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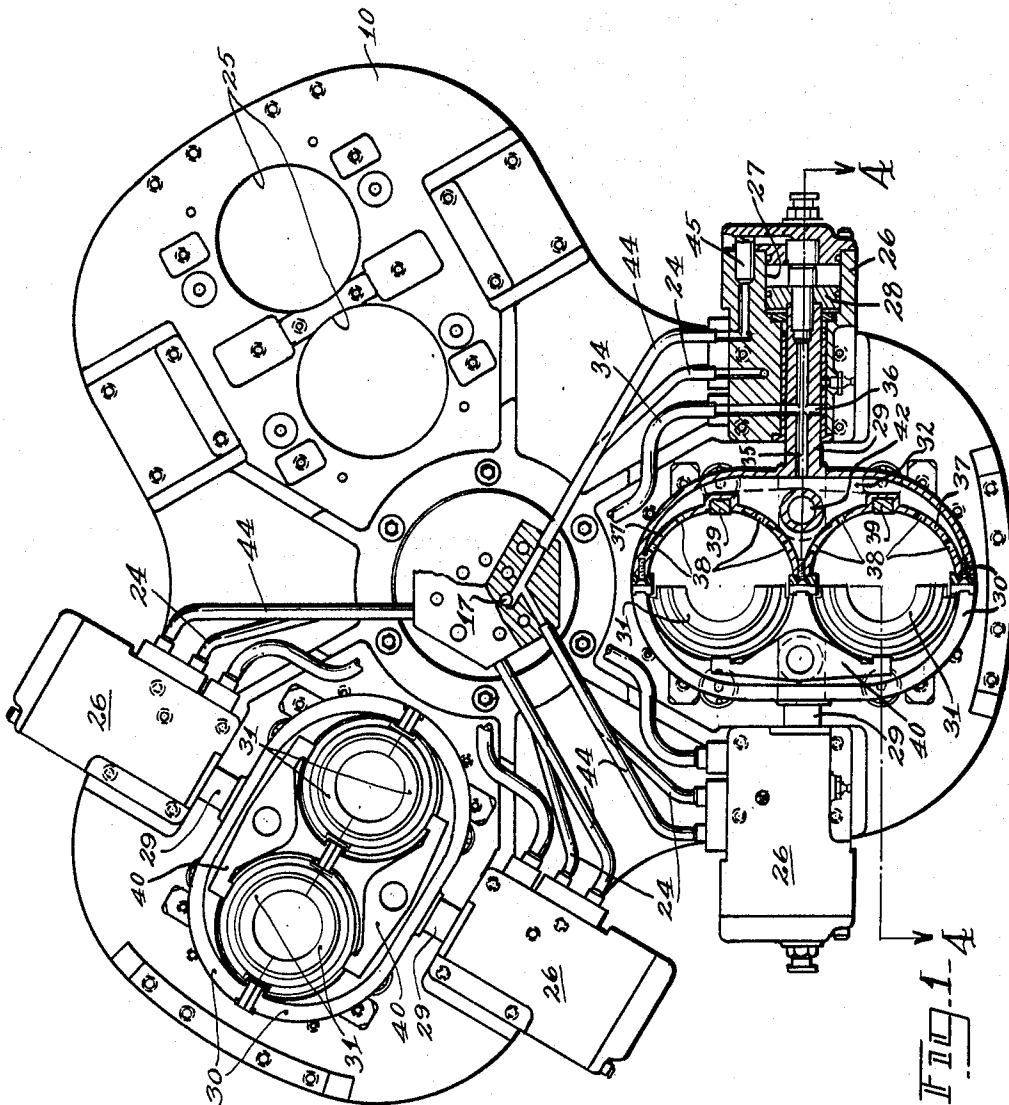
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3,249,418

