Oct. 18, 1949. C. I. LONGENECKER 2,485,208

CONCRETE PLACEMENT APPARATUS

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Fig. 1.

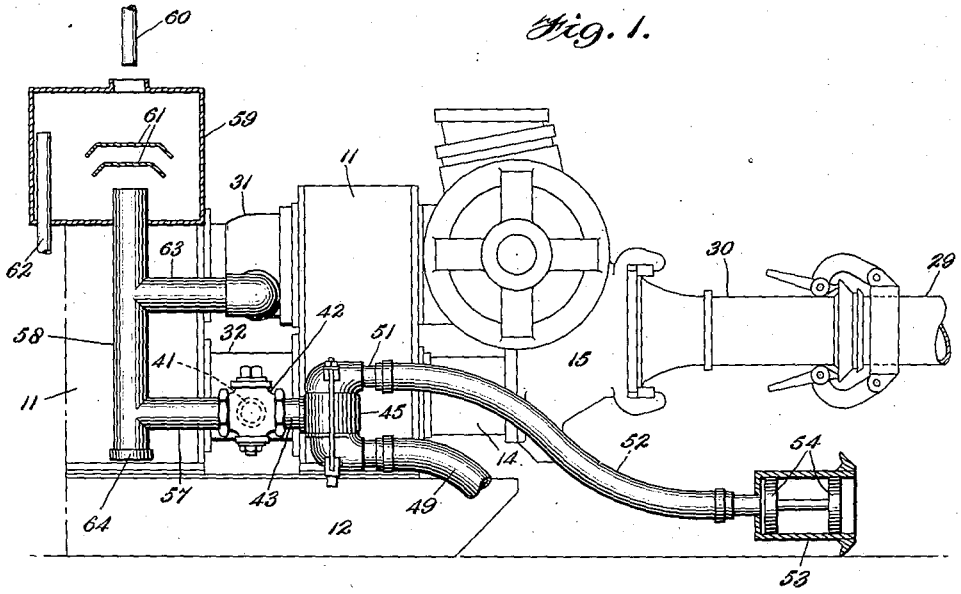
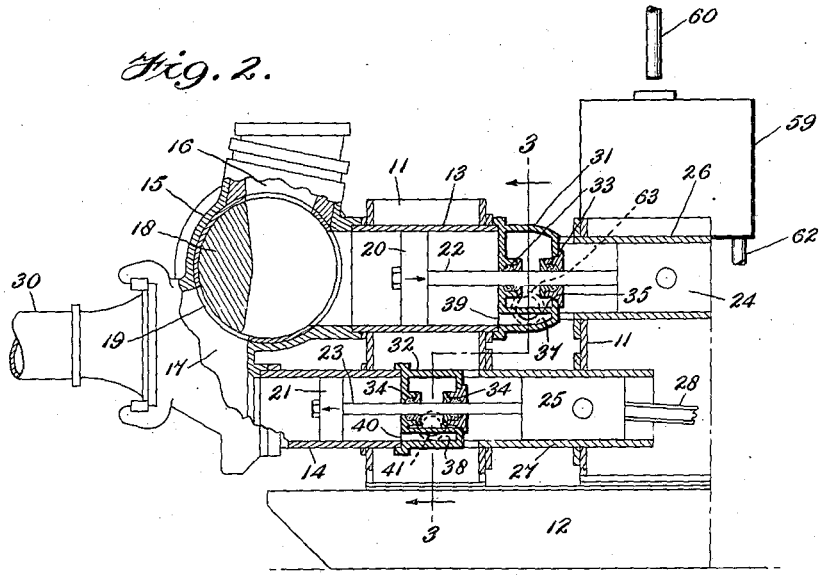


Fig. 2.



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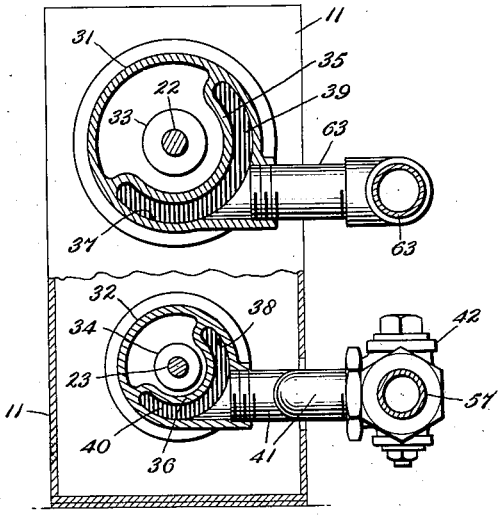

Fig. 3.

