April 16, 1940. H. D. MADDEN 2,197,527

MACHINE AND METHOD FOR SEALING VITREOUS VESSELS

Filed June 8, 1938

Fig. 1.

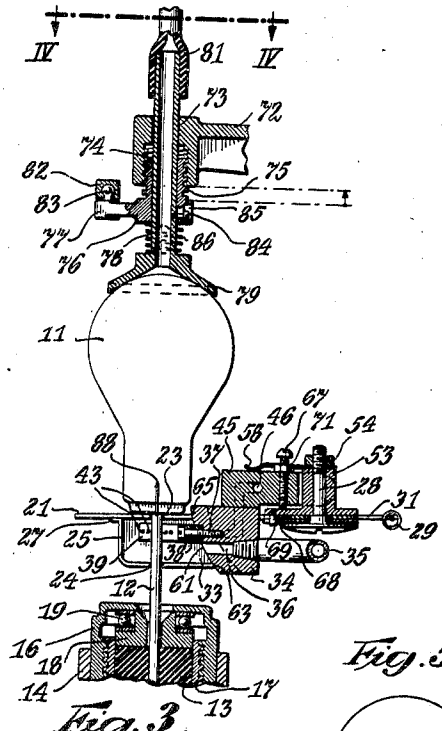


Fig. 2.

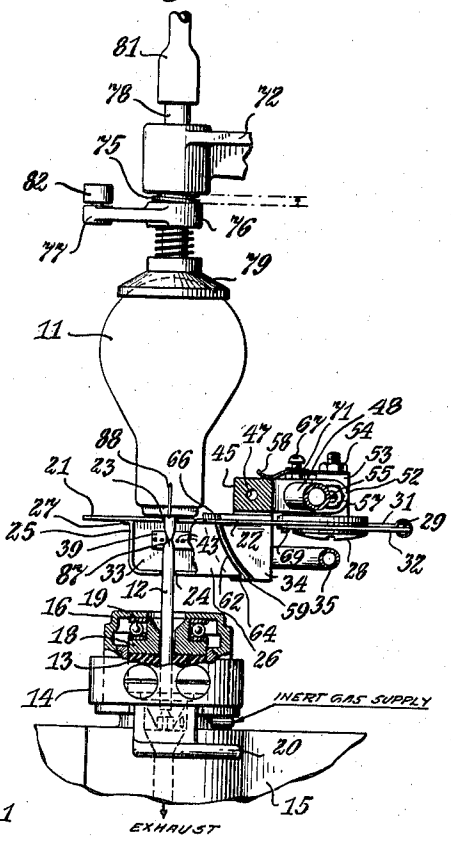


Fig. 3.

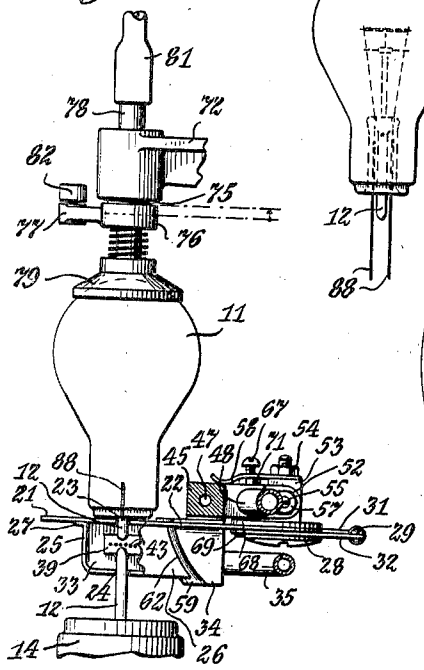
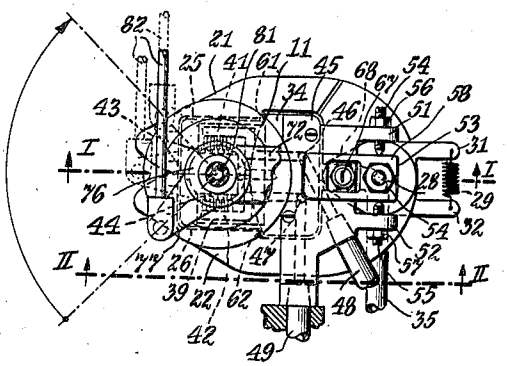


Fig. 5.

