July 9, 1935. C. F. BALL 2,007,888

PUMP FOR CONCRETE AND ANALOGOUS PLASTIC MIXTURES

Filed May 26, 1933 3 Sheets-Sheet 1

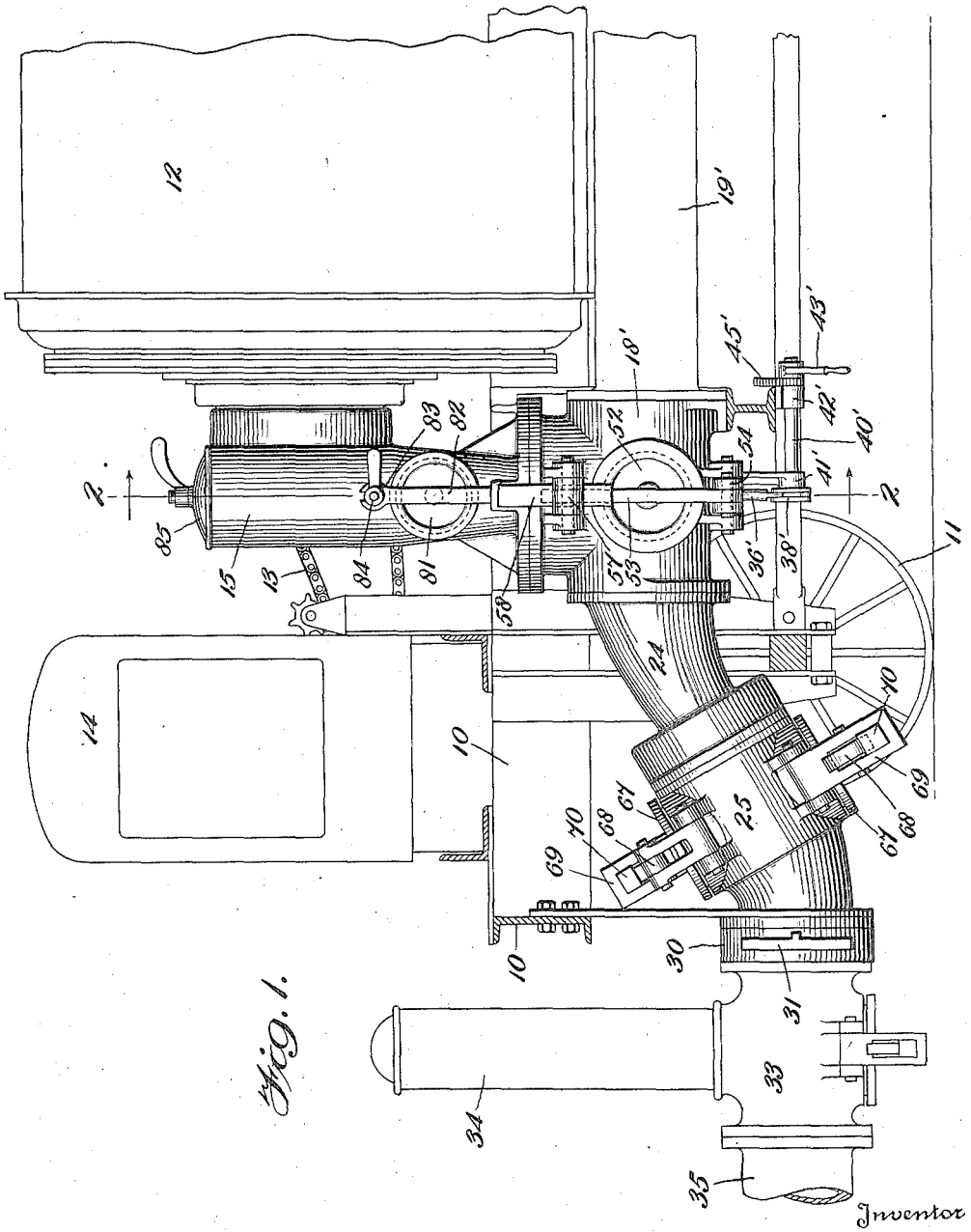

Fig. 1.

