Oct. 9, 1934. E. H. LORENZ ET AL 1,976,239

GLASSWARE FORMING MACHINE

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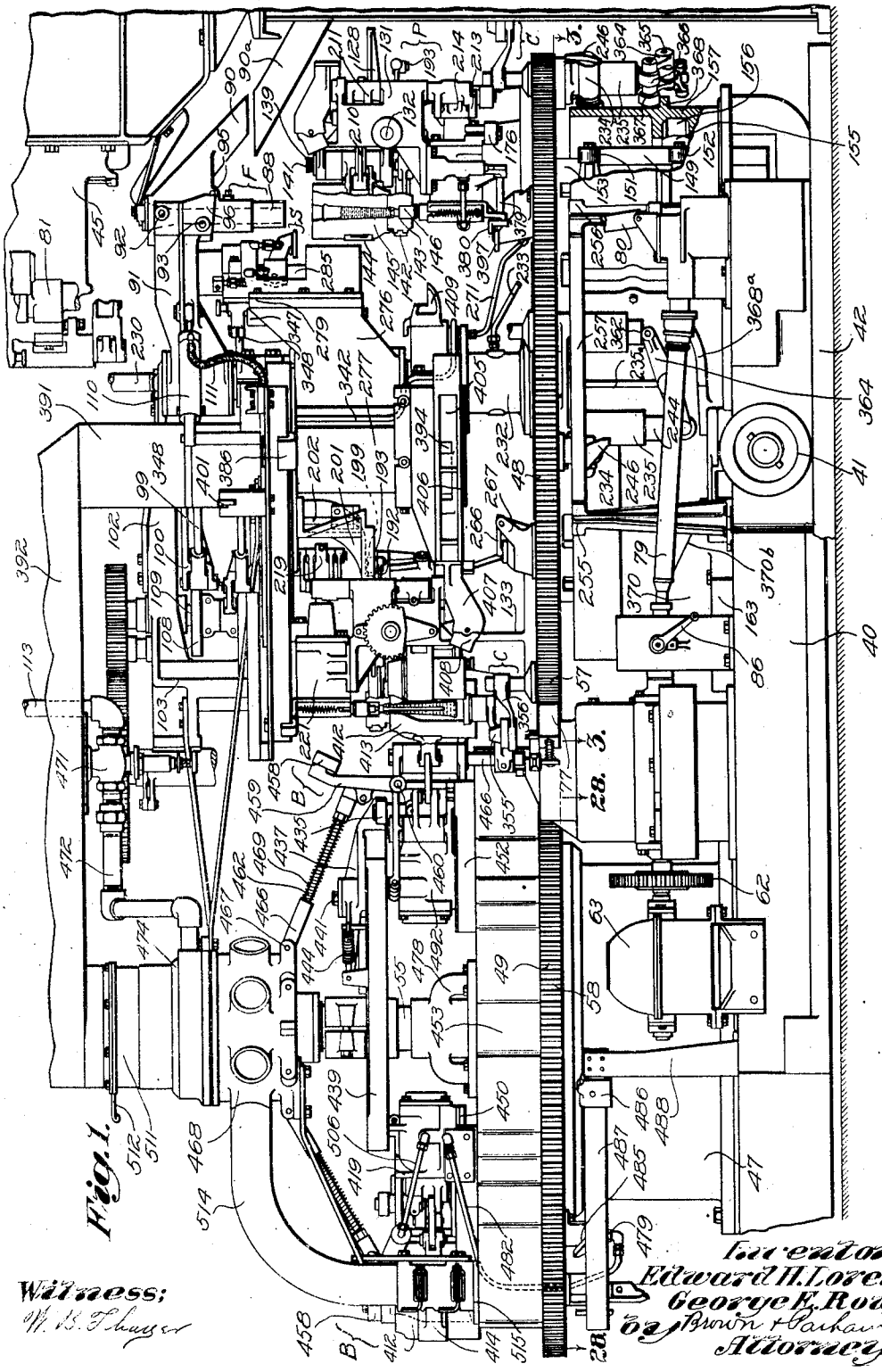

Fig. 1.

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GLASSWARE FORMING MACHINE

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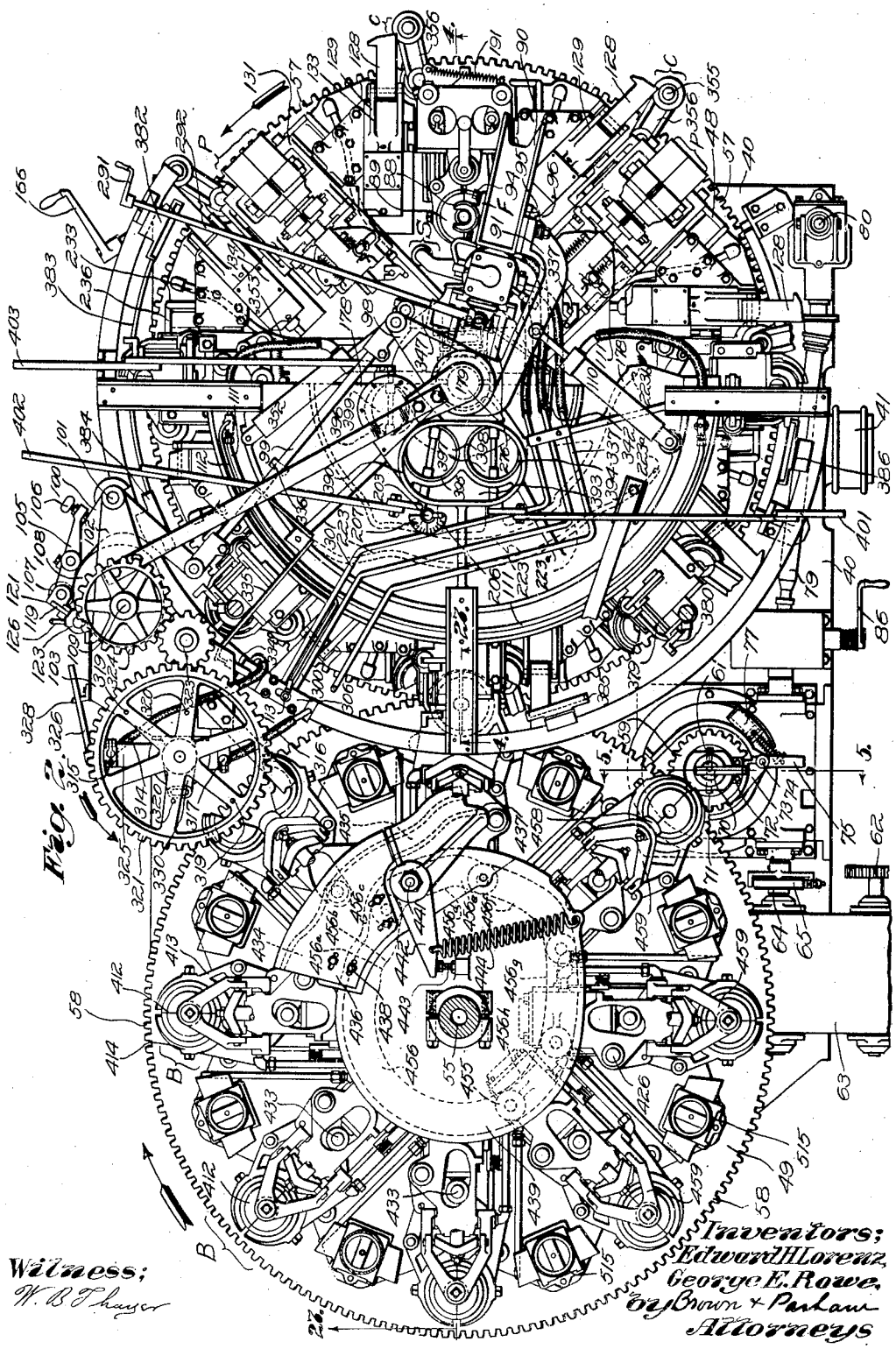

Fig. 2.

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GLASSWARE FORMING MACHINE

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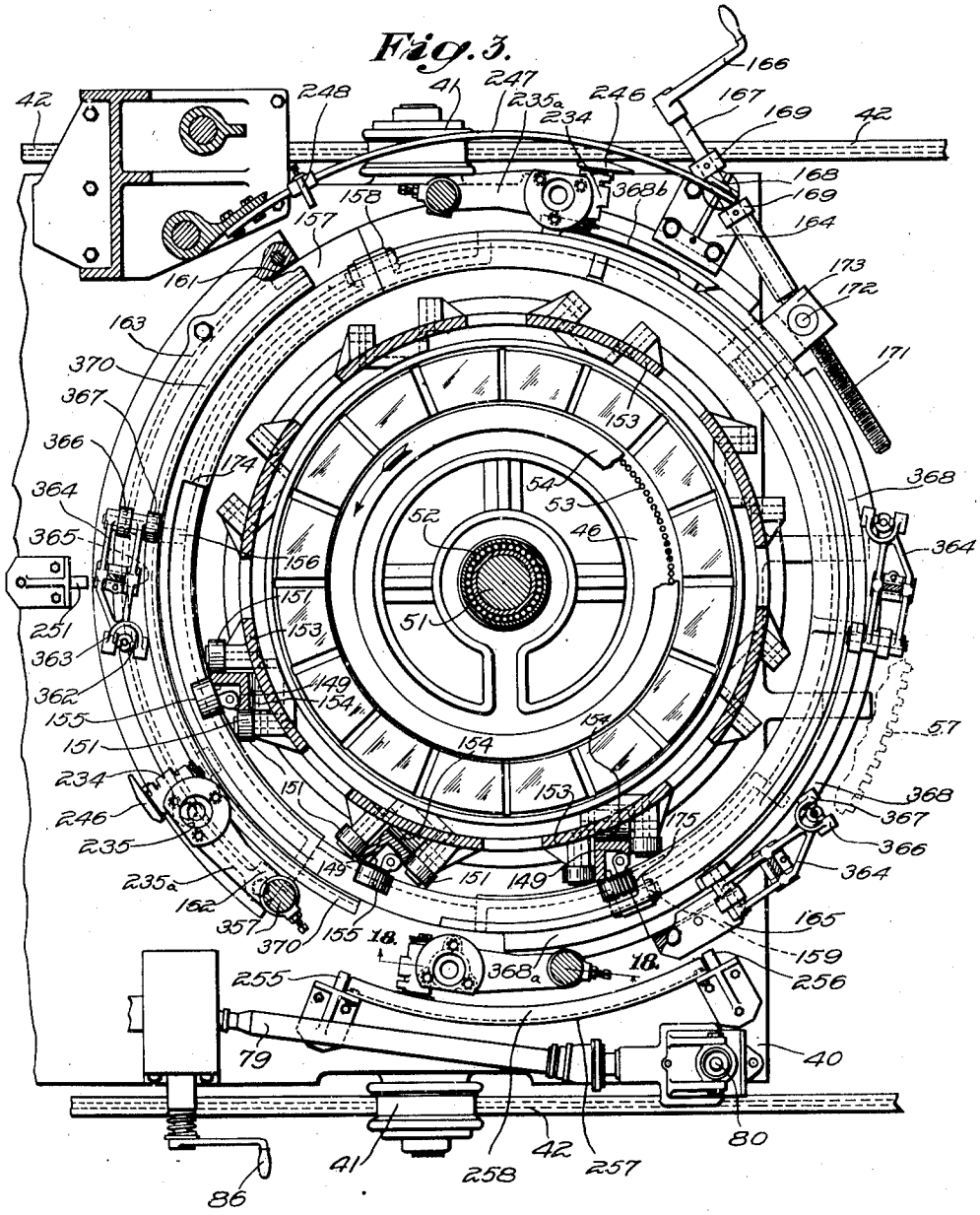
Fig. 3.



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GLASSWARE FORMING MACHINE

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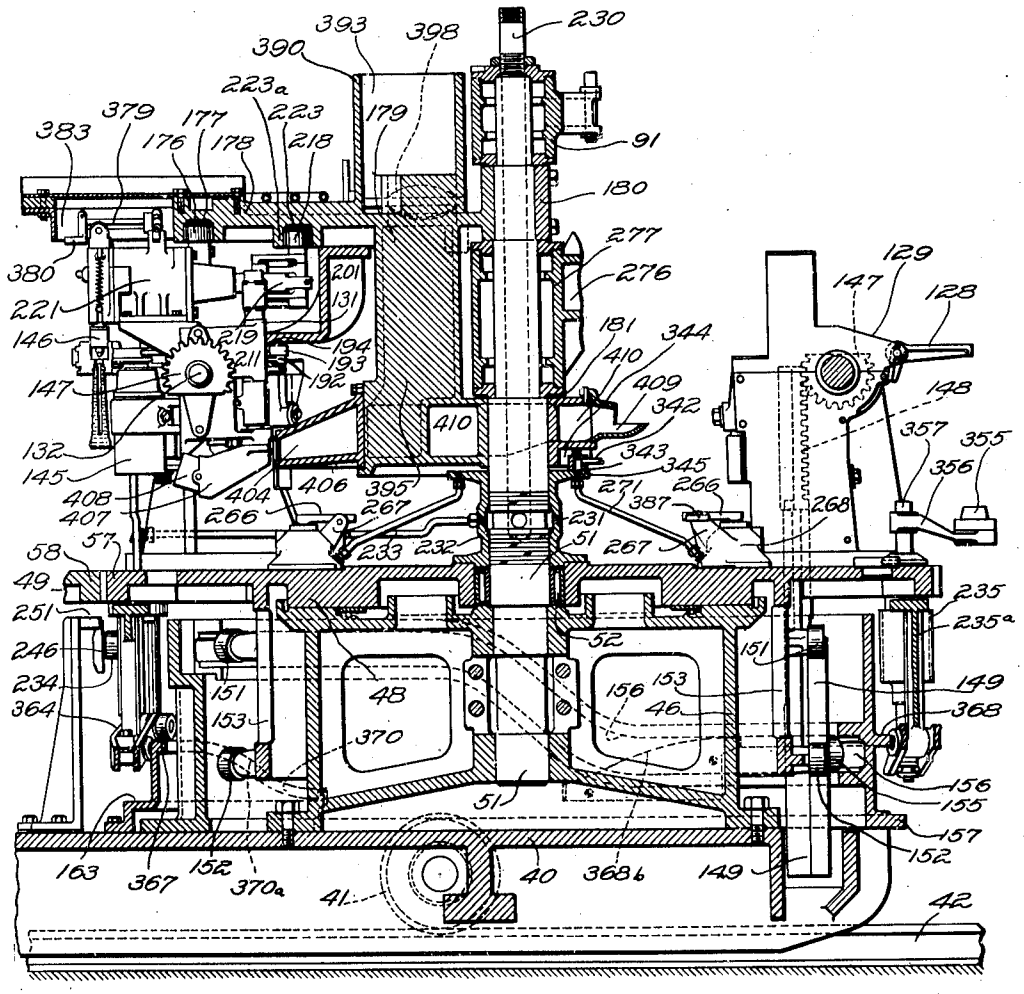
Fig. 4.



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GLASSWARE FORMING MACHINE

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Fig. 6.

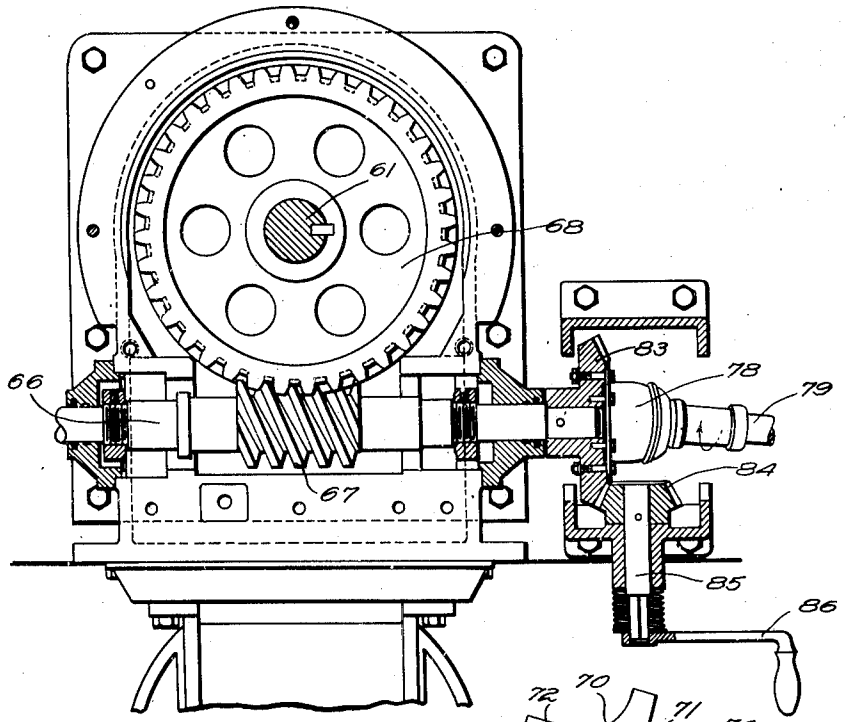
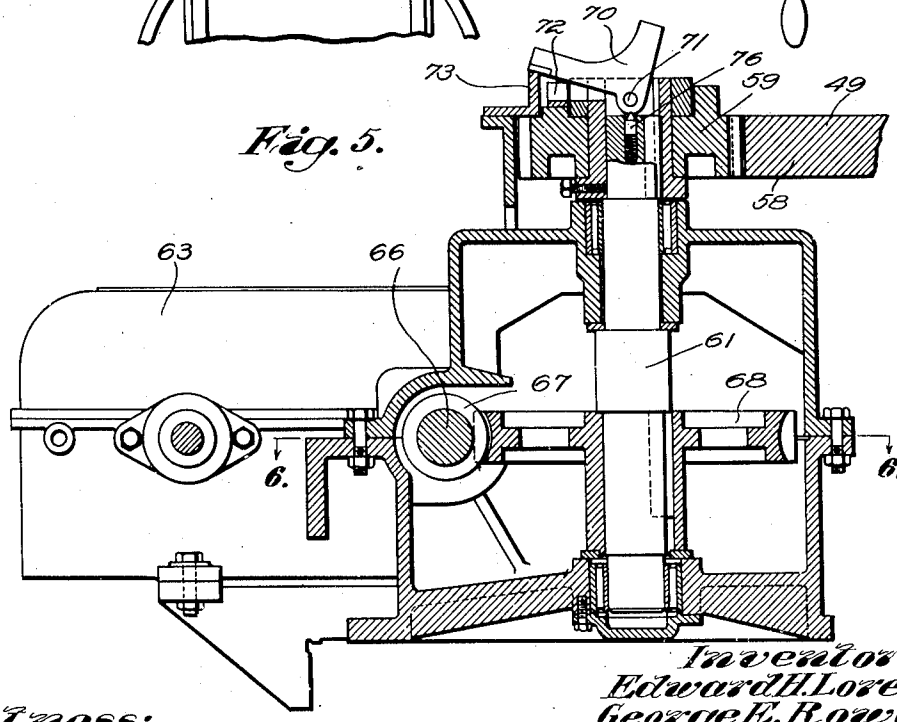


Fig. 5.



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GLASSWARE FORMING MACHINE

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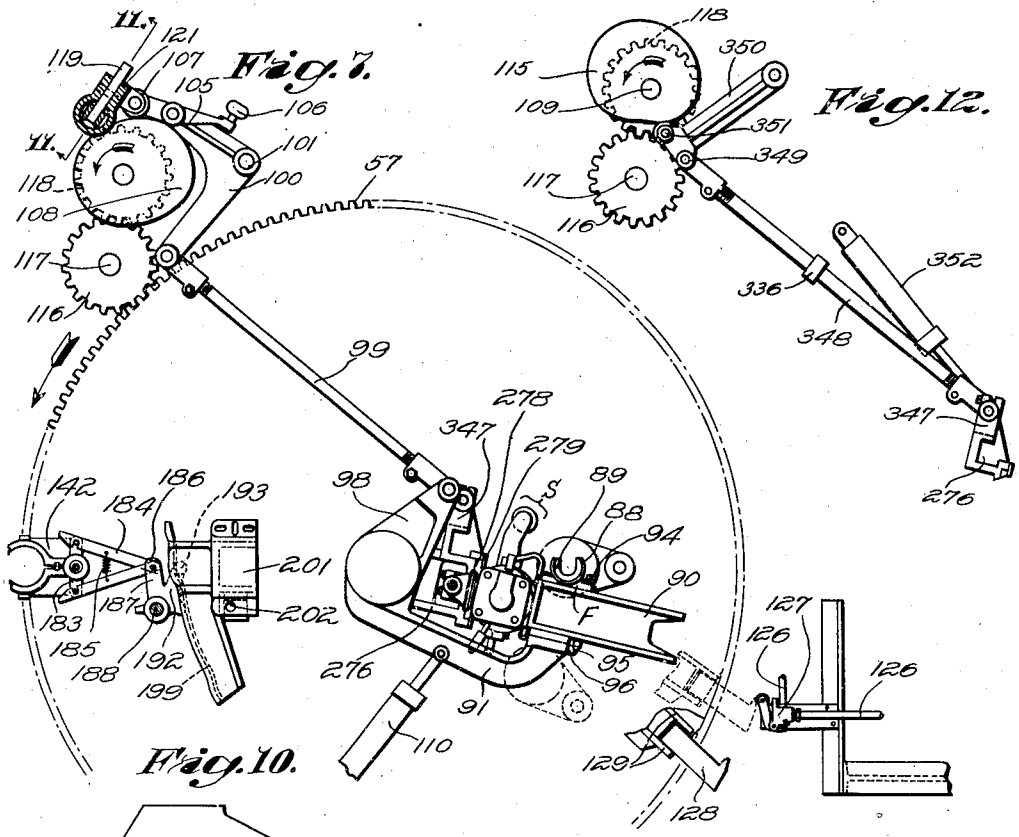


Fig. 7.

Fig. 12.

Fig. 10.

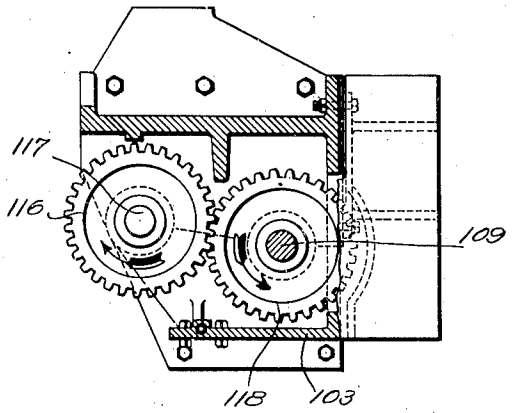
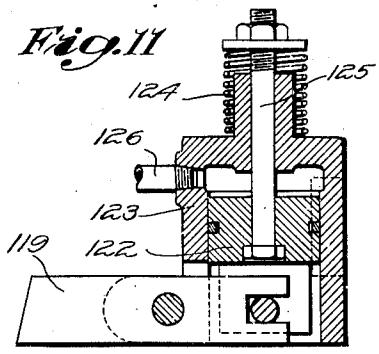


Fig. 11



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GLASSWARE FORMING MACHINE

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Fig. 8.

