Dec. 11, 1928. 1,694,486

C. R. NIXON

GLASS BLOWING MACHINE

Filed June 14, 1927 10 Sheets-Sheet 1

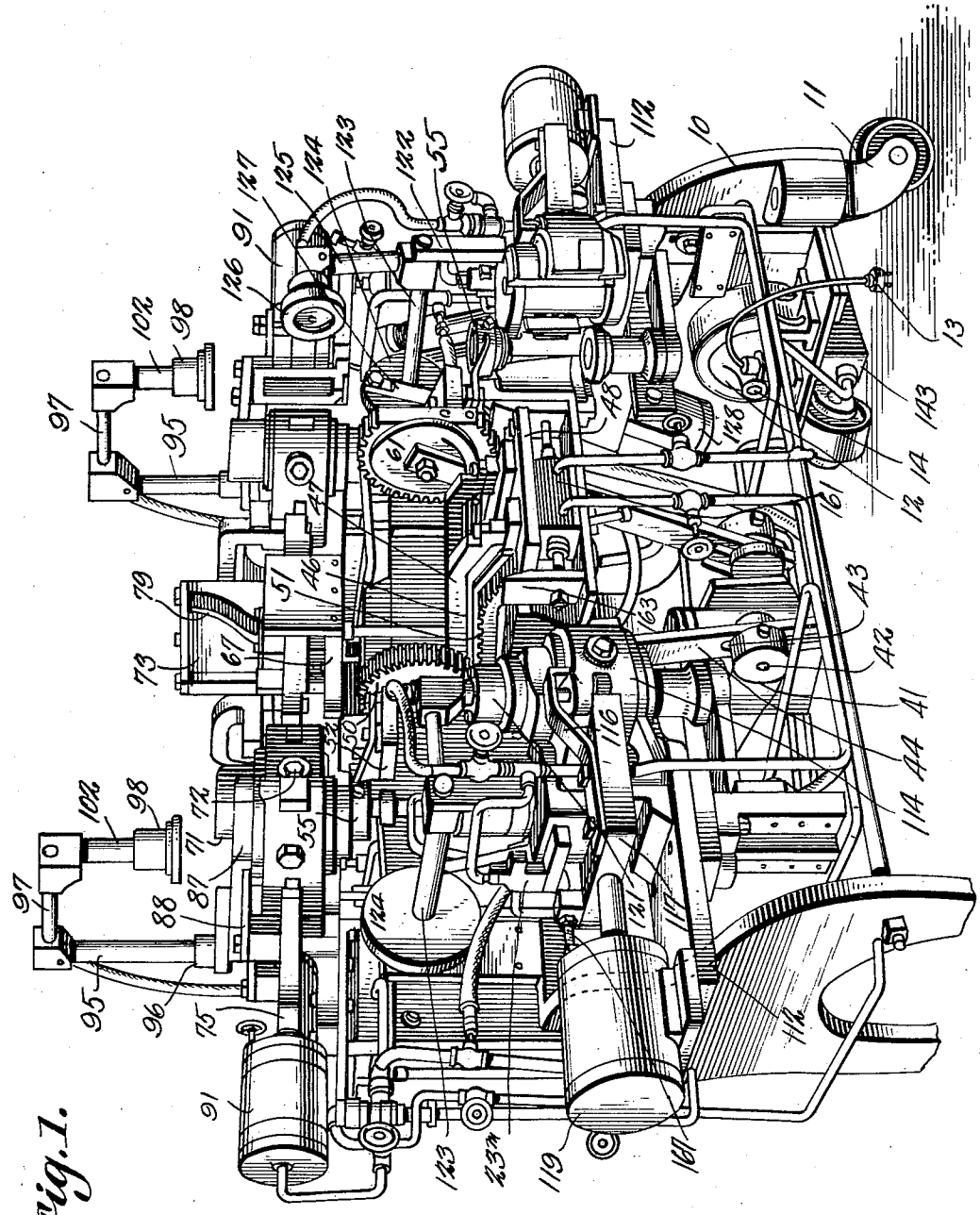


Fig. 1.

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Dec. 11, 1928.

1,694,486

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GLASS BLOWING MACHINE

Filed June 14, 1927

10 Sheets-Sheet 2

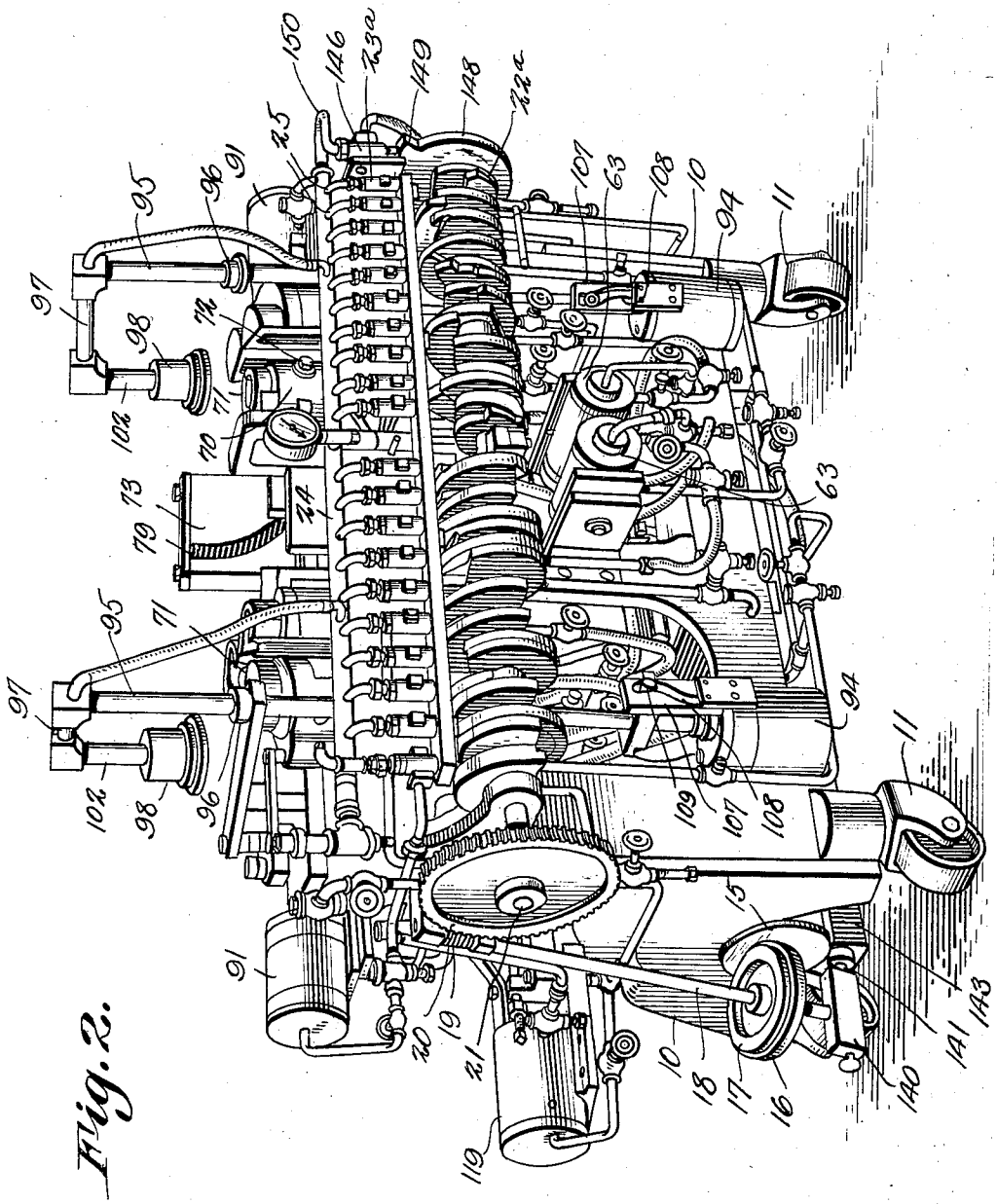


Fig. 2.

