Sept. 27, 1938. C. F. BALL 2,131,681

CONCRETE PUMP

Original Filed Aug. 19, 1931 4 Sheets-Sheet 1

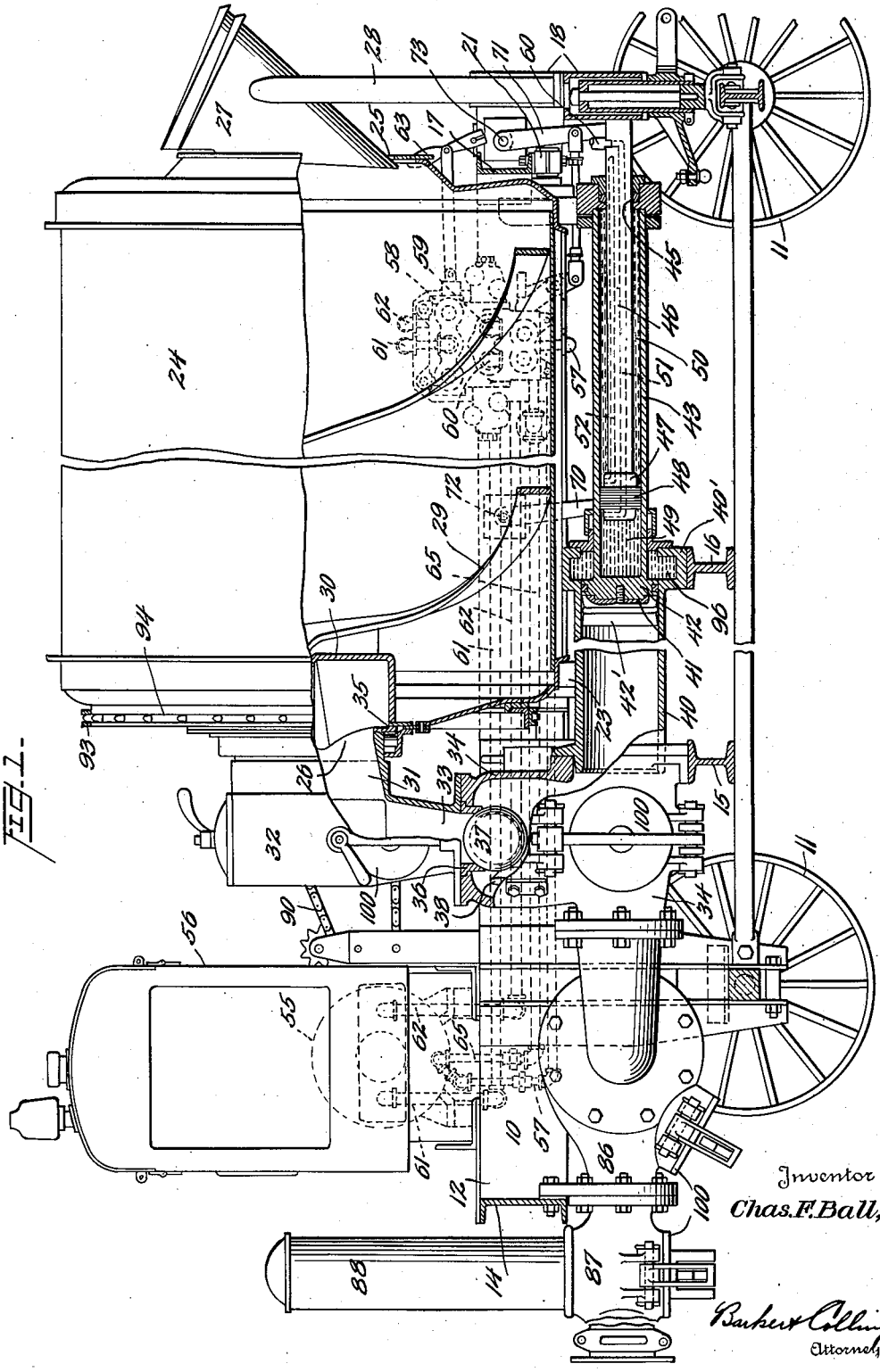

FIG. 1.

