May 24, 1932. R. W. CANFIELD 1,859,956

ELEVATING TAKE-OUT

Filed April 17, 1929 2 Sheets-Sheet 1

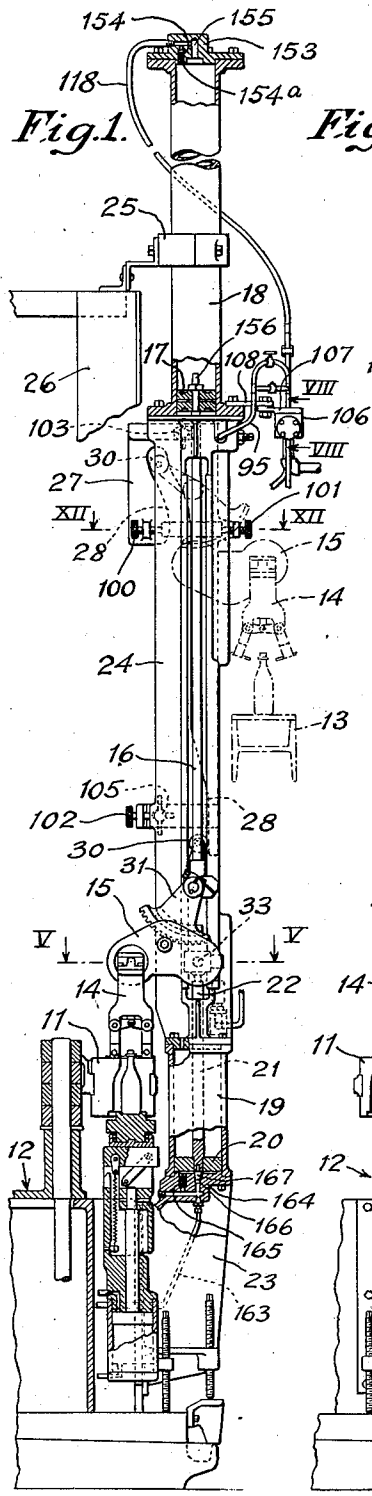

Fig.1.

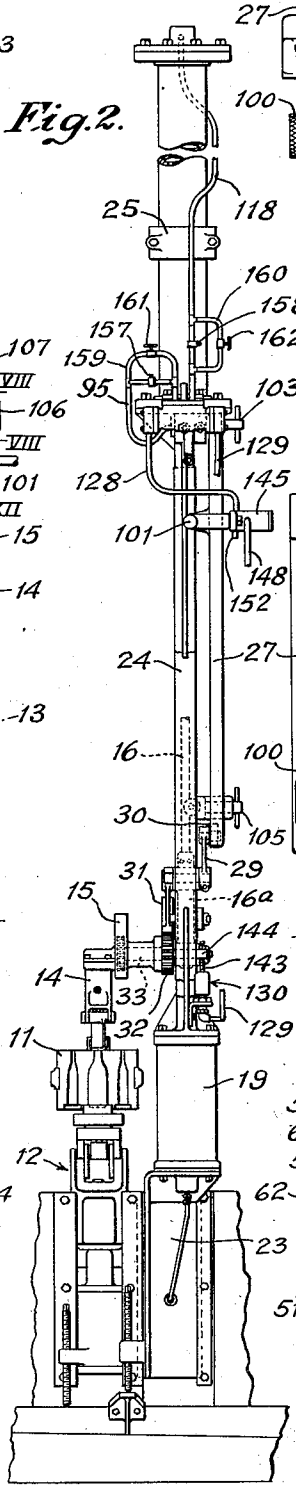

Fig.2.

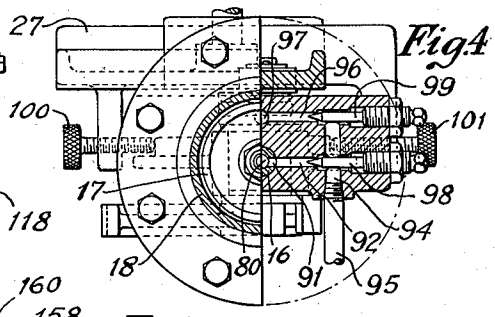

Fig.4

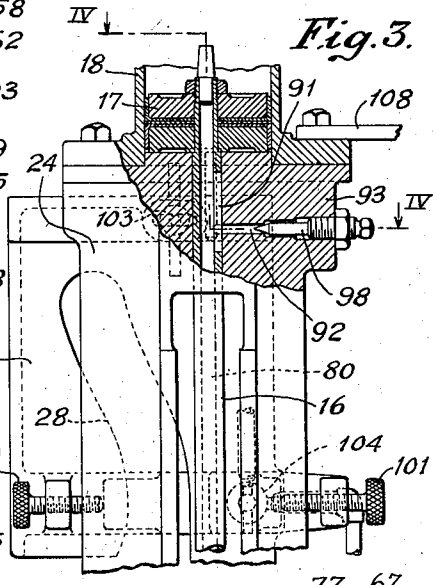

Fig.3.

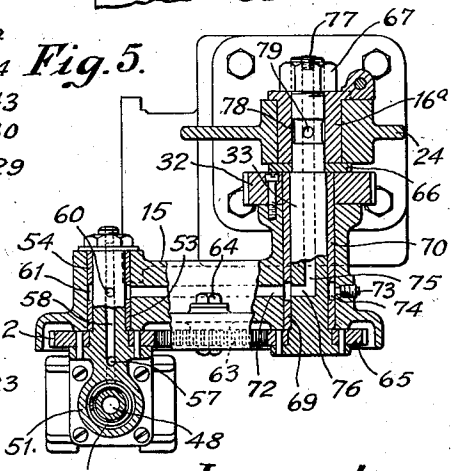

Fig. 5.

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Fig. 7.

