Feb. 17, 1942. G. A. FREEMAN 2,273,439

SEALING ELECTRODES INTO QUARTZ BULBS

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Fig. 1.

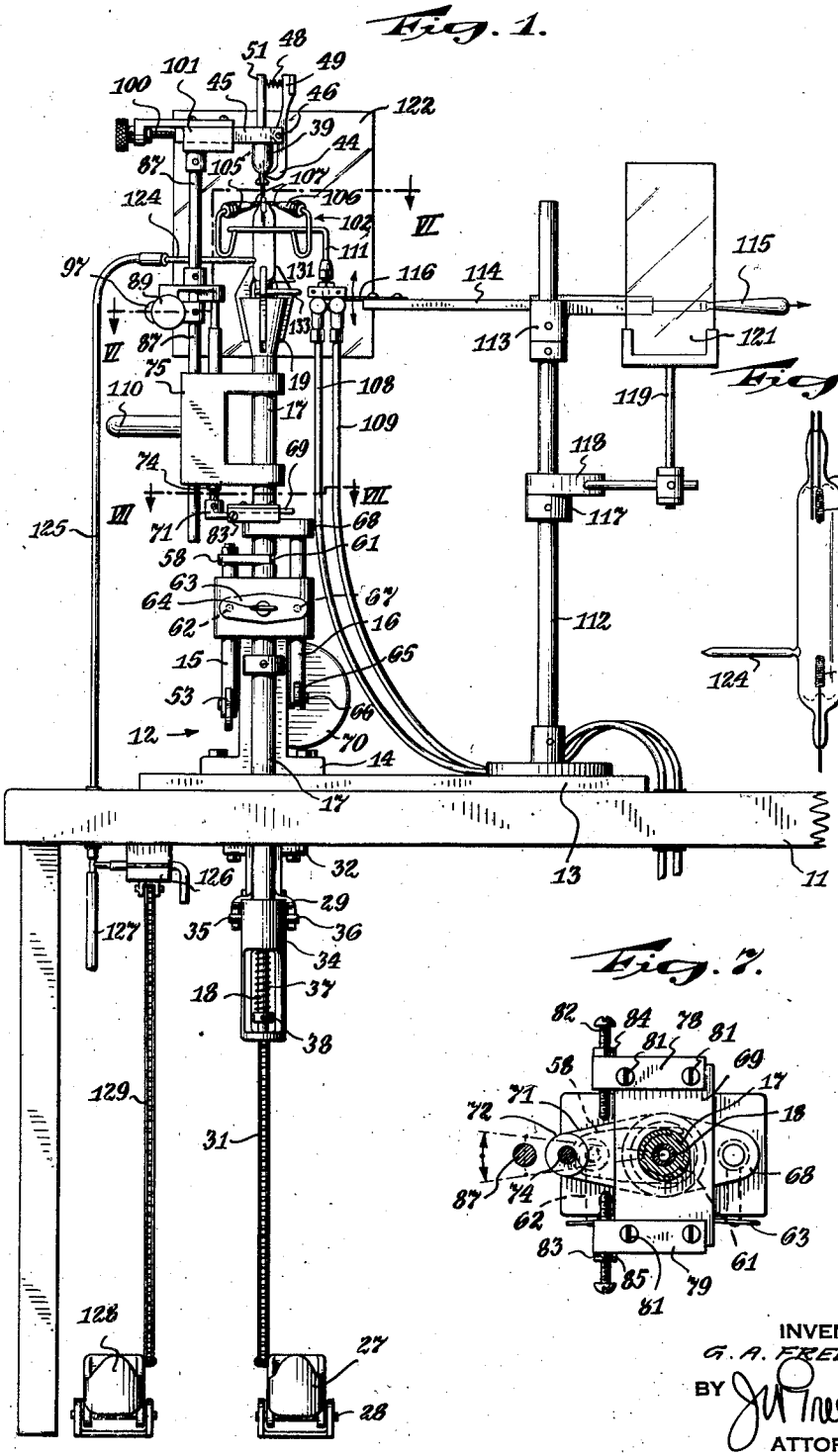


Fig. 8.

Fig. 7.