Inventor

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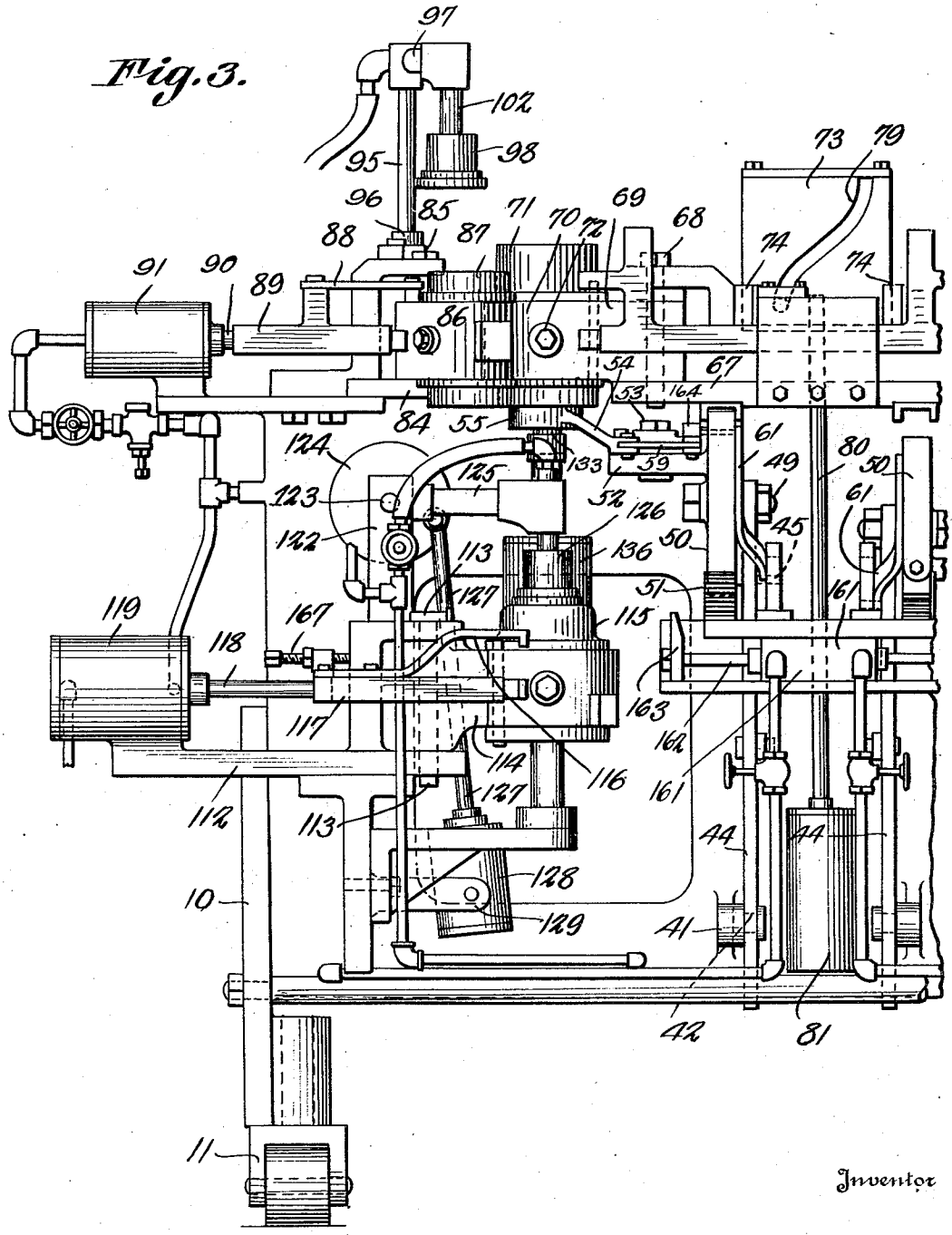
Dec. 11, 1928. 1,694,486

C. R. NIXON

GLASS BLOWING MACHINE

Filed June 14, 1927 10 Sheets-Sheet 3

Fig. 3.



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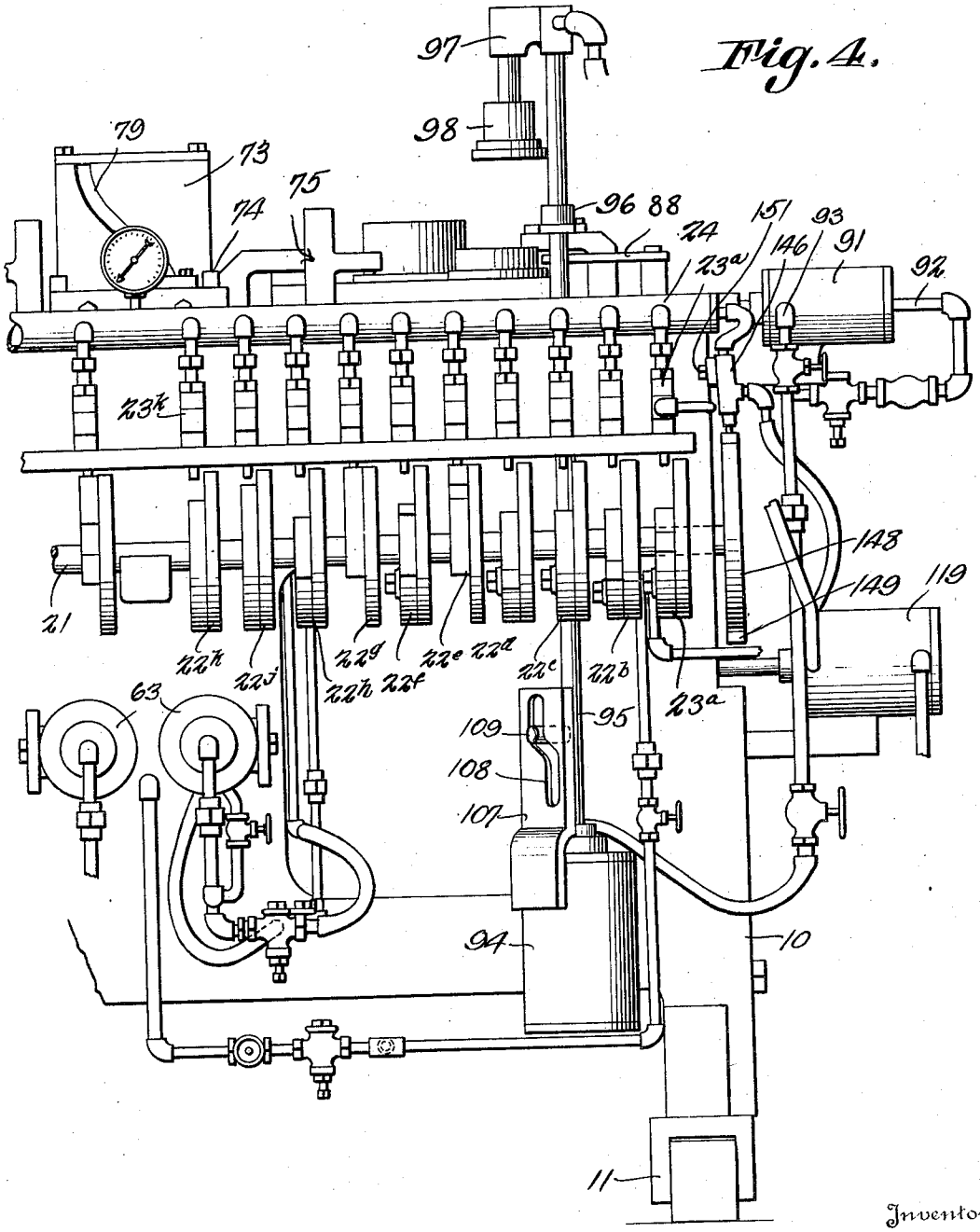
Dec. 11, 1928. 1,694,486

C. R. NIXON

GLASS BLOWING MACHINE

Filed June 14, 1927 10 Sheets-Sheet 4

Fig. 4.



Inventor

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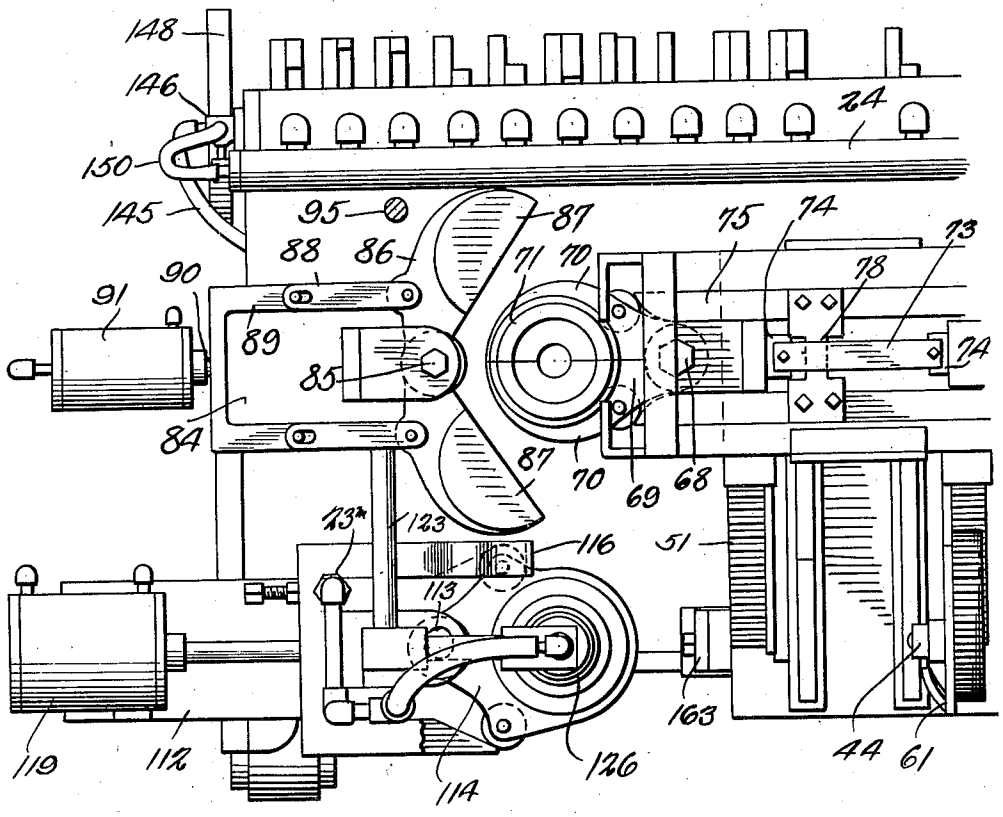
Dec. 11, 1928. 1,694,486

C. R. NIXON

GLASS BLOWING MACHINE

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Fig. 5.



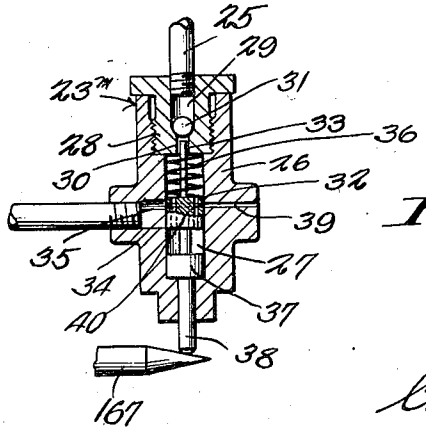


Fig. 11.