Fig. 4.



INVENTOR
H. D. MADDEN.
BY
ATTORNEY

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MACHINE AND METHOD FOR SEALING VITREOUS VESSELS

Harry D. Madden, South Orange, N. J., assignor to Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., a corporation of Pennsylvania

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15 Claims. (Cl. 176—3)

This invention relates to the sealing of vitreous vessels and, more particularly, to tipping-off exhaust tubes of incandescent electric lamps containing gas at a pressure higher than atmospheric.

The principal object of my invention, generally considered, is the tipping-off of the exhaust tubes of incandescent electric lamps, and other devices having vitreous envelopes, which have been filled with gas at a pressure higher than atmospheric.

Another object of my invention is the provision of a method and machine for tipping off exhaust tubes while enclosed in a space containing gas at a pressure higher than atmospheric.

A further object of my invention is the provision of a method and machine for sealing vitreous vessels or lamps having exhaust tubes, in which the device is first positioned with its tube in an exhaust rubber, a pressure chamber being provided for enclosing the portion of said tube to be tipped off, with means for applying pressure in said tipping-off chamber, a suction cup then engaging the top of the device, the exhaust tube being heated in said chamber by means of oxyhydrogen or other flames, whereupon the engaging cup is rotated and raised, twisting and pulling out the exhaust tube to effect the sealing operation.

A still further object of my invention is the tipping-off of the exhaust tubes of vitreous vessels, such as incandescent electric lamps, by means of a sharp oxyhydrogen flame, while said tubes are being twisted.

Other objects and advantages of the invention, relating to the particular arrangement and construction of the various parts, will become apparent as the description proceeds.

Referring to the drawing:

Fig. 1 is a view, partly in side elevation and partly in vertical section on the line I—I of Fig. 4, in the direction of the arrows, of a fragmentary portion of apparatus embodying my invention, an associated lamp being shown in side elevation.

Fig. 2 is a view corresponding generally to Fig. 1 except that more of the apparatus is shown in elevation, as most of the section is on the line II—II of Fig. 4, in the direction of the arrows, the lamp exhaust tube in this position having been slightly twisted and the lamp raised for the purpose of effecting a tipping-off operation.

Fig. 3 is a view corresponding generally to Fig. 2, but showing the position of the lamp when the tipping off operation has been completed and the exhaust tube severed.

Fig. 4 is a plan view of the apparatus, on the line IV—IV of Fig. 1, in the direction of the arrows.

Fig. 5 is an elevational view of a lamp, as shown in Figs. 1, 2, and 3, after having been removed from the machine.

In the Gustin application, Serial No. 144,143, filed May 22, 1937, and owned by the assignee of the present application, there is disclosed a method and machine for sealing vitreous vessels, in which a portion of the exhaust tube of each vessel is enclosed in a pressure chamber and heated until it contracts and effects a seal. In accordance with the present invention, I propose to use a similar pressure chamber, but, in addition, effect the sealing operation while the vitreous vessel is simultaneously twisted and raised, thereby expediting the formation of the seal as well as making for greater certainty in its production.

Incandescent electric lamps, as conventionally manufactured, each include a glass bulb having a neck portion into which a so-called stem is sealed. The stem includes a flare tube, one end of which is flanged and sealed to the bulb neck, and the other terminates in a flattened portion or press through which conductive lead wires are sealed and upon which a filament is mounted. Within the flare tube and extending downwardly from the press are the lead wires, and the exhaust tube leads from an orifice in the flare tube or press for the purpose of exhausting the bulb or filling it with gas at a desired pressure.

When manufacturing lamps of the vacuum type it has been customary to insert the exhaust tube of each in a port leading to a vacuum pump, and after the air or gas has been exhausted from the bulb of the lamp, said tube is heated until the wall thereof collapses, whereupon the lamp becomes sealed and may be removed in a well-known manner by a pulling or stretching operation.

