Oct. 6, 1936. C. I. LONGENECKER 2,056,902

PRESSURE PUMP FOR PLASTIC CONCRETE MIXTURES

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Fig. 1.

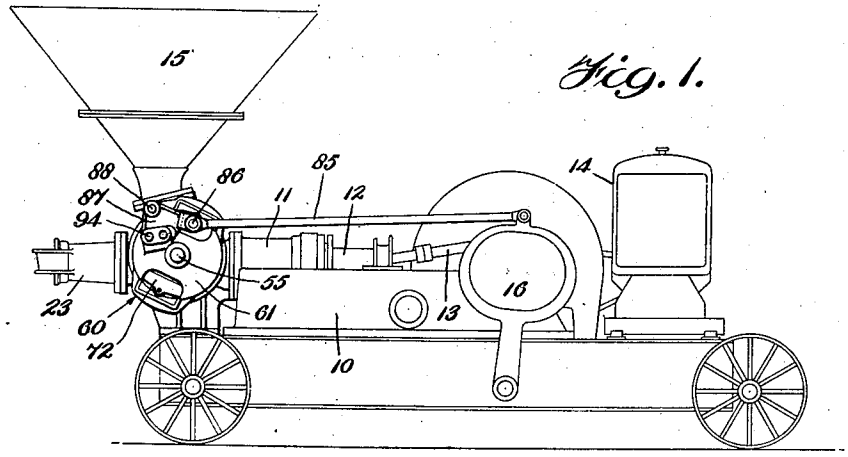

Fig. 2.

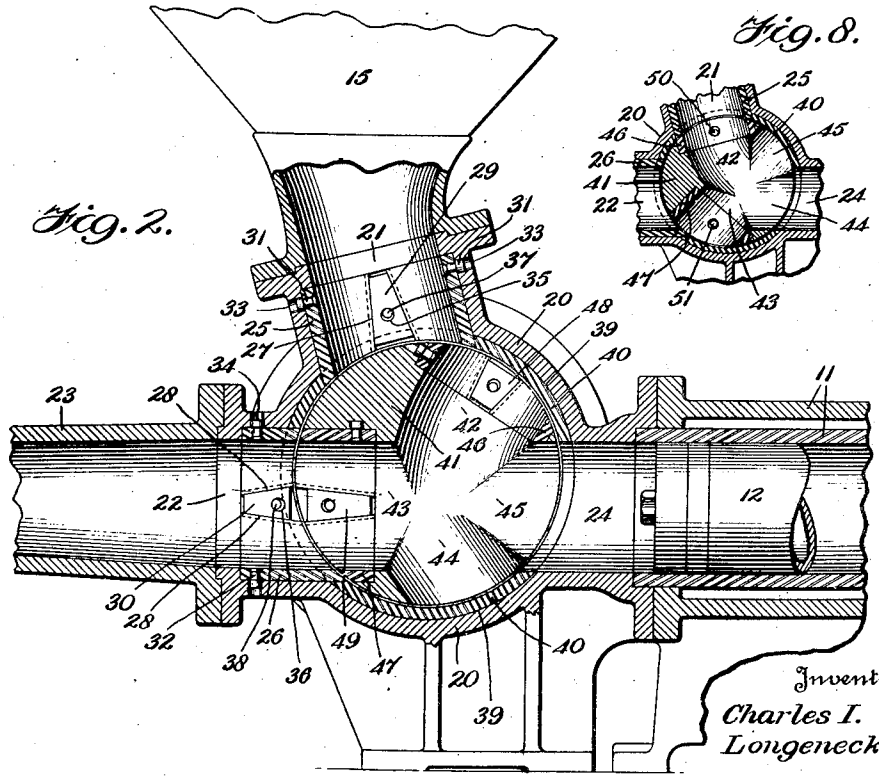

Fig. 8.

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Fig. 3.