INVENTOR
G. A. FREEMAN
BY
ATTORNEY

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Fig. 2.

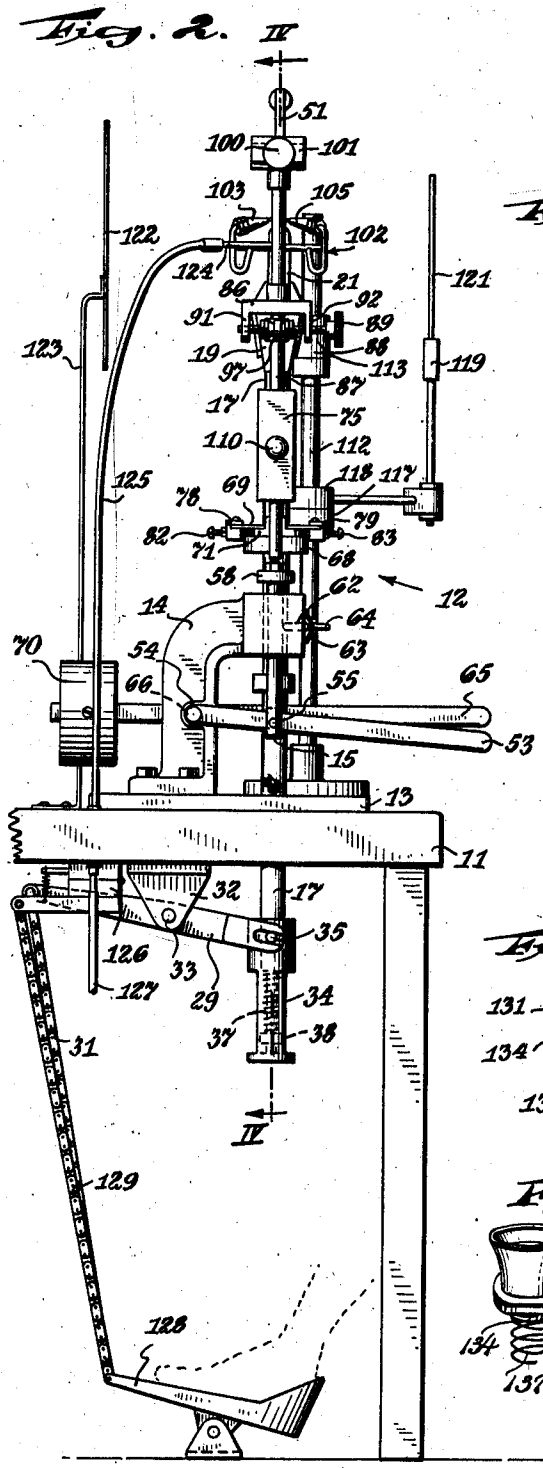


Fig. 4.