When, however, such a lamp, or other vitreous vessel, is filled with a gas at a pressure higher than atmospheric, the exhaust tube will not collapse upon being heated, but rather tends to expand or blow out, due to the internal pressure. The method which I propose to employ for sealing overcomes this tendency to blow out by performing the tipping-off operation while surrounded by gas under higher than normal atmospheric pressure, or corresponding with the pressure of the gas in the lamp bulb and exhaust tube therefrom, while at the same time twisting and pulling out said exhaust tube.

In the drawing of a preferred or selected embodiment of my invention, an incandescent electric lamp is shown with a bulb 11 having an exhaust tube 12, inserted in an apertured exhaust rubber 13 of a head 14, only fragmentary portions of which are illustrated. The head is carried by conveyor 15 and the exhaust rubber 13 is connected to a vacuum line in any desired manner, as shown in the Gustin application previously referred to, in order to be connected to suitable vacuum pumps, not shown.

Inasmuch as apparatus for exhausting and gas filling lamps is well known in the art, the mechanism therefor is only fragmentarily illustrated, in order to show the improvement embodying the present invention.

The head 14 includes a cap 16, screw-threaded to a fitting 17, and adapted to press a washer 18 through ball bearings 19. The cap may be rotated at the proper time, as by means of a laterally extending arm 20, to either press the rubber 13 about the exhaust tube 12, or release the pressure thereon to facilitate insertion therein or withdrawal therefrom of such an exhaust tube.

Assuming that a lamp has been placed in the machine so that the exhaust tube 12 is clamped tightly by pressure being applied to the exhaust rubber 13, and the lamp rotated through the stages wherein it was exhausted to the proper degree, the desired inert gas is then admitted to the bulb 11 through the exhaust tube 12 from the inert gas line, not shown, as will be clear from a consideration of Fig. 1. Before admitting gas, however, the vacuum line is cut off from the lamp in any desired manner, as by means of pressure on a rubber tube connection, as disclosed in the Gustin application previously referred to.

The bulb 11, after being filled with inert gas to the desired pressure, and possibly passing through fires in which the exhaust tube 12 is initially heated immediately beneath the lower part of the stem of the lamp, finally reaches the position illustrated in Figs. 1 and 4, where the tube 12 passes between and separates the baffle plates or spoons 21 and 22, as by moving from the left to take the position represented in Fig. 4, where it is received in portions of the plates 21 and 22, and parts depending therefrom which are notched to provide circular apertures 23 and 24, in which the tube snugly fits when the apparatus is closed.

The baffle plates 21 and 22 carry mechanism, shown more in detail in the Gustin application previously referred to, which will now be briefly described, for performing a tipping-off operation on the exhaust tube 12, while the portion of said tube being tipped off is subjected to a pressure higher than atmospheric. Secured to the lower surfaces of the baffle plates 21 and 22 are burner shield sections 25 and 26. These sections have their upper edges flanged, as indicated at 27, and secured to the lower surfaces of the baffle plates 21 and 22, respectively, by any desired means, as for example, welding or brazing.

The baffle plates 21 and 22 are pivotally mounted on a fulcrum screw 28 and, together with their supported shields 25 and 26, are normally held in closed position about the exhaust tube 12 by means of a spring 29, operating on extensions 31 and 32, from said baffle plates 22 and 21, respectively, so that after the exhaust tube 12 has separated the baffle plates slightly from the position shown in Fig. 4, while moving to the right, as viewed in said figure, it finally reaches the normal position illustrated in Figs. 1 and 2, whereupon the baffle plates and associated burner shields are closed therearound, forming a substantially air-tight chamber encasing the portion of said exhaust tube immediately below the bulb 11.

In order to effect a heating and sealing operation in the chamber so formed, the baffle plates 21 and 22 are connected to a gas outlet block designated by the reference character 34. Said block closes the back or righthand side of the chamber 33 formed by the burner shield portions below the baffle plates, as viewed in Figs. 1 and 2, for example. Connected to the gas outlet block 34 is a pipe 35, which may supply the desired air pressure to the chamber, through the port 36.