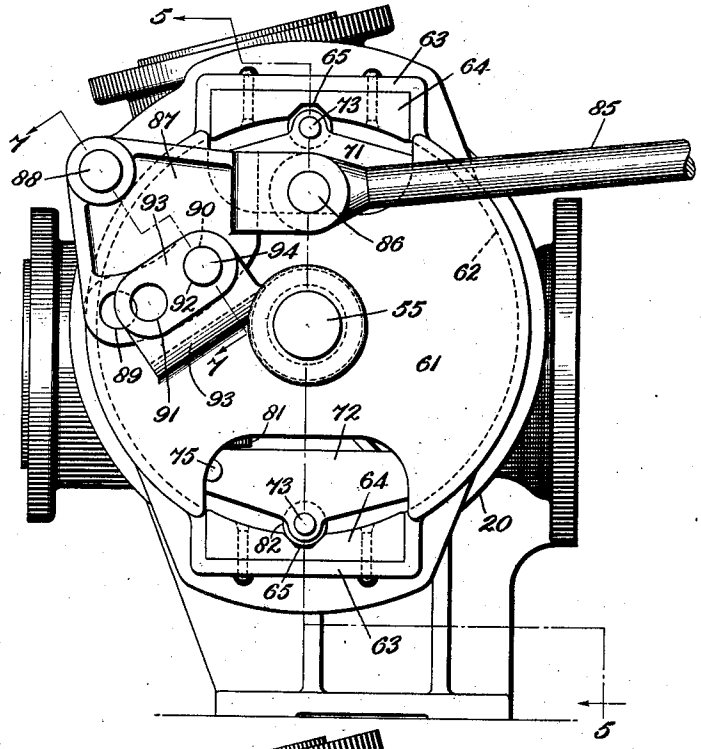

Fig. 4.

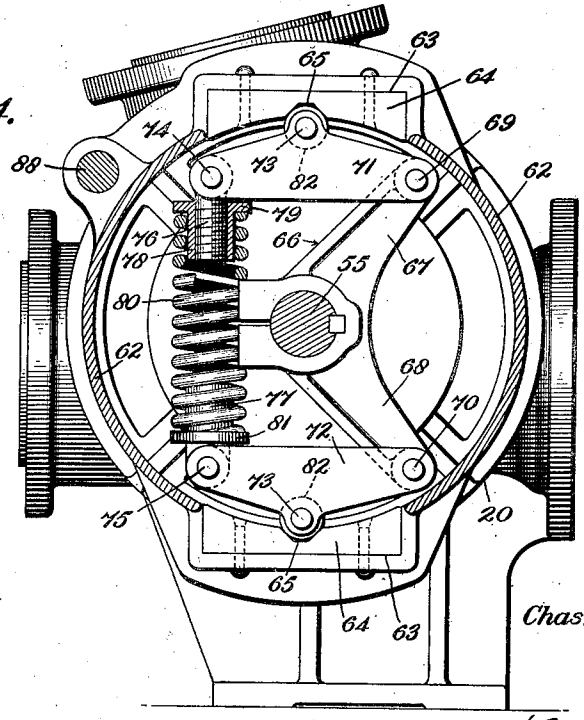

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Fig. 5.