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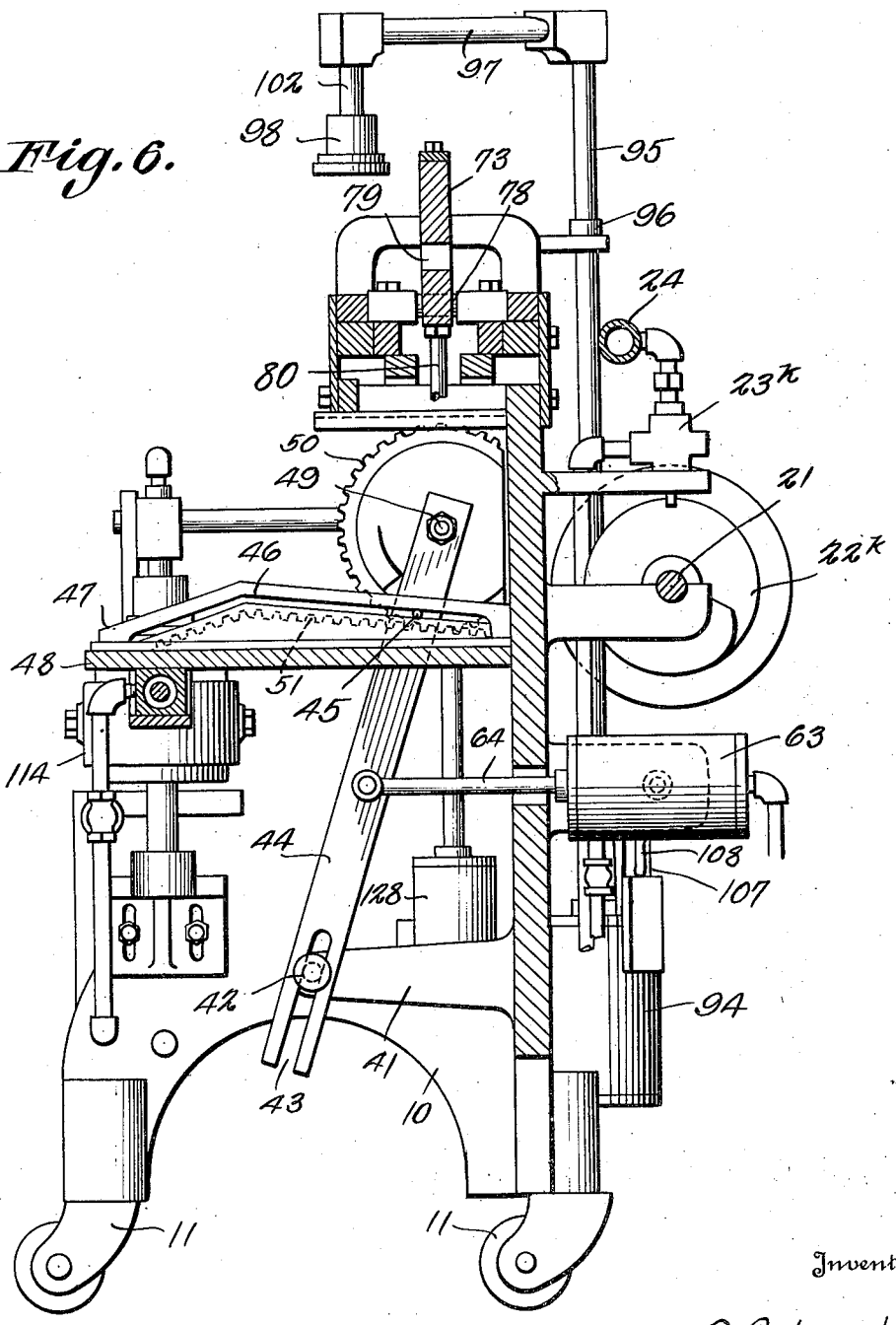
Dec. 11, 1928. 1,694,486

C. R. NIXON

GLASS BLOWING MACHINE

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Fig. 6.



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Dec. 11, 1928. 1,694,486

C. R. NIXON

GLASS BLOWING MACHINE

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Fig. 7.

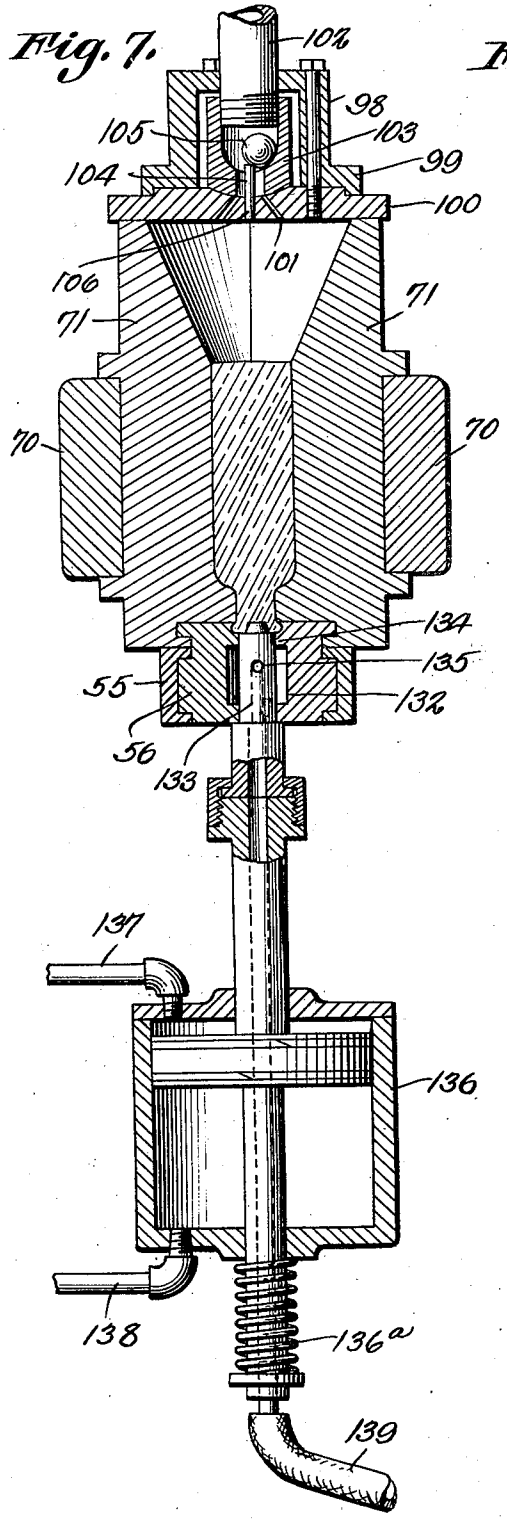


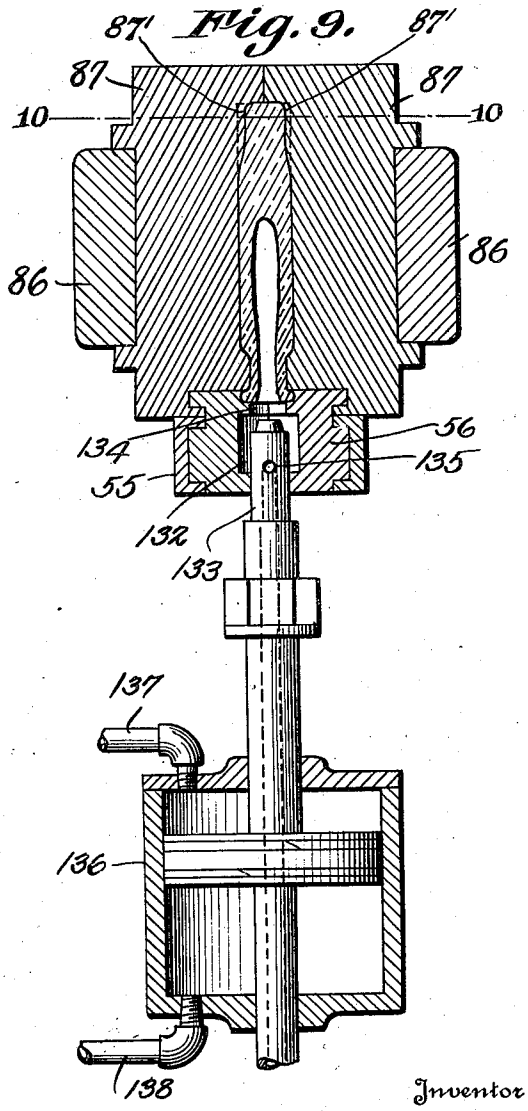
Fig. 8.



Fig. 10.



Fig. 9.



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Dec. 11, 1928. 1,694,486

C. R. NIXON

GLASS BLOWING MACHINE

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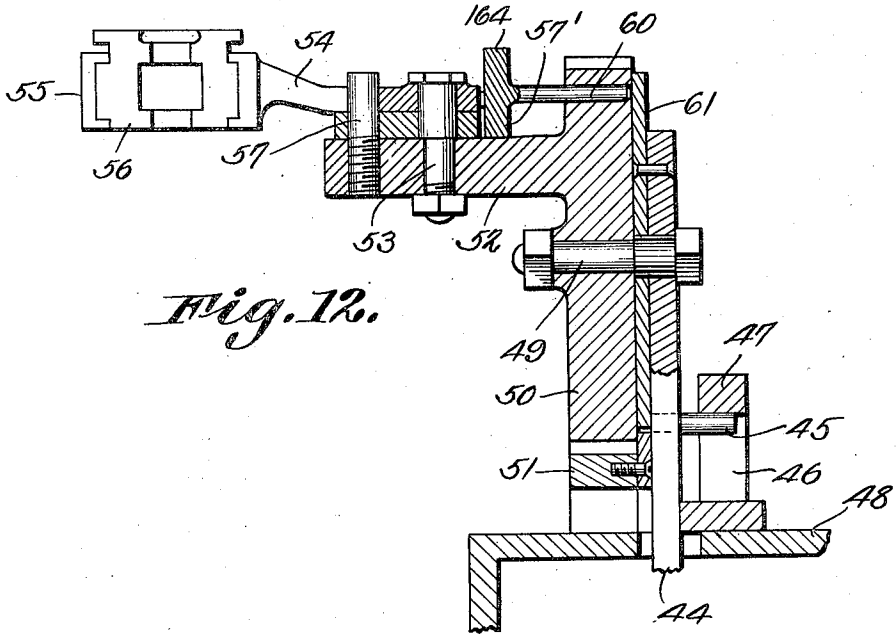


Fig. 12.