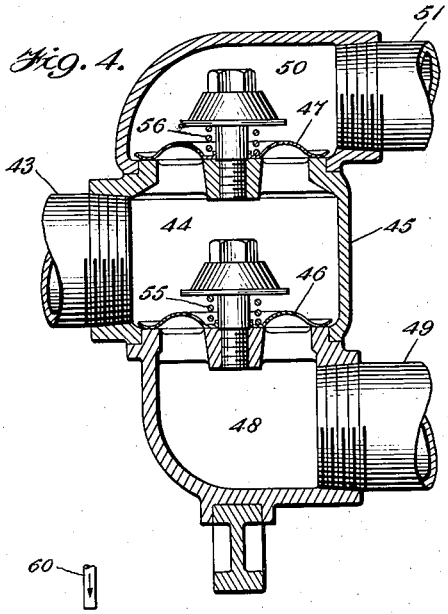

Fig. 4.

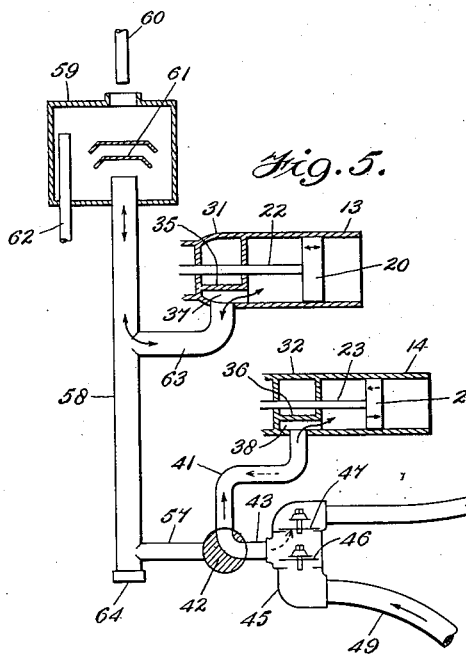

Fig. 5.

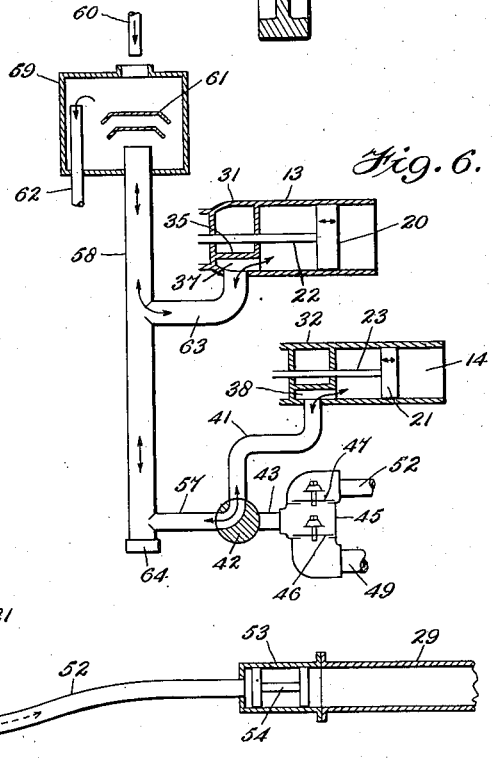

Fig. 6.

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2,485,208

CONCRETE PLACEMENT APPARATUS

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Application November 17, 1947, Serial No. 786,531

8 Claims. (Cl. 103—204)

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The invention relates to systems for the placement of plastic concrete mixtures, and more especially to those wherein the concrete is forced through pipe lines by mechanical pumps such as disclosed in prior U. S. Patent No. 2,017,975 granted October 22, 1935; and the primary object of the invention is to provide improved mechanism in such a system whereby the pump cylinders and the pipe line may be flushed out with water to maintain the system in efficient working condition.

