To all whom it may concern:

Be it known that I, SAMUEL E. WINDER, a citizen of the United States, residing at Waltham, county of Middlesex, State of Massachusetts, have invented a new and useful Automatic Bottle-Blowing Machine, of which the following is a specification.

This invention relates to the art of manufacturing glassware, and more particularly to the automatic pressing, molding and blowing glass bottles, and has for its object to provide a machine wherein the several steps necessary for the formation of a bottle from the gather of glass are performed within the machine entirely automatically, and the only manual operation necessary is the placing of the gather of glass within the press mold of the machine.

It has for a further object to provide a mechanism for automatically cutting the gather of glass after it is placed within the press mold, producing a partial vacuum within the press mold sufficient to draw the gather of glass into the mold and form the neck of the bottle, cause the operation of a mechanism to punch an initial opening in the neck of the blank and thereafter admit air to give a preliminary blowing to shape the blank, next automatically removing the blank from the press mold and maintaining it in an inverted position and bringing it in the same position into the blow mold where the blowing mechanism operates thereon to form a completed bottle and then providing an ejector mechanism for successively removing the finished bottles from the machine.

It has for a further object to provide a novel air valve mechanism whereby air under pressure is controlled and delivered at predetermined times to the different parts of the machine for causing the completion of certain steps in the process of forming and blowing the articles.

It further consists of other novel features of construction, all as will be hereinafter fully set forth.

For the purpose of illustrating my invention, I have shown in the accompanying drawings one form thereof which is at present preferred by me, since the same has been found in practice to give satisfactory and reliable results, although it is to be understood that the various instrumentalities of which my invention consists can be variously arranged and organized and that my invention is not limited to the precise arrangement and organization of these instrumentalities as herein shown and described.

Figure 1 represents a front elevation of a machine embodying my invention and showing one unit of the machine comprising press and blow mold mechanism, the other unit being omitted to avoid confusion. Fig. 2 represents a side elevation of the machine, certain parts being omitted and showing the controlling mechanism performing the first step in the bottle making process. Fig. 3 represents a vertical section of the body portion of the machine. Fig. 4 represents a section of the machine taken above the pressed mold table. Fig. 5 represents a detail of one of the mold posts. Fig. 6 represents a section of one of the mold guide plates. Fig. 7 represents a detail in elevation of one of the mold supports. Fig. 8 represents a detail in plan of one of the cams for operating the mold. Fig. 9 represents a section of the machine taken above the blow mold table, showing the ejector mechanism engaging a completed bottle. Fig. 10 represents a section of a valve for controlling the operation of the ejector arm. Fig. 11 represents a vertical section of a mold and adjacent elements during the blowing step. Fig. 12 represents a section similar to Fig. 9 showing the ejector arm and blow molds in a different position. Fig. 13 represents a side elevation of a portion of the press mold and air controlling mechanism therefor. Fig. 14 represents an elevation of a portion of the machine showing the mechanism for controlling the operation of the ejector. Fig. 15 represents a plan partly in section of a portion of the ejector valve mechanism. Fig. 16 represents a plan of another portion of the same. Fig. 17 represents a side elevation showing the assembled position of the two parts shown in Figs. 15 and 16. Fig. 18 represents a plan of a portion of the blow mold table in its operative relation to the ejector valve mechanism. Fig. 19 represents a vertical section of a press mold showing the plunger mechanism for forming the initial opening in the gather of glass. Fig. 20 represents a similar section of the same showing the plunger mechanism retracted and the gather of glass after the preliminary blowing step. Fig. 21 represents a plan of a portion of the blow mold.
table showing the control mechanism for one of the blow mold units. Fig. 22 represents a section on line x—x Fig. 1 showing the main valve mechanism for controlling the supply of air to all of the blow mold units. Fig. 23 represents a section on line y—y Fig. 24 represents a section on line z—z Fig. 27. Fig. 26 represents a detail in elevation of the main valve controlling col-
lar. Fig. 26 represents an elevation of a portion of the main supporting column showing a detail of a portion of the main valve mechanism. Fig. 27 represents a similar elevation showing the parts in a differ-
ent position.

Similar numerals of reference indicate corresponding parts in the figures.

