

March 31, 1925.

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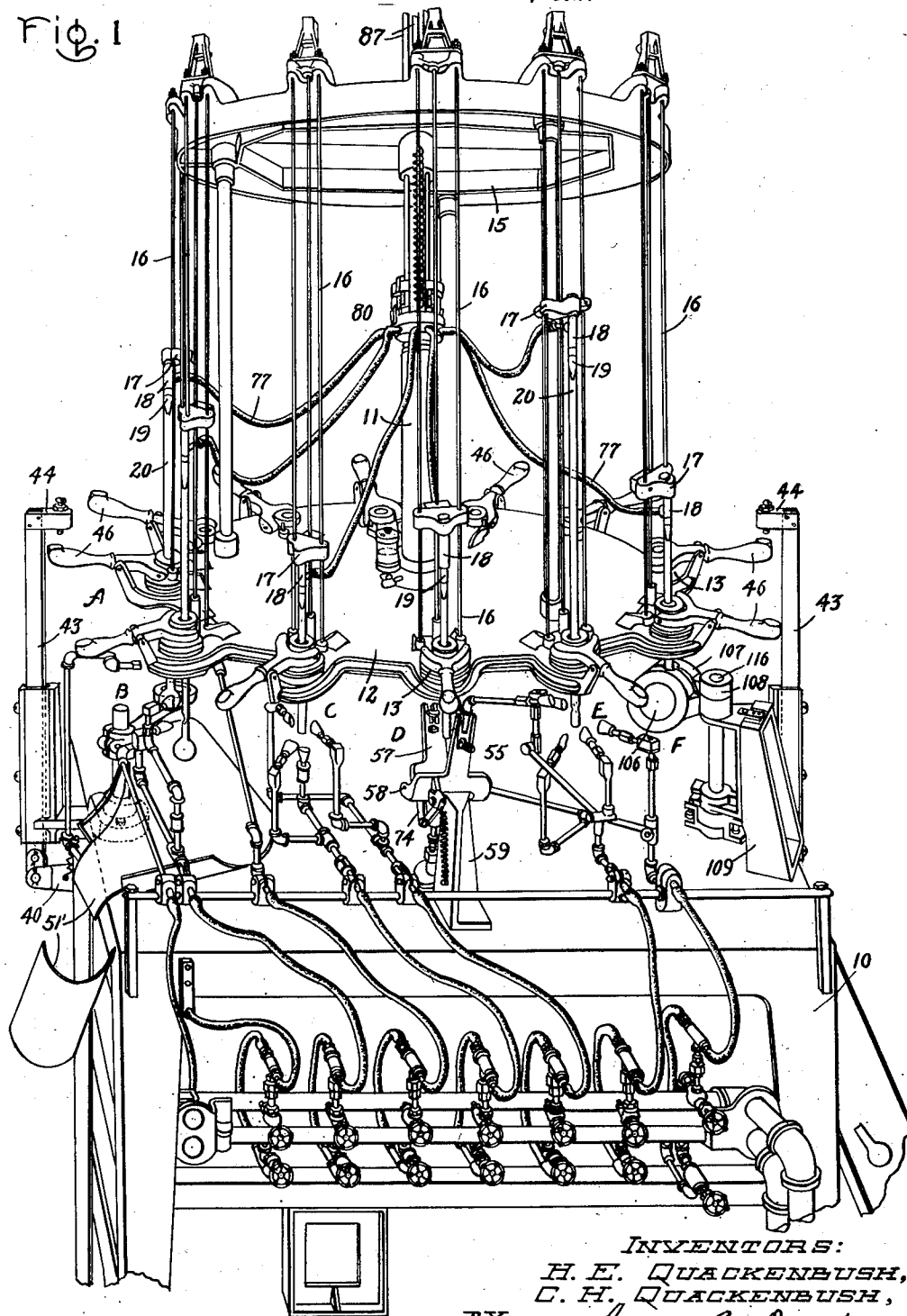
H. E. QUACKENBUSH ET AL