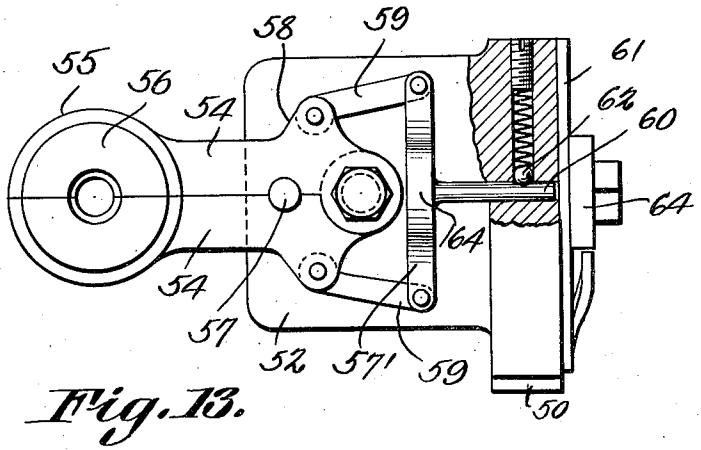


Fig. 13.

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Dec. 11, 1928. 1,694,486

C. R. NIXON

GLASS BLOWING MACHINE

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Fig. 14.

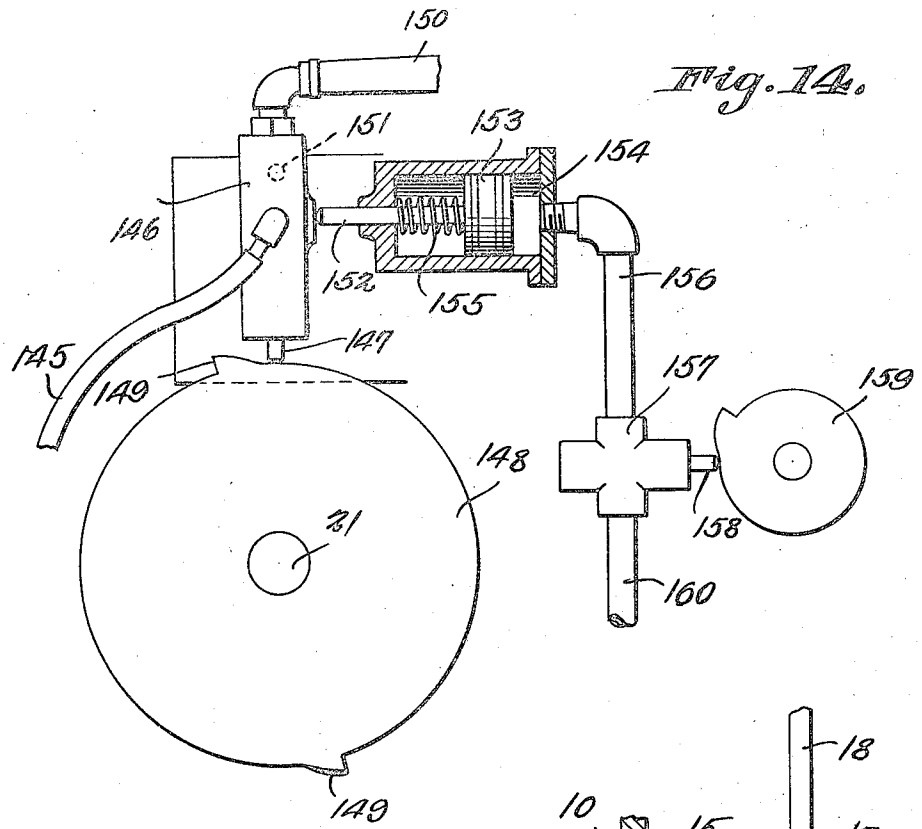
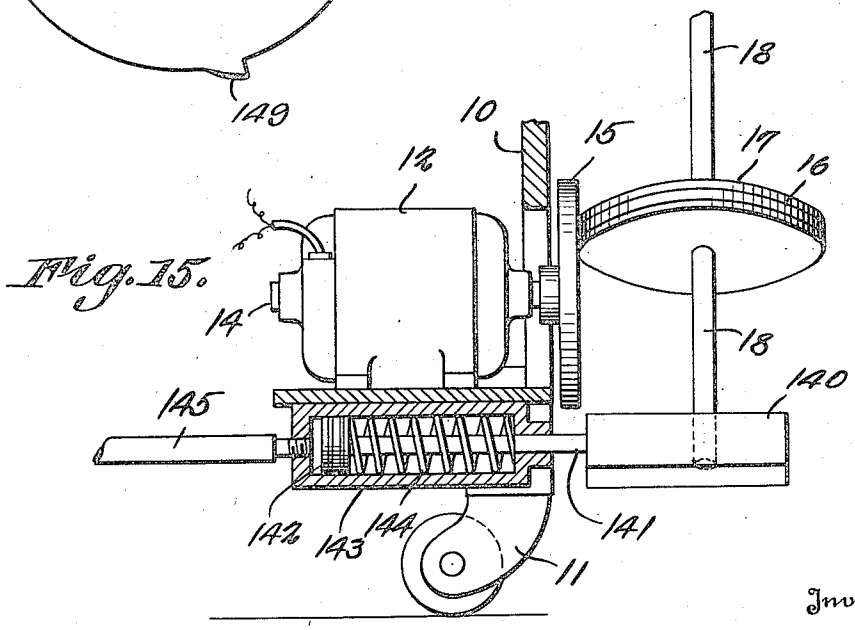


Fig. 15.



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Dec. 11, 1928. 1,694,486

C. R. NIXON

GLASS BLOWING MACHINE

Filed June 14, 1927 10 Sheets-Sheet 10

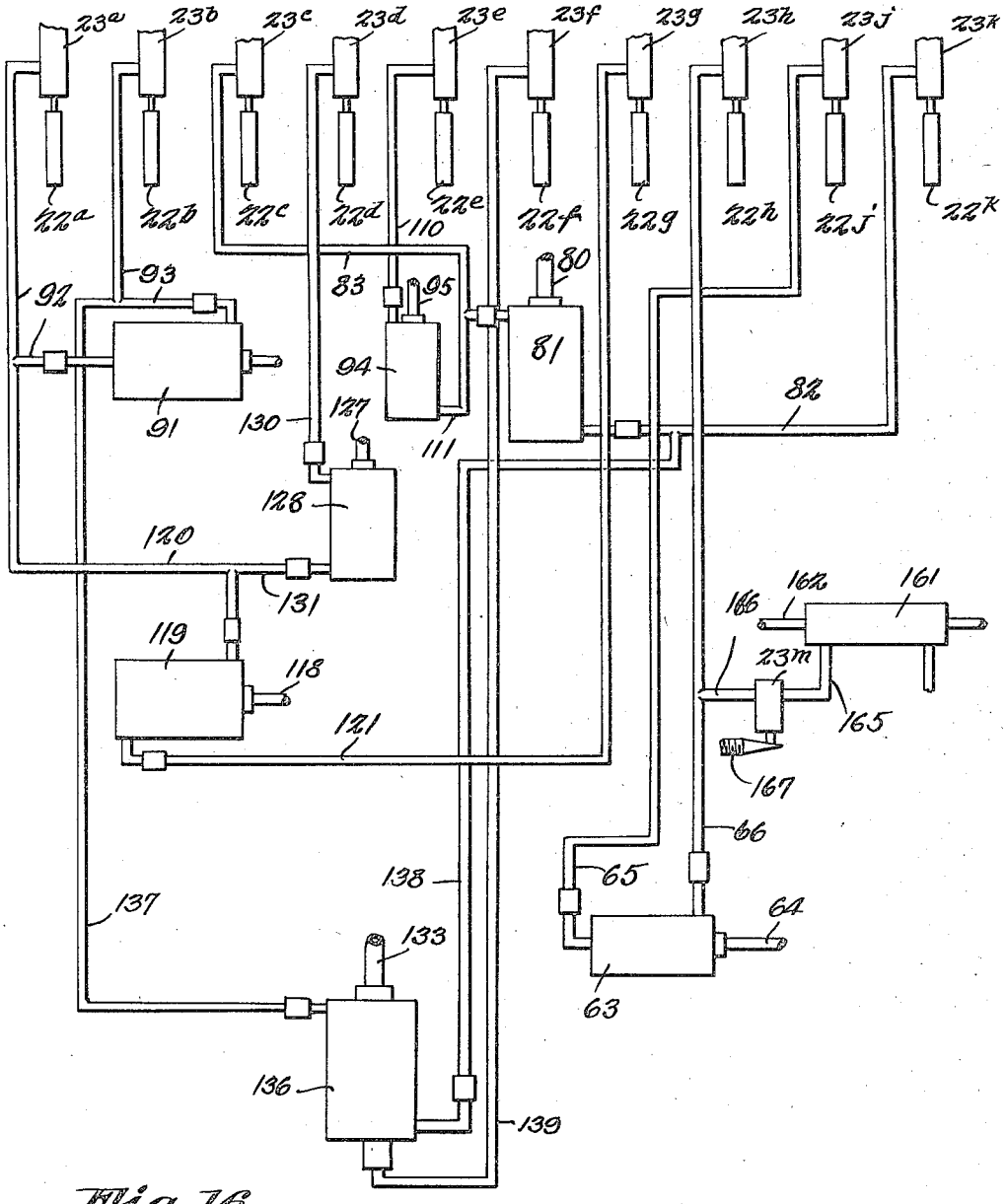


Fig. 16.

Inventor

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Patented Dec. 11, 1928. 1,694,486

UNITED STATES PATENT OFFICE.