AIR OPERATED NECK MOLDS

Filed Nov. 25, 1960

4 Sheets-Sheet 1



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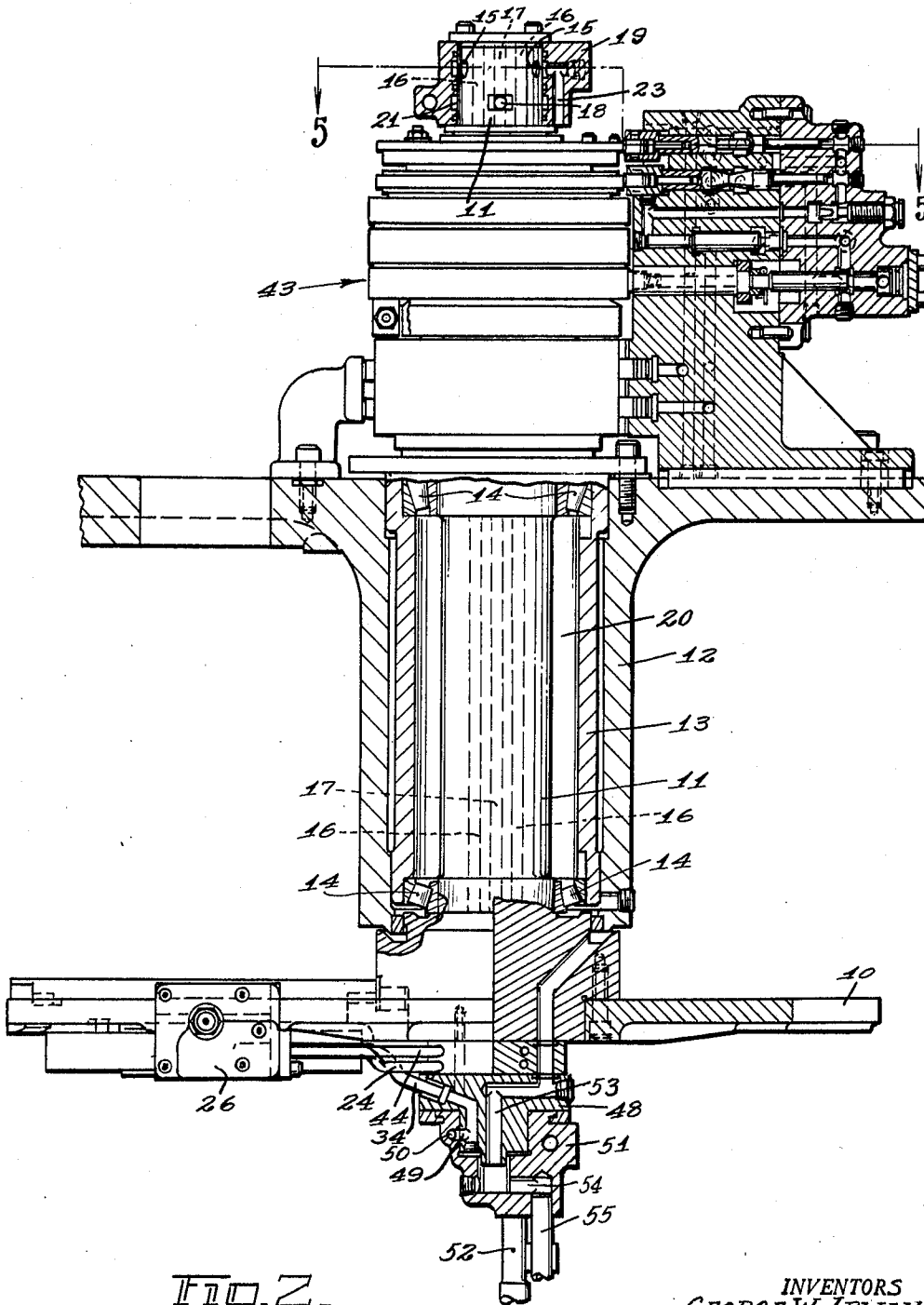


Fig. 2.

