June 30, 1942. F. J. MALLOY 2,288,537

SEALING MACHINE

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Fig. 1.

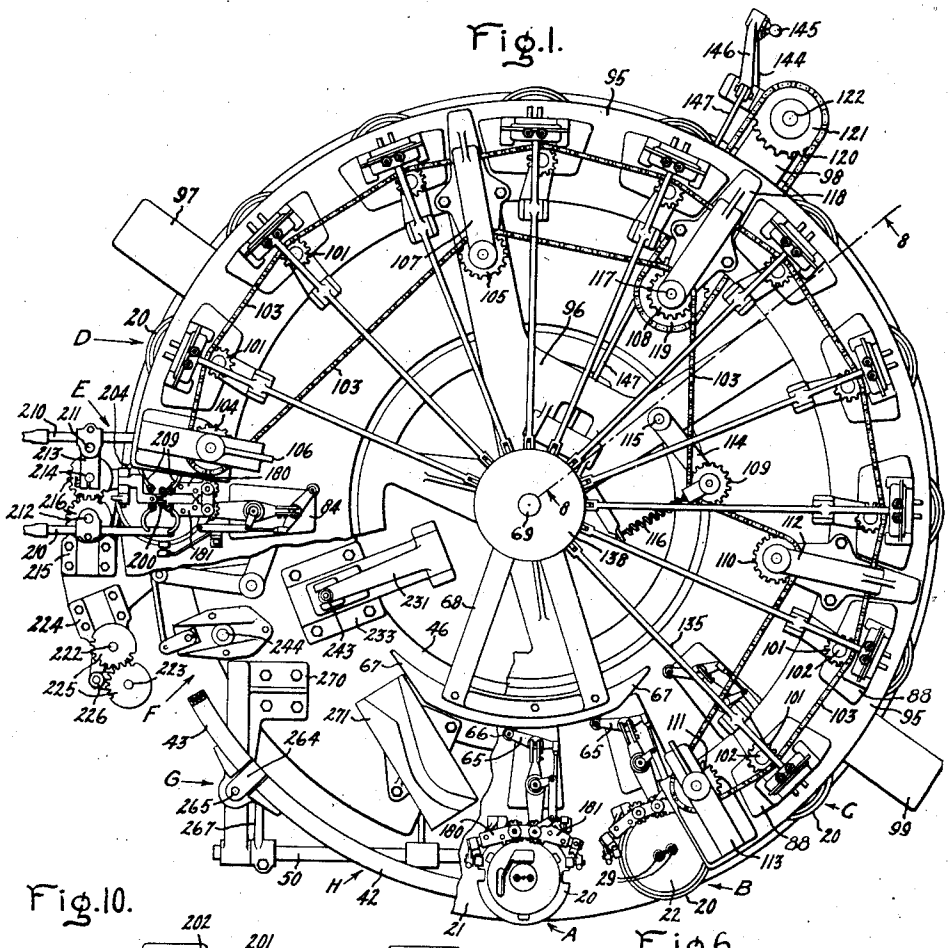


Fig. 10.

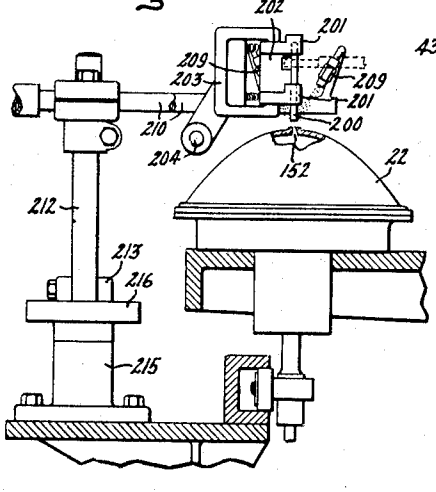
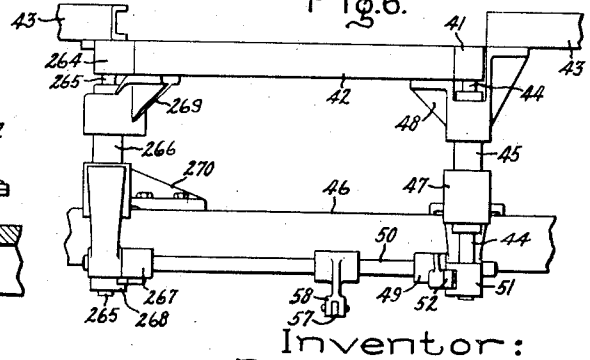


Fig. 6.



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Fig.2.

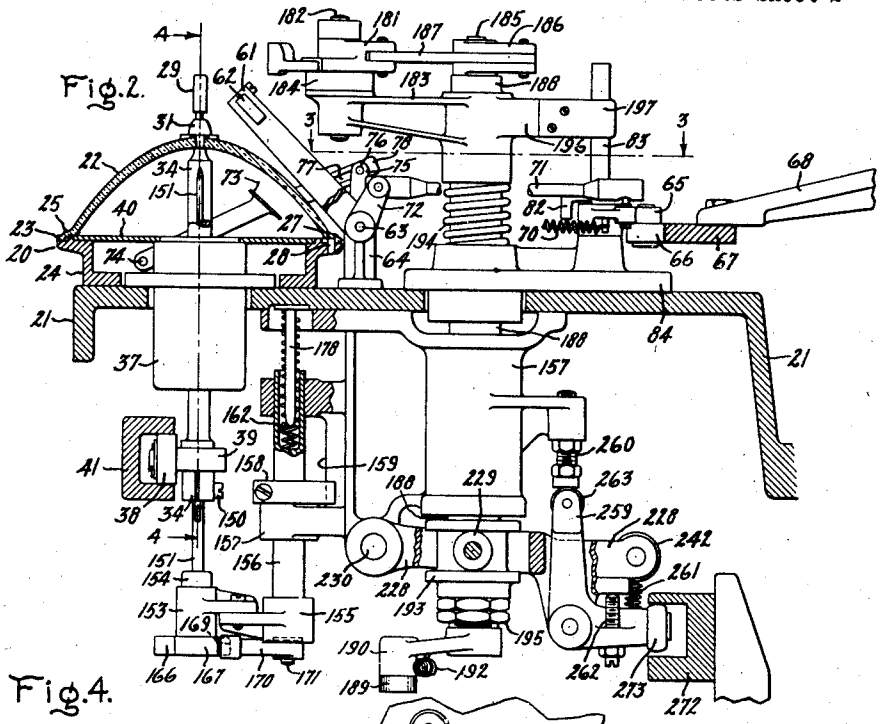


Fig.4.

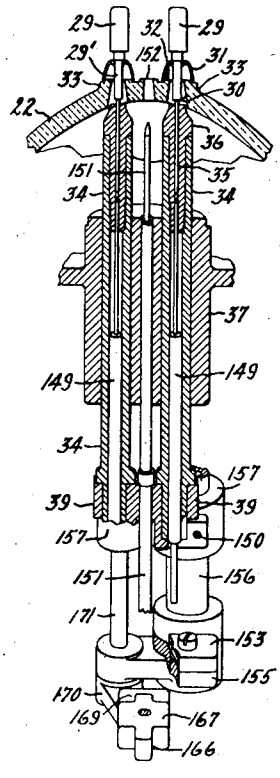


Fig.3.

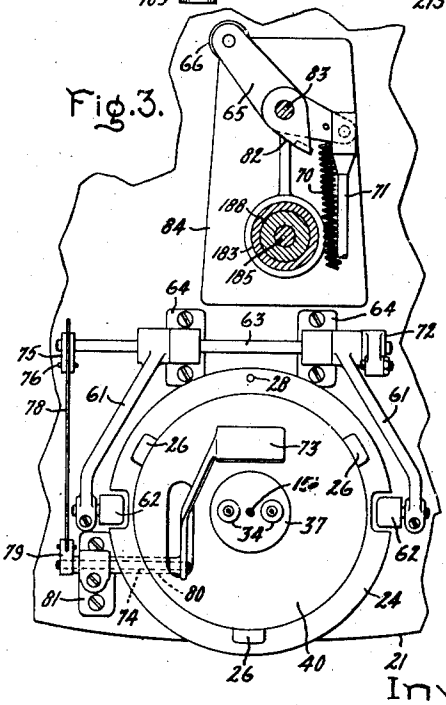
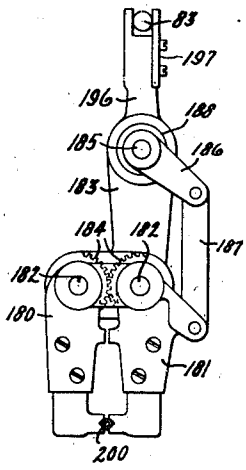


Fig.5.



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SEALING MACHINE

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Fig.8.