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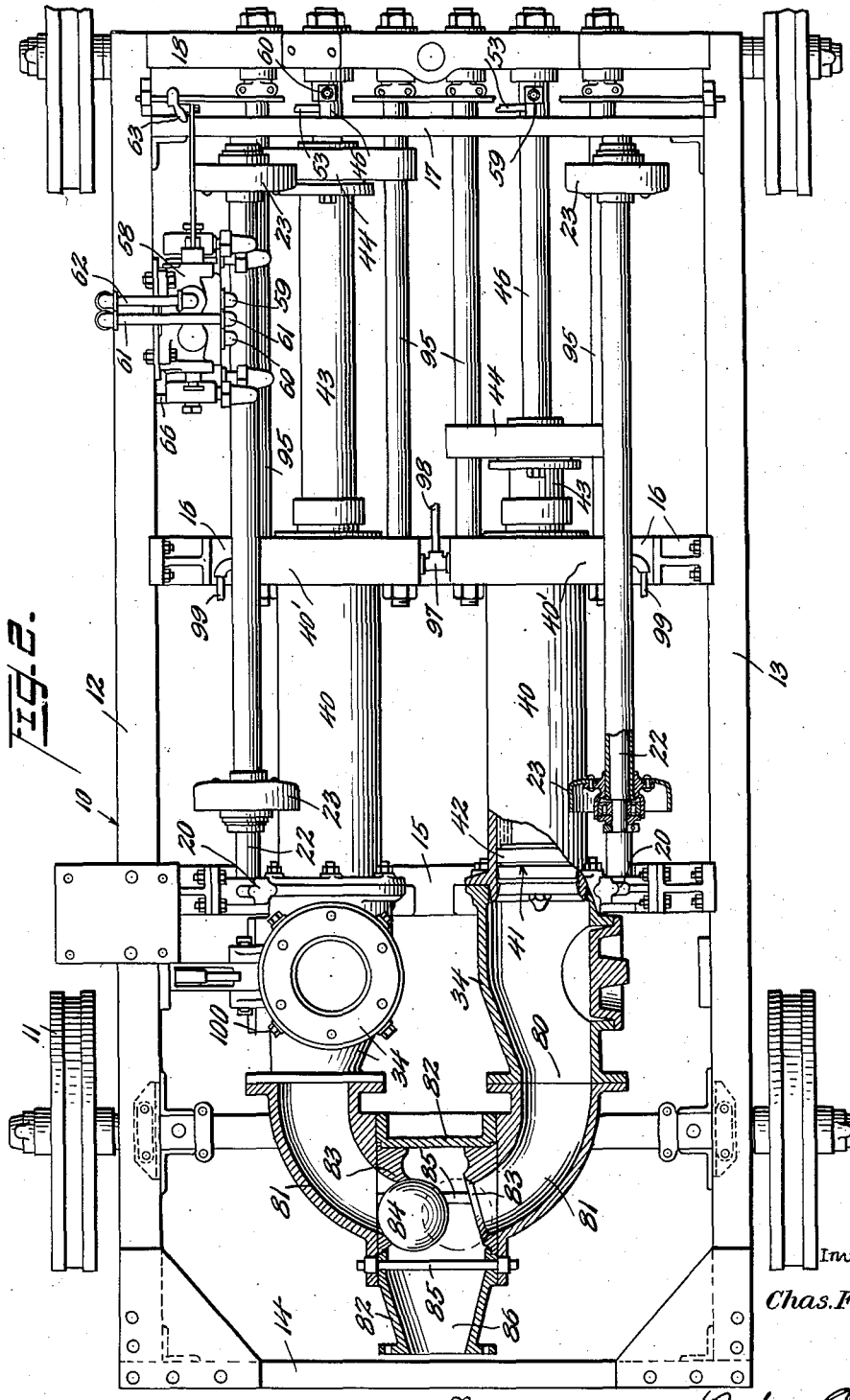

FIG. 2.

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FIG. 4.