AUTOMATIC GLASS BLOWING MACHINE

Filed Feb. 27, 1920

4 Sheets-Sheet 1

Fig. 1



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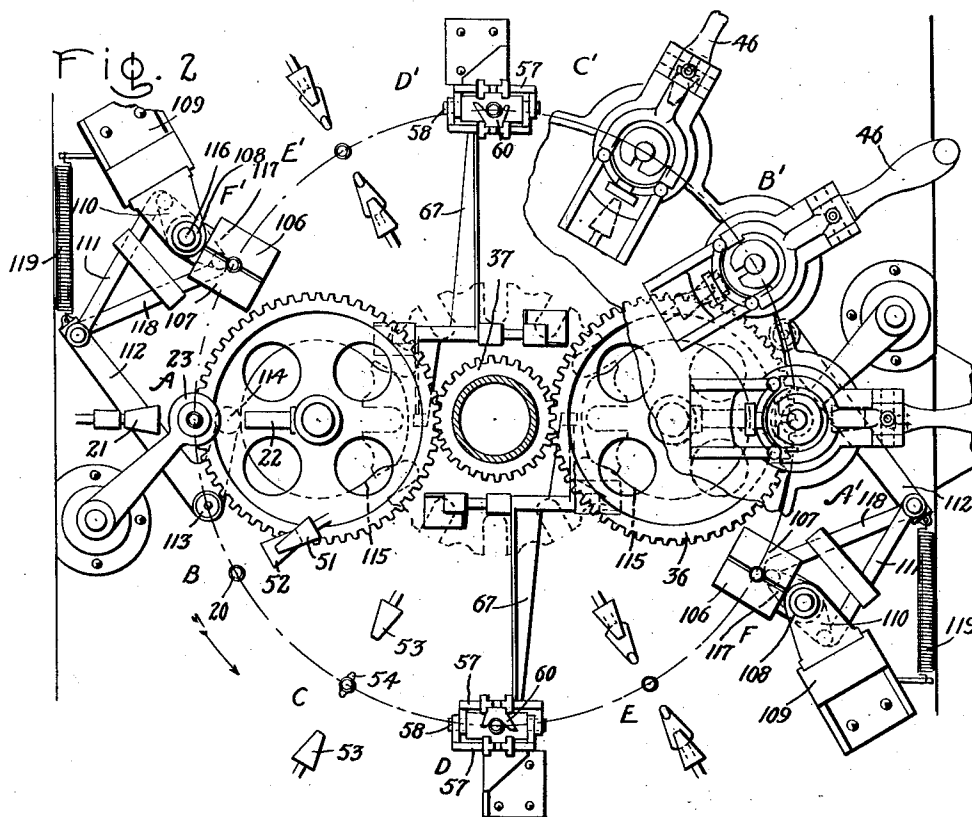
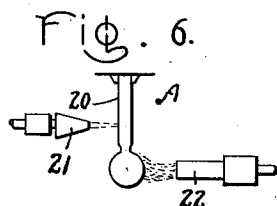
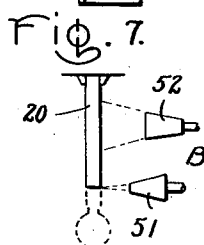
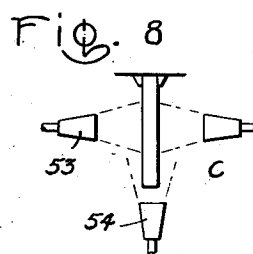
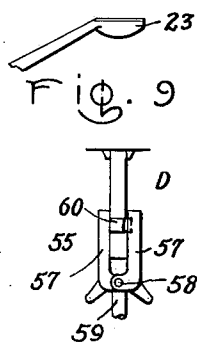
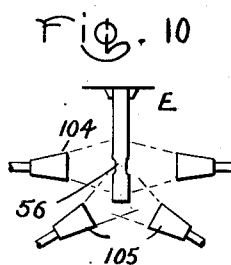
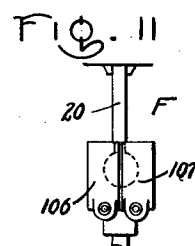
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4 Sheets-Sheet 2



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AUTOMATIC GLASS BLOWING MACHINE

