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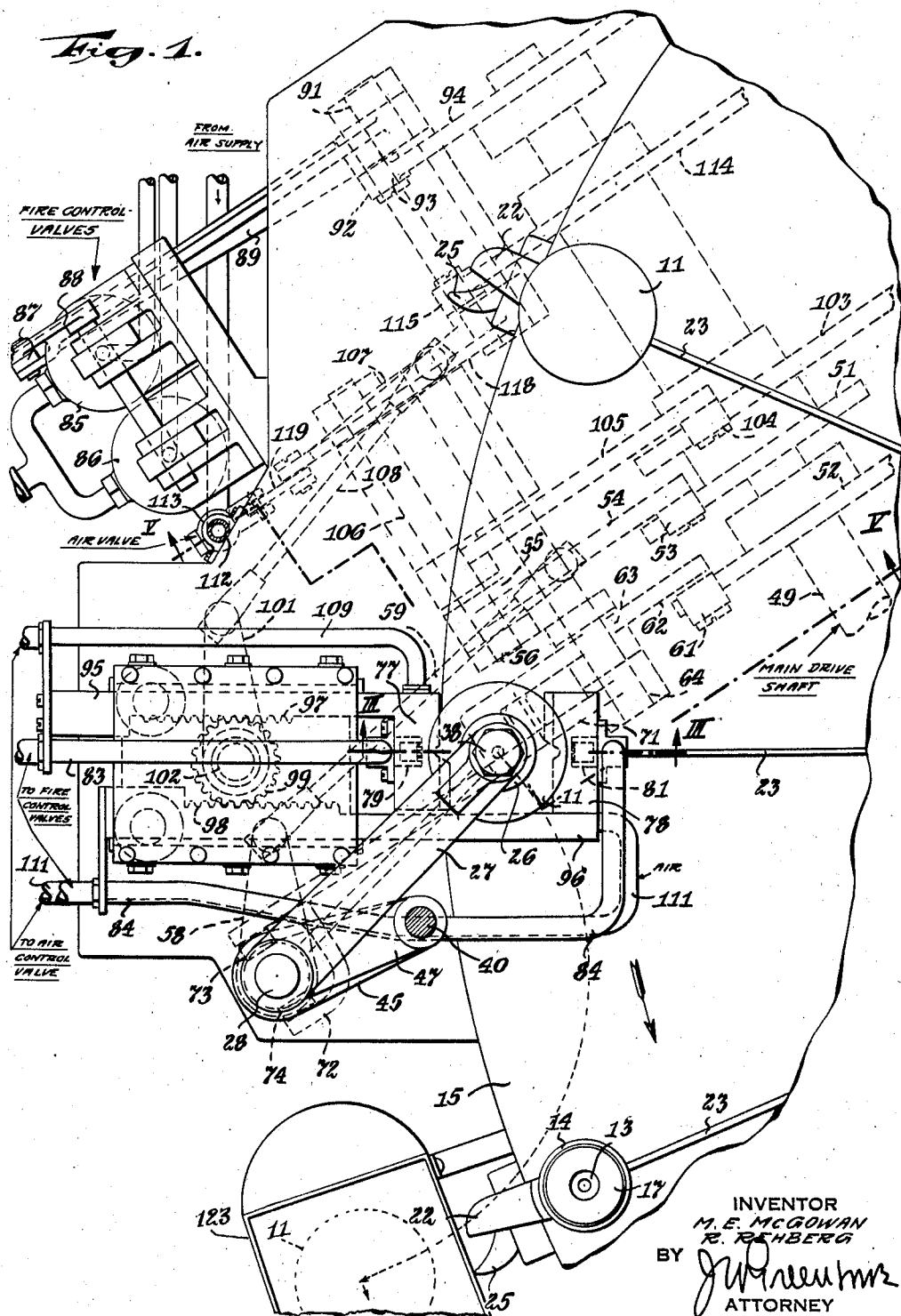
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METHOD AND MACHINE FOR SEALING VITREOUS VESSELS