The front or inner face of the block 34 has a threaded portion 37 receiving a screw 38 which carries the burner 39. Said burner is generally U-shaped in plan, as shown most clearly in Fig. 4, and provided with ports 41 and 42 for a suitable mixture of hydrogen and oxygen, for example, or a suitable mixture of other combustible gas and oxygen, air, or a mixture thereof. A plurality of burner orifices 43 extend from the port 41, and 44, from the port 42, which orifices are very fine so that the oxyhydrogen or other flame produced therebeyond, will not backfire and is very fine and sharp.

In order to provide for feeding the gases mentioned through the ports 41 and 42, a gas inlet block 45 is secured to the upper portion of the said outlet block 34. The block 45 has downwardly extending ports 46 and 47, with lower openings registering with the upper ends of ports 41 and 42, respectively, in the outlet block 34, so as to provide for the transmission of gases from the manifold nipples 48 and 49, which lead from the gas mixer, not shown.

The rear or righthand portion of the gas inlet block 45, as viewed in Fig. 4, has arms 51 and 52 straddling the pivot head 53, in order to pivotally support it and associated parts thereon, as by means of pivot screws 54 and 55, which are adapted to be locked in adjusted positions by means of nuts 56 and 57. The baffles, shields, and associated parts are normally resiliently held in their uppermost or chamber-closing position by means of a spoon spring 58, the rear portion of which is secured to the pivot head 53, as by means of a nut 54' threaded on the fulcrum screw 28.

In order to allow for pivotal motion of the baffles 21 and 22 about their pivot pin or fulcrum screw 28 with respect to the gas outlet block 34, and at the same time allow movement thereof, with respect to the connected inlet and outlet blocks and burner 39, about their horizontal pivot screws 54 and 55, so that the baffles 21 and 22 and the burner shield sections 25 and 26 may be firmly pressed into tight engagement with the adjacent face of the outlet block 34, the front or baffle and shield engaging surface of the gas outlet block 34 is made spherical about a center corresponding with the point of intersection between the vertical axis, about which the baffles 21 and 22 pivot, and the horizontal axis about which they are pivoted to the gas inlet, outlet, and burner members. This surface is designated by the reference character 59 and the rear upright edges 61 and 62 of the burner shield sections 25 and 26, respectively, are made

circular in outline to correspond with the curvature at the places where engagement takes place, as shown most clearly in Figs. 1 and 3.

The rear edges of the lower walls of the burner shield sections 25 and 26 are also formed circular in outline, as shown most clearly in Figs. 1 and 2, and as designated by the reference characters 63 and 64. Likewise the baffles 21 and 22 have their corresponding edges formed circular in outline where they are engaged by the gas outlet block 34, as designated by the reference characters 65 and 66.

It will therefore be seen that the baffles 21 and 22 are free to open and close, while at the same time they are free to pivot about the horizontal axis of the pivot screws 54 and 55, with respect to the gas inlet and outlet blocks, to release the gas pressure if it becomes excessive, while allowing the exhaust tube 12 to move horizontally therebetween, said baffles and associated parts being normally pressed firmly into engagement with the curved face 59 of the outlet block 34 to form a substantially air-tight chamber in which the tipping-off operation is performed.

In order to limit upward swinging movement of the baffles and associated parts with respect to the inlet, outlet, and burner sections 45, 34, and 39, I provide a set screw 67 passing through the gas inlet block 45, and with its lower end normally engaging, or adapted to engage, a flange 68 of the pivot head 53 engaged by the baffles 21 and 22. Said flange 68 has a stud 69 depending therefrom as a locating pin between the baffles 21 and 22. The set screw 67 may be locked in adjusted position by means of a nut 71.

In order to effect the twisting and raising of the lamp after the exhaust tube thereof has been heated to softening temperature in the chamber 33, I provide a bracket 72 with a vertical aperture 73 therein, the upper portion of which is plain and the lower portion threaded, as indicated at 74, to receive the threaded portion 75 of a hub 76 of an actuating arm 77. Passing through the hub 76 is a hollow spindle 78 preferably carrying at its lower end a metal suction or vacuum cup 79, and with its upper end adapted for connection to a vacuum pump, as by means of a flexible tube 81.