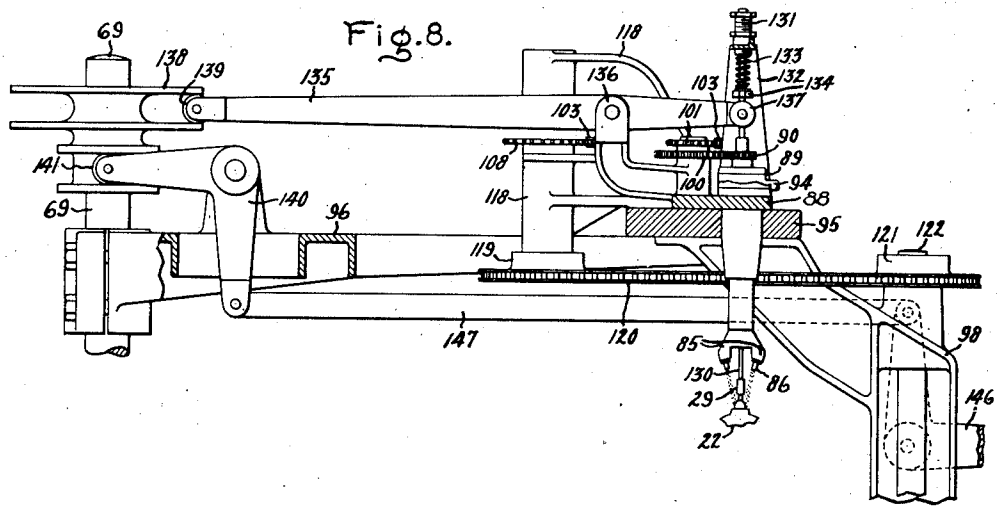


Fig.7.

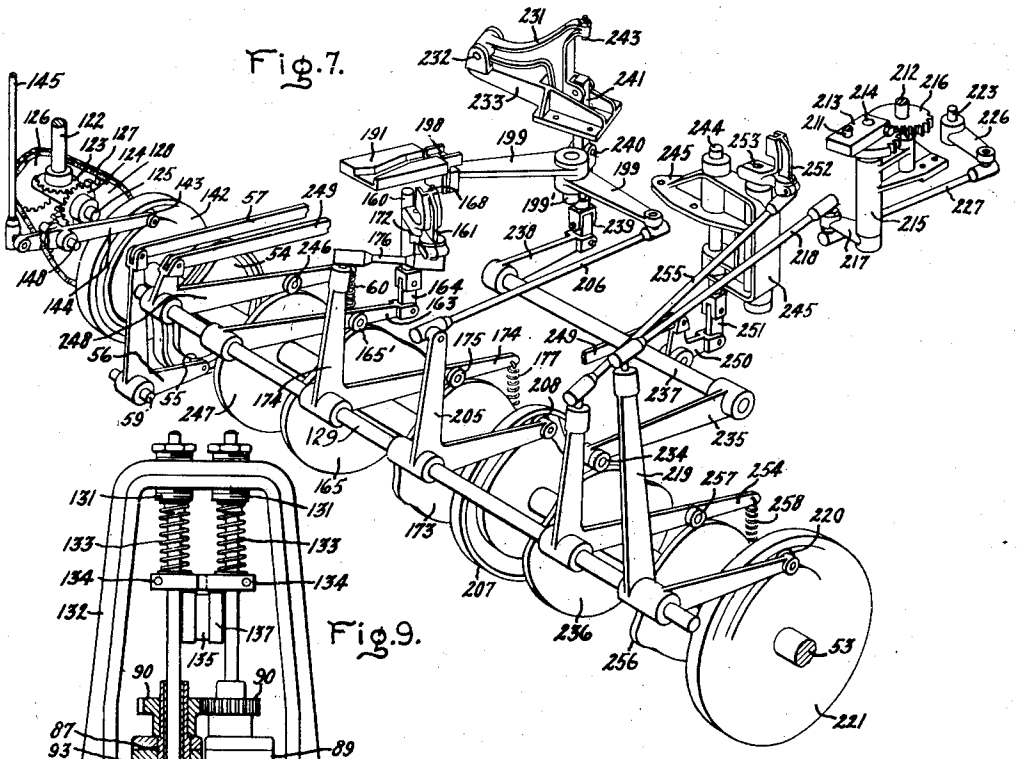


Fig.9.

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Fig. 11.

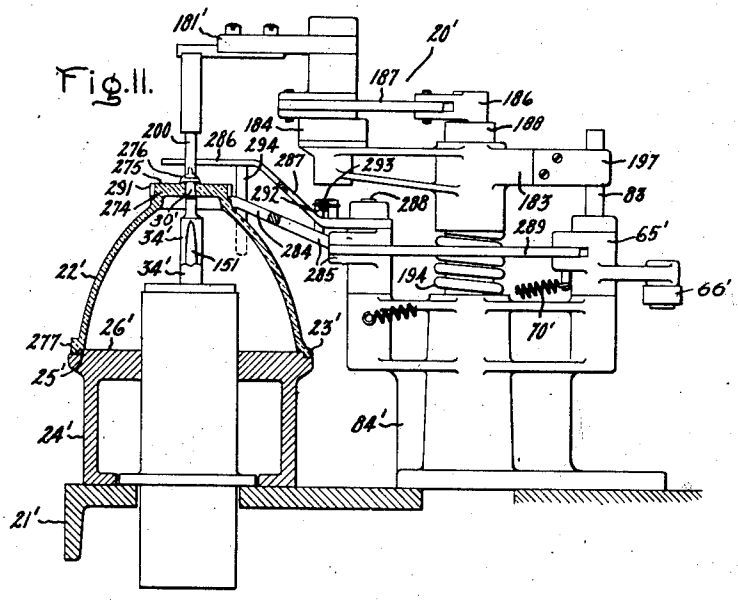


Fig. 12.

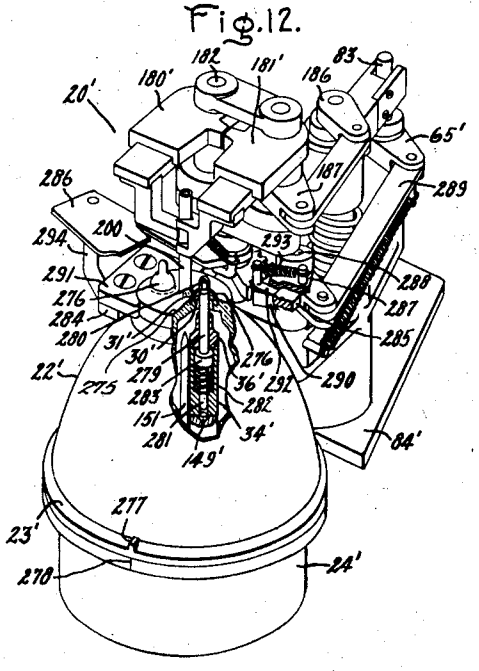
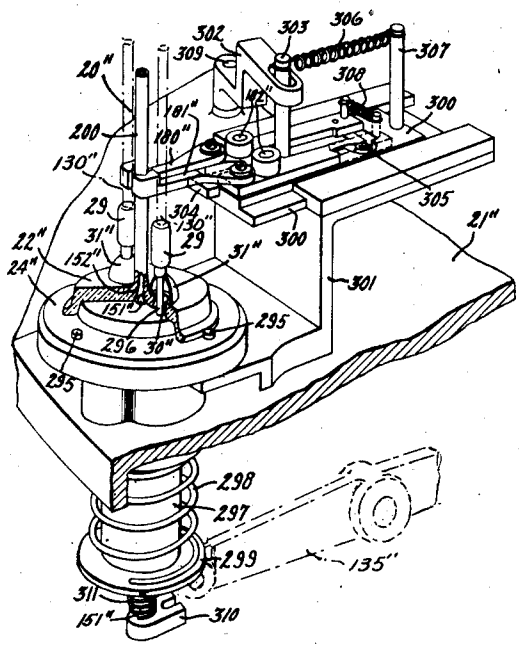


Fig. 13.



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Patented June 30, 1942

2,288,537

UNITED STATES PATENT OFFICE

2,288,537

SEALING MACHINE

Frank J. Malloy, Cleveland Heights, Ohio, assignor to General Electric Company, a corporation of New York

Application March 16, 1939, Serial No. 262,222

23 Claims. (Cl. 49—2)

My invention relates to apparatus for automatically sealing metal terminal elements to a preformed vitreous portion of an incandescent lamp or the like and more particularly to the automatic sealing of an exhaust tube and skirted portions of metal terminal thimbles or skirted terminal posts to a preformed vitreous cup or vitreous reflector section of an incandescent lamp.

Certain types of precision-built lamps like those disclosed in the United States Patent 1,967,852 of D. K. Wright which issued July 24, 1934, and United States application Serial No. 143,504, filed May 19, 1937, by the said D. K. Wright, now Patent No. 2,148,314, are comprised of a pressed glass cup portion, which in the said application is shaped to form a reflector, and a bulb or cover glass which is sealed to the rim thereof. In such instances, metal terminal elements extending through apertures in the vitreous cup and sealed thereto conduct electrical current to a filament within the enclosure formed by the vitreous parts, and an exhaust tube tipped off close to the vitreous cup provides for the exhausting and gas filling of the lamp. The metal terminal elements which usually provide the sole support for the filament are attached to the cup by skirted portions which are fused directly thereto and which permanently seal the joint therebetween as they have either the same rate of expansion or are sufficiently flexible to absorb the difference in expansion of the cup. In every instance the filament is definitely positioned with respect to either the cup or the terminal elements and therefore depends to a certain extent on the proper positioning of the terminal elements on said cup.