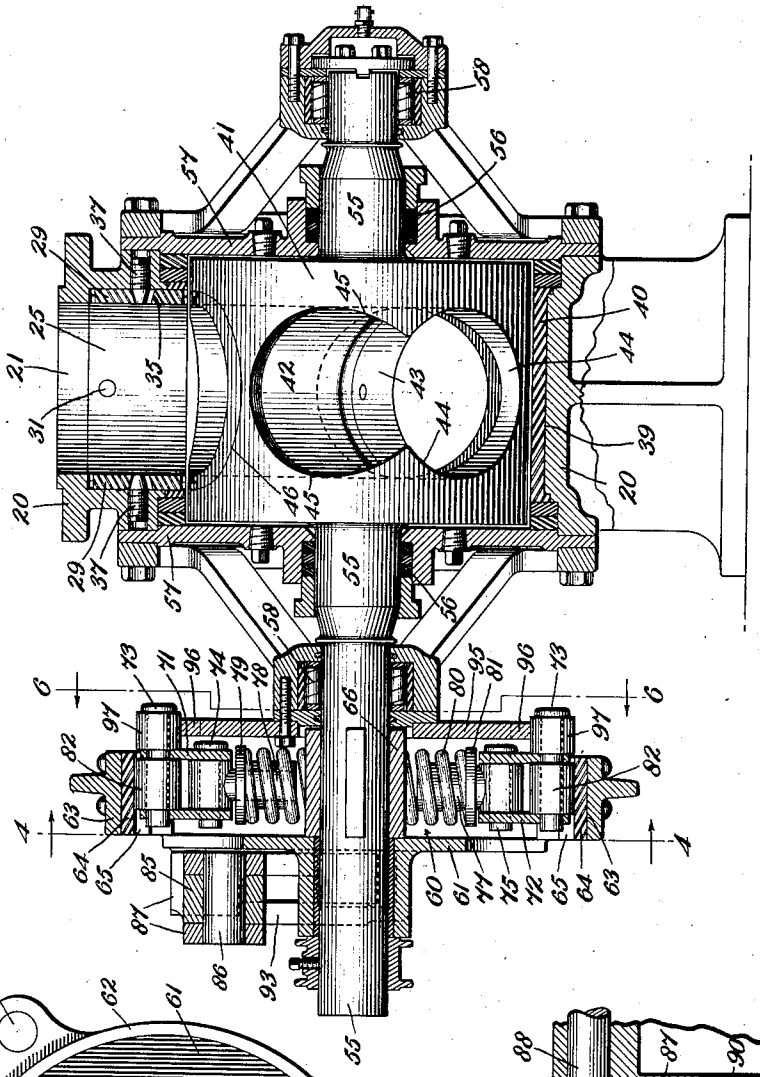


Fig. 6.

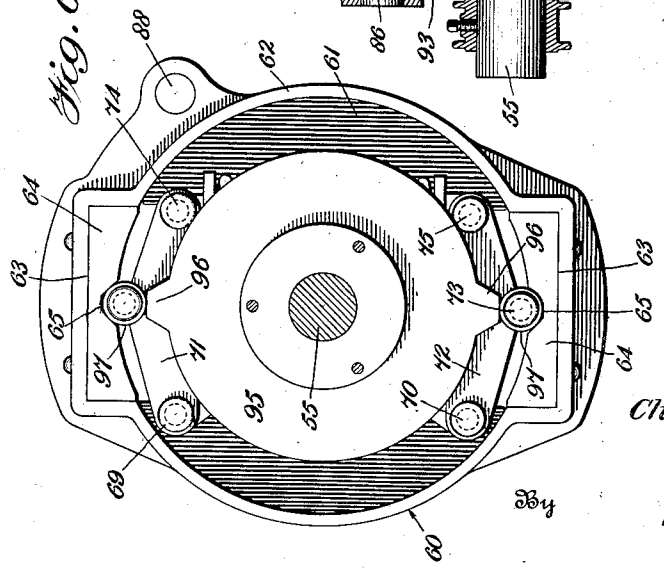
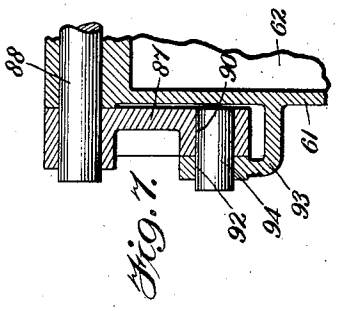


Fig. 7.



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2,056,902

PRESSURE PUMP FOR PLASTIC CONCRETE MIXTURES

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Application November 15, 1933, Serial No. 698,174

9 Claims. (Cl. 103—227)

This invention relates to pressure pumps for plastic concrete mixtures which embody substantial proportions of coarse aggregates, and has for one of its objects to provide a pump of this character in which a single valve, preferably of the oscillatory plug type, controls both the inlet and the outlet passages.