Filed March 29, 1940

3 Sheets-Sheet 1



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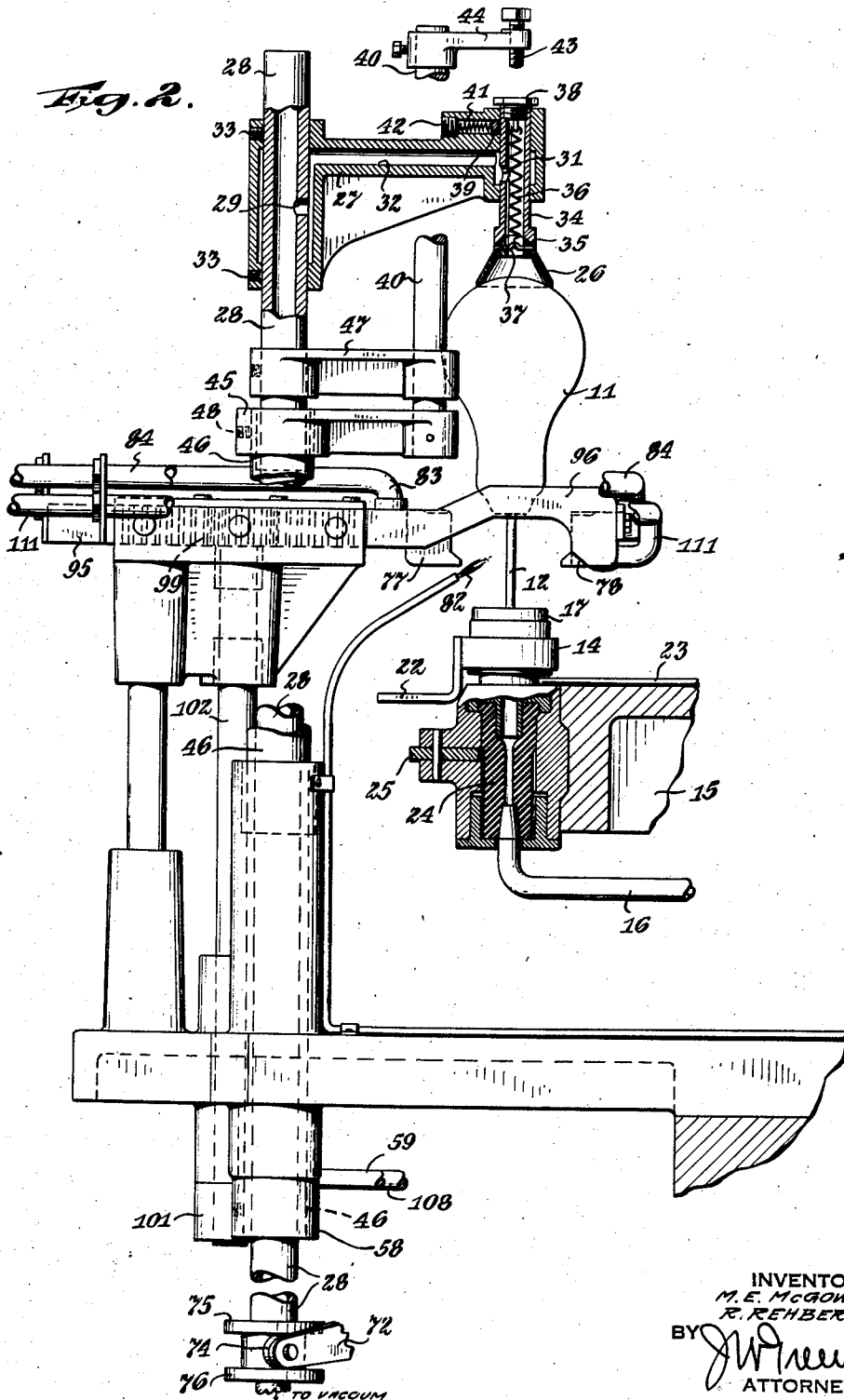
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METHOD AND MACHINE FOR SEALING VITREOUS VESSELS

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Fig. 3.