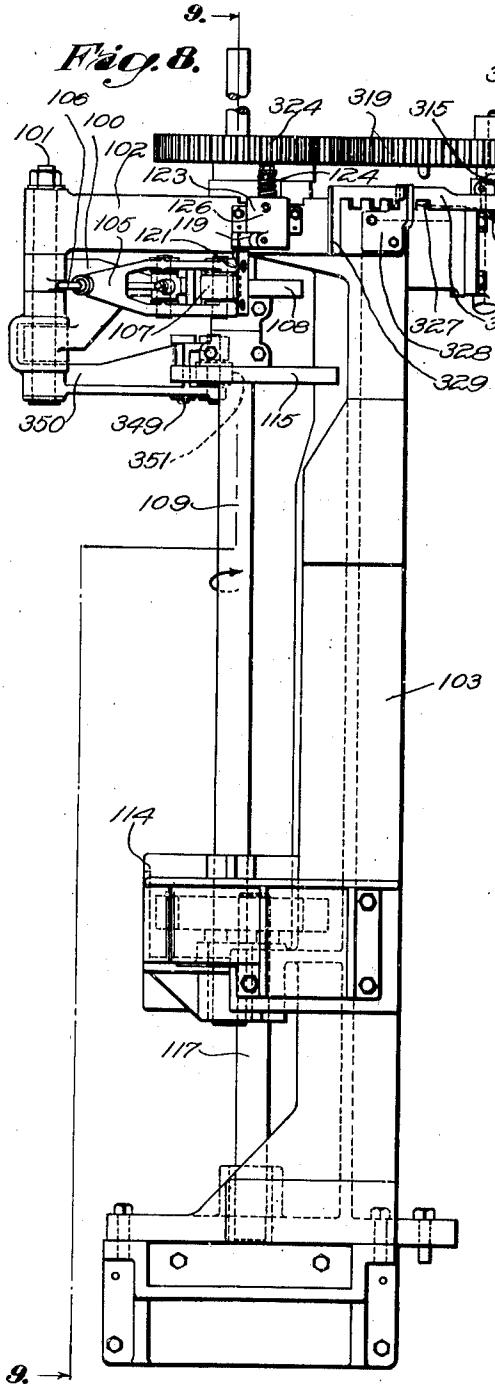
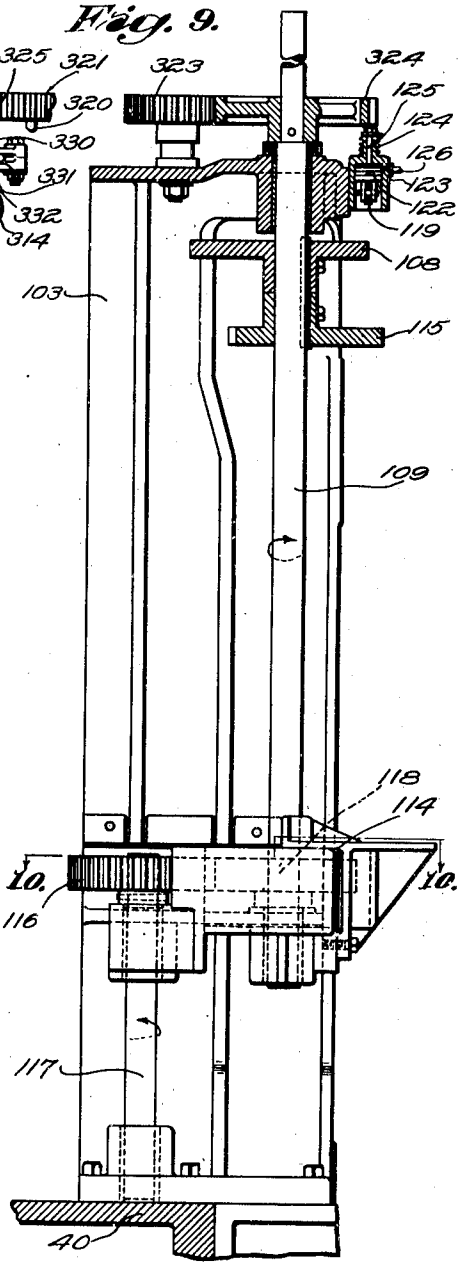


Fig. 9.



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GLASSWARE FORMING MACHINE

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Fig. 13

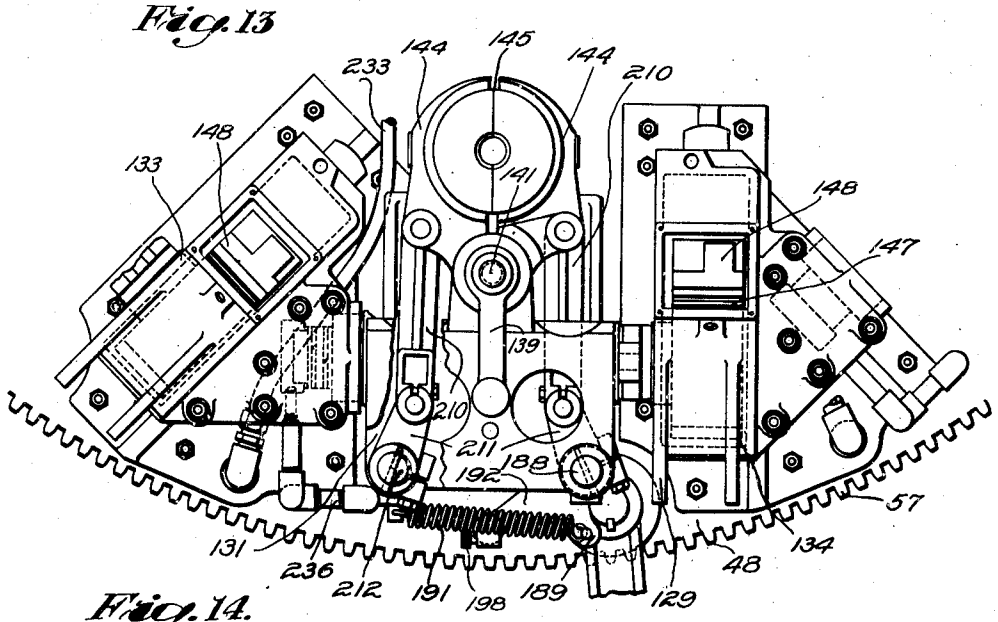


Fig. 14.

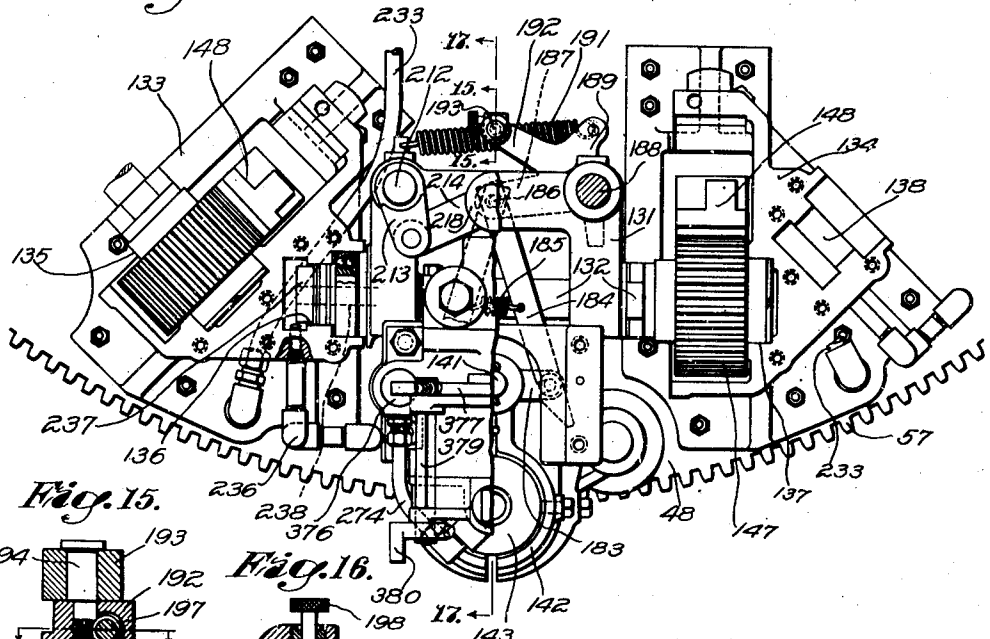
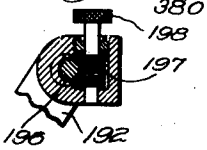


Fig. 15.

Fig. 16.



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GLASSWARE FORMING MACHINE

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Fig. 19.

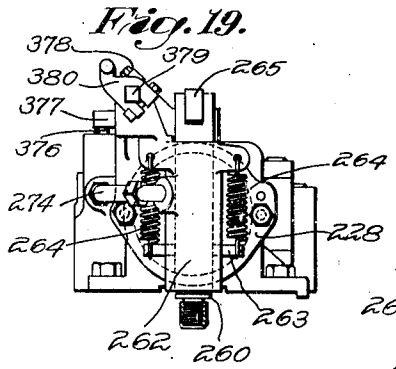

Fig. 17.

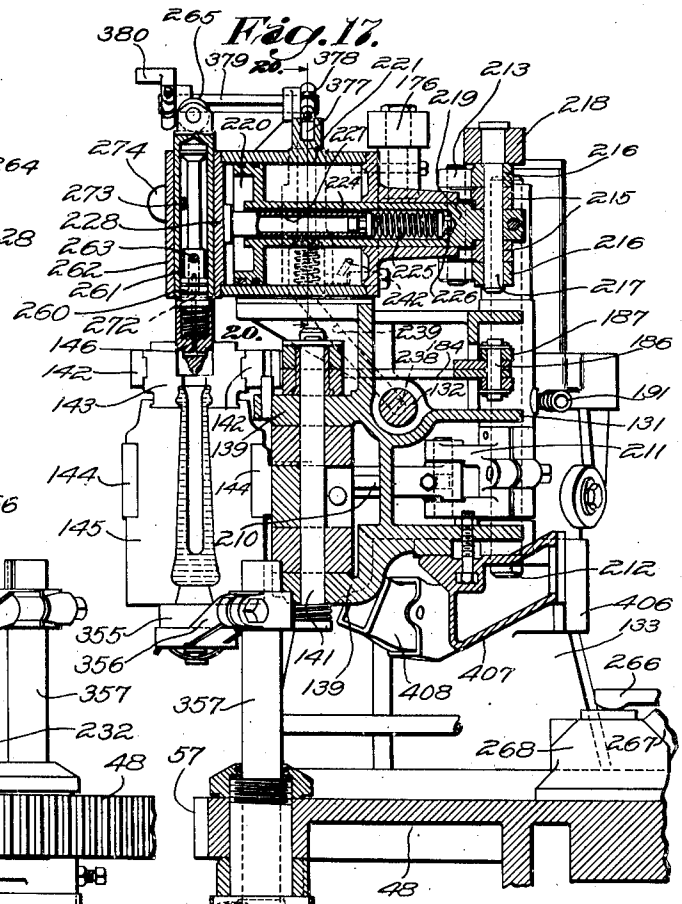

Fig. 18.

Fig. 20.

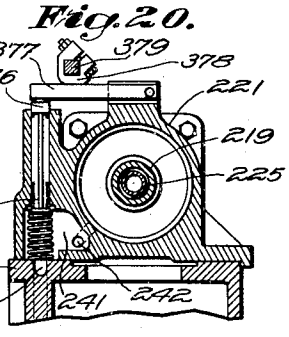

Fig. 21.

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GLASSWARE FORMING MACHINE

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Fig. 22.

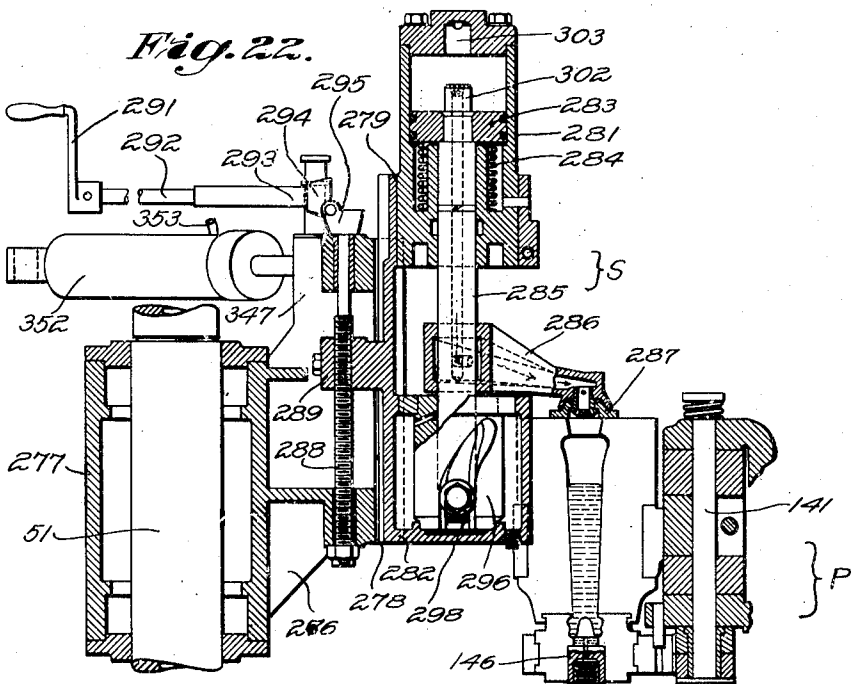

Fig. 23.

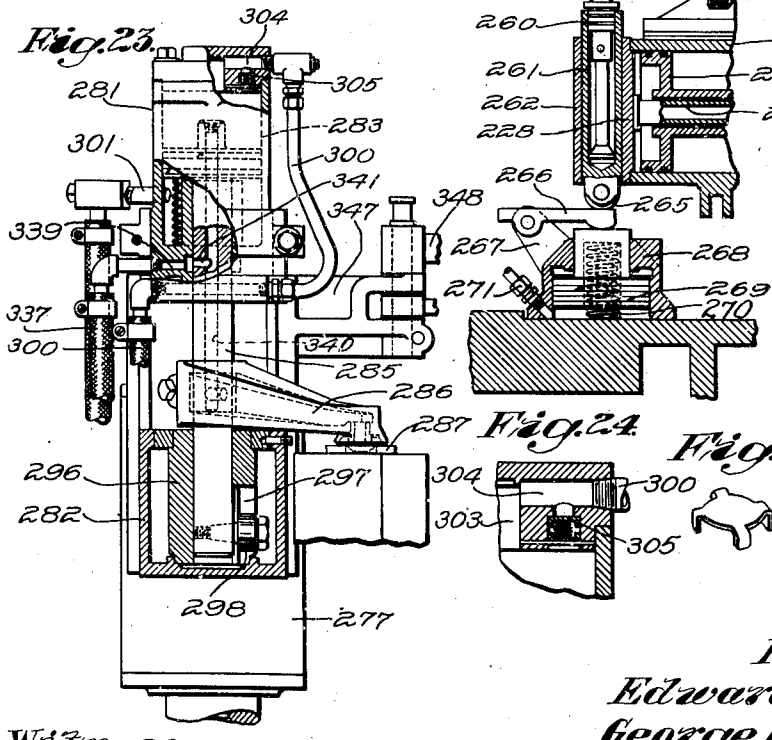

Fig. 24.

Fig. 25. Fig. 26.

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Oct. 9, 1934. E. H. LORENZ ET AL 1,976,239

GLASSWARE FORMING MACHINE

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Fig. 27a.

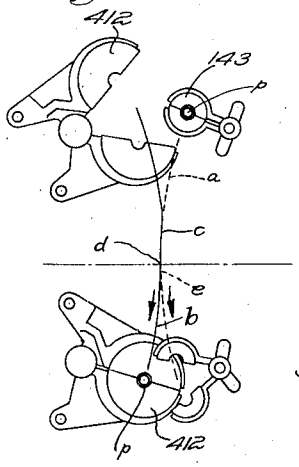

Fig. 27.

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GLASSWARE FORMING MACHINE

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Fig. 28.

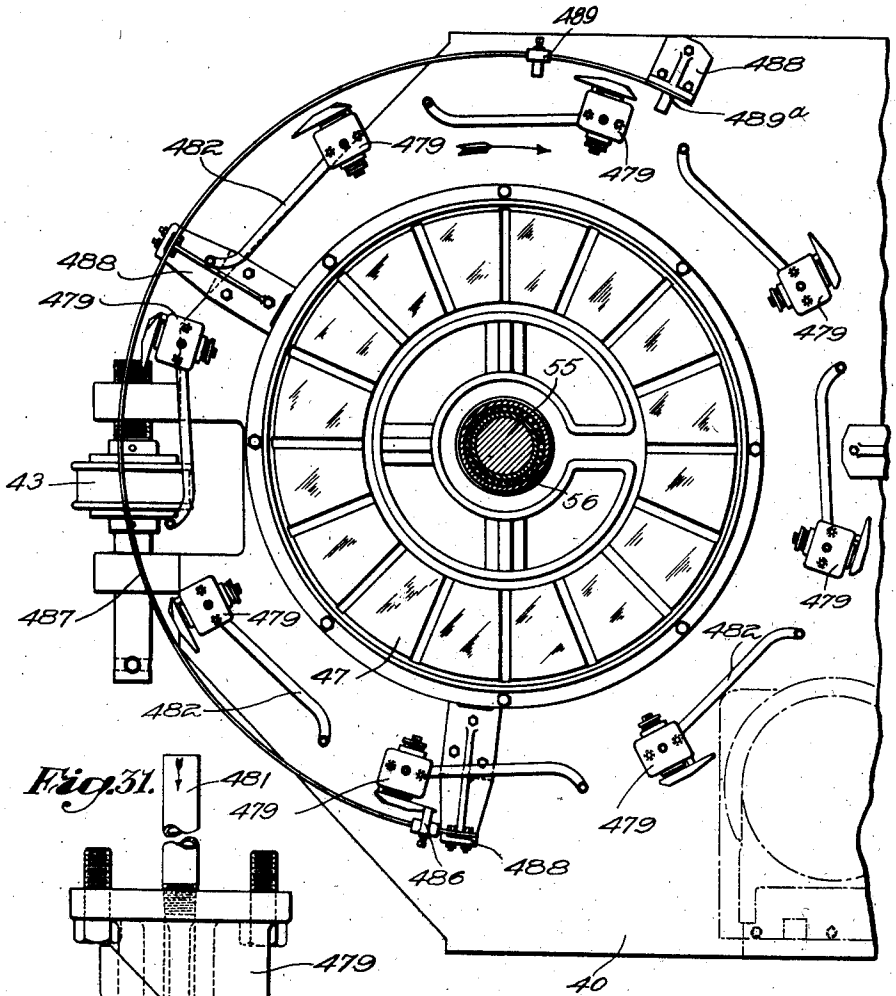

Fig. 31.

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GLASSWARE FORMING MACHINE

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Fig. 29.

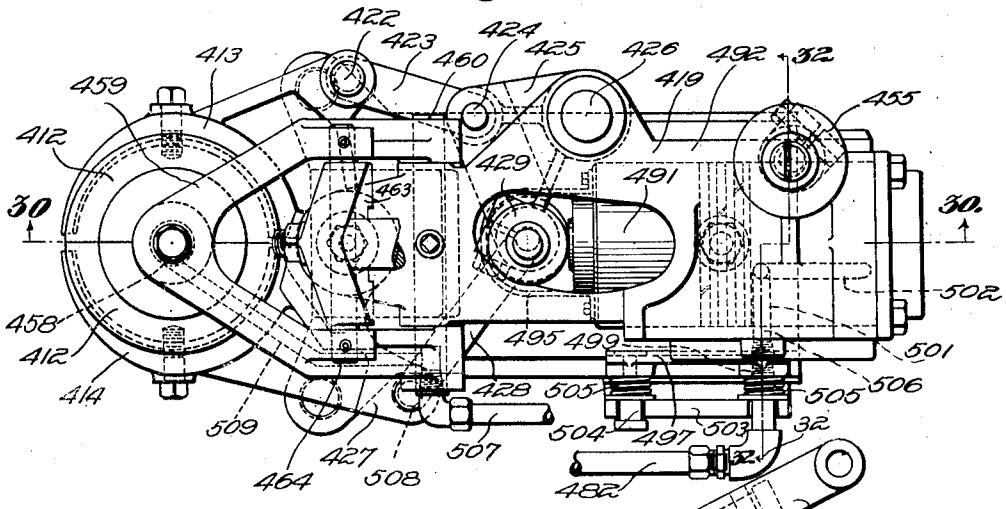
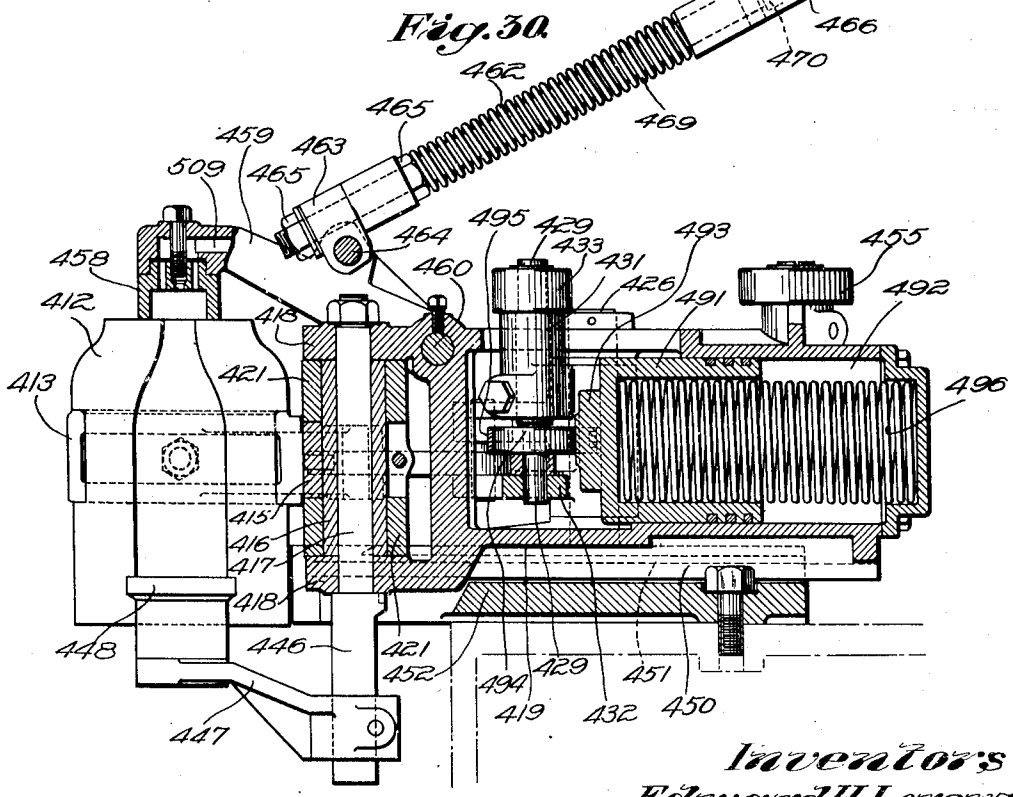


Fig. 30.



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GLASSWARE FORMING MACHINE

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Fig. 32.

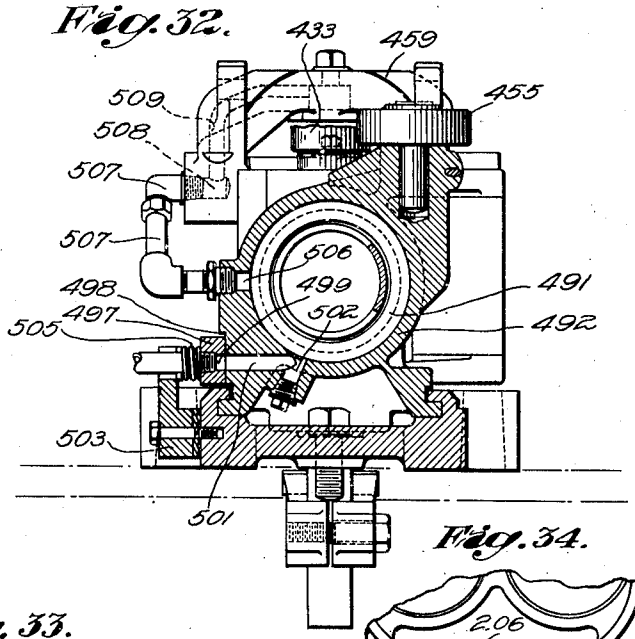


Fig. 34.