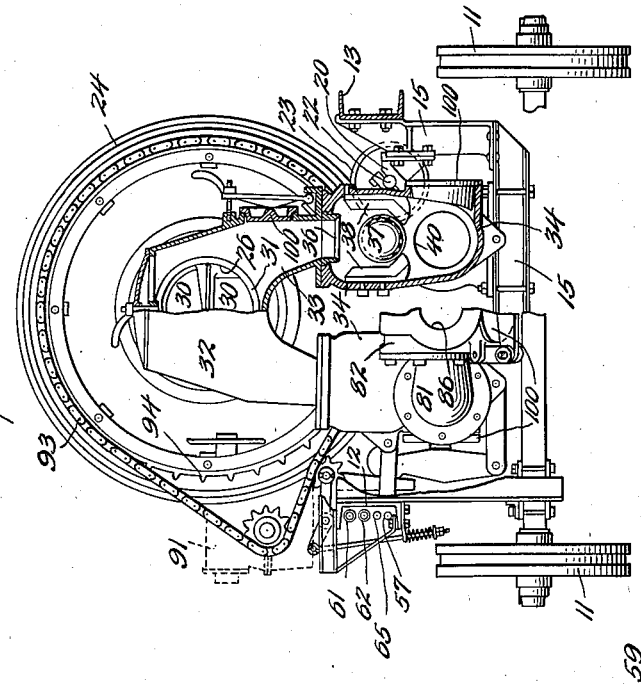

FIG. 7.

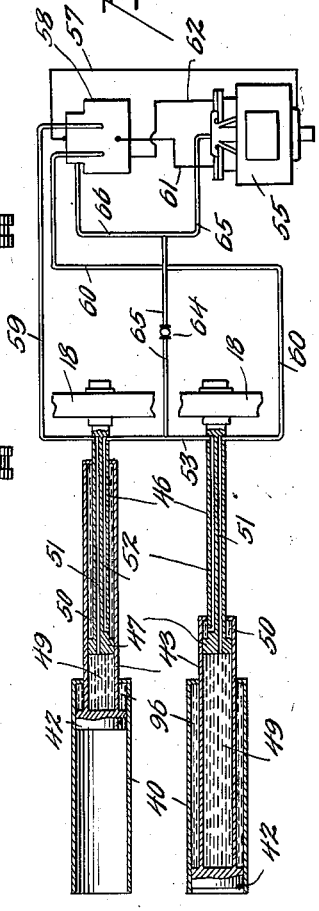

FIG. 3.

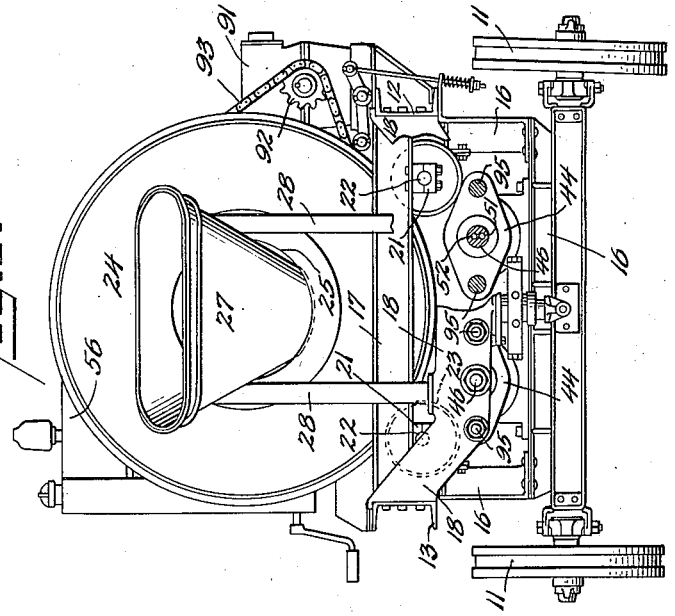

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FIG. 6.

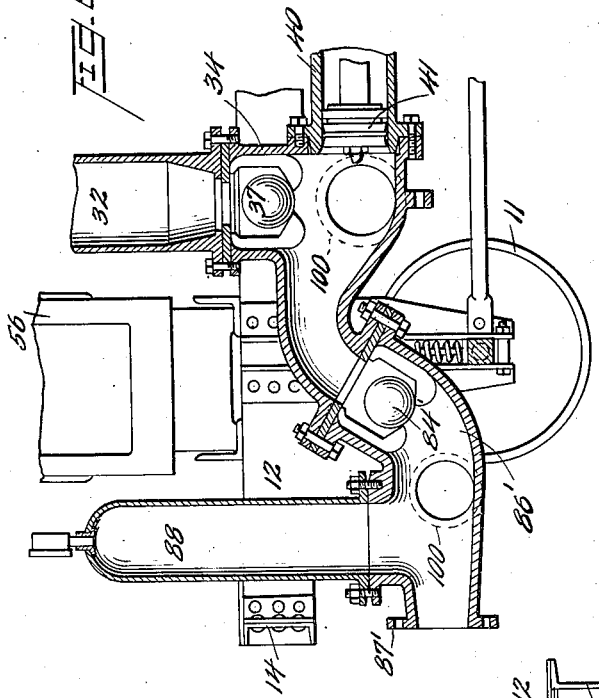


FIG. 8.

