Aug. 17, 1965 F. J. WYTHE 3,201,218

PLUNGER TYPE GLASS FEEDING APPARATUS

Filed Dec. 27, 1961

FIG. 1

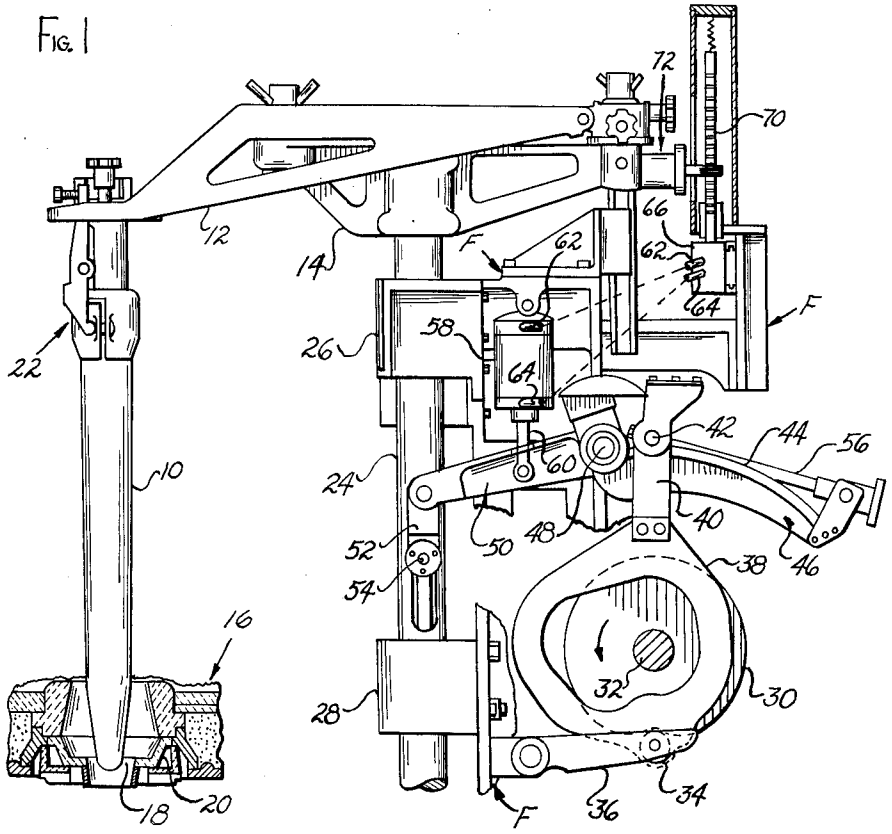
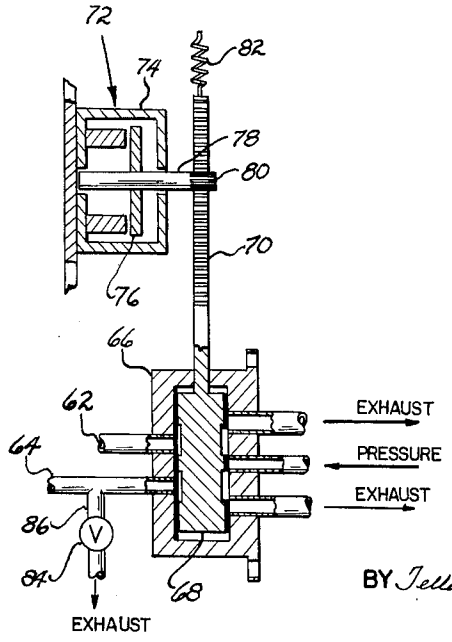


FIG. 2



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PLUNGER TYPE GLASS FEEDING APPARATUS

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This invention relates to glass feeding apparatus of the type which includes a bowl having a bottom opening for the discharge of molten glass as a result of reciprocating a plunger over the opening. The invention relates more specifically to improved means for assisting the mechanism usually employed for effecting plunger reciprocation.