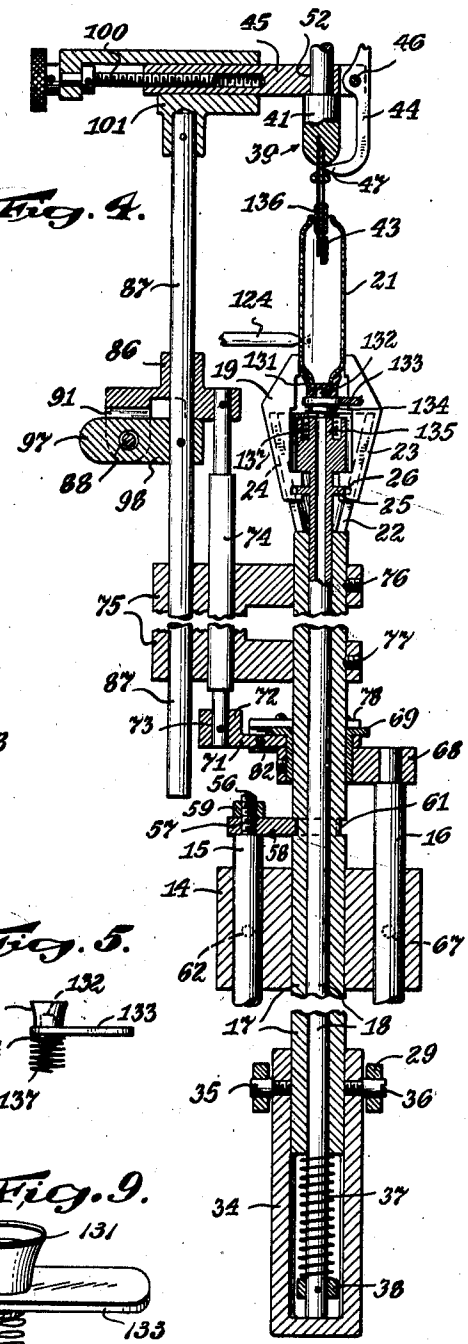


Fig. 5.

Fig. 9.

INVENTOR
G. A. FREEMAN.
BY
ATTORNEY

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Fig. 3.

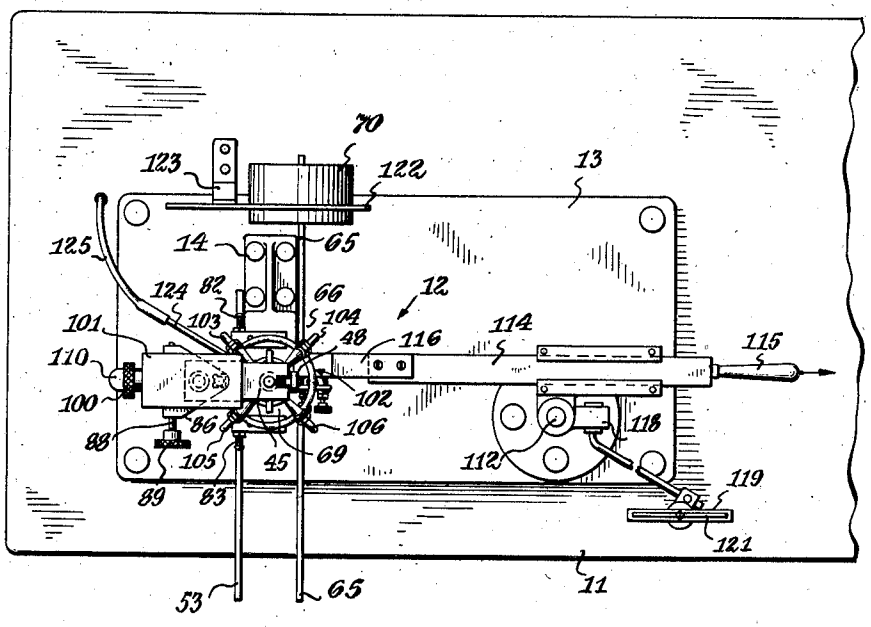
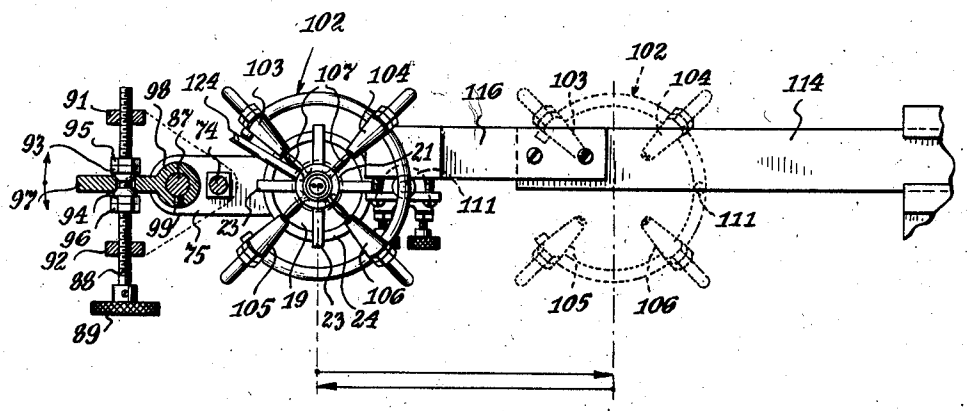


Fig. 6.