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Fig. 2.

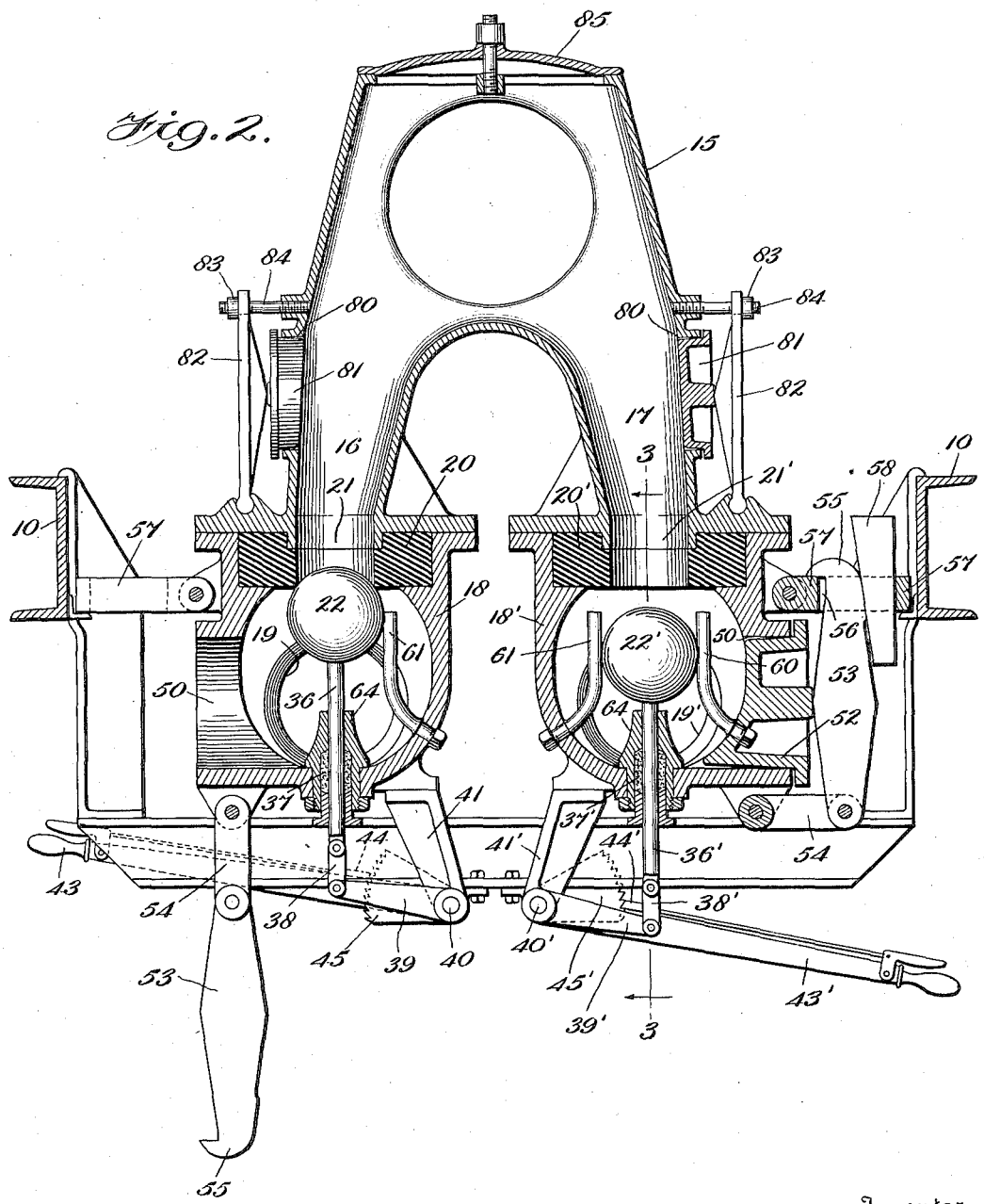

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Fig. 3.