CLARENCE R. NIXON, OF BALTIMORE, MARYLAND, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO BALTIMORE BOTTLE MACHINE CORPORATION, OF BALTIMORE, MARYLAND, A CORPORATION OF MARYLAND.

GLASS-BLOWING MACHINE.

Application filed June 14, 1927. Serial No. 198,773.

This invention relates to glass blowing machines and has special reference to a glass blowing machine for blowing bottles, vials, jars and other like hollow glass articles.

One important object of the invention is to improve the general construction of machines of this character.

A second important object of the invention is to provide an improved machine of this character which will be entirely automatic in its operation from the time the mass of glass to form the bottle or other article is received in the machine to the time the finished article is ready for delivery.

A third important object of the invention is to provide an improved machine of this character wherein the article being blown will be held throughout the first stage of the blowing operation on a suitable support or neck ring in a fixed position and then carried by the neck ring to the final blowing position.

A fourth important object of the invention is the provision of an improved machine of this character wherein the arrangement of parts and their action is such as to entirely eliminate all tendency to distortion of the plastic glass mass by movement thereof rapidly from one place to another as is done in the usual bottle blowing machines, such machines commonly having a number of blowing positions between which the article being blown is rapidly moved and stopped for the successive blowing steps, the motion being lateral first tending to flatten the plastic mass as the motion starts in a direction opposite the motion and then, as the motion stops, tending to flatten the mass in the direction of the motion thereby frequently causing thick and thin spots in the walls of the mass and other distortions.

A fifth important object of the invention is to provide an improved machine of this character wherein the primary steps in the formation of the article are performed at the same place and without any bodily transportation of the partly formed article from one position to another.

A sixth important object of the invention is to provide an improved machine of this class wherein such steps in the blowing as are necessary to establish the final thicknesses of the article walls will be performed without moving the article bodily, the article only being moved for final blowing after the establishment of such thicknesses.

With the above and other objects in view as will be hereinafter apparent, the invention consists in general of certain novel details of construction and combinations of parts hereinafter fully described, illustrated in the accompanying drawings and specifically claimed.

In the accompanying drawings like characters of reference indicate like parts in the several views, and:

Figure 1 is a perspective view showing the front and left hand end of a double machine of this character.

Figure 2 is a perspective view showing the rear and right hand end of such machine.

Figure 3 is a front elevation of the left hand half of the machine, it being understood that the right hand half is symmetric thereto.

Figure 4 is a rear elevation of the part shown in Figure 3.

Figure 5 is a plan view of the part shown in Figure 3.

Figure 6 is a section on the line 6—6 of Figure 3.

Figure 7 is a vertical sectional view through the primary mold and showing the first step in the formation of a bottle in this machine.

Figure 8 is a cross-sectional view through the mass of glass shown in Figure 7.

Figure 9 is a view similar to Figure 7 showing the secondary mold positioned on the article and the second step in the blowing thereof.

Figure 10 is a cross-section showing the shape of the article as held in the mold in Figure 9, the section being on the line 10—10 of Figure 9.

Figure 11 is a detail section through a certain control valve used in a number of places in this machine.

Figure 12 is a vertical section through the neck ring support and showing a portion of the mechanism used to open and close the neck ring together with one section of the ring.

Figure 13 is a plan view partly in section of the neck ring and its support.

Figure 14 is a detail view showing certain

elements used for obtaining correct timing of the operation of certain parts of the machine.

Figure 15 is a detail view of certain other elements used in connection with Figure 14.

Figure 16 is a diagrammatic view of the cylinders, valves, cams and pipe connections used in the operation of the machine.

In the embodiment of the invention herein illustrated the machine has been shown as a double machine. That is to say there are assembled on the single frame two sets of molds and parts associated therewith, these sets being arranged symmetrically on opposite sides of the center of the machine. In connection with this double machine certain parts are not duplicated. It will be understood, for instance, that a single motor may be used to drive both sets of parts and that this motor may have a single connection with certain other parts. Also, it is obvious that such things as air pressure gauges and the like need not be duplicated. Accordingly, while the machine is shown in Figures 1 and 2 as a double machine it will be necessary, in order to understand the operation, to describe merely one half of the machine since the other half operates in like manner.

In this machine there is provided a frame 10 preferably mounted on casters 11 so that it may be rolled into position beneath a suitable supply of glass for molding purposes. Carried by the frame 10 is a motor 12 having the usual socket connection 13 by means of which it may be connected to any suitable source of electric power. The shaft 14 of this motor extends beyond the end wall of the frame 10 and there supports a friction disk 15 which engages a friction band 16 mounted on the periphery of a friction wheel 17 carried by a shaft 18. On this shaft 18 is a worm 19 which meshes with a worm 20 fixed upon a shaft 21 whereon is mounted, for each unit of the machine, a series of ten cams 22 which are distinguished by affixing to the character 22 the first eleven letters of the alphabet with the exception of i. These cams control valves 23 similarly distinguished from each other to the cams 22 by affixing corresponding letters of the alphabet. All of these valves are supplied with air from a suitable air supply pipe 24 having branches 25 connected to the intake ends of the valves. The construction of each of these valves is identical and is the same as the construction of the valve shown in Fig. 11, although this particular valve has a different means of opening and is not located above the cam shaft as are the remainder of the valves 23. It will also be noted that this valve has been indicated by the special designation 23^m. Each of these valves consists of a body 26 having a centrally disposed bore 27 provided with an enlarged and internally threaded upper end wherein is screwed a plug 28 to which is connected the respective inlet branch 25. This branch 25 leads to a chamber 29 having a small opening 30 in its lower end which communicates with the bore 27 and in the chamber 29 is located a ball valve 31 which normally seats on the bottom of the chamber so as to close the port 30. Within the bore 27 is mounted a piston 32 and on the upper end of this piston is a pin 33 of less diameter than the port 30 and projecting into that port so that when the piston 32 is raised the ball 31 will be lifted off its seat and air can flow through the pipe 25, chamber 29, and port 30 into the upper part of the bore 27. The piston 32 is provided with a series of ports 34 so that air from the upper part of the bore can pass into the lower part, when the piston is raised, and may thus pass through an outlet 35 to one of a series of pipes which will hereinafter be described. Normally the piston is held in its depressed position by a spring 36 and is prevented from too great movement downward by a collar 37 engageable on the bottom of the bore 27 and fixed on a pin or stem 38 which projects through the bottom of the body 26 so as to be engaged by the respective cam 22. Furthermore, opposite the port 35 there is provided a bleeder port 39 and extending around the piston is a groove 40 which registers with the port 39 when the piston is fully depressed but which shuts this port off when the piston is raised. Moreover, when the piston is depressed the port 35 is cut off except for communication with the port 39. By means of this arrangement the air under pressure in the apparatus attached to the outlet pipe is exhausted upon closing of the respective valve. It is to be noted that the various cams 22 are set so as to open the valves 23 at proper spaced intervals to ensure effective working of the machine.

On the back of the frame 10 and at the lower part thereof there is provided a forwardly projecting bracket 41 whereon is mounted a pivot pin 42 which is received in a slot 43 in the lower end of a rock arm 44 and adjacent the upper part of this rock arm the arm is provided with a pin 45 which projects into a cam slot 46 formed in a rack member 47 supported on a bracket 48. The upper end of the arm 44 carries a horizontal stub shaft 49 whereon is mounted a gear 50 which meshes with a cam rack 51 formed on the cam member 47. Projecting laterally from the gear 50 is a bracket 52 which supports a vertical stub shaft 53 whereon is pivoted a pair of arms 54, each of which carries at its free end a head 55 wherein is seated one half of a sectional neck mold and slug support 56, these molds being thus adapted for removal and replacement so that different styles and sizes of necks and slug may be handled by the one apparatus. The arms 54 are arranged to close on a positioning pin 57 so that whenever the mold is closed it is held in