It is well known to those skilled in this art that at the conclusion of a concrete pumping operation it is essential that the concrete in the pipe line between the pump and the discharge point be removed therefrom before it has a chance to set and plug the line; also that the line should be flushed out with water to remove those portions of the concrete mixture which otherwise would remain adhering to the interior surface of the pipe and which, hardening thereon, would impede or even make impossible a new placement operation. (See U. S. Patents No. 2,012,944, September 3, 1935; No. 2,087,679, July 20, 1937; and No. 2,123,583, July 12, 1938.)

While the pistons of these concrete pumps carry packings which engage the cylinder walls with sufficient tightness to enable them to pump water, as is brought out in the above mentioned patents, the valves thereof never close completely and they are provided with clearances on the order of $\frac{1}{16}$ inch or more, which peculiarities render such valves wholly unsuitable for handling water. Thus, in order to obtain water under pressure for forcing the concrete out of the pipe line and flushing the latter, it is necessary either to employ a separate water pump, or to equip the concrete pump with supplemental valves capable of handling water.

In the said Patents Nos. 2,012,944 and 2,123,583 these auxiliary valves were elements which were temporarily introduced into the pump and pipe line at the conclusion of a pumping operation, and were removed therefrom before the pump was called upon to again handle concrete. Since the construction of these valves was such that they were not adapted to handle the concrete which unavoidably remained in the pump, the usual procedure comprised disconnecting the pipe line from the outlet of the pump; removing the residual concrete from the pump cylinder, passages and valves by rodding, scraping and washing; placing the inlet water valve in the pump just ahead of its concrete handling inlet valve; positioning the outlet water valve at the open end of

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the pipe line, with a free piston or "go-devil" in the line ahead of it; reconnecting the line to the pump outlet; supplying water to the feed hopper of the pump; and then operating the latter. This water was drawn into the forward portion of the pump cylinder during the backward stroke of the piston, and expelled therefrom by the forward face of the piston during the forward stroke of the latter, passing through the outlet valve and passage of the pump, and the outlet water handling valve, to force the go-devil through the line and thereby push the concrete out ahead of it. The pump cleaning and water valve inserting operations sometimes consumed as much as thirty minutes or more, during which time the concrete in the line remained static, with the chemical reactions between the water and cement therein proceeding and tending to produce setting of the mixture in the line.

In contradistinction to these previous mechanisms, the present invention provides water handling valves which are permanently associated with the pump, out of the line of flow of the concrete through and from the latter, and connected by piping to the rear end of the pump cylinder, which is closed. On the forward stroke of the piston the water is drawn through the inlet water valve and into the rear portion of the cylinder, behind the piston, and is then expelled through the outlet water valve by the piston on its backward stroke. During a pipe line clearing operation the line remains disconnected from the pump outlet, and means are provided, which will be later described in detail, whereby the water discharge passage may be quickly and easily connected to the open end of the line when it is desired to clean out or flush the latter.

When the pump is functioning to pump concrete through the line, the water pumping mechanism just referred to is cut off and rendered inactive; however, the invention includes additional apparatus for supplying water to the rear portion of the pump cylinder during a concrete pumping operation, whereby to keep the cylinder walls free from concrete deposits and avoid scoring and/or undue wear on the cylinder, piston and packing.

While the invention is applicable to single or multiple cylinder concrete pumps such as those disclosed in the aforesaid U. S. Patent No. 2,017,975, for purposes of the present disclosure it has been illustrated in the accompanying drawings forming a part of this specification, as applied to a double cylinder differential type of pump such as is disclosed and claimed in U. S.

Patent No. 2,448,104 granted August 31, 1948, on my co-pending application Serial No. 633,091, filed December 6, 1945.