Reciprocating-piston concrete handling pumps, known to the trade as "Pumpcrete", have been recently placed on the market in single and multiple cylinder types in which seperate oscillatory plug valves are employed for controlling the flow of the plastic concrete through the inlet and outlet passages, and the present invention is a further development of certain of the basic principles embodied in said prior pumps. The valves of these pumps are provided with complete circumferential and end clearances between the plug and the housing to avoid sticking and reduce scoring of the parts due to the character of the material being handled, which clearances are not detrimental from a leakage standpoint because of the now well-recognized "stowing" property of the concrete mixture.

Likewise, because of the said "stowing" characteristic, the said valves are arranged to only partially restrict but never completely close-off a passage when it is desired to stop the flow of the material therethrough, the concrete packing or "stowing" at the restriction and serving as a portion of its own valve dam to completely stop its movement. The degree of restriction is usually adjusted so that the opening left is of a size substantially equal to the maximum dimension of the coarse aggregate being used, and thus the valves only infrequently engage a piece of aggregate which is larger than the average. Yielding means are ordinarily provided in the valve-actuating mechanism to permit the valve to stop short of its normal travel, and thus avoid crushing the aggregate. Ordinarily, the throw or travel of the valves is adjusted each time a material change is made in the average size of the coarse aggregate employed, so that the size of the opening left by the valve when in restricting position will correspond thereto.

For example, with a pump having passage ways 7" in diameter, in handling concrete in which the coarse aggregate comprises gravel or crushed rock in all sizes from ¼" up to say 3" in greatest dimension, the prior practice has been to set the valves so that in their most restricting positions an opening of approximately 3" would be left. The valves thus are not called upon to crush the aggregate, or yield, as the case might be, except occasionally upon encountering a piece of aggregate which is greater than the average maximum of 3" in size. But should the average size of the coarse aggregate be only 2", then before starting the pumping operation a manual adjustment may be made to increase the throw of the valve, whereby the size of the opening is reduced to approximately 2", since the pumps operate more efficiently with the greater restriction when handling such concrete.

In other words, a manual adjustment to control the valve travel and degree of restriction may be made each time the average size of the coarse aggregate changes.

The present invention, in addition to combining the control of the inlet and outlet passages of the pump in a single valve, modifies the partial restriction principle above mentioned to eliminate the necessity for adjustment and variation of the valve travel in accordance with the size of the aggregate being handled. That is to say, the valve is arranged to provide a restriction in its cut-off positions which will leave an opening of say only 1", and this is maintained for all concrete mixtures—except grout and mortar—irrespective of the size of the coarse aggregate contained therein. An overload-release is provided to protect the parts against excessive loads, but so far as the aggregates are concerned, the inlet and outlet ports of both the valve housing and plug are provided with hardened surfaces, which may take the form of bushings, inserts or other wear-resisting means, to act as crushing jaws adapted to crush any pieces of aggregate caught between the edges of the ports during the closing movements of the valve, without excessive injury to the parts.

When pumping grout—a thin mixture of cement and water—or mortar—a mixture of cement, water, and fine aggregate,—it is desirable that the valve completely close off the inlet and outlet passages, and to this end a single adjustment is provided whereby the valve travel may be increased to this extent. In view of the provision of the hardened elements at the ports which enable the valve to crush the coarse aggregate, if necessary, no harm will result if the pump be operated with coarse-aggregate concrete with the valve thus set, and under some conditions and/or with certain aggregates, this setting may be preferable.

Because of the peculiar conformation of the valve passages, it is desirable that the overload-release mechanism above referred to, be prevented from operating at a point mid-way between the open and closed positions of the valve, and it is one of the objects of the present invention to provide simple and efficient means for rendering such overload-release ineffective at this particular point.