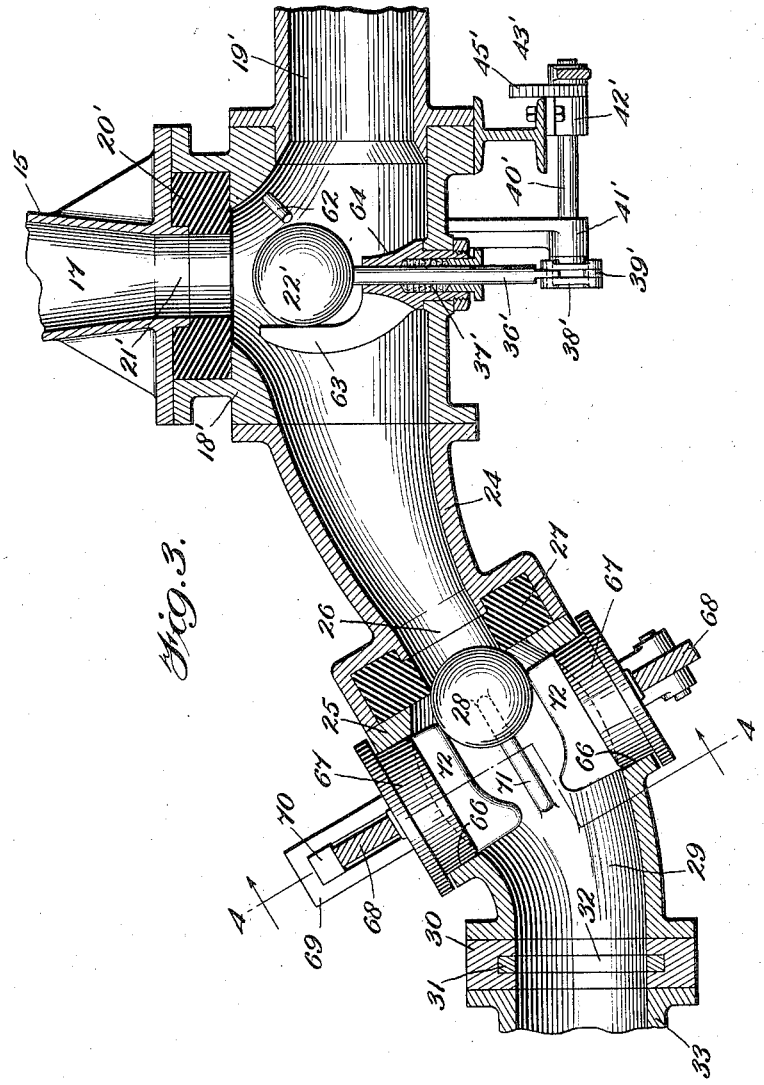
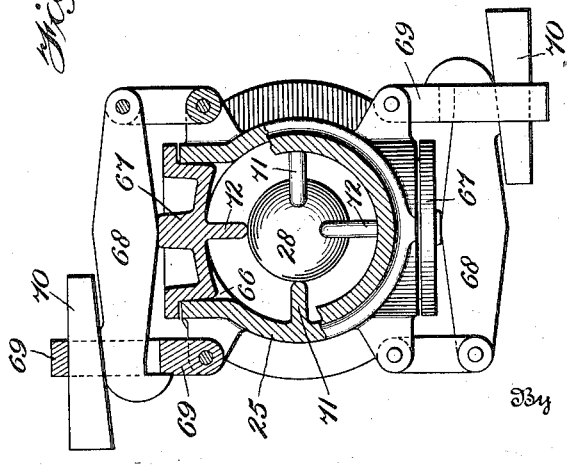


Fig. 4.