In the said drawings:

Figure 1 is a partial side elevational view of such a differential type concrete pump, equipped with one form of cleaning and flushing apparatus constructed and arranged in accordance with the present invention;

Fig. 2 is a central longitudinal sectional view through the cylinders of the pump shown in Fig. 1, looking in a direction opposite to that of the latter figure:

Fig. 3 is an enlarged cross sectional view, on approximately the planes indicated by the line 3—3 of Fig. 2, looking in the direction of the arrows;

Fig. 4 is an enlarged vertical sectional view of the water handling valve unit;

Fig. 5 is a diagrammatic view, illustrating the functioning of the apparatus in an operation of cleaning out the pipe line; and

Fig. 6 is a view similar to Fig. 5, showing the operation of the flushing apparatus when the pump is handling concrete.

Referring to the said drawings in more detail, the pump there shown comprises a framework 11, mounted on skids 12 for portability, and supporting superposed parallel cylinders 13 and 14, the upper of which is of larger diameter than the lower. At their forward ends the cylinders communicate with a valve housing 15 having an inlet passage 16 and a discharge chamber 17. The said valve housing encompasses a valve member 18 of the oscillating plug type, the movements of which control the admission of concrete to the cylinder 13 from the inlet passage 16, as well as the discharge of concrete from said cylinder to the chamber 17 through a port 19. Pistons 20 and 21 are mounted for reciprocation in the respective cylinders 13 and 14, which pistons have piston rods 22 and 23 extending rearwardly to cross-heads or like members 24 and 25 working in guide members 26 and 27. The cross-head members are connected by connecting rods 28—only one of which is here shown—to drive mechanism whereby the pistons are moved simultaneously in opposite directions in their respective cylinders. The discharge chamber 17 of the valve housing 15 communicates with the pipe line 29 by means of a short, readily detachable and removable pipe section 30.

The rearward ends of the cylinders 13 and 14 are closed by hollow cylinder head members 31 and 32 respectively, which are provided with stuffing boxes or glands 33 and 34 through which the piston rods 22 and 23 pass. As best shown in Figs. 2 and 3, the head members 31 and 32 are provided with internal arcuate partitions 35 and 36 which provide arcuate passages 37 and 38 communicating through ports 39 and 40 with the respective cylinders 13 and 14.

Communicating with the passage 38 of the head member 32 is a pipe 41 which leads to a three-way valve 42. A pipe 43 leads from this valve to the central chamber 44 of a valve housing 45 which contains both the inlet and the outlet water handling valves 46 and 47 (see Fig. 4). Water from any appropriate source is supplied to the inlet chamber 48 of the housing 45 by a pipe or hose 49, while water may pass from the outlet chamber 50 of the valve housing through a nipple 51 and hose 52 to a short cylinder 53, open at its forward end, and in which a free piston device or "go-devil" 54 is adapted to be positioned, as indicated in Fig. 1. The water valves 46 and 47 may be of any suitable type, those here shown being metal disks biased to closed position by compression springs 55 and 56.

From the three-way valve 42 a third pipe 57 leads to a vertical pipe or riser 58 which extends upwardly to a tank or reservoir 59 suitably supported on a portion of the pump frame 11. Water is supplied to this reservoir by means of a pipe 60, and one or more baffles 61 are provided in the reservoir to stop surging of the water therein under the action of the pump pistons, as will appear more fully below. The reservoir is also provided with an overflow pipe 62 extending upwardly therein a sufficient distance to maintain a predetermined liquid level in the tank.

A pipe 63 leads from the riser 58 to the passage 37 of the cylinder head member 31; and the lower end of the said riser is preferably provided with a clean-out cap 64 which may be removed as necessary for cleaning purposes.

When the pump is functioning to force concrete through the pipe line 29 during a placement operation, the three-way valve 42 is set to place the pipes 41 and 57 in communication, as shown in Fig. 6, thus cutting off the pipe 43, valves 46 and 47, and water intake and discharge lines 49 and 52 from pump action. Under these conditions, as the pistons 20 and 21 reciprocate in their respective cylinders they alternately draw water from the reservoir 59 through pipes 58, 63, 57 and 41, into the rear portions of the cylinders and expel it therefrom. This constant circulation of wash water in the cylinders behind the pistons effectively washes out any adhesive and/or gritty particles of the concrete mixture which may work their way past the piston packings and keeps the surfaces of the cylinders and pistons clean, thereby eliminating or materially reducing scoring and undue wear thereof. During this phase of operation, water is supplied continuously to the reservoir 59 from pipe 60, and as the water surges back and forth in the pipes 41, 57, 58 and 63 under the piston action, the excess will flow out of the reservoir through the overflow pipe 62. Solids which collect in the lower portion of the pipe 58 may be discharged therefrom from time to time by removal of the clean-out cap 64.