It is a general object of the invention to provide in glass feeding mechanism of the type wherein a rotating cam, a cam follower and a lever linkage are used to lift the plunger and wherein the force of gravity is relied upon for the downward movement of the plunger, a fluid motor for assisting both movements of the plunger so as to provide better control of the plunger force and to assure positive cam and cam follower contact at all times.

As will be described in more detail hereinafter, the glass feeding apparatus to which the present invention is applied includes a vertically reciprocable bracket for supporting the plunger. The bracket is mounted on a vertically reciprocable post which is moved upwardly by a lever when the lever is pivoted by a cam follower engaging the bottom side of a rotating driven cam. A glass feeding apparatus of this type is shown in U.S. Patent No. 2,654,184 and in U.S. Patent No. 2,749,665, and it will be seen from these patents that the weight or gravity force of the plunger, bracket, post, etc. is relied upon to effect the downward movement of the plunger.

It is particularly desirable to assist plunger movement in the downward direction to overcome the resistance of partially cooled but nonetheless molten glass. To this end, a fluid motor comprising a cylinder and piston is mounted on a non-moving part of the apparatus with its piston rod connected to the lever to assist in plunger movement. The fluid motor is preferably reversible and it is controlled by a two-position valve. The valve has a rack formed thereon which is engaged by a pinion formed on one end of a shaft whose rotation is retarded by a slip clutch. The preferred form of slip clutch comprises a magnetic hysteresis brake operable within a housing which is mounted on the bracket for vertical movement. During initial bracket and plunger movement in either direction, there will be no relative movement of the pinion and rack because of the retarded shaft and thus the valve will be shifted to one of its two positions. After the valve has reached the limit of its movement and is placed in one of its two positions, the brake or clutch will slip to permit relative rack and pinion movement.

Therefore, the fluid motor is reversed to assist in plunger and bracket movements in either direction responsive to initial bracket and plunger movement.

The drawing shows a preferred embodiment of the invention and such embodiment will be described, but it will be understood that various changes may be made from the construction disclosed, and that the drawing and description are not to be construed as defining or limiting the scope of the invention, the claims forming a part of this specification being relied upon for that purpose.

Of the drawing:

FIG. 1 is an elevational view of a portion of the glass feeding apparatus and it shows all of the elements thereof that have heretofore been mentioned; and

FIG. 2 is a schematic cross-sectional view showing the clutch and control valve structures.

As shown in FIG. 1 and as more fully shown and described in U.S. Patent 2,749,665, the plunger **10** is

mounted on one end of an arm **12** which is adjustably supported on a bracket **14** for vertical reciprocation therewith relative to a bowl **16**. The bowl **16** is a receptacle for molten glass which is discharged therefrom through a bottom opening **18** in the bowl, the said opening being defined by an orifice ring **20**. The glass is discharged as a result of the vertical reciprocation of the plunger **10** over the opening **18** and substantially along the vertical axis thereof.

The plunger is connected to the end of the arm **12** by clamping means indicated generally by the reference numeral **22**, this forming no part of the present invention and being shown and described in Patent 2,749,665. The bracket **14**, the arm **12** and the plunger **10** are vertically reciprocated as a result of vertical reciprocation of a shaft or post **24** to which the bracket **14** is rigidly connected. The post **24** is moved upwardly and downwardly through upper and lower bushings **26** and **28** which are a part of the fixed frame of the apparatus, the said frame being designated throughout by the letter F.