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UNITED STATES PATENT OFFICE

2,007,888

PUMP FOR CONCRETE AND ANALOGOUS PLASTIC MIXTURES

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Application May 26, 1933, Serial No. 673,058

8 Claims. (Cl. 103—10)

This invention relates to pumps for concrete and other plastic mixtures having similar characteristics, and more particularly to certain improvements in the construction of multiple unit pumps of the type shown, for example, in my prior U. S. application filed August 19, 1931, Serial No. 558,175, entitled Concrete pump, wherein I have disclosed and claimed a double cylinder pump construction primarily intended for the handling of concrete and other similar plastic mixtures.

Concrete, in the true sense of the word, is a plastic mixture of greater or less fluidity, comprising a binder, such as a paste of water and Portland cement, a fine aggregate such as sand, and a coarse aggregate, such as gravel or crushed stone, which latter may run up to two and one-half inches or more in greatest dimension. This mixture is to be distinguished from mortar or grout, which may contain the same constituents except that the coarse aggregate is omitted, and from slurry, which is a thin, easily flowable mixture of cement and water.

Plastic cement mixtures, after the hydration of the cement is completed and the well known chemical reactions take place, constantly tend to harden and set, but in the normal operation of pumps such as those disclosed in my said prior application, so long as the mixture is kept in motion, this characteristic is not particularly detrimental to the pump. Under certain abnormal conditions, e. g. where the machine is frequently stopped for varying periods of time, or through other causes, portions of the mixture may adhere to the walls of the chambers and passages, and harden sufficiently to form a basis for increasing accumulations which may eventually render one or more cylinders of the pump inoperative. In such event, it is highly desirable to be able to block off the non-operative unit or units while the remaining ones continue to function, and to obtain ready access to the obstructed chambers and passages for the purpose of removing the obstructions. Such access is also desirable for the purpose of effecting a thorough cleaning at the conclusion of a pumping operation.

It is therefore one object of the present invention to provide a concrete pump construction having a plurality of working cylinders, or pumping units, in which provision is made for independently blocking off each unit, while the remaining units may continue to operate, and also to provide means for affording ready access to the cylinders and passages of each unit so that obstructions therein may be quickly removed when the unit is blocked off. In the present instance, the blocking off of any particular unit is accomplished through positively holding its inlet valve closed, thereby cutting off the feed of the mixture to that unit, and enabling the chamber to be opened and cleaned while the remaining unit or units continue to function as usual.

It has furthermore been found highly desirable, if not almost essential, in the pumping of concrete and similar mixtures, that prior to the beginning of the pumping operation, either clear water or a thin, readily flowable slurry of cement and water be passed through the system to wet and in effect lubricate the surfaces of the pump chambers and passages, and of the discharge line. Likewise, at the conclusion of a pumping operation, it is desirable to be able to force clear water through the apparatus to flush it out. Although this may be accomplished through the use of separate water pumps, it greatly facilitates matters if the concrete pump, in addition to being able to most effectively handle concrete, can also effectively pump clear water. When pumping concrete the pump valves must of course be capable of passing the largest aggregates which will be encountered, and when open must provide passages of say at least three inches, whereas such openings, of the inlet valves at least, will render the pump very inefficient, if not wholly ineffective, for pumping water and slurry.

It is therefore a further object of the present invention to provide a pump primarily designed for the handling of concrete mixtures, in which the travel of the valves, more particularly the inlet valves, to and from their seated, completely closed positions, may be quickly and easily varied to enable the machine to efficiently handle clear water. Also, by adjusting the valve travel to points intermediate those best suited for the handling of concrete and of water, grout and slurry may also be pumped with a maximum efficiency.

With the above and other objects in view which will appear as the description proceeds, the invention consists in the novel details of construction and combinations of parts more fully hereinafter described and particularly pointed out in the appended claims.