There is no communication between the rearward and forward portions of the cylinders through which water might be transferred from the former to the latter, as any appreciable amount of water introduced into the forward part of the cylinders would be absorbed into the concrete mixture and tend to destroy the water-cement ratio thereof, with detrimental effects on the concrete when set. Of course, a small amount of water may unavoidably leak past the piston packings, but this quantity ordinarily is so small as to be negligible.

When it is desired to clean out the pipe line 29, as at the conclusion of a concrete pumping operation, the line is broken adjacent the pump by removal of the short pipe section 30, and the cylinder 53 containing a go-devil 54 is substituted therefor on the end of the pipe line, as indicated in Fig. 5. The three-way valve 42 is now shifted to the position shown in this figure, cutting off communication between the pipes 57 and 41, and placing the latter in communication with the pipe 43. If the pump be now operated, on the forward stroke of the smaller piston 21 water will be drawn into the rearward portion of the cylinder 14 through supply pipe 49, inlet

valve 46, pipe 43, valve 42, pipe 41 and passage 38, and on the rearward stroke of the piston, will be forced out through pipes 41 and 43, outlet valve 47 and conduit 52 to cylinder 53, where it will propel the go-devil 54 into and through the pipe line 29. The concrete in the latter will be forced out ahead of the go-devil, and the water following it will thoroughly flush any adhering constituents of the mixture from the pipe walls.

During this operation the rearward portion of the larger pump cylinder 13 will continue to be flushed by water from the reservoir 59, as above described; and when the cleaning of the pipe line is completed, the cylinder 53 is disconnected from the line, the short pipe section 30 reinstalled, and the three-way valve 42 restored to its Fig. 6 position, whereupon the system is again ready for concrete placement.

Since the present water handling valves are always completely out of the line of flow of concrete through the pump and pipe line, and since the concrete in the line may be pushed therefrom by the go-devil and the line flushed in much less time than it normally takes to clean out the pump cylinders, passages and valve, the latter operation may be deferred until the line has been cleared and flushed, without much danger of the setting of the residual concrete within the pump. However, to avoid any possibility of such an occurrence, water from any approprate source may be supplied to the inlet passage of the pump during the line cleaning operation, for circulation by the pump pistons through the forward portions of the cylinders 13 and 14, the valve 18, and the discharge chamber 17. The pump outlet of course is disconnected from the pipe line at this time, and while this auxiliary water may not remove all of the aggregate constituents of the mixture from the pump, it will flush out through the pump outlet at least a major portion of the water-cement binding element of the concrete, which is the dangerous constituent from the standpoint of the setting of the residual mixture. Any portions of the concrete remaining in the pump when the line has been cleared may be removed in the usual manner.

Obviously, by omitting the pipe 63 the present apparatus may be readily employed with the single cylinder pumps such as shown in the U. S. Patent No. 2,017,975 mentioned above, in which case such cylinder and its piston will function in substantially the same manner as that described in connection with the smaller cylinder 14 and its piston 21 of the present drawings. It will be understood of course that the construction of the cylinder and the piston actuating mechanism of such single cylinder pump would have to be slightly modified from that shown in the said patent, to correspond substantially to the construction of the present cylinder 14 and piston 21.

What is claimed is:

1. In concrete placement apparatus comprising a pump having a working cylinder closed at one end, a piston working in said cylinder, and valve means for controlling movement of concrete to and from the other end of the cylinder, which valve means are ineffective for handling fluids; a pipe line for the concrete detachably connected with the last mentioned end of the cylinder; inlet and outlet fluid handling valves disposed out of the line of flow of the concrete to and from the pump; fluid conducting connections between said fluid handling valves and the closed end of the cylinder; means for supplying fluid to said inlet valve; and a conduit for conducting fluid from said outlet valve, having means for attachment of the discharge portion thereof to the pipe line when the latter is disconnected from the pump.