The principal object of my invention is to provide a machine for sealing the skirted terminal elements and the exhaust tube to the pressed vitreous cup in a satisfactory manner. Another object of my invention is to provide automatic means for sealing the metal terminal elements and the exhaust tube to the cup more rapidly and economically than heretofore. Another object of my invention is to provide apparatus for sealing the terminal elements to the cup in a uniform position with relation thereto. Other features and advantages of my invention will be apparent from the following detailed description and the accompanying drawings of species thereof.

In the drawings, Fig. 1 is a plan view of the machine of my invention with portions broken away to show the underlying sections; Fig. 2 is a side elevation partially in section of one of the heads of said machine; Fig. 3 is a plan view of the head taken from a section along line 3—3 of Fig. 2; Fig. 4 is a vertical section of the terminal element supporting portion of the head taken along line 4—4 of Fig. 2 with some of the adjoining portions shown in perspective; Fig. 5 is a plan view of the exhaust tube supporting jaws of the head; Fig. 6 is a side elevation of a portion of the track controlling the vertical position of the terminal element positioning means and a portion of the operating means therefore; Fig. 7 is a perspective diagrammatic view of the operating cams and other interconnected operating means for the complete machine; Fig. 8 is a vertical section along line 8—8 of Fig. 1 showing the sealing unit at one of the stations of the turret and the operating means therefor; Fig. 9 is a front elevation partially in section of one of said sealing units on a larger scale; Fig. 10 is a side elevation of the tubulating burners, the exhaust tube introducing means and a portion of the head at station E of the turret; Figs. 11 and 12 are a side elevation and a perspective view respectively of a modified head for sealing a different form of terminal element to a differently shaped vitreous cup in my machine; and Fig. 13 is a perspective view of another modification of the head of my machine to adapt said machine to another form of vitreous cup.

In the particular form of my machine shown in Figs. 1 to 10 inclusive, the metal and glass parts that are to be sealed together are placed in the heads 20 and are advanced through a series of stations in the course of the movements thereof at which the various portions of the sealing operation take place. The heads 20 are mounted at regular spaced intervals on the turret 21 in a circular path adjacent the periphery thereof and are advanced by the turret which is supported and indexed by the usual type of apparatus (not shown). The first operation in the cycle is the introduction of the preformed cup or reflector section 22, which in this instance conforms to that disclosed in the above-mentioned United State patent application of D. K. Wright, Serial No. 143,504. The cup 22, as shown in Figs. 2 and 3, is placed in the head 20 with the outer rim or flange 23 resting on the support 24 so that it is properly positioned vertically, the annular recess 25 in the rim portion resting against the outer faces of three raised portions 26 so that the cup is positioned horizontally, and the notch 27 (only partially shown)

engaging the pin 28 so that the said cup is orientated.

The terminal elements or posts 29 in this case are now fed into the machine, the inner reduced portions 29' thereof being inserted through the terminal apertures 30 (Fig. 4) in the cup 22 and the skirted portions 31 being fitted about the slightly raised inner locating rim 32 of the bosses 33 on the cup 22. In this particular instance, the skirted portions 31 of the terminal posts are of a metal having substantially the same expansion characteristics as the glass of the cup 22 and may for instance be made of the metal alloy known as "Fernico" and disclosed in Patent 1,942,260, which issued to H. Scott on January 2, 1934.

Before the head 20 is indexed out of station A, positioning means or guide tubes 34 located below each of the terminal posts 29 are raised to the position shown in Fig. 4 so that the leads 35 attached to the inner ends of said posts are placed in the snugly fitting axial passages in the caps 36 surmounting said tubes 34. The purpose of said guide tubes 34 is to hold the posts 29 in position during the subsequent operations and they can be used alone to position the posts in case it is desirable to omit the locating rims 32 on the cup 22, although the posts are then preferably introduced at a following station of the head 20 when the guide tubes 34 are in the raised position.

The guide tubes 34 are slidably mounted in the block 37 which is attached directly to the turret 21 and are shifted vertically by means engaging the roller 38 extending from the bracket 39 which fastens the lower ends of said guide tubes together. A cover plate 40 extends between the block 37 and the support 24 to keep out broken glass, etc. The roller 38 at this station is located within the track segment 41 (Figs. 2 and 6) which actuates the guide tubes 34 by moving upward from a position adjacent the lower portion 42 of the track to a position adjacent the upper portion 43 thereof, and is actuated through the rod 44 on which it is mounted. The rod 44 is slidably mounted in the hollow post 45 which is fastened to the frame 46 of the machine by bracket 47 and to the adjacent ends of the lower and upper portions 42 and 43 of the track by the bracket 48 and is shifted by the arm 49 extending from the shaft 50 which engages the block 51 on the end of said rod 44 through the roller 52. Like all other sections of the machine, this section is actuated through the cam shaft 53 shown in Fig. 7 which is located below the back portion of the turret 21 and which actuates the shaft 50 through the cam 54, and also actuates the roller 55 on the lever 56 which engages the ways of said cam 54, the rod 57 and the lever 58 on said shaft 50. The lever 56 is pivoted on the pin 59 which extends from a portion of the frame (not shown).

Following the upward movement of the guide tubes 34, an indexing movement of the turret 21 takes place, advancing the head 20 from station A to station B. No operations are performed on the lamp parts at this station by the machine and it is simply provided to allow the insertion of the terminal posts 29 into place on the cup 22 providing they have not already been placed thereon at the preceding station. At this station, however, the leads 35 on the ends of the terminal posts 29 must be threaded through the apertures in the caps 36. During the indexing movement, the roller 38 passes from the segment 41 to the upper portion 43 of the track and the guide tubes 34 remain in the up position.

During the succeeding indexing movement of the turret 21 which carries the head 20 into the first work station of the machine, the cup 22 is clamped to the support 24 by the arms 61—61 which are moved down until the shoes 62 in the outer ends thereof rest on the outer flange of said cup 22. The arms 61 are fastened to the shaft 63 which is supported by the brackets 64 on the top surface of the turret 21 and are actuated by the movement resulting in lever 65 when the roller 66 thereon passes from the stationary cam 67 (Figs. 1 and 2) during the indexing movement. The cam 67, which is held in position by the bracket 68 extending from the center post 69 of the machine, turns the lever 65 at stations A and B against the contracting force of the spring 70 which thereafter actuates said lever 65. The spring 70 extends between a post (not shown), extending from the turret 21, and the lever 65 which actuates the shaft 63 on which the arms 61 are mounted through the rod 71 and the arm 72 on said shaft 63. On some occasions the cup 22 is not placed in the head 20 and the guide tubes 34 would eventually be injured by the sealing fires at some of the stations if the shield 73 were not lifted to a position over the guide tubes 34. The said shield 73, which as shown in Figs. 2 and 3 extends through the cover plate 40 to the shaft 74, is actuated by the additional downward movement of the arms 61 when the cup 22 is not contacted, as the arm 75 on the shaft 63 then moves so that the pin 76 thereon is moved more than the slot 77 in the link 78 allows. The additional movement of the pin 76 causes the link 78 to swing the arm 79 on the shaft 74 causing the shield 73 to be moved up over the guide tubes 34. The shaft 74 supporting the shield 73 is located within the tube 80 which is held in place by the bracket 81 extending upward from the turret 21. The exact position taken by the shield 73 is under the control of the arm 82 which acts as a stop for the lever 65 and which is fastened to the post 83 extending upward from the base 84.

The indexing motion just referred to advances the head 20 into station C which corresponds to each of the succeeding stations up to and including station D, the said stations being employed for sealing the posts 29 to the cup 22. These stations are ten in number in this particular instance and each is provided with apparatus for heating the bosses 33 of the cup 22 and the skirts 31 of the posts 29 so that they are sealed together, and pushing said posts 29 so that said skirts 31 are embedded in said bosses 33.

The heating apparatus at each of these stations consists of a pair of rotatable burners 85—85 (see Figs. 8 and 9) arranged side by side and each comprising a pair of jets 86—86 located on opposite sides of their axis of rotation. The burners are set 90° apart and are rotated at the same speed in opposite directions so that they revolve in intersecting paths like the blades of an egg-beater. The axis of rotation of each burner 85 is aligned with the axis of the corresponding post 29 so that it directs two rather restricted flames onto the skirt 31 and boss 33 of said post. Each of the burners 85 is mounted on the hollow shaft 87 which extends upward through the base 88 and the gas distribution heads 89 to the gear 90 on the upper end thereof. The combustible gas mixture is conducted to the jets 86 through openings in the burner 85

and the hollowed out space 91 in the shaft 87 sealed by the sleeve 92 which terminates at the apertures in said shaft 87 within the distributing head 89. The heads 89 have a passage 93 therein completely around the shaft 87 so that the combustible gas flows constantly thereto and are connected to a source thereof through the pipes 94. If desired, a manifold can be placed about the machine in the usual manner to conduct the combustible gas to each of the units and suitable valves can be connected to each unit to control the flames at each station. Suitable master valves operated by cams on the main cam shaft 53 can also be provided for reducing the size of said flames during the indexing intervals if desired.

