Sept. 11, 1945. C. I. LONGENECKER 2,384,783

PUMP FOR PLASTIC CONCRETE MIXTURES

Filed Sept. 23, 1943 4 Sheets-Sheet 1

Fig. 1.

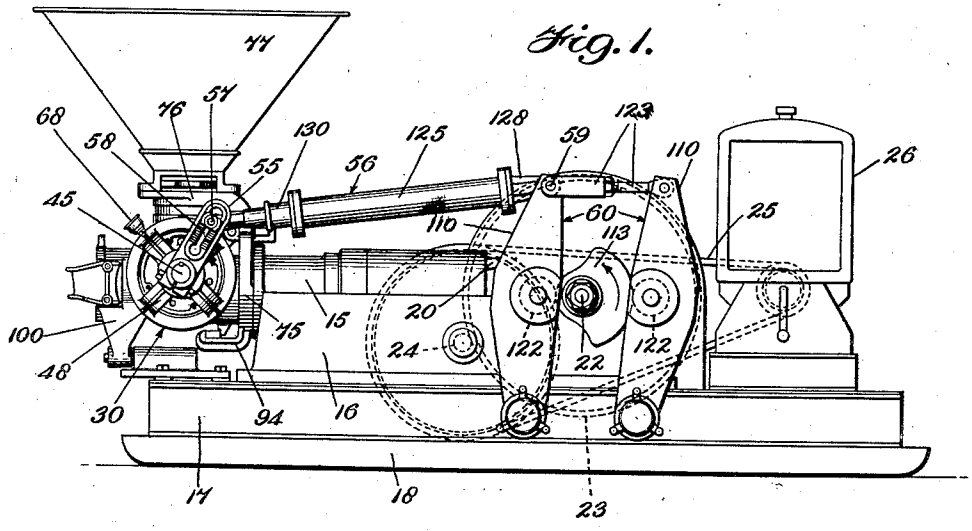
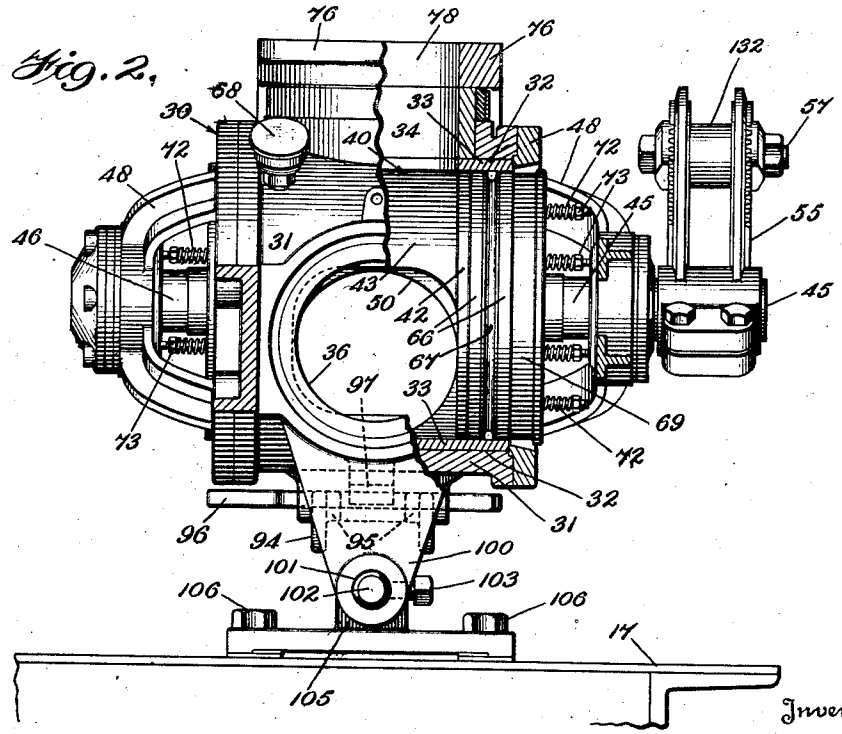


Fig. 2.



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Filed Sept. 23, 1943 4 Sheets-Sheet 2

Fig. 3.