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FIG. 3

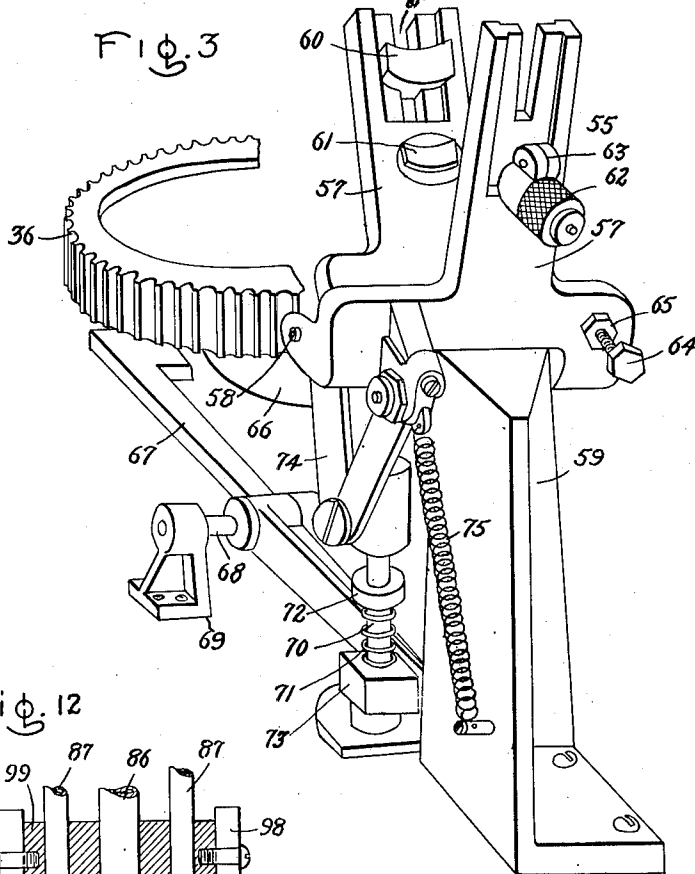


FIG. 12

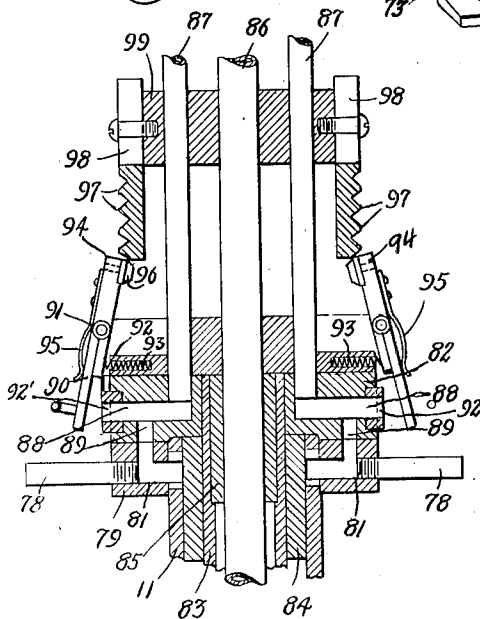
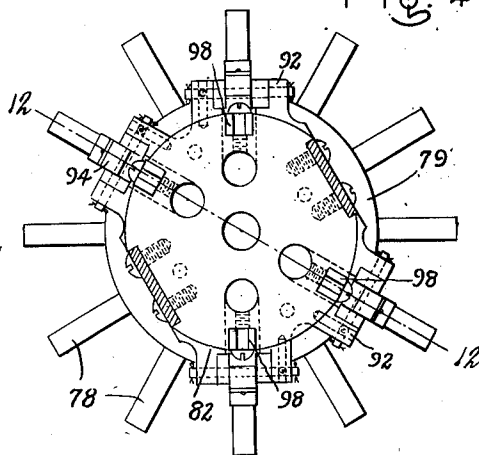


FIG. 4



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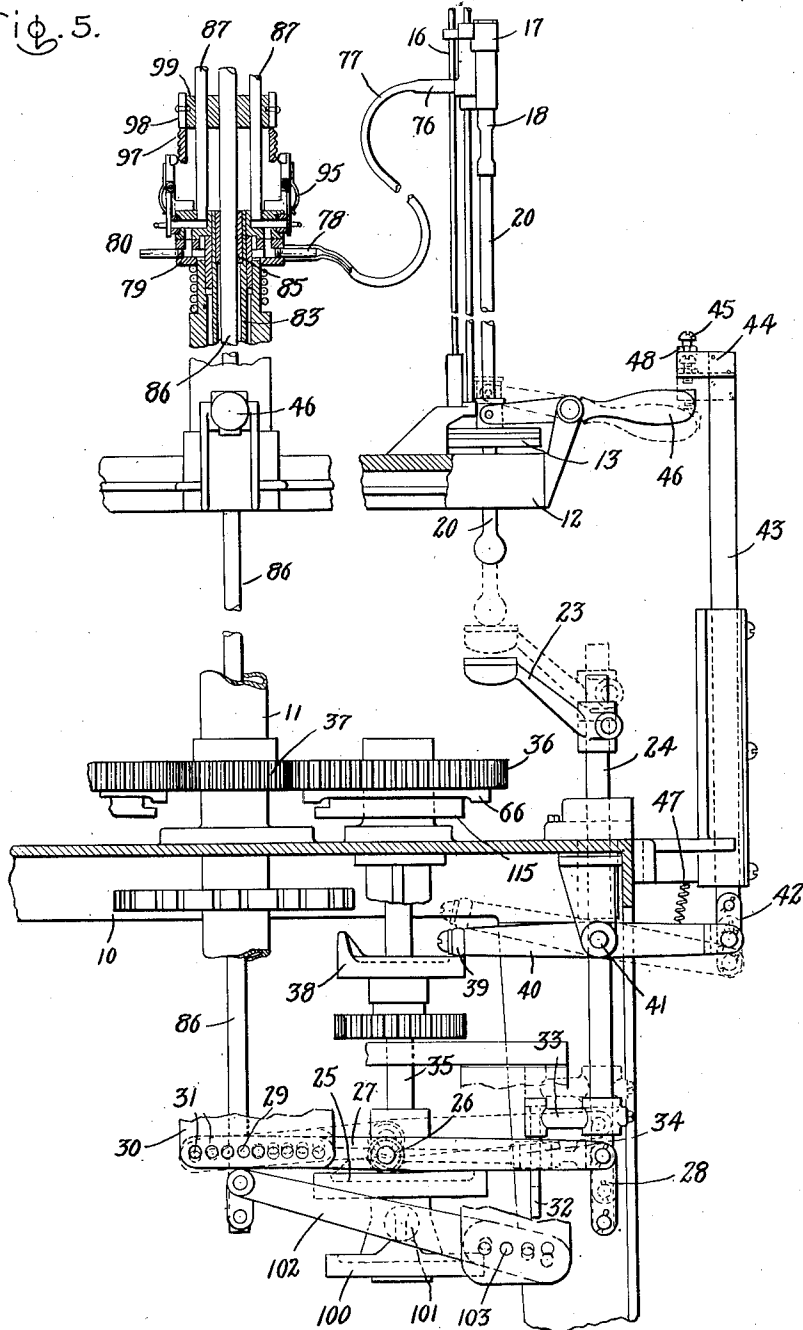
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4 Sheets-Sheet 4

Fig. 5.