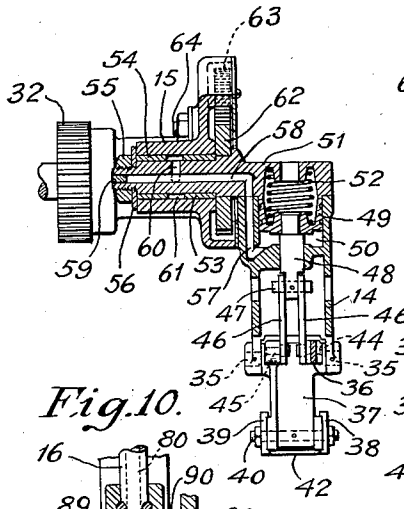


Fig. 6.

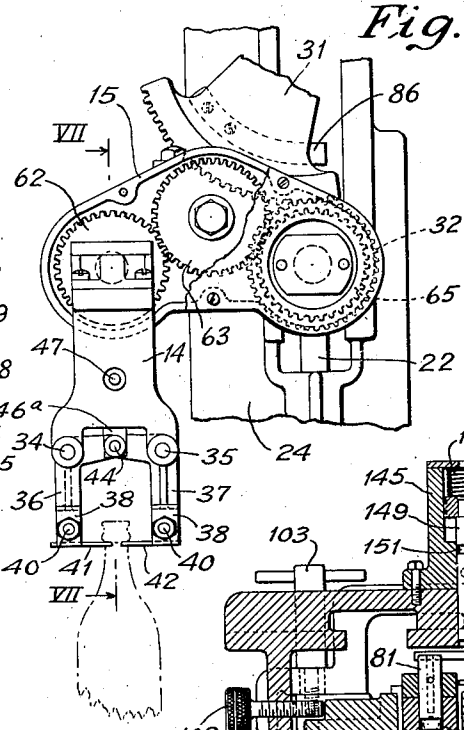


Fig. 12.

Fig. 10.

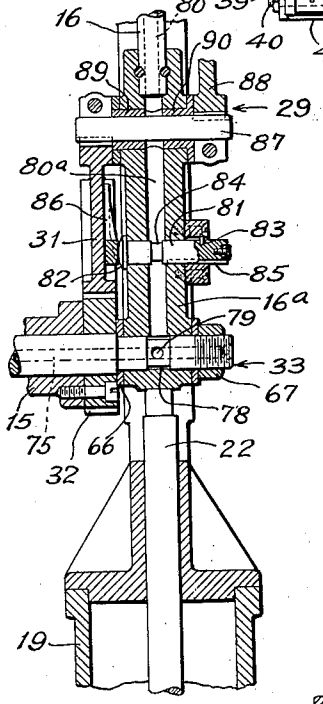


Fig. 9.

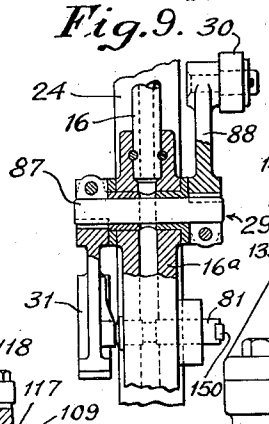


Fig. 11.

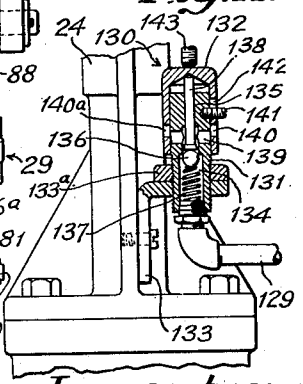
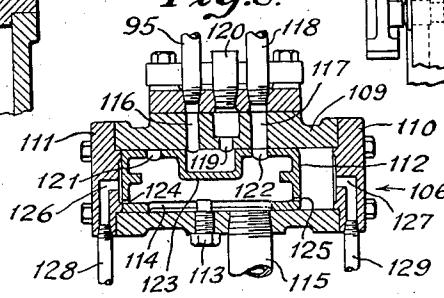


Fig. 8.



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Patented May 24, 1932

1,859,956

UNITED STATES PATENT OFFICE

ROBERT W. CANFIELD, OF WEST HARTFORD, CONNECTICUT, ASSIGNOR TO HARTFORD-EMPIRE COMPANY, OF HARTFORD, CONNECTICUT, A CORPORATION OF DELAWARE

ELEVATING TAKE-OUT

Application filed April 17, 1929. Serial No. 355,726.

My invention relates generally to the manufacture of glassware and more particularly to methods and apparatus for transferring articles of glassware from one point to another.

One of the objects of my invention is to provide improved means for transferring glassware from one position to another, the second position being at a higher level than the first.

A further object is the provision, in apparatus of the character described, of means for shifting the ware laterally to an adjustable distance during the elevation thereof and while maintaining it always in a substantially vertical posture.

A further object is to provide efficient and reliable means for operating such mechanism in selected timed relationship with other apparatus associated therewith.

A further object is the provision in an elevating takeout or transfer device of means for moving glassware gripping tongs downward in a stroke having two distinct steps and having a period of rest or dwell near the bottom of the stroke and just above the gripping position, so that the ware may be gripped at the exact instant desired.

A further object is to provide means for adjusting the speed of the movement of the tongs in carrying the ware from the receiving station to the delivery station and in returning to the receiving station and for adjusting the timing of the gripping action and the subsequent upward movement of the tongs.

Further objects of my invention will appear from the following specification and claims.