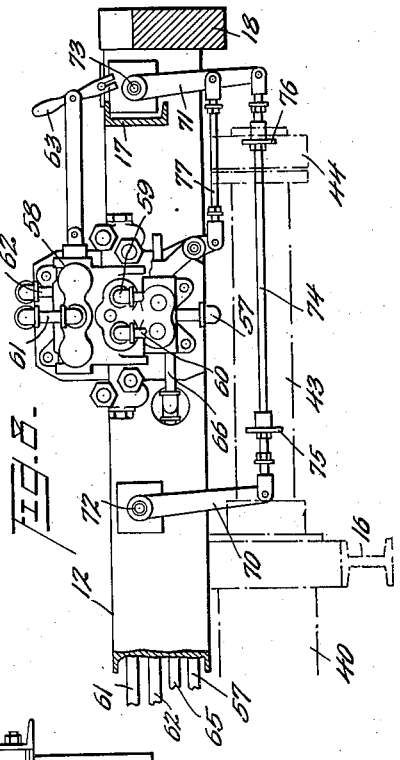
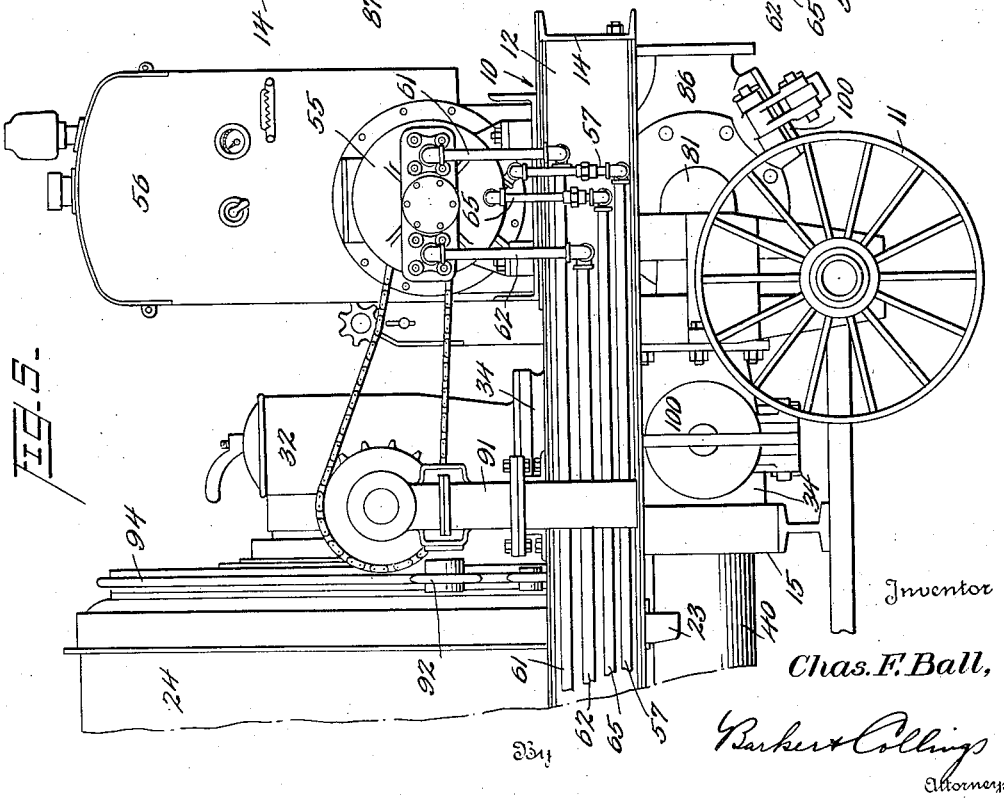


FIG. 5.



