the following description, together with the accompanying drawing in which:

Figs. 1 to 5, inclusive, show a bulb and stem in the various stages during the sealing-in and molding operations.

A machine constructed for practicing a method in accordance with the present invention comprises a conveyor rotated continuously at a given speed by means of a motor as disclosed in my Patent No. 2,212,842, previously referred to. The conveyor carries heads or bulb holders 26 through a circular path and during a portion of their movement with the conveyor the heads are rotated relative to the conveyor.

The heads 26 are of similar construction and a description of one will answer for all. Each head is provided with a rotatable manifold which in conjunction with a bearing holds a hollow supporting shaft. Below the manifold, and constituting a part thereof, is a manifold extension secured to the supporting shaft by a set screw.

Extending upwardly from the manifold are positioned a plurality of burners 55 and 56 to project flames 55' and 56' as shown in Figs. 1 to 4, inclusive. These burners are mounted on stand pipes which communicate with passages in the manifold. The passages communicate with a channel in the manifold extension which is stationary and is connected with a gas or other combustible fluid supply pipe.

As the conveyor rotates, gas flows to the burners, as described in said parent Patent No. 2,212,842, and air is supplied to the head for other purposes to be presently explained.

In the present embodiment of the invention the burners 55 and 56 rotate about the work part to be heated although it is to be understood that if desired a construction may be employed in which the work part may be rotated and the burners held stationary.

The work parts to be fused and united include a bulb 75 and a stem or mount 76. The bulb is so formed as to have a neck portion 77 and the mount includes a glass flare tube 78 having a flared portion or flange 79. One end of the flare tube is provided with a compressed portion or press 81 in which lead wires 82 and 83 are sealed. Extending from the press is an arbor 85 having support wires 86 to hold a filament 87 and extending downwardly from the press is an exhaust tube 88 communicating with the bulb by an orifice 88'.

When sealing a lamp mount to a bulk the mount is held in vertical alignment with the longitudinal axis of the bulb by means of the exhaust tube which is inserted in a tubular receiver 89. This receiver is positioned in the upper end of a hollow shaft 91. The receiver is arranged to extend above the shaft 91 and has a tapered mouth to receive the exhaust tube which is inserted into the receiver and the flange of the flare tube seats on the upper end 89' of the receiver.

The shaft 91 and the sleeve 97 are secured in fixed relation by a set screw 98 and constitute a stem support member movable as a unit longitudinally of the supporting shaft. The shaft 91 extends below the sleeve 97 and is provided with an extended roller disposed in a cam track of a cam mounted on a stationary bracket adjacent to the path of travel of the conveyor. The cam track is so formed that the roller is raised and lowered to reciprocate the stem support member for reasons to be described later. The cam has an extension provided with a cam track to receive a roller at one end of an arm. The other end of the arm is fastened to a shaft of a valve for controlling the flow of air in passage 96.

In accordance with the present invention it is important, during the sealing operation, to provide a circulation of air in the bulb before and during the application of heat to the bulb neck. During the sealing operation when the bulb neck has united with the flare tube and the glass is still plastic, the bulb wall is forced outwardly by air delivered through a passage 109 between shaft 91 and sleeve 97. This passage has its outlet at the top of the stem support but below the upper end 89' of the receiver 89. Air is supplied to passage 109 and circulates within and around the bulb which is held in a support 112.

There is a cap 118 which fits the upper spherical surface of the bulb and serves to hold the bulb on its support during the sealing-in operation. When the bulb is to be removed the cap 118 is lifted by air under pressure.

In accordance with the present invention the sealed portion of the bulb is shaped or molded to a definite form and for this purpose molding members 121 and 122 are provided. When the neck portion or seal is shaped by the molding members the shaped portion is so formed that the stem is positioned in predetermined space relation to the wall of the bulb and the filament is disposed in a given position relative to the shaped seal. The molds are mounted on the outer ends of mold-arms. The opposite ends of the arms are secured adjacent to the upper ends of vertical shafts rotatable in bearings. The shafts are provided with pinions secured thereto and in mesh so that a rotation of one pinion with its shaft will cause an opposite movement of the other pinion, thus rocking the arms to bring the molds into molding relation.