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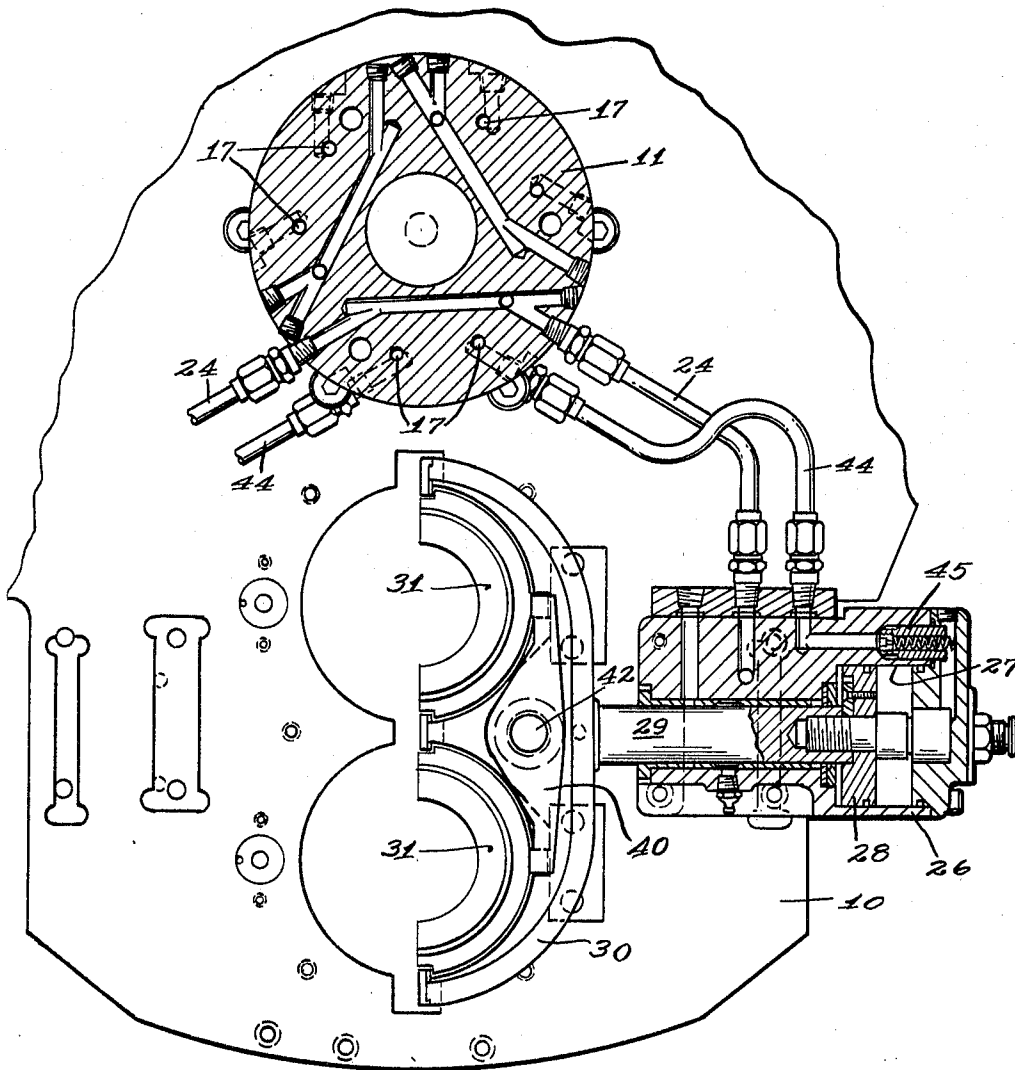


FIG. 3.

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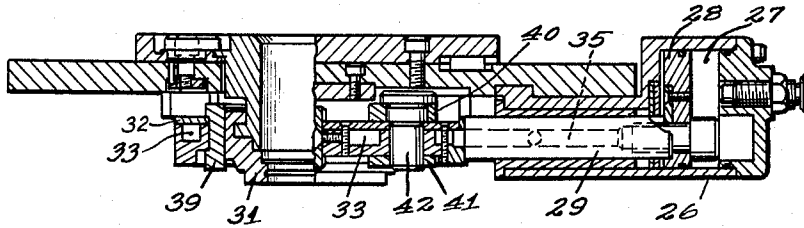


FIG. 4.

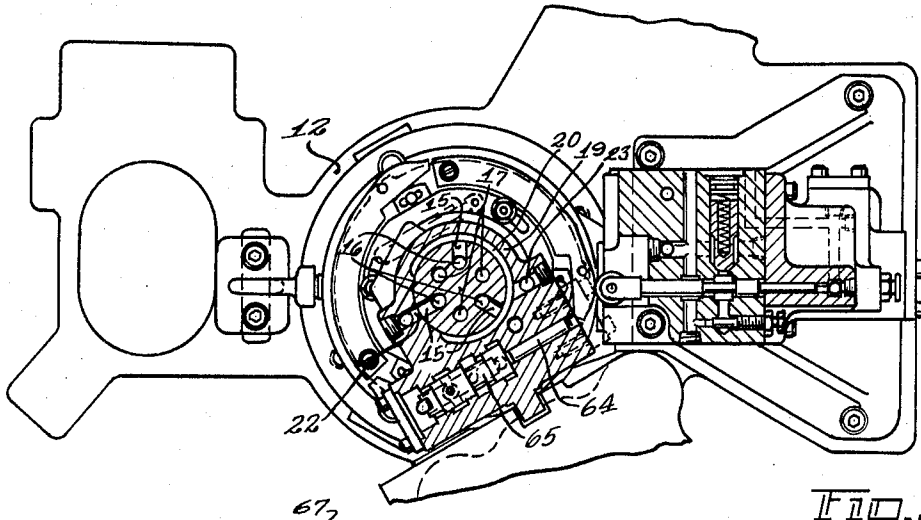


FIG. 5.