Referring to the drawings: 1 designates the base of a machine for molding and blow-
ing glass bottles and like forms and carrying thereon a column 5 preferably centrally dis-
paced with respect to the base 1, and having a flange 3, by means of which it is secured by bolts 4 or like fastening devices to the afo-
said base 1. The flange 3 as here shown, is provided with a circular groove 5 substan-
tially concentric with respect to the column 2 and serving the purpose of a ball race in which are located a plurality of ball-bear-
ings 6, which latter fit into a similar ball race 7 formed in an annulus 8 fitting around the column 2. This annulus 8 is provided on its outer periphery with worm teeth 9 and is also formed with a beveled counterbore por-
tion providing a friction face 10 with which a ring 11, having a cone face 12 thereon, is adapted to coact. This ring 11 is secured by means of keys or pins 13 to a hub 14 where-
by it rotates therewith but may have a slid-
ing movement relative thereto, if desired.

It being noted that the two faces 10 and 12 are friction faces, and are firmly held to-
gether by means of the spring 15, the function of this construction is to provide a friction drive for certain elements presently to be described, and which are attached to the hub 14 so that at certain times when the friction is overcome, the ring 11 will cease to ro-
tate.

The driving mechanism for the annulus 8 comprises, in the present instance, a worm 16 fixedly mounted on a shaft 17, the latter having suitable bearings 18 and carrying thereon a sprocket 19 driven by a sprocket chain 20, from a sprocket 21 mounted on the main shaft 22. The shaft 22 is of course driven from any suitable source of power from the pulley 23 and is adapted to operate continuously.

24 designates the press mold table which, in the present instance, forms an integral part of the hub 14 and carries thereon a plurality of cylinders 25, fixedly secured thereto by means of bolts 26 or the like, which are also secured by similar bolts 27 to the blow mold table 28, here shown as located a suit-
able distance above the table 24. It will thus be apparent that motion transmitted from the annulus 8 to the hub 14 will cause both tables to rotate about the column 2. The table 24, in the present instance, is provided with a plurality of openings 29 adapted to receive a tubular member 30 having a sup-
porting flange 31 thereon by which it is temporarily suspended from the table. The lower end of this member 30 is closed by a cap 32 into which is threaded a sleeve 33, while the upper or table end of the member 30 has fitted thereon a plate 34 to which the sleeve 33 is also attached.

35 designates ports formed in the plate 34 and forming a communication between the space 36 and the ports 37 of the press molds 38. The member 30 is provided with an ex-
haust port 39 adapted at certain times to be engaged by an exhaust head, presently to be described, whereby a vacuum is created in the space 36 to cause the desired suction through the ports 35 and 37 whereby the gather of glass 40 is drawn into the press mold.

41 designates a bushing secured to the sleeve 33 and serving to guide the plunger 42 during the initial stage of punching an opening in the neck of the gather 40. This plunger 42 is slantly mounted in the sleeve 33 and embodies a piston valve 43 closely fit-
ting the bore of the sleeve 33 and controlling the opening and closing of a port 44 for the admission of air under pressure. The pis-
ton 43 has a stem 45 secured thereto, project-
ing exterior of the sleeve 33 where it termi-
nates in a head 46 against which latter a spring 47 has bearing so that the plunger 42, piston 43 and other component parts thereof are normally held retracted as shown in Fig. 20. The operation of the plunger 42 is ef-
fected, in the present instance, by a cam track or way 48 secured to the fixed base 1 and in the path of movement of the head 46.

49 designates a guide plate, fixedly secured to the table 24, having a central opening 50 to receive the flange 31 of the member 30 and end slots 51, these latter being alined with openings 52 in the table 24 in order to permit the studs 53 to pass therethrough and bring the cam rollers 54 into operative rela-
tion with the cam grooves 55 in the disk 56. As shown in Fig. 8, each disk 56 has a cam groove 55 at each end while a central aper-
ture 57 allows the disk to fit over the tubular member 30 upon which it is secured by a col-
lar 58 and set screws 59. The function of the disks 56 is to open and close the press molds 38 at the desired times and oscillation 125 of the disks 56 is effected by providing each with projecting lugs 60 adapted to be en-
gaged by stationary trips 61 at the proper time. Movement of the disks 56 is trans-
mitted to the press molds 38 by means of
posts 62 mounted on base members 63 and to which the studs 53 are connected. The posts 62 are slidingly mounted in the guide plates 49 and are connected by links 64 with the press mold sections, it being noted that these sections 38 are formed with ears 65 pivoted on a spindle 66 which is fixedly secured, in the present instance, to the guide plates 49.