Rotation of the spindle 78 and cup 79 is effected on corresponding movement of the actuating arm 77 through rod 82 pivotally connected thereto as indicated at 83, by a stud 84 outstanding from the spindle 78 and reciprocable in a corresponding slot 85 in the hub 76. A coil spring 86 holds the cup 79 and its spindle 78 normally in lowermost position, but allows movement thereof, to the necessary extent, with respect to the hub 76, upon counterclockwise rotation of said hub, as viewed in Fig. 4, and engagement thereof with the bulb 11, so that undue strain on the bulb does not occur. Upon subsequent clockwise rotation of the hub 76, by corresponding movement of the rod 82, the lamp bulb 11, which has become gripped by said cup 79, is rotated clockwise and correspondingly raised, due to upward rotation of the threaded portion 75 of the hub 76 in the threaded portion 74 of the bracket 72, thus twisting and stretching the desired portion of the exhaust tube 12, after the same has been heated to a softening temperature, and effecting the desired seal therein.

From the foregoing disclosure it will be seen that I have provided means whereby the lamp bulb 11, or other hollow vessel, may be exhausted, filled with an inert gas, and finally moved to a position where that portion of its exhaust tube 12, immediately below the bulb neck, is enclosed in the chamber 33, formed by the baffle plates 21 and 22, above, the burner shields 25 and 26 to the sides and front, and the gas outlet block 34 to the rear.

While so enclosed, oxyhydrogen flames or other heating means are positioned to create a heat zone about the tube 12 at a point designated by the reference character 87, to rapidly seal and cut off the tube, while air pressure supplied by pipe 35 prevents expansion of the exhaust tube, while allowing it to contract naturally in accordance with the surface tension of the glass to secure the desired seal.

During the sealing or tipping-off operation, the bulb is rotated and raised by the corresponding action of the engaged suction cup 79, while connected to a vacuum line through tube 81, to cause adherence of the bulb 11 thereto, to twist and stretch the seal and thereby improve the sealing operation, by effecting a quicker cut-off and avoiding an undesired accumulation of glass at the point of tipping-off. During the sealing or tipping-off operation, the lead wires 88 are, of course, bent to lie above the baffle plates 21 and 22, protected from damage by excessive heat.

The baffles 21 and 22 are pivotally mounted about the pin 28, so that they may move away from and toward one another to allow for the reception and release of the exhaust tubes of lamps associated therewith, and pivotally mounted about a horizontal axis with respect to the gas outlet block and associated parts, while spring pressed upwardly, thereby maintaining the chamber 33 closed to as great an extent as possible, and avoiding an unnecessary escape of compressed air and gas, even when the baffles are open for the reception of an exhaust tube. The bulb 11, after being tipped off, may be removed by hand or by the usual automatic means.

Although a preferred embodiment of my invention has been shown, it will be understood that modifications may be made within the spirit and scope of the appended claims.

I claim:

1. The method of sealing a vitreous vessel, gas-filled to a super-atmospheric pressure, and having an exhaust tube, comprising enclosing a portion of said tube in a chamber, creating a pressure above atmospheric in said chamber, heating said tube, and twisting the same to cause it to collapse for tipping-off purposes.

2. The method of sealing a vitreous vessel having a tubular extension after said vessel is filled with a gas above atmospheric pressure, comprising enclosing a portion of said extension in a chamber, creating a pressure above atmospheric in said chamber, heating said tube in said chamber, and twisting the same to effect tipping-off thereof.

3. The method of tipping-off an exhaust tube from a vessel containing a gas at a pressure above atmospheric, comprising enclosing a portion of said tube in a chamber containing gas at a pressure corresponding with that of the pressure in said vessel, heating said exhaust tube in said chamber to its softening point, and twisting to effect a seal.

4. The method of sealing-off lamps, gas-filled to a super-atmospheric pressure, and having exhaust tubes, comprising applying heat to soften said tubes, and twisting under super-atmospheric pressure to effect a tipping-off thereof.

5. The method of sealing-off a lamp gas-filled

above atmospheric pressure and having an exhaust tube, comprising positioning only a portion of said tube in an enclosed space, introducing into said space a gas above atmospheric pressure like that of the fill gas, heating said portion to soften the wall thereof and twisting and elongating said tube to effect sealing thereof.