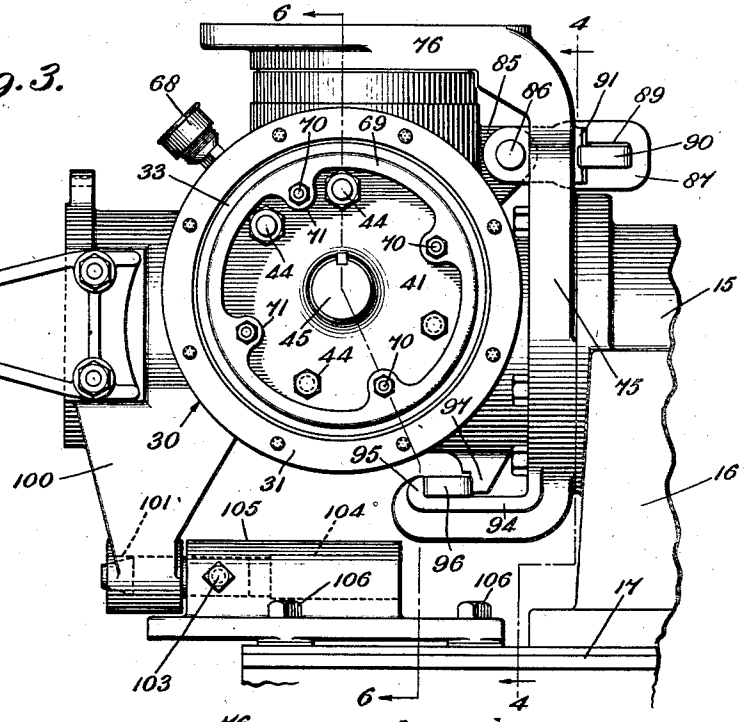
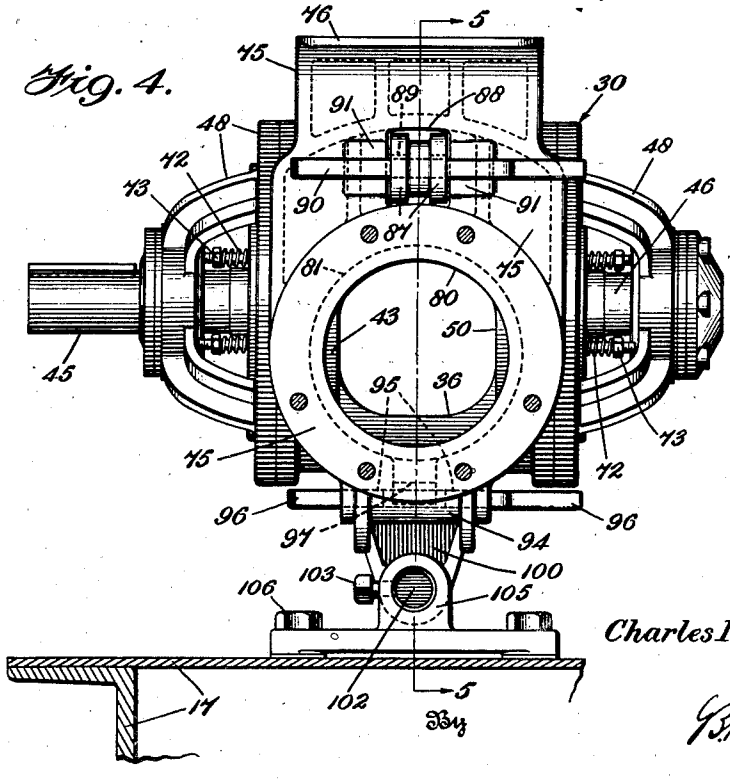


Fig. 4.



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Filed Sept. 23, 1943 4 Sheets-Sheet 3

Fig. 5.