a definite position with respect to the gear 50. In order to open and close the neck mold and slug support each of the arms 54 is provided with a lateral projection 58 which is connected by a pivoted link 59 with the respective end of a yoke 57′ located between the shaft 53 and gear 50 and positioned to slide on the upper surface of the bracket 52. This yoke is provided with a stem 60 which projects through a suitable opening in the gear to engage a cam plate 61 fixed to the upper end of the arm 44. A ball ratchet 62 of the usual type serves to releasably lock the yoke in its forward position. Mounted on the frame 10 is a horizontal cylinder 63 provided with an ordinary piston carrying a rod 64 which connects with the arm 44 so that, as the piston moves forwardly the arm 44 will likewise be rocked forwardly and as the piston moves in the opposite direction the arm 44 will be rocked backwardly. The cylinder 63 is preferably termed a gear operating cylinder and has its rear end connected by a pipe 65 with the valve 23^j operated by the cam 22^j. Similarly the front end of the cylinder 63 is connected by a pipe 66 with the valve 23^h operated by the cam 22^h. Thus when one of these cams opens its valve the other will permit the valve to remain closed so that the piston in the cylinder 63 is pushed forward or rearward as the case may be. At the upper part of the frame there is supported a bracket 67 which carries a vertical pivot shaft or pin 68 whereon is pivoted a pair of arms 69 having heads 70 which carry the primary or receiving mold halves 71, these being held in the heads 70 by suitable bolts 72. At 73 is a cam plate which is mounted for vertical sliding movement in guides 74 and is connected to the arms 69 by a sliding yoke 75 having a bar 78 engaging the groove 79 of the plate 73. This groove is so arranged and proportioned that upon the plate 73 being depressed the mold halves will open and upon the plate being raised the mold halves will close. The pate 73 is carried on the piston rod 80 of a cyinder 81 which has one end connected by a pipe 82 with the valve 23^k actuated by the cam 22^k. The upper end of this cylinder is connected by a pipe 83 with the valve 23^c actuated by the cam 22^c. Thus when the cam 22^c opens its valve the plate is depressed and the mold halves opened while. when the valve 23^k is opened the plate is raised and the mold halves closed. Also there is provided a bracket 84 carrying a pivot shaft 85 whereon is pivoted a pair of arms 86 carrying mold halves 87 which forms the secondary mold when closed. this secondary mold being closed at the top as best seen in Figure 5. It will be observed that the closing of the bottom of this blank forming mold enables the bottle to be blown without any marks such as are usual with independent bottom mold closures. Furthermore the sides of the mold are provided with inset portions or bosses 87′ so that the glass being formed will be urged away from these sides and thus enable a bottle to be made of uniform thickness throughout and without the usual bulge found in machine blown bottles. The arms 86 are connected by links 88 with a yoke 89 carried by the piston rod 90 of a cylinder 91 having one end connected by a pipe 92 with the valve 23^a, the other end being connected by a pipe 93 with the valve 23^b. This arrangement is such that when the valve 23^a is opened the secondary mold is closed and when the valve 23^b is opened the secondary mold is opened. It will be noted from Figures 3 and 5 that both the primary or slug receiving mold and the secondary or forming mold close on the combined neck mold and slug support when closed. In other words, both of these molds close on the same station. Secured to the frame is a cylinder 94 which has a long piston rod 95 extending up through a suitable guide 96 at the top of the machine and the upper end of this rod carries an arm 97 from which depends a blow head 98. This blow head is best seen in Figure 3 and is provided with a casing 99 closed at its bottom by a plate 100 having a series of air ports 101. The supply pipe 102 by which the head is connected to the arm carries on its lower end a valve casing 103 which seats securely on the plate 100 and is provided with a port 104 which communicates with the ports 101. The valve casing 103 has a slight vertical movement in the casing 99 and in the chamber of this valve casing is a ball valve 105 which, when the valve casing is depressed, is engaged by a pin 106 carried by the closure plate 100 so that the ball is lifted off its seat and air can flow from the pipe 102 through the ports 101. However, when the blow head is lifted the ball 105 drops backward on to its seat and the supply of air through the ports 101 is cut off. This blow head is intended to seat on top of the slug receiving mold but is normally out of alinement with this slug receiving mold. However, the cylinder 94 carries a cam plate 107 having a cam groove or slot 108 wherein moves a pin 109 projecting laterally from the rod 95. Thus when the head is drawn down it not only moves downwardly but, through the middle part of its movement, it swings laterally into alinement over the mold. The cylinder 94 has its upper end connected by a pipe 110 with the valve 23^e while its lower end is connected by a pipe 111 with the pipe 83 and thus with the valve 23^c. Accordingly, as the valve 23^c is opened the blow head will be raised and simultaneously the plate 73 will be lowered, the groove or slot 79 in that plate being so shaped that the raising of the blow head will slightly precede the opening of the mold.

Below and to the rear of the molds just

mentioned there is provided a bracket 112 carrying a vertical pivot shaft 113 whereon is pivoted a pair of arms 114 carrying finishing mold halves 115 and these arms are connected by links 116 with a yoke 117 carried by a piston rod 118 operated by a cylinder 119. This cylinder 119 has the end adjacent the mold connected by a pipe 120 with the pipe 92 and thus with the valve 23^a. The other end of this cylinder is connected by a pipe 121 with the valve 23^g. Also the bracket 112 supports a vertical arm 122 carrying a horizontal shaft 123 whereon is a crank disk 124 from which extends an arm 125 supporting the finishing blow head 126, the construction of which is identical with the blow head previously described. Normally this blow head 126 is held raised so as to leave the top of the finishing mold clear but the crank disk 124 has a piston rod 127 connected thereto and this rod is actuated by a cylinder 128 pivotally mounted on a bracket 129. The cylinder 128 has its upper end connected by a pipe 130 with the valve 23^d. The lower end of this cylinder is connected by a pipe 131 with the pipe 120.

It will be noted that the mold halves 56 are cored from top to bottom so that when closed there is provided a chamber 132 into which extends a plunger 133 which closely fits in the top part of the opening through these mold halves when raised and when depressed leaves this top part open, as shown in Figure 5, to form a port 134. This plunger is hollow to form an air passage and at its upper end, within the chamber 132, is provided with a port 135. Moreover, the plunger 133 forms the piston rod for a cylinder 136 which has its upper end connected by a pipe 137 with the pipe 93 and also has its lower end connected by a pipe 138 with the pipe 82. Furthermore, the lower end of the plunger itself is connected by a pipe 139 with the valve 23^f.

The lower end of the shaft 18 is swingingly journaled in a block or bearing 140 which is carried by a piston rod 141 provided with a head 142 working in a cylinder 143. This rod is normally held in retracted position by a spring 144 and when in such position the friction wheel and disk are pressed together so that the machine is driven. However, the cylinder 143 is provided with an air supply pipe 145 leading to a valve 146, see Figure 14. This valve is of the ordinary poppet type and has a stem 147 which engages a cam 148 having, for the purpose of this double machine, a pair of diametrically disposed teeth 149 alternately engaging the valve stem 147. This valve 146 is connected by a pipe 150 with the main supply and is of the same type as the remaining valves. Moreover, the valve is swingingly supported on a pivot 151 and is engaged by the rod 152 of a piston 153 moving in a cylinder 154 and normally urged away from the valve 146 by a spring 155. The cylinder 154 is supplied with air from a pipe 156, this supply being controlled by a valve 157 having a stem 158 engaged by a single toothed cam 159. The valve 157 is supplied with air through a pipe 160. The arrangement of these parts is such that lifting of the valve stem 147 by a tooth 149 opens the valve 146 to supply air to the cylinder 143 and separate the friction wheel and disk so that the machine is momentarily stopped until the cam 159 is rotated sufficiently to admit air through the valve 157 whereupon the rod 152 pushes the valve 146 to the left in Figure 14, it having been resting on the tooth 149 during the stoppage of the machine, and thereby allows the valve 146 to close and exhaust the air from the cylinder 143 so that the friction wheel again engages the disk.

In order to open the neck ring and slug support there is provided centrally of the machine a cylinder 161 having a piston rod 162 which carries on each end a trip member 163 so positioned as to engage the lug 164, see Figure 12, projecting from the cross head 57 when the gear 50 has been rolled to invert the neck ring. In order to effect movement of this trip 163 the cylinder 161 has a pipe 165 leading from each end and each of these pipes communicates with a valve 23^m which is in turn connected to the pipe 66 by a pipe 166. Mounted on the cross head 117 is an adjustable pin 167 having a tapered point which engages the stem of the valve 23^m and upon retraction of the cross head opens the valve 23^m so that air is admitted to the appropriate end of the cylinder 161, the trip member 163 is moved and this pulls on the lug 164 thus opening the neck ring.

In general operation of the device it is to be understood that the primary mold, shown in Figure 3, is closed at the starting of the operation and that the blow head is moved up and away from this primary mold. By suitable means, not deemed necessary to be shown, a slug of glass is deposited in this primary or receiving mold. At the same time the plunger 133 is raised as shown in Figure 3. Now the cams are so fixed on the cam shaft that as the motor starts the first thing that happens is that the valve 23^e is opened which delivers air to the top of the cylinder 94 moving the first blow head downward to the position shown in Figure 3 and thus supplying air to the top of the primary mold and forcing the slug into a solid mass in the bottom of the mold as shown. As the cam shaft revolves the valve 23^c opens the air line to the bottom of the cylinder 94 and lifts off the blow head also permitting air to flow to the top of cylinder 81 to open the primary mold. Valve 23^k which has held air pressure in the bottom of cylinder 81 and also in the bottom of cylinder 136 at this time releases and the spring 136^a moves the plunger 133 downwardly. Valve

23^a opens in proper time relation with the valve 23^c and admits air to the cylinder 91 to close the second or shaping mold which molds the article being blown to the general form of the finished article, air from the port 135 starting the cavity therein. At the same time air also is admitted to cylinders 119 and 128 so that the finishing mold is opened and the second blow head is raised. Next the valve 23^f opens which serves to permit blowing of the slug to fill the secondary or blank shaping mold. The valve 23^b comes into action to permit air to flow to cylinder 91 to open the secondary mold and also to permit air to flow to the upper part of cylinder 136 which pulls the neck forming plunger out of the neck ring. At this stage the blank bottle is supported solely by its neck in the neck ring, standing up therefrom. Next the valve 23^j is opened which operates the neck ring reversing gear and the neck ring is swung rearwardly and at the same time turned over, the cam rack serving to lift it slightly just before it comes into position on the final or finishing mold. Valve 23^g now admits air to cylinder 119 closing the finishing mold. At this time the pin 167 operates to release the neck ring so that this is out of the way when the blow head comes down on the finishing mold which takes place when the valve 23^h opens, this valve also returning the neck ring by actuating the gear operating cylinder but it is to be noted that what really happens here is that air is held in the rear of cylinder 63 from valve 23^j until the proper time for the gear of the neck ring to return to its normal position and is then cut off, pressure from valve 23^h having been established in the front of the cylinder 63 so that the instant the tapered pin 167 operates the neck is tripped and returned. Valve 23^d now opens and places the lower blow head in position by admitting air to the cylinder 128 and at this time valve 23^k opens to close the primary mold and move the plunger 133 upwardly to the position in Figure 3 ready to blow a second article.

There has thus been provided a simple and efficient device of the kind described and for the purpose specified.

It is obvious that minor changes may be made in the form and construction of the invention without departing from the material spirit thereof. It is not, therefore, desired to confine the invention to the exact form herein shown and described, but it is desired to include all such as properly come within the scope claimed.

Having thus described the invention, what is claimed as new, is:

1. In a glass blowing machine, a combined slug support and neck mold adapted to form a mold bottom, a primary blank mold having hinged sections movable to close on and open from said neck mold, a secondary blank forming mold also movable to close on and open from said neck mold, said blank forming mold having the bottle bottom forming end closed and means to effect successive closing and opening of the primary mold and closing and opening of the secondary mold.