It will be apparent that when the disks 56 are shifted that a corresponding movement of the press molds will take place, they being either opened or closed as the case may be. Assuming they have been closed about a gather of glass, as shown in Fig. 19, a suction is produced in the space 36 which through the ports 35 and 37 draws the glass into the mold. While the glass is thus held by suction, the plunger 42 is operated, through the head 46 meeting the cam track 48 and a preliminary opening punched in the glass. On leaving the cam track 48 the plunger 42 is withdrawn and a blowing step takes place which produces the effect shown at 67 in Fig. 20.

25 Designates a frame suitably carried, in the present instance by the base 1 and carrying a cross head 69 in which is slidingly mounted a cam 70, having connection with the piston 71 of a cylinder 72. This cam 70 coacts with a roller 73 carried by the latch bar 74, the parts being maintained in proper engagement through the medium of a spring 75 which is secured at one end to the bar 74 and at the other end to a fixed portion of the frame 68. This latch bar 74 is normally held engaging one of the notches 76 formed in the edge of the table 24 and by which the table is locked after making a partial rotation. The latch bar 74 is withdrawn from its locking position by a movement of the cam 70 which is effected by admitting fluid pressure into the cylinder 72 by way of the conduits 77 and 78.

79 Designates a three way control valve for the pressure fluid and the position thereof of controls the flow of pressure fluid to the conduits 77, 78 and blow head 101. The operation of the valve 79 is effected by a foot treadle 80 operating through suitable link connections 81 and held in normal position by means of the spring 82. It is desirable to provide a means to lock the treadle 80 for a predetermined time, and for this purpose I utilize a catch 83 suitably pivoted adjacent to the treadle 80. The treadle 80 is pivotally supported by the bracket 85, by which the catch 83 is operated by subjecting the treadle 80 to a predetermined motion when the treadle 80 is depressed. In order to release the treadle 80 I preferably employ a pin 86 slidingly mounted on the head of cylinder 72 and projecting interior thereof so that when the piston 71 descends it will strike the said pin 86 and cause the catch 83 to be swung back, thereby releasing the treadle 80 which is shifted by spring 82 to again operate the valve 79.

87 Designates a cylinder suitably mounted on the frame 68 and embodying the piston 88 and rod 89 which form the operating means for a plate 90 slidingly mounted on the table 91 and adapted to be reciprocated by the movement of the piston 88. The cylinder 87 received pressure fluid through the pipes or conduits 92 and 93, the same being respectively connected to the conduits 77 and 78. The plate 90 carries thereon a pair of rollers 94 suitably spaced apart to receive the cutter blades 95 which are pivoted at 96 and have end portions formed as wiper cams 97 adapted to engage the rollers 94. This movement of the plate 90 in one direction causes the cutter blades 95 to close while the opposite movement opens them. It will be noted that these cutter blades 95 are so positioned that when the table 24 rotates and brings a press mold adjacent the frame 68, the top of the said mold will be directly beneath these cutters with the mold opening axially aligned with the meeting edges of the blades.

98 Designates a suction head suitably mounted on the frame 68 and adapted to be connected to a pumping element or the like for producing the desired vacuum. To the head 98 a lever arm 99 is connected having a slot and pin connection 100 with the latch bar 74 so that movement of the latter causes the head 98 to move toward or away from the tubular member 30. When the head 98 is moved to engage the member 30, it aligns with the port 39 and thus produces the desired vacuum for drawing the gather of glass into the press mold.

101 Designates a blow head suitably secured to a link 102 which is pivoted on a bracket 103, and operated by a fluid motor 104. Air is supplied to the head 101 through the conduit 105 and the parts are so positioned and controlled as to come into operation just after the glass in the press mold has received the initial punch by plunger 42. Thus the gather of glass will be inserted, cut and punched at station A Fig. 12 and then the latch bar 74 will be withdrawn permitting the table 24 to move, say one-eighth of a revolution, to station B. At this station the blow head 101 is brought into engagement with the tubular member 30 and its nozzle into alignment with the port 14, so that the preliminary blowing step shown in Fig. 20 may take place. After the step is completed the table 24 brings the press mold to station C where the molds are automatically opened as heretofore described and the glass blank removed to the blow mold table 28.