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Patented Sept. 27, 1938 2,131,681

# UNITED STATES PATENT OFFICE

2,131,681

## CONCRETE PUMP

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Original application August 19, 1931, Serial No. 558,175. Divided and this application June 11, 1934, Serial No. 730,108

2 Claims. (Cl. 83—73)

This invention relates to pumps of the reciprocating piston type and has for one of its objects to provide a pump of this character which will be particularly adapted for the pumping of concrete and other similar plastic mixtures which embody relatively large heavy aggregates.

A still further object of the invention is to provide a concrete pump having a receptacle for receiving pre-mixed, or partially mixed concrete, or even unmixed concrete making materials, which receptacle is adapted to mix and to maintain such concrete in completely mixed and unsegregated condition and to feed the same to the pump cylinders.

A still further object of the invention is to provide a concrete pump which will be more efficient in action than those which have been heretofore proposed.

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 set forth 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 concrete pump constructed in accordance with the present invention;

Figure 2 is a partial plan view of the parts shown in Figure 1, the concrete receiving and agitating drum, the power plant, and the fluid pressure pump, being omitted and certain of the parts being shown in section;

Figure 3 is an end elevational view partly broken away, of the parts shown in Figure 1 as seen from the right of the latter figure;

Figure 4 is an end elevational view, partly broken away, of the parts shown in Figure 1 as seen from the left of the said figure, the power plant and certain other parts being omitted for the sake of clearness;

Figure 5 is a fragmentary side elevational view of the rear end portion of the apparatus, as seen from the side opposite to that shown in Figure 1, and showing the fluid pressure pump;

Figure 6 is a fragmentary vertical sectional view through the outlet conduit showing a slightly modified form of outlet valve construction;

Figure 7 is a diagrammatic view illustrating the fluid circuits between the fluid pressure pump, the control valve and the concrete pump pistons; and

Figure 8 is a fragmentary sectional elevational view, showing the means for automatically shifting the fluid control valve.

In the said drawings the numeral 10 indicates a main frame of substantially rectangular construction, which may be stationary if desired, but which is here shown as being mounted upon suitable wheels 11, in order that the pump may be portable and moved from place to place as desired. The said frame 10 is here shown as comprising the longitudinal side channels 12 and 13, and the transverse members 14, 15, 16, 17 and 18, rigidly connected in any suitable manner to the said channels. As best shown in Figures 2, 3 and 4, the transverse member 15 carries a pair of clamping blocks 20, while the member 17 carries a companion pair of blocks 21, which pairs of blocks receive and hold the longitudinally extending shafts 22, upon which are rotatably mounted the drum-supporting rollers 23. A concrete receiving and agitating drum 24 is mounted for rotation in either direction upon the rollers 23, which drum is or may be of substantially the construction commonly employed in rotating-drum concrete mixer practice. The said drum is provided with the axial charging and discharging openings 25 and 26, respectively, into the former of which extends a charging hopper 27 carried by suitable upright supports 28. The interior of the drum carries the well known helical mixing blades 29, arranged to thoroughly mix the constituents when the drum is rotated in one direction, and which also serve to move the concrete from right to left, as viewed in Figure 1, toward the discharge opening 26 when the drum is rotated in the opposite direction; and the discharge end of the drum is preferably provided with the transverse curved pick-up and discharge troughs 30, which through the rotation of the drum in the last mentioned direction, pick-up and positively move the concrete to and through the discharge opening 26, all as is disclosed and claimed in my copending application filed June 24, 1931, Serial No. 546,591, now Patent No. 2,006,728, granted July 2, 1935.

The discharge opening 26 of the drum communicates with the horizontal passage 31 of a chest 32, which, as is best shown in Figure 4, is provided with a pair of downwardly extending discharge passages 33, each leading to a valve housing 34. The chest being stationary, whereas the drum is rotatable, a suitable slip joint or running seal 35 is provided between the two, to prevent escape of the concrete.

The valve housings 34 are each provided with

a seat 36 for receiving the ball valves 37, which constitute the intake valves of the cylinders of the concrete pump. The balls 37 are preferably hollow, to increase their tendency to rise toward their seats, and they may, if desired, be covered with rubber or similar yielding material to render their seating more certain. Suitable fingers or retainers 38 are provided in the housings 34 to limit the outward movement of the balls.