In order to more clearly explain the invention, I have shown one embodiment thereof in the accompanying drawings, in which:

Figure 1 is a general view in elevation of apparatus illustrating my invention, with parts broken away and parts in section;

Fig. 2 is a view in elevation of the apparatus of Fig. 1 taken at right angles thereto;

Fig. 3 is a view partly in section and partly in elevation, showing on an enlarged scale a part of the standard, shown in Fig. 1 and some of the passages through which pressure fluid may flow;

Fig. 4 is a view of a part of the apparatus of Fig. 1, partly in plan and partly in section taken on the line IV—IV of Fig. 3;

Fig. 5 is a view of a part of the apparatus of Fig. 1, shown in horizontal section taken on the line V—V of Fig. 1;

Fig. 6 is a view in elevation of a detail of Fig. 1 on an enlarged scale and showing the tongs and the tongs oscillating mechanism with the cover plate partly broken away;

Fig. 7 is a view of the tongs mechanism in vertical section and on an enlarged scale taken substantially on the line VII—VII of Fig. 6;

Fig. 8 is an enlarged sectional view of the control valve taken substantially on the line VIII—VIII of Fig. 1;

Fig. 9 is a view of a detail of the apparatus of Fig. 1 on an enlarged scale with parts broken away and parts in section and showing a segment and cam roll forming part of the apparatus;

Fig. 10 is a view similar to Fig. 9, but showing additional details;

Fig. 11 is a view of a detail of the apparatus of Fig. 1, shown partly in elevation and partly in section and on an enlarged scale, and showing the automatic relief valve; and

Fig. 12 is a view in horizontal section taken substantially on the line XII—XII of Fig. 1, but showing the transfer apparatus at its upper position.

In general, the apparatus illustrated comprises tongs carried by the lower end of a vertically sliding piston rod. The upper end of the rod is attached to a piston adapted to be reciprocated in a relatively long vertical pressure cylinder. When pressure is introduced into the lower part of the cylinder, the tongs will be raised to elevate the ware, and when pressure is introduced to the upper part of the cylinder, the tongs will be returned to the receiving position. The tongs are mounted upon a tongs carrier, which is pivotally supported at one end of a pivoted arm. The arm is pivoted on the above-mentioned piston rod to oscillate about a horizontal axis and carries a series of gears which are actuated in such manner that the tongs carrier is

constantly maintained in a vertical posture. Thus, by movement of the piston rod, the ware is transported vertically and by oscillation of the arm, it is moved laterally while being maintained continuously substantially vertical. Oscillation of the arm about its pivot is obtained by a double-armed lever, which carries at one end a sector adapted to coact with a gear secured to the pivoted arm. This lever carries at its other end a cam roll adapted to coact with a suitably formed and positioned cam groove. Suitable fluid pressure passages are provided to allow pressure to pass through the piston rod and through the oscillating arm to the tongs carrier at proper times to close the tongs to cause them to grasp ware to be transported. The tongs may be opened by spring means when the closing pressure has been released.

Valves are provided for timing the various movements of the apparatus, some of these valves being operated automatically by the movement of the ware transferring members and some being controlled by a separate timing device that is synchronized with the operations of an associated forming machine. The valves include an automatically operated relief valve mounted in position to be actuated by a moving part, when the piston rod reaches a point adjacent to its lowest position. Immediately upon the operation of the relief valve, pressure is diverted from the upper part of the main cylinder, to the tongs and to the lower part of said main cylinder to cause the immediate closing of the tongs and the reversal of movement of the piston and piston rod for the elevation of the ware. An auxiliary pressure cylinder is provided below the path of movement of the piston rod for interposing a stop intermittently in position to cooperate with the downwardly moving piston rod to arrest the tongs immediately above their gripping position, whereby the gripping action may be more exactly timed to cooperate with the forming machine.

Referring specifically to Figs. 1 and 2 of the drawings, the apparatus there illustrated includes a transfer device adapted to transport articles of glassware from a mold 11 of a glassware forming machine 12 to a glassware buck 13. The transfer apparatus comprises generally tongs carried by a tongs carrier 14, mounted upon the arm 15 for oscillation about a horizontal axis. The arm 15 is in turn pivoted upon the lower end of a vertically sliding piston rod 16. The upper end of the piston rod 16 is fastened to the piston 17 of a main cylinder 18. Thus, it is obvious that pressure introduced into the main cylinder 18 below the piston, will serve to raise the rod 16 and the tongs carrier 14 and pressure introduced into the cylinder 18 above the piston 17 will tend to return the tongs downward.

Means are provided for arresting the downward movement of the tongs at a point just above their ware-grasping position for the purpose of exactly timing the ware-grasping action thereof. This means includes an auxiliary pressure cylinder 19, a piston 20 reciprocable within the cylinder and a piston rod 21 secured to the piston and having its upper end 22 formed as a stop adapted to be moved intermittently to position to cooperate with the lower end of the piston rod 16 to arrest temporarily the downward movement of the piston rod 16 and consequently the downward movement of the tongs carried by the tongs carrier 14, the stop 22 being also adapted to be removed at desired intervals to allow the continued downward movement of the tongs.

The parts of the apparatus may be mounted in any suitable manner. For instance, I have shown a bracket 23 adjustably mounted upon the base of the forming machine 12 and supporting at its upper end the auxiliary pressure cylinder 19 which is suitably secured thereto. Fastened upon and supported by the upper end of the cylinder 19 is a standard 24 upon the upper end of which is fastened in turn the main pressure cylinder 18. Suitable bracing means such as the structure 25—26 may be employed to steady the main pressure cylinder.

I provide means for oscillating the arm 15 about a horizontal axis to cause a lateral movement of the ware while it is being elevated. Adjustably fastened to the standard 24 is a cam plate 27 formed with a cam path 28. Arranged to coact with the cam path 28 and with the arm 15 is a double-armed lever 29. This lever carries at one end a cam roller 30 adapted to follow the cam path 28 and carries on the other arm, a toothed sector 31. The teeth of the sector are arranged to mesh with the teeth of a gear 32 that is mounted for oscillation about the axis of the pivot shaft 33 of the arm 15, the gear 32 being suitably secured to the arm 15 so that oscillation of the gear causes oscillation of the arm. Thus, the cam path through its associated mechanism controls the oscillation of the arm 15 and the lateral movement of the ware carried by the tongs.

The details of the ware gripping tongs and the fluid pressure passages immediately associated with said tongs for closing them are shown in Figs. 6 and 7. The tongs head 14 carries on pivots 34 and 35 a pair of bell crank levers 36 and 37. Each of these bell crank levers has its lower arm formed with a T shaped cross section and carries adjacent to the lower end of each arm a pair of fingers 38 and 39. Bolts 40 are employed to secure the fingers to the lower end of the bell crank levers, the fingers cooperating with the bell crank levers 36 and 37 to form grooves which receive ware gripping members 41 and 42.