Referring now to the blow mold table 28 and its adjuncts it will be noted that there are a plurality of blow mold units 106 dis-
posed on the table in a corresponding manner to the press molds on the table 24, and therefore a description of one of them should suffice for all. Referring first to the mechanism for bringing the glass blank from the press mold table to the blow mold table, 107 designates a bottom former having a plurality of ports 108 therethrough which communicate with the interior of the tubular stem 109 to which the former is attached. This stem 109 is fixed to a bracket 110 of the member 111 which is mounted for sliding movement on an upright 112 carried by the table 28. The member 111 is also provided with an ear 113 by means of which it is fixed to the piston rod 114 connected to piston 115 within cylinder 25. By this construction the head 111 may be raised or lowered, thereby carrying the bottom former 107 down through an opening 116 in the table 28 into engagement with the blank in the press mold as shown in Fig. 20. The pressure fluid for operating the piston 115 is conveyed by pipes 117 and 118 to the respective ends of the cylinder 25, the said pipes being connected to a main control valve presently to be described.

119 designates a blow mold formed in sections each of which is pivotally mounted on the spindle 120, which latter is affixed to an apertured plate 121 resting on the guide plate 122. This guide plate 122 is provided with a central opening 123 and is slotted at each end as shown at 124 to receive the blocks 125 which connect by links 126 with the respective mold sections. Each block 125 carries a pin 127 fitting within a cam groove 128 at each side of the cam plate 129, which latter is centrally apertured to form a bearing on the central hub 130 of the guide plates 122. The cam plate 129 is preferably moved in one direction by a pressure controlled motor 131 to which the pressure fluid is admitted at the desired moment, and in the opposite direction by a suitable trip mechanism hereinafter described.

132 designates the blow heads of which in the present instance there are four, each being suitably pivoted at 133 to a cylinder 25 so that they may be swung independently to align with the respective blow mold openings.

134 designates a lug or pin secured to each cam plate 129 and projecting, through a suitable curved slot 135 in the table 28, into engagement with an elongated opening 136 formed in the extension 137 of each blow head 132. By this construction movement of either the cam plates 129 causes the corresponding blow head 132 to be swung either into or out of alignment with a blow mold opening. In order to admit air to the blow mold heads 132, a port 138 is formed in each having communication by way of a flexible pipe or tube 139 with its adjacent cylinder 25, this connection being preferably made at the lower end of the cylinders, as shown in Fig. 1, so that air will only enter the blow heads when the bottom formers 109 are in their respective upper positions.

It will further be noted that each blow head forms substantially an air-tight joint with the bottom of the table 28 whereby leakage is prevented at the time the blow heads are not beneath the blow mold opening.

140 designates a trip arm secured to the head 132 and projecting therefrom in order to operate certain parts hereinafter to be described.

Referring now to the main air control mechanism, attention is first directed to the fact that in my preferred construction, the column 2 is utilized as a chamber for the exhaust from the several cylinders 25, and it will be noted that its upper end adjacent the table 28 is provided with a pair of channels 142 and 143 with which the air pressure pipes 144 and 145 communicate respectively, the said pipes passing interiorly of the column 2 and through a sleeve 146 which is secured, in the present instance, in a vacuum chamber 147.

148 designates a plurality of exhaust ports formed in the column 2 and preferably aligned with the inlet channel 149.

149 designates a second row of exhaust ports in the column 2 adjacent the inlet channel 143. The two channels 142 and 143 communicate respectively with and are connected to the pipes 144 and 145 by means of the inlet ports 150 and 151.

152 designates a collar to which the cylinder supply pipes 117 and 118 are connected and through which they pass in order to form communications at certain times with the respective channels 142 and 143 and the exhaust ports 149 and 148, it being understood that this collar fits over the column 2 and is seated upon the table 28, being retained in this position by means of a retaining ring 153, which latter is fixedly secured to the column 2 by means of set bolts 154, or like fastening devices. It will thus be apparent that as the table 28 rotates, it carries the collar 152 with it and thereafter successively brings the two pipes 117 and 118 into position to receive air under pressure and operate one of the pistons in one of the cylinders for one movement, and then as this pipe 117 is brought into position to exhaust by way of ports 148, a second pipe 118 will be receiving air under pressure from channel 143, and it in turn will exhaust through the ports 149 as the collar 152 continues its movement.

The vacuum chamber 147 communicates by way of the ports 145 in the sleeve 146 with the interior thereof, and it will here be understood that this sleeve is closed at its inner end and is connected by means of 130...
the pipe 156 with a suitable suction device.

To this vacuum chamber 147 are connected a plurality of flexible conduits 157, each of which leads to its respective bottom blank 107 and by means of which the blanks are suspended in inverted position during the blowing operation.