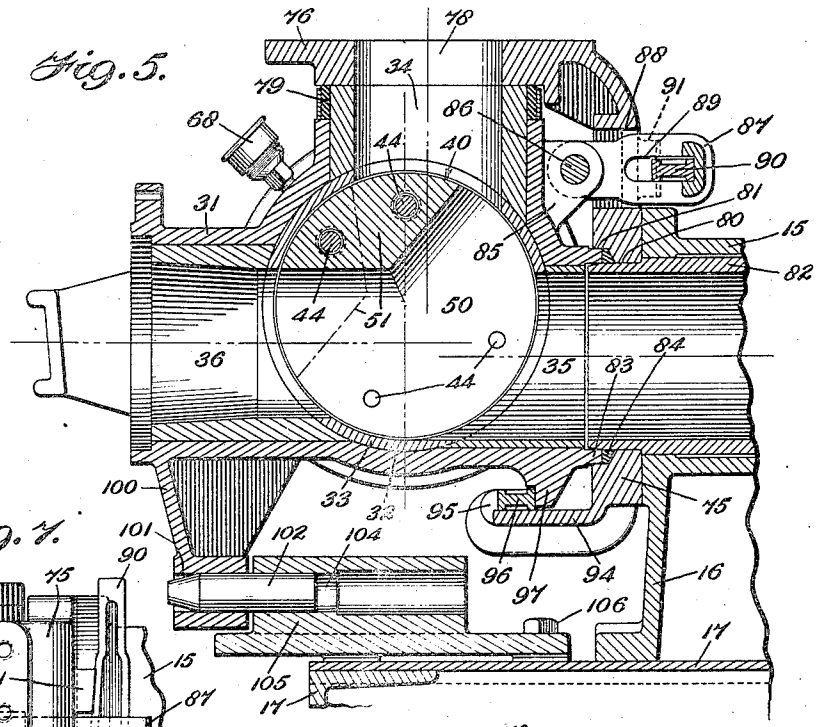


Fig. 7.

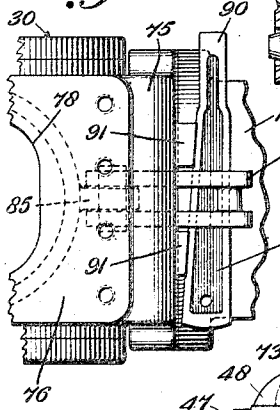
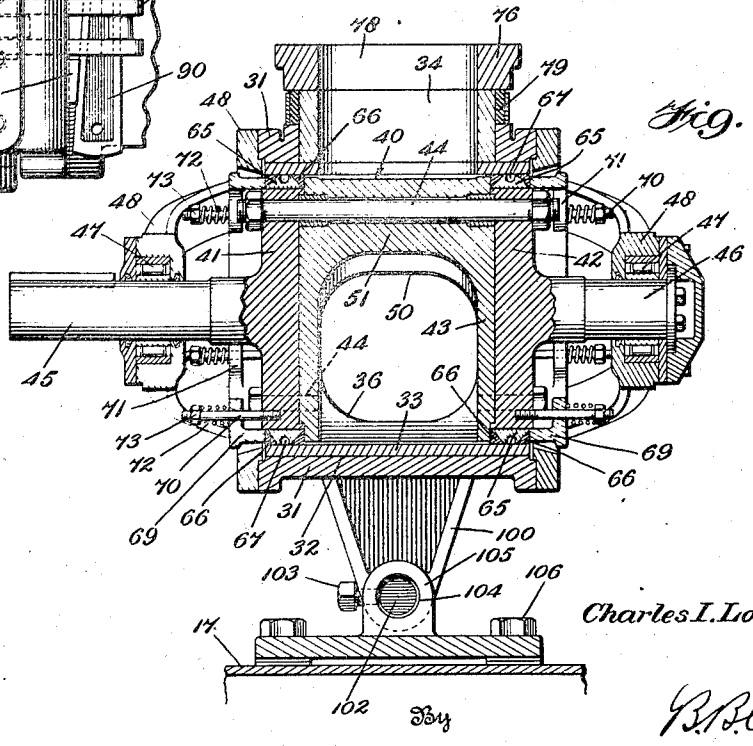


Fig. 6.



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Filed Sept. 23, 1943 4 Sheets-Sheet 4

Fig. 8.