Mechanical means is employed to lift the post **24** and thus the bracket **14** and plunger **10**. Accordingly, this means is indirectly connected with the plunger, and as shown in FIG. 1, it includes a cam **30** which is secured to a cam shaft **32** for driven rotation in a counterclockwise direction. The mechanical means for lifting the plunger also includes a cam follower comprising a roller **34** engaging the bottom side of the cam **30**, the roller being supported on the end of a pivoted arm **36** and being further supported on a pair of straps which straddle the cam, one of the straps being designated by the numeral **38**. The straps have extensions such as shown at **40** which project upwardly and journal a roller **42** engaging the upper arcuate surface **44** of a lever **46**. The lever **46** is pivotally mounted at **48** to the frame F and the arcuate surface **44** thereof is formed on a radius from the center of the cam-following roller **34** when the said roller is on that portion of the cam periphery nearest the cam axis.

On the opposite side of the pivot point **48** from the arcuate portion **44**, the lever **46** has a portion **50** which is bifurcated at its end to straddle the vertically movable post **24**. The said bifurcated end is pivotally connected to a pair of linkages, such as the link **52**, which are pivotally connected at their other ends to a pin **54** which is secured transversely in the post **24**. Therefore, upon clockwise pivoting movement of the lever **46** as viewed in FIG. 1, the post **24** will be lifted and this lifts the plunger **10** and the bracket **14**.

It will be seen that the lever **46** is pivoted in the clockwise direction to lift the plunger when the cam following roller **34** rides upon the radially outer portions of the periphery of the cam **30**. The magnitude of lifting movement or "stroke" of the plunger **10** varies in proportion to the distance separating the axis of the lever actuating roller **42** from the lever pivot axis **48**. This distance can be adjusted to adjust the stroke by means of a manually operated screw **56** which is threaded into the support for the lever actuating roller **42**.

As has been said, and as will be seen from the drawing, the return or downward stroke of the plunger **10** is caused primarily by the gravity force or weight of the plunger, the bracket **14**, the post **24** and the associated vertically movable elements. As has also been said, both movements of the plunger **10** are assisted by a fluid motor identified by the numeral **58** on the drawing. The said fluid motor comprises either an hydraulic or pneumatic cylinder which is supported on the frame F for substantially vertical movement of a piston having a rod extension **60** which is pivotally connected with the lever **46** on the portion **50** thereof. A fluid conduit **62** is connected to the upper end of the fluid motor cylinder and a

similar fluid conduit 64 is connected to the lower end of the said cylinder. These conduits extend from a control valve housing 66 which is mounted on the frame F. As will be described more fully, the control valve functions to connect the fluid conduit 62 to a source of fluid under pressure while exhausing fluid from the conduit 64 when the valve is in one of its two positions, and when the valve is in the other of its two positions, the conduit 64 is pressurized while the conduit 62 is exhausted. Thus, by operation of the control valve, the fluid motor 58 is operated either to drive the piston rod 60 downwardly to effect counterclockwise pivoting movement of the lever 46 and downward movement of the plunger 10 or to retract the piston rod 60 so as to assist clockwise movement of the lever 46 and lifting movement of the plunger 10.

As shown in both figures of the drawing, the two-position valve 68 which is operable within the valve housing 66 has a gear rack extension 70 formed thereon and which is reciprocated by a slip clutch indicated generally at 72 to place the valve in its one end other positions. The preferred slip clutch 72 comprises a magnetic hysteresis brake and it includes a housing 74 which is supported on the bracket 14 for vertical movements therewith. The clutch also includes an armature 76 which is keyed to a shaft 78 having a pinion 80 formed on its outer end to engage the rack 70. The clutch or brake is normally energized to retard rotation of the armature 76 and the shaft 78 whereby upon initial movement of the plunger and bracket and thus the clutch housing 74, the retarded shaft and pinion 80 will not rotate and thus the rack 70 and valve 68 will be moved responsive to initial movement of the plunger. That is, when the plunger 10 starts to move downwardly the valve 68 will be placed in its one position at the limit of its downward movement. Thereafter, the armature 76 will slip and relative movement will take place between the pinion 80 and the rack 70. When the plunger 10 starts to move upwardly, the retarded clutch armature and shaft will cause the rack and valve 68 to be moved upwardly to the limit of its movement within the housing 66, thus placing the valve in the other of its two positions. Thereafter, continued upward movement of the plunger will cause clutch slippage and there will be relative rack and pinion movement.