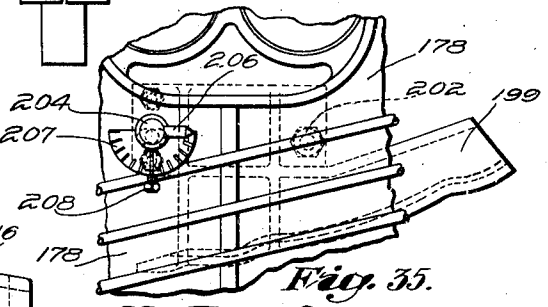


Fig. 33.

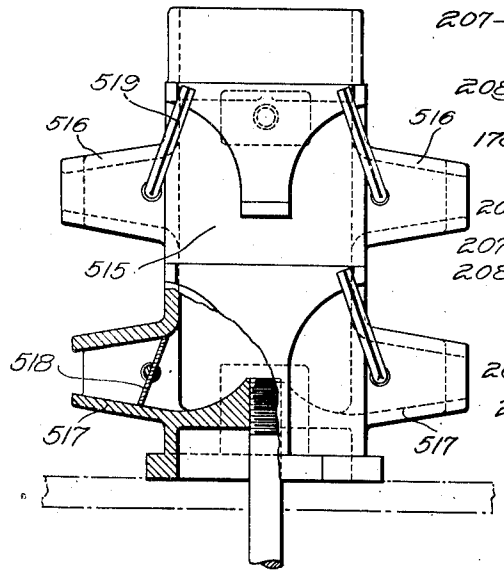
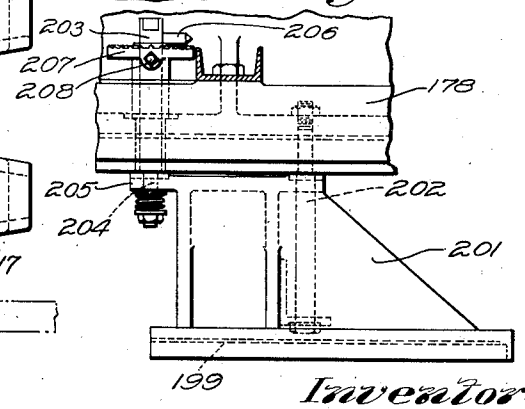


Fig. 35.



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GLASSWARE FORMING MACHINE

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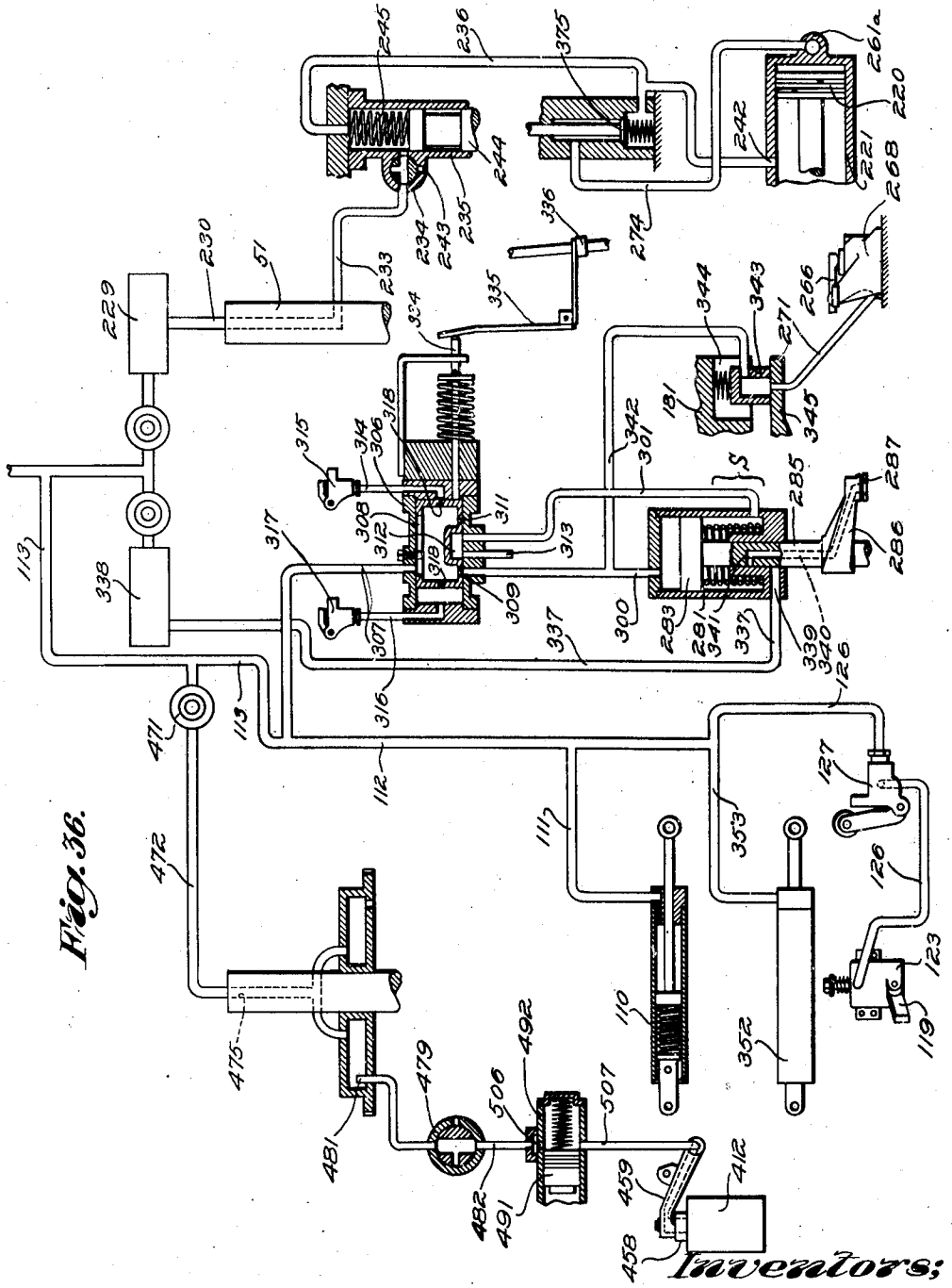

Fig. 36.

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Patented Oct. 9, 1934 1,976,239

UNITED STATES PATENT OFFICE

1,976,239

GLASSWARE FORMING MACHINE

Edward H. Lorenz and George E. Rowe, West Hartford, Conn., assignors to Hartford-Empire Company, Hartford, Conn., a corporation of Delaware

Application October 31, 1930, Serial No. 492,407

46 Claims. (Cl. 49—5)

This invention relates to glassware forming machines and has particular relation to such machines which comprise two horizontal mold tables supported for rotation about spaced vertical axes, upon one of which tables parison forming or parison mold units are mounted, and the other of which carries finishing or blow mold units.

More specifically, the invention is concerned with a glassware forming machine of the above character in which the parison forming units may be inverted for the reception of mold charges, which may be supplied thereto by the well known suspended charge feeding method, and for settle blowing the charges in the parison forming units, after which the units may be reverted and the charges counterblown therein, to form parisons in neck-up position. The parisons may then be transferred to the blow mold units on the blow mold table wherein they are blown to final shape.

Heretofore, two-table glassware forming machines generally have been operated intermittently, necessarily entailing a comparatively low speed at which the glassware is made therein. The usefulness of two-table glassware forming machines previously proposed also has been limited by the character of the feeding and shaping cycle of operation, resulting further in a low rate of production of finished ware as well as lack of attainment of a desirably high standard of quality in the ware. Thus, in such prior machines, limited efficiency of operation has been enforced by excessive periods of idleness of the finishing molds due to the fact that said two-table machines have not usually been capable of being employed in practicing what is known as "the overlapping cycle" method. Said method involves feeding glass to, and shaping it in, a parison mold unit at the same time that a previously formed parison is being blown to final shape in a companion finishing or blow mold unit.

Moreover, the forming machines of the two-table type heretofore contemplated have not usually been constructed so as to permit flexibility of operation, whereby different stages or phases of the glass forming cycle may be varied as is desirable, if not necessary, for efficient and rapid manufacture of glassware of high quality, especially glassware varying greatly in size and/or shape.

In order to overcome the foregoing limitations more or less inherent in the two-table forming machines heretofore proposed, it is the general object of the present invention to provide a two-table machine of the general character above referred to which may be continuously operated, which is well adapted for carrying out "the overlapping cycle" method of forming glassware, such as bottles and other hollow ware, and which is so constructed and arranged as to provide for variations in the individual steps of the method, and for flexibility of operation in general.

A more specific object of the invention is to provide a novel glassware forming machine of the kind in which the parison forming units are inverted for the supply of charges of glass thereto and are afterwards reverted, and embodying means of novel construction for effecting the inversion and reversion of the said units.

A further object of the invention is to provide a novel glassware forming machine of the character in which charges of glass are supplied from a suitable feeder to continuously rotating parison mold units when said units are inverted, and comprising novel mechanism for directing such charges from the feeder into the molds while the molds are traveling.

It also is an object of the invention to provide a machine having continuously rotating parison mold units, each of the units comprising a neck mold and a parison body mold, and having mechanism of novel character associated therewith for operating the molds.

Another object of the invention is to provide mechanism of novel character in a machine of the kind referred to, for operating neck pins which are associated with the parison mold units.

A still further object of the invention is to provide a machine of the character in which charges of glass are settle blown in parison mold units to compact the charges therein, and are afterwards counterblown to expand the charges and form parisons in the units, and comprising novel and improved mechanisms for performing the settle blowing and counterblowing operations.

It also is an object of the invention to provide in a machine for forming glassware, finishing or blow molds and operating mechanisms therefor of novel construction.

Another object of the invention is to provide means of novel character in a continuous two-table machine, for automatically transferring parisons from continuously moving parison forming units on the one table, to companion, continuously moving, blow mold units on the other table.

In the operation of certain prior two-table forming machines, each of the body molds of the parison forming units on one table is completely opened when the shaping of a parison therein is finished, leaving the parison supported by the

neck ring for transfer to one of the blow mold units on the other table, after which transfer, finish blowing air is applied to the parison to blow it to final form. During the period between the opening of the body mold and the beginning of the finish blowing, the parison reheats, that is, the temperature conditions in the parison tend to equalize.

A further object of this invention is to provide means of novel construction in a two-table forming machine for partially opening or "cracking" the body molds of the parison forming units on the one table prior to the complete opening thereof for the transfer of the parisons to the blow mold units on the other table. As a result of the provision of such means, a material part of the reheating of the parisons is effected while they are held out of contact with the body molds but while enclosed thereby, the molds preventing the circulation of air in contact with the parisons and reflecting heat into contact therewith, thereby greatly increasing the efficiency of the reheating operation.

A still further object of the invention is to provide mechanism of novel character for operating blow heads adapted to supply finish blowing air to the blow molds of a glass forming machine.

The invention contemplates other improvements of novel character in a glassware forming machine which are not specifically enumerated here, but which will become apparent from the following description of an illustrated embodiment of the invention.

In order that the invention may more readily be understood and its manifold advantages appreciated, reference should be had to the accompanying drawings in which a machine embodying the invention is depicted.

In said drawings:

Figure 1 is a view in side elevation of a continuous two-table glassware forming machine embodying the invention, parts being omitted for clarity;

Fig. 2 is a view principally in top plan, but partially in horizontal section of the construction shown in Fig. 1, portions of the structure shown in Fig. 1 being omitted to show parts of the apparatus otherwise concealed;

Fig. 3 is an enlarged view in horizontal section of the parison mold table supporting structure, said view being taken substantially on the line 3—3 of Fig. 1;

Fig. 4 is a view in longitudinal vertical section of a portion of the parison mold table shown in Figs. 1 and 2, certain mechanisms carried by said table being omitted for clarity, and said view being taken substantially on the line 4—4 of Fig. 2;

Fig. 5 is an enlarged view in vertical transverse section showing a portion of the driving mechanism for the machine, said view being taken substantially on the line 5—5 of Fig. 2;

Fig. 6 is a view in horizontal sectional top plan of the construction shown in Fig. 5 and taken on the line 6—6 of said Fig. 5;

Fig. 7 is a partially diagrammatic view in top plan, showing in detail the construction and arrangement of the mold feed or funnel operating mechanism;

Fig. 8 is an enlarged view in rear elevation of a portion of the construction shown in Fig. 2, illustrating in detail driving mechanism for operating the funnel feed device and the settle blow head;

Fig. 9 is a view in vertical transverse section of the construction shown in Fig. 8 and taken substantially on the line 9—9 of Fig. 8;

Fig. 10 is a view in transverse horizontal section taken on the line 10—10 of Fig. 9;

Fig. 11 is a view in transverse vertical section of a detent for cooperating with the funnel feed mechanism, said view being taken substantially on the line 11—11 of Fig. 7;

Fig. 12 is a detail view in top plan of a portion of the settle blow head operating mechanism, part of which also appears in Fig. 7;

Fig. 13 is an enlarged view in top plan of a single parison forming unit in inverted position;

Fig. 14 is a view similar to Fig. 13, but partially broken away, and showing the parison forming unit in reverted position;

Fig. 15 is an enlarged detail view in vertical section taken substantially on the line 15—15 of Fig. 14 and showing means for adjusting the neck mold operating cam roller;

Fig. 16 is a view in horizontal section taken on the line 16—16 of Fig. 15;

Fig. 17 is a view in vertical section of the parison forming unit shown in Fig. 14, taken on the line 17—17 of Fig. 14, and showing part of the counterblow baffle plate mechanism in side elevation;

Fig. 18 is a view partly in front elevation and partly in vertical longitudinal section of a fragmentary portion of the construction shown in Fig. 1, the sectional portion of said view being taken substantially on the line 18—18 of Fig. 3;

Fig. 19 is a view in elevation looking from the left toward the upper part of the structure shown in Fig. 17, and showing parts of neck pin and counterblow valve operating means, also shown in Fig. 17;

Fig. 20 is a view in transverse vertical section taken on the line 20—20 of Fig. 17 and showing the counterblow valve and operating means therefor;

Fig. 21 is an enlarged detail view in elevation of a valve for controlling the passage of air to and from pneumatic parison body mold operating means;

Fig. 22 is an enlarged view principally in vertical radial section of the settle blow head operating mechanism and settle blow head, and of a fragmentary portion of a parison forming unit, and showing the parts in the positions which they assume when the settle blow head is traveling in engagement with the bottom of the moving parison body mold of said unit;

Fig. 23 is an enlarged view partially in front elevation and partially in vertical section of part of the settle blow head operating mechanism shown in Fig. 22 looking from the right of said Fig. 22;

Fig. 24 is an enlarged view in vertical transverse section of a valve member of the settle blow head mechanism shown in Fig. 23;

Fig. 25 is an enlarged view in perspective of the valve member shown in Fig. 24;

Fig. 26 is an enlarged view in perspective of a spring seat associated with the valve member shown in Figs. 23 and 24;

Fig. 27 is a view in longitudinal vertical section of the blow mold table and supporting structure therefor, parts being omitted for clearness of illustration, and said view being taken substantially on the line 27—27 of Fig. 2;

Fig. 27*a* is a diagram illustrating the transfer of a parison from a parison forming unit to a blow mold unit;

Fig. 28 is a view in horizontal sectional top plan

of the supporting structure for the blow mold table and showing the arrangement of valves for controlling the application of blowing air to the blow molds, said view being taken substantially on the line 28—28 of Fig. 1;

Fig. 29 is an enlarged view in top plan of a blow mold unit including both the blow mold and a blow head therefor, and associated mechanisms;

Fig. 30 is a view in vertical longitudinal section of the construction shown in Fig. 29 and taken on the line 30—30 of said Fig. 29;

Fig. 31 is an enlarged detailed view in front elevation of one of the blowing air control valves shown in Fig. 28;

Fig. 32 is a view in transverse vertical section of the construction shown in Fig. 29 and taken on the line 32—32 of said Fig. 29;

Fig. 33 is an enlarged view principally in front elevation and partly in vertical section of one of a number of cooling air distributing units for the blow molds on the blow mold table;

Fig. 34 is an enlarged view in top plan of a fragmentary portion of the construction shown in Figs. 1 and 2, and illustrating the mechanism for adjusting the neck mold operating cam;

Fig. 35 is a view in side elevation of the structure shown in Fig. 34; and

Fig. 36 is a diagrammatic view depicting the distribution of air pressure to the various blow heads, air cushions and air motors of the machine.

General description

In general, apparatus embodying the invention may comprise a pair of horizontal mold tables mounted for rotation about spaced vertical columns, one of said tables having a plurality of parison forming units mounted thereon, and the other of the tables carrying an equal number of blow mold units. The parison forming units are generally designated at P, Figs. 1 and 2, and the finishing mold units are generally designated at B.

The mold tables preferably are driven in opposite directions by suitable driving means so that companion pairs of parison forming and blowing units are successively moved together in the same general direction through a transfer zone between the axes of the mold tables.

The parison forming units P may be substantially identical in construction as may also the blow mold units, and although the construction shown in the drawings comprises eight parison forming units and a like number of blow mold units, any other desired number of such units may be employed.

Each parison forming or parison mold unit P comprises a sectional neck mold, a sectional body mold, and a neck pin arranged to be projected inwardly of the neck mold to form an initial blowing cavity in a charge for a parison, and to be afterwards withdrawn.

Each parison forming unit is preferably mounted on the parison mold table for inversion and reversion in a vertical radial plane, and cam controlled mechanism may be provided for inverting the unit inwardly of the mold table for the supply of a charge of glass thereto, and for the settle blowing of the charge. Said mechanism may be arranged to revert the unit outwardly of the table for the counterblowing of the charge into a parison in neck-up position and for the transfer of the parison in the same position to a companion blow mold unit, and it may be capable of adjustment to change the times of inversion and reversion.

Apparatus embodying the invention may comprise means for positively holding the units in reverted vertical position during successive transfer operations, and for relieving strain on the cam controlled mechanism which inverts and reverts the units which strain may be caused by the operation of the parison body molds of the units.

A suitable feeder may be provided for the supply of charges of glass to the units P, and a single guide designated generally at F, may be employed for successively directing the charges from the feeder to said units. The guide may have mechanism associated therewith for swinging it with accelerated movement from a position of rest beneath the feeder where a charge passes into the guide, forwardly in an arcuate path overlying the path of the inverted units a sufficient distance to cause the guide to travel in vertical alignment with a unit, as the charge slides through the guide into the molds of the unit, and backwardly to the position of rest. In this manner the guide serves successive units.

Means may be provided for selectively directing charges of glass to selected units by means of the guide and its operating mechanism, and to this end, a cullet chute may be connected to the guide F for receiving the charges which otherwise would be delivered to the unselected units.

The neck molds of the units P may be opened and closed by cam controlled mechanism which preferably is adjustable.

The body molds may be opened by cam controlled mechanism, and closed by pneumatic means which supplies the necessary power but which operates under the control of the cam means. The pneumatic means may hold the body molds closed during and after the inversion of the units and also after reversion while the charges are counterblown into parisons. The pneumatic means may also be so constructed and operated as to permit the body molds to be partially opened or "cracked" upon completion of the parisons, for the reheating thereof while enclosed by the molds.

The neck pin operating mechanism of each unit P may be arranged to be actuated in response to the inversion of the unit to project the neck pin inwardly of the neck mold, and in response to the reversion of the unit to withdraw the neck pin. Therefore, the time of operation of the neck pin is changed when the invert mechanism is adjusted.

A single settle blow head designated generally at S, may successively serve settle blowing air to the units P, the operating mechanism therefor being arranged to cause it to travel successively with the units.

The apparatus of the invention may include means for counterbalancing the force of the settle blow head mechanism on the units and on the inverting mechanism therefor, and to hold the neck pin seated in opposition to the force of the settle blowing air.

The units may have valves associated therewith for controlling the supply of counterblowing air and counterblow baffle plates for supporting the charges during the counterblowing thereof.

The baffle plates which are designated generally at C, may each be raised into and held in operative position by pneumatic power means, operating under the control of cam means which determines the time of such operation, and which also effects

the movement of each baffle plate to inoperative position.

Each blow mold unit B includes a sectional blow mold and a blow head. Said unit is mounted for radial movement on its table. Radial movement of a unit B may be effected by a cam to cause the engagement and disengagement of a blow head and the blow mold of the unit, and to move the blow mold in a path concentric with the axis of the parison mold table while the mold is closing about a parison suspended from the neck mold of the companion unit P in effecting the transfer of the parison from a unit P to its companion unit B_1.

The neck mold may be opened by its cam after the blow mold has closed in effecting the transfer although the neck mold cam and the blow mold closing means preferably are arranged for adjustment.

Each blow mold unit B preferably embodies means for preventing passage of air to its associated blow head when the mold is held open, as by glass caught between the mold sections. The mold operating means also may include special means to hold the mold closed in opposition to the pressure of the blowing air on the interior thereof.

General construction and driving mechanism

All of the various parts of the machine are mounted upon a base 40, Figs. 1 to 4, which may consist of a unitary casting of elongate shape and having wheels 41 mounted on the sides near one end thereof running on side rails 42 and a third wheel 43, Figs. 27 and 28, suitably mounted near the center of the other end of the base, and riding on a center rail 44. This arrangement permits the machine to be bodily moved into and out of position beneath a glass feeder 45 (Fig. 1) of suitable known construction and serving to supply charges of glass to the units P of the machine.

A pair of pedestals 46 and 47, Figs. 1, 3, 4, 27 and 28, are bolted to the base 40, the pedestal 46 having a bearing surface upon which the parison mold table 48 rotates, and the pedestal 47 having a similar bearing surface upon which rests the blow mold table 49.

The parison mold table is centered about a column 51 in pedestal 46, Figs. 3 and 4, and roller bearings 52 are interposed between the column and the hub of the table to reduce frictional resistance to the rotation of the table. The pedestal 46 may have a raceway formed therein, Fig. 3, in which ball bearings 53 are located which carry a ring 54, said ring in turn supporting the weight of the parison mold table.

Similarly, the pedestal 47 has a column 55 mounted therein, Figs. 1, 2, 27 and 28, for centering the blow mold table 49, roller bearings 56 being interposed between the column and the hub of the blow mold table.

Formed on the edges of the parison mold and blow mold tables 48 and 49 respectively, are the gears 57 and 58 meshing with each other on the line of centers of the tables. The construction and arrangement of the table gears is best shown in Figs. 1 and 2. They provide means for continuously rotating the mold tables in synchronism with each other and in opposite directions, the parison mold table being rotated in a counter-clockwise direction and the blow mold table being rotated in a clockwise direction, as indicated by the arrows Fig. 2. If desired, the directions of rotation of the mold tables may be reversed.

Considering now the driving means, and referring particularly to Figs. 1, 2, 5 and 6, it will be seen that the blow mold table serves to rotate the parison mold table, and that the blow mold table in turn is driven by a pinion 59 in mesh with gear 58 and loosely mounted on a vertical shaft 61.

Means preferably are provided for connecting and disconnecting the pinion and the vertical drive shaft 61 to start or stop the rotation of the mold tables. Said means will presently be described.

The vertical shaft 61 may be driven from a prime mover (not shown) connected to the gear 62 on the driving shaft of a variable speed reduction mechanism 63, the driven shaft 64 of which is connected through a load release device 65 (Fig. 2) of suitable known construction to the horizontal worm shaft 66, Figs. 5 and 6. Said worm shaft 66 has a worm 67 thereon in mesh with worm gear 68, keyed to the vertical drive shaft 61, previously mentioned. Thus it will be seen that when the pinion 59 is connected to the vertical shaft 61, the pinion will be driven from the variable speed device 63, by means of which the desired speed of rotation of the mold tables may be obtained.