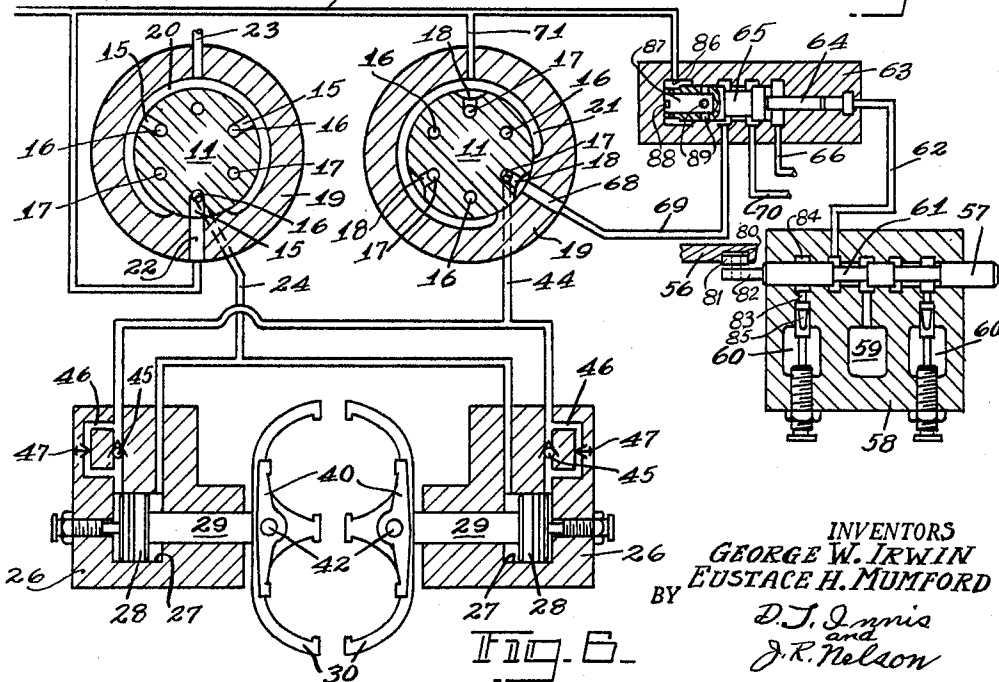


FIG. 6.

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AIR OPERATED NECK MOLDS

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6 Claims. (Cl. 65—356)

This invention relates to apparatus for operating neck molds on a glass forming machine. More specifically, this invention relates to an air operated mechanism carried by the ware transfer turret for maintaining the neck molds or neck rings closed during the forming operations and for opening the neck molds during the takeout operation.

Heretofore, it has been the practice to utilize oil as the fluid for maintaining the neck molds closed and to provide a mechanical mechanism for opening the neck molds. This mechanical mechanism, in prior devices, has been mounted on a stationary portion of the machine adjacent the takeout station. When attempting to open the neck molds from a mechanism that is mounted separate from the structure that carries the neck molds, there has been difficulty experienced in maintaining proper alignment of the neck molds so that the neck molds can be opened simultaneously. Furthermore, by having engagement of such a mechanism with the neck molds, a certain amount of wear is unavoidable at the point of engagement thus requiring continuous adjustment so as to not throw off the timing of the machine operations.

An additional problem, when utilizing oil as the fluid for maintaining the neck molds closed during pressing and blowing hollow glass articles, is that the oil has a tendency to leak out onto the hot surfaces of the molds requiring frequent cleaning and also presents a serious fire hazard.

It is an object of this invention to provide apparatus for maintaining the neck molds closed during the forming operations which utilize air as the force applying means.

An additional object of this invention is to provide mechanism for opening and closing the neck molds which is carried in its entirety by the mold transfer turret.

A further object of this invention is to provide means for cooling the neck mold holders during operation of the machine.

A still further object of this invention is to provide efficient cooling means for cooling the neck molds.

Additionally, it is an object of this invention to provide a mechanism for opening and closing the neck molds by relative linear movement of the neck mold halves.

The specific nature of this invention, as well as other objects and advantages thereof, will become apparent to those skilled in the art from the following detailed description thereof taken in conjunction with the annexed sheets of drawings, wherein:

FIG. 1 is a schematic bottom plan view of the neck mold carrying turret with portions in cross-section and some parts removed for clarity of illustration;

FIG. 2 is a schematic elevation of the neck mold carrying turret and its support structure with portions thereof in cross-section;

FIG. 3 is a schematic bottom plan view of a portion of the turret with some parts removed and the support shaft and air motor in section;

FIG. 4 is an inverted cross-section taken at line 4—4 on FIG. 1, on a slightly enlarged scale;

FIG. 5 is a cross-sectional view taken at line 5—5 on FIG. 2, and

FIG. 6 is a diagrammatic view of the fluid control circuit with mechanical parts being shown in section.