Referring to the accompanying drawings forming a part of this specification in which like reference characters designate like parts in all the views:—

Figure 1 is a side elevational view, partly broken away, of a portion of a double cylinder reciprocating piston pump of the type shown in my said

prior co-pending application, and constructed in accordance with the present invention;

Figure 2 is a transverse vertical sectional view, on an enlarged scale, taken approximately on the plane indicated by the line 2—2 of Figure 1, looking in the direction of the arrows;

Figure 3 is a central longitudinal sectional view through a portion of the working cylinder, valve chambers, and discharge passage of one of the units of the pump, taken approximately on the plane indicated by the line 3—3 of Figure 2; and

Figure 4 is a transverse sectional view through the outlet valve, taken approximately on the plane indicated by the line 4—4 of Figure 3, looking in the direction of the arrows.

Referring more particularly to the said drawings the pump, as was fully disclosed in my said prior application, No. 558,175, is preferably mounted on a chassis frame 10 which may be supported upon suitable wheels 11 for the sake of ready portability, and which frame carries a rotatable drum 12 for receiving pre-mixed concrete and maintaining the same in completely mixed condition through its rotation, which may be accomplished through suitable driving connections 13 from a motor contained within the housing 14. The contents of the drum 12 are constantly fed toward the left as viewed in Figure 1 and discharged into a distributing or feed chest 15, the lower portion of which is bifurcated to provide the downwardly extending passages 16 and 17 leading respectively into the inlet valve housings 18 and 18' which communicate with the working cylinders 19 and 19' and are provided with the heavy rubber or other resilient seating rings 20 and 20' respectively, surrounding the inlet ports 21 and 21', as clearly shown in Figures 2 and 3. The said ports 21 and 21' are controlled respectively by the hollow valve balls 22 and 22' which act as inlet check valves for permitting the mixture to pass from the passages 16 and 17 to the respective working cylinders as the pistons in the cylinders 19 and 19' alternately move backward, and preventing the return of the mixture upwardly into the said passages as the pistons move forward.

As best shown in Figure 3, the inlet valve casings 18 and 18' communicate by means of short connections 24 with outlet valve housings 25 through ports 26, which are preferably surrounded by resilient seating rings 27, similar to the rings 20 and 20', and arranged to coact with the hollow valve balls 28. The outlet valve housings 25 are provided with discharge passages 29, which communicate with cut-off valve housings 30, in which are mounted suitable cut-off valve members 31. These valves may conveniently take the form of manually operable slides having ports 32 which may be moved into and out of alinement with the passages 29 to permit or prevent the passage of the mixture, as will be readily understood; and beyond these cut-off valves there is preferably provided a fitting 33 which carries an air dome 34 as is fully disclosed in my said prior application. Beyond the air domes 34 the discharge pipes 35 of the units preferably join into a common discharge conduit which may be extended from the point of pumping to the place of use. This general construction as thus far described, with the exception of the cut-off valves 31, and resilient valve seats 20 and 27, is substantially the same as that disclosed in my said prior application No. 558,175.

It will be understood that in the normal operation of the pump, as the pistons within the cylinders 19 and 19' are alternately reciprocated they suck the concrete mixture from the chest 15 into their respective cylinders, past the ball check valves 22 and 22', upon their backward strokes, while upon the forward or working strokes the mixture thus drawn in is forced out of the working cylinders through the passages 24, the inlet valves such as 22 and 22' at this time seating against the resilient rings 20 and 20' to close off the respective inlet ports.

As above indicated should one or more of the pumping units be rendered inoperative due to a hardening and building up of portions of the concrete mixture in the valve chambers, that particular unit may be blocked off for cleaning purposes through a positive holding of the inlet valve ball such as 22 or 22' against its seat, thereby preventing feed of the mixture to that particular working cylinder and enabling the said valve chamber to be opened up and cleaned out. The mechanism here shown for accomplishing the positive holding of the inlet valves in seated position to block off a unit comprises rods 36 and 36' which extend upwardly through the bottom of the valve housings 18 and 18' through suitable glands or stuffing boxes 37 and 37' and the outer ends of which rods are connected through links 38 and 38' with arms 39 and 39' carried by jackshafts 40 and 40' journalled in suitable bearings 41, 41' and 42 and 42'. The other end of the said shafts 40 and 40' carry hand levers 43 and 43' having associated with them latching mechanism here shown as comprising dogs 44 and 44' carried by the said hand levers, and toothed sectors 45 and 45' rigid with the bearings 42 and 42', whereby the said levers may be maintained in a number of different positions as required.