The pinion 59 is connected to, and disconnected from, the shaft 61 by means of a bell crank 70 pivoted at 71 in a slot formed in the upper end of shaft 61. The laterally extending arm of the bell crank 70 is so arranged that pivotal movement thereof about its fulcrum serves to move the arm into and out of the space between a pair of lugs 72 secured to the top of the pinion 59, Figs. 2 and 5. Such movement of the bell crank device 70 is effected manually by means of a cam 73 pivoted at 74 and having an operating handle 75, whereby the cam is swung into and out of position for engagement with the outer end of the laterally extending arm of the bell crank device to raise it out of the space between the lugs or to permit it to drop into said space. The bell crank 70 is held in its elevated position by means of a detent 76, Fig. 5.

Inadvertent operation of cam 73 to start the machine when the air supply thereto is off, is prevented by a pneumatic stop 77, which engages a pin on handle 75 when the air is off, but is retracted to non-stop position when the air is on.

The mechanism for driving the mold tables also preferably is employed for driving the feeder designated generally at 45, and to this end, worm shaft 66 is connected by a universal joint 78, Fig. 6, to a shaft 79 extending along one side of the base of the machine and slightly inclined downwardly to where it is connected through suitable gearing, not shown, to an upwardly extending shaft, a part of which is shown at 80, Fig. 1. Shaft 80 in turn is connected by means not shown to synchronizing mechanism designated generally at 81, associated with and operating the feeder 45.

From the foregoing it will be seen that the mechanism which serves to drive the table may be operated to drive both the mold tables and the feeder, or for driving the feeder alone when the pinion 59 is disconnected from the shaft 61, as previously explained.

The driving mechanism also preferably includes means for manual operation of the machine and for setting the mold tables in motion to relieve the starting torque on the prime mover, said means comprising a bevel gear 83, Fig. 6, secured to the worm shaft 66, said bevel gear being engaged by a bevel pinion 84 on crank shaft 85 which may be manually rotated by means of the crank 86, Figs. 1, 2 and 6, detachably connected thereto.

The funnel feed "F" and cullet chute associated therewith

We now come to consider the mechanism for directing mold charges from the feeder 45 into the inverted parison forming units during the continuous travel thereof or for positioning a cullet chute in the vertical path of the charges in lieu of the funnel, when it is desired to interrupt the feeding of the charges to one or more of the parison mold units without stopping the feeder. Such mechanism is shown in Figs. 1, 2 and 7 to 11 inclusive, which now will be referred to, reference also being made incidentally to Fig. 4.

As shown in Figs. 1, 2 and 7, a funnel or guide 88 which is cut away on one side as shown at 89, is bolted to cullet chute 90 which, in turn, is secured to a horizontal arm 91 by means of a pivot bolt 92, Fig. 1, and a set bolt or screw 93. By reference to Figs. 1, 2 and 7, it will be seen that guide 88 is substantially U-shaped in cross-section for its entire length and of substantially uniform cross-section. The cross-sectional area of the guide also is relatively small, not differing greatly from that of the mold cavity as shown in Figs. 1 and 2. Consequently, the charge for the mold unit fits sufficiently snugly in the channel of the guide to be held in vertical position thereby, as hereinafter explained more fully. The guide is cut away to permit it to be moved into its position of rest without striking the bottom of a charge being formed by the feeder, if the charge should extend below the top of the guide. Cullet chute 90 is arranged to discharge glass into a stationary chute 90*a*, Fig. 1, which may lead to a cullet bin, not shown. By loosening the bolt 93, the cullet chute, and hence the funnel, may be adjusted through a vertical radial plane to align the funnel with the molds of the parison forming units, such adjustment being effected by means of a horizontal screw bolt 94, Figs. 2 and 7, in the funnel guide and chute 90, and having a tapered end 95 bearing against a curved surface 96 on the end of the arm 91.

As shown in Figs. 1, 2 and 4, the arm 91 is mounted for oscillation on the top of the column 51 of the parison mold table. Said arm is so shaped as to support the funnel and cullet chute rearwardly thereof (Fig. 2) to provide clearance for the settle blow head mechanism S.

The arm 91 has mechanism connected thereto for oscillating the funnel or guide from a stationary charge receiving position beneath the feeder and in vertical alignment with the discharge orifice thereof, in an arcuate path above the path of travel of the several parison forming units successively in vertical coincidence therewith and for a sufficient distance to direct charges of glass into the molds of the moving units without distorting the charges. The charges are kept in the guide as a result of the accelerated movement thereof and by their own inertia. Said mechanism also is adapted to prevent alignment of the funnel with the feeder so that the charges of glass will be directed into the cullet chute and the operation of the feeder may be continued when the operation of shaping of charges in one or more parison forming units is discontinued.

Said arm oscillating mechanism includes a crank 98, Figs. 2 and 7, formed preferably integrally with and extending rearwardly of, the arm 91, and connected by an adjustable link 99, Figs. 1, 2 and 7, to the inner arm of a horizontally positioned bell crank lever 100, Figs. 1, 2, 7 and 8. Said lever 100 is fulcrumed on a depending pivot stud 101, Figs. 2, 7 and 8 mounted in an arm 102 extending laterally of the top of framework 103. Framework 103 is positioned between but to the rear of the mold tables as is clearly shown in Figs. 1 and 2.

Bell crank lever 100 in turn has an arm 105, Figs. 2, 7 and 8, pivotally mounted thereon and adjustable relative thereto, such adjustment being effected by a thumb screw 106. Arm 105 carries a cam roller 107 which rides on the edge of a cam 108, Figs. 1, 2, 7, 8 and 9 on vertical cam shaft 109, journaled in framework 103. Arm 105 is adjusted to vary the initial position of the guide for the delivery of charges of different thickness.

Cam roller 107 yieldingly is held in engagement with cam 108 by means of an air spring 110 connected to arm 91, and receiving air from a supply conduit 111, Figs. 1, 2 and 36, which in turn is connected by conduit 112 to high pressure air supply line 113.

The vertical cam shaft 109 is mounted near its upper end in the horizontal top portion of framework 103 and journaled at its lower end in a laterally extending bracket 114 secured to the framework 103 as shown in Figs. 8 and 9. The cam shaft 109 is continuously driven to continuously drive the cam 108 and also a cam 115 which controls the settle blow head mechanism S as hereinafter stated. Said shaft 109 is so driven by means of a spur gear 116, Figs. 7 and 9, mounted on a vertical shaft 117 journaled in framework 103, and meshing with gear 57 on the parison mold table as shown in Fig. 7. Gear 116 also meshes with a gear 118 on the bottom of shaft 109, as indicated in Fig. 9 and as shown in Fig. 7. Thus the parison forming table serves to drive the funnel and settle blow head oscillating mechanisms, thereby providing synchronism between the operation of the mechanisms and the rotation of the units P.

As previously stated, the guide F is first caused to dwell in a position of rest beneath and in alignment with the feeder until a charge passes into the guide. Because of such alignment and the uniform and relatively small cross-sectional area of the guide channel, the charge initially slides into the channel in contact with the back wall and side walls thereof which retain the charge in vertical position. This avoids impact of the guide with the charge when the guide is moved as explained below.

The guide with the charge therein is now moved forwardly with an accelerated bodily movement, as briefly explained hereinbefore. Such accelerated movement is necessary to bring the guide and the charge up to the speed of, and into vertical alignment with, the mold unit which is to receive the charge. The guide is now caused to travel with the receiving unit in vertical alignment therewith until after the charge slides into the mold cavity. The movements of the guide assist in maintaining the charge in vertical position in the guide because the inertia of the charge urges the charge into sliding contact with the back wall portion of the guide channel. This tends to insure accurate central delivery of the charge to the mold cavity and avoids impact of the charge with either or both sides of the mold cavity which would result in chill spots on the charge and waviness in the finished glassware.

It will be understood that as soon as a charge is severed, the charge drops very rapidly by gravity. In fact, the charge is continuously dropping from the time of severance until it finally is received in the mold cavity. In order that there may be adequate control over the charge during this time, the guide is made relatively long as illustrated, its length being several times its greatest inside transverse dimension, permitting the charge to be received while the guide is at rest, acceleration of the guide, and movement of the guide in vertical alignment with a mold for a sufficient distance to insure accurate central delivery of the charge to the mold cavity. If a relatively short guide were to be used, the charge would pass out of control before the operations above-described could be effected.

As will be obvious, the above described mechanism associated with arm 91 oscillates both the funnel and cullet chute, and said mechanism has a detent associated therewith for limiting the return swing of said arm in order that charges from the feeder will be directed into the cullet chute instead of the funnel, at selected times. Said detent comprises a lever 119, Figs. 2, 7, 8, and 11, which is so positioned that vertical movement thereof carries it into and out of a position for engagement with a stop 121 secured to the outer end of lever 105, previously referred to. Thus, when the outer end of the lever or detent is lowered, the stop 121 strikes the end of the lever as the bell crank 100 swings in a counterclockwise direction, preventing the cam roller 107 from engaging its cam 108 to a greater or less extent, so that the funnel 88 does not register with the feeder, but instead, the cullet chute 90 receives the charge from the feeder and discharges it to cullet.

The pivoted lever or detent 119 is operated by the following means:

The inner end of said lever has a pin and slot connection with a piston 122, Figs. 9 and 11, in cylinder 123, Figs. 2, 8, 9, and 11, said piston being urged to uppermost position by means of a compression spring 124 bearing against a washer on a rod 125 of the piston. Thus when the piston 122 is in its uppermost position as aforesaid, detent lever 119 will be in operative position.

Detent lever 119, however, is moved to inoperative position by the admission of air pressure through a conduit 126, Figs. 2, 9, 11 and 36, which may lead from pressure line 112 as indicated in said Fig. 36, into the space in the upper end of cylinder 123, whereupon the lever 119 merely rides on the top or stop 121.

Such admission of air pressure to cylinder 123 is controlled selectively to cause charges to be selectively supplied to the parison forming units, by means of a stationary valve 127, Figs. 7 and 36, in the air supply conduit 126. Said valve is positioned for engagement by cam members 128, Figs. 1, 4 and 7, associated, and rotating, with the respective parison forming units.

Cam members 128 are pivoted in brackets 129 carried by the supports for the respective parison forming units. Being so pivoted, the cam member for any particular parison forming unit may be swung into such a position that as the parison forming unit moves toward the feeder, the member will operate valve 127 to cause detent 119 to be moved to inoperative position, resulting in the delivery of a charge to that unit. On the other hand, if it is desired to prevent the feeding of a charge to any one or more selected parison forming units, the corresponding cam member or members may be swung inwardly of the mold table so that the valve 127 will remain closed and the detent in operative position, to prevent the direction of charges into the selected parison forming unit or units.

The parison forming units "P"

The parison forming units being substantially identical in construction, only one of such units need be described.

Generally considered, the parison forming unit P comprises a main U-shaped casting 131, Figs. 1, 2, 4, 13, 14 and 17, through the arms of which extends a shaft 132, the ends of said shaft being trunnioned in bearings of supports or pedestals 133, 134, Figs. 2, 13, and 14, arising from the mold table. The supports 133, 134, are so positioned relative to the mold table, and the shaft 132 is so arranged in the supports, that the axis of the shaft is tangential to a circle concentric with the axis of the mold table. Referring to Fig. 2, it will be seen of the two supports for each unit, one is parallel to and the other at an angle to the radial center line of the unit.

Each support has a pair of bearings therein in which the adjoining ends of the shafts 132 of adjacent mold units are journaled, as shown for example in Fig. 14 wherein the support 133 has bearings 135 and 136 formed therein, and in like manner support 134 is provided with bearings 137 and 138. The angular arrangement of the supports and the pairs of bearings in each of them permits the use of a greater number of mold units on a single mold table than would be possible if separate pairs of supports were provided for each unit, the supports and units being of equal number in the construction illustrated.

As shown in Figs. 1 and 17, the parison mold casting 131 has vertically spaced lugs 139 formed thereon for receiving and holding a hinge pin 141 upon which the holders 142 for the sections of the neck molds 143 are mounted, as also are the holders 144 for the sections 145 of the parison body molds. See also Figs. 13 and 14.

The casting 131 also carries mechanism for opening and closing the neck mold and parison body mold, and for supporting and operating a neck pin 146, Figs. 1 and 17, which is projected into and withdrawn from the neck mold to assist in forming the neck finish of the parison therein, all as hereinafter explained.

The mounting of the casting 131 on shaft 132 permits the parison forming unit to be swung through a radial plane with respect to the mold table, to present the parison forming unit bottom up or in the position in which it is shown in Figs. 1 and 22, in which inverted position a charge of glass is supplied to the unit by funnel F and the charge afterwards compacted therein by the operation of the settle blow head mechanism S. Thus it will be seen that the parison forming unit is swung inwardly of the mold table to cause it to follow a circular path having a shorter radius than the radius of the path of the unit when it is in reverted position, or in the position in which one of said units is shown in Figs. 4 and 17. This facilitates the feeding of glass to the parison forming unit because it results in a reduction in the linear speed of travel thereof.

The mechanism for inverting and reverting the parison forming unit will first be described after which the construction and operation of the mold opening and closing means, of the neck pin operating means, of the settle blow head operating mechanism, and settle blow air supply means, and

of the counterblow baffle plate and counterblow air supply means, all will in turn be explained in the order named.

Mechanism for inverting and reverting the parison forming units (P)

The construction and operation of the parison forming unit inverting and reverting mechanism may best be understood by reference to Figs. 3, 4, 13, and 14. As shown in Figs. 4 and 14, shaft 132 has a pinion 147 affixed thereto in mesh with a vertically disposed rack 148 extending upwardly through openings in table 48 and a support 133, or 134, and constituting an upward extension of a vertical slide 149, (Figs. 1, 3 and 4) of L-shape in cross section. The slide 149 is guided by vertically spaced pairs of opposed rollers 151 and 152, the rollers of each pair being disposed laterally of the slide, and mounted on studs carried by a skirt 153 depending from the mold table 48, as is clearly shown in Figs. 3 and 4. The slide 149 similarly is guided by rollers 154 engaging the rear side thereof.

Slide 149 is reciprocated to invert and revert the parison forming unit through the rack and pinion previously referred to, by means of a cam roller 155 carried by the slide, Figs. 1, 3, and 4, which roller rides in an inwardly facing cam track 156 formed in a barrel shaped casting or drum 157 resting on the base 40 of the machine. It will be understood that other similar rollers on slides which invert and revert the several parison forming units, also operatively engage cam 156.

The cam casting 157 is divided in two parts, which are bolted together as indicated at 158 and 159, Fig. 3, so that said casting may be removed and replaced by one having a cam 156 of different characteristics from that of the casting previously in use.

Casting 157 is slidably mounted on the base 40 being held concentric with the column 51 of the table and hence with the mold table itself, by means of bearing surfaces 161 and 162, Fig. 3, provided on the ends of a cam casting 163, the purpose of which is hereinafter explained, and separate bearing members or guides 164 and 165.

Angular adjustment of the cam casting 157 relative to the base of the machine and relative to the parison mold table is effected manually by means of a crank 166, Figs. 1 and 3, on crank shaft 167, Fig. 3. Crank shaft 167 is held against longitudinal movement in a bearing 168 provided on the guide member 164, by means of collars 169, said shaft having a threaded portion 171 passing through a nut, not shown, pivoted at 172 in lugs formed on the cam casting 157, one of which lugs is indicated at 173. Thus, by rotating the crank 156, the cam casting 157 is angularly adjusted to vary the time of inversion and reversion of the parison forming units. This may be done while the machine is in operation.

The cam 156 is cut away as shown in Fig. 3, between the points indicated at 174 and 175, so that when a cam roller 155 is traveling between those points, it is not operated by said cam. During such travel of the cam roller 155, the parison forming unit is held in fixed reverted position by means of an additional cam roller 176, Fig. 4, on the top of the casting 131, which rides in a cam track 177 formed on the under side of a semi-circular cam disc or plate 178, Figs. 2 and 4. The semi-circular plate 178 overhangs the parison mold table and constitutes a horizontal extension of a wind box construction 179 hereinafter described, provided with vertically spaced hub members 180 and 181 by means of which it is securely mounted upon the column 51 of the parison mold table. The cams 156 and 177 overlap each other at their ends to a sufficient extent to insure that the control of the parison forming unit will be smoothly transferred from one cam to the other.

It will be understood that the cams 156 and 176 cooperate with rollers 155 and 176 respectively, associated with the several parison forming units. It should further be remarked that one of the purposes of the cam roller 176 and cam 177 is to assure that the parison forming unit will be held in exact vertical position throughout its travel in the transfer zone so that exact alignment of the neck mold and parison with the companion blow mold may be obtained for the transfer of a parison.

Another purpose of cam 177 is to absorb the thrust on the units and the invert mechanism therefor, which otherwise would be exerted on them by the body mold operating means, as later explained.

The neck mold and body mold operating mechanisms

The construction of the mechanisms for opening and closing the neck mold and body mold of a parison forming unit P may now be described, reference being had particularly to Figs. 3, 4, 13 to 17, 20 and 21. It should be stated that the mold operating mechanisms of the several units P are identical in construction and operation and hence only one of each of them is described.

Considering first the neck mold operating means, it will be observed that the holders 142 for the sections 143 of the neck mold have laterally and oppositely extending arms 183, Figs. 7 and 14, said arms having pin and slot connections with links 184, Figs. 7, 14 and 17, held in engagement with the said arms 183 by a tension spring 185, and being connected at their inner ends to a common pivot pin 186. Also connected to the pin 186 is the arm 187, Figs. 7, 14 and 17, of a bell crank lever loosely mounted on a rock shaft 188 journaled in one corner of the U-shaped casting 131 of the parison forming unit. Said bell crank lever has a second arm 189, Figs. 13 and 14, to which one end of a tension spring 191 is connected, the other end thereof being anchored on a stud rigid with the parison forming unit, so that the spring tends to hold the neck mold closed. Said bell crank lever has a third arm 192 formed thereon, Figs. 1, 7, 13, and 14, which carries a cam roller 193 at its outer end.

As shown in Figs. 14, 15 and 16, cam roller 193 is adjustably mounted on the arm 192 being received by the upper portion of a stud shaft 194 having a lower portion 195 of reduced cross section eccentric with respect to the upper portion and journaled in arm 192. Portion 195 is provided with a worm gear 196 engaged by a worm 197 on a shaft provided with a thumb piece 198 by means of which the stud shaft 194 may be rotated to adjust the cam roller 193 relative to the neck mold operating mechanism above described, and relative to a cam 199, Figs. 1, 4, 7, 34 and 35 with which the roller cooperates to open the neck mold in the transfer zone. Such adjustment of the cam roller serves to vary the time and/or rate of opening of the neck ring, and similar individual adjustments may be made of the other neck ring operating mechanisms, of the units P.

The neck mold operating cam 199 is formed on the bottom side of a cam bracket 201, Figs. 1, 4, 7, 34 and 35 adjustably secured to the under side of the semi-circular cam disc or plate 178 by means of a vertical pivot bolt 202, Figs. 1, 34, and 35 about which the said cam bracket and cam may angularly by adjusted. Such adjustment is effected by means of a vertical rotary pin 203, journaled in the cam plate 178 as shown in Figs. 2, 34 and 35, and having a reduced eccentric bottom portion 204 passing through a lug 205 in the cam member 201 as shown. The lower part of said eccentric portion may be surrounded by a compression spring to assist in retaining the cam member 201 in horizontal position in engagement with the under side of the cam plate 178.

The rotary shaft 203 is provided with a pointer 206 cooperating with a scale 207, Figs. 2, 34 and 35, and such scale may be screw threaded to receive a set screw 208 adapted to bear against the upper part of shaft 203. Upon loosening of the set screw, the shaft may be rotated to angularly adjust cam 199 about its pivot bolt support 202, thereby collectively varying the time and/or rate of opening and closing of the neck molds of the various units P.

It should be remarked that springs 191 normally hold the neck molds closed and the cam 199 is supported in such a position relative to the parison mold table as to be successively engaged by cam rollers 193 of the neck molds of the various parison forming units as they travel through the transfer zone, to effect the opening of the neck molds to release parisons to the companion blow molds on the blow mold table, and to afterwards close the molds. Cam 199 may thus be adjusted to effect the opening of a neck mold with a single snap movement shortly after the companion blow mold has closed about a parison, thereby preventing relative movement between the parison and the molds during the transfer. The transfer operation is described in greater detail hereinafter.

The parison body mold operating mechanism now will be explained with particular reference to Figs. 1, 3, 4, 13, 14, 17, 18, 20, 21 and 36, and it being again noted that the mold operating means of the various units have the same construction and operation.

As shown in Figs. 1, 13 and 17, the body mold holders 144 have links 210 pivotally connected thereto which in turn are pivotally connected to crank arms 211 mounted respectively on rock shafts 212 and 188, the latter having previously been referred to in connection with the description of the neck mold operating mechanism. The shafts 212 and 188 being journaled in the corners of the U-shaped casting 131 of the parison forming unit, carry the crank arms 211 on their bottom ends, as shown in Figs. 1, 13 and 17, and at their upper ends carry similar crank arms 213, Figs. 1, 4 and 17. Each crank arm 213 is connected to a link 214. The links 214 are provided with spaced arms 215 and 216 respectively, Fig. 17, connected to a common pivot pin 217 carrying a cam roller 218.

Also connected to pin 217 is the rod 219, Figs. 1, 4 and 17, of a piston 220 in cylinder 221 secured to the top of the casting 131. The cam roller 218 is adapted to engage a cam 223, Figs. 2 and 4, (especially the outer edge 223*a* thereof) formed on the under side of cam plate 178, for effecting opening and closing movements of the body mold. It will be understood that the cam 223 serves to operate the body molds of the various parison forming units in succession.

The opening and closing movement of the body mold is controlled primarily by the above described cam mechanism, but said mold also is partially opened or cracked by means including piston 220 in cylinder 221, as the parison forming unit approaches the transfer station, to begin the reheat of a parison previously formed therein, such operation being permitted by the cam mechanism. Said piston also serves to hold the body mold closed upon disengagement of cam roller 218 with cam 223, during the time that the parison forming unit is being inverted, is held inverted, and is being reverted, and further operates to hold roller 218 in engagement with portion 223*a* of cam 223.

The cracking of the body mold is effected by the movement of piston 220 to the right looking at Fig. 17, such movement being permitted by the exhaust of air pressure from cylinder 221 in the space to the rear of the piston through means presently to be described. It will be understood that piston 220 acts through its rod 219 and the linkage to which it is connected to the mold holders, in opening and closing said mold.

The cracking of the mold is effected and limited under the control of the exhaust from cylinder 220 by mechanism contained within a recess 224 in piston rod 219, Fig. 17, the major portion of which is tubular. Said mechanism comprises a compression spring 225 surrounding a pin 226, bearing against a nut fast on the inner end, and a collar loose on the outer headed end, of said pin. When piston 220 is in its outer position (Fig. 17) spring 225 is compressed by the engagement of the collar against which it bears, with the inner end of sleeve 227, the outer end of which abuts head 228 of cylinder 221.

Upon exhaust of air pressure from the space in the inner end of cylinder 221, as previously described, piston 220 is moved to the right under the action of compression spring 225 which expands to an extent sufficient to crack the body mold, such expansion being limited by the engagement of the head on pin 226 with the collar on the outer end of pin 226. It will be understood, of course, that the spring 225 acts on the rod 219 of the piston 220, the motion of which is transmitted to the body mold holders by means of the linkage previously referred to.

Admission of fluid pressure to the space in the inner end of cylinder 221 acts on piston 220 to move said piston to the left, looking at Fig. 17, to close the body mold. The means for exhausting air pressure from, and admitting air pressure to the cylinder 221 will now be described.