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 here-

inafter 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 of a pump constructed in accordance with the present invention, the valve being shown as set for partial restricting movements;

Figure 2 is an enlarged longitiudinal sectional view through a portion of the cylinder, the valve, and a portion of the inlet and outlet passages, the valve being shown in the position which it assumes during the pressure stroke of the piston;

Figure 3 is an enlarged side elevational view of the valve showing the means for varying the travel of the valve plug, the setting here shown being that for producing total closure of the ports;

Figure 4 is a vertical sectional view taken approximately on the plane indicated by the line 4—4 of Figure 5 and showing the overload-release mechanism;

Figure 5 is a transverse sectional view through the valve and overload-release mechanism taken approximately on the plane indicated by the line 5—5 of Figure 3;

Figure 6 is a sectional elevational view taken approximately on the plane indicated by the line 6—6 of Figure 5 and showing the mechanism for rendering the overload-release ineffective at approximately the mid-point in the valve travel;

Figure 7 is a detail fragmentary sectional view taken approximately on the plane indicated by the line 7—7 of Figure 3; and

Figure 8 is a reduced fragmentary sectional view through the valve, similar to Figure 2, and showing a slightly modified form of bushing or lining for the inlet and outlet ports, the valve in this instance being shown in the position it assumes during the suction stroke of the piston.

The pump in general is similar to the prior pumps above referred to, comprising a bed 10, cylinder 11 mounted thereon, and piston 12 reciprocating in said cylinder by means of a piston rod 13 driven by a crank and gearing (not shown) from a motor mounted within the housing 14. The pump is also provided with a supply hopper 15 and with an oscillating valve actuating lever 16 which is rapidly intermittently moved back and forth by means of suitable cams, also not shown, upon the crank shaft.

The present valve as best shown in Figures 2 and 5, comprises a housing 20 provided with an inlet passage 21, which communicates with the supply hopper 15, an outlet passage 22 which communicates with the discharge line 23, and a passage 24 which communicates with the interior of the cylinder 11. The passages 22 and 24 are preferably in alinement with one another while the passage 21 is at an acute angle to the passage 22 as will be clear from Figures 2 and 8.

The passages 21 and 22 are provided with the hardened wear-resisting bushings or linings 25 and 26 respectively which, in the form shown in Figure 2, comprise substantially semi-cylindrical segments having inclined edges 27 and 28 for coaction with wedge shaped members 29 and 30 which are also preferably of hardened metal and which when assembled as shown in Figure 2 serve to expand and retain the semi-cylindrical sections within the counterbores of the passages 21 and 22, as will be readily understood. The semi-cylindrical members may be provided with suitable dowels 31 and 32 receivable in apertures 33 and 34 in the valve housing to prevent longitudinal movement of the segments and the wedges 29 and 30 are preferably provided with apertures 35 and 36 for engagement by the threaded pins 37 and 38 which retain the said wedges against longitudinal movement.

The bore 39 of the housing 20 is preferably provided with a hardened lining sleeve 40 and within this sleeve there is mounted the valve plug 41 having complete circumferential clearance between itself and said lining 40, and provided with the passageways 42, 43, 44 and 45 arranged substantially as shown in Figure 2. The passageways 42 and 43 are provided with hardened lining members 46 and 47 the construction of which may be substantially the same as that above described in connection with the linings for the passages 21 and 22 and the members thereof are retained in place by suitable wedges 48 and 49.

In lieu of the split linings 25, 26, 46 and 47 the wear-resisting members may of course be made in the form of complete annuli or tubes as shown in Figure 8, in which event they may be retained in place by threaded pins such as 50 and 51 similar to the pins which retain the wedges 29, 30, etc. in place in Figure 2.

Referring now more particularly to Figures 3 to 7 inclusive, and to Figure 5 in particular, it will be noted that the valve plug 41 is mounted on the shaft or spindle 55 which passes through suitable packing glands 56 carried by the end plates 57 of the valve housing, said shaft being preferably journalled in the out-board anti-friction bearings 58, which bearings, being outside of the packing glands 56, are effectively protected against the working of any of the finer abrasive materials therein and in practice have been found to have a very long life.