INVENTOR
G. A. FREEMAN.
BY
ATTORNEY

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UNITED STATES PATENT OFFICE

2,273,439

SEALING ELECTRODES INTO QUARTZ BULBS

George A. Freeman, East Orange, N. J., assignor to Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., a corporation of Pennsylvania

Application August 6, 1940, Serial No. 351,627

13 Claims. (Cl. 176—3)

This invention relates to the manufacture of quartz lamps and more particularly to a machine developed to replace the slow, highly-skilled, hand operation formerly used for sealing electrodes into the bulbs thereof.

The principal object of my invention, generally considered, is to provide a method and machine to facilitate the manufacture of quartz lamps.

Another object of my invention is to manufacture quartz lamps in an improved manner involving no rotating parts.

A still further object of my invention is a machine for sealing electrodes into quartz lamps, in which provision is made for lateral and vertical adjustment of the electrode position, a chuck is provided for receiving either a single or a double bead electrode, and in which means is provided for changing the position of and vibrating the fires, as well as foot control for releasing the lamp being manufactured and adjusting the pressure of the inert gas therein, whereby the speed of production may be increased and less skill required.

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:

Fig. 1 is a front elevational view, with parts in section, of a machine embodying my invention.

Fig. 2 is a side elevational view, from the left, of the machine shown in Fig. 1.

Fig. 3 is a plan of the machine shown in Figs. 1 and 2.

Fig. 4 is an enlarged fragmentary sectional view on the line IV—IV of Fig. 2, in the direction of the arrows.

Fig. 5 is a detailed elevational view of the resilient plug, for sealing one end of the lamp being manufactured, and associated parts.

Fig. 6 is an enlarged fragmentary plan of the machine, with parts in horizontal section, on the line VI—VI of Fig. 1.

Fig. 7 is a detailed sectional view on the line VII—VII of Fig. 1, in the direction of the arrows.

Fig. 8 is an elevational view of a quartz lamp which my machine is adapted to make.

Fig. 9 is a perspective view of the parts shown in Fig. 5.

The present invention is an improvement over that described and claimed in my application Serial No. 242,178, filed November 25, 1938, now Patent No. 2,215,641, dated September 24, 1940, and owned by the assignee of the present application. In accordance with said earlier application, the envelope, of a quartz lamp to be manufactured, is placed in the chuck of a lathe and the electrodes sealed, one at a time, into the ends thereof, while rotating. The method and machine of the present invention were developed to replace the slow, highly skilled operation required in accordance with said earlier application.

Referring to the drawings in detail, like parts being designated by like reference characters, there is shown a table or bench 11, upon which is mounted a machine 12. The machine 12, of the present embodiment comprises a base 13, from which extends a bracket 14, in which are movably mounted rods 15 and 16. The bracket 14 also carries an upright tubular member 17 in which reciprocates an operating rod 18 for the chuck 19, adapted to hold the quartz lamp, envelope or tube 21, while being manufactured.

The chuck 19 comprises guides 22, supported on the upper end of the tubular member 17, and gripping members 23, which are guided upwardly and outwardly by virtue of diagonal guide ribs 24, fitting corresponding grooves in the members 23, when the rod 18 is raised. The rod 18 has lugs 25 fitting in corresponding notches 26 in the gripping members 23 for effecting this movement. Operation of the chuck 19 is effected, in the present embodiment by a pedal 27, pivoted to the floor as indicated at 28, and operating a lever 29 through chain 31. The lever 29 is pivoted to a bracket 32, as indicated at 33 and its opposite end embraces a socket member 34 and receives lugs 35 and 36 thereon. The socket member 34 fits over the lower end of the tubular member 17 and, when the pedal 27 is depressed, raises the rod 18 against the action of the spring 37. The spring 37 acts between the lower end of the tubular member 17 and a collar 38 on the lower end portion of the rod 18.

The machine is also provided with an upper chuck 39, comprising a member 41 socketed to receive either the lead-in conductor of a single electrode 42 or the lead-in conductors of a double electrode 43, or one comprising a main electrode and a starting electrode, which conductor or conductors are clamped therein by means of a lever 44 pivoted to the supporting member 45, as indicated at 46, and having a lower arm pointed, as indicated at 47 and urged into engagement with the secured wire or wires of the supported electrode by means of a coil spring 48 acting between the upward extension 49 of

the lever 44 and the upper portion 51, of the socket member 14, which fits in a corresponding opening 52 in the supporting member 45.