2. In a glass blowing machine, a combined slug support and neck mold adapted to form a mold bottom, a primary blank mold having hinged sections movable to close on and open from said neck mold, a secondary blank forming mold also movable to close on and open from said neck mold, said blank forming mold having the bottle bottom forming end closed, means to effect successive closing and opening of the primary mold and closing and opening of the secondary mold, and means to retain the neck mold in fixed position during the opening and closing of the primary and secondary molds.

3. In a glass blowing machine, a combined slug support and neck mold adapted to form a mold bottom, a primary blank mold having hinged sections movable to close on and open from said neck mold, a secondary blank forming mold also movable to close on and open from said neck mold, said blank forming mold having the bottle bottom forming end closed, means to effect successive closing and opening of the primary mold and closing and opening of the secondary mold, a blow head movable into and out of cooperative relation with the primary mold in its closed position, and means to move said blow head into and out of such relation with the primary mold during the time the latter is closed.

4. In a glass blowing machine, a combined slug support and neck mold adapted to form a mold bottom, a primary blank mold having hinged sections movable to close on and open from said neck mold, a secondary blank forming mold also movable to close on and open from said neck mold, said blank forming mold having the bottle bottom forming end closed, means to effect successive closing and opening of the primary mold and closing and opening of the secondary mold, means to retain the neck mold in fixed position during the opening and closing of the primary and secondary molds, a blow head movable into and out of cooperative relation with the primary mold in its closed position, and means to move said blow head into and out of such relation with the primary mold during the time the latter is closed.

5. In a glass blowing machine, a combined slug support and neck mold adapted to form a mold bottom, a primary blank mold having hinged sections movable to close on and open from said neck mold, a secondary blank forming mold also movable to close on and open from said neck mold, said blank forming mold having the bottle bottom forming end closed, means to effect successive closing and

opening of the primary mold and closing and opening of the secondary mold, and means to force air through the neck ring into the secondary mold during the time the secondary mold is closed and to cut off such air prior to opening of the said secondary mold.

6. In a glass blowing machine, a combined slug support and neck mold adapted to form a mold bottom, a primary blank mold having hinged sections movable to close on and open from said neck mold, a secondary blank forming mold also movable to close on and open from said neck mold, said blank forming mold having the bottle bottom forming end closed, means to effect successive closing and opening of the primary mold and closing and opening of the secondary mold, means to retain the neck mold in fixed position during the opening and closing of the primary and secondary molds, and means to force air through the neck ring into the secondary mold during the time the secondary mold is closed and to cut off such air prior to opening of the said secondary mold.

7. In a glass blowing machine, a combined slug support and neck mold adapted to form a mold bottom, a primary blank mold having hinged sections movable to close on and open from said neck mold, a secondary blank forming mold also movable to close on and open from said neck mold, said blank forming mold having the bottle bottom forming end closed, means to effect successive closing and opening of the primary mold and closing and opening of the secondary mold, a blow head movable into and out of cooperative relation with the primary mold in its closed position, means to move said blow head into and out of such relation with the primary mold during the time the latter is closed, and means to force air through the neck ring into the secondary mold during the time the secondary mold is closed and to cut off such air prior to opening of the said secondary mold.

8. In a glass blowing machine, a combined slug support and neck mold adapted to form a mold bottom, a primary blank mold having hinged sections movable to close on and open from said neck mold, a secondary blank forming mold also movable to close on and open from said neck mold, said blank forming mold having the bottle bottom forming end closed, means to effect successive closing and opening of the primary mold and closing and opening of the secondary mold, means to retain the neck mold in fixed position during the opening and closing of the primary and secondary molds, a blow head movable into and out of cooperative relation with the primary mold in its closed position, means to move said blow head into and out of such relation with the primary mold during the time the latter is closed, and means to force air through the neck ring into the secondary mold during the time the secondary mold is closed and to cut off such air prior to opening of the said secondary mold.

9. In a glass blowing machine, a combined slug support and neck mold adapted to form a mold bottom, a primary blank mold having hinged sections movable to close on and open from said neck mold, a secondary blank forming mold also movable to close on and open from said neck mold, means to effect successive closing and opening of the primary mold and closing and opening of the secondary mold, means to retain the neck mold in fixed position during the opening and closing of the primary and secondary molds, a finishing mold adapted to open and close at a point remote from the point of opening and closing of the primary and secondary mold, said neck mold retaining means including elements arranged to move the neck mold into cooperative relation with the finishing mold subsequent to the opening of the secondary mold and prior to the closing of the finishing mold, and means to open and close the finishing mold.

10. In a glass blowing machine, a combined slug support and neck mold adapted to form a mold bottom, a primary blank mold having hinged sections movable to close on and open from said neck mold, a secondary blank forming mold also movable to close on and open from said neck mold, means to effect successive closing and opening of the primary mold and closing and opening of the secondary mold, means to retain the neck mold in fixed position during the opening and closing of the primary and secondary molds, a blow head movable into and out of cooperative relation with the primary mold in its closed position, means to move said blow head into and out of such relation with the primary mold during the time the latter is closed, a finishing mold adapted to open and close at a point remote from the point of opening and closing of the primary and secondary mold, said neck mold retaining means including elements arranged to move the neck mold into cooperative relation with the finishing mold subsequent to the opening of the secondary mold and prior to the closing of the finishing mold, and means to open and close the finishing mold.

11. In a glass blowing machine, a combined slug support and neck mold adapted to form a mold bottom, a primary blank mold having hinged sections movable to close on and open from said neck mold, a secondary blank forming mold also movable to close on and open from said neck mold, means to effect successive closing and opening of the primary mold and closing and opening of the secondary mold, means to retain the neck mold in fixed position during the opening and closing of the primary and secondary molds,

means to force air through the neck ring into the secondary mold during the time the secondary mold is closed and to cut off such air prior to opening of the said secondary mold, a finishing mold adapted to open and close at a point remote from the point of opening and closing of the primary and secondary mold, said neck mold retaining means including elements arranged to move the neck mold into cooperative relation with the finishing mold subsequent to the opening of the secondary mold and prior to the closing of the finishing mold, and means to open and close the finishing mold.

12. In a glass blowing machine, a combined slug support and neck mold adapted to form a mold bottom, a primary blank mold having hinged sections movable to close on and open from said neck mold, a secondary blank forming mold also movable to close on and open from said neck mold, means to effect successive closing and opening of the primary mold and closing and opening of the secondary mold, means to retain the neck mold in fixed position during the opening and closing of the primary and secondary molds, a blow head movable into and out of cooperative relation with the primary mold in its closed position, means to move said blow head into and out of such relation with the primary mold during the time the latter is closed, means to force air through the neck ring into the secondary mold during the time the secondary mold is closed and to cut off such air prior to opening of the said secondary mold, a finishing mold adapted to open and close at a point remote from the point of opening and closing of the primary and secondary mold, said neck mold retaining means including elements arranged to move the neck mold into cooperative relation with the finishing mold subsequent to the opening of the secondary mold and prior to the closing of the finishing mold, and means to open and close the finishing mold.

13. In a glass blowing machine, a combined slug support and neck mold adapted to form a mold bottom, a primary blank mold having hinged sections movable to close on and open from said neck mold, a secondary blank forming mold also movable to close on and open from said neck mold, means to effect successive closing and opening of the primary mold and closing and opening of the secondary mold, means to retain the neck mold in fixed position during the opening and closing of the primary and secondary molds, a finishing mold adapted to open and close at a point remote from the point of opening and closing of the primary and secondary mold, said neck mold retaining means including elements arranged to move the neck mold into cooperative relation with the finishing mold subsequent to the opening of the secondary mold and prior to the closing of the finishing mold, means to open and close the finishing mold, a second blow head movable into and out of cooperative relation with the finishing mold, means to open and retract the neck mold upon completion of its movement to cooperative relation with the finishing mold and subsequent to closing of the latter, and means to move the second blow head into cooperative relation with the finishing mold subsequent to the opening of the neck mold and to move the second blow head away from the finishing mold prior to the opening of the latter.

14. In a glass blowing machine, a combined slug support and neck mold adapted to form a mold bottom, a primary blank mold having hinged sections movable to close on and open from said neck mold, a secondary blank forming mold also movable to close on and open from said neck mold, means to effect successive closing and opening of the primary mold and closing and opening of the secondary mold, means to retain the neck mold in fixed position during the opening and closing of the primary and secondary molds, a blow head movable into and out of cooperative relation with the primary mold in its closed position, means to move said blow head into and out of such relation with the primary mold during the time the latter is closed, a finishing mold adapted to open and close at a point remote from the point of opening and closing of the primary and secondary mold, said neck mold retaining means including elements arranged to move the neck mold into cooperative relation with the finishing mold subsequent to the opening of the secondary mold and prior to the closing of the finishing mold, means to open and close the finishing mold, a second blow head movable into and out of cooperative relation with the finishing mold, means to open and retract the neck mold upon completion of its movement to cooperative relation with the finishing mold and subsequent to closing of the latter, and means to move the second blow head into cooperative relation with the finishing mold subsequent to the opening of the neck mold and to move the second blow head away from the finishing mold prior to the opening of the latter.

15. In a glass blowing machine, a combined slug support and neck mold adapted to form a mold bottom, a primary blank mold having hinged sections movable to close on and open from said neck mold, a secondary blank forming mold also movable to close on and open from said neck mold, means to effect successive closing and opening of the primary mold and closing and opening of the secondary mold, means to retain the neck mold in fixed position during the opening and closing of the primary and secondary molds, means to force air through the neck ring into the secondary mold during the time the secondary mold is closed and to cut off such air prior

to opening of the said secondary mold, a finishing mold adapted to open and close at a point remote from the point of opening and closing of the primary and secondary mold, said neck mold retaining means including elements arranged to move the neck mold into co-operative relation with the finishing mold subsequent to the opening of the secondary mold and prior to the closing of the finishing mold, means to open and close the finishing mold, a second blow head movable into and out of cooperative relation with the finishing mold, means to open and retract the neck mold upon completion of its movement to cooperative relation with the finishing mold and subsequent to closing of the latter, and means to move the second blow head into cooperative relation with the finishing mold subsequent to the opening of the neck mold and to move the second blow head away from the finishing mold prior to the opening of the latter.