Support for the burners 85 as well as all other portions of each of the sealing units depends on the bases 88 which as shown in Figs. 1 and 8 are mounted on an arcuate plate 95 located above all the stations from C to D inclusive. The plate 95 is supported in turn both by the bracket 96 extending from the center post 69 of the machine and the brackets 97, 98 and 99 which extend outward and downward about the turret 21 to the frame 46 (only partially shown). Rotation of the burners 85 is brought about through the gears 90 which in each sealing unit mesh together so that said burners 85 cannot interfere with each other and which are driven from a third gear 100 meshing with one of the gears 90. The gear 100 in each case is attached directly to a sprocket 101 which is rotated about the pin 102 extending from the base 88 therewith by a common actuating means engaging each of said sprockets 101 through the chain 103. Since the sealing units extend along a single path, the chain 103 engages the sprockets 101 of each in turn and then passes over the idler sprockets 104 and 105 carried by the brackets 106 and 107, the drive sprocket 108, the take-up sprocket 109 and the idler sprockets 110 and 111 carried by the brackets 112 and 113 respectively before re-engaging the sprockets 101. The brackets 106, 107, 112 and 113 are stationary members being fastened to the plate 95 whereas the arm 114 which supports the take-up sprocket 109 is pivoted on the pin 115 extending from the bracket 96 and is biased by the spring 116 which extends from an arm fastened to said bracket 96. The driven sprocket 108 is one portion of a drive system transferring to the chain 103 the motion of the cam shaft 53 and is mounted on the shaft 117 carried by the bracket 118 extending from the plate 95. The drive system from the shaft 117 consists of the sprocket 119, the chain 120, the sprocket 121 and the shaft 122 held by the bracket 98 as shown in Figs. 1 and 8 and as shown in Fig. 7 of the bevel gears 123 and 124, the shaft 125, the sprocket 126, the chain 127 and the sprocket 128 on the cam shaft 53.

Associated with the burners 85 are the push rods 130 which apply the necessary pressure to the terminal posts 29 to cause the skirts 31 thereof to sink into the thickness of the cup 22. As shown in Figs. 7 and 8, the push rods 130 are located directly above the terminal posts 29 in the sleeves 92 and extend upward into the threaded bushings 131 in the upper portion of the yoke 132 which is carried by the base 88. The push rods 130 rest on the terminal posts 29 only during the rest period of the head 20 at which time they are pressed down by the expanding force of the springs 133 which butt against the bushings 131 and the blocks 134 which are clamped thereto. The threaded bushings 131 can be screwed in or out of the yoke 132 to adjust the compression of the springs 133 and consequently the pressure exerted by the push rods 130 to match the conditions existing at each particular station and the particular type of glass and fire setting used. During the indexing intervals, the push rods 130 are raised to a position above the terminal posts 29 by a lever 135 which is then turned about the pins 136 in the bases 88 so that the rollers 137 are carried against and raise the blocks 134. The push rods 130 are kept from turning by the blocks 134 which in each unit butt against each other and are so shaped as to prevent any rotative movement. The lever 135 of each sealing unit is actuated by the collar 138 which provides a circumferential groove in which the roller 139 on the end of said lever 135 is located and which brings about the necessary motion in the lever 135 by moving vertically. The collar 138 is slidably mounted on the center post 69 of the machine and is held in place by the lever 140 which extends about the lower portion thereof and engages a second circumferential groove therein through the rollers 141 at opposite sides thereof. The motion of the lever 140 necessary to shift the push rods 130 is brought about by the rotation of the cam 142 on the cam shaft 53 (Fig. 7) which is engaged by the roller 143 on the lever 144 which in turn transfers its motion to lever 140 through the rod 145, lever 146 (Figs. 1 and 8) and bar 147. The lever 144 is pivoted on the pin 148 which extends from a portion of the frame (not shown) whereas levers 140 and 146 are pivoted on the supporting brackets 96 and 98 respectively for the plate 95. The extent to which the skirts 31 of the terminal posts 29 are forced into the bosses 33 of the cups 22 is controlled either by the length of movement allowed the arm 135 or by the rods 149 within the guide tubes 34 and the caps 36 as the said rods can be positioned so that the lower ends of the leads 35 of the terminal posts engage and rest on the upper ends thereof at the limit of motion. Adjustment of the rods 149 is made following the loosening of the screws 150 which pull the split lower portions of both the block 39 and the guide tubes 34 together about the lower end of said rods 149. The operations of the sealing units alone are sufficient to seal the posts 29 to the cups 22 at a fairly rapid rate even when said cups 22 are made of hard glass such as that known as "Pyrex" which has a relatively high softening temperature and at the completion of all operations at station D all portions of the skirt 31 contacting the cup 22 are tightly sealed thereto.

Simultaneously with the performance of the sealing operations at station D, a sharp pointed rod 151 is raised into the exhaust aperture 152 in the cup 22 and turned so as to loosen and dislodge any particles of glass, etc., that may be obstructing said aperture. The rod 151 is a permanent part of the head 20 as shown in Figs. 2 and 4 and is located in slide ways in the blocks 37 and 39 and the arm 153 in which it is positioned vertically by the collar 154 which rests on said arm 153. The arm 153 is fastened to the arm 155 extending from the lower end of the post 156 which, although slidably and rotatably mounted in the bracket 157, is held in position by the engagement of the collar 158 with said bracket 157. The collar 158 is clamped onto the post 156 and positions said post 156 vertically by

resting on a portion of the bracket 157 and radially by engaging through a groove therein a ridge 159 (Fig. 2) extending along the adjacent portion of the bracket 157. At station D, these parts of the head 20 are located above the push rod 160 and the arm 161 shown in Fig. 7 which are mounted on a portion of the frame underlying the turret 21 and which are caused to engage and operate said parts to operate the rod 151. The push rod 160 produces the upward movement in the rod 151 by moving vertically so as to engage and push the lower end of the arm 155 and the post 156 to the new position and during said movement causes the spring 162 which butts against the upper end of said post 156 and is largely located within a well therein to be compressed. The push rod 160 is actuated by the lever 163 which is connected thereto by the link 164 and which engages the cam 165 on the cam shaft 53 through the roller 165'. The lever 163 pivots on the lay shaft 129 like the other similarly cam actuated apparatus. The lever 161 produces the turning motion in the rod 151 through engagement with the tongue 166 of the cross arm 167 on the lower end thereof which is carried into the groove 168 of said lever 161 when the rod 151 is raised to its upper position. The upward movement also carries the tongue 169, on the end of the cross arm 167, from the groove in the arm 170 which, up to now, has kept the cross arm 167 from turning. The arm 170 is held in a fixed position by the rod 171 (Fig. 4) which extends from the bracket 157. When the lever 161 is properly registered with the cross arm 167, it and the pin 172 on which it is mounted are turned by means operated by the cam 173 on the cam shaft 53 which consists of the lever 174 engaging the cam 173 through the roller 175 and lever 161 through the link 176. The lever 174 is biased by the spring 177 so that the roller 175 follows the curvature of the cam 173. Both the push rod 160 and the pin 172 are held in place on the frame by a bracket (not shown) which allows them to move as desired and which is a duplicate of a similar bracket shown with similar means at a following station of the head. The return downward movement of the push rod 160 is followed by the rod 151 because of the expansion of the spring 162 which is held in proper alignment by the pin 178 located within the upper end thereof.

The next operation of the machine takes place during the indexing movement of the head 20 from station D to station E and is the forerunner of the operations necessary to seal an exhaust tube to the cup 22 above the exhaust passage 152 therein. The operation referred to is the partial closing of the jaws 180—181 (Figs. 1, 2 and 5) which are to support the exhaust tube at a later instant and which are pivoted on pins 182 extending upwardly from the arm 183. The jaws 180 and 181 are caused to move together by the gear segments 184 on the lower portions thereof which mesh together and are actuated through the rotation of the shaft 185 to which jaw 181 is connected through the arm 186 and link 187 and which extends down through the hollow column 188 supporting the arm 183. The indexing movement referred to carries the roller 189 on the arm 190 which is mounted on the lower end of the shaft 185 into the ways of the cam 191 (Fig. 7) which turns said arm 190 and said shaft 185 sufficiently to nearly close the jaws 180 and 181. Normally the jaws 180 and 181 are kept widely separated by the contracting force of the spring 192 which extends between arm 190 and a post (not shown) extending downward from the lower surface of the turret 21. During this interval and during all other prior operations of the machine the jaws 180 and 181 remain at a set vertical position determined by the position of the collar 193 on the lower end of the hollow column 188 as the spring 194 which separates the arm 183 and the base 84 of the head 20 pushes said column 188 upward until said collar 193 rests against the bracket 157. The collar 193 is screwed onto the lower end of the column 188 and is locked in place thereon by the nuts 195. Since the jaws 180 and 181 must be aligned with the other portions of the head 20 to hold the exhaust tube at the proper position, the arm 183 is provided with a rearward extending portion 196 which, together with the plate 197 attached thereto, engages the opposite sides of the post 83. The final indexing movements of the head 20 carrying it into station E advance the roller 189 of arm 190 beyond the cam 191 and into the ways 198 in the block carried by the lever 199 which continues to hold the jaws 180 and 181 in an open position.