When a hand lever such as 43' is in its lowermost position as is indicated at the right of Figure 2, its rod 36' is likewise in a lowered position, thereby permitting the inlet valve ball such as 22' to open to the extent necessary to permit the passage of the largest aggregates which may be contained in the mixture. On the other hand, by raising a hand lever to a position such as is shown for the lever 43 at the left of Figure 2, through the shaft 40, arm 39 and linkage 38, the rod 36 will be forced upwardly to positively hold its inlet valve ball such as 22 firmly seated against its resilient seat 20, thereby cutting off the feed of the mixture from the passage 16 of chest 15 so that the working chamber constituted by the cylinder 19, valve housing 18 and connection 24, may be opened up and cleaned out without shutting down the pump completely, but permitting the other unit or units to continue in operation.

In order to afford ready access to the valve chambers the housings 18 and 18' are preferably provided with clean-out openings 50 which are normally closed by covers 52 readily removably retained in position by clamping members or bars 53 engageable with the said covers and which bars are preferably pivotally secured to the valve housing as by links 54. The said bars 53 are provided with heads 55 which are passed through openings 56 in yoke members 57 which are likewise pivotally mounted on the valve housings, and wedges 58 are driven in behind the heads 55 to firmly lock the parts in closing position, as will be readily understood from Figure 2.

When it is desired to remove one of the closures 52 for cleaning purposes, the wedge such as 58 is knocked out of the yoke member 57, thus permitting the head 55 to be disengaged from the said yoke and withdrawn from the opening

therein, and the links 54 and bar 53 to be dropped to the positions shown at the left of Figure 2. The closure member 52 may then be withdrawn from the clean-out opening 50 and access obtained to the interior of the valve housing.

For the purposes of guiding the inlet valve balls such as 22 and 22' each closure member such as 52 may carry a valve guiding member 60 while the valve housing itself may be provided with other guiding members 61 and 62 and a fourth valve guide 63 may be carried by the plug member 64 which constitutes the guide for the valve adjusting rods 36 and 36', as will be clearly seen from Figure 3. The valve guides 60 carried by the clean-out closures 52 of course will be removed with the said closures and if for any reason it becomes necessary to remove the valve balls when the pump is completely out of operation, they may be easily withdrawn through the openings 50 with this guide member 60 out of the way.

The outlet valve housings 25 are also preferably provided with clean-out openings whereby access may be readily attained to the valve chambers thereof and for the purpose of removing the outlet valve balls such as 26 when desired. As best shown in Figures 3 and 4 each outlet valve housing 25 is preferably provided with oppositely disposed clean-out openings 66 which are normally closed by removable closure members 67 which are similar in construction to the closures 52 above described. These closures 67 are normally retained in position by pivoted clamping bars 68 engaged with yokes 69 and wedged in position by wedging members 70 in a manner similar to that described in connection with the closures 52. The valve housings 25 may be provided with oppositely disposed valve guide members 71 and each closure member 67 may be provided with a guide member 72 for guiding and retaining the valve ball 28 in operative position.

The manually operable cut-off valves 31 above described are provided in order to prevent reverse flow of the mixture which has been forced beyond the outlet valves 28 during such time as a unit may be inoperative for cleaning purposes. When a slide member 31 is moved so as to bring its port 32 out of register with the passage 29, obviously reverse flow of the mixture which has passed the said outlet valve will be prevented and the clean-out closures 67 of the discharge valve housing may be removed and the valve housing thoroughly cleaned.

The feed chest 15 may also be provided with clean-out openings 80 in each of its legs, which are normally closed by closure members 81 retained in position by locking bars 82 which in turn are locked against displacement by manually operated nuts 83 engaging threaded studs 84. The said chest may be provided with a readily removable cover 85 as best shown in Figures 1 and 2.