6. The method of tipping-off lamps gas-filled above atmospheric pressure, comprising enclosing only portions of the exhaust tubes thereof in a closed chamber, introducing gas into said chamber at a pressure above atmospheric like that of the fill gas, directing oxyhydrogen flames on said enclosed portions, and twisting to effect a sealing operation.

7. The method of sealing a vitreous vessel having an exhaust tube extending therefrom comprising positioning said tube in an exhaust rubber for evacuation and gas filling, moving said vessel so that a portion of said tube is enclosed in a pressure chamber, applying pressure in said chamber to balance the gas filling in said vessel, softening the tube in said chamber by the application of heat, and finally rotating and raising said vessel to twist, pull out, and seal the exhaust tube thereof.

8. The method of sealing a vitreous vessel gas-filled above atmospheric pressure having an exhaust tube, comprising enclosing a portion of said tube in a chamber, maintaining a pressure above atmospheric in said chamber, heating said tube, and twisting the same to cause it to collapse for tipping-off purposes.

9. The method of sealing a vitreous vessel having an exhaust tube extending therefrom comprising positioning said tube in an exhaust rubber for evacuation and gas filling, moving said vessel so that a portion of said tube is enclosed in a chamber, softening the tube in said chamber by the application of heat, and finally rotating and raising said vessel, to twist, pull out, and seal the exhaust tube thereof.

10. A machine for tipping off exhaust tubes of vessels, comprising a chamber enclosing a tipping-off burner, means for accomplishing the insertion and removal of an exhaust tube of such a vessel with respect to said chamber, and means for twisting said vessel while said exhaust tube is softened by heat of said burner, to facilitate sealing thereof.

11. A machine for tipping off exhaust tubes of vessels containing gas at a pressure higher than atmospheric, comprising a chamber enclosing a tipping-off burner, means for accomplishing only the insertion and removal of an exhaust tube of such a vessel with respect to said chamber, and means for twisting said vessel while said exhaust tube is softened by heat, to facilitate sealing thereof.

12. A machine for tipping off exhaust tubes of vessels comprising a tipping-off burner, means for accomplishing the insertion and removal of an exhaust tube of a vessel with respect to said burner, and means for twisting and raising said vessel, after softening of the exhaust tube by said burner, to facilitate the tipping-off operation.

13. A machine for tipping off exhaust tubes of vessels containing gas at a pressure higher than atmospheric, comprising a chamber enclosing a tipping-off burner, means for introducing compressed air into said chamber, means for inserting and removing an exhaust tube of a vessel with respect to said chamber, and means for twisting and raising said vessel, after softening the exhaust tube, to facilitate the tipping-off operation.

14. A machine for tipping-off the exhaust tubes of incandescent electric lamps, comprising a chamber defined by pivotally mounted walls which are normally pressed together, but movable away from one another to admit exhaust tubes, a tipping-off burner normally enclosed by said walls, means for introducing gas at higher than atmospheric pressure into the space defined by said walls, and means for gripping a lamp, and raising and twisting the same after softening its exhaust tube, to effect a tipping-off operation.

15. A machine for tipping-off exhaust tubes of incandescent electric lamps comprising a gas inlet block, a gas outlet block depending therefrom, a pair of baffles pivotally movable about a normally vertical axis, complementary burner shield portions carried by said baffles, said baffles and shield portions being pivotally mounted to rotate with respect to said blocks about a normally horizontal axis, said baffles, shields and outlet block normally engaging surfaces of one another to define a chamber, a burner block secured to said outlet block and normally enclosed in said chamber, the surface of said outlet block engaged by said baffles and shields being spherical with its center at the point of intersection of said vertical and horizontal axes, the engaged edges of said baffles and shields being correspondingly circular, resilient means for pressing said circular edges into engagement with said spherical surface to provide a substantially air-tight chamber enclosing said burner, a vertically reciprocal suction cup disposed above said chamber, means connecting said cup to a vacuum line in order to cause it to adhere to an associated lamp, and means associated with said cup for twisting and raising it to effect corresponding motion of the associated lamp to facilitate the sealing operation.

HARRY D. MADDEN.