These ware gripping members have ware contacting edges suitably curved to fit the parts of the ware to be grasped and are held securely, but adjustably, in place by the tightness of the bolts 40, the latter serving to maintain the fingers 38—39 clamped to the ware gripping members. The ends of the bell crank levers 36 and 37 opposite the ware supporting members carry pivot pins 44 and 45 respectively, the pins 44 and 45 passing also through apertures in the lower ends of links 46*a* and 46, respectively. The upper ends of the links 46 and 46*a* are pivoted on a common pivot pin 47 which is secured to the lower end of a piston rod 48. The piston rod 48 is carried by a piston 49 mounted in a cylindrical pressure chamber 50, formed in the upper part of the tongs carrier 14. The upper end of the tongs carrier 14 is suitably secured to a fitting 51 and a spring 52 is inserted between the piston 49 and the upper part of the fitting 51, the spring serving to urge the piston downward and thus tending to open the tongs ware gripping members 41 and 42. Fluid pressure introduced at suitable times between the piston 49 may serve to raise the piston and thus to close the tongs supporting members 41 and 42. The fitting 51 is mounted for movement of oscillation about its axis in bushings 53 and 54 within the arm 15 and serves to pivotally connect the tongs carrier with the arm 15. A nut 55 bearing upon a washer 56 is secured to the end of the fitting 51 opposite the tongs head 14 to maintain the assembly of the parts described. A bore 57 connected with the pressure cylinder 50 is formed in the tongs head 14 for supplying pressure fluid to the said pressure chamber 50 and registers with a substantially longitudinal bore 58 passing substantially centrally through the fitting 51. A plug 59 closes the end of the bore 58 opposite the bore 57, and an intersecting bore 60 connects the said bore 58 with an annular chamber 61 formed between the bushings 53 and 54. Pressure may be supplied to the chamber 61 in a manner to be presently described.

A device by which the ware gripping tongs and the ware are maintained constantly in a vertical posture is shown in Figs. 5, 6 and 7. Secured to the fitting 51 between the bushing 53 and the outer end of the fitting, a gear 62 is mounted for oscillation with the fitting 51 about the axis of the latter and meshes with a similar gear 63 freely mounted on a pivot 64 upon the arm 15. A third gear 65 meshes with the gear 63 and is mounted upon the pivot shaft 33, being secured to the said shaft 33 to prevent movement relative thereto. As shown specifically in Fig. 5, the inner end portion of the shaft 33 is mounted in a transverse opening in the lower part 16*a* of the sliding rod 16 and is secured to the latter by a nut 67 fastened to the inner portion of the shaft 33 and a washer 66 is interposed between a shoulder on the shaft 33 adjacent to the gear 32 and the rod 16*a*. The shaft 33 may be adjusted angularly about its axis when the nut 67 has been loosened. This adjustment may be employed to adjust the levels of the ware take-up and delivery positions of the tongs on the arm 15 without changing the operation of the mechanism for moving the tongs vertically. The arm 15 may be mounted on bushings 69 and 70 and fastened to the gear 32 so that the rotation of the gear 32 causes oscillation of the arm 15 about the axis of the shaft 33 and a consequent lateral movement of the tongs carrier 14. Since the shaft 33 and gear 65 are held against turning about the axis of the shaft 33 and the gears 62 and 65 have the same pitch and number of teeth, the oscillation of the arm 15 about the axis of said shaft will cause, through the enmeshed gears 62 and 63, a relative angular movement of the pivotally connected tongs carrier and outer end of the arm 15 sufficient to maintain the tongs head 14 continuously in a vertical position.

Additional passages are provided to allow pressure fluid to flow from the sliding piston rod 16*a* to the tongs carrier 14 for the purpose of closing the tongs. Extending substantially centrally through the arm 15 is a bore 72 which serves to connect the annular chamber 61 with a similar annular chamber 74 arranged between the bushings 69 and 70. A bore 75 extending substantially centrally of the shaft 33 is connected with the annular chamber 74 by a radial bore 76 and is closed at its opposite end by a plug 77. A reduced portion of the shaft 33 arranged to be positioned within the sliding rod 16 forms another annular chamber 78 and another radial bore 79 in the shaft 33 connects the said annular chamber 78 with the central bore 75.

The pressure fluid passages connecting the annular chamber 78 with the rod 16 and the mounting of the lever 29 are shown more clearly in Fig. 10. The annular chamber 78 opens into a substantially central bore 80*a* formed in the sliding rod 16*a* and thus pressure passing downward through the rod may pass through the passages previously described into the tongs head and into the pressure chamber 50 for actuating the tongs gripping members. A valve is provided in the lower part 16*a* of the sliding rod 16 for cutting off pressure from the upper part of the rod and for allowing excess pressure below the valve to escape to the open air. This valve comprises a sliding member 81 having a head 82, and an annular groove 84 which serves at times to connect the upper part of the sliding rod 16*a* with the lower part of the said rod. A pin 83 limits movements of the valve and a longitudinal groove 85 serves when the slide valve has been moved to the left from the position seen in

Fig. 10 to exhaust pressure from the lower part of the rod 16*a* to the open air to allow the opening of the tongs. A cam 86 formed with the sector 31 serves to move the slide valve to the position shown in Fig. 10 for the purpose of connecting the upper and the lower parts of the bore 80*a* and for the purpose of closing the vent passage 85.

The double armed lever 29 for causing oscillation of the arm 15, comprises a shaft 87, on one end of which is mounted and suitably secured the sector 31, and on the other end of which is similarly secured an arm 88 carrying the cam roller 30 (Fig. 9). The shaft 87 is mounted in bushings 89 and 90 which pass through a transverse opening in the sliding rod 16*a*, thus providing an annular passage around the shaft 87 between the bushings 89 and 90 for the passage of pressure fluid. The upper end of the lower part 16*a* is fastened to the lower end of the sliding rod 16, the bore 80*a* registering with the bore 80 of the sliding rod 16.