156 designates a standard secured to the base 1 and serving to support an ejector mechanism comprising a sleeve 159 loosely mounted for oscillating movement on the standard 158 and carrying a tubular arm 160, which terminates in a suction head 161. This suction head 161 is preferably of a contour similar to the finished article or bottle, and is provided with ports 162 whereby the vacuum in the head temporarily secures the bottle to the arm 160. The sleeve 159 as here shown, is provided with a port 163 longitudinally disposed thereof and communicating at one end therewith the interior of the arm 160, while its opposite end terminates in a radially disposed port 164 adapted at certain times to be brought into communication with a centrally arranged port 165, which latter communicates with a suction head 166 to which is connected the pipe 167 leading to a suitable source of vacuum producing means.

168 designates an exhaust port formed in the sleeve 159 communicating at all times with the atmosphere and at certain times with the port 164, whereby the vacuum in the sleeve 159 is relieved to release the completed article from the suction head 161.

The movement of the sleeve 159 to shift the arm 160 from one position to another is accomplished, in the present instance, by means of a motor 169 having connected thereto the pressure pipes 170 and 171, these latter being preferably flexible and secured to a rotary valve 172 loosely mounted on the standard 158 and having therein vertically disposed ports 173 and 174 with which the respective pipes 170 and 171 communicate. This valve member as here shown is also provided with a horizontally disposed arm 175 having the function of a trip which normally projects into the path of movement of the trip arm 140 on the blow head 192, whereby the said valve is moved in one direction, while movement in the opposite direction is controlled by the second trip arm 176, here shown as vertically disposed in the path of movement of a lug 177 secured to or integral with the sleeve 159.

178 designates an annulus fixedly secured by means of set screws 179 or the like, to the standard 158 admitting the valve 172 and provided with an inlet port 180 and exhaust ports 181, these latter being preferably located on opposite sides of the inlet port 180. This port 180 is connected to a source of air under pressure by way of the pipe 182, the same leading from a suitable source as will be understood. It will thus be apparent that air entering the inlet port 180 will pass through into the pipe 170 or pipe 171, according to the position of the valve 172, and for the purpose of describing the action which takes place, it will be assumed that the port 173 for the pipe 170 is at this time in line with the inlet port 180 thereby admitting air under pressure to one side of the motor cylinder 109 which will immediately cause the piston rod 183 of said motor to move, carrying with it the link 184 which is connected to the sleeve 159, thereby swinging the latter in the direction to bring the arm 160 into engaging position with a completed bottle. At the end of the movement just described, the lug 177 will strike the trip arm 176 and shift the valve 172 to change the relation between the two sets of ports, thereby bringing the port 174 into communication with the air inlet port 180 and the port 173 into alignment with one of the exhaust ports 181. As soon as this takes place, air under pressure will pass through pipe 171 to the opposite end of the motor cylinder 169, and the movement of the parts controlled thereby will be reversed.

In order to bring the valve 172 back to the first position above described, I depend upon the rotary movement of the table 28 carrying the blow head 132 upon which latter is located the trip arm 140 which projects a sufficient distance to engage the trip arm 179 and cause the action just described.

In order to operate the blow mold motors 181 at the right times to either open or close the blow molds, I preferably provide a port 185 in each side of the column 2, each of which is so located as to cause the blow molds to open at the correct station. It will be noted that the ports 185 communicate with the air inlet port 142 in order to supply the required motive fluid. Adjacent each of the ports 185 is an exhaust port 186 drilled through the column 2 and in the same horizontal plane with the said ports 185, the operation being readily understood when the motor connections are explained. Each motor 181 is provided with a flexible connection 187 from one end of its cylinder to a nipple 188 in the collar 153, the location of these four nipples being in a horizontal plane coincident with the plane of the ports 185. Thus, each time a nipple 188 aligns with a port 185, air will be admitted to the proper motor 181 and operate the same to open its blow mold. In the present construction the arrangement of the ports and nipples is such that the motors are operated in pairs, that is, two 125 are opened together while the other two are closed, or as shown in Fig. 9 at stations A' and C' the molds are opened and at stations B' and D' the molds are opened. The opposite end of each of the motor cylinders 130...
is connected by a flexible tube 189 with a nipple 190 also in the collar 152, and passing through the same in order to communicate with ports 191 connected to the inlet port 149. There are two of these ports 191, each so located as to cause closing of the blow molds at the stations A' and C'. Exhaust ports 192 are also provided to relieve the pressure on the motors at the proper time, and it will here be noted that both the sets of ports 185, 186 and 191, 192 are so arranged that when air enters one end of outputs by ports 185 and when air enters from ports 191, the other end of the cylinders exhausts by ports 186.