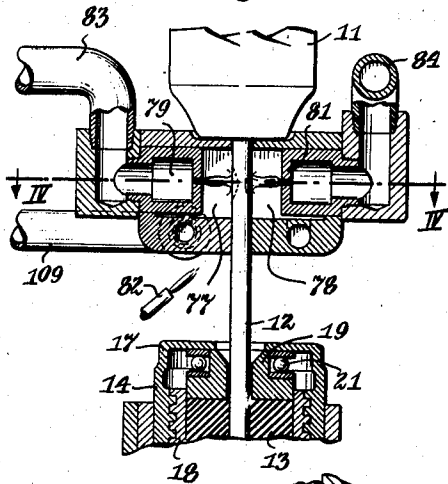
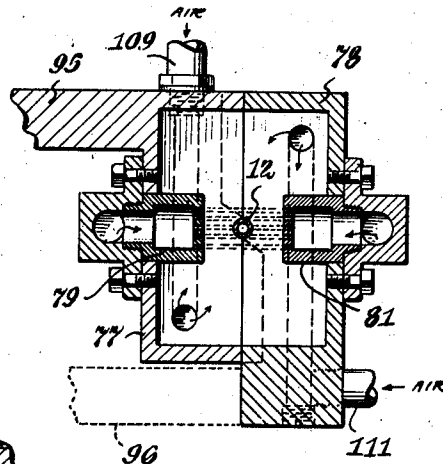
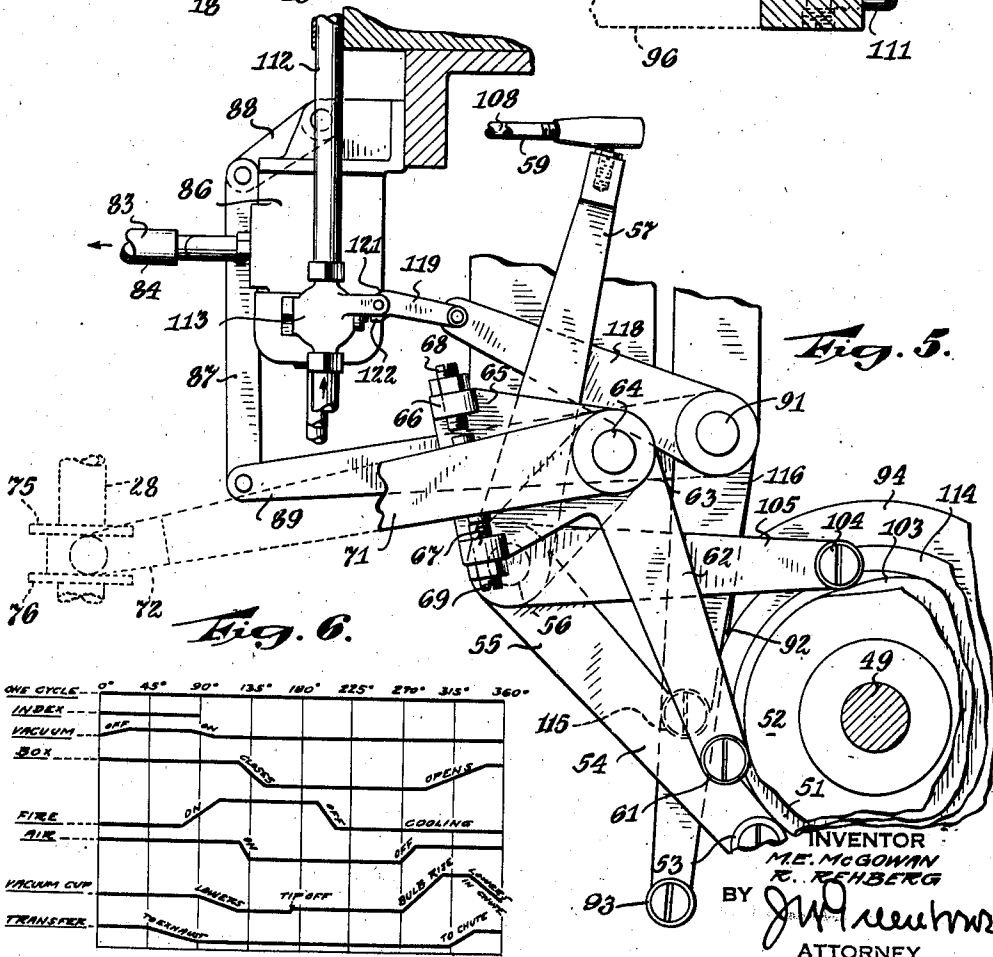


Fig. 4.