The pressure fluid passages of the upper part of the rod 16 are shown more particularly in Figs. 3 and 4. The upper part of the bore 80 of the sliding rod 16 may be at times connected through a slot 91 with a bore 92 formed in a head 93 of the standard 24. An intersecting bore 94 connects the bore 92 with a combined pressure supply and vent pipe 95 and thus pressure may be supplied therefrom through passages 94, 92, 80, 80*a*, 79, 75, 76, 72, 60, 58 and 57 for purposes previously described. A bore 96 arranged in the head 93 parallel to the bore 92 connects the inner end of the bore 94 with a bore 97 arranged in the head 93 parallel to the bore 80. The bore 97 leads to the pressure cylinder 18 and serves to supply pressure thereto under the piston 17 for the purpose of raising the piston. Adjustable needle valves 98 and 99 are arranged in the bores 92 and 96, respectively, for the purpose of varying the proportionate rate of flow of fluid pressure to the bores 92 and 96 and thus varying the time of movement of the piston 17 upward relative to the time of the closing of the tongs members. These valves may also serve, if desired, to regulate the speed of upward and downward movements of the elevating mechanism. After the movement of the rod 16 upward has raised the slot 91 and thus closed the bore 80 against the inlet of air through the bore 92, pressure from within the chamber 18 may pass through the slot 91 into the said bore 80 to maintain the tongs in a closed position.

Means are provided for adjusting the cam path 28 to change the amount of oscillation of the arm 15 and thus to change the amount of lateral movement of the tongs. The cam plate 27 has lugs offset therefrom through which pass adjusting screws 100, 101 and 102 (Fig. 1). These adjusting screws bear upon parts of the standard 24 and by means thereof it is possible to vary the position of the cam path 28 to vary the amount of throw and to adjust laterally the ware receiving point and the ware delivery point. Clamp screws 103, 104 and 105 (Figs. 1, 2 and 3) serve to aid in maintaining the cam plate in the adjusted position.

A main controlling valve is provided for directing pressure fluid to the various parts of the apparatus when desired. As shown more particularly in Figs. 1 and 2, the pressure pipe 95 leads from the head 93 to a valve chest 106, which is mounted by means of brackets 107 and 108 upon the lower flange of the pressure cylinder 18. The valve chest is shown more clearly in Fig. 8 and comprises a substantially cylindrical casing 109, and end plates 110 and 111 attached to said casing 109. Within the casing is positioned a slidable valve member 112 and a guide screw 113 secured in the bottom of the casing 109, registers with a slot 114 in the valve member 112 to guide the valve member and maintain it in correct alignment. The interior of the valve member 112 is maintained in communication through the slot 114 with the main pressure supply pipe 115 which is in constant communication with a supply of fluid pressure (not shown). The top of the casing 109 has a port 116 communicating with the pipe 95, a port 117 communicating with a similar pipe 118 and a port 119 communicating with a vent pipe 120. The valve member 112 is arranged with a port 121 for registering at times with the port 116 and with a port 122 for registering at other times with the port 117. An internal flange 123 serves to connect the port 116 with the port 119 when the port 122 registers with the port 117 and serves to connect the port 117 with the port 119 when the port 121 registers with the port 116. For purposes later to be described, there are adjacent to the bottom of the valve member 112 two bleed openings 124 and 125, one opening being arranged on each end of the member 112. Ports 126 and 127 in the end plates 111 and 110, respectively, connect the interior of the valve 106 with the timing pipes 128 and 129, respectively.

The movable valve member 112 is designed to fill only a part of the space within the valve casing 109 and is designed to slide from one end of the valve to the other. The remaining space is designed to be filled with air under pressure, which may escape thereinto from the interior of the member 112 through the bleed ports 124 and 125 in the said member 112 and which may thus build up pressure in one or both of the pipes 128 or 129. Whenever either of the pipes 128 and 129 is connected with the atmosphere, the pressure on that side is dissipated and therefore if there is pressure in the other pipe it causes the movement of the valve member 112 toward the vented pipe. Assume, for

example, that the valve member 112 is in the position shown in Fig. 8, that the pipe 128 is open to the atmosphere so that fluid pressure in the port 126 and the pipe 128 is dissipated and that fluid pressure is being maintained in the pipe 129, the port 127 and the space within the valve chamber to the right of the movable valve member 112, then pressure may slowly escape through the bleed passage 124 into the port 126, the pipe 128 and to the atmosphere. Assuming now that the exhaust valve of pipe 128 is closed so that pressure begins to build up in said pipe and in the port 126. The valve member 112 is still maintained adjacent to the end plate 111 by the fluid pressure to the right of the valve member (Fig. 8), but when the pipe 129 is vented to the atmosphere, the pressure to the right of the valve member 112 is exhausted and the pressure on the left causes a quick movement of the valve member toward the end plate 110. Thus, pipe 118 which had previously been under pressure is vented to the atmosphere through the pipe 120 and fluid pressure is caused to enter pipe 95 which had previously been vented. The valve member 112 will be maintained in a position adjacent to the end plate 110 until the pipe 128 is again vented when excess pressure built up to the right of the valve will cause the shifting of the valve toward the left to the position shown in Fig. 8.