In carrying out the operation of the machine, the several steps in the formation of a single bottle will be followed, as it will be understood that each unit of the machine performs its functions independently, and in the present machine, four operations are going on simultaneously, thus one unit is cutting and punching one bottle blank; another unit is forming an initial opening in a second blank; another unit is blowing a third blank, while another unit is discharging a completed bottle.

The drive annulus 8 is first connected with the source of power and therefore the two tables 24 and 28 and columns 2 are ready to rotate as soon as the latch 74 releases them, since of course the friction member 12 is contacting with the annulus 8 and tending to rotate.

With the parts in the position shown in Fig. 12, the operator drops a gather of glass into the opening of the press mold 38 and at the same time presses the treadle 80 until it is held by the latch 83. The position of the press mold at this time is such that the suction head 58 connects with port 44 and the glass is therefore drawn quickly into place. The lowering of the treadle 80 causes the three way valve 79 to turn to admit air to the cylinders 72 and 88, the former shifting the cross head 70 and the latter operating the cutters 95 which sever the glass close to the top of the press mold. The downward movement of the cross head 70 withdraws the latch bar 74 and cuts off the suction from head 98. The table 24 is therefore released and turns through approximately one-eighth of a revolution. At this point the cross head 70 has lowered far enough to allow the spring 75 to return the latch bar 74 so that it engages the next notch 76 and again locks the table 24. Furthermore, the piston 71 has at this time struck the pin 86 to release the treadle 80 and the return movement of this member under the influence of spring 82 again shifts the three way valve 79 and causes air to be delivered to the blow head 101, which in the meantime has been brought up to port 44 through the operation of motor 104. The press mold 38 in passing from its initial position to this one-eighth position has passed over the cam 48 and the plunger 49 has been forced upwardly to form a preliminary opening in the blank.

Referring now to the upper table 28, the step of lowering one of the bottom formers 107 has taken place while the foregoing operations have been effected. The collar 152 has rotated one-eighth of a turn and brought pipe 117 into communication with the port 142, thus admitting air to one cylinder 25 and causing piston 115 to lower and bring the said former 107 into contact with the glass blank as illustrated in Fig. 29. It is in this position that air is admitted through port 44 to blow the opening 67 and press the blank firmly on the former 117, where it is held secure by the vacuum produced in the said former. After this step, the table 24 is automatically released, by the upward movement of cross head 70, which of course follows from the valve 79 having been shifted by the disengagement of latch 88 as heretofore described, and thereupon moves another eighth turn, bringing the blank to station B. At this station the press mold 38 is automatically opened by the engagement of the lug 60 with the stationary trip 61. It is now time for the bottom former 107 to convey the blank to the blow mold table 28. The collar 152 is therefore in position to exhaust the upper end of cylinder 25 through ports 148 and admit air to the lower end by way of ports 143 and pipe 118 so that the former 107 moves upwardly carrying the blank into position within the blow mold 119 at station B'. The movement of the table 28 from the station B' brings the nipple 188 in collar 152 into alignment with port 185 so that the motor 131 is operated to close the mold about the blank and when station C' is reached, the blow head 132 is positioned as shown in Fig. 11 and air enters the blank and blows the complete bottle. From station C' the blow mold moves to station D' where port 185 aligns with exhaust port 192 and port 186 aligns with inlet 191 so that motor 131 is again operated, but in the reverse direction and the blow mold is opened. As soon as the mold opens, the vacuum ejector arm 160 swings up automatically and grips the bottle which it then removes and delivers to a suitable point. As this ejector action has already been described in detail it is thought unnecessary to here repeat the several movements. It will now be apparent that I have devised a complete unitary structure well adapted for the purpose intended and which is simple in construction, positive in operation and automatically carries out a series of steps, one following another, and all con-
continuing in a complete cycle which begins with a gather of molten glass and ends with a completed article delivered to a suitable point.