Each inlet valve housing 34 is secured to and communicates with the open end of a horizontal pump cylinder 40. As will be clear from Figure 2, these cylinders are disposed longitudinally of the frame 10 in spaced parallel relation, and are secured to and supported by the transverse frame members 15 and 16. In each cylinder there is mounted for reciprocation a hollow piston 41, having a solid head 42 provided with a cupped packing 42', sealing the piston against the passage of liquid there around. Each piston 41 is also provided with an elongated tubular skirt 43, see Figure 1, which skirts are of somewhat smaller diameter than the heads 42 and cylinders 40, and are closed at their ends opposite to the heads by removable cross-heads 44, apertured as at 45 to accommodate the horizontal rods 46, rigidly supported by the end transverse member 18, and arranged coaxial with, and extending into, the said skirts. The said rods 46 carry at their free ends abutments 47 having packing rings 48 slidably engaging the interior surface of the skirts and providing within the latter two chambers 49 and 50.

Each rod 46 is provided with a longitudinally extending duct or passage 51 through which fluid may be alternately introduced into and exhausted from the chambers 49, as will appear more fully below; and each rod is further provided with a second duct or passage 52, communicating with the chambers 50. The latter passages are connected exteriorly of the pistons by a pipe 53, see Figures 2 and 7, whereby fluid may flow freely back and forth between the two chambers 50.

For supplying fluid under pressure to the chambers 49, whereby the pistons 41 may be reciprocated, there is provided any suitable fluid pressure pump 55, driven by an internal combustion engine or other source of power enclosed within a housing 56 mounted on the frame 10. The said pump 55 forces fluid, e. g. oil, through a pipe 57 to a control or distributing valve 58, from which it is fed alternately to pipes 59 and 60, each of which leads to one of the passages 51 in the rods 46, which communicate with the chambers 49. When the valve is in such position that it is feeding fluid to the pipe 59, for example, the said valve has placed the companion pipe 60 in communication with a return pipe 61 leading from the valve back to the pump 55. As the fluid is forced through the pipe 59 and passage 51 into a chamber 49, it reacts against the abutment 47 and moves the piston 41 toward the left, as viewed in Figure 1, the skirt 43 sliding over the abutment, and the cross-head 44 sliding on the rod 46. This movement reduces the size of the chamber 50 and forces the oil therein out through the passage 52 and pipe 53 to the other chamber 50, where it reacts upon the other cross-head 44 to move that element and its associated skirt 43 and piston head 42 toward the right. The fluid pressure in one chamber 49 thus moves one piston 41 in one direction, and simultaneously through the medium of the fluid in chambers 50, passages 52 and pipe 53, moves the other piston in the opposite direction; and when the valve 58 changes the feed of fluid to pipe 60, the motions of the respective pistons will be reversed. On each movement toward the right, as seen in Figure 1, each piston 41 will draw concrete into its cylinder 40 from the chest 32 through its respective inlet valve 37, and on the return stroke will force it out of the cylinder again, as will be readily understood.

A by-pass pipe 62 is provided between the fluid pump 55 and valve 58, through which the oil may be returned to the pump, upon manipulation of the hand lever 63, without passing to the chambers 49, when it is desired to stop the concrete pump without stopping the fluid pump.

The chambers 50 are filled with oil at the outset, and except for leakage, there is no flow of this oil other than back and forth between the said chambers. Some oil from the chambers 49 however, will pass the packing rings 48 on the abutments 47, into the chambers 50; and should pressure in these latter chambers become excessive, the pressure will open a relief valve 64, permitting the excess oil to return through a pipe 65 to the pump 55. A branch 66 of this pipe leads back to the valve 58.

The details of the fluid pump 55 and of the valve 58 form no part of the present invention, those illustrated being in common use and procurable in the open market.

One means of automatically actuating the valve 58 to reverse the fluid flow is shown in Figure 8. A pair of arms 70 and 71 are pivotally hung as at 72 and 73, on the side frame member 12, and their lower ends are connected by a rod 74 on which is mounted a pair of spaced adjustable stops 75 and 76, which are engageable by one of the cross-heads 44 as it approaches each end of its stroke. The rod 74 is thus moved, first in one direction and then in the other, and such movements are transmitted through the arm 71 and linkage 77 to the valve 58, whereby it is caused to direct the oil from pipe 57 alternately to pipes 59 and 60.