UNITED STATES PATENT OFFICE

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METHOD AND MACHINE FOR SEALING
VITREOUS VESSELS

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16 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 our invention, generally considered, is to tip off the exhaust tubes of incandescent electric lamps after the same have been filled with gas at a pressure higher than atmospheric.

Another object of our invention is to provide a method and machine for tipping off exhaust tubes of gas-filled lamps, while said tubes are enclosed in a space containing air or other gas at a pressure above atmospheric.

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 drawings:

Figure 1 is a plan of apparatus embodying our invention.

Figure 2 is an elevational view, partly in vertical section, of the apparatus illustrated in Figure 1.

Figure 3 is a vertical sectional view, with portions in elevation on the line III—III of Figure 1, in the direction of the arrows.

Figure 4 is a horizontal sectional view on the line IV—IV of Figure 3, in the direction of the arrows.

Figure 5 is a vertical sectional view, with parts in elevation, on the line V—V of Figure 1, in the direction of the arrows.

Figure 6 is a diagram to indicate the movement of the parts for a complete rotation of the controlling cam shaft.

Incandescent electric lamps, as ordinarily manufactured, include a glass bulb having a reduced or neck portion, into which a so-called stem is sealed. The stem includes what is termed 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 an exhaust tube leads from an orifice in the flare tube or press for the purpose of removing air from the bulb and filling it with gas at a desired pressure.

When manufacturing vacuum lamps, it is customary to insert each exhaust tube into a port connected to a vacuum pump and, after the air or gas has been exhausted from the bulb, the tube

is then heated until the wall thereof collapses, whereupon the lamp becomes sealed and may be removed in any well-known manner.

When, however, the lamp is filled with an inert gas at a pressure higher than atmospheric, the exhaust tube will not collapse, even upon being heated, but rather tends to expand or blow out due to the internal pressure. The method which we propose to employ for sealing overcomes this tendency to blow out by performing the tipping off operation in a chamber containing air or other gas at higher than normal atmospheric pressure, or corresponding with the pressure of the gas in the lamp bulb and exhaust tube therefrom, that is, preferably substantially equal to or higher than said gas pressure.

The apparatus which we propose to use is an improvement over that described and claimed in the Gustin application, Serial #144,143, filed May 22, 1937, now Patent No. 2,215,100, dated September 17, 1940, and owned by the assignee of the present application.

In the drawings of a preferred or selected embodiment of our invention, an incandescent electric lamp 11, is shown having an exhaust tube 12 inserted in an apertured exhaust rubber 13 of a head 14 with an exhaust port. The head 14 is carried on an exhaust machine spider 15 and connected through a vacuum line 16 to suitable vacuum pumps, not shown.

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

The head 14 desirably includes a cap 17, screw-threaded to a fitting 18 and adapted to press a washer 19 through ball bearings 21. The cap 17 may be rotated at the proper times by means of its laterally extending arm 22, to either press the rubber 13 about an exhaust tube, or release the pressure thereon to facilitate insertion and removal of such a tube.

Assuming that the exhaust tube 12 of the lamp 11 has been clamped in the position illustrated in Figures 1, 2 and 3, the lamps revolved about the axis of the spider 15 through the stages wherein it is exhausted to the proper degree, and the desired inert gas admitted through the exhaust tube 12, from an inert gas line 23, as will be clear from a consideration of Figure 2. Before admitting the gas, however, the vacuum line 16 is cut off from the lamp, as by pressure applied to the rubber tube connection 24 in a well-known

manner, or by means of a pivoted valve member 25.

After being gas filled, as before described, the lamp is indexed into tipping-off position under a vacuum rubber cup 26. This cup is carried by an arm 27 adapted to reciprocate to a limited extent with a hollow vertically-movable rod 28. The vacuum connection to the cup 26 is made through ports 29, 31 and passage 32, a cam-operated valve, not shown, opening the vacuum connection to the hollow rod 28. The rod 28 is, in fact, a reciprocating vacuum supply pipe, the lower end of which is flexibly connected, as by means of a rubber tube to said cam-operated valve.

Arm 27 is adjustably mounted on the hollow rod 28, as by means of set screws 33, in order to allow for the tipping off of shorter or longer bulbs. It will be understood that although our method and apparatus are particularly adapted for tipping-off gas filled bulbs, vacuum type bulbs may also be handled.