The several sealing steps or operations performed by the machine fully described and claimed in the parent patent, previously referred to, will be understood more clearly by reference to the drawing.

A stem or mount is fed to a head at one conveyor position, and a bulb is fed to the head at the next position. The stem and bulb are thus positioned as shown in Fig. 1. This is an important feature of the present invention since it is of great advantage to provide mechanism for performing a sealing-in operation without moving a bulb from one fire setting to another.

Heretofore, as above mentioned, when a sealing-in operation was performed the bulb and mount were first moved into, and retained for a

time interval in a preheating zone which was employed to remove any strains or internal stress within the glass parts. The assembled parts were then moved to another heat zone for a fusing or sealing operation. Obviously this required a time period for preheating and a time period for fusing operation and essentially slowed up the machine.

In accordance with the present invention, the preheating operation is eliminated since the present method makes it possible to seal-in and mold or shape the bulb neck in one position. This is accomplished, as above mentioned, by circulating air in the bulb during the fusing operation. It has been found that by providing the passage 109 for the delivery of air to the bulb, this flow of air, which first passes the initially heated wall of the bulb, is heated and acts to carry away or dissipate heat and has an annealing effect so that the fires 55' and 56' may be of relatively high temperature and directed in full force against the neck of the bulb, as shown in Fig. 1. By virtue of having the maximum radius of the receiver 89 smaller than the distance of the passage 109 from the axis of the shaft 91, the longitudinal discharge of air along the initially heated wall or neck of the bulb is not interfered with. These fires soften the glass which contracts and fuses with the flange 79 closing the bottom of the bulb, as shown in Fig. 2.

The air issuing from the passage 109 is then directed against the inner fused wall of the bulb neck below the flange and causes the wall to bulge, as shown in Fig. 3, and thin down until the lower end or cullet 141 is separated from the bulb, as shown in Fig. 4. The cullet when severed from the bulb drops onto a receiving platform or chute 141'. At this time the molds 121 and 122 are moved into close relation with the softened bulb neck. The fires 55' and 56' serve to keep the molds at an elevated temperature.

It will be noted that when the molds close about the bulb neck the lower end of the bulb is above the bottom thereof. At this time the shaft 91 is lowered bringing the upper end of the stem receiver or holder 89 flush with the lower inner surface of the molds, and the upper end of the holder 89 serves as a portion of the bottom surface of the mold. Air is then supplied to the bulb through passage 96 and exerts sufficient force to press the softened glass against the bottom wall of the mold. The mold could be made so that the molten bulb neck would more completely fill the mold, but, owing to variations in the thickness of the flare tube, the molds are made so as to allow for this variation. Thus when the bulb neck has been blown into the mold, as shown in Fig. 5, the thickness of the wall may vary but the outside overall length will be controlled.

It has been found that good results may also be obtained by introducing air into the bulb for circulation through passage 96 to the orifice 88'. The air thus delivered to the bulb flows around the wall and serves to transfer heat from the wall when the bulb is subjected to the hot sealing fires and to prevent cracking. When the air is delivered through the exhaust tube, it is necessary to temporarily terminate this flow of air just prior to the union between the bulb and flare tube, and to provide a current of air through passage 109 to sever the lower portion or cullet 141.

Heretofore in the molding of a bulb neck it has been the practice to carefully avoid any sharp corners; that is, all the corners were made of arcuate or rounded fillet form since it was believed that sharp bends or angular shoulders would subsequently cause cracks by reason of the strains set up in the glass. In lamp making, however, it is of great advantage to provide a sharply defined shoulder, especially in cases where it is necessary to have a close fit between a base and a bulb neck.

Ignoring prior teaching, the present invention provides a mold so formed that a bulb neck is shaped with a right-angle shoulder or abutment 142 and, by reason of the present method of sealing and shaping, the bulbs are found to be free from detrimental strains. Tests including the manufacture and storage of bulbs so made, clearly show that bulbs produced in accordance with the present invention are free from cracks, and resist the rough handling attending shipment as well as the lamps made heretofore, if not to a greater extent.