As will be observed with reference to FIG. 2, when the valve 68 is in its one position, i.e., the down position resulting from initial downward movement of the plunger 10, it will direct fluid under pressure from a source into the conduit 62 to the top of the fluid motor 58 to assist in the downward movement and to help maintain the plunger 10 in its down position. At the same time, the valve 68 will connect the conduit 64 to an exhaust port. When the valve is in its other or up position, the conduit 64 will be connected to the pressurized source while the conduit 62 is exhausted. It will be noted that the valve is connected to a tension spring 82 tending to place it in its other or up position. This is so arranged to effect upward movement of the plunger 10 or to assist in such upward movement to avoid freeze-up of the plunger in the bowl outlet whenever the glass feeding apparatus is not being operated.

In most installations, it is desirable to limit the upward force applied by the fluid motor 58 to less than the weight of the plunger, the bracket, and the associated vertically movable elements. The purpose for this is to assure that positive contact will always be maintained, due to the force of gravity, between the cam follower 34 and the cam 30. In such installations, it will be necessary to stop the operation of the feeder mechanism with a radial distant point on the periphery of the cam 30 engaging the follower 34 in order to assure that the plunger 10 will be elevated.

The means limiting the upward force of the fluid motor 58 comprises pressure limiting means in the form of a valve 84 which is disposed in an exhaust conduit 86 tapped into the conduit 64. Thus, whenever the pressure in the conduit 64 exceeds a predetermined level, the valve 84 will open to reduce the pressure in the conduit 64 to the level wherein the resultant upward force is less than the applied force of gravity.

The invention claimed is:

1. In glass feeding apparatus of the type which includes a bowl having a bottom opening for the discharge of molten glass as a result of vertical reciprocation of a plunger over the opening, and wherein plunger lifting is effected primarily by mechanical means connected with the plunger and including a rotating cam while downward movement is caused by gravity, improved means for assisting plunger movement in both directions and comprising a reversible fluid motor connected with the mechanical means, a two position control valve operatively connected with said fluid motor, and valve actuating means comprising a magnetic clutch having a housing mounted for movement with the plunger and also having a retarded shaft provided with a pinion, and the valve being provided with a rack engaged by the pinion whereby during initial downward movement of the plunger there is no relative rack and pinion movement so that the valve is placed in one position to effect a fluid motor assist to such plunger movement and thereafter the clutch slips to permit relative rack and pinion movement, and whereby during initial upward movement of the plunger there is no relative rack and pinion movement so that the valve is placed in its other position to effect a fluid motor assist to such plunger movement and thereafter the clutch slips to permit relative rack and pinion movement.

2. Improved means for assisting glass feeder plunger movement as set forth in claim 1 and wherein fluid pressure limiting means is operatively connected with said valve and fluid motor to limit the lifting force provided by the fluid motor to less than the gravity force.

3. In glass feeding apparatus of the type which includes a bowl having a bottom opening for the discharge of molten glass as a result of vertical movement of a plunger over the opening; and wherein the plunger is supported on a vertically reciprocable bracket which is lifted by a rotating cam, cam follower and lever connected with the bracket while downward movement thereof is caused by gravity; improved means for assisting plunger reciprocation in both directions and comprising a reversible fluid motor connected to the lever, a two position control valve operatively connected to the fluid motor, valve actuating means comprising a magnetic clutch having a retarded shaft provided with a pinion, the valve being provided with a rack engaged by the pinion so that during initial downward and upward movement of the plunger there will be no relative rack and pinion movement and the valve will be placed in its one and other positions, respectively, to provide a fluid motor assist to such respective plunger movements, and fluid pressure limiting means operatively connected with said valve and fluid motor to limit the lifting force provided by the fluid motor to less than the force of gravity.

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