I have provided an automatic relief valve 130 which serves to exhaust pressure from the pipe 129 at the instant that the tongs reach a point approximating their lower limit. Thus, the valve member 112 may be shifted at the exact instant the tongs attain the lowest position desired, and the closing of the tongs and the upward movement thereof may be started immediately. As shown most clearly in Figs. 2 and 11, the relief valve 130 is secured to the lower part of the standard 24. It comprises an inner valve member 131, an outer valve casing 132 and the supports 133 and 133*a* by which it is suitably secured to the standard 24. The inner valve member 131 is formed with an enlarged longitudinal bore 134 extending through substantially the lower half of the said valve member and with a reduced longitudinal bore 135 extending through the upper half thereof. A ball check valve 136 and a spring 137 are contained within the lower bore 134, the spring serving to resiliently keep the ball valve upon a seat formed by the lower portion of the bore 135. A rod 138 is positioned in the bore 135 and serves when depressed by the casing 132, to unseat the ball valve 136 and allow fluid pressure to pass from the bore 134 and the pipe 129. An intersecting diametrical bore 139 through the upper portion of the valve member 131 registers with ports 140 and 140*a* in the valve casing 132 and a stop screw 141 screwed into the upper portion of the member 131 is adapted to move in a slot 142 in the casing 132 and thus limit the upward and downward movement of the casing 132 upon the valve member 131. As shown more clearly in Fig. 2, an adjustable screw 143 is secured within a lug 144 upon the slidable rod 16*a* and serves to open the relief valve 130 by pressing downward at times upon the valve casing 132. Obviously this screw 143 may be adjusted to exactly predetermine the point in the downward stroke of the rod 16 at which the stroke of the piston 17 will be reversed and the tongs will be moved upward.

In Fig. 12 I have shown means for moving the slide valve 81 from the position shown in Fig. 10 to a position in which the upper and lower parts of the bore 80*a* are separated from each other and in which the lower part of the bore 80*a* is vented to the atmosphere. Secured to the cam plate 27 is a relatively small pressure cylinder 145 arranged substantially in the horizontal plane of the adjusting screws 100 and 101. The pressure cylinder 145 is adapted to contain the piston 146 which is continuously urged inward by a spring 147, but which may be forced outward by fluid pressure in the pressure cylinder 145. The fluid pressure may be supplied to the pressure cylinder through a pipe 148 from a timer (not shown) and pressure within the cylinder may be suddenly exhausted by the said timer at the exact instant at which it is desired to move the piston. Secured to the piston 146 is a piston rod 149 having its opposite end adapted to contact (when the tongs are positioned at the delivery position) with an offset member 150 fixedly secured to an end of the valve member 81. The member 150 is of such length and width as to be in alignment with the piston rod 149 in all adjusted positions of the cam plate 27. Movement of the piston 146 and the piston rod 149 thus may cause a shifting of the valve 81 from the position shown in Fig. 10 to a position in which the lower part of the bore 80*a* is vented to the atmosphere. This will cause the exhaust of pressure from the tongs head and allow the opening of the tongs members 36 and 37 by the spring 52 to release the ware. The pipe 128 is also connected to the pressure cylinder 145 and the piston rod 149 has a reduced portion 151 forming an annular groove by which, when the piston rod 149 has been forced inward by the spring 147, the pipe 128 may be connected with an aligned vent pipe 152. Thus, upon the venting of pressure in the pipe 148 by the timer, the piston rod 149 will be moved inward to open the tongs, releasing the ware and to exhaust excess pressure from the left hand side (Fig. 8) of the valve 106 to cause the valve member 112 to move suddenly to the left. Thereupon pressure will be supplied to the pipe 118 leading to the upper

part of the main pressure cylinder 18 and cause the downward movement of the piston 17 and the associated tongs mechanism.

As stated above, pressure fluid may be supplied to the upper part of the main cylinder 18 for the purpose of lowering the piston 17 and the associated ware transporting apparatus. As shown more clearly in Figs. 1 and 2, the pipe 118 leads to the head 153 of the main pressure cylinder 18 for supplying pressure thereto, the head 153 being formed with two separate bores or passages connecting the said pipe 118 with the interior of the main pressure cylinder 18. One of the passages 154, contains a spring pressed check valve 154*a*, to allow the initial entrance of pressure fluid into the cylinder while the other, 155, is formed to receive the upwardly projecting plunger 156 of the piston 17 and thus to provide an air cushion for gradually slowing down the movement of the piston when it is approaching its upper limit.

Further means are provided by which the speed of the downward movement of the piston and tongs may be regulated and differences in speed due to the pull of gravity upon the traveling parts may be eliminated. One way check valves 157 and 158 are inserted in the pipes 95 and 118, respectively, and by-pass pipes 159 and 160 are connected to the said pipes 95 and 118, respectively, to by-pass fluid at times, around said check valves. Adjustable bleed valves 161 and 162 are arranged in the by-pass pipes 159 and 160, respectively, for regulating the flow of fluid pressure therethrough. The check valve 157 lets air pass freely into the lower part of the main cylinder 18, but prevents air from passing out of the lower part of the cylinder, except through the adjustable bleed valve 161. The check valve 158 lets air freely into the upper part of the cylinder 18 but prevents air from passing out from the upper part of said cylinder 18 except through the bleed valve 162. By adjustment of the various bleed valves, I am enabled not only to regulate the speed of the movements of the piston and the associated parts and to compensate for the pull of gravity on the down movement, but am also able to attain a smooth movement of all the working parts.

Pressure fluid is supplied to the lower part of the cylinder 19 for the purpose of raising the piston 20 therein to provide a temporary stop as previously described, and is exhausted therefrom at predetermined intervals by a pipe 163 leading to timing mechanism (not shown). Thus, the lowering of the piston 20 and the completion of the down-stroke of the piston 17 and the tongs mechanism are timed exactly by the exhaust of pressure from the said pipe 163. The lower head 164 of the cylinder 19 is formed similarly to the upper head 153 of the main pressure cylinder 18 having an inwardly opening spring pressed check valve 165, to allow the initial entrance of pressure fluid into the cylinder and an air cushioning bore 166 adapted to receive a plunger 167.