Vertical movement of the chuck 19 is effected by means of a hand lever 53, pivoted to the bracket 14, as indicated at 54, and to the reciprocating rod 15, as indicated at 55. The upper end of the rod 15 has a reduced extension 56 passing through an aperture 57 in a connecting plate 58. The plate 58 is secured to the rod 15 by means of a nut 59 threaded to the extension 56, and tightened to clamp down on the plate 58. The plate 58 has a notch in which a reduced portion 61 of the tubular member 17 fits, so that movement of the operating lever 53 is transmitted to the member 17 for raising or lowering the chuck 19.

In order to insure that the chuck 19 stays in the position to which it is moved, I provide an aperture in the bracket 14, communicating with the aperture which receives the rod 15, and insert a pin 62 therein. I cause said pin to frictionally engage the rod 15 by resilient means, such as a plate spring 63, one end of which engages the outer end thereof, and the central portion of which is secured in place to the outer face of the bracket 14, as by means of a wing bolt 64.

The upper chuck 39 is adjusted in a similar manner by means of the hand lever 65, which is likewise pivoted to the bracket 14, connected to the reciprocating rod 16 by means of a pivot pin 66, and provided with a counterbalance 70, for said rod and associated parts, adjustably positioned on a rearward extension thereof. The rod 16 is also preferably held in position by a movable pin 67, frictionally engaging the same, as under the action of the spring 63. The upper end of the rod 16 carries a plate 68 to which is secured a yoke 69 through which the tubular member 17 passes. The yoke 69 receives between it and the plate 68, a connecting plate 71 having a lateral extension 72 apertured, as indicated at 73, to receive the lower end portion of a rod 74 which, in turn, passes through a bracket member 75, secured to the tubular member 17, as by means of screws 76 and 77.

Angular members 78 and 79 are secured to the yoke 69, at the sides thereof, as by means of screws 81. Ends of these angular members project beyond the yoke 69 at the sides of the connecting plate 71. These extensions are threaded and receive stop screws 82 and 83, locked in adjusted positions, as by means of nuts 84 and 85, the inner ends of said screws providing a desired adjustable clearance at the sides of the plate 71, to limit turning movement of said plate, tubular member 17, chuck 19, and the associated parts about the bracket 14.

To the upper end of the rod 74 is secured a connecting collar 86 through which a rod 87 passes, the lower end of said rod also passing through the member 75. Turning of the rod 87 and supported parts is effected by means of an adjusting screw 88, having a knurled operating head 89 threaded into flanges 91 and 92 depending from the connecting collar 86. An intermediate portion of the screw 88 carries nuts 93 and 94 held in adjusted position by lock nuts 95 and 96, and movably securing therebetween a flange 97 outstanding from a collar member 98 secured to the rod 87, as by means of a screw 99. It will thus be seen that turning of the knurled member 89 effects a limited rotation of the rod 87, and through it the supported head member 101 and the slidably mounted member 45. The latter is adjustably connected to the member 101 by a screw 100, turnable in a depending flange portion of the said member by its knurled head, and thereby effecting lateral movement of the same.

It will thus be seen that the lever 65 effects vertical movement of the upper chuck 39 through connecting members 16, 68, 71, 74, 86, 98, 87, 101, and 45. Bodily turning movement of the chucks 39 and 19 is effected by a swinging the member 75, as by its handle 110. Swinging movement of the chuck 39 about the axis of the rod 87 is effected by turning the knurled operating head 89.