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UNITED STATES PATENT OFFICE.

HARVEY E. QUACKENBUSH AND CLEVELAND H. QUACKENBUSH, OF CLEVELAND, OHIO, ASSIGNORS TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

AUTOMATIC GLASS-BLOWING MACHINE.

Application filed February 27, 1920. Serial No. 361,818.

To all whom it may concern:

Be it known that we, HARVEY E. QUACKENBUSH and CLEVELAND H. QUACKENBUSH, citizens of the United States, residing at Cleveland, county of Cuyahoga, State of Ohio, have invented certain new and useful Improvements in Automatic Glass Blowing Machines, of which the following is a specification.

Our invention relates to improvements in automatic machines for blowing glass articles from glass tubing and more particularly to machines of this character for manufacturing incandescent lamp bulbs such as the machine disclosed and described in the application of Frank B. Hofstetter and Francis J. Rippl, Serial No. 39,697, filed July 13, 1915, for automatic glass blowing machines. The objects of our improvement are first, to provide better regulation of the air supplied to the glass to be blown through an improved air regulating and distributing mechanism; second to decrease the amount of breakage by using glass tubing of a larger diameter than that of the neck of the bulb mold; third to provide automatic means for lowering the glass tubing the proper distance at the proper time.

According to the invention described in the above mentioned application of Hofstetter and Rippl, provision is made for one or more holders for glass tubing and a number of means which are caused to act upon the glass tubing to fuse a portion thereof and to blow the fused portion into the desired article, such means preferably including a mold of some description. In its preferred form their invention comprises means for automatically advancing the tubing after the formation of an article so as to bring it into position for the formation of another article. Means are also preferably included for detaching each article after its formation and for preliminary shaping the end of the glass tube for the formation of the next article. Although the object of their invention may be obtained in other ways, they prefer that the fusing means, the molding and other means be located at fixed points and that the glass tubing be carried from one means to another. This is preferably secured by providing means for rotating the holders upon

an axis external thereof and by making such rotation intermittent so that the glass tube may be successively brought into operative relation with each means in a predetermined sequence and allowed to remain in such relation for a predetermined interval until the desired step has been accomplished. As the continuous rotation of the glass tube during the various operations is desirable, they prefer to include means for securing this rotation.

Our invention will be more clearly understood by referring to the accompanying drawings, in which is shown a machine of the Hofstetter and Rippl type especially adapted for the manufacture of incandescent lamp bulbs and in which Fig. 1 is a perspective view of a bulb blowing machine embodying our invention; Fig. 2 is a diagrammatic top plan view of our improved machine showing the chuck opening means, the positions of the molds, heating means, etc.; Fig. 3 is a perspective view of the neck forming device used in connection with our improved machine; Fig. 4 is a plan view of the air valve and air valve operating means; Fig. 5 is a fragmentary elevation of our improved machine showing the air valve and operating means therefor and the bulb gauge and operating means therefor and the chuck opening means; Figs. 6 to 11 represent the various steps during the operation of the machine in the formation of the completed bulb from the lower end of the glass tube. Fig. 6 represents a completed bulb showing the preliminary cut-off fire and the annealing flame; in this view the chucks are about to be opened and the bulb will fall on the gauge below. Fig. 7 shows the bulb being cut off. Fig. 8 shows the glass tube being heated before entering the neck mold. Fig. 9 shows the neck-forming operation. Fig. 10 represents the glass tube being finally heated before entering the bulb mold. Fig. 11 represents the bulb mold during the blowing operation. Fig. 12 is a sectional view of the air valve and air valve operating means taken on the line 12—12 of Fig. 4.

The machine in the preferred form thereof shown in the drawing comprises a table 10 (Fig. 1) to which is attached the various means which form the bulb from the lower

end of the glass tubing and extending through the table is a tubular shaft 11 to which is fastened a disc 12 which carries the rotatable chucks 13. Each chuck carries
 5 a pinion meshing with a large toothed wheel which is partially encased in the disc 12 and is mounted on and driven by a hollow drive shaft. Extending upwardly from the disc 12 and carried above by a spider
 10 15 mechanically connected thereto are a number of sets of rods 16 which serve as guides for the glass tube holders and air receivers 17. Pipes 18, extend from the holders 17 and each has attached thereto a
 15 rubber hose 19 which fits into the glass tube 20 and holds it in position in alignment with the chuck 13 and also serves to deliver air to the glass tube. The disc 12 is rotated intermittently so as to cause each of the
 20 chucks and tube holding means to stop for a definite period with the depending glass tube in operative relation to one of a series of means each of which has a definite function in producing the bulb. The chucks are
 25 continuously rotated during the complete operation.