Referring to FIGS. 1 and 2, there is shown a horizontal turret 10 connected to the lower end of a vertical shaft

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11. The vertical shaft 11 is mounted concentric within a downwardly extending hollow support member 12 which form a stationary part of the forming machine. The support element 12 has an inner bearing sleeve 13 which carries bearing members 14 in supporting relationship with respect to the shaft 11 and retains shaft 11 against axial movement within the support element 12.

The upper end of the shaft 11 is provided with three inlet ports 15 which extend radially toward the center of the shaft 11 where they individually intercept one of three vertical passageways 16, which extend throughout the length of the shaft 11. In addition to the vertical passageways 16 there are three additional vertically extending passageways 17 which communicate with three radially extending ports 18 adjacent the top of the shaft 11. The axes of ports 18 lie in a horizontal plane which is vertically below a parallel plane which includes the axes of inlet ports 15.

Surrounding the upper end of the shaft 11 is a valve body 19 having two axially spaced internal annular grooves which form chambers 20 and 21. The chambers 20 and 21 extend circumferentially within the valve body 19 substantially 300°.

An inlet passage 22 extends through the wall of the valve body 19 and opens into that portion of the valve body 19 which is not relieved to form the chamber 20. Diametrically opposite the passage 22 there is provided an exhaust passage 23 extending through the wall of the valve body 19 which communicates at its inner end with the chamber 20. Connected to the lower end of the shaft 11 are three conduits 24 which communicate at their inner ends with the vertical passageways 16.

As best shown in FIGS. 1 and 2, the turret 10 is provided with pairs of openings 25 which are 120° apart and have centers which lie on the radii of the turret 10. To the bottom of turret 10 on opposite sides of the openings 25 are fastened a pair of air motors 26. The air motors 26 are provided with cylindrical bores forming piston chambers 27 within which slide pistons 28. Connected to the pistons 28 and extending outward through the walls of the air motors 26 are piston rods 29 which are formed integral with neck mold holders 30. The neck mold holders 30 are adapted to hold two "C" shaped neck mold halves 31 in side-by-side relationship. As can best be seen in FIG. 1, there are two neck mold holders 30 in opposing relationship and each contains two neck mold halves 31 so that they may be opened and closed by the reciprocation of the pistons 28 and the holders 30.

Referring now to FIGS. 1 and 4, there is shown an arrangement for mounting the neck mold halves 31 in the neck mold holders 30 so that upon closing of the neck molds, cooling air will be applied thereto. The neck mold halves 31 are retained within the holders 30 but have their exterior wall spaced away from the surrounding wall of the neck mold holder 30. The neck mold holders 30 are formed "U" shaped in cross-section and have an overlying member 32 fixed thereto so as to form a hollow chamber 33 within the neck mold holders 30. The chamber 33 communicates with a cooling air inlet pipe 34 through a passageway 35 which extends axially through the piston rod 29. Within the piston rods 29 are radially extending ports 36 which communicate with the air cooling inlet pipe 34 when the mold holders are in closed position.

When the mold holders are opened, the piston rods 29 are retracted to seal off the radial ports 36 so that the cooling air is introduced to the interior of the mold holders only when they are in closed position. In this respect, it should be pointed out that the mold holders 30 are closed during the entire cycle of operation of the machine with the exception of the short time when the holders are

opened to release the ware at the takeout station. This opening of the holders at the takeout station is a relatively short period of time in relation to the total time cycle of the machine. The mold holders 30 have an inner vertical wall 37 which surrounds the neck molds 31 and these inner walls 37 have a plurality of air outlet ports 38 through which the cooling air, which is fed to the interior of the mold holders, will pass out and impinge on the exterior surfaces of the neck mold halves. This impingement of cooling air will result in controlled cooling of the neck mold halves.

The neck molds 31, when mounted in the neck mold holders 30, have diametrically opposed exterior surfaces in abutting relationship with vertically extending pressure pads 39. The pressure pads 39 are individual to each mold half 31 and are adapted to apply a closing force to the mold halves when the mold holders of each pair of holders are moved into closing position. The pads 39 of each individual holder are joined together both above and below the mold holder structure by means of equalizer arms 40 and 41 which are pivotally mounted to the mold holder at their centers by means of a pivot pin 42. Thus, it can be seen that upon closing of the mold holders and the contained neck mold halves, the equalizer arms 40 and 41 will carry the pressure pads 39 in force applying relationship with respect to the mold halves 31 in such a manner that the mold halves will be held closed by equal forces.

Referring to FIGS. 2 and 5, the shaft 11 is indexed by means of a hydraulic indexing mechanism 43. The indexing mechanism 43 is fully disclosed in application Serial Number 806,957, filed April 16, 1959, and assigned to the assignee of this application.