When the head 20 is completely advanced into station E, an exhaust tube 200 is placed between the jaws 180 and 181 in the proper position to be sealed to the cup 22. The exhaust tube 200 in this instance is automatically fed into position by apparatus (not shown) like that already disclosed in United States Patent 2,005,496 which issued on June 18, 1935, to Donovan and Illingworth, and is placed in the head 20 by movement of the transfer jaws 201 and 202 thereof. The jaws 201 and 202 are mounted on the bracket 203 which turns in a clockwise direction about the pin 204 to carry the exhaust tube 200 to the proper position above the exhaust aperture 152 and releases said exhaust tube 200 and moves back from this position following the closing of the jaws 180 and 181 of the head 20. This present movement of the jaws 180 and 181 is caused by further adjustment of the arm 190 which is brought about by motion of lever 199 (Fig. 7) and shifts the spring 192 from one side of the shaft 185 to the opposite side so that it now functions to hold said jaws 180 and 181 closed. The lever 199 is operated by the lever 205 which is connected thereto through the rod 206 and engages the ways of the cam 207 on the cam shaft 53 through the roller 208. Lever 199 is pivoted on the pin 199' which is held by a portion of the frame (not shown). The sealing of the exhaust tube 200 to the cup 22 takes place both at station E and at station F indicated in Fig. 1, and is brought about by the series of four burners 209 at station E and by a similar set (not shown) at station F. The burners 209 as shown in Figs. 1 and 10 are mounted in pairs on the pipes 210 and are arranged so as to direct fairly sharp flames upon all sides of the cup 22 adjacent the exhaust aperture 152 and the lower end of the exhaust tube 200. The combustible gas is conducted to the burners 209 through the pipes 210 which are connected to the source thereof through flexible hose slipped over the outer ends thereof and which are supported by the post 211 and the shaft 212 in respective instances. The post 211 is fastened by means of the arm 213 to the shaft 214 which is mounted in the bracket 215 in a like manner to the shaft 212 and like said shaft 212 functions as a support and means for moving the burners 209.

Since the burners 209 extend between the heads 20 of the turret 21 they are moved to and

from the sealing position between indexing movements by the rotation of the shafts 212 and 214 which are connected together by the intermeshing gear segments 216 on each. The shaft 214 extends through the bracket 215 to the arm 217 (Fig. 7) which is connected through the rod 218 to the lever 219 and causes the burners 209 to be moved at the proper interval because of the engagement of the roller 220 on said lever 219 with the ways of the cam 221. The exhaust tube sealing burners at station F are supported and actuated in a similar manner to those of station E in that they are indirectly mounted in pairs on the shafts 222 and 223 which are pivoted in the stationary bracket 224 and which are operated together by the intermeshing gear segments 225 on each. The shaft 223 extends through the bracket 224 to the arm 226 which is connected through the rod 227 to the arm 217 of the operating means of the other burners 209 so as to be operated thereby.

The exhaust tube 200 remains separated from the cup 22 until station F is reached at which time the jaws 180 and 181 supporting it are moved down a short distance to bring the end of said exhaust tube 200 further into the flames and then, after an interval, are moved still further down carrying the said exhaust tube 200 against the cup 22. These movements of the jaws 180 and 181 are brought about by the downward adjustment of the hollow column 188 which is actuated by the lever 228 through engagement with the collar 193 on the lower end of said column 188. The lever 228 is comprised of two sections lying at opposite sides of the collar 193 which they engage through rollers like that shown at 229 and which are pivoted on the ends of the pin 230 extending from the bracket 157 and is operated by the downward movement of the claw 231 (Figs. 1 and 7) which is located above the other end thereof at this station. The claw 231 is pivotally mounted on the pin 232 held by the base 233 and is influenced by the motion created in the roller 234 on the arm 235 by the cam 236 which is transferred thereto through the shaft 237 carried by a portion of the frame (not shown), the arm 238, the universal joints 239 and 240 and the bar 241. The claw 231 engages the roller 242 in the outer end of the lever 228 through the screw 243 and pulls the jaws 180 and 181 down so far that the softened end of the exhaust tube 200 is distorted and spreads outward somewhat.

Because of the extra movement of the exhaust tube 200 provided to assure the positive contact and sealing of the cup 22 thereto, the pointed rod 151 of the head 20 is again raised into the exhaust opening 152 of said cup 22 but this time to prevent said opening 152 from being closed. The rod 151 must necessarily extend into the opening in the exhaust tube 200 for this purpose and can if desired be used to govern the size of the exhaust passage at the junction of the tube 200 and the cup 22. The rod 151 is actuated as in the prior instance by a push rod 244 carried by a bracket 245 which engages the end of the post 156 and arm 155 and which is operated by the motion of the roller 246 engaging the cam 247 on the cam shaft 53 which is transferred to said push rod 244 through the lever 248, bar 249 (in two sections laterally offset from each other in Fig. 7 to preserve the relation of the parts of the machine as much as possible), the lever 250 pivoted on a portion of the frame 46 (not shown) and the link 251. Lever 248 is biased, so as to cause the roller 246 to follow the contour of the cam 247, by the spring 60 which extends to a portion of the frame (not shown). To destroy any tendency of the rod 151 to stick to the cup 22 or the exhaust tube 200, said rod 151 is turned back and forth by the arm 252 (Fig. 7) which engages the tongue 166 on the cross arm 167 thereof in the same manner as the arm 161 at station D when the rod 151 is in the raised position. The arm 252 is fastened to the pin 253 pivotally mounted in the bracket 245 and is actuated by the lever 254 to which it is connected by the rod 255 and which engages the cam 256 through the roller 257. The lever 254 is biased by the spring 258 which extends from a portion of the frame so that the roller 257 follows the contour of the cam 256.

Following the sealing of the exhaust tube 200 to the cup 22, the jaws 180 and 181 must be kept in the lowered position to avoid any injury to the seal therebetween and must therefore be engaged by means other than the claw 231 which is located only at station F. The means for this purpose is the latch 259 which is pivotally mounted on the lever 228 and which swings to a position under the stud 260 carried by the bracket 157 when the claw 231 pulls said lever 228 to the lower position. The latch 259 is biased by the spring 261 which butts against the lever 228 so that it is moved until the stop screw 262 engages the said lever 228 and is correctly positioned below the stud 260. In this latter position, the roller 263 on the upper end of the latch 259 is not actually in contact with the stud 260 but is separated about one thirty-second of an inch therefrom and the hollow column 188 and the jaws 180 and 181 move upward as urged by the expanding force of spring 194 when the roller 242 is carried out from under the claw 231 by the indexing movement of the head 20. This motion causes the exhaust tube 200 to be stretched and worked at the point it is attached to the cup 22 making a more satisfactory seal.

With the succeeding indexing motion of the head 20 the first of the course of events leading to the removal of the finished product of this machine begins as the guide tubes 34 are lowered to their starting position. Up to this time the roller 38 of the supporting apparatus for the guide tubes 34 has been located within the raised track portion 43 (Figs. 1 and 6) but at station G, indicated in Fig. 1, the roller 38 passes into the track segment 264 and is lowered into alignment with the lower track portion 42 thereby. The track segment 264 is mounted on the upper end of the rod 265 which is carried in the hollow post 266 and is operated by the arm 267 on the shaft 50 which engages the block 268 on said rod 265 in the manner of the arm 49 at station A. The shaft 50 functions as the operating means for the track segment 264 and the track segment 41 at station A as previously described and brings about both the down movement of the segment 264 and the up movement of segment 41 by the same rotative motion. The return movements of the track segments 264 and 41 follow closely the indexing of the rollers 38 therefrom and occur prior to the advancing of another set of rollers 38 into the segments during the same indexing period. As at station A, the upper and lower track portions 43 and 42 respectively are supported by the bracket 269 on the hollow post 266 which is supported by the bracket 270 extending from the frame 46 and engaging the shaft 50. The succeeding indexing movements of the head 20 carrying it into station H and again into sta-

tion A cause the jaws 180 and 181 to be separated and the hold down shoes 62 to be lifted from the cup 22 by the arms 61. The first of these actions is brought about by the cam 271 which is located on a portion of the frame 46 below the turret 21 between these stations and which engages the roller 189 on the arm 190 controlling the movement of the jaws 180 and 181. During this movement, the spring 192 swings to the opposite side of the shaft 185 and is then in position to hold the jaws 180 and 181 open. The arms 61 are operated by the cam 67 which engages and actuates the roller 66 on the arm 65 of the control means therefore.