In the operation of the apparatus illustrated, articles of glassware are fabricated by the forming machine 12, each mold 11 thereof being opened while the tongs are positioned just above said mold. The stop member 22, which is interposed beneath the sliding rod 16*a* and held upward by air pressure under the piston 20 in the cylinder 19 holds the tongs so positioned. The pressure in the pipe 163 is released by suitable means such as mechanism associated with the forming machine 12. Then the piston 20 is allowed to descend and air pressure above the piston 17 in the main cylinder 18 forces the rod 16 downward. The tongs head 14 which has been held just above the mold 11, therefore descends carrying the tongs gripping members 41 and 42 downward around the neck of the article to be grasped. During this movement the members 41 and 42 have been held separated by the spring 52. As the tongs mechanism and the sliding rod reach substantially their lowest position, the screw 143 strikes the valve casing 132 and through the rod 138 unseats the ball valve 136 allowing the pressure in the pipe 129 to escape through the bore 139 and the ports 140 and 140*a*. The escape of pressure from the pipe 129 allows the excess pressure in the port 126 and the pipe 128 to force the valve member 112 from the position shown in Fig. 8 to a position adjacent to the end plate 110. This causes pressure in the pipe 118 to be exhausted through the vent pipe 120 and causes pressure to be supplied to the pipe 95. The pressure entering the pipe 95 first passes through the bore 92 and downward through the bore 80, then through the bores 79, 75, 76, 72, 60, 58 and 57 into the chamber 50 to raise the piston 49, thus closing the tongs members 41 and 42 around the neck of the ware. The pressure next passes from the pipe 95 through the bore 94 to the bore 96 and upwardly through the bore 97 into the lower part of the main pressure cylinder 18 to raise the piston 17 and lift the sliding rod 16 and the tongs mechanism. As soon as the slot 91 reaches the pressure cylinder 18, part of the pressure is diverted downward through the piston rod to maintain the tongs in their closed position. Fluid pressure above the piston 17 escapes through the pipe 118, the port 119 and the vent pipe 120. The movement of the tongs mechanism upward causes an oscillation of the sector 31 by reason of the coaction of the cam roller 30 with the cam path 28, but the ware is held in a vertical posture by the relative movement of the gears 62, 63 and 65. During the upward movement of the tongs, the timer mechanism mentioned above closes the exhaust port connected to the pipe 163 and sup-

plies fluid under pressure to the lower part of the cylinder 19 to position the stop 22 for the next cycle. Near the end of the upward movement of the tongs, the plunger 156 enters the bore 155 and cushions the stopping movement thereof. At about the same time, the coaction of the roller 30 with the upper portion of the cam path completes the oscillation of the arm 15 to move such arm substantially into the dotted line position of Fig. 1. When the said arm 15 and the tongs carrier 14 reach substantially the position shown in dotted lines in Fig. 1, pressure is exhausted from the pipe 148 by suitable means such as a valve associated with the forming machine 12 and the spring 147 forces the rod 149 against the offset projection 150 and thus pushes the valve 81 from the position shown in Figs. 10 and 12 to a position in which the upper and lower parts of the bore 80*a* are separated from each other and the lower part thereof is vented to the atmosphere. This exhaust of pressure from below the valve 81 allows the spring 52 to push downward upon the piston 49 and thus to open the tongs members 41 and 42 to release the ware. At substantially the same time the annular groove 151 allows the venting of the pipe 128 through the aligned vent passage 152, which action allows the valve member 112 to move from a position adjacent to the end plate 110 to a position adjacent to the end plate 111, and serves to vent the pipe 95 to the pipe 120 and to supply pressure to the pipe 118. The pressure supplied through the pipe 118 forces the piston 17 downward, the excess pressure below the piston escaping through the passages 97, 96, 94 and the pipe 95. The downward movement of the piston 17 carries the rod 16 and the tongs operating mechanism including the tongs head 14. The coaction of the cam roller 30 and cam path 28 causes an oscillation of the sector 31 and the consequent oscillation of the arm 15 to move the tongs mechanism laterally. As the tongs mechanism near its lowest position, the movement of the sector 31 causes the cam 86 to bear against the head 82 of the slide valve 81 to move the valve to the position shown in Fig. 10, in preparation for its function on the upward movement. Soon thereafter the lower end of the rod 16*a* contacts with the stop 22 on the piston rod 21 of the piston 20 and is held in this position by air under pressure which has entered the cylinder 19. The cycle has thus been completed and the mechanism is so held until the pressure in the pipe 163 is again exhausted as described above.

I have shown and described a form of apparatus arranged to transfer glassware from a forming machine to a conveyor, but my invention is obviously not limited thereto and may be employed to transfer ware from any receiving station to any delivery station.

It is to be understood that the above described embodiment of the invention is for the purpose of illustration only and various changes may be made therein without departing from the spirit and scope of the invention.

I claim as my invention:

1. In apparatus for transferring glassware from a ware receiving station to a ware delivery station, means for holding the said glassware, means for moving said holding means vertically, and automatic means for arresting the movement of the holding means intermediate its upper and lower limits to cause a dwell in the movement of said holding means.

2. In apparatus for transferring glassware from a relatively low ware receiving station to a higher ware delivery station, means for holding the said ware, means for moving said holding means vertically in an up-stroke and a down-stroke, automatic means for arresting the movement of the ware holding means during the down-stroke at a point just above the ware receiving station to cause a dwell in the movement thereof, whereby the instant of arrival of the ware holding means at the ware receiving station may be accurately predetermined.

3. In apparatus for transferring articles of glassware, means for holding said articles, fluid pressure means for moving said holding means vertically in an up-stroke and in a down-stroke, and automatic means for interrupting said vertically moving means to divide the down-stroke into two distinct phases separated by a period of dwell.

4. In apparatus for transferring articles of glassware, means for holding said articles, means for moving said holding means vertically in an up-stroke and in a down-stroke, automatic means for interrupting said vertically moving means to divide the down-stroke into two distinct phases, and means for starting the up-stroke immediately upon the completion of the down-stroke.

5. In apparatus for transferring glassware from a ware receiving station to a ware delivery station, means for holding the said glassware, means for moving the said holding means vertically in an up-stroke and a down-stroke, means for causing a dwell of the down-stroke just above the ware receiving position, said last-named means comprising a fluid pressure cylinder, a piston within the said cylinder, a piston rod attached to the said piston, a stop upon the said piston rod, and fluid pressure means for raising the piston to position the stop beneath a moving part of the means for moving said holding means, and means for releasing the pressure from beneath the piston at selected predetermined intervals for withdrawing the stop and allowing the completion of the downward stroke.