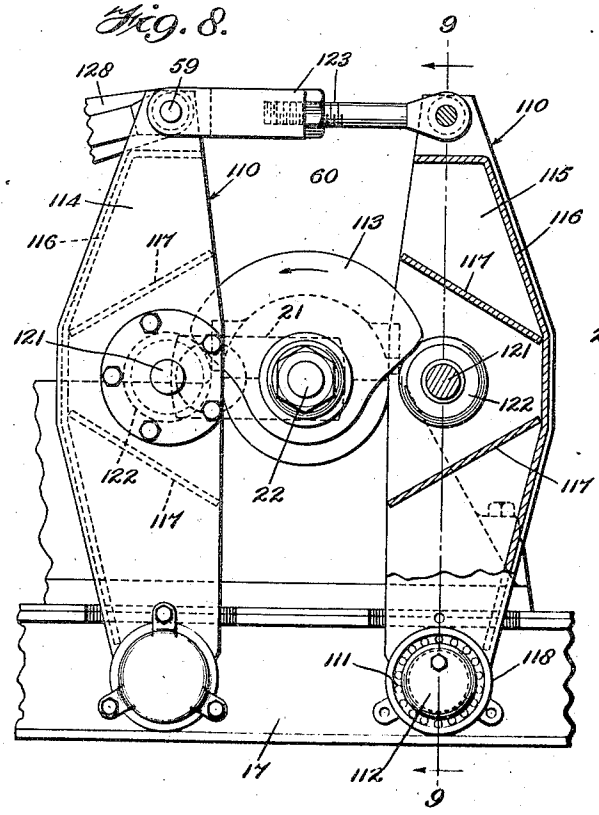


Fig. 9.

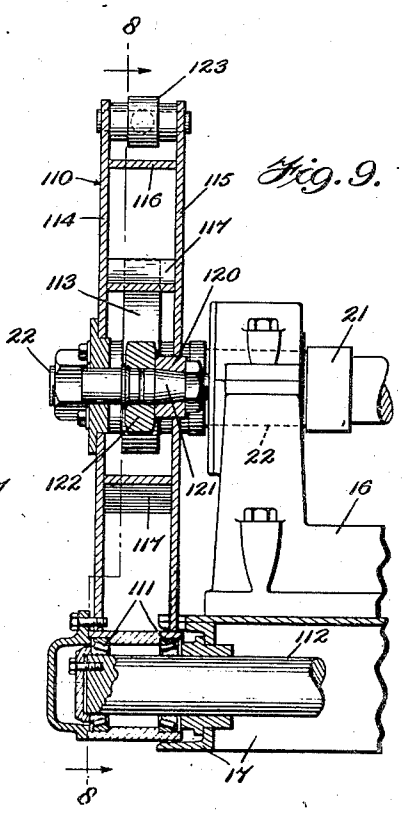
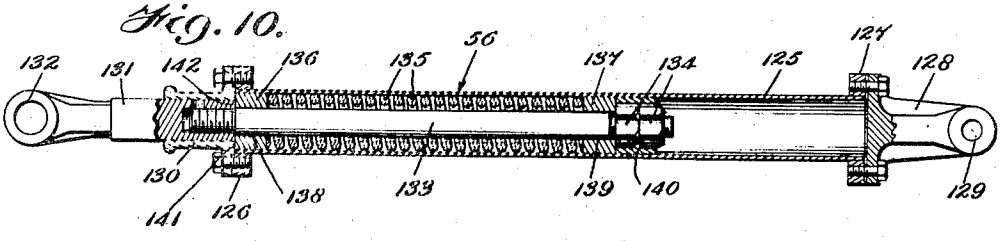


Fig. 10.



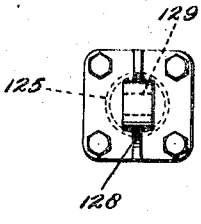


Fig. 11.

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2,384,783

UNITED STATES PATENT OFFICE

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PUMP FOR PLASTIC CONCRETE MIXTURES

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Application September 23, 1943, Serial No. 503,549

9 Claims. (Cl. 103—228)

The invention relates to pumps and more especially those of the reciprocating piston type which are primarily intended for forcing plastic concrete mixtures in confined streams, generic examples of which may be found in prior U. S. Patents Nos. 2,017,974 and 2,017,975 granted October 22, 1935 on applications filed by Otto M. Kastner and Jacobus C. Kooyman, respectively. The machine disclosed in each of these said patents was of the double valve type, i. e. it had separate valves for controlling the inlet and outlet passages through which the plastic mixture moved to and from the working cylinder; and while certain of the features of the present invention are applicable or readily adaptable to such double valve pumps, in other aspects the present apparatus more resembles that disclosed in my prior U. S. Patent No. 2,056,902 granted October 6, 1936, in that it employs a single valve for controlling movement of the mixture through the passages leading to and from the cylinder.

The principal objects of the invention are to improve the valve structure and its mounting; the mechanism for actuating the valve in timed relation to the movements of the working piston; and the means for packing the valve against leakage.