In order to accommodate variations in the shape of the bulbs and off-center mounting in the exhaust machine, the vacuum cup 26 is connected to the arm 27 by means of a vertically movable hollow stem 34, united to said cup with a swivel joint 35 therebetween. The cup 26 is resiliently held in place with respect to said stem 34 as by means of a coiled tension spring 36 connected at its lower end to a pin 37 through said cup 26, and at its upper end to a screw plug 38.

The stem 34 is arranged to simply slide or reciprocate in the arm 27, that is, without rotation, yet be practically vacuum tight with respect thereto. A plug 39, pressed against the stem 34 by means of a spring 41, held under adjusted tension by means of screw plug 42, is provided in order to hold the stem 34 at a height determined by maximum variations. A screw 43 adjustably mounted in a bracket 44, extending from the upper end of a guide rod 40 held by arm 45 on sleeve 46, in which the hollow rod 28 reciprocates, is provided for resetting the stem 34 to the lowest position, as the bulb 11 is transferred, so that it is then in the proper position to engage and hold the next bulb. The arm 27 is caused to turn with the screw 43 and bracket 44 by means of arm 45 fixed to the sleeve 46 by set screw 48, as the arm 47, fixed on rod 28, is adapted to reciprocate on the rod 40.

The lamp tipping-off mechanism is operated by a shaft 49, driven from the exhaust machine, and carrying a series of cams which control the operation of the various parts in the desired sequence, shown graphically in Figure 6. The oscillation of the sleeve 46 and reciprocation of rod 28 are respectively controlled by two cams numbered 51 and 52. The cam 51 for oscillating the sleeve 46, thereby also oscillating the rod 28 through guide rod 40 and arm 47, engages a roller 53 on the lower arm 54 of a bell crank lever 55 pivoted on a shaft 56. The sleeve 46 extends from its operating arm 58 fixed thereon to its driven arm 45 and serves as a bearing for the reciprocating rod 28. The upper arm 57 of said crank lever 55 operates the arm 58 (Figs. 1 and 2), fixed on the sleeve 46, through a connecting rod 59, in order to turn said arm 45 with said sleeve 46 and oscillate, through the arm 47 and rod 28, the arm 27 to and from a position over the lamp 11, as shown in Figure 2.

The cam 52 for reciprocating the rod 28, engages roller 61 on lower arm 62 of bell crank lever 63, pivotally mounted on shaft 64. The upper arm 65 of said crank lever has outstanding

lug portions 66 and 67 carrying set screws 68 and 69, forming a jaw between which a lever 71, pivoted on the shaft 64, is mounted and operated thereby, with a desired amount of lost motion therebetween. The outer or free end of the arm 71 is provided with a jaw 72 carrying trunnions 73 and 74, normally engaging between upper and lower abutments 75 and 76 on hollow rod 28, in order to allow for raising and lowering said rod, the vacuum cup 26, and a lamp when picked up by said cup. In this way provision is made for not only rotating, but also simultaneously reciprocating the rod 28 and imparting corresponding movement to a lamp 11.

Pressure chambers 77 and 78 are provided for enclosing a portion of the exhaust tube 12 of a lamp 11 during the tipping off operation. These chambers carry oxyhydrogen or other burners 79 and 81. The gas issuing from said burners is adapted to be ignited by pilot light 82. The chambers are also supplied with gas pipes 83 and 84 connected to a source of supply, not shown, through controlling valves 85 and 86. These valves are operated, in the desired sequence, by connecting rod 87 acting on valve-operating arm 88, the former being in turn connected to an operating arm 89 mounted on shaft 91, which shaft is in turn operated by lever 92 carried thereon, and having roller 93 engaged by fire-control operating cam 94 on shaft 49.

Pressure chambers 77 and 78 are respectively secured to frames 95 and 96 carrying racks 97 and 98. A gear 99 is positioned between said racks, and operated by lever 101 on carrying gear shaft 102. The lever 101 is connected to the pressure chamber operating cam 103 by roller 104 on operating arm 105, fixed on shaft 106, which shaft also carries lever 107 transmitting movement to arm 101 through connecting rod 108.