As above stated when the inlet valves 22 and 22' are permitted by the rods 36 and 36' to open to their fullest extent, they provide passages sufficient to accommodate the largest aggregates which the pump is designed to handle. These passages may be say three inches or more in smallest dimension, but as above explained such passages render the pump highly inefficient if not wholly ineffective for the handling of clear water and slurry. On the other hand, if the levers 43 and 43' be moved upwardly to elevate the rods 36 and 36' so as to cut down the valve travel and provide valve openings of say one-fourth to one-half inch the pump may be effectively used for handling clear water and slurry and forcing it through the system to initially wet and lubricate the pump, valve housing, and discharge line surfaces, and also to flush out the system at the conclusion of a pumping operation, as above described. In like manner if the travel of the valves 22 and 22' be adjusted to points intermediate those best suited for the handling of water and of concrete mixtures, it is possible for the pump to most effectively handle mortar or grout mixtures.

It is obvious that those skilled in the art may vary the details of construction as well as the precise arrangement of parts without departing from the spirit of the invention, and therefore it is not wished to be limited to the above disclosure except as may be required by the claims.

What is claimed is:

1. In a pump for concrete and the like, having a plurality of pumping units each provided with an inlet valve automatically operable in response to movement of the pressure member of the pump, the combination of means for holding each of said valves closed at will to stop the functioning of its unit while the remaining unit or units may continue to function.

2. In a pump for concrete and the like, having a plurality of pumping units each provided with a gravity controlled inlet valve, the combination of means for positively holding each valve seated, against the action of gravity, to stop the functioning of its unit while the remaining unit or units may continue to function.

3. In a pump for concrete and the like, having a plurality of pumping units each provided with an inlet valve, an outlet valve, and discharge connections leading from said outlet valves, the combination of means for holding any of said inlet valves closed to prevent the entrance of the material to the unit controlled thereby while the remaining unit or units may continue to function; and cut-off valves in said discharge connections for preventing back-flow from the discharge line to a non-operating chamber.

4. In a pump for concrete and the like, having a plurality of pumping units each provided with an inlet valve, an outlet valve, clean-out openings adjacent each of said valves, and discharge connections leading from said outlet valves, the combination of means for holding any of said inlet valves closed to prevent the entrance of the material to the unit controlled thereby while the remaining unit or units may continue to function; cut-off valves in said discharge connections beyond said outlet valves for preventing back-flow of the material from the discharge line to a non-operating unit; and readily removable means normally closing said clean-out openings and affording ready access to the valve chambers of a unit for cleaning, when its inlet and cut-off valves are closed.

5. In a pump for concrete and the like having a working cylinder, an inlet valve chamber provided with an inlet port, and a valve in said chamber for controlling said port, the combination of a member extending into said chamber and engageable with said valve; and means operable at will for moving said member to cause it to hold said valve in closed position to positively cut off the feed of the material to said chamber.

6. In a pump for concrete and the like having a working cylinder, a valve chamber provided with an inlet port, and a check-valve ball in said chamber for controlling said port, the combina-

tion of a member extending through a wall of said chamber and engageable with said valve ball; a manually operable lever exterior of the chamber for moving said member to a position to hold said valve ball seated; and latch means carried by said lever for holding the parts in said valve seating position.

7. In a pump for concrete and other similar materials, a working chamber having an inlet port; a valve for controlling said port; means for limiting the opening movement of said valve; and manually operable means exterior of the pump for adjusting said limiting means to change the distance said valve opens to enable the pump to most effectively handle materials of different consistencies or composition.

8. In a pump for concrete and other similar materials provided with a chamber having an inlet port; a valve for controlling said port, said valve being arranged to open a predetermined maximum amount for the handling of concrete containing large aggregates; and means operable from the exterior of the pump, arranged to reduce the degree of opening of said valve to enable the pump to most efficiently handle grout, slurry, or water.

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