For purposes of disclosure a pump of the above mentioned generic type, embodying typical examples of the features constituting the present invention, has been illustrated in the accompanying drawings forming a part of this specification, in which

Figure 1 is a side elevational view of such pump;

Fig. 2 is an enlarged end elevational view, partly broken away and in section, of the valve and its mounting, as seen from the left of Fig. 1;

Fig. 3 is a side elevational view of the valve and mounting, on the same scale as Fig. 2, looking in the same direction as in Fig. 1 but with the actuating arm and the bearing spider for the valve shaft removed;

Fig. 4 is a sectional-elevational view of the valve and mounting, as seen from the planes indicated by the line 4—4 of Fig. 3, looking in the direction of the arrows;

Fig. 5 is a longitudinal sectional view, taken approximately on the plane indicated by the line 5—5 of Fig. 4, looking in the direction of the arrows;

Fig. 6 is a cross sectional view, taken approximately along the planes indicated by the line 6—6 of Fig. 3, looking in the direction of the arrows;

Fig. 7 is a fragmentary plan view of the valve and mounting;

Fig. 8 is an enlarged side elevational view of the cam and levers for actuating the valve, said view being partly broken away and in section on approximately the planes indicated by the line 8—8 of Fig. 9;

Fig. 9 is a transverse sectional view of said actuating cam and levers, taken approximately along the plane indicated by the line 9—9 of Fig. 8, looking in the direction of the arrows;

Fig. 10 is a longitudinal sectional view, partly in elevation, of the connecting rod for the valve; and

Fig. 11 is an end elevational view of the said rod, as seen from the right of Fig. 10.

Referring more particularly to Fig. 1, the pump comprises a working chamber or cylinder 15 carried by a bed 16 mounted on a frame 17 provided with skids 18 for ground traverse. A piston (not shown) is reciprocated within the said cylinder by means of a piston rod 20 and crank 21, carried by or formed on the main shaft 22, see Figs. 8 and 9. The said shaft is driven by spur gearing 23 from a countershaft 24, which in turn is driven by a belt drive 25 from an internal combustion engine or other motor contained within a housing 26.

The single valve for controlling the passages through which the mixture moves to and from the cylinder 15 is indicated generally at 30, and as in the pumps of the prior patents mentioned above is of the oscillating plug type. As will be readily understood from Figs. 2–7 inclusive, this valve comprises a body 31 having a transverse bore 32, which is preferably provided with a hardened wear-resisting liner 33. The said body is also provided with an inlet passage 34 leading to the said bore 32; a cylinder passage 35, alined with and affording communication between the cylinder 15 and the said bore; and a discharge passage 36 leading from the bore. As is best shown in Fig. 5, the inlet passage 34 is disposed at substantially right angles to the passages 35 and 36, and its axis is somewhat offset from the axis of the bore 32, while the axis of the discharge passage 36 is somewhat higher than that of the cylinder passage 35, all as indicated by the center lines shown in said figure.

A valve plug 40 is mounted for oscillation within the bore 32 which plug, as best shown in Fig. 6, comprises two end elements 41 and 42, and an intermediate element 43, all of which are rigidly secured together by bolts 44. The respective end members 41 and 42 carry the stub shafts or trunnions 45 and 46 which are journaled in outboard

bearings 47 housed in spiders 48 which are secured to each end of the valve body 31. The intermediate plug member 43 is provided with a passage 50 through which the plastic concrete mixture may move alternately from the inlet passage 34 to the cylinder 15, and from the said cylinder to the discharge passage 36. The said plug passage 50 is so formed as to provide a valve segment 51 which is oscillatable between a discharge position, illustrated in full lines in Fig. 5, and an inlet position, indicated in broken lines in said figure. In the first of these positions the segment partially restricts the inlet passage 34 while permitting free and unobstructed flow of the mixture from the cylinder 15 to the discharge passage 36 through the passages 35 and 50, while in the second of said positions the segment partially restricts the outlet passage 36 while permitting free and unobstructed flow of the mixture from inlet passage 34 to the cylinder 15 through the passages 50 and 35.

By constructing the valve plug 40 in three sections as above described, the intermediate element 43, which operates solely in the zone of the ports of the passages 34, 35 and 36, may be formed of a material, such for example, as a high carbon alloy steel, which is particularly adapted, through heat-treatment or otherwise, to withstand the abrasive action of the concrete mixture moving through the said passages and its own passage 50, while the two trunnion-carrying end elements 41 and 42 may take the form of ordinary steel castings or forgings, which are better adapted for machining and/or less expensive. Furthermore, when wear resulting from said abrasive action ultimately makes renewal of certain of the valve parts necessary, only the intermediate element 43 of the plug need be replaced, since the end elements 41 and 42 are not subject to such abrasion-induced wear.