Upon the movement of the pressure chambers 77 and 78 to enclose an exhaust tube portion therein, compressed air is admitted to the enclosure defined by said chambers through pipes 109 and 111, which transport the same from supply pipe 112 through valve 113, operated by air pressure control cam 114 engaging roller 115 on arm 116 fixed on shaft 91 which carries arm 118 fixed thereto. The latter arm transmits motion to the valve by being pivoted to the long arm 119 of a bell crank 121, the other arm 122 of which is adapted to effect opening or closing of the valve 113, as desired.

Having now described the construction and arrangement of the apparatus for effecting tipping off of gas filled or other vitreous devices, such as incandescent electric lamps, we will now describe a preferred method of operating said apparatus.

Referring to Figure 6, there is shown a chart which represents what happens during one complete revolution, or turning of the cam shaft 49 through 360°. The lamp is indexed, or moved to the tip off position, during the movement of the cam shaft through 90°, as indicated by the line marked "index." The hollow vacuum rod 28 is rotated and caused to reciprocate downward to bring the vacuum cup 26 directly over to engage the lamp 11 when indexed in the tipping off position illustrated. This is effected by the cams 51 and 52, and represented by the lines marked "transfer" and "vacuum cup" which show that when the cam shaft has turned through 90°, the vacuum cup has been moved to a position directly over the lamp and then said cup is sim-

ply lowered to engage the same, that is it is lowered without rotation or supplementary motion. The line marked "vacuum" shows that the valve connecting the rod 28 to the vacuum pumps is opened as the cup 26 descends.

The lower line marked "transfer" also shows that before the vacuum cup is lowered it is revolved about the axis of the rod 28 to the "exhaust" position, or over the lamp. During this rotation, gas issuing from the burners 79 and 81 is ignited by the pilot light 82, as shown by the line marked "fire," but the pressure chambers 77 and 78 do not start to close until after the vacuum cup has descended and vacuum has been applied thereto, as indicated by the line marked "vacuum."

At about 125°, as shown by the line marked "box," the pressure chambers start to close, and after they are completely closed, with the compressed air applied therein, as shown by the line marked "air," for the length of time indicated in the chart, the fires effect a sufficient softening of the exhaust tube, so that just shortly before the cam shaft has rotated 180° the vacuum cup is simply raised to effect the tip-off indicated.

The controlling cam 52 has a riser tending to overstretch most sizes of exhaust tubing, thereby necessitating the use of adjusting screws 68 and 69 to provide the necessary lost motion for regulating the stretch in the size of tubing operated on.

The operation of the vacuum cup 26 is controlled to stretch the exhaust tube at the proper time, indicated on the chart by the words "tip-off," after which the tip is allowed to remain enclosed in the pressure chambers with the pressure applied, to facilitate rapid cooling of and prevent the pressure of the gas in the bulb from blowing out the tip. The cooling of the tip, however, begins in compressed air heated by the burners 79 and 81, as indicated in Fig. 6. After these burners are turned off, the compressed air in the chambers 77 and 78 cools by radiation and the admixture of cold air from the pipes 109 and 111 to maintain the pressure. It will be seen that the tip is thus effectively annealed, prior to exposure to room temperature, thereby avoiding the possibility of cracking.

After the tip cools sufficiently, the bulb is again simply raised, starting at about 270° as indicated, and revolved about the axis of the rod 28 for transfer to the chute 123. The lamp is finally dropped in the chute, as shown in Figure 1, and on the lines marked "vacuum cup" and "transfer," the air pressure having been turned off before this time, and the pressure chambers opened shortly thereafter.

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

We claim:

1. The method of sealing a vitreous vessel having an exhaust tube, comprising enclosing only a portion of said tube in a chamber, introducing compressed air into said chamber, heating a portion of said enclosed tube, simply slightly raising said vessel to restrict and tip off said tube in said chamber, and after cooling of the tip in the heated compressed air again simply raising said vessel to remove the tipped off tube from said chamber.

2. The method of sealing a vitreous vessel hav-

ing an exhaust tube, comprising enclosing only a portion of said tube in a chamber, introducing into said chamber air compressed above atmospheric, heating a portion of said enclosed tube, simply slightly raising said vessel to restrict and tip off said tube in said chamber, allowing the tip to cool an appreciable length of time in said heated compressed air and raising still further to remove it from said chamber.