In order to effect fusion of the seal glass end portions of the quartz envelope 21 about the electrode lead wires, there is provided a heating device 102 which, in the present embodiment, comprises four oxyhydrogen burners 103, 104, 105, and 106 which direct fires 107 to a central point therebetween. The burners are fed with oxygen and hydrogen through flexible tubes 108 and 109, which connect, for mixing of the gases, and unite with a metal tube 111 serving to support said burners. The whole heating arrangement, in the present embodiment, is supported from an upright member 112, secured to the base 13 of the machine and carrying a bracket 113 in which is adjustably slidable a rod 114 having an operating handle 115. The rod 114 carries the pipe 111 and connected burners 103 to 106, inclusive, by means of flat leaf spring 116, making it possible to cause up and down vibration of the fires 107 during sealing. The position of the upright 112 and the length of the rod 114 are such that said rod is slidable in the bracket 113 from the position shown in Fig. 1, where the burners surround the envelope 21, to the position shown in dotted lines in Fig. 6, where the burners are out of the way.

The rod 112 also desirably carries a collar 117 supporting a yoke 118 which, in turn, carries a frame 119, and a piece of green or other filter glass 121, which serves to protect the eyes of the operator during the sealing-in process.

Back of the sealing position of the tube 21, as shown in Figs. 1 and 2, is a mirror 122, supported on a bracket 123 so that the operator may, without trouble, get a view of the back of the quartz envelope 21 during the sealing-in process.

In order to prevent oxidation of the electrodes' leads during the sealing-in process, I desirably provide for the introduction of inert gas, such as nitrogen, through the exhaust tube 124 extending from the side of the envelope 21, and preferably disposed adjacent the initially lower end, in order to benefit most from the inert gas flush. Said exhaust tube is, therefore connected by means of a flexible tube 125 to a line 127 from which the nitrogen flows. A valve 126 is desirably associated with said line 127 and controlled by means of a pedal 128 through a chain or other connecting means 129. The valve 126 corresponds essentially to the pressure release device 17 of my copending application Serial #242,178, filed November 25, 1938, and owned by the assignee of the present application, in that it serves to permit the escape of more or less of the supply gas so as to control the pressure thereof, avoiding an excess of pressure during the sealing-in operation.

The lamps may be made in the machine just described by loading a quartz envelope or bulb 21 thereinto after first closing the lower end thereof, by means of a rubber cap or plug 131.

In the present instance, I am assuming that the

lamp bulb 21 has been previously prepared with "sealing glass" on each end and holes blown where the electrode beads are to be sealed thereto, and having an open exhaust tube 124 extending laterally therefrom or substantially perpendicular to the lamp axis. The "sealing glass" forming the non-cylindrical portions 20 of the bulb 21 may consist of Corning 723 vacuum degasified hard glass or the bulb 21 may be formed with "flux glass" ends like the "container 10" of my copending application, Serial No. 284,575, filed July 15, 1939, and owned by the assignee of the present application. Such "flux glass" preferably contains approximately 80 to 85% quartz. One glass I have found especially suitable contains approximately 83% quartz (SiO_2), 13% boric oxide (B_2O_3) and 4% alumina (Al_2O_3). I find it preferable that the hole closed by the cap 131 is the smaller one or that adapted to receive the single electrode 42. The cap 131 may be handled by mounting on a projection 132 on the end portion of a plate 133. The lower side of the plate 133 desirably has a depending projection 134 around which a coiled spring 137 is centered, the lower end of said spring fitting over over a boss 135 at the upper end of the operating rod 18. The envelope or tube 21 is then fixed in the chuck 19, as by depressing the pedal 27 and then releasing it to allow the jaws 23 to grip said envelope therebetween, the cap or plug 131 being held in position over the lower hole in said envelope 21 by the action of the spring 137.

The bulb 21 is then connected to the nitrogen supply, as by applying the tube 125 over the exhaust tube 124, causing said tube to be flushed with nitrogen or other inert gas. An electrode 43, which may be produced in a manner disclosed in my copending application Serial No. 284,575, previously referred to, is then inserted in the chuck 39. The bulb and the electrode are moved together approximately to the position where they will be after being sealed, as by means of the levers 53 and 65.

The fires 107 are then moved into the position shown in full lines in Fig. 6, to heat the seal glass about the bead 136 of the electrode 43, while the latter is protected by the inert gas.