Air under pressure for cylinder 221 may be conducted from high pressure line 113, Fig. 36, past a suitable reducing valve discharging into an accumulator 229. A conduit 230, Figs. 1, 4 and 36 conducts air from the accumulator downwardly through the column 51 into a manifold 231 formed in the column and hub 232 of the table. From the manifold 231 the air pressure is distributed through conduits 233, Figs. 1, 2, 4, 13, 14, 18 and 36, said conduits in turn leading downwardly through table 48 to three-way rotary plug valves 234 individual to the parison forming units. Said valves are shown in Figs. 1, 3, 4, 18, 21, and 36, and their casings are formed integrally with cylinders 235, depending from the bottom of table 48 to which they are secured near its periphery by brackets 235*a* with which they are integrally formed. Said valves are identical

in construction and are all operated by the same means as will presently be described.

As shown in Fig. 18, each valve 234 controls the admission and exhaust of air to and from the cylinder 235. Said cylinder communicates with a conduit 236 through a port in the table opening into the cylinder.

Conduit 236, as shown in Figs. 2, 13 and 14 (and indicated in Fig. 36) leads upwardly into a chamber 237 formed at the end of bearing 136 in a support 133 of a parison forming unit. Chamber 237 in turn communicates through a passageway formed in shaft 132 and indicated at 238, Figs. 14 and 17, with a duct 239, Figs. 17 and 20, formed in the casting 131 and opening into a chamber 241 in the cylinder 221, as clearly shown in Fig. 20. From chamber 241 air may flow through a port 242 into and out of the space in the inner end of cylinder 221. Thus it will be seen that valve 234 controls the admission and exhaust of air pressure to and from the inner end (Fig. 17) of cylinder 221, through the intermediate chamber 241.

Air is conducted from chamber 241 to and through the neck pin 146 for counterblowing, and for cooling the neck pin and body mold, as hereinafter explained, and of course at times when valve 234 is in air supplying position.

It will be seen that air pressure may be admitted to or exhausted from cylinder 221 through the connections just described, irrespective of the position of the parison forming unit, that is to say, whether it is in inverted or reverted position. It also will be understood that the several conduits 233 and valves 234 of the several units P communicate with their respective body mold cylinders 221 through conduits and passageways of identical arrangement and construction.

When the valve 234 is in the position shown in Fig. 18, air pressure flows through the valve to cylinder 221, tending to hold the body mold closed. However, when the valve is rotated through an angle of 90°, the air supply is cut off and communication established between cylinder 235 and an exhaust duct 243 in the casing of the valve, thereby exhausting air from cylinder 221 to permit the previously described partial and complete opening of the body mold.

Cylinder 235 contains a piston 244 urged downwardly by the admission of air to said cylinder and by a compression spring 245 in the cylinder. Said piston forms part of a counterflow baffle plate mechanism as hereinafter explained. The piston and cylinder are ported as shown to permit passage of air through the cylinder irrespective of the position of the piston therein.

Valve 234 is operated by means of a dog 246 connected to the rotary portion thereof, as shown in Figs. 1, 3, 4, and 21. Valve 234 and its dog 246 being supported by cylinder 235 near the edge of the mold table, said dog is moved in a circular path by the rotation of the table and such movement is employed to effect the operation of the valve. To this end, a circular rail 247, Fig. 3, is mounted on suitable brackets, and supports a stop or button 248 adjustably held thereon in the path of movement of dog 246, which upon striking the stop, turns valve 234 to exhaust position to permit cracking of the body mold at the proper selected distance in advance of the transfer zone. The stop 248 is in a position to be struck by the lower end of dog 246, that is, the portion of the dog indicated at 250, Fig. 21, to swing the dog and the valve clockwise through an angle of 90° to exhaust position. In Fig. 21, the dog 246 is shown in full lines in the position in which it is held prior to being rotated by stop 248, and in dotted lines showing its position after such rotation. Thus the successive actuation of the valves 234 to exhaust position by stop 248 permits the successive cracking of the body molds, and allows the body molds afterwards to be completely opened by cam 223. The time of cracking of the molds may be varied by shifting stop 248 on rail 247.

A second stop or button 251, Figs. 3 and 4, is positioned to engage the upper portion 254 of dog 246 to return the dog into full line position as shown in Fig. 21, and to turn the valve 234 into the position shown in Fig. 18, for the supply of air under pressure to the cylinder 221, resulting in urging the body mold toward closed position and urging cam roller 218 of the body mold operating mechanism into tight engagement with the outer edge 223*a*, Figs. 2 and 4, of cam 223.

It is the cam 223 which primarily effects the complete opening of the body mold, and the admission of air pressure into cylinder 221 applies enough power to piston 220 to close the body mold which operates, however, under the control of cam 223 and roller 218, which determines the time and rate of closing of the mold. Thus a relatively heavy mold may be easily closed. The forces or strains developed during the mold opening and closing operations are absorbed by cam 177, which relieves the units and invert mechanism therefor of such strains or forces.

After the cam roller 218 is disengaged from the cam 223 just prior to the inversion of the parison forming unit, and during and after the inversion of the unit, piston 220 operates to hold the body mold closed until the above described cracking of the mold takes place. Such action of piston 220 is of particular utility in holding the mold closed in opposition to the force of the counterblowing air on the interior thereof.

Safety devices for closing the body mold

Referring to Fig. 2, it will be seen that the outer portion 223*a* of cam 223 extends outwardly of the mold table, and as previously explained, operation of valve 234 by stop 251 results in the admission of air pressure to cylinder 221 to urge the cam roller 218 into engagement with that portion of the cam. In order to insure that the body mold will be closed, or at least partially closed, in the event of the failure of the air supply to the machine, or the jamming of glass in the mold, the inner portion 223*b*, of cam 218, Fig. 2, is bent outwardly of the table, as shown, at the exit end of the cam 223 for engagement by the cam roller 218, such engagement causing the body mold to be closed to about a 15° parting, thereby insuring clearance of the mold with the other parts of the machine when it is being inverted. The cam roller is moved in such a path as to strike the portion 223*b* of the cam when air pressure fails, because the piston 220 in cylinder 221 will not then operate to urge the cam roller into contact with the outer portion 223*a* of the cam 223.

If for any reason the machine should be stopped and a valve 234 moved to exhaust position after passing the stop member 251, piston 220 would fail to operate to hold cam roller 218 into engagement with the outer portion 223*a* of the cam and then the body mold would not be completely closed, even though the air pressure to the machine had not been interrupted. To insure that

the body mold will be closed in such a contingency, an additional stop member 255, Figs. 1 and 3, is positioned in the path of travel of dogs 246 to make certain that the valves 234 will be in air supplying position prior to the time that the parison forming units are inverted. A similar stop member 256 may be located beyond the stop member 255, and during the travel of the various valves 234 between said members, movement thereof to exhaust position is positively prevented by a rail 257 of circular shape, having an inwardly extending flange 258, Fig. 3, with the under side of which the flat end portions 259 of dogs 246, Fig. 21, cooperate to positively prevent the turning of the dogs, and the rotation of the valves to exhaust position, while the parison forming units are being inverted. Such arrangement makes certain that the parison body molds will be closed to clear the other parts of the machine during the inverting movement thereof, so long as the air pressure supply to the machine continues.

It will be understood that the valves 234 will remain in air-supplying position during the travel of the valves in a counterclockwise direction from the point located by stop member 251 to the point fixed by stop member 248, which operate respectively to move the valves to air supply and exhaust positions. Hence in the usual operation of the machine, pistons 220 will operate to urge the body molds toward closed position, except during the travel of the various valves and their dogs from stop member 248 to stop member 251.

The neck pin and operating means therefor

The neck pin 146 and the mounting therefor is best shown in Figs. 17 and 19 and now will be described, it being observed that the means for operating the neck pins of the units P are alike.

The neck pin or forming member 146 is screw threaded on a plunger 260 loosely mounted in a sleeve 261, said sleeve, in turn, being slidably mounted in tubular boss 262 formed on the head 228 of cylinder 221. The plunger 260 has air-tight engagement with the sleeve 261, though loosely mounted therein, by virtue of the provision of piston rings thereon, as shown. The loose mounting of the plunger in sleeve 261 permits self-centering of the neck pin 146 in the neck mold 143 with which it cooperates.

Plunger 260 is loosely connected to the sleeve 261 by means of a pin 263 passing through openings in both of them. The ends of pin 263 extend outwardly through the boss 262 to where they are connected to the bottom ends of tension springs 264, Fig. 19, the upper ends of which are anchored on the cylinder head 228. Springs 264 act to hold the neck sleeve and the neck pin in retracted position.

The neck pin is projected into the neck mold into neck forming position, when the parison forming unit is inverted, such inverting movement causing engagement of a roller 265 on the upper closed end of sleeve 261 with the outer end of a radially extending horizontal lever 266, Figs. 1, 4 and 22, pivoted on a bracket 267 on an air motor 268. The air motor 268 is so located that the lever 266 is held in radial alignment with the path of vertical movement of the neck pin sleeve, whereby the inversion of the parison forming unit causes the roller 265 on said sleeve to engage the outer end of the lever as shown in Fig. 22, resulting in the projection of the neck pin into the neck mold, in which position it is shown in said figure.

The air motor 268 comprises a piston 269, a reduced upward extension of which engages the under side of the outer end of lever 266 to hold it substantially in horizontal position for operating the neck pin as above described. A spring 270 within piston 269 yieldingly holds said piston in uppermost position. Said spring cushions the blank mold unit as it comes to rest in inverted position, being compressed at that time by the weight of said unit. Air pressure may be admitted into air motor 268 through a conduit 271, Figs. 1, 4, 22, and 36, as hereinafter explained in greater detail, for opposing the pressure of settle blowing air on the neck pin and hence insuring that it will remain seated or in projected position during the settle blowing operation especially in the settle blowing of parisons for wide-mouth ware, and also for counterbalancing the pressure of the settle blow head on the parison forming unit during the settle blowing of a charge, thus relieving the inverting mechanism of strain. In this manner the unit is held in exactly vertical position as shown in Fig. 22.

It will be understood that when the unit P is reverted, springs 264 will act to retract the neck pin from the neck mold as a result of the disengagement of roller 265 and lever 266, and that the times of operation of the neck pin are determined by the times of inversion and reversion of the unit, which latter are varied by the adjustment of drum 157. The inertia of the unit P to reversion is largely overcome by spring 270, which expands as the reversion of the unit begins.

As shown in Fig. 17, a passageway 272 is provided in the neck pin 146 and the plunger 262 for the passage of air therethrough. The upper end of the passageway 272 opens into the space in sleeve 261 into which air pressure is conducted through a port 273 in the sleeve 261, adapted to register with a similar port, not shown, in the boss 262, when the sleeve and plunger are in retracted position. This permits passage of air pressure through a conduit 274, Figs. 14, 17, 19 and 36, connected to the port in boss 262, into and through the sleeve and thence downwardly through the neck pin for counterblowing, and for cooling the neck pin and body mold, as is explained later.

It previously has been mentioned that the apparatus of the invention includes means for introducing settle blowing air into the parison forming unit when it is in inverted position to compact a charge of glass in the body mold and neck mold, and also for counterblowing the charge when the unit is in reverted position to form the charge into a parison. The description of such means now will be proceeded with.

The settle blow mechanism S

The settle blow mechanism includes a settle blow head proper and, as previously indicated herein, means for causing it to travel successively with the several parison forming units during the continuous travel thereof in inverted position. The settle blow head mechanism also comprises means for vertically reciprocating and simultaneously rotating the settle blow head into and out of capping relation with the bottoms of the body molds of the parison forming units.

Referring to Figs. 1, 2, 4, 7 and 22, it will be seen that the settle blow head mechanism is carried by an upwardly extending arm 276, the hub portion 277 of which is swiveled on the column 51 of the parison mold table intermediate the hubs 180 and 181, Fig. 4, of the wind box structure 179.

Such mounting of the settle blow head mechanism permits oscillation thereof for successive travel of the settle blow head with the parison forming units.

The outer vertical face of the arm 276 has a slideway 278 formed thereon, Figs. 7 and 22, receiving a guide 279 on the upper end of which an air motor 281, Figs. 22 and 23, is held in vertically spaced relation to a casing 282 carried on the bottom end of the guide, for containing cam mechanism as later explained.

Air motor 281 comprises a piston 283 engaged on its under side by a spring 284 and having a downwardly extending piston rod 285 upon which a hollow arm 286 is mounted. Arm 286 has a blow head 287 affixed thereto by a swivel connection as shown.

The mounting of the guide 279 on arm 276 permits vertical adjustment of the mechanism carried by the guide and including the blow head to accommodate the head to parison molds of different lengths, and such adjustment is effected by means of a non-rising screw 288 rotatably mounted in the arm 276 and passing through a screw threaded lug 289 extending rearwardly from the guide 279. Rotation of screw 288 in one direction or the other effects the lowering or raising of the settle blow head 287, and such rotation is manually effected by means of a crank 291, Figs. 2 and 22, on crank shaft 292 journaled at its inner end on the top of the arm 276 as indicated at 293, and carrying on its inner end a bevel gear 294 in mesh with a similar bevel gear 295 on the upper end of screw 288. It will be observed by reference to Fig. 2, that crank shaft 292 supports crank 291 at the rear of the machine for convenient access thereto by the operator.

Air motor 281 serves to reciprocate and rotate the blow head 287 downwardly and outwardly, and upwardly and inwardly, into and out of capping and blowing relation with the bottoms of the parison molds as now will be explained, the blow head mechanism being caused to travel successively with the units for that purpose by means later described.

As shown in Figs. 22 and 23, the rod 285 of the air motor extends downwardly into the casing 282 through a barrel 296 in said casing, and having a helical cam 297 cut therein, engaged by a cam roller 298 on the bottom end of the shaft. Cam 297 is shaped to convert a part of the reciprocatory motion of shaft 285 imparted thereto by air motor 281 into rotary motion, as a result of which the settle blow head is both reciprocated and oscillated at the same time.

As will be apparent from Figs. 22 and 23, downward movement of piston 283 of air motor 281, is effected by the admission of air pressure to the space in the upper end of cylinder of the air motor through a conduit 300, and the exhaust of air pressure from the space in the lower end of the cylinder through a conduit 301. Similarly, admission of air pressure into the space in the lower end of the cylinder through conduit 301, and the exhaust of air pressure from the space in the upper end of the cylinder, results in the upward movement of the air motor. When the supply of air pressure to the air motor is discontinued, spring 284 raises piston 283 to move blow head 287 inwardly and upwardly to inoperative position out of the way of other parts of the machine.

The last part of the upward travel of the piston 283 is cushioned by the entrance of a head or boss 302 on piston rod 285 above the piston, into a recess 303 in which the boss loosely fits, causing air to be trapped above the piston, which air slowly escapes therefrom through a passageway 304, Fig. 23, into conduit 300. Rapid admission of air pressure through conduit 300 into the space in the upper end of the air motor is permitted by a check valve 305 controlling a port leading downwardly from passageway 304, as is clearly shown in Figs. 23 and 24.

Alternate admission of air pressure and the exhaust thereof through the conduits 300 and 301 respectively, to lower and raise the settle blow head is controlled by a valve 306, Figs. 2 and 36, of the reciprocating piston type. Air pressure is conducted to the valve 306 through a high pressure conduit 307, Fig. 36, which may lead from high pressure supply conduit 113, and which is constantly in communication with the interior of a hollow piston member 308 of the valve. Piston 308 is provided with air supply ports 309 and 311 adapted to register alternately with ports in the valve casing to which the conduits 300 and 301 are respectively connected. Said piston also has an exhaust duct 312 formed therein which alternately permits communication between either of the conduits 300 and 301 with an exhaust conduit 313 leading from the valve casing.

Thus it will be seen that when the piston 308 is moved to the right in which position it is shown in Fig. 36, air pressure from conduit 307 will flow through the piston, passing from the interior thereof through port 309 and conduit 300 into the space at the upper end of air motor 281, while at the same time air pressure will be exhausted from the space in the lower end of the air motor through conduit 301, the piston exhaust duct 312, and the exhaust conduit 313, as a result of which the settle blow head will be lowered and rotated into a position to engage the open bottom of an inverted parison mold. When the piston 308 of valve 306 is moved to the left, the above-described distribution of air pressure will be reversed, and the settle blow head will be raised and rotated out of blowing position.

Movement of piston 308 to the right, looking at Fig. 36, is caused by the exhaust of fluid pressure from the right hand space of the air motor through, a conduit 314, Figs. 2, 8 and 36, and a relief valve 315. In like manner, movement of piston 308 to the left is effected by the exhaust of fluid pressure from the space in the left hand end of the valve through a conduit 316 and a relief valve 317. Piston 308 is provided with bleed ports 318 in its opposite ends which permit fluid pressure to build up against one end or the other of the piston to effect reciprocation thereof when either of the relief valves 315 or 317 is opened.

Relief valves 315 and 317 are operated in timed relation to the rotation of the parison mold unit to effect the lowering and raising of the settle blow head at the proper time, by means of diametrically opposed cams or lugs 319 and 320 respectively, Figs. 2 and 8, depending from the spokes of horizontal gear 321.

Gear 321 is carried by a vertical shaft 322, Fig. 8, journaled in the horizontal upper portion of frame work 103, and is driven by a pinion 323, Figs. 2, 8 and 9, in mesh with a gear 324 mounted on an upward extension of shaft 109, previously referred to. Shaft 322 is positioned to support and operate suitable takeout mechanism, not shown, for removing finished articles of glassware from blow mold units B. For example, takeout mechanism such as is shown in the patent to

H. W. Ingle, No. 1,921,389, granted August 8, 1933, may be operated by shaft 322.

Valve 315 is carried by an arm 325, Figs. 2 and 8, loosely mounted on vertical shaft 322, said arm supporting the valve in the path of travel of the lugs or cams 319, 320. Angular running adjustment of valve 315 relative to its operating cams or lugs is effected by means of an arm 326, pivotally connected to the outer end of arm 325, and provided with notches 327 cooperating with a bracket 328, and a handle 329 for setting the valve in adjusted position.

Valve 317 is mounted upon the inwardly extending arm of a bell crank 330, Figs. 2 and 8, loose on shaft 322, the other arm of which is adjustably connected by a bolt 331 to a stationary arm 332 extending laterally from the journal of shaft 322.

From the foregoing it will be understood that the valves 315 and 317 respectively controlling the lowering and raising of the settle blow head, are operated in timed relation to the movement of the parison forming unit and that running adjustment of the settle blow head lowering valve 315 and non-running adjustment of the settle blow head raising valve 317 may be effected for varying the times of raising and lowering of the blow head.

If for any reason the piston valve 308 which controls the lowering and raising of the settle blow head should stick, the blow head might then be held in lowermost position where it might strike, or be struck by, other parts of the machine. Therefore, in order to insure that the settle blow head always will be raised at the proper time, the piston 308 is provided with a spring pressed plunger 334, Figs. 2 and 36, engaged by one arm of a horizontal bell crank lever 335, the other arm of which is forked for cooperation with a collar 336 (Fig. 12) on a link (348) of the hereinafter described blowhead oscillating mechanism. When said mechanism operates to cause the blow head to oscillate, collar 336 will strike the arm of bell crank lever 335, positively moving piston 308 to the left, Fig. 36, thereby insuring that the settle blow head will be raised out of the path of the funnel and/or of the other parts of the machine when it should.

The lowering and raising of the settle blow head controls the application of settle blowing air through said head to the charge of glass in the mold with which the head cooperates. Settle blowing air is supplied through a conduit 337, Figs. 2, 22 and 36, which may lead from an accumulator 338, receiving air through suitable reducing valves from high pressure line 113, into a duct 339, Fig. 23, in the base of air motor 281. Communication is established between duct 339, Fig. 23, and a passageway 340 in piston rod 285, when the settle blow head is reciprocated and oscillated downwardly into blowing position, through port 341 in rod 285. Consequently, the settle blowing air will flow through the passageway 340 in rod 285 through the hollow arm 286 which supports the blow head 287 and through the blow head into the parison body mold. It will be understood that when the settle blow head is raised, port 341 will be moved upwardly out of registry with duct 340 and the settle blowing air then will be cut off.

As previously stated, air motor 268 serves to counterbalance the force of the settle blow head and settle blow air on the neck pin and parison mold unit, as a result of the introduction of air to the air motor through conduit 271. Such air is supplied to the air motor through a conduit 342, Figs. 1, 2, 4, and 36, leading from conduit 300 to a hollow shoe 343, Figs. 4 and 36, located in a radial slot 344 formed on the under side of hub 181 of the wind supply structure, Fig. 4, and spring pressed into engagement with the horizontal surface of a ported flange 345 formed on the hub 232 of the mold table. The ports in the flange 345 have the conduits 271 of the various air motors 266 connected thereto, as a result of which the rotation of the mold tables causes successive registry of the shoe 343 with the ports, thereby providing successive communication between conduit 342 and the conduits 271.

It will be seen that a common source of air pressure is provided for air motor 268, air motor 281, and the blow head 287. Therefore, when valve 308 is moved into a position to lower the blow head, and the shoe 343 is in communication with the appropriate conduit 271, both the force of air motor 281 on the whole unit P, and the force of the settle blowing air on the neck pin, will be counterbalanced by air motor 268. This prevents strain on the invert mechanism and unseating of the neck pin during the settle blowing operation.

The mechanism for successively moving the settle blow head with the parison mold units now will be described.

The upwardly inclined settle blow head supporting arm 276, Figs. 1, 2, 7, 12 and 23, is provided with a rearwardly extending arm 347, to which one end of the previously mentioned link 348 is pivotally and adjustably connected. The other end of link 348 is pivotally connected at 349, Figs. 1, 8, and 12, with the inner end of a lever 350 swingably mounted on the bottom end of the pivot stud 101 which also supports the arm 100 of the funnel operating mechanism, as previously described. Lever 350 also carries a cam roller 351 on its inner end which bears against the edge of cam 115 which, as previously stated, is mounted on shaft 109 whereby it is driven by the same means which drives the funnel oscillating mechanism.

Also connected to the arm 347 is an air spring 352, Figs. 2, 12, 22 and 36, which receives air pressure through a conduit 353, connected to conduit 112 supplying air pressure to air spring 111 of the funnel oscillating mechanism. Air spring 352 operates to yieldingly hold cam roller 351 in engagement with cam 115.

Thus, cam 115, being rotated by the shaft 109 upon which it is mounted, serves to oscillate the settle blow head mechanism periodically to cause it to travel with successive parison forming units in the direction of travel thereof for a sufficient distance to permit the settle blow head to be moved into and out of engagement with the bottoms of the parison molds, by means previously described, while said mechanism moves as a unit. Cams 108 and 115 which oscillate the feed funnel and settle blow head respectively, preferably are mounted on the shaft 109 in such angular relation as to cause the settle blow head to begin its travel with a parison mold, immediately after the delivery of a charge thereto, but prior to the termination of the travel of the funnel with that mold, in order to effect the settle blowing of the charge at the earliest practicable time. Fig. 1 illustrates the arrangement of the funnel and the settle blow head which permits such operation without interference, or parts striking each other.

It already has been pointed out that after

the settle blowing of a charge of glass in an inverted parison forming unit P, the unit is reverted and a counterblow baffle plate device C raised into engagement with the bottom of the parison mold for counterblowing the charge of glass into a parison. The construction and operation of one of the counterblow baffle plate devices C, and means synchronized therewith for applying counterblow air to a charge in a parison forming unit, now will be considered.

The counterblow baffle plate devices C and counterblow air supply means

The counterblow baffle plates individual to the parison forming units are substantially identical in construction and operation as also are the means associated with each of the units for controlling the application of counterblow air.

As shown in Figs. 1, 2, 4, 17 and 18, each counterblow baffle plate, designated at 355, is removably secured to an arm 356, clamped for adjustment on the upper end of a vertical shaft 357 slidably and rotatably journaled in the parison mold table 48 near the periphery thereof, and in an arm of bracket 235*a*, previously mentioned. The lower portion of shaft 357 is surrounded by an encased barrel cam 358, Fig. 17, which receives a cam roller 359 on shaft 357 for effecting oscillation of the baffle plate when it is reciprocated as hereinafter explained.