As shown in Figs. 1 and 2, these means correspond in number to the number of holders and are indicated in positions A to
 30 F and A' to F'. The position A (Fig. 6) is for preheating the tubing at the point of cut-off by means of a burner 21 and for annealing the completed bulb with a burner 22. Also in this position a gauge 23 (Fig.
 35 5) attached to the rod 24 is automatically raised into definite position beneath the completed bulb by the action of the cam 25 on the roller 26 pinned to the arm 27 which is connected to the rod 24 through the link
 40 28. The arm 27 is pinned at 29 to the support 30 carried by the bed 10 and by changing the pin to any other hole 31 in the arm 27 the amount of upward movement of the gauge 23 may be adjusted. The rod 24 is
 45 prevented from rotation by a pin 32 attached thereto by the arm 33 and loosely sliding in a slot 34 in the arm 27. The cam 25 is fastened to the shaft 35 which is carried in suitable bearings by the bed 10
 50 and the support 30 and which is driven through the gear 36 attached thereto and an intermediate gear 37, from the main power shaft (not shown). The chuck 13 is opened
 55 by the action of the cam 38 fastened to the shaft 35, on the roller 39 attached to one end of the arm 40 which is pivoted at 41 to the bed 10 and connected through the link 42 to the rod 43 having an arm 44
 60 in which is a bolt 45 which forces downwardly the handle 46 of the chuck 13 thereby causing the chuck to open permitting the glass tube 20 to fall until the bulb rests upon the gauge 23 as shown in dotted lines in Fig. 5. The rod 43 is returned upwardly
 65 by the action of the spring 47 which is at-

tached to the arm 40 and the bed 10. The bolt 45 has a nut 48 which locks it into position in the arm 44 of the rod 43 which permits an adjustment to be made in the amount of downward movement given to
 70 the handle 46. The chuck 13 is of the ordinary cone type and contains a spring, not shown, which closes the same and at the same time raises the handle 46.

At position B (Fig. 7) the completed bulb
 75 is cut off with a burner 51 and falls into a chute 51' (Fig. 1) which conveys it to a suitable container. At the same time, the tubing is preheated with a burner 52 to remove the chill.

The apparatus at position C (Fig. 8) comprises two burners 53 for intensively heating that portion of the tubing in which the neck is to be formed and a burner 54 directly beneath the tubing which heats the
 85 tubing to fuse and close the end thereof, the burner 51 in position B having partially fused and closed the end when cutting off the completed bulb.

In position D (Figs. 2, 3 and 9) is a neck-
 90 forming mechanism 55 which produces a neck portion 56 (Fig. 10) in the tubing. The forming mechanism consists of two similar members 57 which are pivoted at 58 to a standard 59 mounted on the bed 10.
 95 In one member 57 is a neck forming mold 60 and in each member 57 is mold 61 which steadies the tubing without decreasing its diameter. The mold 60 may be adjusted up and down in the slot 61'. The molds 61
 100 may be adjusted to different diameter tubing by means of the nut 62 which moves it into and out of the member 57 and is locked into position by the lock nut 63. The
 105 amount of closure of the two members 57 is determined by the position of the bolt 64 which screws into one member and is locked therein by the nut 65. The closure of the
 110 members 57 is effected through the action of a cam 66, which is fastened to the shaft 35 previously mentioned, upon one end of a lever 67 pivoted on a shaft 68 carried by the standards 69 which are mounted on the
 115 bed 10. The other end of the lever 67 is flexibly connected to the rod 70 through a spring 71 which is wrapped about the rod 70 and bears against a collar 72 on the rod 70 and against a block 73 on the lever 67
 120 which has an opening into which the rod 70 passes. The flexible connection tends to prevent the jamming of the members 57 which are connected to the rod 70 through the links 74. A spring 75 fastened to the front member 57 and to the standard 59
 125 acts to open the members 57 when the closing pressure exerted by the cam 66 through the mechanism described is removed. While the neck is being formed in the glass tubing, air under low pressure is preferably
 130 admitted thereto in a series of puffs.