Reference may be had to the above identified application for the details of the mechanism for indexing the turret. Suffice it to say that the mechanism 43 will rotate shaft 11 in 120° intervals so that the neck molds 31 carried by the turret 10 will transfer the parisons formed at one station to a blow station; blown articles from the blow station to the takeout station; and empty neck molds will be carried from the takeout station to the parison forming station. All of the above operations are carried out simultaneously. In this sense, the forming apparatus of which this invention forms a part is a three-station full overlap cycle machine.

As previously stated, shaft 11, in addition to the passageway 16, also has vertically extending passageways 17 which are connected to conduits 44 which in turn are connected to air motors 26 behind pistons 28.

Within the lines 44 are check valves 45 which allow air to flow to the piston chamber 27 but prevent the return flow except through a parallel bypass line 46 containing a throttle valve 47. Thus, as air pressure is fed through lines 17 by means of valve body 19, the pistons 28 will be moved toward each other resulting in closing of the neck mold halves 31.

As can best be seen in FIG. 4, the piston 28 is mounted with respect to its piston rod 29 thus preventing any possibility of the rod 29 being rotated out of proper alignment. Also it should be pointed out that the surface areas upon which the air under pressure may act with respect to the sides of the piston 28 are different. The outer or closing sides of the pistons 28 have a greater surface area than the opening or inner sides of the pistons. This is obvious from the fact that the piston rods extend from the inner side. Thus, under the application of the same pressure to both sides of the piston 28, the piston will necessarily be operative to hold the mold halves closed.

The cooling air which is applied to the inside of the neck mold holders 30, as previously stated, is supplied through the inlet pipes 34. The ends of the air inlet pipes 34 opposite the end connected to the mold holders is connected to a valve body 48 (see FIG. 2) which is fixed to and rotates with the shaft 11 and turret 10. The valve body 48 has a series of radially outwardly extend-

ing ports 49 which communicate with ports 50 contained in an annular internally tapped member 51 within which the valve body 48 is adapted to rotate. The annular tapped member 51 is held stationary during the indexing of the turret and shaft 11. Air is supplied to the tapped member 51 through an air inlet conduit 52. The valve body 48 also contains a drain passage 53 which is in continuous communication with drain port 54, in the tapped member 51. Thus, any oil leaking from the bearings 14 will be conveyed through the drain passage 53 to the port 54 from which an oil drain line 55 extends to a suitable sump or collecting point (not shown).

The tapped member 51 which connects the cooling air to the neck mold holders is designed so that cooling air will be fed to all the neck mold holders while the holders are at the forming stations and the takeout station. However, it should be recognized that if it is desirable to cool the mold holders and neck molds, when they are positioned at one of the stations only, it would only be necessary to block off the ports 50 which are in communication with the neck mold holders when they are at other than the desired station. Thus, it can be seen that the neck mold cooling arrangement may be selective in that cooling may be obtained at the press station, at the blow station, or at the takeout station or any combination thereof. Furthermore, the particular location and placement of the air outlet ports 38 located in the inner walls 37 of the mold holders may be selected as desired so as to provide any desired pattern of cooling to the neck molds.

Turning now to FIG. 6, the operation of the neck mold mechanism will be described. The operations of the opening and closing mechanism for the neck mold halves 31 is initiated through the operation of a cam 56 which is rotated by a constant speed timing motor (not shown). The cam 56, which is generally circular in plan view, has a channel or groove 80 formed in its under surface which forms a cam track. A roller 81 rides in said groove and is connected to end 82 of spool valve 57. Rotation of the cam 56 will move spool valve 57 axially in a main timing valve block 58. The main valve block 58 has a pressure supply passage 59 and two exhaust passages 60, the left-hand exhaust passage being the exhaust passage that is utilized in this mechanism. The left-hand exhaust passage 60 is in communication through passage 83 with an annular groove 84 formed in the valve block 58 in surrounding relationship to the spool valve 57. For rate control purposes the passage 83 has an axially adjustable throttle valve 85 positioned therein. This adjustability is provided by the threaded connection of the valve 85 with the valve body 58. In FIG. 6, the spool valve 57 is positioned to the right by the cam 56 and oil under pressure in passage 59 will flow past an undercut portion 61 of the spool valve 57 and into a conduit 62. The conduit 62 is connected to one end of a pilot valve 63 and will force a slidable piston 64 to the left to the position shown in FIG. 6.

Movement of the piston member 64 will force a floating spool 65 within pilot valve 63 to the position shown in FIG. 6. Any oil that may escape past the piston member 64 is drained from the pilot valve 63 through an oil drain line 66 connected thereto.