3. The method of handling a vitreous vessel having an exhaust tube, comprising enclosing only a portion of said tube in a chamber, introducing compressed air into said chamber, heating a portion of said enclosed tube, simply slightly raising said vessel to restrict and tip off said tube in said chamber, cooling the tip in said heated compressed air, raising said vessel still further to remove the tip from said chamber, and then swinging said vessel to a discharge chute.

4. The method of handling a vitreous vessel containing gas at a pressure higher than atmospheric and having an exhaust tube, comprising positioning it in the tip-off position on an exhaust machine, swinging a vacuum cup over said vessel, lowering said cup to engage the top of said vessel, igniting fires in complementary pressure chambers, moving said chambers together to enclose and heat a portion of said exhaust tube while creating a pressure above atmospheric in said chambers, simply raising said vacuum cup to restrict and tip off the exhaust tube while enclosed in said chambers, allowing the tip to anneal and cool for an appreciable length of time under the pressure in said chambers, simply raising said vacuum cup while withdrawing said heated chambers from one another, and swinging said cup to remove said vessel to a discharge chute.

5. A machine for tipping off exhaust tubes of vessels, comprising complementary chambers each containing a tipping off burner, means for reciprocating said chambers away from or toward one another to enclose a portion of the exhaust tube of a vessel to be tipped off therein, means for supplying compressed air to said chambers during tipping off, and means for first simply slightly raising the vessel to restrict and tip off said tube while enclosed in said chambers and then, after annealing and cooling of the tip in said heated chambers, raising still further to remove the exhaust tip from said chambers.

6. A machine for tipping off exhaust tubes of vessels containing gas at a pressure higher than atmospheric, comprising a chamber consisting of counterpart compartments opening toward one another, each compartment carrying a rack and mounted to reciprocate toward and away from one other to enclose or release an exhaust tube, and a gear mounted between said racks for operating said compartments.

7. A machine for tipping off exhaust tubes of vessels containing gas at a pressure higher than atmospheric, comprising a chamber defined by counterpart compartments opening toward one another, mounted to reciprocate toward and away from each other to enclose or release an exhaust tube, and each containing a burner positioned to cooperate with that in the other compartment to effect a tipping off operation.

8. A machine for tipping off exhaust tubes of vessels containing gas at a pressure higher than atmospheric, comprising counterpart compartments opening toward one another and mounted

to reciprocate toward and away from each other to enclose or release an exhaust tube, and pipes connected to said compartments for admitting compressed air thereto for the tipping off operation.

9. A machine for tipping off exhaust tubes of vessels containing gas at a pressure higher than atmospheric, comprising counterpart chambers opening toward and mounted to reciprocate to and from one another to enclose or release an exhaust tube, and means associated therewith for simply raising the vessel carrying said exhaust tube, in timed relation with heating means in said chambers, to effect a tipping off operation therein.

10. The method of making an incandescent electric lamp with a bulb gas-filled to a pressure above atmospheric and having an exhaust tube, comprising supporting said bulb on an exhausting head with its tube in an exhaust rubber, exhausting and gas-filling to the desired extent, indexing said bulb in its tipping-off position, swinging bulb-gripping means to a point directly over said bulb and then moving it downward along the axis of said bulb to grip the top thereof, igniting tipping-off fires carried in parts of a pressure chamber, moving said parts toward one another to enclose a portion of said exhaust tube and cause said fires to heat the same, introducing compressed air into said chamber to balance the gas pressure in said bulb, simply slightly raising said gripping means with its bulb after said fires have softened said tube, to tip off the latter, turning off said fires, allowing the tip to cool in said compressed air while enclosed in said chamber, cutting off said compressed air, further raising said bulb, and then swinging to remove to a discharge chute.

11. A machine for making an incandescent electric lamp with a bulb gas-filled to a pressure above atmospheric and having an exhaust tube, comprising an exhausting head having a rubber for receiving the exhaust tube of said bulb, mechanism for moving said bulb to the tipping-off position on said machine, bulb-gripping means, mechanism for swinging said means over, and then moving it downwardly along the axis of, said bulb, to engage the latter, when so positioned, and then first raising the same slightly for tipping off, and finally removing said bulb from the machine, a pair of complementary pressure chamber parts mounted to reciprocate and enclose or release a portion of said exhaust tube, burners carried by said parts and operable in the chamber for softening said exhaust tube, and connections for introducing compressed air into said chamber.