6. In apparatus for transferring glassware

from a ware receiving station to a ware delivery station, means for holding the said glassware, fluid pressure means for moving the said holding means vertically in an up-stroke and a down-stroke, and means controlling the fluid pressure means to cause the up-stroke to be started immediately upon the conclusion of the down-stroke, said control means comprising a valve controlling the supply of fluid pressure to said fluid pressure means, and means connected to the fluid pressure means for operating the said valve substantially at the conclusion of the down-stroke.

7. In apparatus for transporting glassware from a ware receiving station to a ware delivery station, means for holding the said glassware, and means for moving the said holding means vertically, comprising a substantially vertical cylinder having heads, a piston positioned within the cylinder, fluid pressure connections leading to the upper end of the said cylinder and to the lower end thereof and adapted to supply pressure fluid alternately above and below said piston, a rod fastened to the said piston and supporting the said ware holding means, and a plunger secured to the said piston on the side opposite the piston rod, one of the heads of the said cylinder having a bore for receiving the said plunger to cushion the movement of said ware holding means in one direction.

8. In apparatus for transporting glassware from a ware receiving station to a ware delivery station, means for holding the said ware, comprising a tongs carrier having a pressure chamber therein, levers mounted on said carrier, ware gripping members adjustably secured to said levers, a piston mounted in the said chamber, a piston rod fastened to the said piston, and to the said levers, a spring for urging the said piston in one direction to move the ware contacting members to an open position, and fluid pressure means for moving the piston in the opposite direction to move the ware contacting members to a gripping position, and means for elevating the said ware holding means.

9. In apparatus for transferring articles of glassware, means for holding said articles, means for moving said holding means vertically, means including a cam, for moving said holding means laterally in a vertical plane, and means for adjusting said cam to vary the extent of the lateral movement.

10. In apparatus for transferring glassware from a ware receiving station to a ware delivery station, means for holding the said glassware, means for moving the said holding means vertically, and means for moving the holding means laterally during the vertical movement thereof, comprising an arm mounted on a pivot upon a part of the vertically moving means, a gear fixed to the said arm and mounted on the same pivot, a double armed lever mounted on the vertically moving means, a sector secured upon the said double armed lever and having teeth meshed with the said gear, a cam roller also secured upon the said arm, a substantially vertical cam path arranged to coact with the said cam roller, the cam path causing the cam roller to move laterally during the vertical movement of the roller and thereby oscillating the arm about its pivot.

11. In apparatus for transporting glassware from a ware receiving station to a ware delivery station, fluid pressure means for holding the said glassware, fluid pressure means for moving the said holding means vertically, and common means for controlling the action of said holding means and the action of said vertically moving means comprising a valve, fluid pressure connections extending from said valve to said holding means and to said second named fluid pressure means, exhaust openings connected to said valve, a source of fluid pressure supply connected to said valve, and movable means within said valve for selectively connecting either of the first-named pressure connections with either the exhaust opening or the fluid pressure supply.

12. In apparatus for transferring glassware from a ware receiving station to a ware delivery station, means for holding the said ware, fluid pressure operated means for causing said holding means to grasp said ware, an arm supporting said ware holding means, a pivot for said arm, means for oscillating said arm about said pivot, a fluid pressure cylinder, a source of fluid pressure supply adapted to supply pressure to said cylinder, a piston within said cylinder, a piston rod attached to said piston, the said pivot being mounted on said piston rod, and bores extending through said piston rod, said pivot, said oscillating arm, and said ware holding means for allowing the passage of pressure fluid to said ware holding means to operate said ware holding means.

13. In apparatus for transferring glassware from a ware receiving station to a ware delivery station, means for holding said glassware, fluid pressure operated means for causing said holding means to grasp said ware, fluid pressure means for moving said ware holding means vertically in up-stroke and down-stroke, means for causing the immediate engagement of the ware and the inception of the up-stroke immediately upon the completion of the down-stroke, and means for varying the relative time of movement of operation of the ware engaging means and of the up-stroke operating means, said time varying means comprising a source of pressure fluid supply, a pair of passages connected to said source of pressure fluid supply, one of said passages leading to the ware releasing means and the other passage leading

to the up-stroke movement operating means, and adjustable needle valves positioned within said passages.

14. In apparatus for transferring glassware from a ware receiving station to a ware delivery station, means for holding the said glassware, means for moving the said holding means vertically, comprising a fluid pressure cylinder, fluid pressure connections to the said cylinder, and means for compensating for the pull of gravity upon said moving means, said compensating means comprising a check valve interposed in the fluid pressure connections and adapted to allow the passage of pressure freely therethrough on the up-stroke of the piston and to prevent the passage of fluid pressure on the down-stroke of the piston, a by-pass for allowing pressure fluid to pass around the said check valve, and an adjustable bleed valve interposed in the by-pass.

15. In apparatus for transferring glassware from a ware receiving station to a ware delivery station, means for holding the said glassware, fluid pressure means for causing the said holding means to grasp the glassware at desired times, a spring for causing said wear holding means to release said glassware, except when said fluid pressure grasping means is active, a piston rod for supporting said ware holding means and moving the ware holding means vertically, said piston rod having a substantially longitudinal bore for conducting pressure fluid to said ware holding means, a slide valve within said bore, a cam for opening said valve to allow pressure fluid to flow through said passage, an auxiliary pressure cylinder, a piston within said cylinder, and a piston rod attached to said piston, for moving said valve from an open position to a closed position to prevent fluid pressure from flowing through said passage and for allowing fluid pressure to be vented from said ware holding means.

16. In apparatus for transferring glassware from a ware receiving station to a ware delivery station, ware holding means, fluid pressure means for causing the ware holding means to grasp the ware, means for moving the ware holding means vertically, means to move the ware holding means about a horizontal axis, and spring pressed means for causing the ware holding means to release the ware.

Signed at Hartford, Connecticut, this 12th day of April, 1929.

ROBERT W. CANFIELD.