The trunnion 45 of the valve plug projects beyond its bearing 47 and rigidly carries a slotted actuating arm 55, here shown as of the type disclosed in U. S. Patent No. 2,127,663 granted August 23, 1938 on an application filed by Louis G. Hilkemeier. One end of a connecting rod 56, to be later described more in detail, has an adjustable connection 57 with the slot 58 of the arm 55, while the other end of said connecting rod is pivotally connected at 59 to a valve actuating mechanism 60, also to be more fully hereinafter described.

As best shown in Figs. 2, 3 and 6, the end elements 41 and 42 of the valve plug 40 are of somewhat smaller diameter than that of the intermediate element 43, and in each of the annular recesses thus provided between the circumferential faces of the elements 41 and 42 and the inner face of the liner 33 there is disposed a set of packing rings. Each of these sets comprises a metallic annulus 65 having oppositely beveled ends against which abut rawhide, rubber or similar yielding rings 66 of substantially triangular cross section. The outer circumferential face of the metallic ring 65 is provided with a medial groove 67 into which lubricating and/or concrete setting-inhibiting material, such for example as hard grease, may be forced from grease cups 68 mounted on the valve body 31. A pressure annulus or gland 69 concentrically engages the outer yieldable ring 66, being slidably mounted upon studs 70 carried by the plug elements 41 and 42, which studs pass through ears 71 formed on the annulus 69, as will be clear from Figs. 2 and 3. Helical compression springs 72 surround each of the studs 70 between the ears 71 and adjusting nuts 73 threaded upon the outer end portions of the said studs, which springs constantly urge the glands 69 against the packing rings, as will be readily understood. Obviously the pressure exerted by the springs 72 upon the glands may be varied as desired by adjustment of the nuts 73.

In this connection it will be noted that, in contradistinction to the valves heretofore commonly employed in pumps of this character, no end plates are employed for closing the open ends of the plug bore. As a result any leakage of mixture constituents through the seal provided by the packing rings 65 and 66, due to wear on the said rings, may be quickly detected by visible inspection of the seal, and prompt steps taken to overcome it by adjustment of the nuts 73 (which are constantly readily accessible) to increase the pressure exerted by springs 72 upon the gland rings 69.

While the glands or pressure rings 69 are here shown as carried by the valve plug 40, it will be readily obvious to those skilled in the art that they might also be mounted on the spiders 48.

The valve 30 is mounted in operative position in relation to the cylinder 15 in a manner to greatly facilitate its removal and replacement. To this end a bracket member 75 is rigidly secured to the end of the cylinder 15, which bracket has an upper horizontal platform 76 upon which is mounted a mixture supply hopper 77. The said platform is provided with a passage 78 affording unobstructed communication between the outlet port of said hopper and the inlet passage 34 of the valve, and a rubber or equivalent yieldable gasket 79 may be employed to prevent leakage at the joint between these passages.

The vertical portion of the bracket member 75 is provided with a bore 80 and a counterbore 81 through which extends the end of a hardened wear-resistant liner 82 with which the cylinder 15 is provided, see Figs. 4 and 5. The counterbore 81 readily removably receives the cylinder passage spigot 83 of the valve body 31, suitable packing 84 being seated in said counterbore to provide a leak-proof joint. The said valve body is provided with an ear 85 to which is pivotally secured as at 86 a link 87 which projects through an aperture 88 formed in the upper part of the vertical portion of the bracket 75. The projecting portion of the link 87 is provided with a slot 89 through which a wedge 90 is inserted, which wedge engages with a pair of pads 91 carried by the bracket 75, one to either side of the opening 88, see Figs. 3, 4, 5 and 7.

The lower part of the vertical portion of the bracket 75 is provided with a forwardly extending arm 94, the forward end of which is formed with a pair of transversely spaced pads 95. A wedge 96 is inserted between these pads and a medial lug 97 depending from the valve body 31, which lug is adapted to pass between the spaced pads as the valve body is moved longitudinally of the pump in assembly and disassembly. As will be readily understood, the link 87, wedge 90 and pads 91, and the pads 95, wedge 96 and lug 97, constitute quick-detachable means for firmly securing the valve 30 in the operative position illustrated in the drawings.