12. A machine for making an incandescent electric lamp with a bulb gas-filled to a pressure above atmospheric and having an exhaust tube, comprising an exhausting head having a rubber for receiving the exhaust tube of such a bulb, mechanism for moving said bulb to the tipping-off position of said machine, a vacuum cup, a stem, means adjustably connecting said cup to the lower end portion of said stem, an arm in which said stem is vertically slidable, a hollow rod connected to vacuum-producing means, said arm being mounted to swing about the axis of said rod, a bracket mounted on said machine, a set screw in said bracket and overlying the stem to which the vacuum cup is connected, for resetting the same to its lowest position as the bulb is transferred, mechanism for moving said hollow rod to swing the cup over and then cause it

to simply move downward to engage said bulb, then raise it a small amount for tipping-off, and finally raise it a relatively large amount and swing said bulb from the machine, means for enclosing a portion of said exhaust tube, means in said enclosing means for softening the enclosed portion of said tube for tipping off purposes, and means for balancing the pressure of the gas in said bulb during said tipping off operation.

13. A machine for making an incandescent electric lamp with a bulb gas-filled to a pressure above atmospheric and having an exhaust tube, comprising an exhausting head having a rubber for receiving the exhaust tube of such a bulb, mechanism for moving said bulb to the tipping-off position of said machine, gripping means, a stem, said gripping means being adjustably connected to the lower end portion of said stem, an arm in which said stem is vertically slidable, a rod, said arm being mounted to swing about the axis of said rod, a bracket mounted on said machine, a set screw in said bracket and overlying the stem to which the gripping means is connected, for resetting the same to its lowest position as the bulb is transferred, and mechanism for moving said rod to, swing the gripping means over and then cause it to simply move downward to engage said bulb, then raise it a small amount for tipping-off, and finally raise it a relatively large amount and swing said bulb from the machine.

14. A machine for making an incandescent electric lamp with a bulb gas-filled to a pressure above atmospheric and having an exhaust tube, comprising an exhausting head having a rubber for receiving the exhaust tube of such a bulb, a vacuum cup, and adjustable mechanism for operating said cup to effect a tipping off movement and final removal of said bulb from the machine, comprising a cam, a bell crank lever pivotally mounted and having an arm operatively engaging said cam, another arm having outstanding lug portions carrying set screws forming a jaw, a lever disposed in said jaw with a desired amount of lost motion, means connecting said lever to said vacuum cup, means connecting said cup to vacuum-producing means, and means for softening said exhaust tube.

15. A machine for making incandescent electric lamps with bulbs gas filled to a pressure above atmospheric and having exhaust tubes, comprising an exhaust head with an exhaust rubber for receiving said tubes, mechanism for exhausting and gas filling such lamps to the desired extent, mechanism for moving said bulbs one by one to the tipping off position, bulb-gripping means, mechanism for swinging said means, a pressure chamber formed as a plurality of parts mounted for movement toward and away from one another, each of said parts carrying a tipping off burner, means for igniting said burners prior to closing the chamber about said tube, mechanism for moving said parts toward and away from each other, means for introducing compressed air into said tipping off chamber, and mechanism for actuating said bulb-gripping means to move it to a point directly over each bulb when in tipping off position, then moving the same downward along the axis of said bulb to grip the top thereof, then simply slightly raise the bulb after the burners have softened the tube to tip off the latter, then further raise said bulb and swing to remove it to a discharge chute, and mechanism to turn

off the burners and allow the tip to cool in the compressed air while enclosed in said chamber, and then cut off said compressed air.

16. The method of sealing a vitreous vessel containing gas at a pressure higher than atmospheric and having an exhaust tube, comprising indexing said vessel, igniting tipping off fires carried in parts of a pressure chamber, moving said parts toward one another to enclose a portion of said exhaust tube and cause said fires to heat the same, introducing compressed air

into said chamber to balance the pressure of gas in said vessel, simply slightly raising said vessel after said fires have softened said tube to tip off the latter, turning off said fires, allowing the tip to cool in said heated compressed air while enclosed in said chamber, cutting off said compressed air, and further raising and removing said vessel.

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