Each valve housing 34 is provided with an outlet opening 80, communicating with an outlet conduit 81, leading to an outlet valve housing 82. This housing is provided with a pair of opposed seats 83, and a single outlet valve ball 84, of similar construction to the balls 37, is mounted therein between guides 85. The ball 84 shuttles back and forth horizontally between the seats 83, in response to the alternate pressures exerted on the concrete by the pistons 41, and a single valve ball thus controls the discharge from both cylinders 40. The housing 82 has a discharge passage 86, provided with a connection 87 to which the distributing pipe or conduit may be attached. The usual equalizing air pressure chamber 88 may be mounted on the said connection 87.

In the slightly modified construction shown in Figure 6, separate outlet valves 84' are employed for each cylinder, and in this instance the balls move at an angle of approximately 45° instead of horizontally, as when only one valve is used.

The motor within the housing 56, in addition to driving the fluid pump 55, also furnishes power for rotating the drum 24. Power from the motor shaft may be taken by a chain 90 to a worm reduction gearing within a casing 91, and thence by a sprocket 92, chain 93 and sprocket gear 94 to the said drum.

The cross-heads 44 are preferably mounted and slide upon fixed guide rods 95, extending be-

tween and rigidly fixed to the transverse frame member 18 and the enlarged ends 40' of the cylinders 40, see Figure 2.

Each cylinder 40 is provided at its right hand end, as viewed in Figures 1 and 2, with a wash-water chamber 96. The said chambers are interconnected by a pipe 97, see Figure 2, into which leads a water supply pipe 98, and each chamber is further provided with a bleeder outlet 99. The wash-water within the said chambers for the most part merely moves back and forth in the cylinders 40 behind the piston heads 42, in the same manner as does the oil in the chambers 50. A slight flow of wash-water is provided however, from the supply pipe 98, due to the slow discharge through the bleeders 99.

The volume of the fluid supplied to the pump 55 is practically constant, and therefore the movement of the pistons 61 in the cylinders 40, back and forth, is uniform throughout the entire length of their stroke. Since one piston picks up immediately where the other leaves off, and at the same speed, the concrete in the delivery pipe is kept in continuous motion and a smooth flow of concrete, substantially without pulsations, emerges from the distributing pipe. It is important to keep the concrete in continuous motion, since any stoppage, even for short periods, requires relatively great increase in pressure to overcome the static friction between the concrete and the walls of the distributing pipe and to restore kinetic energy to the concrete. Any stoppage of the movement of the concrete, even for comparatively short periods, introduces the liability of segregation, and also adherence, hardening and building up of the concrete on the various surfaces of the apparatus.

Clean-out holes are provided at suitable points in the various passages, which are normally closed by cover plates 100.

This application is a division of my prior copending application filed August 19, 1931, Ser. No. 558,175, entitled Concrete pump now Patent No. 1,991,342, granted February 12, 1935.

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 pumping apparatus for plastic concrete mixtures embodying substantial proportions of coarse aggregates, having a frame, and a plurality of working cylinders mounted thereon, a material receiving and agitating drum mounted on said frame above said cylinders, said drum being rotatable on a horizontal axis and provided with a material outlet opening in one of its end walls; a chest having a horizontal portion communicating with said opening to receive material therefrom, said chest also having a plurality of depending legs each communicating with a cylinder; a running seal between said drum and the horizontal portion of said chest; means in said drum arranged to agitate and move the material through said opening into said chest; and valve means arranged to prevent material in the cylinders from flowing back into the legs of said chest.

2. In mechanical pumping apparatus for plastic concrete mixtures embodying substantial proportions of coarse aggregate, a pressure concrete pump having a plurality of working cylinders each provided with an inlet; a rotatable concrete receiving and agitating drum mounted above said pump and having an end discharge opening; a chest having depending legs surmounting the inlets of the respective pump cylinders, and a lateral extension communicating with said drum opening, and providing closed passages between said opening and inlets; and means in said drum for discharging concrete from said drum into said chest extension faster than the pump withdraws it from the chest, whereby to keep said closed passages constantly filled with the mixture and segregation of the latter prevented.

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