As shown in the drawing, the molds employed are shaped with ledges 145 so formed that the resultant formation of the bulb includes an annular shoulder having a surface substantially transverse to the longitudinal axis of the bulb and substantially right angular in shape. Furthermore, the bulb neck is so formed as to provide a cylindrical plug or extension 146 with a relatively sharp edge 153. Between the cylindrical plug and adjacent to the abutment is formed a ring 147 which may be so proportioned as to snugly fit the inner surface of the unthreaded portion of a base which is usually in the form of a metal shell. Thus, when a base is positioned to surround the bulb neck it is fittted to the surface of the ring 147 and pressed against the seat or abutment 145. The extension 146 desirably corresponds with the minimum diameter of the base threads and flares outwardly on a curved surface to unite with the ring 147.

The hereinbafore mentioned advantages attributed to the special form of bulb neck have been directed to its use in connection with a base to be secured by mechanical means such as shown and described in my Patent No. 2,119,681, dated June 7, 1938, and owned by the present assignee.

The abutment and sharp-corner formation is of great importance, however, in connection with the use of bases which are secured by a basing cement.

With this construction the base, whether of plain tubular form or of threaded form, is frictionally fitted to the bulb neck and it has been found that when a basing cement is employed the quantity of cement necessary is relatively small and that a fraction of the amount ordinarily used serves to hold the base. It has also been found by providing the abutment and annular seat and by proportioning the lower end 153 of the extension of such diameter as to contact with the inner surface of the threaded portion of the base, when a threaded base is used, that the base is held against lateral movement and the only duty of the cement is to prevent endwise movement of the base.

The structural arrangement of the bulb neck and base is such that very little strain is imposed on the cement and the base is prevented from rocking. As stated, a very thin layer of cement serves to hold the base against removal. This results in an economy of cement which is an important factor in connection with articles, such as incandescent electric lamps, produced in great quantities.

The present invention not only provides a new and improved sealing method, but a new article of

manufacture is produced in the form of a bulb neck adapted for use to hold a cemented base more firmly and constructed so as to cooperate with means for holding a base mechanically.

Although a preferred embodiment of the invention is shown and described herein, it is to be understood that modifications may be made without departing from the spirit and scope of the invention as set forth in the appended claims.

I claim:

1. The method of sealing a bulb with a neck portion to a flare tube which comprises creating a high temperature heat zone, assembling a bulb and flare tube with the neck portion of said bulb surrounding an end of said flare tube, positioning said assembled parts with said neck portion in said heat zone, and blowing air between said neck portion and tube, along the inner surface of said neck portion, until the latter and said flare tube end are united by fusion.

2. The method of sealing a bulb having an elongated neck to the larger end of a flare tube which comprises assembling the bulb and tube with said larger end within said neck intermediate said bulb and the end of said neck, heating a portion of said neck adjacent to said larger end to fuse the latter to said neck, circulating air between said neck and tube and on into said bulb during the fusing period, and after sealing continuing the flow of air into said neck below the line of fusion to sever the cullet.

3. The method of sealing a bulb having an elongated neck portion to one end of a flare tube which comprises assembling the bulb and tube with one end of said tube within said neck intermediate said bulb and the end of said neck portion, heating a portion of said neck adjacent to the end of said tube, at full sealing intensity, to fuse said tube to said neck, and blowing air into the bulb between said neck portion and the end of said tube and on into the main portion of said bulb during the fusing period.

4. The method of sealing a bulb having an elongated neck portion to one end of a flare tube which comprises assembling the bulb and tube with one end of said tube within said neck intermediate said bulb and the end of said neck portion, heating a portion of said neck adjacent to the end of said tube to fuse said tube to said neck, causing a flow of air between said neck portion and the end of said tube, and along the inner surface of the former, during the fusing period, and after sealing continuing the flow of air to sever the neck portion below the place of union to remove the cullet.