One end of the shaft 55 carries the overload-release mechanism which is indicated generally at 60. This mechanism comprises a housing 61 which is journalled upon the shaft 55 and is provided with an annular flange 62 having at substantially diametrically opposite sides outwardly offset rectangular recesses 63 in which are mounted the hardened steel blocks 64. These blocks are provided with notches or recesses 65 as clearly shown in Figures 5 and 6.

Also carried by the shaft 55 and rigid therewith is a substantially L-shaped member 66 to the ends of the arms 67 and 68 of which are pivotally connected as by the pins 69 and 70 one end of the pairs of links 71 and 72. These said links extend substantially parallel and carry at approximately their mid-portions pins or studs 73 and at their other ends are pivotally connected as by the pins 74 and 75 to the studs 76 and 77. Stud 76 is preferably threaded and has mounted upon it a thimble 78 having a flange 79 which serves as a seat for one end of a helical spring 80, the other end of which is seated upon a similar flange 81 provided upon the stud 77. By changing the position of the thimble 78 and flange 79 upon the threaded stud 76, the force exerted by the spring 80 may be varied to press the rollers 82 with greater or less force into the recesses 65, as will be readily understood.

The pins 73 carried by the links 71 and 72 have rotatably mounted upon them rollers 82 which are adapted to be received in the recesses 65 with which the blocks 64 are provided as will be clear from Figures 3 and 4. The said rollers are, however, yieldingly held within these recesses by reason of the pressure exerted by the

spring 80 upon the links 71 and 72, and there is thus provided a driving connection between the member 66 carried by shaft 55 and the housing 60 which is journalled upon the said shaft, which connection will yield upon excessive resistance being met by the valve plug 41 as it oscillates. In other words, if the valve during its motion from one position to the other encounters a piece of aggregate which it cannot crush or if, as is sometimes the case, a piece of iron or other uncrushable material should get into the valve, the movement of the plug may be stopped while the movement of the housing 60, which constitutes the driving member, may continue with the rollers 82 being forced out of the recesses 65 and up onto the arcuate surfaces of the blocks 64 as will be readily understood. When the valve actuating mechanism starts its return stroke the rollers 82 will ride over the curved surfaces of the blocks 64 until they reach the recesses 65 and during this portion of the movement no motion will be transmitted to the valve plug. When the rollers reach these recesses they will be forced therein under the influence of the spring 80, and the driving and driven members will thus again be coupled together.

As above stated the pump is provided with a rock lever 16 for actuating the valve and to this there is connected one end of a pitman or link 85, the other end of which is pivotally connected as by pin 86 to the travel-regulating arm 87. This arm, as is best shown in Figures 3 and 7, is substantially triangular in shape and is pivotally mounted by the pin or shaft 88 upon the housing 62 of the overload-release mechanism. The said arm is provided with a pair of spaced apertures 89 and 90 which are adapted to be selectively alined with similar apertures 91 and 92 provided in a bracket or lug 93 which is rigid with the housing 61. When the apertures 90 and 92 are alined and a pin 94 passed therethrough, thus locking the arm 87 to the housing member 61, the parts will be in the positions shown in Figure 3 with the connecting pin 86 at a given distance from the axis of shaft 55. The rock lever 16 and the pitman 85 always travel the same distance under the action of the valve actuating cams, and with the parts in the positions shown in Figure 3, in the present instance the valve plug 41 will be moved through an angle of approximately 74° to move the passageway 43 out of alinement with the passageway 22 and to bring the passageway 42 into substantial alinement with the passageway 21, as will be readily understood. This said movement is sufficient to completely mis-aline the passageway 43 with the passageway 22 and likewise, when the valve is moved in the opposite direction back toward the position shown in Figure 2 the intake ports will be completely mis-alined, and the intake passage 21 completely blocked-off.