The electrode 43 is then moved around to close the seal quickly, as by means of one or both the adjusting screws 88 and 100, with or without movement of the bracket member 75, after the material has been softened to the desired extent. The fires 107 are then pushed aside and, while the glass is still soft, the seal is blown around by increasing the gas pressure by movement of the control pedal 128. The lamp 21 and end cap 131 are then taken from the chuck 19, the cap 131 being removed, and the lamp turned, other end up, and put back in the chuck 19, for the second seal.

In the present instance, the second seal is made with the single electrode 42, although the operations may be reversed if desired. The electrode chuck has two holes in it, so that either type bead can be accommodated. After the second electrode has been sealed in the end of the bulb, preferably in the same manner as the first, the lamp is removed and the exhaust tube 124 tipped off, leaving a portion about 2" long, so that the nitrogen or other inert gas may be retained therein until the lamp has been exhausted.

From the foregoing disclosure it will be seen that I have devised a machine to replace the slow, highly skilled, hand operation of sealing electrodes into quartz lamps, said machine involving important features, such as no rotating parts, an oxyhydrogen burner having four or six fires placed around a circle, mounted on a spring for slight vertical motion, and laterally movable for convenient disposition when not wanted, as during loading. The machine also has a two-way lateral adjustment, as well as a vertical adjustment of the position of the electrode being sealed in, a chuck for holding either single or double beads, while being sealed in, being employed and a removable plug being used for closing one end of the lamp bulb, while the first seal is being made. On account of the various adjustments provided, it will be seen that I am not limited to use for the manufacture of quartz lamps of any definite size.

Although a preferred embodiment of my invention has been disclosed, 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 electrodes into a quartz bulb having an exhaust tube and sealing glass on each end with holes where the electrodes are to pass thereinto, comprising holding the bulb with its axis vertical and means closing the lower hole, passing inert gas into said exhaust tube, positioning an electrode in the upper hole, heating the sealing glass around the upper hole, moving the inserted electrode around to close the seal quickly, forming the seal by increasing the pressure of said inert gas, turning the bulb over, opening the other hole, and again holding with its axis vertical, positioning the other electrode in the remaining hole, sealing said electrode in place in the same manner as the first electrode, and tipping off the exhaust tube to hold the protective inert gas in the bulb.

2. The method of sealing electrodes into a quartz bulb, having an exhaust tube and sealing glass on each end, with holes for receiving said electrodes, comprising holding the bulb with its axis vertical and means closing the lower hole, flushing with inert gas, positioning an electrode in the upper hole and heating the sealing glass therearound, moving the inserted electrode to close the seal quickly, turning the bulb over, opening the other hole, and again holding with its axis vertical, positioning the other electrode in the remaining hole, sealing in place in a manner similar to that for the first electrode, and tipping off the exhaust tube.

3. The method of sealing electrodes into a quartz bulb having an exhaust tube and sealing glass on each end, with holes where the electrodes are to pass thereinto, comprising closing one of the holes in said bulb, passing inert gas into said exhaust tube, positioning an electrode in the open hole, heating the sealing glass around said open hole, moving the inserted electrode to close the seal quickly, forming the seal by varying the pressure of said inert gas, opening said other hole, positioning the other electrode in the other hole, sealing said other electrode in place in the same manner as the first electrode, and tipping off the exhaust tube thereof.

4. The method of sealing electrodes into a quartz bulb having an exhaust tube and sealing glass on each end, with holes where the electrodes are to pass thereinto, comprising positioning an electrode in one of said holes while closing the other, heating the sealing glass around said electrode in the hole, moving said electrode to close the seal quickly, opening the other hole, posi-

tioning the other electrode in said opened hole, sealing in a similar manner, and tipping off the exhaust tube.

5. The method of sealing electrodes into a quartz bulb having an exhaust tube and sealing glass at each end, with holes where the electrodes are to pass thereinto, comprising positioning an electrode in one of said holes while closing the other, heating the sealing glass around said positioned electrode, to cause sealing thereof in said bulb, opening the other hole, positioning the other electrode in said opened hole, sealing the electrode in place in the same manner as the first electrode, and tipping off the exhaust tube.