5. The method of uniting a mount having a flare tube to a bulb with main and neck portions comprising supporting said parts with the neck of the bulb surrounding the larger end of said flare tube, heating the neck to cause it to contract and seal to said larger end, and causing a fluid to pass into the bulb between said flare tube and neck, over the heated surface of said neck and circulate within the main portion of said bulb before and during the sealing operation.

6. The method of uniting a bulb with main and neck portions to a mount of an incandescent electric lamp having a flare tube, comprising supporting said parts with the neck portion of said bulb surrounding the flare tube of said mount and extending beyond said tube, heating said neck portion to seal it to said flare tube, circulating a fluid during the sealing operation by first, directing said fluid between said tube and neck portion, and on into the main portion of the bulb, and then, after sealing, against the bulb neck below the seal portion, to sever the lower part of said neck portion, moving molding members about said seal while still plastic, and forcing a fluid under pressure into said bulb to shape said neck portion in said molding members.

7. The method of sealing bulbs having main and neck portions to flare tubes, comprising supporting a bulb with its neck portion surrounding one end of such a tube and extending there beyond, heating said neck portion around said tube, at full sealing intensity while the latter is cold, blowing gas between said neck portion and tube and on into the main portion of said bulb while heating until sealing takes place, terminating the flow of gas into the main portion of said bulb just prior to the union of the bulb and flare tube, and after sealing admitting gas to the neck below said union to remove the cullet therefrom.

8. The method of sealing bulbs having main and neck portions to flare tubes, comprising supporting a bulb with its neck portion surrounding one end of such a tube, heating the neck portion while blowing air longitudinally between the tube and inner surface of the neck portion, and on into said bulb, sealing said neck portion to one end of said tube, continuing blowing of said air to sever the cullet below the seal portion, moving molds to clamp over the seal portion of said neck, while soft, and introducing fluid under pressure to said bulb to cause the seal portion to expand and fill said molds.

9. The method of sealing bulbs having main and neck portions to flare tubes, comprising supporting a bulb with its neck portion surrounding one end of such a tube and extending therebeyond, heating said neck portion around said tube to seal it to one end thereof, blowing gas between said neck portion and tube and on into the main portion of said bulb while heating until sealing takes place, terminating the flow of gas into said main portion just prior to the union of the neck portion and flare tube, after sealing admitting gas to the neck portion below the union to remove the cullet therefrom, moving molds to clamp over the seal portion of said neck, said molds being formed with shoulders and inner surfaces, so as to form a shoulder on said neck portion and cause the part of said neck portion adjacent said seal to terminate in a cylindrical portion joined to said tube by an annular portion extending transverse to the longitudinal axis of the bulb, and whereby said cylindrical portion is joined to said shoulder by a ring portion, having a diameter intermediate that of the shoulder and cylindrical portion, and connected to the latter by a curved flaring portion, and admitting fluid pressure to said bulb to cause the seal portion to expand and fill said molds to accurately produce the shoulder, cylindrical, annular, ring, and curved flaring portions.

10. The method of uniting a bulb with main and neck portions to a mount of an incandescent electric lamp having a flare tube, comprising supporting said parts with the neck portion of said bulb surrounding the flare tube of said mount and extending beyond said tube, heating said neck portion around said tube at full sealing intensity while the latter is cold to seal said neck portion to said tube, circulating a fluid during the sealing operation by first, directing it between said tube and neck portion and on into the main portion of the bulb, and then after sealing, against the neck portion below the union, to sever the cullet therefrom, moving molding members about

said union while still plastic, and forcing a fluid under pressure into said bulb to shape the neck portion in said molding members.

11. The method of sealing bulbs having main and neck portions to flare tubes, comprising supporting a bulb with its neck portion surrounding one end of such a tube and extending therebeyond, heating said neck portion to seal it to said tube, blowing gas between said neck portion and tube and on into the main portion of said bulb, while heating until sealing takes place, terminating the flow of gas into the main portion of said bulb just prior to the union of the bulb and flare tube, after sealing admitting gas to the neck portion below said union to remove the cullet therefrom, moving molding members about said union while plastic, and forcing a fluid under pressure into said bulb to shape the neck portion in said molding members.

MICHAEL E. McGOWAN.