The air is delivered to the glass tubing 20 through the rubber hose 19 and pipe 18 as previously described. The air is delivered to the pipe 18 through a nipple 76 (Figs. 1, 4, 5 and 12) and rubber hose 77 which is connected to a nipple 78, of which there is one for every holder 17, on the lower member 79 of the distributing valve 80. The member 79 is mounted on the central tubular shaft 11, previously described, so as to rotate therewith. For each nipple 78, there is an air passage 81 opening through the upper surface of the member 79. The upper member 82 of the distributing valve 80 is mounted to closely coincide with the lower member 79 on a tubular shaft 83 carried inside the tubular shaft 11 and separated therefrom by the bushing 84. A bushing 85 separates the shaft 83 from the tubular shaft 86 which passes through it. A source of air pressure is connected through rubber hose (not shown) to the upper ends of the pipes 87 which parallel the shaft 86 and are attached to the upper member 82 of the valve as shown in Figs. 5 and 12. An air passage 88 leads from each pipe 87 to the outside periphery of the upper member 82 and a passage 89 leading from the passage 88 opens on the under side of the member 82 so as to register at the appropriate time with the proper passage 81 leading to the tubing on which a neck is being formed in the mold at position D. A plate 90, which is pivoted by a pin 91 in a standard 92 fastened to the upper member 82, is positioned to close over the periphery opening or port 92' of the passage 88 but normally being held away from the port by the spring 93 carried in the base of the standard 92. A plate 94 also pivoted by the pin 91 in the standard 92 has a stiff spring finger 95 attached thereto and bearing on the plate 90 so as to force it over the port 92' of passage 88 when the projection 96 attached to the upper end of the plate 94 comes into engagement with the series of notches 97 on the plate 98 which is fastened to the disc 99 attached to the shaft 86 which is raised and lowered by the action of the cam 100 carried by the shaft 35, previously described, on a roller 101 carried by the arm 102 pinned at one end to the shaft 86 and adjustably pivoted at the other end in a standard 103 carried by the bed 10. When the mold members close about the end of the heated glass tubing, the plate 98 is caused to descend as just described bringing the notches 97 into engagement with the projection 96 of the plate 94 which in turn alternately causes the stiff spring finger 95 to force the plate 90 over the port to cause the full air pressure to be exerted on the tubing and then permits the pressure exerted by the spring finger 95 to be lessened so that the air escapes from the passage 88 into the

atmosphere. The admission of a series of air puffs causes the heated tubing to retain its shape while the neck is being formed and also to distribute the glass.

At position E (Fig. 10), the portion of the tubing which is to be formed into a bulb is intensively heated by the two pairs of burners 104 and 105.

Position F (Figs. 1, 2 and 11) is a bulb blowing position in which the mold members 106 and 107 are closed about the end of the tubing, the neck portion 56 of the tubing coinciding with the neck of the mold members 106 and 107 while air is delivered to the tubing as hereinafter described. The mold member 106 is connected to a sleeve 108 which is supported in a standard 109 carried on the bed 10 and to the lower end of the sleeve 108 is fastened an arm 110 which is connected through a link 111 with the crank 112 which is pivoted at 113 to the bed 10. On the other arm of the crank 112 is pinned a roller 114 which rides on the cam 115 fastened on shaft 35. A rod 116 which is carried inside the sleeve 108 and which has an arm 117 fastened to its lower end and connected at one end of the mold half 107 and at the other through the link 118 with the crank 112 just mentioned. A spring 110 is fastened to one arm of the crank 112 and to the bed 10 so as to hold the roller 114 against the cam 115. The cam 115 acts to separate the mold members at the proper time and the spring 119 is tend to keep the mold members closed.

The air is delivered to the glass tubing 20 through mechanism similar to that described in position D for delivering air while the neck is being formed. However, in blowing the bulb a larger air pressure is preferably used. The series of air puffs, produced as before, distributes the glass before the bulb is actually blown.

In operation, the glass tubing is preliminarily heated at the point of cut off and gauged in position A and at position B the bulb or tubing is cut off while a preliminary heat is given to that portion of the tube which is to later form the neck of a bulb. The cutting off operation partially closes the end of the tubing and in position C a burner completes the closure of the tube while an intensive heat is given the neck portion. At position D the neck is formed in a molding mechanism while a series of low pressure air puffs is admitted to the glass tubing through the air valve mechanism. In position E the lower end of the tubing is intensively heated and at the position F a bulb is blown on the end thereof in the molding mechanism described while a series of higher pressure air puffs is admitted to the tubing. The cycle of operations is then repeated for positions A' to F' and so on.

While we have described a specific apparatus various modifications will be apparent to those skilled in the art.

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

1. An air distributing device comprising a member having an inlet port connected to a source of air pressure, an outlet port and a relief port, a closure for said relief port pivotally mounted adjacent thereto, a notched member mounted adjacent to said closure and means for causing relative movement between said notched member and said closure to cause a swinging movement of the latter into and out of engagement with said relief port.

2. An air distributing device comprising two members movable relatively to each other one having an outlet port connected to a blowing mechanism and an inlet port and the other member having an outlet port adapted to register with the inlet port of the first mentioned member, an inlet port connected to a source of air pressure and a relief port, a closure for said relief port pivotally mounted adjacent thereto, a notched member mounted adjacent to said closure and means for causing relative movement between said notched member and said closure to cause a swinging movement of the latter into and out of engagement with said relief port.