Shaft 357 carries a grooved collar 361 on its bottom end which receives the pins or trunnion 362 provided on the bifurcated portion 363, Figs. 3 and 17, of a yoke or lever 364. The yoke 364 is pivotally supported intermediate its ends on bracket 235*a*, Figs. 1, 3, 4, 17 and 18, as indicated at 365. On its rearward end, the yoke 364 carries a pair of rollers 366 and 367, Figs. 1, 3, 4 and 18.

Roller 366 is engaged by the bottom of piston 244 in cylinder 235 at all times, it already having been explained that the piston is part of the baffle plate operating mechanism. Roller 367, however, is a cam roller which rides on cams 368 and 370 located in the path of travel of the roller, as a result of the rotation of the table 48 by which said roller is carried.

Said cams control the raising and lowering of the rearward end of yoke or lever 364 to respectively lower and swing out, and raise and swing in, the baffle plate, it being understood that the swinging of the baffle plate is effected by barrel cam 358. However, the admission of air pressure to cylinder 235 by valve 234, to close the parison body mold, as above explained, applies power to piston 244 for lowering the rearward end of yoke or lever 364 and raising the baffle plate and swinging it inwardly of the table to operative position for counterblowing, and for yieldingly holding the plate seated in the bottom of the appropriate parison body mold against the force of the counterblowing air applied to the glass in the mold. Thus the piston 244 provides the necessary power for raising the baffle plate and holding it raised, under the control of the cams 368 and 370, which are designed to determine the times and rates of the movement of the plate to operative position.

The cams 368 and 369 positively control the lowering and outward swinging of the baffle plate, they being shaped to raise the rearward end of yoke 364 at desired times for that purpose. During the resulting movements of the baffle plate to inoperative position, air pressure is exhausted from cylinder 235 (by the operation of valve 234 to permit cracking of the body mold) in one instance, to permit piston 244 to move upwardly freely in cylinder 235, and in another instance such application of air pressure to the piston is maintained, at which time the piston acts as an air spring, as more fully explained hereinafter. Spring 245 acts on piston 244 to overcome the frictional resistance to its movement when the air pressure is off.

Cam 368, Figs. 1, 3 and 4, is formed on the outside of the casting 157 on the interior of which the invert cam 156 is formed. As shown in Fig. 1, the advance end of cam 368 comprises an upwardly sloping portion 368*a*, which portion is engaged by roller 367 to elevate the rearward end of the yoke, causing the baffle plate to be lowered and swung outwardly of the mold table into a position to permit the parison forming unit with which the plate is associated to be inverted without obstruction. At this time, valve 234 will be in air supply position to hold the body mold closed, as a result of which piston 244 acts as an air spring to hold roller 367 in engagement with cam 368.

Cam 368 including its advanced portion 368*a* preferably is formed integrally with the casting 157 and when said casting is interchanged with another similar casting to provide an invert cam of different characteristics, cam 368 also will be accordingly changed so that the operation of the counterblow baffle plates will be properly synchronized with the inverting and reverting of the parison forming units. The angular adjustment of cam 156 also results in corresponding adjustment of cam 368.

Adjacent the end of cam 368 where cam roller 367 leaves it, a cam member 368*b*, Figs. 3 and 4, inclined downwardly in the direction of rotation of the mold table and of the travel of the cam roller 367, is removably secured to the outer side of casting 157. This portion 368*b* constitutes a continuation of cam 368 and allows piston 244 to lower the rearward end of yoke 364 to effect a raising and inward swinging movement of the counterblow baffle plate into engagement with the bottom of a parison mold unit for the counterblowing of a charge therein into a parison. Power is applied to piston 244 at this time because valve 234 is in air supply position to hold the body mold closed during counterblowing.

Cam portion 368*b* is interchangeable with other similar portions not shown, which makes it possible to vary the time of movement of the baffle plates into engagement with the molds independently of the adjustment of cam 368 by the rotation of the casting 157.

Upon completion of the counterblowing operation, the counterblow baffle plate is lowered and swung outwardly of the table by the engagement of cam roller 367 with fixed cam 370, Figs. 1, 3 and 4, formed integrally with the cam casting 163 previously mentioned. The forward end of cam 370 is spaced from cam 368 and is inclined upwardly as shown at 370*a*, Fig. 4. Such movement of the baffle plate permits it to clear parts carried by the blow mold table, and during the operation, piston 244 is free to move upwardly in cylinder 235 because of the previous actuation of valve 234 to exhaust position for the opening of the body mold.

The rear end of cam 370, or the end thereof where roller 367 moves out of engagement with the cam, is inclined downwardly as shown at 370*b*, Fig. 1, and is spaced from the forward or advance end 368*a* of cam 368, (see Fig. 3). Portion 370*b* of cam 370 causes or permits roller 367, and hence the rear end of yoke 364 to be low-

ered, and the baffle plate supporting arm to be moved upwardly and swung inwardly by piston 244, valve 234 being in air supply position when the machine is in operation. The main purpose of this arrangement is to permit adjustment of arm 356 on its vertical shaft 357, when the body mold, and hence the baffle plate therefor, are changed while the machine is not in operation, to insure that the new baffle plate will properly seat in the body mold during counterblowing. In other words, it permits "setting up" of the baffle plate, and it is necessary to push down shaft 357 and raise piston 244, to change the baffle plate.

It will be understood that air pressure to the machine will be off when the machine is idle and the baffle plate is "set up" although valve 234 is open. After the exchange of baffle plates and the "setting up" is completed, spring 245 will act to urge piston 244 downwardly as far as it will go so that the piston will not be "slammed" down, when the air pressure is turned on. Thus injury to the baffle plate operating mechanism is avoided.

The means for controlling the supply of counterblow air in a single unit P, which means also serves to discharge air through the neck pin for cooling purposes, will now be described.

The counterblow air supply means

As already stated, air is supplied through the neck pin mechanism by means of conduit 274, Fig. 19, and said conduit leads from chamber 241, Fig. 20, formed in the casting containing cylinder 220. Passage of air from chamber 241 into conduit 274 is controlled by an upwardly seating spring pressed valve 375, Fig. 20, the upper end of which has a cylindrical portion 376 partially protruding from the valve casing and adapted to open conduit 274 to the atmosphere when the valve is raised and to close said conduit to the atmosphere when the valve is lowered for the passage of counterblowing air.

The upper end portion 376 of the valve is engaged by the outer end of a lever 377, Figs. 14, 17, 19 and 20, pivotally mounted at its inner end upon and extending transversely of the cylinder 220. Lever 377 is engaged on its upper side by a V-shaped cam member 378 fastened on the inner end of a crank shaft 379 carrying a crank 380 on its outer end. See Figures 2, 4, 14, 17 and 19.

Rotation of shaft 379 counterclockwise (Fig. 20) permits lever 377 and valve 375 to be raised by the valve spring and rotation of the crank arm in the opposite direction, that is, clockwise, causes the lever and valve to be depressed (Fig. 20) to permit the passage of counterblowing air from chamber 241 past the valve 375, through conduit 274, port 273 in the neck pin sleeve, and through the sleeve and neck pin into contact with a charge of glass in the parison forming unit. The charge is then blown into contact with the walls of the molds of said unit, and with the counterblow baffle plate by such air pressure. It will be understood that valve 234 will be in air supplying position when the counterblowing is to take place, so that air may flow to chamber 241 from which it is taken for such counterblowing, said valve having previously been moved to such position by the engagement of dog 246 with one of the stops 251, 255, etc., for introducing air into cylinder 220 for purposes hereinbefore set forth.

Rotation of the crank arm 380 in a direction to open the counterblow air supply valve, i. e., clockwise, is effected by means of a cam 382, Fig. 2, mounted preferably adjustably on a circular rail 383 supported above the mold table, as shown in Fig. 2, and arranged to hold the cam 382 in the path of travel of crank arm 380, whereby the crank arm strikes the cam at the time that the counterblowing is to begin, resulting in the opening of the counterblow air supply valve. Beyond the cam 382 is a similar cam 384 on rail 383 which is arranged to be struck by the crank arm 380 to rotate the crank counterclockwise, causing the counterblow air supply valve to be closed and permitting air to be exhausted through the neck pin and conduit 274 past the head 376 of said valve. It will be observed that by adjusting the cams 382 and 384 on rail 383, the times of beginning and ending and the period of counterblowing may be varied.

Positioned in the path of travel of the crank arm 380 beyond the line of centers of the mold table is a third cam 385, Figs. 1 and 2, similar to cam 382 and adjustably supported by suitable overhead framework for moving the crank 380 clockwise to open counterblow air supply valve 375 whereby air is caused to pass through the neck pin for cooling the said neck pin and the interior of the body mold. A fourth cam 386, similar to cam 384, may be mounted on the overhead framework supporting cam 385, for engagement by the crank arm to move the valve 375 to closed position terminating the supply of cooling air to the neck pin. However, if it is desired to continue the cooling of the neck pin and body mold until the parison forming unit is inverted, cam 386 may be omitted, and the valve 375 finally closed by the engagement of crank arm 380 with a stop 387, Figs. 1 and 4, on the mounting for air motor 268. As a parison forming unit is inverted, and the neck pin operating mechanism moved into engagement with lever 266, crank arm 380 will strike stop 387 and be rotated counterclockwise to close the valve 375 if not already so operated by a cam 386.

Valve 234 also will be in open position to supply air to chamber 241 at the time that the cooling of the neck pin takes place as a result of dog 246 striking stop 251, as already explained.

The cams 382, 384, 385, and 386 each are successively engaged by crank arms 380 of the several units P for controlling the supply of air thereto for counterblowing and for cooling the neck pins. The periods of counterblowing and neck pin cooling may be varied by shifting the cams on their supports.

Parison body mold cooling means

Means have already been described for cooling the neck pins associated with the parison mold units and for cooling the interiors of the body molds and mechanism embodying the invention also preferably includes means for blowing cooling air on the outsides of the body molds of said units.

Reference already has been made to the wind box structure 179 mounted on the column 51 of the parison mold table and carrying the cam plate 178. Said wind box has an upstanding inlet portion 390, Figs. 2 and 4, to which is fitted a pipe 391, Fig. 1, leading downwardly from a wind supply chamber or box 392. The wind supply box 392 also supplies cooling air to the blow mold table as hereinafter explained.

The upstanding inlet portion 390 of the wind box structure 379 terminates in a manifold chamber 393, Figs. 2 and 4, from which vertical passageways 394, 395, 396 in the vertical structure

379 lead downwardly. Passage of air through the vertical passageways 394, 395 and 396 is controlled respectively by dampers 397, 398 and 399 which may be adjusted by linkages connected respectively to operating levers, indicated at 401, 402 and 403, Fig. 2.

The bottoms of the vertical passages 394 and 395 open outwardly of the table into separate discharge chambers 404, Fig. 4, and 405, Fig. 1, provided in a semi-circular casting 406 bolted to the bottom of the wind box casting 179, as shown in Figs. 1 and 4.

As shown in Figs. 1, 4 and 17, each of the parison forming units carries a hollow air conducting member 407, the inner end portion of which is shaped for sliding engagement with the outer edge of the casting 406 for successively receiving cooling air from the chambers 404 and 405 provided in said casting. The outer portion of the member 407 carries a pair of nozzles 408 adjustably mounted on pivots in spaced openings in the outer ends of member 407, and arranged to discharge cooling air into contact with the sections 145 of the parison body mold.

By means of the above described construction, cooling air may be applied successively to the body molds while they are held in upright position and during the travel thereof from a point at which the molds are reverted to near the point at which the inversion of the parison forming unit begins, and the application of cooling air to the molds may be separately controlled in zones respectively in advance of and beyond the transfer zone between the tables.

Said molds also may have cooling air applied thereto when in inverted position and prior to the supply of charges thereto by means of a stationary nozzle 409, Figs. 1 and 4, leading from air chamber 410 in the bottom of the casting 179 and receiving air from the vertical passageway 396 in said casting. Nozzle 409 is shaped to direct cooling wind in the required direction successively to cool the molds of the parison forming units.

The blow mold units B

As previously stated herein, the parisons formed in the parison forming units P are successively transferred to the blow mold units B on the blow mold table 49, continuously rotated to move units B past the line of centers of the mold tables on or near which the transfer operation in each instance is effected.

Each blow mold unit comprises a blow mold, preferably mounted for movement radially of the tables 49 whereby the mold may be caused to follow the path of travel of a suspended parison during the time in which it is being closed about the parison for the transfer. Each of said units also comprises a bottom plate, a blow head, a blowing air control valve, and means carried by the blow mold table for applying cooling air to the molds when they are opened.

Considering the construction of a single blow mold unit, and referring particularly to Figs. 1, 2, 27, 29 and 30, it will be seen that the sections 412 of the blow mold are mounted in holders 413 and 414. Holder 413 is clamped by means of its hub 415, Fig. 30, to the central portion of a sleeve 416 rotatably mounted on a stationary hinge pin 417 passing through vertically spaced lugs 418 of a carriage 419, which may be formed of a single casting. The hub 415 of holder 413 is split as indicated in Fig. 30, the split ends having a clamping bolt passing therethrough as shown. Said hub 415 is included between the hub portions 421 of holder 414 which are loose on the sleeve 416.

The mounting of the holders 413 and 414 on the sleeve 416 permits the holders to be removed as a unit from the carriage 419 upon withdrawal of the hinge pin 417.

Holder 413 is pivotally connected at 422 with the outer end of a link 423, the inner end of which is pivotally connected at 424 to a triangular bell crank lever 425. Bell crank lever 425 is swingably mounted upon a vertical pivot stud 426 suitably mounted in lugs formed on the carriage 419.

Mold holder 414 is provided with a rearwardly extending arm 427 connected at its inner end to a link 428 which extends inwardly of the mold carriage to where it is connected to a vertical pin 429 adjustably mounted in vertically spaced lugs or arms 431 and 432 of bell crank lever 425, and extending inwardly of an opening in casting 419. The upper portion of pin 429 is eccentric to the lower portion thereof and is enlarged to provide a mounting for a cam roller 433 which periodically engages cams 434 and 435 respectively, Figs. 1, 2 and 27, in cam plates 436 and 437, to open and close the molds. As will be obvious, the position of roller 433 radially of the mold table may be varied by angularly adjusting pin 429 in lugs 431, 432.

Cam plate 436 is slotted to receive bolts 438 by means of which said plate is adjustably secured to a cam plate 439, clamped to the column 55 of the blow mold table, and supported above said table.

Cam 434 is shaped to effect the opening of the blow mold through its cooperation with cam roller 433 as the mold approaches a position where finished ware is removed therefrom, and to hold the mold open to receive a parison in the transfer zone between the tables.

Cam plate 437 also is carried by cam plate 439, being pivotally mounted thereon by means of a pivot stud 441, Figs. 1, 2, and 27, arising from the top of said cam plate 439. Said cam plate 437 has an inwardly extending arm 442 formed thereon, the inner end of which abuts an adjustable screw 443 mounted in a lug on the top of cam plate 439, with which screw the inner end of arm 442 yieldingly is held in engagement by means of a tension spring 444.

Cam 435 is so shaped as to close the blow mold through its cooperation with cam roller 433 preferably on the line of centers of the mold table, although the time of closing of the blow mold may be varied by adjusting screw 443 to swing the cam plate 437 about its pivot stud 441.

The pivot pin 417 for the mold holders, may be provided with a downwardly extending portion 446, Figs. 1, 27 and 30, to which may be clamped the arm 447 which supports a bottom plate 448 for the blow mold, and stationarily held in position to be enclosed by the mold.

The blow mold carriage 419 is provided on its bottom with a guide 450, Figs. 1, 27, and 30, received by a slideway 451 in a slide plate 452 bolted to the top 453 of a chamber 454 provided on the mold table for a purpose hereinafter stated. Such mounting of the blow mold carriage permits radial movement thereof outwardly and inwardly of the table. As shown in Figs. 29 and 30, plate 452 is secured to the table at its inner end by a single bolt, and at its outer end by a pair of bolts passing through oversize holes in the plate. This arrangement permits angular ad-

justment of the unit B whereby it may be aligned with the companion unit P on the parison mold table.

Radial movement of the carriage 419 is controlled by means of a cam roller 455 mounted on an adjustable eccentric on the upper inner end portion of the carriage, and engaging a cam 456, Figs. 2 and 27, formed on the under side of cam plate 439. Roller 455 is offset with respect to the radial center line of the carriage and mold, moving in advance thereof, as shown.

Cam 456 is peculiarly shaped to effect certain outward and inward radial movements of the blow mold carriage and blow mold, for producing particular operative effects.

Thus, the portion of said cam indicated at 456*a* is slightly extended outwardly, as shown, to effect a slight outward movement of the carriage and mold in response to which movement, the blowhead is slightly raised by means described farther on to permit the initial opening movement of the blow mold by cam 434, while a finished article resting on bottom plate 448, is steadied by the blow head.

Just beyond the portion 456*a* of cam 456, a concentric portion 456*b* is formed which holds the blow mold carriage in fixed radial position during the travel of roller 455 therethrough but during such travel, the blow mold is opened further by cam 434.

Adjoining concentric portion 456*b* is an outwardly extending portion 456*c* which effects a decided outward radial movement of the blow mold carriage, and movement of the blowhead to uppermost position by the hereinafter described means, while the blow mold continues to open to the widest extent to permit removal of the finished article of glassware by take-out mechanism, not shown. The last part of the opening movement of the mold is assisted by the outward radial movement which urges roller 433 into engagement with its cam 434, which cam however, preferably is shaped to almost entirely compensate for the outward movement of the roller and at the same time move the roller 433 inwardly to open the blow mold at the desired rate and time.

Portion 456*c* of cam 456 leads to another outwardly extending portion 456*d* thereof which produces additional outward movement of the blow mold carriage and blow mold shortly before the closing movement of the mold is begun, by the cooperation of roller 433 with mold closing cam 435. As a result the blow mold is projected toward the approaching companion unit P from the neck mold of which an exposed parison is suspended. This permits closing of the blow mold about the parison, the closing operation continuing as the companion units P and B move into and through the transfer zone.

As said units approach the line of centers of the mold tables, a reentrant portion 456*e* of cam 456 causes inward radial movement of the blow mold carriage so that the closing blow mold travels in a path concentric with the axis of the parison mold table in vertical alignment with the neck mold and parison.

The complete transfer operation is described in detail below.

The travel of the blow mold about the axis of the parison mold table is terminated about the time that the vertical axis of the mold is on the line of centers of the tables, by the entrance of roller 455 into portion 456*f* of cam 456 which is concentric with the axis of the blow mold table, and which causes the blow mold to move away from the line of centers in an arc tangent to that part of the path of the mold which is concentric with the parison mold table. (See Fig. 27*a*).

From portion 456*f* of cam 456, roller 455 moves into an inwardly extending portion 456*g* of said cam which both moves the blow mold carriage and blow mold (now containing a parison) inwardly to innermost position, and effects the lowering of the blow head, these operations occurring by the time that the unit has traveled about 90° beyond the line of centers of the tables.

The blow mold unit then is held in innermost position by the concentric portion 456*h* of cam 456 until roller 455 again engages cam portion 456*a*.

The transfer operation

The preferred mode of operating the mechanism in effecting the transfer of a parison from a neck mold to the companion blow mold, is illustrated in Fig. 27*a*. In said figure, the path of the neck mold 143, which supports a parison *p* suspended therefrom, is shown by the dot and dash line *a*, and the path of the companion blow mold 412 is indicated by the solid line *b*. The blow mold 412 is shown in partially closed position as it approaches the neck mold, and the direction in which the molds move toward and past the center line of the mold tables, is indicated by the arrows. At about the point indicated at *c*, the closing blow mold has moved into vertical alignment with the neck mold 143 and parison *p* and continues so to move from said point *c* to approximately the point indicated at *d* on the center line of the tables at which point the mold may be closed completely by the cooperation of cam roller 433 with cam 435. The point *d* may be directly above the point of tangency of the pitch circles of gears 57 and 58. The neck opening of the blow mold preferably is sufficiently small to enable the mold to hold the parison from twisting when the mold is closed.

From point *d* on, the blow mold preferably is moved in a path tangential to the path of movement of the neck mold about at the line of centers as already explained, and slightly beyond the line of centers of the mold tables, the neck mold may be quickly opened at approximately the point *e*.

It will readily be seen that between points *d* and *e* the circular paths *a* and *b* virtually coincide even though the exact point of tangency may be at *d*, because the paths have relatively long diameters. Therefore, the neck mold may be opened after the blow mold has closed, without any appreciable twisting of the neck of the parison.

It is difficult as a practical matter to transfer parisons from one continuously moving mold to another continuously moving mold, without injuring them. At the time of transfer, the parisons are still quite hot, and have to be to permit them to be properly blown into finished articles. They may easily be marred during the transfer and defects caused at that time are apt to appear in the finished ware.

It is very important to transfer all kinds of parisons in such a manner that they will be held in vertical position in the blow molds. Thus, if precautions are not taken, the bottom side of a parison may be thrown against the inside of the blow mold, causing local chilling and uneven distribution of the glass when the parison is blown to final shape. This is known as "heel tapping".

The apparatus of this invention prevents "heel tapping" in the transfer of the parisons because of the fact that the blow molds move away from

the line of centers with a smooth action, in following a path such as is indicated at *b* in Fig. 27*a*. This avoids abrupt movement of the molds which would cause the bottoms of the parisons to be thrown into contact with the molds by the inertia of the parisons.

Where parisons non-circular in cross section, for glassware of similar character such as panel bottles, are transferred, it not only is highly desirable to prevent "heel tapping", but it is necessary that the parisons be delivered to, and held in, the blow molds with the sides of the parisons parallel with the sides of the non-circular cavities of the molds. Twisting of the parisons out of such alignment with the mold cavities causes certain corners of the finished ware to blow too thick, and other corners too thin.

This invention also provides novel means for efficiently transferring parisons non-circular in cross section to blow molds having non-circular cavities, said means including the blow mold closing cam which operates to close a mold about a parison as they are brought into vertical alignment and at the time that the sides of the parison are parallel to the sides of the mold cavity, the blow mold then holding the parison against twisting forces thereon, until the neck mold is opened by its cam. Thus, the parison is prevented from twisting before or after it is transferred, being held at all times by either the neck mold or the blow mold.

The times of closing of the blow molds and the opening of the neck molds are not so essential in the transfer of parisons circular in cross section, provided that they are not so loosely held, or otherwise operated upon to cause "heel tapping" or other undesirable distortion. They may obviously be twisted to limited extent relative to the blow molds without consequence. Therefore the times of closing of the blow molds may be changed by adjusting cam 435, and the times of opening of the neck molds may likewise be varied by properly adjusting cam 199. But in transferring non-circular parisons according to the invention, the blow molds are closed before the neck molds are opened.

Construction and operation of finish blow head

In addition to carrying the blow mold and bottom plate of the blow mold unit, carriage 419 also carries the blow head 458, Figs. 1, 2, 27, 29 and 30. Blow head 458 is loosely mounted on the outer end of a yoke 459, the arms of which are supported at their inner ends upon a horizontal stud 460 secured in the upper portion of carriage 419 as shown in Figs. 29 and 30. Yoke 459 is swung about the axis of stud shaft 460 to lower and raise the blow head 458 into and out of engagement with the blow mold.

The movements of the blow head into and out of engagement with the blow mold are effected respectively in response to the inward and outward radial movement of carriage 419 resulting from the cooperation of cam roller 455 with cam 456, as previously stated. For effecting such operation of the blow head, an upwardly inclined rod 462 is connected thereto by means of a bifurcated member 463 pivotally supported on a stud shaft 464, mounted on and extending between the arms of yoke 459. Said rod 462 is screw threaded on its lower end where it passes through the member 463 to receive nuts 465 which serve to adjustably connect the rod to said member.