Air under pressure from a suitable source of constant pressure air is introduced through an inlet conduit 67. The conduit 67 is connected to the inlet passage 22 of the valve body 19. The inlet passage 22 is connected to one of the vertical passageways 16 with this particular passageway connected to conduit 24. The conduit 24 in the schematic view on FIG. 6 branches and connects the air under pressure to the inside of piston chambers 27 thus forcing pistons 28 to move away from each other. Air which is trapped in back of the pistons 28 is forced out past throttle valve 47 into a conduit 44 which is connected to one of the vertical passageways 17. With

the shaft 11 in the position shown in FIG. 6, this particular passageway 17 is connected to a port 68 in the valve body 19. The port 68 is connected to the pilot valve 63 by a conduit 69, and with the spool valve 65 in the position shown, the conduit 69 will be in communication with an air exhaust line 70, thus exhausting the air which is trapped in back of the pistons 28. Obviously, adjustment of the valves 47 may be made so as to control the rate of movement of the pistons away for each and to prevent sudden shocks which would be transmitted to the neck molds if the pistons 28 were permitted to move away from each other at too great a speed.

While FIG. 6 shows the connection to only a single pair of neck mold holders, it should be pointed out that the other two neck mold holders have conduits 24 and 44 connected thereto as well. However as illustrated in FIG. 6, the specific neck mold holders shown are in their open position which occurs only at the takeout station when the conduit 44 is exhausted. The other conduits, similar to 44, which are connected to the other two sets of neck mold holders (not shown) will be receiving air under pressure from the other two vertical passageways 17. This air under pressure is fed to the passageways 17 by means of a branch conduit 71 which connects inlet conduit 67 with the chamber 21 formed within the valve body 19. At the same time that air under pressure is being fed to conduit 24, which is connected to the neck mold holders that are positioned at the takeout station, the other two conduits similar to conduit 24 will be connected to exhaust through the passage 23. As previously stated, the vertical passageways 16 are connected at their lower ends to conduits 24 and in the position shown in FIG. 6, the other two vertical passageways 16 are open, at their upper ends, to the chamber 20 within the valve body 19 and this chamber 20 is exhausted through the exhaust passage 23.

The above description has explained the operation of the neck mold opening system. To close the neck mold holders 30, the main timing cam 56 is rotated so as to shift the valve spool 57 to the left. Shifting of the valve spool 57 to the left will move the undercut portion 61 thereof to the left so as to exhaust the conduit 62 and thus release the oil pressure in back of the piston member 64. With the release of this pressure, the floating spool 65, within the pilot valve 63, will move to the right under the influence of air under pressure in line 67. As can be seen when viewing FIG. 6, the line 67 is connected to a chamber 86 formed in the valve block 63. Pressure in this chamber 86 will also be present in the hollow interior 87 of the floating spool valve 65. Communication between the interior 87 of the valve and chamber 86 is maintained by recesses 88 formed at the end of valve 65. Thus it can be seen that the interior of valve 65 is always under pressure and thus the valve is biased toward the right as viewed in FIG. 6. Ports 89 formed in the valve 65 will connect the interior 87 of the valve to conduit 69 when the valve is shifted to the right. Shifting of the floating spool 65 to the right will connect the air pressure line 67 to conduit 69 resulting in air under pressure being fed to conduit 44. Air under pressure in conduit 44 will reach the outside of pistons 28 and by reason of the fact that the surface area of the outside of pistons 28 is greater than the inside area thereof, the pressure will be greater on the outside of the pistons causing them to move toward each other and close the neck mold holders. This closing of the neck molds is done after the neck molds have been opened a sufficient time to allow the ware to be removed from the neck molds. With the neck mold holders closed, the turret 10 and shaft 11 will be rotated 120°.

Assuming now that the shaft 11 has been rotated 120°, the specifically shown conduit 24 will now be connected through its vertical passageway 16 to the chamber 20 which, as previously stated, is exhausted through the ex-

haust passage 23. Simultaneously, with this connection of the conduit 24 to exhaust, the specifically shown conduit 44 will now be in communication with the pressurized chamber 21 within the valve body 19 and air under pressure will be maintained in the conduit 44 and the neck mold holders will remain closed.

Thus it can be seen that applicants have provided a mechanism for opening and closing the neck molds which utilizes air as the force applying medium. In addition, the neck mold operating mechanism is carried entirely by the ware transfer turret thus providing a self-contained mechanism which is not subject to externally applied stresses and is not dependent upon separately mounted mechanism for effecting the opening of the neck molds that have been required in the prior art devices of this nature. Applicants have also provided an efficient arrangement for selectively cooling the neck molds and the holders during substantially the entire operating cycle of this ware forming machine.

Various modifications may be restored to within the spirit and scope of the appended claims.