16. In a glass blowing machine, a combined slug support and neck mold adapted to form a mold bottom, a primary blank mold having hinged sections movable to close on and open from said neck mold, a secondary blank forming mold also movable to close on and open from said neck mold, means to effect successive closing and opening of the primary mold and closing and opening of the secondary mold, means to retain the neck mold in fixed position during the opening and closing of the primary and secondary molds, a blow head movable into and out of cooperative relation with the primary mold in its closed position, means to move said blow head into and out of such relation with the primary mold during the time the latter is closed, means to force air through the neck ring into the secondary mold during the time the secondary mold is closed and to cut off such air prior to opening of the said secondary mold, a finishing mold adapted to open and close at a point remote from the point of opening and closing of the primary and secondary mold, said neck mold retaining means including elements arranged to move the neck mold into cooperative relation with the finishing mold subsequent to the opening of the secondary mold and prior to the closing of the finishing mold, means to open and close the finishing mold, a second blow head movable into and out of cooperative relation with the finishing mold, means to open and retract the neck mold upon completion of its movement to cooperative relation with the finishing mold and subsequent to closing of the latter, and means to move the second blow head into cooperative relation with the finishing mold subsequent to the opening of the neck mold and to move the second blow head away from the finishing mold prior to the opening of the latter.

17. In a glass blowing machine, a combined slug support and neck mold adapted to form a mold bottom, a primary blank mold having hinged sections movable to close on and open from said neck mold, a secondary blank forming mold also movable to close on and open from said neck mold, means to effect successive closing and opening of the primary mold and closing and opening of the secondary mold, means to retain the neck mold in fixed position during the opening and closing of the primary and secondary molds, a finishing mold adapted to open and close at a point remote from the point of opening and closing of the primary and secondary mold, said neck mold retaining means including elements arranged to move and insert the neck mold into cooperative relation with the finishing mold subsequent to the opening of the secondary mold and prior to the closing of the finishing mold, and means to open and close the finishing mold.

18. In a glass blowing machine, a combined slug support and neck mold adapted to form a mold bottom, a primary blank mold having hinged sections movable to close on and open from said neck mold, a secondary blank forming mold also movable to close on and open from said neck mold, means to effect successive closing and opening of the primary mold and closing and opening of the secondary mold, means to retain the neck mold in fixed position during the opening and closing of the primary and secondary molds, a blow head movable into and out of cooperative relation with the primary mold in its closed position, means to move said blow head into and out of such relation with the primary mold during the time the latter is closed, a finishing mold adapted to open and close at a point remote from the point of opening and closing of the primary and secondary mold, said neck mold retaining means including elements arranged to move and insert the neck mold into cooperative relation with the finishing mold subsequent to the opening of the secondary mold and prior to the closing of the finishing mold, and means to open and close the finishing mold.

19. In a glass blowing machine, a combined slug support and neck mold adapted to form a mold bottom, a primary blank mold having hinged sections movable to close on and open from said neck mold, a secondary blank forming mold also movable to close on and open from said neck mold, means to effect successive closing and opening of the primary mold and closing and opening of the secondary mold, means to retain the neck mold in fixed position during the opening and closing of the primary and secondary molds, means to force air through the neck ring into the secondary mold during the time the secondary mold is closed and to cut off

such air prior to opening of the said secondary mold, a finishing mold adapted to open and close at a point remote from the point of opening and closing of the primary and secondary mold, said neck mold retaining means including elements arranged to move and insert the neck mold into cooperative relation with the finishing mold subsequent to the opening of the secondary mold and prior to the closing of the finishing mold, and means to open and close the finishing mold.

20. In a glass blowing machine, a combined slug support and neck mold adapted to form a mold bottom, a primary blank mold having hinged sections movable to close on and open from said neck mold, a secondary blank forming mold also movable to close on and open from said neck mold, means to effect successive closing and opening of the primary mold and closing and opening of the secondary mold, means to retain the neck mold in fixed position during the opening and closing of the primary and secondary molds, a blow head movable into and out of cooperative relation with the primary mold in its closed position, means to move said blow head into and out of such relation with the primary mold during the time the latter is closed, means to force air through the neck ring into the secondary mold during the time the secondary mold is closed and to cut off such air prior to opening of the said secondary mold, a finishing mold adapted to open and close at a point remote from the point of opening and closing of the primary and secondary mold, said neck mold retaining means including elements arranged to move and insert the neck mold into cooperative relation with the finishing mold subsequent to the opening of the secondary mold and prior to the closing of the finishing mold, and means to open and close the finishing mold.

21. In a glass blowing machine, a combined slug support and neck mold adapted to form a mold bottom, a primary blank mold having hinged sections movable to close on and open from said neck mold, a secondary blank forming mold also movable to close on and open from said neck mold, means to effect successive closing and opening of the primary mold and closing and opening of the secondary mold, means to retain the neck mold in fixed position during the opening and closing of the primary and secondary molds, a finishing mold adapted to open and close at a point remote from the point of opening and closing of the primary and secondary mold, said neck mold retaining means including elements arranged to move and insert the neck mold into cooperative relation with the finishing mold subsequent to the opening of the secondary mold and prior to the closing of the finishing mold, means to open and close the finishing mold, a second blow head movable into and out of cooperative relation with the finishing mold, means to open and retract the neck mold upon completion of its movement to cooperative relation with the finishing mold and subsequent to closing of the latter, and means to move the second blow head into cooperative relation with the finishing mold subsequent to the opening of the neck mold and to move the second blow head away from the finishing mold prior to the opening of the latter.

22. In a glass blowing machine, a combined slug support and neck mold adapted to form a mold bottom, a primary blank mold having hinged sections movable to close on and open from said neck mold, a secondary blank forming mold also movable to close on and open from said neck mold, means to effect successive closing and opening of the primary mold and closing and opening of the secondary mold, means to retain the neck mold in fixed position during the opening and closing of the primary and secondary molds, a blow head movable into and out of cooperative relation with the primary mold in its closed position, means to move said blow head into and out of such relation with the primary mold during the time the latter is closed, a finishing mold adapted to open and close at a point remote from the point of opening and closing of the primary and secondary mold, said neck mold retaining means including elements arranged to move and insert the neck mold into cooperative relation with the finishing mold subsequent to the opening of the secondary mold and prior to the closing of the finishing mold, means to open and close the finishing mold, a second blow head movable into and out of cooperative relation with the finishing mold, means to open and retract the neck mold upon completion of its movement to cooperative relation with the finishing mold and subsequent to closing of the latter, and means to move the second blow head into cooperative relation with the finishing mold subsequent to the opening of the neck mold and to move the second blow head away from the finishing mold prior to the opening of the latter.

23. In a glass blowing machine, a combined slug support and neck mold adapted to form a mold bottom, a primary blank mold having hinged sections movable to close on and open from said neck mold, a secondary blank forming mold also movable to close on and open from said neck mold, means to effect successive closing and opening of the primary mold and closing and opening of the secondary mold, means to retain the neck mold in fixed position during the opening and closing of the primary and secondary molds, means to force air through the neck ring into the secondary mold during the time the secondary mold is closed and to cut off such air prior to opening of the said secondary mold, a finishing mold adapted to open and close at a point remote from the

point of opening and closing of the primary and secondary mold, said neck mold retaining means including elements arranged to move and insert the neck mold into cooperative relation with the finishing mold subsequent to the opening of the secondary mold and prior to the closing of the finishing mold, means to open and close the finishing mold, a second blow head movable into and out of cooperative relation with the finishing mold, means to open and retract the neck mold upon completion of its movement to cooperative relation with the finishing mold and subsequent to closing of the latter, and means to move the second blow head into cooperative relation with the finishing mold subsequent to the opening of the neck mold and to move the second blow head away from the finishing mold prior to the opening of the latter.

24. In a glass blowing machine, a combined slug support and neck mold adapted to form a mold bottom, a primary blank mold having hinged sections movable to close on and open from said neck mold, a secondary blank forming mold also movable to close on and open from said neck mold, means to effect successive closing and opening of the primary mold and closing and opening of the secondary mold, means to retain the neck mold in fixed position during the opening and closing of the primary and secondary molds, a blow head movable into and out of cooperative relation with the primary mold in its closed position, means to move said blow head into and out of such relation with the primary mold during the time the latter is closed, means to force air through the neck ring into the secondary mold during the time the secondary mold is closed and to cut off such air prior to opening of the said secondary mold, a finishing mold adapted to open and close at a point remote from the point of opening and closing of the primary and secondary mold, said neck mold retaining means including elements arranged to move and insert the neck mold into cooperative relation with the finishing mold subsequent to the opening of the secondary mold and prior to the closing of the finishing mold, means to open and close the finishing mold, a second blow head movable into and out of cooperative relation with the finishing mold, means to open and retract the neck mold upon completion of its movement to cooperative relation with the finishing mold and subsequent to closing of the latter, and means to move the second blow head into cooperative relation with the finishing mold subsequent to the opening of the neck mold and to move the second blow head away from the finishing mold prior to the opening of the latter.

25. In a glass blowing machine, a blank forming mold having a closed bottle bottom forming end and provided with inwardly projecting portions arranged to distribute the glass to form bottle walls of even thickness by forcing the plastic glass away from the center of the bottle toward the outer wall thereof.

26. A sectional hinged blank forming mold having its upper end closed by portions integral with the mold sides and forming a bottle bottom forming end, the lower end of said mold being adapted to close around a blow-head and secure the mold thereto.

In testimony whereof I affix my signature.

CLARENCE R. NIXON.