It will now be apparent that I have devised a novel and useful construction of an automatic bottle blowing machine which embodies the features of advantage enumerated as desirable in the statement of the invention and the above description, and while I have, in the present instance, shown and described a preferred embodiment thereof which has been found in practice to give satisfactory and reliable results, it is to be understood that the same is susceptible of modification in various particulars without departing from the spirit or scope of the invention set forth in any of its advantages.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. In an apparatus for forming hollow glass articles, a base, a bearing member rotatably mounted thereon, means for intermittently actuating said member, a plurality of tables suitably supported by said bearing member and adapted to rotate therewith, means to intermittently release said tables from actuation by said bearing member, a press mold carried by one table, means to produce a vacuum in said press mold to draw a gather of glass therein, a cutting device, means to form a preliminary opening in the glass blank formed in said press mold, a blow mold, a carrier for delivering said blank to said blow mold, and means to blow said blank into a completed article.

2. In an apparatus for forming hollow glass articles, a plurality of tables mounted for rotary movement, means to rotate said tables, a mechanism for intermittently locking said tables, a press mold carried by one of said tables, means to seat a gather of glass in said press mold, a bottom former automatically actuated to engage said glass, a blowing mechanism for forcing said glass into engagement with said bottom former, a blow mold carried by the other table, and means for delivering said glass to said blow mold in inverted position.

3. In an apparatus for forming hollow glass articles, a plurality of tables suitably supported for rotary movement, a press mold carried by one of said tables, means for sucking glass into said mold, a bottom former automatically actuated to engage said glass at a predetermined time, a plunger adapted to form a preliminary opening in said glass, blowing mechanism for forming said glass in said press mold and forcing the same into engagement with said bottom former, a suction device connected to said bottom former, a blow mold operatively mounted on the other table, means to operate said bottom former to deliver said glass to said blow mold, and means to admit pressure fluid to said blow mold.

4. In an apparatus for forming hollow glass articles, a plurality of tables suitably mounted for rotary movement, means to rotate said tables, a press mold carried by one of said tables, a locking mechanism adapted to automatically bring said tables to rest at predetermined intervals, a glass cutting device mounted adjacent thereto, and means to simultaneously operate said cutting device and said locking mechanism.

5. In an apparatus for forming hollow glass articles, a plurality of tables suitably mounted for rotary movement, means to intermittently actuate said tables, a cylinder positioned adjacent said tables, a piston in said cylinder, a bottom former slidingly mounted with respect to said tables, connections between said bottom former and said cylinder, a press mold carried by one of said tables, a blow mold carried by the second table, means controlling a pressure fluid to said cylinder whereby said bottom former is reciprocated, and means to produce a vacuum in said bottom former.

6. In an apparatus for forming hollow glass articles, a plurality of tables suitably mounted for rotary movement, means to intermittently actuate said tables, a plurality of cylinders positioned adjacent said tables, a plurality of pistons for said cylinders, a bottom former actuated by each piston and slidingly mounted with respect to said tables, a plurality of press molds carried by one of said tables, a plurality of blow molds carried by the other table, means controlling a pressure fluid to said cylinders whereby said bottom formers are reciprocated, and means to produce a vacuum in said bottom formers.

7. In an apparatus for forming hollow glass articles, a table, a press mold operatively mounted thereon, means to produce a partial vacuum in said press mold to draw a gather of glass therein, a punching and blowing mechanism adapted to cooperate with the lower end of said press mold to automatically form a preliminary opening in said glass, a second table, having an opening therein aligned with said press mold, positioned above said press mold table, a blow mold operatively mounted on said second table and in alignment with said opening, a bottom former slidingly mounted on said second table and adapted to pass through said blow mold and into said press mold, means to produce a vacuum in said bottom former, and means to reciprocate said bottom former to engage a glass blank in said press mold and remove the same in inverted position into said blow mold.

8. In an apparatus for forming hollow glass articles, a table having an opening therein, a press mold carried by said table.
and aligned with said opening, a punching
and blowing mechanism located beneath said
press mold and adapted to automatically
form a preliminary opening in a glass blank
contained in said press mold, a second table
having an opening therein aligned with said
press mold opening, a blow mold carried by
said second table aligned with said opening
therein, a bottom former slidingly mounted
on said second table, means to produce a
vacuum therein, a motor adapted to recipro-
cate said bottom former to move the same
through said blow mold into engagement
with said glass blank in said press mold and
deliver the same to said blow mold, and
means to automatically admit pressure to
said motor to operate said bottom former at
predetermined times.