The upper end of rod 462 extends through an opening in a clevis 466 pivoted at 467, Figs. 1 and 27, to the bottom of a manifold 468 rotatable on the upper portion of column 55 of the mold table, and provided for a purpose hereinafter explained. Movement of rod 462 outwardly of the mold table relative to clevis 466 is limited by a collar 470, Fig. 30, on the upper end of the rod 462 and arranged to engage a shoulder formed in said clevis.

Rod 462 and hence yoke 459 to which the rod is connected by bifurcated member 463, are yieldingly urged outwardly of the mold table and the blow head urged towards its lower position, by means of a compression spring 469 surrounding the rod 462 and engaging the clevis 466 at one end and the innermost nut 465 on the rod 462 at its other end.

When the mold carriage 419 is moved outwardly of its table, the headed end 470 of rod 462 strikes the shoulder in the clevis 466 causing the blow head to be swung upwardly out of blowing position, thereby permitting a blown article of glassware to be removed from the blow mold. However, when the carriage 419 is moved inwardly of the table, rod 462 acted on by spring 469 will cause the blow head to be swung downwardly into blowing position in airtight engagement with the blow mold.

Means for supplying blowing air to the blow head

As shown in Figs. 1 and 36, finish blowing air may be supplied from the pressure line 113, a branch of which leads through a pressure reducing valve 471 discharging into a conduit 472 communicating through a port 473, Fig. 27, and a stationary casing 474 on column 55, with a vertical passageway 475 in said column. At its bottom end, passageway 475 opens into an annular chamber 476 formed partially in the column and partially in a hub member 477 provided on the top 453 of chamber 454. Hub member 477 has passageways 478 formed therein which lead into the chamber 454, previously mentioned, said chamber constituting an air accumulator from which air pressure is supplied to the various blow molds as now will be explained.

Secured to the under side of the table 49 are blowing air control valves 479, Figs. 1, 27, 28, and 31, said valves being supported near the peripheral edge of said table.

Valves 479 are identical in construction and are operated by the same means and hence only one of them need be described. Referring to Fig. 31, it will be seen that valve 479 comprises an inlet port to which air is conducted by a pipe 481 which as shown in Fig. 27 extends upwardly through the bottom of the table into the air chamber 454. A discharge conduit 482, Figs. 1, 27 and 29, leads upwardly from valve 479 to the blow head with which it is associated, the passage of air from conduit 482 to the blow head being hereinafter explained. Said valve also includes an exhaust port 483, and the supply of air through the valve to the conduit 482, or the exhaust of air through said conduit to and through the exhaust port is controlled by the rotary plug 484 which is turned to air supply or exhaust positions by means of a dog 485 secured thereto.

Dog 485 being moved in a circular path by the rotation of the table, is operated to turn the valve to air supply position by means of a stop member 486 adjustably mounted on a circular supporting rail 487, Figs. 1 and 28, held in position by brackets 488 arising from the base 40 of the machine. Dog 485 is operated in like manner to turn the

valve to cut-off and exhaust position by a stop 489, Fig. 28, adjustably mounted on the terminal portion of the rail 487. A safety stop 489*a* is provided at the end of rail 487 to insure that such operations of valves 479 will take place.

Stop 486 may be positioned to move dog 485 to air supply position to supply blowing air to the appropriate blow head at about the time that said head is moved into engagement with its blow mold as a result of the inward movement of the blow mold unit, as for example, when said unit has traveled through an angle of approximately 90° from the transfer zone. If desired, however, stop 486 may be shifted to begin the finish blowing at a later time. Dog 489 on the other hand is usually positioned to move the dog 485 to cut off and exhaust position just prior to the disengagement of the blow head and mold and the opening of the blow mold.

As shown in Figs. 1 and 29, blowing air supply conduit 482 leads upwardly from valve 479 to the rear end of the slide 452 for the blow mold carriage. Blowing air supplied through conduit 482 passes to the blow head 458 by way of a pneumatic device cooperating with the blow mold opening and closing mechanism, to insure that the blow mold will be held closed during the final blowing operation.

Said device comprises a piston 491, Figs. 29, 30 and 32, mounted in a cylinder 492 provided in the blow mold carriage 419. The outer end of piston 491 has a boss 493 formed thereon which bears against a roller 494 on the pin 429, previously referred to, intermediate the lugs 431 and 432. Said boss may be held in engagement with said roller by means of a strap 495 connected to the outer end of the piston and surrounding the roller. A compression spring 496 may be provided in the cylinder 492 for urging piston 491 outwardly of the cylinder, but said spring may be omitted to permit the mold holders easily to be separated for changing the blow mold.

In order to conduct the blowing air supplied by conduit 482, (which air eventually is conducted to the blow head), into the cylinder 492, conduit 482 is connected to a stationary shoe 497, Figs. 29 and 32, engaging a slideway 498 formed on the side of cylinder 492 and having a port 499 formed therein adapted to register with a transverse port 501 in cylinder 492, which in turn communicates with a longitudinal port 502 formed on the interior of the cylinder 492.

The shoe 497 is supported by a bracket 503 bolted to the side of the slide plate 452 for the blow mold carriage 419. The shoe is loosely held by the bracket by means of a bolt 504 connected to one end of the shoe and extending through one end of the bracket, and by the conduit 482 itself which extends through the bracket and is connected to the other end of the shoe The bolt 504 and the conduit 482 are surrounded by compression springs 505 for yieldingly holding the shoe in engagement with the slideway 498.

By the above described means, the finish blowing air delivered through conduit 482 passes into cylinder 492 wherein it exerts pressure on piston 491 which in turn operates the mold closing mechanism to insure that the mold will be held closed during the finish blowing operation.

From the cylinder 492, the finish blowing air discharges through a port 506 in the cylinder wall, Figs. 29 and 32, into a conduit 507, Figs. 1, 32, and 29, connected at its outer end to an elbow through which air flows into a port 508 in one end of the pivot shaft 460. Said port 508 in turn communicates with a passageway 509, Figs. 29, 30, and 32, formed in one of the arms of yoke member 459 and leading to the blow head 458.

Port 506 is so located in the cylinder 492 as to be closed by piston 491, to prevent passage of air to the blow head when the mold is held open, as for example by glass caught between the mold sections.

The blow mold cooling means

As already stated, the wind chamber 392 supplies cooling air for cooling the blow molds as well as for cooling the parison molds. To this end, said chamber is provided with a downwardly extending pipe 511, Fig. 1, having a damper 512 therein, said pipe being connected to the air supply casing 474, Fig. 27, which as previously explained, is secured to the top of the column 55 of the blow mold table. The casing 474 has sliding air tight engagement with manifold 468 rotatably mounted on the column 55 beneath said casing and supplying wind to pipes 514, which are bent downwardly toward the top of the blow mold table to where each of them is connected to an air distributing unit 515, Figs. 1, 2, and 33. As shown in Figs. 2 and 33, each of the air distributing units comprises a casing on which pairs of oppositely directed nozzles 516 and 517 are formed. Said nozzles have dampers 518 mounted in the entrance ends thereof which may be adjusted by means of operating handles 519 for regulating the amount of cooling air which is discharged therethrough into contact with the blow molds of the adjacent blow mold units toward which the nozzles are directed. Fig. 2 illustrates the position of the air distributing units on the blow mold table, and the manner in which the opposed nozzles thereon are directed toward the blow molds.

The sliding engagement of the manifold 513 with the stationary member 474 permits cooling air to be directed through the means above described against the blow mold units at all times, except that as said units pass the transfer station, passage of air through the wind pipes 514 is prevented by a baffle plate 520 secured to the under side of the bottom of the casing 474 and slidably engaging the inner side of the manifold 513 so as to shut off the passage of air successively through the wind pipes 514 as the blow mold units approach the transfer zone. This prevents cooling air from being directed against the parisons which are exposed by the opening of the parison body molds just prior to their transfer to the blow molds.

Complete operation

One preferred mode of operating the above-described apparatus embodying the invention is as follows:

The mold tables are continuously rotated in opposite directions at the appropriate speed to cause the parison forming units on the parison mold table to be successively moved past the feeding position and also to be carried across the line of centers of the mold tables for the transfer of parisons to the blow mold units which arrive in the transfer zone at the same time as the companion parison forming units.

The cycle of operation of a single parison forming unit P is first described, beginning with the unit in the position in which a parison previously formed therein is transferred to the companion blow mold unit B, after which the cycle of the unit B is explained, it being understood that all of

units P and B respectively operate in the same manner.

As said unit passes through the transfer zone, the parison body mold is open, and the neck mold is opened at the desired point by the engagement of cam roller 193 with cam 199. Cam 199 may be so adjusted as to effect the opening of the neck mold within an angle extending for example from approximately 5° in advance of the point of tangency of the mold tables to approximately 2° beyond said point, but as previously stated, said cam preferably is adjusted to snap the neck ring open just beyond the line of centers at said point.

As the parison forming unit moves away from the transfer zone, dog 246 strikes stop or button 251 to turn on the parison body mold closing air, and the neck mold is closed by cam 199. The neck mold is completely closed first, after which the body mold is closed by the admission by air into cylinder 221 which acts on piston 220 urging the body mold to closed position and effecting such closing in conjunction with the cam roller 218 and cam 223, as previously described. The body mold may be closed, for example, during the travel of the unit through an angle extending approximately from 40° to 70° from the point of tangency of the mold tables.

During the transfer operation and the closing of the neck mold and body mold, the baffle plate remains down, but may be raised prior to the complete closing of the body mold as cam roller 367 rides down the downwardly inclined portion 370*b* of baffle plate cam 370. Thus the counterblow baffle plate may be raised while the unit is passing through an angle beginning approximately 34° beyond the point of tangency of the mold tables, and ending approximately 74° past said point so that the baffle plate is raised during the closing of the body mold to permit the smooth transfer of cam roller 367 from fixed cam 370 to adjustable cam 368. It already has been explained that one purpose of the raising of the baffle plate at this time is for "setting up" or adjusting the baffle plates to the body molds.

The parison forming units may now be inverted by the cooperation of roller 155 with cam 156. Cam 156 may be shaped to effect the inversion of the parison forming unit during the travel thereof through an angle of approximately 40°, and by adjusting the casting 157 by means of crank 166, the time of inversion may be varied. Thus the casting 157 may be adjusted through an angle of approximately 19° to cause the inversion to begin at any point in the travel of the parison forming unit from approximately 100° to approximately 119° beyond the point of tangency of the mold tables.

The baffle plate is moved down by the engagement of cam roller 367 with cam 368, the time of beginning of such movement depending upon the adjusted position of casting 157 which carries the cam 368 as well as the invert cam 156. The downward movement of the baffle plate always begins before the inversion of the parison forming unit and may be initiated during the travel of the unit through an angle of say 40°, beginning from approximately 80° to 99° beyond the point of tangency of the mold tables. The lowering of the baffle plate and the inversion of the parison forming unit may overlap to a certain extent, provided that the baffle plate always is moved out of the way of the parts of the parison forming unit to permit the inversion thereof.

The continuous rotation of the parison forming table carries the inverted parison forming unit beneath the feeder which supplies a charge of glass thereto. The funnel or guide F which directs the charge into the inverted mold while it travels may be oscillated by cam 108 in an arcuate path beneath the feeder across the line of centers of the mold tables from a position of rest, say 7° advance of the line, to about 10° beyond said line. The operation of the guide is such as to prevent undue impact thereof with the charge. The path of the bottom of the guide or funnel F may be shifted radially by adjusting bolt 94. The initial angular position of the guide also may be changed by the adjustment of arm 105 of the guide oscillating mechanism. Such adjustments usually are made for delivering charges of different thickness, and to insure that the charges will not be deformed by undue impact with the guide or the molds.

It also will be recalled that selective guiding of charges into the units P is accomplished by selectively moving cam members 128 to operative position.

The settle blow head mechanism S, which is oscillated to cause it to travel with successive blank forming units, preferably is set in motion by its operating cam 115 prior to the completion of the travel of the funnel with the parison forming unit, so that by the time the charge has entered the molds, the settle blow head 287 may be moved downwardly and swung outwardly by the operation of piston 283 in cylinder 281 to engage the blow head with the bottom of the parison mold and to cause settle blowing air to be introduced into the mold while the settle blow head travels therewith.

In the meantime, the funnel F is caused to return to its initial position by the operation of cam 108, for the beginning of the travel of the funnel with the succeeding parison forming unit, and just before the settle blow head has completed its travel with the preceding parison forming unit, said head may be raised from engagement with the parison mold, the forward travel of the head terminated, and the head moved back to its initial position to permit it to travel with said succeeding parison forming unit.

It will be understood that the arcs of travel of the funnel or guide F and the settle blow head S may be varied, if desired, by changing cams 108 and 115 respectively, and that the times of engagement and disengagement of the settle blow head are predetermined by the adjustments of valves 315 and 317.

Subsequent to the settle blowing of the charge in the parison forming unit, and during the continuous rotation thereof, the unit is reverted by the action of cam 156 on cam roller 155, such reversion beginning at a time depending upon the adjustment of casting 157. This permits withdrawal of the neck pin by its springs at a time predetermined by the aforesaid adjustment of cam casting 157. The reversion of the unit preferably takes place during the travel thereof through an angle of approximately 40° and may, for example, begin at a point varying from approximately 207° to 226° beyond the point of tangency of the mold tables.

Also during the reversion of the parison forming unit, the raising and inward swinging of the counterblow baffle plate may be initiated by piston 244 in cylinder 235 under the control of cam 368. The time of beginning of such movement depends upon the position in which casting 157, carrying the baffle plate control cam 368, is adjusted. However, if desired, the raising of the baffle plate

may be effected irrespective of the position of adjustment of said casting by the use of a removable cam member 368*b* of selected contour, provided of course that the baffle plate is not raised and swung inwardly to the fullest extent prior to the beginning of the reversion of the parison forming unit, or into a position where it would obstruct the reversion thereof. The raising of the baffle plate, which is effected by said cam portion 368*b* may, for example, begin during the travel of the associated parison forming unit from approximately 228° to approximately 247° beyond the point of tangency of the mold tables. Thus during the travel of the parison forming unit through an angle of say 25°, the baffle plate may be raised from its lowermost and outermost position into, and yieldingly held in, engagement with the bottom of the parison mold, immediately after said mold is vertically positioned by the reversion of the unit.

As soon as the counterblow baffle plate has engaged the bottom of the parison mold, the valve 375 which controls the passage of counterblow air through the neck pin into and against the charge of glass, may be moved to open position by the engagement of crank arm 380 with cam 382. The time of opening of the valve 375 is varied according to the time at which the counterblow baffle plate moves into engagement with the parison mold, by shifting cam 382 on its support 383. Valve 375 remains open for a sufficient period of time to properly blow the charge of glass into a parison and is closed by the engagement of crank 380 with cam 384, the position of which may be changed to vary the period of counterblowing.

The counterblowing may, for example, be effected during the travel of the parison forming unit through an angle of approximately 50°, or less, depending upon the position of the cams 382 and 384, and during the travel of said unit from approximately 251° to approximately 301° from the point of tangency of the mold tables.

Upon completion of the counterblowing, a dog 246 connected to a valve 234 strikes the stop member or button 248 to move the valve to exhaust position which permits the cracking of the parison mold, leaving the parison supported by the neck mold, and also by the baffle plate which prevents sagging of the parison. However, the stop 248 may be slightly advanced relative to cam 384 which closes the counterblow valve 375, to compensate for the time required in the exhausting of air pressure from cylinder 221 to permit the cracking of the parison body mold, but the actual cracking of the mold should not take place before the termination of the counterblowing. The period during which the mold is cracked may be varied by shifting stop or button 248 on its support, and the mold may be cracked or held partially open, during the travel of the parison forming unit from approximately 285° to approximately 322° beyond the point of tangency of the mold tables at the transfer zone where the complete opening of the body mold may begin.

As previously stated herein, the parison body mold is held slightly opened or cracked to permit the reheating of the parison out of contact with the body mold, but while enclosed thereby. Thus said mold protects the parison from air currents and acts a heat reflector during reheating.

The lowering of the baffle plate and outward swinging thereof may be initiated by the engagement of cam roller 367 with the forward end of cam 370 at any time after the termination of the counterblowing operation but before the final opening movement of the body mold. For example, the lowering of the baffle plate may begin when the parison forming unit has traveled through an angle of approximately 316° from the point of tangency of the tables.

Thus as the parison forming unit moves toward the transfer zone, the baffle plate is moved downwardly and swung outwardly into inoperative position, and the parison is exposed for transfer to the appropriate blow mold by the complete opening of the body mold.

In the meantime, the companion blow mold unit also is rotated toward the transfer zone, the blow head having previously been raised, as a result of the projection of the unit outwardly of the blow mold table by the operation of cam roller 455 by cam 456, which, acting in conjunction with cam 434 and cam roller 433, also effects the opening of the blow mold.

As the parison forming unit P and the blow mold unit B move along their converging paths, the blow mold is caused to move in the circular path of the neck mold and parison as it closes under the control of cam 435. Thus by the time that the mold units reach the line of centers of the mold tables, the blow mold may be completely closed about the parison suspended from the neck mold. Then as the mold units pass the line of centers, the neck mold may be snapped open by the action of cam 199 on roller 193, as previously described, and the blow mold moved away from the neck mold in a path tangential to the path of travel of the neck mold, and concentric with the blow mold table.

It previously has been explained that the transfer operation may be effected in a manner different from that above described, by suitably adjusting the neck mold opening cam 199 and the blow mold closing cam 435. Thus said cams may be positioned to cause the opening of the neck mold and the closing of the blow mold at any desired times in the transfer of parisons circular in cross section, but preferably are positioned to close the blow mold before the neck mold is opened in the transfer of non-circular parisons to prevent twisting thereof.

As the blow mold unit is carried away from the transfer position, it may be held in fixed radial position until cam roller 465 moves onto the portion of cam 456 which effects further inward radial movement thereof to lower blow head 458 into engagement with the blow mold containing the parison. After this, a dog 485 of a blowing air supply valve 479 may strike a stop or button 486 moving the valve to air supply position, which air as previously explained flows through cylinder 492 and acts on piston 491 therein, to hold the blow mold closed, and passes from the cylinder through the blow head 458 into the parison in the blow mold, provided, of course, that the mold is closed so that the piston does not obstruct the passage of air from the cylinder.

The beginning of the finish blowing operation may take place when the blow mold unit has moved through an angle of say 80° from the line of centers at the transfer zone, though the time of beginning of the finish blowing may be varied by shifting the stop or button 486 on its support. Such finish blowing may be continued until the blow mold unit has traveled through an angle of approximately 278°, although, of course, the time at which the finish blowing is terminated also may be varied by the adjustment of the stop or button 489, which actuates the blow-

ing air supply valve to cut off and exhaust position. Preferably, however, a substantial part of the finish blowing operation takes place in the unit B, while a charge of glass is supplied to and shaped in the companion unit P. This reduces the time in which the finishing mold is idle and results in an overlap in the cycles of operation of companion parison and blow mold units.

Said valve is moved to cut off position just prior to the time that the outward radial movement of the blow molds is initiated by the cooperation of cam roller 455 with cam 456. Further rotation of the blow mold unit results in slight outward radial movement of the unit to slightly raise the blow head, which then steadies the finished article of glassware resting on the bottom plate as the mold is stripped from the glass. The blow head then is raised to its uppermost position by further outward movement of the blow mold carriage as the blow mold opens completely for the removal of the finished article. Another parison formed in the meantime in the companion unit P, now is transferred to the unit B, as above explained, and the cycle of operation of the unit B is repeated.

It will be understood that various changes may be made in the details of construction and in the mode of operation of the illustrated embodiment of the invention described above, without departing from the scope of the appended claims, and that while the invention has been described with reference to a two-table continuous machine to which glass may be supplied by suspended charge feeding, it might also be employed in other types of machines.

Having thus described our invention, what we desire to claim and secure by Letters Patent is:

1. Apparatus for forming glassware, comprising a horizontal mold table, a plurality of parison-forming units thereon, means for continuously rotating said table, a feeder for supplying charges of glass successively to said units, a guide normally positioned and held stationary beneath said feeder, means for oscillating said guide away from and toward its position of rest, to cause it to travel successively with said units to successively direct said charges thereto, preventing means in addition to the last-named means for preventing the delivery of charges by said guide to said units, and control means for controlling the operation of said preventing means, said control means being associated with said units and individual thereto for selectively preventing the delivery of charges by said guide to one or more of said units.

2. Apparatus for forming glassware comprising a horizontal mold table, a plurality of parison forming units on said table, means for continuously rotating said table, a feeder for supplying separate charges of glass to said units, a guide for directing said charges of glass into said units, means for oscillating said guide in an arcuate path extending beneath said feeder and overlying the path of travel of said units, said means being timed to cause said guide to travel successively with said units as they pass beneath said feeder, a cullet chute movable with said guide, and means operable at selected times for causing selected charges of glass to be received by said cullet chute instead of the said guide, including means for limiting the arc of travel of said guide to prevent alignment thereof with the feeder.

3. A glassware forming machine comprising a base, a horizontal mold table supported on said base in vertically spaced relation thereto for rotation about a vertical axis, a plurality of parison forming units each including a blank mold and a neck mold carried by said table, said units being mounted on said table for oscillation in vertical planes, and means for oscillating said units to invert and revert them in timed relation to the rotation of the mold table, comprising a drum rotatably mounted on said base, a cam formed on said drum, means operated by said cam in response to rotation of said table for inverting and reverting said units, means for rotating said drum relative to said base and to said mold table for varying the time of inversion and reversion of said unit, a plurality of finishing molds held upright at all times, and automatic means for transferring parisons from said units to said finishing molds.

4. A glassware forming machine comprising a horizontal mold table mounted for rotation about a vertical axis, a parison forming unit including a sectional body mold mounted on said table for inversion and reversion in a vertical radial plane, mechanism for inverting and reverting said unit, means for opening and closing said body mold when said unit is in reverted position, and rigid means separate from said mechanism for relieving it of the stresses and strains produced thereon by said body mold open and closing means.

5. A glassware forming machine comprising a base, a horizontal mold table mounted on said base for rotation about a vertical axis, a plurality of parison forming units carried by said table, said units being mounted for oscillation through vertical planes, means for oscillating said units to successively invert and revert them, said means comprising a drum mounted on said base beneath said table, a cam formed on said drum, mechanism interposed between said cam and said units and operating in response to the rotation of said table for inverting and reverting said units, said cam being cut away through an angle in which said units travel in reverted position, a cam supported above said table, and included at least partially within the angle in which said first-named cam is cut away, and rollers associated with said units and adapted to successively engage said second-named cam for positively holding said units in position after they have successively been reverted by the operative effect of said first-named cam.

6. A glassware forming machine comprising a horizontal mold table mounted for rotation about a vertical axis, a plurality of parison mold units on said table each including a neck mold and a body mold, means for successively inverting said units for the supply of charges of glass thereto, a single settle blow head for successively compacting the charges of glass in the molds of said units, means for oscillating said settle blow head to cause it to travel successively with said units, means synchronized with said oscillating means for moving the settle blow head into and out of engagement with the parison molds of said units while traveling therewith, said last named means including a pneumatically operated valve for controlling the operation of said last-named means, and valve means and timing means therefor for effecting pneumatic operation of said valve, and mechanism operated by a driven part of said machine for insuring the operation of said valve.

7. A glassware forming machine comprising a horizontal mold table, mounted for rotation about

a vertical axis, means for rotating said table, a parison forming unit on said table including a neck mold and a body mold, means for inverting said unit about a horizontal axis for the supply of a charge of glass thereto, a settle blow head located when operative laterally of the axis of inversion of said unit, for compacting a charge of glass in the molds of said unit, means for moving said settle blow head into engagement with the body mold of said unit to effect the settle blowing operation, said means exerting a downward turning force on said unit about its axis of inversion, and means for exerting an equal upward turning force on said unit about its axis of inversion to counterbalance the force of said blow head thereon, said last named means including a vertically movable member and means for applying pressure thereto to hold it in raised position to exert said upward turning force on said unit.