However, if the pin 94 be withdrawn from the alined apertures 90 and 92, and the travel regulating arm 87 be swung upon its pin 88 to bring the apertures 89 and 91 into alinement, and the pin 94 then be inserted in these alined apertures, as shown in Figure 1, the effect will be to move the pin 86 which connects the pitman 85 with the arm 87 outwardly from the axis of shaft 55, and since the longitudinal travel of the pitman 85 still remains the same the effect is to reduce the arcuate travel of the valve to approximately 52° with the result that the passageways 42 and 43 will not be moved a sufficient distance to completely cut off the passages 21 and 22 but an opening of approximately one inch will be left as indicated in Figures 2 and 8 with the valve in these respective positions.

The valve actuating cams, as is customary in this type of pump, are designed to impart relatively rapid movement to the valve from one position to the other, which movement of course takes place when the piston 12 is substantially stationary at the respective ends of its stroke. This, together with the fact that the intake passage 42 of the valve plug is at substantially right angles to the outlet passage 43, thereby providing a crooked, sharp angled course from inlet to outlet, which tends to eliminate "back-slip" of the material, or in other words, reverse flow of the concrete mixture from the outlet passage back through the inlet passage due to back pressure which will necessarily exist in the discharge line when the mixture is being pumped vertically upward. That is to say, because of the comparatively thick, sticky nature of the mixture, its natural tendency when under pressure is to move in straight lines, and it resists any effort to cause it to make sharp turns, such as would be necessary to move from passage 43 to passage 42.

As above mentioned it is desirable to prevent the overload-release mechanism from functioning when the valve is in substantially mid-position since if movement of the plug be arrested at this point such 'back-slip" might occur. For this purpose there is provided a simple and effective means best shown in Figures 5 and 6. That is to say, a substantially circular plate or disk 95 is bolted or otherwise rigidly secured to the housing of the anti-friction bearing 58 which is adjacent the overload-release mechanism 60, which disk is provided with a pair of substantially diametrically opposed projections 96. The pins 73 which journal the rollers 82 of the overload release mechanism also carry adidtional rollers 97 disposed in alinement with the disk 95 and when the valve is in mid-position as shown in Figures 5 and 6, these said rollers 97 just clear the outer surfaces of the cam projections 96. Obviously, should the overload release mechanism tend to function when the parts are in this position to withdraw the rollers 82 from the recesses 65, such action will be prevented by engagement of the rollers 97 with the cam projections 96. However, when the valve has moved beyond the mid-point the rollers 97 will have been moved clear in one direction or the other of the projections 96 and functioning of the overload release mechanism will again be permitted.

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 I claim is:

1. In a pump for moving plastic concrete mixtures which embody substantial proportions of coarse aggregates, a working chamber; a pressure member working in said chamber; a valve housing having a port communicating with said chamber, an inlet port, and an outlet port; a valve member in said housing having a plurality of passages so arranged that in one position they afford free and unobstructed communication between said outlet and working chamber ports, with a portion of said member partially restricting said inlet port, and in another position they

afford free and unobstructed communication between said inlet and working chamber ports, with a portion of said member partially restricting said outlet port, said partial restrictions serving through "stowing" of the mixture thereat to cut off the movement of the mixture through the passage thus restricted; and means for moving said valve member from one position to the other.

2. In a pump for handling plastic concrete mixtures which embody substantial proportions of coarse aggregates, a working chamber; a pressure member working in said chamber; a valve housing having a port communicating with said chamber, an inlet port, and an outlet port; a valve member in said housing having a plurality of passages so arranged that in one position they afford free and unobstructed communication between said outlet and working chamber ports with a portion of said member partially restricting said inlet port, and in another position they afford free and unobstructed communication between said inlet and working chamber port, with a portion of said member partially restricting said outlet port, said partial restrictions serving through "stowing" of the mixture thereat to cut off the flow of the mixture through the passage thus restricted; means for moving said valve member from one position to the other; and means for varying the travel of said valve member to cause it to completely close said inlet and outlet ports if desired.