The forward portion of the valve body, beneath the discharge passage 36, is provided with a depending leg 100, having an aperture or socket 101 in its lower portion which is slidably received

on a pin 102 which is secured by a set screw 103 in the bore 104 of a barrel 105 attached to the pump frame 17 by bolts 106. These parts serve to position and guide the valve body during assembly, and also support the forward end of the valve in the assembled position. The rearward end of the body is of course positioned and supported in the counterbore 81 of the bracket 75, and the valve is firmly but nevertheless readily removably secured in place by the wedges 90 and 96, and their associated parts, as will be readily understood from the drawings and the above explanation.

The details of the construction of the valve actuating mechanism 60 referred to above, are best shown in Figs. 8 and 9. A pair of lever structures 110 have their lower ends journaled by suitable bearings 111 upon fixed shafts 112 mounted transversely of the pump frame 17, in planes substantially equidistantly in front and to the rear respectively of the vertical plane of the main shaft 22 of the pump, which shaft rigidly carries a cam 113. The levers 110 are constructed principally of sheet metal, and comprise spaced front and back plates 114 and 115, an end plate 116, intermediate bracing plates 117 and a hub 118, which houses the bearings 111. The several plates and hub are welded together substantially as shown to form a structure closed on all sides except that facing the cam 113.

At the medial portion, in substantially the horizontal plane of the main shaft 22, the back plate 115 is provided with a boss 120 in which is rigidly mounted a stub shaft 121. A roller 122 is journaled on the said stub shaft in position to engage the peripheral face of the cam 113. At their tops the lever structures 110 are connected by an adjustable connection 123, whereby the levers may be adjusted toward and from one another to properly position the rollers 122 for engagement with the cam face.

While in accordance with the principles set forth in the prior Patents Nos. 2,017,974 and 2,017,975 mentioned above, the valve segment 51 never completely closes off the inlet and outlet passages 34 and 36, it may happen that in its movement to block one or the other of said passages a piece of the large aggregate of the concrete mixture, or a piece of some extraneous material, such as tramp iron, which may have gotten into the mixture inadvertently, may be caught between the advancing edge of the segment and the wall of the passage. To prevent overload on and possible damage to the valve and/or other parts of the machine, the connecting rod 56, by means of which the motion of the cam-actuated levers 110 is transmitted to the valve, is so constructed as to yield and permit stoppage of movement of the valve plug in either direction, notwithstanding continued movement of the levers 110 through their regular cycle.

The construction of the said connecting rod is best shown in Figs. 10 and 11, from which it will be seen that the rod comprises a tubular housing 125 having flanges 126 and 127 at its respective ends, to the latter of which is bolted or otherwise secured an end member 128 having an eye 129 to receive the pivotal connection 59 whereby the rod assembly is connected to the cam-actuated mechanism 60 for movement thereby. To the flange 126 there is removably secured a thimble 130 which slidably accommodates an end member 131 having an eye 132 for receiving the pin 57 by means of which the forward end of the rod assembly is connected to the slotted valve arm 55. The end member 131 rigidly carries a rod 133 which extends rearwardly in the housing 125 axially thereof and is provided at its rear end with a pair of lock nuts 134. A compression spring 135 surrounds the rod 133, being longitudinally confined between a pair of sleeves 136 and 137 which are slidably mounted in the housing 125 and are respectively provided with bores 138 and 139 which slidably accommodate the rod 133. The sleeve 136 normally abuts the shoulders 141 and 142 provided by the thimble 130 and the end member 131 respectively at the forward end of the housing 125, while the sleeve 137 normally abuts the forward nut 134 and a stop ring 140 fixedly carried by the said housing.

The spring 135 is of such strength as to transmit without yielding all pressures normally encountered in moving the valve plug 40 and its segment 51 to and fro through the concrete mixture. However, if in moving the valve from say the full line to the broken line positions indicated in Fig. 5 (in which the connecting rod 56 would be moving from right to left, as seen in Figs. 1 and 10), the segment 51 should trap a piece of large aggregate, or encounter a large piece of extraneous material, whereby resistance to its movement will be materially increased, the spring 135 will yield, permitting the end member 128, housing 125 and thimble 130 to continue their leftward movement under the action of the cam-actuated mechanism 60, while the valve plug 40, arm 57, end member 131 and rod 133 remain stationary. During this action the sleeve 137 is slid along the rod 133 by the stop ring 140 of the housing, while the sleeve 136 is restrained against movement by its engagement with the abutment shoulder 142 provided by the end member 131.