8. A glassware forming machine comprising a horizontal mold table mounted for rotation about a vertical axis, a parison forming unit on said table, including a body mold and a neck mold, means for rotating said table, means for inverting said unit about a horizontal axis for the supply of a charge of glass thereto, a settle blow head located when operative laterally of the axis of inversion of said unit, for compacting the charge of glass in the molds of said unit, a neck pin associated with said unit for forming an initial blowing cavity in the charge, means for projecting said neck pin inwardly of the neck mold, means for engaging said settle blow head with the bottom of the body mold of said unit, means for introducing settle blowing air through said blow head, said blow head and said settle blowing air exerting a downward turning force on said unit in one direction about its axis of inversion, and means for exerting an equal upward turning force on said unit to counterbalance the downward force of the settle blow head thereon, and for retaining the neck pin in projected position, said last named means including a vertically movable member and means for applying pressure thereto to hold it in raised position to exert said upward turning force on said unit.

9. A glassware forming machine comprising a horizontal mold table mounted for rotation about a vertical axis, a plurality of parison forming units on said table, means for rotating said table, means for inverting said units for the supply of charges of glass thereto, means for settle blowing the charges of glass delivered to said units, said means exerting a downward force on said units, and means individual to and associated respectively with said units for exerting an equal upward force thereon to counterbalance the downward force of said settle blow means.

10. A glassware forming machine comprising a horizontal mold table mounted for rotation about a vertical axis, a plurality of mold units on said table, means for rotating said table, means for supplying quotas of glass to said units, blowing air supply means, means for moving said air supply means into engagement with said units to blow the glass therein and operating to exert forces on said units in one direction, means individual to said units for exerting equal counterbalancing forces on said units in opposition to the forces of the air supply means thereon, and means for timing the operation of said counterbalancing means to cause operation thereof only during the engagement of the air supply means with said units.

11. A glassware forming machine comprising a horizontal mold table mounted for rotation about a vertical axis, a parison forming unit including a body mold and a neck mold carried by said table, means for rotating said table, means for supplying a charge of glass to said unit for a parison, means for shaping said charge of glass into a parison in said unit, pneumatic means for partially opening the body mold to leave the parison supported by the neck mold out of contact with the walls of the body mold but enclosed thereby, to effect the reheating of the parison while said unit is rotated about the axis of the mold table, and cam controlled means for completely opening the body mold for the removal of the parison from said unit.

12. A glassware forming machine comprising a horizontal mold table mounted for rotation about a vertical axis, a parison forming unit comprising a neck mold and a body mold carried by said table, a pneumatic device for operating the body mold, means for rotating said table, means for supplying a charge of glass to said unit, means for shaping said charge into a parison in said unit, valve means carried by said mold table for effecting the partial opening of the body mold by said pneumatic device to leave the parison supported out of contact with the walls of said mold, but enclosed thereby, to effect the reheating of the parison during the travel thereof through a predetermined arc, automatic means for preventing the opening of the mold to sufficient extent to expose the parison to air currents during its travel through said arc, a stationary member positioned in the path of travel of the valve means and engaged thereby as a result of the rotation of the mold table, to effect the partial opening of the body mold, means for shifting said stationary member relative to the axis of the mold table to vary the time at which said body mold is partially opened, and means for completely opening said body mold for the removal of the parison from said unit.

13. A glassware forming machine comprising a horizontal mold table mounted for rotation about a vertical axis, a plurality of parison forming units carried by said table, means for successively supplying charges of glass to said units, means for successively shaping said charges into parisons in said units, each of said units comprising a neck mold and a body mold, pneumatic devices for operating the body molds, valve means associated with said respective parison forming units for actuating the respective pneumatic devices, to partially open said body molds and thus leaving the parisons formed successively therein supported out of contact with the molds while enclosed thereby, to effect the reheating of the parisons during the travel of each of them through a predetermined arc, automatic means for preventing the opening of said molds to a sufficient extent to expose the parisons to air currents during their travel through said arc, a single stationary member for successively operating said valve means, and means for successively completely opening said body molds for the removal of parisons therefrom.

14. A glassware forming machine comprising a horizontal mold table mounted for rotation about a vertical axis, a parison forming unit including a body mold carried by said table, means for rotating said table, means for supplying a charge of glass to said unit, means for intro-

ducing blowing air into said unit to shape the charge of glass therein, pneumatic means for holding the body mold closed in opposition to the mold opening force of said blowing air, means for opening the body mold, valve means and means timing the operation thereof for operating said pneumatic means for supplying power to close the body mold, and cam actuated means for controlling the time and rate of the closing of the body mold by said pneumatic means.

15. A glassware forming machine comprising a parison mold table mounted for rotation about a vertical axis, a parison forming unit mounted on said table, means for rotating said table to move said unit from a feeding position where a charge of glass is supplied thereto to a transfer position where a parison is removed from said unit, said unit comprising a neck mold and a body mold, means for opening said body mold as said unit moves toward said transfer station, pneumatic power means for closing said body mold as said unit moves away from the transfer position, cam means operating in conjunction with said pneumatic means for controlling the closing of said body mold, means for operating said pneumatic means as said unit moves away from the transfer position to urge the body mold toward closed position, and means for inverting said unit as it moves toward the feeding position, said pneumatic means operating to hold said body mold closed during the inversion of said unit and after such inversion.

16. A glassware forming machine comprising a horizontal mold table mounted for rotation about a vertical axis, a parison forming unit carried by said table, means for rotating said table to move said unit from a feeding position to a transfer position, said unit comprising a neck mold and a body mold, means for opening said body mold as said unit moves to the transfer position, pneumatic means for closing the body mold as the unit moves away from the transfer position, cam means for controlling the operation of said pneumatic means, means for inverting said unit as it moves toward the feeding position, said pneumatic means operating to hold the body mold closed during and after the inversion of said unit, and means operable to close the body mold prior to the inversion thereof upon failure of the supply of air to said pneumatic means.

17. A glassware forming machine comprising a horizontal mold table mounted for rotation about a vertical axis, a parison forming unit comprising a neck mold and body mold carried by said table, means for rotating said table to move said unit from a feeding position to a transfer position, means for supplying a charge of glass to said unit at said feeding position, means for shaping said charge of glass into a parison in said unit, pneumatic means for operating the body mold of said unit, means for actuating said pneumatic means to partially open said body mold upon movement thereof toward the transfer position to leave the previously formed parison supported out of contact with the walls of said mold while enclosed thereby to effect the reheating of the parison, cam means for completely opening the body mold as said unit is moved to the transfer position, for the removal of the parison therefrom, means for subsequently operating said pneumatic means to close the body mold under the control of the cam means as said unit is moved away from the transfer position, means for inverting said unit as it moves toward the feeding position, said pneumatic means operating to hold the body mold closed during and after the inversion of said unit.

18. In combination with a glass forming machine, a parison forming unit comprising a body mold and a neck mold, a neck pin associated with the neck mold, an actuator for said neck pin movable with said unit, means for inverting said unit for the supply of a charge of glass thereto, a vertically movable buffer positioned in the path of said actuator operable in response to the inversion of said unit to project said neck pin inwardly of said neck mold and to yieldingly limit the inversion of said unit, and means for applying fluid pressure to said buffer, to hold the buffer in raised position and to retain said neck pin in inwardly projected position.

19. In combination with a glass forming machine, a parison forming unit including a neck mold and a body mold, a neck pin adapted to be projected inwardly of and withdrawn through said neck mold, an actuator for said neck pin associated with said unit, means for inverting and reverting said unit, a vertically movable buffer supported in the path of inversion of said actuator operable in response to the operation of said last named means for controlling the actuation of said neck pin, means for periodically applying fluid pressure to said buffer to hold it in raised position and to retain said neck pin seated, and means for varying the time of operation of said inverting and reverting means to vary the time at which said neck pin is actuated.

20. A glassware forming machine comprising a mold table, a parison mold unit thereon, means for continuously rotating said table, said unit comprising a body mold and a neck mold, a neck pin permanently associated with said neck mold, means adapted to be connected to and disconnected from said neck pin to project said neck pin inwardly of said neck mold, settle blowing air supply means adapted to engage said unit, power means for effecting such engagement, power means including a vertically movable member adapted to be connected to said neck pin projecting means for exerting force thereon in opposition to the force of the settle blowing air on the neck pin, to retain said neck pin in projected position during the supply of air to said unit, and means common to both of said power means for periodically causing equal and opposed downward and upward forces to be exerted thereby on said unit, and to hold said vertically movable member in raised position to exert said upward force on said unit.

21. A glassware forming machine comprising a horizontal mold table mounted for rotation about a vertical axis, a parison forming unit mounted on said table, a counterblow baffle plate associated with said unit, means for inverting said unit for the supply of a charge of glass thereto, and for reverting said unit to counterblow said charge into a parison in said unit and against said baffle plate, said means comprising a cam formed on a drum encircling the axis of said table, mecahnism connected to said counterblow plate for moving it into and out of engagement with the bottom of the body of mold of said unit, a cam formed on said drum for operating said mechanism, and means for angularly shifting said drum relative to said table to simultaneously vary the time of inversion and reversion of said unit and the movement of said baffle plate into operative position.

22. A glassware forming machine comprising a horizontal mold table mounted for rotation

about a vertical axis, a parison forming unit including a body mold carried by said table, a counterblow baffle plate associated with said unit and movable with said table, pneumatic power means for moving said baffle plate into, and for yieldingly holding it in, engagement with said body mold, means controlling the supply of pressure to said pneumatic means, and cam actuated mechanism for controlling the application of the power of said pneumatic power means to said baffle plate.

23. A glassware forming machine comprising a horizontal mold table mounted for rotation about a vertical axis, a plurality of parison forming units carried by said table, each of said units including a neck mold and a neck pin associated therewith and a body mold, means for successively supplying charges of glass to said units, passageways formed in the neck pins of said units for the introduction of air thereinto, valves individual to said units for controlling the passage of air through said neck pins, mechanisms moving with said units for opening and closing said valves, means for operating said mechanisms to open and close said valves to successively counterblow charges of glass in said units into parisons, means for removing the successively formed parisons from said units, and means for opening and closing said valves to cause air to flow successively through said neck pins to cool said neck pins and body molds after the removal of the parisons from said units.

24. A glassware forming machine comprising a horizontal mold table mounted for rotation about a vertical axis, means for continuously rotating said table, a plurality of parison forming units carried by said table, each of said units including a neck mold and a body mold, counterblow baffle plates carried by said table and supported independently of said units, means for successively inverting said units for the supply of charges of glass thereto, means for successively reverting said units and for moving the counterblow baffle plates associated therewith into engagement with the bottoms of the reverted body molds for counterblowing the charges of glass into parisons, means for controlling the supply of air to said units for counterblowing said charges, means for varying within the cycle of the machine the time of operation of the inverting and reverting means, and means for synchronizing the operations of the counterblow baffle plate operating means and the counterblow air supply means, with said inverting and reverting means.

25. A glassware forming machine comprising a blow mold table, a blow mold thereon, a blow head adapted to be moved into and out of engagement with said blow mold, means for moving said blow mold radially of its table, and means operating in response to the radial movement of said blow mold for moving said blow head into and out of engagement therewith.

26. A glassware forming machine comprising a blow mold table, a blow mold thereon, a carriage for said blow mold mounted for movement radially of the table, a blow head supported by said carriage, for oscillation in a vertical plane into and out of engagement with said blow mold, means for reciprocating said carriage to move the blow mold inwardly and outwardly of the table, and means connected to said blow head for causing it to be moved into and out of engagement with said blow mold upon inward and outward movement of said blow mold relative to said table.

27. A glassware forming machine comprising a blow mold table mounted for rotation about a vertical axis, a blow mold thereon, a blow head associated with said blow mold, means for moving said blow mold inwardly and outwardly of its table, means operating in response to the movement of the blow mold relative to its table for engaging and disengaging the blow head and blow mold, and means operating in response to the rotation of the blow mold, and during the movement of said mold outwardly of the table, for opening said blow mold.

28. A glassware forming machine comprising a blow mold table, a blow mold thereon, mold operating linkage connected to the blow mold, a cam so constructed and arranged as to operate said linkage to close the blow mold and to be disconnected from said linkage after closing of the blow mold, pneumatic means for retaining said blow mold closed after the cam and linkage are disconnected and for opposing the tendency of the mold to open under pressure of the blowing air introduced into said mold, and means providing an operative connection between said pneumatic means and said mold during rotation of said table.

29. A glassware forming machine comprising a mold table, a blow mold thereon, a blow head associated with said blow mold, means for opening and closing the blow mold, means for conducting blowing air through the blow head into the blow mold when said blow mold is closed, pneumatic means for retaining said blow mold closed upon the introduction of blowing air thereinto, a common source of air for said blow head and pneumatic means, and means dependent upon the operation of said pneumatic means for controlling the passage of air through said blow head.

30. A glassware forming machine comprising a mold table, a blow mold thereon, a blow head for supplying blowing air to said mold, means for conducting blowing air to said blow head, means for closing said blow mold, and means operating upon failure of the mold to close, to obstruct the passage of blowing air to said blow head without preventing rotation of said table.

31. Glassware forming apparatus comprising a horizontal mold table, a plurality of parison forming units on said table, means for continuously rotating said table, a feeder for supplying charges of glass to said units, a guide for directing said charges into said units, and means for actuating said guide, including means for holding said guide in a position of rest in register with the feeder as a charge of glass is discharged by the feeder into, and placed under the control of, the guide, means for thereafter bodily swinging the guide with the charge of glass therein from its position of rest with an accelerated movement until the guide is traveling at the same speed as one of said units and for thereafter causing said guide to travel vertically aligned with said unit, for the delivery of the charge thereto during such travel, and means for timing the operation of said last named means to cause said guide successively to direct charges of glass from said feeder into said units as they continuously rotate.

32. The method of directing charges of glass from a feeder into a plurality of moving parison forming units, which comprises holding a guide at rest in charge-receiving position beneath and in axial alignment with a feeder and in the vertical path of charges discharged from the feeder, passing a charge from the feeder into the guide while the guide is held at rest and thus placing the charge under control of the guide, and bodily mov-

ing the guide from its position of rest with an accelerated movement in an arcuate path overlying the path of the mold units and thereafter causing the guide to travel in vertical alignment with one of said units as the charge slides through the guide and into the unit.

33. Apparatus for forming glassware, comprising a horizontal mold table, a plurality of parison-forming units thereon, means for continuously rotating said table, a feeder for supplying charges of glass successively to said units, a guide normally positioned and held stationary beneath said feeder, means for oscillating said guide away from and toward its position of rest, to cause it to travel successively with said units to successively direct said charges thereto, preventing means in addition to the last-named means for preventing the delivery of charges by said guide to one or more of said units, and control means for controlling the operation of said preventing means, said control means being associated with one or more of said units and individual thereto, and operable while said table is rotating, for selectively preventing the delivery of charges by said guide to one or more of said units.

34. A glassware forming machine comprising a mold table, means for continuously rotating said table, a plurality of parison forming units on said table, each of said units including a body mold, means for inverting said units for the supply of charges of glass thereto and for the settle blowing of said charges therein, means for settle blowing the charges, power means for applying said settle blow means to said molds, thereby exerting a downward thrust on said units, a plurality of counterbalancing devices carried by said table and associated respectively with said units, and means for successively rendering said devices operable to counteract the downward thrusts of the settle blowing means on said units.

35. In combination with the rotary table of a glassware forming machine having a plurality of parison forming units mounted thereon, means for successively moving said units into inverted position on said table for the reception of charges of glass, a guide for successively delivering such charges to the units, means for oscillating said guide in an arcuate path, whereby the charges may be delivered centrally to the units while they are rotating, means for successively applying settle blowing air to said units to compact the charges therein, comprising a settle blow head, means for oscillating said settle blow head in an arcuate path so that the blow head may be held in engagement with successive units to settle blow the charges while the units are rotating, said last-named means being separate from the means for oscillating said guide, means for timing the operations of the guide and blow head so that the settle blow head begins its travel in the direction of rotation of the mold units prior to the cessation of the travel of the guide with said units, and means for preventing interference between the blow head and said guide.

36. In combination with a rotary table of a glassware forming machine having a plurality of parison forming units thereon, a glass feeder for supplying charges of glass to said units, a guide for directing said charges into said units, said guide comprising a member open for substantially its full length on one side thereof, and means for operating said guide comprising means for holding said guide in a position of rest in axial alignment with the orifice of the feeder while a charge of glass formed by the feeder passes into, and is placed under the control of, the guide, means for bodily swinging the guide from its position of rest with an accelerated movement until the guide is travelling at the same speed as one of said units and for then causing the funnel to travel with said unit in vertical axial alignment therewith, and means for timing the operation of the guide operating means for the successive delivery of charges into successive units in the aforesaid manner.

37. A glassware forming machine comprising a parison mold table, a parison mold thereon, means for inverting and reverting said parison mold, pneumatic power means for closing said parison mold and for holding it in closed position during the inversion and reversion thereof, a counterblow baffle plate adapted to be moved into and out of engagement with the bottom of the parison mold, pneumatic power means for moving the baffle plate into engagement with the parison mold and for yieldingly holding it in such engagement, a source of air pressure for the pneumatic power means associated with the parison mold and counterblow baffle plate respectively, and a single means for controlling the admission of air pressure from said source to both of said pneumatic means.

38. A glassware forming machine comprising a horizontal mold table mounted for rotation about a vertical axis, a parison forming unit including a body mold carried by said table, a counterblow baffle plate associated with said unit and movable with said table, pneumatic power means for moving said baffle plate into, and for yieldingly holding it in engagement with, the body mold, means controlling the supply of pressure to said pneumatic means, and cam means for controlling the positioning of the baffle plate by said pneumatic means, said cam means and said pneumatic means being so arranged that the pneumatic means acts as an air cushion for the cam means at times when the baffle plate is out of engagement with the parison forming unit.

39. A glassware forming machine comprising a horizontal mold table, a parison forming unit including a sectional body mold mounted on said table, holders for the sections of the body mold rigidly connected thereto, means for rotating said table, means for supplying a charge of glass to said unit and for forming it into a parison therein, automatic means for cracking said body mold and for holding it cracked during a predetermined period to controllably effect reheating of the parison while practically enclosed by the body mold, said automatic means including pneumatic means connected to the mold, a stationary member, and valve means carried by the table for controlling the pneumatic means and arranged to be actuated by said member for cracking the mold in response to the rotation of the table upon the arrival of the mold in a predetermined angular position, a finishing mold, other means operable at the conclusion of the period in which the mold is cracked for completely opening the blank mold for the transfer of the parison to the finishing mold, and means for transferring the parison to the finishing mold.

40. A glassware forming machine comprising a horizontal mold table, means for rotating the table, a parison forming unit including a sectional body mold mounted on said table, holders for the sections of the body mold rigidly connected thereto, means for forming a parison in said unit, automatic means for cracking said body

mold and for holding it cracked during a predetermined period to controllably effect reheating of the parison while practically enclosed by the body mold, said automatic means including a pneumatic device, a stationary member, valve means held in position to be engaged with the stationary member in response to the rotation of the table upon the arrival of the body mold at an angular position predetermined by the position of said member, a finishing mold, means in addition to the pneumatic device operable at the conclusion of the period in which the mold is cracked, for completely opening the blank mold for the transfer of the parison to the finishing mold, means for transferring the parison to the finishing mold, and means for supporting said stationary member for access and adjustment during operation of the machine.

41. A glassware forming machine comprising a horizontal mold table mounted for rotation about a vertical axis, a parison-forming unit mounted on said table, a counterblow baffle plate associated with said unit, means for inverting said unit for the supply of a charge of glass thereto and for reverting said unit to counterblow said charge into a parison in said unit and against said baffle plate, said means comprising a cam normally fixed but angularly shiftable about the axis of said table, mechanism connected to said counterblow baffle plate for moving it into and out of engagement with the bottom of the body mold of said unit, a cam for operating said mechanism, and means for angularly shifting said cams to simultaneously vary the time of inversion and reversion of said unit and the movement of said baffle plate into operative position.

42. In combination with a mold table having a plurality of mold units thereon and means for continuously rotating said table, a feeder for supplying separated charges of glass to said units, mechanism for directing separated charges from the feeder to said units successively comprising a guide, means for mounting said guide for horizontal oscillatory movement about the axis of said table and in an arcuate path overlying the path of said mold units, and means for actuating said guide comprising means for causing said guide to dwell in axial alignment with said feeder for sufficient time for a separated charge to descend vertically into and to be brought under control of said guide, means for thereafter initiating bodily swinging movement of said guide and for accelerating such movement until it attains the speed of and is brought into vertical coincidence with the mold unit which is to receive the charge, and means for thereafter causing said guide to travel bodily with said unit while in such coincidence.

43. In combination with a mold table having a plurality of mold units thereon and means for continuously rotating said table, a feeder for supplying separated charges of glass to said units, mechanism for directing separated charges of glass to said units successively comprising a guide, a support for the guide mounted for oscillatory movement about the axis of said mold table, said guide being constantly held in vertical position by said support, and means for actuating said support to cause the guide to dwell in a position of rest in alignment with the feeder while a charge passes into and comes under control of the guide, to thereafter effect accelerated bodily movement of the guide to attain the speed of, and vertical coincidence with, a mold unit which is to receive the charge, and to thereafter cause the guide to travel bodily while in such coincidence with the mold unit, said last-named means comprising a rotary cam, and means for continuously rotating said cam in timed relation with said mold table.

44. In combination with a mold table having a plurality of mold units thereon and means for continuously rotating said table, a feeder for supplying separated charges of glass to said units, mechanism for directing said charges successively to said units comprising a guide, a support for the guide mounted for oscillatory movement about the axis of the mold table, said guide being held in vertical position by said support at all times, the guide being of relatively small cross-sectional area and of substantially uniform size throughout its length, whereby charges of glass are held in vertical position in said guide, and driving means having permanent operative connecton with said support for actuating the support and the guide to cause the guide to dwell in a position of rest while in alignment with said feeder, to effect an accelerated bodily movement of the guide to attain the speed of and to bring the guide into vertical coincidence with the mold unit which is to receive the charge, and thereafter to cause the guide to travel bodily with said unit while in vertical coincidence therewith.

45. Apparatus for forming glassware, comprising a horizontal mold table, a plurality of parison-forming units thereon, means for continuously rotating said table, a feeder for supplying charges of glass successively to said units, a single guide for delivering charges from said feeder to said units, means for actuating said guide to effect such delivery of the charges, a preventing means in addition to the last-named means for preventing the delivery of charges by said guide to said units, and control means for controlling the operation of said preventing means, said control means being associated with said units and individual thereto for selectively preventing the delivery of charges by said guide to one or more of said units.

46. A glassware forming machine comprising a base, a horizontal mold table supported on said base in vertically spaced relation thereto for rotation about a vertical axis, a plurality of parison forming units, each including a blank mold and a neck mold carried by said table, said units being mounted on said table for oscillation in vertical planes, and means for oscillating said units to invert and revert them in timed relation to the rotation of the mold table, comprising a drum rotatably mounted on said base, a cam formed on said drum, means operated by said cam in response to rotation of said table for inverting and reverting said units, means for counterblowing charges of glass in said units subsequent to reversion thereof, means for rotating said drum relative to said base and to said mold table for varying the time of inversion and reversion of said units, whereby the said units may attain reverted position ready for counterblowing at an earlier or later time in the cycle of the machine as desired, a plurality of finishing molds in upright position at all times, and automatic means for transferring parisons from said units to said finishing molds.

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