The only remaining undescribed operation of the machine occurs during the course of the movements of the head 20 from station H to station B, and consists in the release of the latch 259 of the head 20 so that the jaws 180 and 181 are caused to move up to the original position. The operation actually finishes the cycle of operation, as the jaws 180 and 181 do not function until a much later station, and is brought about by cam 272 partially shown in Fig. 2 which engages the roller 273 on the latch 259 and turns said latch 259 so that it is moved out from under the stud 260. The cam 272 is mounted at these stations on the frame 46 underlying the turret 21 and provides vertically varying ways which catch the roller 273 and pull it downward during the indexing motion.

Although the machine now completely described is only designed to function properly with substantially the form of terminals elements 29 and cup 22 shown, suitable modifications therein can be made without departing from the scope of the invention to allow it to operate equally as well with other forms thereof such as those shown in Figs. 11 and 12. In this latter instance, the cup 22' is deeper and is provided with a neck portion 274 closed off by a relatively heavy end wall 275 to which the terminal elements or thimbles 276, in this case, and the exhaust tube 200 are sealed. The cup 22' is placed in the head 20' (Fig. 12) first, and is so arranged thereon that the outer rim or flange 23' rests on the support 24' and the recess 25' engages the raised portion 26' which centers it.

The proper orientation of the cup 22' to position the lead apertures 30' over the guides 34' is brought about manually by the operator who turns said cup 22' until the lug or protuberance 277 is aligned with the mark 278 on the support 24'. The lug 277 corresponds to the notch 27 on the cup 22 in that it bears a definite relation to the apertures 30' which are provided to accommodate the filament supporting leads of the lamp and which are to be sealed off by the metal terminal elements or thimbles 276. Although in the prior instance the terminal elements 29 are inserted into the head 20 either before or after the upward movement of the guides 34, in this instance it is preferred that the terminal elements or thimbles 276 be placed in the head 20' after the guides 34' rise to their upper position as then the upper ends of the pins 279 carried thereby extend through the apertures 30' and the thimbles 276 are rested thereon. The upper ends of the pins 279 are somewhat smaller than the adjacent portions thereof and the tubular portions 280 of the thimbles 276 pass down over said ends until said thimbles 276 engage the larger adjacent portions which support them. The pins 279 are held by the guides 34' which slidably engage the lower ends 281 thereof and the caps 36' on the upper ends of said guides 34' which engage an intermediate part thereof and are positioned vertically by the expansion of the springs 282 which are located about the lower ends 281 thereof and which press the collar 283 there on against the cap 36'. The springs 282 allow the pins 279 and the thimbles 276 to be moved downward an amount necessary to allow the skirts 31' of said thimbles to be embedded into the end wall 275 of the cup 22' during the sealing operation which can be determined for instance when the lower ends 281 of said pins 279 engage the upper ends of the rods 149'.

Following the insertion of the cup 22' and the terminal thimbles 276 the operations of the machine take place in the regular order, the first being the closing of the holding jaws 284 and 285 (only the former appears in full in the drawing) on the neck portion 274 of the cup 22' or the closing of said jaws 284 and 285 and the swinging of the heat shields 286 and 287 (only one is shown completely) into position thereabove if the head 20' does not contain a cup 22'. The jaws 284 and 285 correspond to the arms 61 of the head 20 and are operated about the pins 288 extending from the base 84' by the lever 65' which is connected to the jaw 285 through the link 289 and which is operated by the cam 67. The spring 70' extending from lever 65' causes the roller 66' thereon to follow the contour of the cam 67. Adjoining portions 290 of the jaws 284 and 285 located about the pins 288 are provided with gear teeth which mesh together and which cause said jaws 284 and 285 to be operated as a unit. The cup 22' is not engaged directly by the jaws 284 and 285 but is contacted through an asbestos block 291 on each which fits snugly about the upper portion of the neck portion 274 of said cup 22' and which prevents vertical movement thereof due to the slightly larger size of the remainder of said neck portion 274. The heat shields 286 and 287 are pivoted in a similar manner on the pins 288 and are operated through the posts 292 extending sideward and upward from the jaws 284 and 285 respectively against which they are held by the contraction of the springs 293. The springs 293 extend between the upper end of the posts 292 and the posts extending from the heat shields 286 and 287. Since the posts 292 are moved with the jaws 284 and 285, the heat shields 286 and 287 follow the motion thereof and finally come in contact with each other forming a single shield over the guides 34' when the head 20' does not contain a cup 22'. Should the head 20' contain a cup 22', the movement of the shields 286 and 287 is arrested when the posts 294 extending from the lower face thereof engage said cup 22' and the continuing movement of the jaws 284 and 285 is taken up by the expansion of the springs 293.

The following operations of the machine in this instance correspond exactly to those of the machine already described, although the sealing units located at stations C to D inclusive are mounted higher above the surface of the turret 21 than before and engage the tubular portion 280 of the terminal thimbles 276. During the operation of the sealing units, the jaws 180' and 181' are separated to give easy access to the thimbles 276 and are closed to the position shown after the completion of the sealing operation. The jaws 180' and 181' are closed on the exhaust tube 200 and are shifted vertically by means corresponding to that shown in the other construction. In some instances, it may be desir-

able to provide holes in the thimbles 276 to provide passage for a straight through leading-in wire. In such instances the edge of the hole is apt to be irregular and cause improper operation of the push rods 130 unless the centers thereof are relieved so that only the outer rim of the end of the tubular portions 280 of the thimbles 276 are engaged.

Another modification of my machine suitable for sealing the terminal elements 29 to the cup 22'' is partially shown in Fig. 13. This modification illustrates the construction of the head 20'' of a machine best suited for operation with another form of cup 22'' much shallower than those shown heretofore and especially suited to close off the neck of the conventional form of lamp bulb in the manner disclosed in United States Patent 2,098,080 issued November 2, 1937, to D. K. Wright. The cup 22'' is placed on the support 24'' with the outer rim or flange in engagement with the three equidistantly spaced pins 295 which locate it at the desired position thereon and is orientated in the correct position by the insertion of the reduced portion 296 of the terminal posts 29 through the apertures 30''—30'' in said cup 22'' and the support 24'' respectively.

The sealing of the skirts 31''—31'' of the terminal posts 29 to the cup 22'' is brought about at the various stations of the turret 21'' at which burners like those already described are located but differs from the former instances in that the push rods or abutment members 130'' engaging the terminal posts 29 remain stationary and the support 24'' is raised. In this instance, the support 24'' is mounted on the upper end of the hollow post 297 and normally remains in the position shown because of the expanding force of the spring 298 which is located between the flange 299 on the lower end of the hollow post 297 and the lower surface of the turret 21''. As in the prior instances, the downward pressure is applied to the posts 29 during the rest period of the head 20'' at said stations, but in this instance a lever 135'' corresponding to lever 135 is moved upward against the flange 299 and raises the support 24'' and cup 22'' the necessary amount to carry the ends of the posts 29 against the push rods 130''. The apparatus for supporting the exhaust tube 200 also differs somewhat from the other apparatus shown in that the exhaust tube 200 is now gripped by the two-part jaws 180'' and 181'' which are pivoted on the pins 182'' extending from the slide 300. The slide 300 is carried in the ways of the bracket 301 which is fastened to the support 24'' and allows the jaws 180'' and 181'' to be withdrawn from a position over the cup 22'' when the posts 29 are being sealed thereto. At the moment the exhaust tube 200 is introduced into the machine, the slide 300 is moved forward by the arm 302 which engages the post 303 extending from a second slide 304 within ways of slide 300 until the forward limit of motion is reached at which time a post (not shown) extending through a slot in the bracket 301 from the lower surface of the slide engages the bracket 301. The additional movement of the arm 302 causes the second slide 304 to move in its ways carrying the cam surfaces on the inner end thereof between the rollers 305 (only one shown) on the ends of the jaws 180'' and 181'' which are closed. Normally the second slide 304 is held back in its ways so that the inner end butts against the end thereof by the spring 306 which extends between the post 303 and the post 307 and the jaws 180'' and 181'' are held in an open position by the spring 308 which extends between posts in the inner ends of each. The arm 302 is fastened to the pin 309 which extends through the turret 21'' and which is operated in much the same manner as the lever 65 by a cam corresponding to cam 67 although these parts are not shown. As in both prior cases, a rod 151'' is provided to clear and keep the exhaust opening 152'' communicating with the passage in the exhaust tube 200. In this instance, the rod 151'' extends through the support 24'' and the hollow post 297 to the arm 310 which is separated from said hollow post 297 by the spring 311 and is operated as in the prior instances by means engaging the end thereof and said arm 310. In this case, the flames of the sealing fires strike the support 24'' when the head 20'' does not contain a cup 22'' as no guard is provided therefor.

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

1. In a machine for sealing the skirts of metal terminal elements to vitreous cups around openings in said cups, the combination of a rotatable turret, a plurality of heads mounted at regular intervals adjacent the periphery thereof each comprising a support for a vitreous cup, means for definitely locating said cup thereon and means mounted adjacent said support for positioning a terminal element with its skirt in sealing relation to the edges of the opening in said cup, means located along the path of movement of a head for heating the adjacent portions of the cup and the skirt of the terminal element carried by the head and means for producing a relative movement between said cup and skirt to cause the rim of said skirt to be sealed and embedded in said cup around said opening.