3. In a pump for handling plastic concrete mixtures, a working chamber; inlet and outlet passages leading to and from said chamber; a pressure member working in said chamber; a valve for controlling at least one of said passages; means including a driving member connected to said valve, and a pitman, for moving said valve to control said passage; a travel-regulating member adjustably carried by said driving member and connected to said pitman; means for positively connecting said travel-regulating member to said driving member in a plurality of different positions, whereby the position of the connection between the travel-regulating member and pitman is varied to change the length of travel of the valve whereby the pump may be readily adapted to the handling of plastic mixtures which either do or do not embody substantial proportions of coarse aggregates; and means for actuating said pitman.

4. In a pump for handling plastic concrete mixtures, a working chamber; inlet and outlet passages leading to and from said chamber; a pressure member working in said chamber; a valve controlling said passages; means, including a driving member connected to said valve and a pitman, for moving said valve, said driving member being provided with a plurality of apertures; a travel-regulating member pivotally carried by said driving member, and having a pivotal connection with said pitman, said travel-regulating member also having apertures arranged to aline with various apertures of said driving member as said travel-regulating member is swung upon its pivotal mounting to shift the position of said pivotal connection between the travel-regulating member and pitman; means engageable in the alined apertures of the travel-regulating and driving members to positively connect the same; and means for actuating said pitman.

5. In a pump for handling plastic concrete mixtures which embody substantial proportions of coarse aggregates, a working chamber; a pressure member working in said chamber; a valve for controlling the flow of the concrete mixture to and from said chamber, comprising a housing and a valve member movable therein, said housing and valve member being provided with co-operating passages for the mixture; means comprising hardened metal bushings in said valve passages arranged to crush any coarse aggregates present in the passage ports during closing movements of the valve member; and means for moving said valve member.

6. In a pump for handling plastic concrete mixtures which embody substantial proportions of coarse aggregates, a working chamber; a pressure member working in said chamber; a valve movable from one position to another for controlling the flow of concrete to said chamber; an overload release mechanism connected to said valve, arranged to permit stoppage of the valve movement should the valve encounter resistance in excess of a predetermined amount; and means for rendering said overload release mechanism temporarily inoperative at a predetermined point intermediate the open and closed positions of the valve.

7. In a pump for handling plastic concrete mixtures which embody substantial proportions of coarse aggregates, a working chamber; a pressure member working in said chamber; a valve movable from one position to another for controlling the flow of concrete to said chamber; an overload release mechanism connected to said valve, arranged to permit stoppage of the valve movement should the valve encounter resistance in excess of a predetermined amount; and a cam for rendering said overload release mechanism temporarily inoperative at a predetermined point intermediate the open and closed positions of the valve.

8. In a pump for handling plastic concrete mixtures which embody substantial proportions of coarse aggregates, a working chamber; a pressure member working in said chamber; a valve movable from an open to a closed position and vice versa, for controlling the flow of concrete from said chamber; an overload release mechanism connected to said valve, arranged to permit stoppage of the valve movement should the valve encounter an excessive amount of resistance; a member adjacent the valve having projections thereon; and members carried by the overload release mechanism arranged to co-operate with said projections to render said release mechanism inoperative at a predetermined point intermediate the open and closed positions of the valve.

9. In a pump for moving plastic concrete mixtures which embody substantial proportions of coarse aggregates, a working chamber; a pressure member working in said chamber; and a single valve for controlling the movement of concrete to and from said chamber, comprising a housing having inlet and outlet ports, and a valve member having angularly disposed inlet and outlet passages of substantially equal cross sectional area, arranged to be respectively alternately aligned with said inlet and outlet ports and to be moved at least partially out of such alignment, said passages intersecting one another to provide a sharply angular course which assists in preventing back-slip of the mixture when said passages are simultaneously only partially aligned with their respective parts as the valve moves from one position to the other.

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