3. An air distributing device comprising a lower rotatable member having an outlet port connected to a blowing mechanism and an inlet port and an upper stationary member having an outlet port adapted to register with said inlet port of the lower member during the rotation of the latter, an inlet port connected to a source of air pressure and a relief port, a closure for said relief port pivotally mounted on said upper member, a notched member mounted adjacent to said closure and means for automatically moving said notched member to cause the notches thereon to travel over a portion of said closure and to cause a swinging movement thereof into and out of engagement with said relief port.

4. An air distributing device comprising a lower rotatable member having an outlet port connected to a blowing mechanism and an inlet port and an upper stationary member having an outlet port adapted to register with said inlet port of said lower member during the rotation of the latter, an inlet port connected to a source of air pressure and a relief port, a closure for said relief port, and means brought into operation during the registry of the outlet port of the upper member and the inlet port of the lower member for alternately seating and unseating said closure.

5. An air distributing device comprising

a lower rotatable member having an outlet port connected to a blowing mechanism and an inlet port and an upper stationary member having an outlet port adapted to register with said inlet port of said lower member during the rotation of the latter, an inlet port connected to a source of air pressure and a relief port, a closure for said relief port, and reciprocating means brought into operation during the registry of the outlet port of the upper member and the inlet port of the lower member for alternately seating and unseating said closure.

6. A machine for automatically forming glass articles from tubes comprising a substantially vertically disposed guide mounted to revolve about a substantially vertical axis external thereof, a holder slidably supported on said guide and comprising means for receiving the upper end of a glass tube and having a passage therethrough to communicate with said tube, an air supplying means communicating with said passage, independently of said guide, means disposed in the path of revolution of the lower end of said tube to progressively form an article therefrom, means controlling said air supplying means to cause delivery of air pressure to said tube at a definite stage in the formation of said article, and means for causing said holder to be automatically lowered after the formation of each article.

7. A machine for automatically forming glass articles from tubes comprising a plurality of substantially vertically disposed guides mounted to revolve about a substantially vertical axis external thereof and each having a holder slidably supported thereon comprising means for receiving the upper end of a glass tube and having a passage therethrough to communicate with said tube, an air supplying means communicating with each of said passages, independently of said guide, means disposed in the path of revolution of the lower ends of said tubes to progressively form articles therefrom, means controlling said air supplying means to cause delivery of air pressure to said tubes at a definite stage in the formation of said articles and means for causing each of said holders to be automatically lowered after the formation of an article from the tube carried thereby.

8. A machine for automatically forming glass articles from tubes comprising a substantially vertically disposed guide, a holder slidably supported on said guide and comprising means for receiving the upper end of a glass tube and having a passage therethrough to communicate with said tube, an air supplying means communicating with said passage independently of said guide, a chuck mounted in alignment with said holder and adapted to engage said tube near its lower end, means for rotating said

chuck, means for forming a glass article from the lower portion of said tube, means controlling said air supplying means to cause delivery of air pressure to said tube at a definite stage in the formation of said article and means for automatically causing said chuck to be released to allow the lowering of said tube after the formation of each article.

10 9. A machine for automatically forming glass articles from tubes comprising a substantially vertically disposed guide rod, a holder slidably supported on said guide rod and comprising means for receiving the
15 upper end of a glass tube and having a passage therethrough to communicate with said tube, an air supplying means communicating with said passage, independently of said guide, means for forming a glass article
20 from the lower portion of said tube, means controlling said air supplying means to cause delivery of air pressure of said tube at a definite stage in the formation of said article, and means for causing said holder to
25 be automatically lowered after the formation of each article.

10. A machine for automatically forming glass articles from tubes comprising a substantially vertically disposed guide rod
30 mounted to revolve about a substantially vertical axis external thereof, a holder slidably supported on said guide rod and comprising means for receiving the upper end of a glass tube and having a passage there-
35 through to communicate with said tube, an air supplying means communicating with said passage, independently of said guide means disposed in the path of revolution of the lower end of said tube to progressively
40 form an article therefrom, means controlling said air supplying means to cause delivery of air pressure to said tube at a definite stage in the formation of said article, and means for causing said holder
45 to be automatically lowered after the formation of each article.

11. A machine for automatically forming glass articles from tubes comprising a substantially vertically disposed guide mounted
50 to revolve about a substantially vertical axis external thereof, a holder slidably supported on said guide and comprising means for receiving the upper end of a glass tube and having a passage therethrough to com-
55 municate with said tube, an air supplying means communicating with said passage, independently of said guide, a chuck substantially aligned with said holder and adapted to engage said tube near the lower end
60 thereof, means for rotating said chuck, means disposed in the path of revolution of the lower end of said tube to progressively form an article therefrom, means controlling said air supplying means to cause
65 delivery of air pressure to said tube at a

definite stage in the formation of said article and means for automatically causing the release of said chuck to cause said tube to be lowered after the formation of each article.