2. In a machine for sealing the skirts of metal terminal elements to vitreous cups around openings in said cups, the combination of a rotatable turret, a plurality of heads mounted at regular intervals adjacent the periphery thereof each comprising a support for a vitreous cup, means for definitely locating said cup thereon and means mounted adjacent said support for positioning a terminal element with its skirt in sealing relation to the edges of the opening in said cup, a plurality of burners located at several stations along the path of movement of a head directing flames against the adjacent portions of the cup and the skirt of the terminal element carried by the head, means for causing said burners to rotate about the terminal element when the head is located at said stations to cause said portions of said cup and skirt to be uniformly heated, and means located at least at some of said stations for urging said terminal element toward said support to cause the rim of the skirt thereof to be sealed and embedded in said cup around said opening.

3. In a machine for sealing the skirts of metal terminal elements to vitreous cups around openings in said cups, the combination of a rotatable turret, a plurality of heads mounted at regular intervals adjacent the periphery thereof each comprising a support for a vitreous cup, means for definitely locating said cup thereon and means extending through said support for locating adjacent terminal elements on definite axes intersecting the support and cup so that the skirts of said terminal elements are adjacent to the edges of the said openings in said cup, a plurality of burners rotatable in intersecting paths above

the head and in alignment with the said axes through the terminal elements at several of the stations taken by the heads along the path of movement for directing flames against the adjacent portions of the cup and the skirts of the terminal elements carried by the head, gears connected to each of said burners for causing the rotation of said burners about the said axes and preventing interference therebetween, means engaging one of said gears for causing the rotation of said burners, push rods in alignment with the said axes at at least some of the stations, said push rods being arranged to engage the ends of the said terminal elements, and means for actuating said push rods to cause them to urge said terminal elements toward the said cup so that the rims of the skirts thereof are embedded in said cup and become fused thereto around said openings.

4. In a machine for sealing the skirts of metal terminal elements to vitreous cups around openings in said cups, the combination of a rotatable turret, a plurality of heads mounted at regular intervals adjacent the periphery thereof each comprising a support for holding a vitreous cup in an inverted position, means projecting from said support and engaging the rim portion of said cup for centering it thereon, means mounted on said turret adjacent the said support arranged to engage the upper portion of said cup to hold it in position on said support and means for actuating said last-mentioned means in proper time relation to the rotation of the turret, means mounted adjacent said support for positioning a terminal element with its skirt in sealing relation to the edges of the opening in said cup, means located along the path of movement of a head for heating the adjacent portions of the cup and the skirt of the terminal element carried by the head, and means for producing a relative movement between said cup and skirt to cause the rim of said skirt to be embedded in the cup and become sealed thereto around said opening.

5. In a machine for sealing the skirts of metal terminal elements to apertured vitreous cups, the combination of a rotatable turret, a plurality of heads mounted at regular intervals adjacent the periphery thereof each comprising a support for a vitreous cup, means projecting from said support and engaging the rim portion of said cup for centering it thereon, and a guide tube extending through said support and in alignment with an aperture in said cup adapted to receive portions of a terminal element placed on the cup to cause said terminal element to be positioned thereon in sealing relation to said cup around said aperture, means located along the path of movement of a head for heating the adjacent portions of the cup and the skirt of the terminal element carried by the head and means for producing a relative movement between said cup and skirt to cause the rim of said skirt to be embedded in the cup and become sealed thereto around said aperture.

6. In a machine for sealing the skirts of metal terminal elements to apertured vitreous cups, the combination of a rotatable turret, a plurality of heads mounted at regular intervals adjacent the periphery thereof each comprising a support for a vitreous cup, means projecting from said support and engaging the rim portion of said cup for centering it thereon, and a guide extending through said support and an aperture in said cup adapted to position a terminal element placed on the end thereof in sealing relation to said cup around said aperture, means located along the path of movement of a head for heating the adjacent portions of the cup and the skirt of the terminal element carried by the head and means for producing a relative movement between said cup and skirt to cause the rim of said skirt to be embedded in the cup and become sealed thereto around said aperture.

7. In a machine for sealing the skirts of metal terminal elements to apertured vitreous cups, the combination of a rotatable turret, a plurality of heads mounted at regular intervals adjacent the periphery thereof each comprising a support for a vitreous cup, means projecting from said support and engaging the rim portion of said cup for centering it thereon, guide means extending through said support and in alignment with apertures in said cup adapted to engage a portion of a terminal element resting on said cup to position said terminal element in sealing relation to said cup around said aperture and limiting means associated with said guide means for permitting only a limited movement of said terminal element toward said cup and support, means located along the path of movement of a head for heating the adjacent portions of the cup and the skirt of the terminal element carried by the head and means for producing a relative movement between said skirt and cup permitted by the limiting means to cause the rim of the skirt to be embedded in the cup and become sealed thereto around said aperture.

8. In a machine for sealing the skirts of metal terminal elements to vitreous cups around openings in said cups, the combination of a rotatable turret, a plurality of heads mounted at regular intervals adjacent the periphery thereof each comprising a support for holding a vitreous cup in an inverted position, means projecting from said support and engaging the rim portion of said cup and a notch therein for centering and orientating said cup thereon, a pair of arms mounted adjacent said support arranged to be moved into engagement with the upper portion of said cup and means for actuating said arms to cause the cup to be held against the support thereby, means mounted adjacent said support for positioning a terminal element with its skirt in sealing relation to the edges of the opening in said cup, means located along the path of movement of a head for heating the adjacent portions of the cup and the skirt of the terminal element carried by the head and means for producing a relativce movement between said skirt and cup to cause the rim of said skirt to be embedded in the cup and become sealed thereto around said opening.

9. In a machine for setaling the skirts of metal terminal elements to apertured vitreous cups, the combination of a rotatable turret, a plurality of heads mounted at regular intervals adjacent the periphery thereof each comprising a support for a vitreous cup, means projecting from said support and engaging the rim portion of said cup for centering it thereon, positioning means extending through said support and in alignment with apertures in said cup for locating a terminal element placed thereon in sealing relation to said cup around said aperture, a shield mounted adjacent said positioning means adapted to be moved to a position thereabove and means having a portion moving through the position taken by said cup for causing said shield to move to said position when said cup is not engaged so as to protect said positioning means

from the heat of the sealing operation, means located along the path of movement of a head for heating the adjacent portions of the cup and the skirt of the terminal element carried by the head and means for producing a relative movement between said skirt and cup to cause the rim of said skirt to be embedded in the cup and become sealed thereto around said aperture.

10. In a machine for sealing the skirts of metal terminal elements to apertured vitreous cups, the combination of a rotatable turret, a plurality of heads mounted at regular intervals adjacent the periphery thereof each comprising a support for holding a vitreous cup in an inverted position, means projecting from said support and engaging the rim portion of said cup for centering it thereon, means extending through said support and in alignment with an aperture in said cup for positioning a terminal element placed thereon in sealing relation to said cup around said aperture, a pair of arms mounted adjacent said support adapted to be moved into engagement with the upper portion of said cup, means for actuating said arms to cause said cup to be held against the support thereby, a shield mounted adjacent the terminal element positioning means adapted to be moved to a position thereabove, and meane actuated by the additional movement of the said arms when a cup is not engaged thereby for moving the shield to said position to cause the terminal element positioning means to be protected from the heat of the sealing operation, means located along the path of movement of a head for heating the adjacent portions of the cup and the skirts of the terminal element carried by the head and means for producing a reltaive movement between said skirt and cup to cause the rim of said skirt to be embedded in the cup and become sealed thereto around said aperture.

11. In a machine for sealing exhaust tubes and the skirts of metal terminal elements to apertured vitreous cups, the combination of a rotatable turret, a plurality of heads mounted at regular intervals adjacent the periphery thereof each comprising a support for a vitreous cup, means for definitely locating said vitreous cup thereon, means mounted adjacent said support for positioning a terminal element with its skirt in sealing relation to the edges of an aperture in the said cup and means located adjacent said support adapted to hold an exhaust tube in alignment with an exhaust aperture in said cup, means located along the path of movement of a head for heating the adjacent portions of the cup and the skirt of the terminal element carried by the head, means for producing a relative movement between said skirt and cup to cause the rim of said skirt to be embedded therein and become sealed thereto around the adjacent aperture, means further along the path of movement of said head for causing the exhaust tube holding means thereof to engage and position an exhaust tube against the exhaust aperture of the cup, and means for heating the adjoining portions of said exhaust tube and cup to cause them to be sealed together.

12. In a machine for sealing exhaust tubes and the skirts of metal terminal elements to apertured vitreous cups, the combination of a rotatable turret, a plurality of heads mounted at regular intervals adjacent the periphery thereof each comprising a support for a vitreous cup, means for definitely locating said vitreous cup thereon, means mounted adjacent said support for positioning a terminal element with its skirt in sealing relation to the edges of an aperture in the said cup, and means located adjacent said support adapted to hold an exhaust tube in alignment with an exhaust aperture in said cup, means located along the path of movement of a head for heating the adjacent portions of the cup and the skirts of the terminal element carried by the head, means for producing a relative movement between said skirt and cup to cause the rim of said skirt to be embedded therein and become sealed thereto around the adjacent aperture, means further along the path of movement of said head for causing the exhaust tube holding means thereof to engage and position an exhaust tube against the exhaust aperture of the cup, movable burners located adjacent the said turret for heating the adjoining portions of said exhaust tube and cup to cause them to be sealed together and means for moving said burners out of and into operative relation to the heads during rotation of the turret.