We claim:

1. In a glassware forming machine, the combination of a vertically disposed shaft, means supporting said shaft for rotation about its vertical axis, a horizontally disposed turret connected to said shaft, said turret adapted to support a plurality of two-piece neck molds at circumferentially spaced points thereabout, each neck mold support comprising a pair of oppositely disposed fluid motors connected to said turret, said pair of fluid motors having axially aligned output shafts, a holder for a neck mold half mounted on the extending end of each of said output shafts in facing relationship, a source of fluid under pressure, means connected between said source and said pair of fluid motors for actuating said motors in unison to move said holders toward and away from each other, a neck mold half carried by each holder, each holder being further defined as forming a hollow chamber, means connected to each holder for supplying coolant to the chamber therein, and ports formed in said holders in facing relationship to the neck mold halves carried thereby, whereby coolant is directed from the holder against the neck mold half.

2. In a three-station glassware forming machine, the combination comprising a vertical shaft, a turret fixed to the lower end of said shaft, means above said turret for rotatably supporting said shaft, said turret adapted to support three sets of two-piece neck molds at circumferentially spaced points thereabout, each neck mold support comprising a pair of axially aligned cylinders fixed to said turret, a piston and connected rod in each cylinder, a holder for a neck mold half mounted on the extending end of each of said rods in facing relationship, a source of fluid under pressure, means connecting said source and said pair of cylinders for actuating said pistons in unison to move said holders toward and away from each other, a neck mold half carried by each holder, each holder being further defined as comprising a hollow chamber, means connected to each holder for supplying coolant to the chamber therein, and ports formed in said holders in facing relationship to the neck mold halves carried thereby, whereby coolant is directed from the holder against the neck mold half.

3. In a glass forming machine of the type having a horizontal rotatable neck mold carrying turret, the combination comprising a plurality of neck mold holders a plurality of air motors, said air motors each having an output shaft connected to and supporting a neck mold holder, said air motors being connected to said turret in axially aligned, opposed pairs, said holders being formed of hollow arms having a generally C-shaped plan, means connected to said arms for introducing cooling air to the interior of said holders, a plurality of split neck molds, each holder embracing a neck mold half, a plurality of ports formed in the embracing face of each

holder for directing coolant from each holder upon the external surface of each neck mold half, means responsive to rotation of said turret for sequentially applying air to said air motors, and wherein said means for introducing coolant to said holders is operative only when the holders are in mold closing position.

4. In a three-station glassware forming machine having a horizontal ware transfer turret, the combination comprising a vertical shaft connected to said turret for rotatably supporting same, a plurality of pairs of vertical passages extending throughout the length of said shaft, a plurality of radially extending ports communicating with said passages at the end thereof, a stationary air inlet chamber surrounding said one end of said shaft for selectively admitting air to said passages, three sets of two air motors mounted on said turret each set of motors having their output shafts being axially aligned and extending toward each other, three sets of neck mold holders, one set positioned between each set of air motors and individually connected to a respective motor output shaft, means connecting said air motors to said pairs of passage whereby the selective introduction of air will cause said air motors to open and close said mold holders, a neck mold half mounted in each holder, said mold holders further comprising hollow members in surrounding relationship with respect to the neck molds, a source of cooling fluid means connected between said source and the interior of said mold holders and means for venting said mold holders in the area adjacent said mold halves whereby both the holders and molds are cooled during the operation thereof.

5. In a glassware forming machine of the three-station indexing turret type where the parison and blown ware are laterally conveyed by its neck from station to station, the sub-combination of a plural neck mold support comprising a pair of cylinders mounted on said turret for movement therewith, a reciprocable piston within each cylinder and operable in opposing relationship, a neck mold half holder connected to each piston, a pair of side-by-side neck mold halves loosely retained in each holder, conduit means connected to said cylinder on opposite sides of said pistons for selectively admitting air thereto for effecting relative linear movement of said

holders toward and away from each other, a pressure pad positioned between each holder and its respective neck mold, a centrally pivoted arm connected to each holder and having its free ends in abutting relationship with respect to the pressure pads of adjacent mold halves on each holder whereby equal closing forces are applied to each mold half.

6. In a glassware forming machine of the three-station indexing turret type where the parison and blown ware are laterally conveyed by their neck from station to station, the sub-combination of a plural neck mold support comprising a pair of cylinders mounted on said turret for movement therewith, a reciprocable piston within each cylinder and operable in opposing relationship, for a neck mold holder half connected to each piston, a pair of side-by-side neck mold halves mounted in each holder, each holder being formed of an internally hollow member, means connected to each holder for introducing cooling air to the interior thereof, each holder further having openings therethrough in the area juxtaposed the mold halves for directing cooling air to the surface of said neck molds, and conduit means connected to said cylinders on opposite sides of said pistons for admitting air thereto for effecting relative linear movement of said holders toward and away from each other.

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