12. A machine for automatically forming glass articles from tubes comprising a plu-
rality of substantially vertically disposed guides mounted to revolve about a substan-
tially vertical axis external thereof and each
75 having a holder slidably supported thereon comprising means for receiving the upper end of a glass tube and having a passage therethrough to communicate with said tube, an air supplying means communicat-
80 ing with each of said passages, independently of said guides, chucks each substantially aligned with said holders for engaging said tubes near the lower ends thereof, means for rotating each of said chucks,
85 means disposed in the path of revolution of the lower ends of said tubes to progressively form articles therefrom, means controlling said air supplying means to cause delivery of air pressure to said tubes at a definite
90 stage in the formation of each of said articles and means for causing each of said chucks to be released to cause a lowering of a tube after the formation of an article therefrom.

13. In a machine for forming bulbs from glass tubing, the combination of a holder for receiving an end of a section of tubing, means disposed so as to operate on the op-
posite end of said tubing section to fuse the
100 same and means connected to said holder for supplying air to said tubing section in a series of puffs of predetermined duration.

14. In a machine for forming bulbs from glass tubing, the combination of a support
105 having mounted thereon a series of holders each adapted to receive an end of a section of glass tubing, means adapted to operate upon the opposite ends of said tubing sections to fuse the same, and means connected
110 to said holders for supplying air to said tubing sections at predetermined intervals in a series of puffs of predetermined duration.

15. In a machine for forming bulbs from glass tubing, the combination of a movable
115 support having mounted thereon a series of holders each adapted to receive an end of a section of glass tubing, means disposed in their path of movement to successively operate upon the opposite ends of said tubing
120 sections to fuse the same, and means connected to said holders for supplying air to said tubing sections at predetermined intervals in a series of puffs of predetermined
125 duration.

16. In a machine for forming articles from glass tubing, the combination of a substantially vertically disposed guide, a support for said guide mounted for rotation
130 about a substantially vertical axis, a holder

slidably mounted on and externally of said guide comprising means for receiving the upper end of a glass tube and having a passage therein adapted to communicate with said tube, an air distributing means mounted at the axis of rotation of the aforesaid support and directly connected with said holder, means disposed adjacent to the path of travel of the lower end of said tube to heat and shape the same, means for rotating said support and means for causing air to be delivered by said air distributing means to said holder during the shaping operation.

17. In a machine for forming articles from glass tubing, the combination of a plurality of substantially vertically disposed guides, a support for said guides mounted for rotation about a substantially vertical axis, holders each slidably mounted on and externally of one of said guides and comprising means for receiving the upper end of a glass tube and having a passage therein adapted to communicate with said tube, an air distributing means mounted at the axis of rotation of the aforesaid support and directly connected with each of said holders, means disposed adjacent to the path of travel of the lower ends of said tubes to heat and shape the same, means for rotating said support and means for causing air to be delivered by said air distributing means to each of said holders successively.

18. In a machine for forming articles from glass tubing, the combination of a substantially vertical guide rod, a holder slidably mounted thereon externally thereof comprising means for receiving an end of a glass tube and having a passage therein adapted to communicate with said tube, means for retaining said holder successively at various levels and means for delivering directly air to said holder at predetermined intervals.

19. In a machine for forming articles from glass tubing, the combination of a substantially vertical guide rod, a holder slidably mounted thereon externally thereof comprising means for receiving an end of a glass tube and having a passage therein adapted to communicate with said tube, a chuck mounted so that said tube extends through and is gripped thereby, means for

releasing and closing said chuck at predetermined intervals so that the glass tube is maintained successively at various levels, and means for delivering directly air to said holder at predetermined intervals.

20. In a machine for forming articles from glass tubing, the combination of a series of holders mounted about a substantially vertical axis and each comprising means for receiving a glass tube and having a passage therein adapted to communicate with said tube, an air distributing valve located at the aforesaid axis and above the level of the lower ends of said tubes, direct connections between said valve and said holders, means for rotating said holders and means in timed relation therewith for actuating said valve to supply air successively to said tubes.

21. In a machine for reshaping glass tubing, the combination of a holder for receiving an end of section of tubing, means disposed so as to operate on the opposite end of said tubing section to fuse the same and means connected to said holder for supplying air to said tubing section in a series of puffs of predetermined duration.

22. In a machine for reshaping glass tubing, the combination of a support having mounted thereon a series of holders each adapted to receive an end of a section of glass tubing, means adapted to operate upon the opposite ends of said tubing sections to fuse the same, and means connected to said holders for supplying air to said tubing sections at predetermined intervals in a series of puffs of predetermined duration.

23. In a machine for reshaping glass tubing, the combination of a movable support having mounted thereon a series of holders each adapted to receive an end of a section of glass tubing, means disposed in their path of movement to successively operate upon the opposite ends of said tubing sections to fuse the same, and means connected to said holders for supplying air to said tubing sections at predetermined intervals in a series of puffs of predetermined duration.

In witness whereof, we have hereunto set our hands this 23rd day of February, 1920.

HARVEY E. QUACKENBUSH.
CLEVELAND H. QUACKENBUSH.