13. In a machine for sealing exhaust tubes and the skirts of metal terminal elements to apertured vitreous cups, the combination of a rotatable turret, a plurality of heads mounted at regular intervals adjacent the periphery thereof each comprising a support for a vitreous cup, means for definitely locating said vitreous cup thereon, means mounted adjacent said support for positioning a terminal element with its skirt in sealing relation to the edges of an aperture in the said cup and movable means located adjacent said support adapted to hold an exhaust tube in alignment with an exhaust aperture in said cup, means located along the path of movement of a head for heating the adjacent portions of the cup and the skirts of the terminal element carried by said head, means for producing a relative movement between said skirt and cup to cause the rim of said skirt to be embedded therein and become sealed thereto around the adjacent aperture, means further along the path of movement of said head for causing the exhaust tube holding means thereof to engage and position an exhaust tube adjacent to the exhaust aperture of the cup, means for heating the adjoining portions of the said exhaust tube and cup and means for first moving said exhaust tube holding means toward the said support and cup to cause the end of said exhaust tube to contact and seal thereto and thereafter moving said exhaust tube holding means in the opposite direction to cause the seal between said cup and exhaust tube to be worked.

14. In a machine for sealing exhaust tubes and the skirts of metal terminal elements to apertured vitreous cups, the combination of a rotatable turret, a plurality of heads mounted at regular intervals adjacent the periphery thereof each comprising a support for a vitreous cup, means for definitely locating said vitreous cup thereon, means mounted adjacent said support for positioning a terminal element with its skirt in sealing relation to the edges of an aperture in said cup, means located adjacent said support adapted to hold an exhaust tube in alignment with an aperture in said cup and a rod extending through said support and in alignment with an exhaust aperture in said cup arranged to be moved thereinto, means located along the path of movement of a head for heating the adjacent portions of the cup and the skirt of the terminal elements carried by the head, means for producing a relative movement between said skirt and cup to cause

the rim of said skirt to be embedded in the cup and become sealed thereto around the adjacent aperture, and means further along the path of movement of said head for causing the exhaust tube holding means thereof to engage and position an exhaust tube with an end thereof against said exhaust aperture, means for heating the adjoining portions of said exhaust tube and cup to cause them to be sealed together and means for moving the said rod through said exhaust aperture in the cup and into the exhaust tube to preserve the opening therethrough during the sealing operation.

15. In a machine for sealing exhaust tubes and the skirts of metal terminal elements to apertured vitreous cups, the combination of a rotatable turret, a plurality of heads mounted at regular intervals adjacent the periphery thereof each comprising a support for a vitreous cup, means for definitely locating said vitreous cup thereon, means mounted adjacent said support for positioning a terminal element with its skirt in sealing relation to the edges of an aperture in the said cup, jaws located adjacent said support adapted to hold an exhaust tube in alignment with an exhaust aperture in said cup, and a slide for supporting said jaws adapted to carry them to and from a position above the said support and cup, means located along the path of movement of a head for heating the adjacent portions of the cup and the skirt of the terminal element carried by the head, stationary abutment members above said cup support, means for raising said cup support to carry the terminal elements against said abutment members and cause the rim of said skirt to be embedded in the cup and become sealed thereto around the adjacent aperture, and means further along the path of movement of said head for causing the jaws thereof to grip an exhaust tube, and for causing the said slide to move said jaws to a position over the support on said head and for positioning the exhaust tube in alignment with the exhaust aperture in the cup, and means for heating the adjoining portions of said exhaust tube and cup to cause them to be sealed together.

16. In a machine for sealing the skirts of metal terminal elements to vitreous cups around openings in said cups, the combination of a rotatable turret, a plurality of heads mounted at regular intervals adjacent the periphery thereof each comprising a support for a vitreous cup, means for definitely locating said cup thereon and means mounted adjacent said support for positioning a terminal element with its skirt in sealing relation to the edges of an opening in the said cup, a plurality of burners located at several stations along the path of movement of a head for directing flames against the adjacent portions of the cup and skirt of the terminal element carried by the head, means for causing said burners to rotate about the terminal element when the head is located at said stations to cause said portions of the cup and skirt to be uniformly heated, stationary abutment members above said cup support, and means located at least at some of said stations for raising said support to carry the terminal elements against said abutment members and cause the rim of the skirt thereof to be embedded in said cup and become sealed thereto around the opening therein.

17. In a machine for sealing exhaust tubes and the skirts of metal terminal elements to apertured vitreous cups, the combination of a rotatable turret, a plurality of heads mounted at regular intervals adjacent the periphery thereof each comprising a support for holding a vitreous cup in an inverted position, means projecting from said support and engaging the rim portion of said cup for centering it thereon, jaws mounted adjacent said support adapted to engage and grip the upper portion of said cup for holding it in place, means for actuating said jaws in proper time relation to the rotation of said turret, guide tubes extending through said support and in alignment with apertures in said cup adapted to receive portions of terminal elements placed on said cup to cause said elements to be positioned thereon in sealing relation to said cup around said apertures, a shield mounted adjacent the said support adapted to be moved over said guide tubes, a finger extending from said shield and movable through the position taken by said cup and by said shield, means for actuating said shield either to carry the said finger against said cup or, if a cup is not present, to the said position above the guide tubes for protecting them from the heat of the sealing operation, and means located adjacent said support adapted to hold an exhaust tube in alignment with an exhaust aperture in said cup, means located along the path of movement of a head for heating the adjacent portions of the cup and the skirts of the terminal elements carried by the head, means for producing a relative movement between said skirts and cup to cause the rims of said skirts to be embedded therein and become sealed thereto around the adjacent aperture, and means further along the path of movement of the head for causing the exhaust tube holding means thereof to engage and position an exhaust tube with an end thereof against the exhaust aperture of the cup, and means for heating the adjoining portions of said exhaust tube and cup to cause them to be sealed together.

18. In a device of the character described, means for supporting a glass member having a plurality of openings therein comparatively close together with terminal members having metallic skirt portions in sealing relation to the edges of said openings, and a plurality of burners mounted to rotate on axes in alignment with said openings, each of said burners comprising a pair of jets located on opposite sides of its axis of rotation and arranged to direct flames toward the opening and associated terminal skirt portion with which it is aligned, and means for rotating said burners at the same speed so that the jets revolve in intersecting circular paths.

19. The combination set forth in claim 18, including a rod member disposed in the axis of rotation of each burner and arranged to engage the end of the associated terminal members, and means for effecting a relative movement of the rod members and the said support means toward each other to press the skirt portions of the terminals against said glass member around the openings therein.

20. In a device of the character described, a movable carrier having thereon heads each comprising means for supporting a glass member having openings therein located relatively close together, upwardly extending rod-like guide members in alignment with said openings and arranged to support, at their upper ends, terminal members having metallic skirt portions in sealing relation to the edges of said openings, clamping means arranged to engage said glass member and clamp it to its support, burners located above and adjacent to the path of travel of said heads

for heating the said skirts and the adjacent portions of said glass member, shield means carried by each of said heads, and means actuated by the clamping means on each head upon absence of a glass member from said head for moving the shield means to a position over the guide members on the head to protect them from the flames of the burners.

21. In a device of the character described, an intermittently movable carrier having thereon heads each comprising support means for a glass member having a plurality of openings therein with terminal members having metallic skirt portions in sealing relation to the edges of said openings, a plurality of sets of burners mounted at spaced heating stations adjacent to the path of movement of said heads and arranged to heat the said terminal skirt portions and the adjacent portions of said glass member, push rod members associated with each set of burners and arranged to engage the terminal members, means for applying pressure to said push rod members to press the terminal members against the glass member during periods of rest of the carrier at the heating stations, and means for removing the pressure from said push rods during movement of said carrier.

22. In a device of the character described, an intermittently movable carrier having thereon heads which are indexed through a plurality of stations by said carrier; each of said heads comprising support means for a glass member having a plurality of openings therein, vertically disposed rod-like guide members in alignment with said openings and arranged to support, at their upper ends, terminal members having metallic skirt portions in sealing relation to the edges of said openings, and clamping means arranged to engage said glass member and clamp it to its support upon movement of said carrier; a plurality of sets of burners mounted at spaced heating stations adjacent to the path of movement of said heads and arranged to heat the said terminal skirt portions and the adjacent portions of the glass member, and push rod members associated with each set of burners and arranged to engage the terminal members to urge the skirt portions thereof against said glass member during the heating thereof.

23. A device as set forth in claim 22 wherein the guide members are provided with axial passages for receiving downward extensions of the terminal members, and adjustable rod members in said passages arranged to be engaged by the lower ends of said extensions to limit the amount of downward movement of said terminals caused by said push rods.

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