Should the abnormal resistance be encountered during the reverse movement of the valve, i. e., from the broken line to the full line positions of Fig. 5, the spring 135 will again yield, permitting the thimble 130, housing 125 and end member 128 to continue their movement toward the right, while motion of the valve plug 40, valve arm 57, end member 131, rod 133 and lock nuts 134 ceases. In this case however, the sleeve 136 will be drawn along the rod 133 by the thimble 130, whereas the sleeve 137 will be restrained by the abutment provided by the now stationary lock nuts 134. It thus results that damage to the valve and/or other parts of the apparatus due to abnormal resistance to movement of the oscillating valve will be prevented by the yieldable connecting rod assembly 56, regardless of the direction in which such movement is taking place.

In this connection it will be readily understood from the foregoing that the lock nuts 134 and shoulder 142 of the valve-connected element serve alternatively (depending upon the direction of movement at the time abnormal valve resistance is encountered) as abutments for the respective ends of the spring 135, against which the latter is compressed by the shoulder 141 and ring 140 of the element connected to the valve-actuating mechanism 60, operating respectively against the end of said spring opposite that which is at the time being restrained by the said lock nuts 134 or shoulder 142.

The member 131, rod 133, nuts 134, spring 135 and sleeves 136 and 137 comprise an assembly which may be withdrawn as a unit from the housing 125 for inspection, repair and/or

replacement, by merely removing the bolts which secure the thimble 130 to the said housing.

What is claimed is:

1. In a pressure pump for plastic concrete mixtures, having a working chamber and a mixture-controlling valve: a bracket member carried by said chamber for readily detachably engaging and supporting a portion of said valve in operative position relative to the chamber; and wedging means engaging portions of the valve and bracket member to secure the valve in said operative position.

2. In a pressure pump for plastic concrete mixtures, having a working chamber and a mixture-controlling valve: a bracket carried by said chamber provided with an aperture and with a recess for readily removably receiving and supporting a portion of said valve in operative position relative to the chamber; a member carried by the valve, projecting through said bracket aperture; and quick detachable means engaging said valve-carried member and bracket to secure the valve in said operative position.

3. In a pressure pump for plastic concrete mixtures, having a working chamber and a mixture-controlling valve: a bracket carried by said chamber provided with an aperture and with means for readily detachably engaging and supporting a portion of said valve in operative position relative to the chamber; a link carried by the valve and projecting through said bracket aperture; and wedging means engaging with said link and portions of said bracket to secure the valve in said operative position.

4. In a pressure pump for plastic concrete mixtures, having a working chamber and a mixture-controlling valve: a bracket carried by said chamber, provided with an arm and with means for readily detachably engaging and supporting a portion of said valve in operative position relative to the chamber; a projection carried by the valve; and quick-detachable means co-operating with said projection and said bracket arm to secure said valve in said operative position.

5. In a pressure pump for plastic concrete mixtures, having a working chamber and a mixture-controlling valve: a bracket carried by said chamber, provided with an angularly extending arm and with a recess for readily removably receiving and supporting a portion of said valve in operative position relative to the chamber; a lug formed on the body of the valve; and wedging means engaging said lug and bracket arm to quick-detachably secure the valve in said operative position.

6. In a pressure pump for plastic concrete mixtures, having a working chamber, a valve for controlling flow of the mixture to said chamber, and a hopper for supplying the mixture to said valve: means for supporting said hopper in juxtaposition to but independently of the valve; and quick-detachable means for securing the valve in operative position relative to said hopper and working chamber.

7. In a pressure pump for plastic concrete mixtures, having a working chamber, a valve for controlling flow of the mixture to said chamber, and a hopper for supplying the mixture to said valve: a member adjacent the working chamber for supporting said hopper in juxtaposition to but independently of the valve, said member having means readily detachably engagable by a portion of the valve to operatively position the latter relative to the chamber and hopper; and quick-detachable means for securing the valve in said operative position.

8. In a pressure pump for plastic concrete mixtures, having a working chamber, a valve for controlling flow of the mixture to said chamber, and a hopper for supplying the mixture to said valve: a bracket member carried by the working chamber having an angularly disposed portion for supporting said hopper in juxtaposition to but independently of the valve; means for readily removably supporting the valve in operative position relative to said hopper and chamber; and quick-detachable means for securing the valve in said position.

9. In a pressure pump for plastic concrete mixtures, having a working chamber, a support therefor, and a mixture controlling valve: pin and socket means carried by said valve and said support respectively for readily removably positioning the valve in operative relation to said working chamber; and quick-detachable means for securing the valve in operative position.

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