9. In an apparatus for forming hollow
glass articles, a plurality of tables suitably
mounted for rotation and each having a plural-
ity of openings therein, a press mold oper-
atively positioned on one of said tables
and aligned with each opening in said table,
a blow mold operatively mounted on another
table and aligned with each opening therein,
a bottom former slidingly mounted on said
blow mold table in operative relation to
each blow mold and adapted to pass through
the same and into a press mold, means to
reciprocate said bottom formers at a predeter-
ned time, a punching mechanism fixedly
mounted adjacent said press mold table,
and means to automatically operate said
punching mechanism to form an initial open-
ing in a gather of glass in a press mold.

10. In an apparatus for forming hollow
glass articles, a plurality of tables suitably
mounted for rotation and each having a plural-
ity of openings therein, a press mold oper-
atively positioned on one of said tables
and aligned with each opening in said table, a blow mold operatively mounted
on another table and aligned with each opening therein, a bottom former slidingly mounted on said
blow mold table in operative relation to
each blow mold and adapted to pass through
the same and into a press mold, means to
reciprocate said bottom formers at a predeter-
ned time, a punching mechanism fixedly
mounted adjacent said press mold table,
and means to automatically operate said
punching mechanism to form an initial open-
ing in a gather of glass in a press mold.

11. In an apparatus for forming hollow
glass articles, a plurality of tables suitably
mounted for rotation and each having a plural-
ity of openings therein, a press mold oper-
atively positioned on one of said tables
and aligned with each opening in said table,
a blow mold operatively mounted on an-
other table and aligned with each opening
therein, a bottom former slidingly mounted
on said blow mold table in operative relation
to each blow mold and adapted to pass through
the same and into a press mold, means to
reciprocate said bottom formers at a predeter-
ned time, a punching mechanism fixedly
mounted adjacent said press mold table,
and means to automatically operate said
punching mechanism to form an initial open-
ing in a gather of glass in a press mold.

12. In an apparatus for forming hollow
glass articles, a plurality of tables suitably
mounted for rotation each having a plural-
ity of openings therein, a press mold oper-
atively positioned on one of said tables
and aligned with each opening in said table,
a blow mold operatively mounted on an-
other table and aligned with each opening
therein, a bottom former slidingly mounted
on said blow mold table in operative relation
to each blow mold and adapted to pass
through the same and into a press mold, means to reciprocate said bottom formers
at a predetermined time, a blow head mech-
nanism fixedly mounted adjacent said press
mold table, means to intermittently rotate
said tables, and means to successively oper-
ate said blow head mechanism to form an
initial opening in a gather of glass posi-
tioned in each press mold.

13. In an apparatus for forming hollow
glass articles, a base, a column fixedly se-
cured thereto, a plurality of tables rotat-
tably mounted on said column, a plurality
of cylinders secured to said tables and
adapted to rotate therewith, a plurality of
press molds carried by one of said tables, a plurality of blow molds carried by another
of said tables, each of said blow molds being
aligned with a press mold, bottom formers
slidings mounted on one of said tables adapted to pass through each of said
blow molds and into operative relation with
a press mold, a piston in each cylinder, con-
nexions between each piston and each bot-
tom former, a rotary valve carried by said
column, means to admit fluid pressure to
d said valve, and means between each cylin-
der and said valve to control the admission
and exhaust of fluid pressure to each cylin-
der.

14. In an apparatus for forming hollow
glass articles, a base, a column fixedly se-
cured thereto, a plurality of tables rotata-
ably mounted on said column, a plurality
of cylinders secured to said tables and
adapted to rotate therewith, a plurality of
press molds carried by one of said tables, a plurality of blow molds carried by another
of said tables, each of said blow molds being
aligned with a press mold, bottom formers slidings mounted on one of said tables adapted to pass through each of said
blow molds and into operative relation...
with a press mold, a piston in each cylinder, connections between each piston and each bottom former, a blow head operatively positioned with respect to each blow mold, connections between each blow head and each cylinder, a rotary valve arranged on said column and adapted to control the admission and exhaust at predetermined times of fluid pressure.

In an apparatus for forming hollow glass articles, a table having an opening therein, a press mold carried by said table and alined with said opening, a punching and blowing mechanism located beneath said press mold and adapted to automatically form a preliminary opening in a glass blank contained in said press mold, a second table having an opening therein alined with said press mold opening, a blow mold carried by said second table alined with said opening therein, a bottom former slidingly mounted on said second table, a motor adapted to reciprocate said bottom former to move the same through said blow mold into engagement with said glass blank in said press mold and deliver the same to said blow mold, and means to automatically admit pressure to said motor to operate said bottom former at predetermined times.

Witnesses:

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