6. The method of sealing electrodes into a quartz bulb having an exhaust tube and sealing glass at each end, with holes where the electrodes are to pass thereinto, comprising positioning an electrode in one of said holes while closing the other, heating the sealing glass around said positioned electrode, to cause sealing thereof in said bulb, opening the other hole, positioning the other electrode in said opened hole, and sealing the electrode in place in the same manner as the first electrode.

7. Apparatus for sealing electrodes into a quartz bulb having an exhaust tube and sealing glass on each end, with holes therein where the electrodes are to pass thereinto, comprising a chuck for holding such a bulb with its axis vertical, resilient means for closing the lower end of said bulb, a pedal for operating said chuck, a lever for raising and lowering said chuck, means for connecting said exhaust tube to a source of inert gas, a pedal for controlling the pressure of said gas, a chuck for holding an electrode in position in the upper hole of said bulb, a lever for moving said chuck up and down, screws for adjusting the position of said chuck from side to side and to and from the operator, a multiple burner for providing fires to encircle the upper end of said bulb, means for moving said fires to and from position with regard to said bulb, flexible tubes for supplying fuel to said fires, and means resiliently mounting said fires.

8. Apparatus for sealing electrodes into a bulb having an exhaust tube and a hole at each end therein where the electrodes are to pass there into, comprising means for holding the bulb with its axis upright, resilient means for closing the lower hole in said bulb, means for operating said holding means, means for raising and lowering said holding means, means for supplying inert gas to said bulb, means for controlling the pressure of said gas, means for holding the electrode in position in the upper hole of said bulb, means for moving said electrode holding means up and down, means for adjusting the position of said holding means from side to side, a burner to provide fires to encircle the upper end portion of said bulb, means for moving said fires to and from position with respect to said bulb, and means for supplying fuel to said fires.

9. Apparatus for sealing electrodes into a quartz bulb having an exhaust tube and sealing glass on each end, with holes therein where the electrodes are to pass thereinto, comprising a chuck for holding a bulb with its axis vertical, resilient means for closing the lower hole in said bulb, means for connecting said exhaust tube to a source of inert gas, a chuck for holding an electrode in position in the upper hole in said bulb, and a multiple burner for providing fires to encircle the upper end portion of said bulb around said hole.

10. Apparatus for sealing electrodes into a quartz bulb having an exhaust tube and sealing glass on each end, with holes therein where the electrodes are to pass thereinto, comprising a chuck for holding a bulb with its axis vertical, resilient means for closing the lower end of said bulb, means for operating said chuck, means for raising and lowering the same, means for connecting said exhaust tube to a source of inert gas, a chuck for holding an electrode in position in the upper hole of said bulb, and a multiple burner for providing fires to encircle the upper end of said bulb.

11. Apparatus for sealing electrodes into a quartz bulb having an exhaust tube and sealing glass on each end, with holes therein where the electrodes are to pass thereinto, comprising a chuck for holding a bulb with its axis vertical, resilient means for closing the lower end of said bulb, means for connecting said exhaust tube to a source of inert gas, means for controlling the pressure of said gas, a chuck for holding an electrode in position in the upper hole of said bulb, and means for providing fires encircling the upper end portion of said bulb.

12. Apparatus for sealing electrodes into a quartz bulb having an exhaust tube and sealing glass on each end, with holes therein where the electrodes are to pass thereinto, comprising a chuck adapted to hold such a bulb with its axis vertical, resilient means for closing the lower hole therein, means for connecting said exhaust tube to a source of inert gas, means for holding an electrode in position in the upper hole of said bulb, a lever for moving said holding means up and down, means for adjusting the position of said holding means from side to side, and means for providing fires encircling the upper end portion of said bulb.

13. Apparatus for sealing electrodes into a quartz bulb having an exhaust tube and sealing glass on each end, with holes therein where the electrodes are to pass thereinto, comprising a chuck for holding a bulb with its axis vertical and resilient means therebeneath closing the lower hole in said bulb, means for connecting a source of inert gas to said exhaust tube, a chuck for holding an electrode in position in the upper hole of said bulb, a multiple burner to provide fires encircling the upper end portion with respect to said bulb, means for supplying fuel to said burner, and means for resiliently mounting the same.

GEORGE A. FREEMAN.