2. In concrete placement apparatus comprising a pump having a working cylinder closed at one end, a piston working in said cylinder, passages for conducting concrete to and from the other end of the cylinder, and valve means for controlling movement of the concrete through said passages, which valve means are ineffective for handling fluids; a pipe line for the concrete detachably connected with the last mentioned end of the cylinder; inlet and outlet fluid handling valves permanently mounted outside of said concrete conducting passages and pipe line; permanent fluid conducting connections between said fluid handling valves and the closed end of the pump cylinder; valve means controlling said connections; means for supplying fluid to said inlet valve; and a conduit for conducting fluid from said outlet valve, having means for ready attachment of the discharge portion thereof to the pipe line when the latter is disconnected from the pump.

3. In concrete placement apparatus comprising a pump having a working cylinder closed at one end, a piston working therein, and valve means for controlling movement of concrete to and from the other end of said cylinder, which valve means are ineffective for handling fluids; a pipe line for the concrete detachably connected with the last mentioned end of the cylinder; inlet and outlet fluid handling valves permanently disposed out of the line of flow of the concrete to and from the pump; fluid conducting connections between said fluid handling valves and the closed end of the cylinder; means for supplying fluid to said inlet valve; a conduit for conducting fluid from said outlet valve; a cylinder connected to said conduit, such cylinder having means for the attachment thereof to the pipe line when the latter is disconnected from the pump; and a free piston in said last named cylinder adapted to be forced through the pipe line by fluid supplied to such cylinder, to remove concrete from said line.

4. In concrete placement apparatus comprising a pump having a working cylinder closed at one end, a piston working therein, and valve means for controlling movement of concrete to and from the other end of said cylinder, which valve means are ineffective for handling fluids; a pipe line for the concrete detachably connected with the last mentioned end of the cylinder; a unitary dual valve device permanently mounted outside the pump, comprising inlet and outlet fluid handling valves disposed out of the line of flow of the concrete to and from the pump; fluid conducting connections between such valves and the closed end of the pump cylinder; valve means controlling said connections; means for supplying fluid to said inlet valve; a conduit for conducting fluid from said outlet valve; a cylinder having a closed end connected to said conduit, and an open end for register with and attachment to the pipe line when the latter is disconnected from the pump; and a free piston in said last named cylinder adapted to be forced through the pipe line by fluid supplied to such cylinder, to remove concrete from said line.

5. In concrete placement apparatus, a pump comprising a working cylinder open at both ends,

a piston mounted for reciprocation therein, and valve means for controlling movement of concrete to and from one end of said cylinder, which valve means are ineffective for handling fluids; a head element detachably secured to and closing the other end of the cylinder, and having a fluid passage communicating therewith behind the piston; a pipe line detachably connected to the pump for receiving concrete under pressure from said cylinder; inlet and outlet fluid handling valves mounted adjacent the pump, out of the line of flow of concrete to and from the latter; fluid conducting connections between said fluid handling valves and the passage in said cylinder head element; means for supplying fluid to said inlet valve; a readily movable conduit for conducting fluid from said outlet valve; a cylinder having a closed end connected to said conduit, and an open end provided with means for ready attachment thereof to the pipe line when the latter is disconnected from the pump; and a free piston in said last named cylinder adapted to be forced through the pipe line by fluid supplied to such cylinder, to remove concrete from said line.

6. In concrete placement apparatus, a pump having a working cylinder closed at one end, a piston working therein, and valve means for controlling movement of concrete to and from the other end of the cylinder, which valve means are ineffective for handling fluids; a pipe line detachably connected to the pump for receiving concrete under pressure from said cylinder; inlet and outlet fluid handling valves disposed out of the line of flow of the concrete to and from the pump; fluid conducting connections between said fluid handling valves and the closed end of the cylinder; means for supplying fluid to said inlet valve for passage through said connections to the cylinder behind the piston; a conduit for conducting fluid from said outlet valve and having means for attachment of the discharge portion thereof to the pipe line when the latter is disconnected from the pump; means for supplying fluid to said fluid conducting connections independently of said fluid handling inlet valve; and valve means in said connections arranged to alternatively connect them with said inlet valve and said independent fluid supply means.

7. Concrete placement apparatus, comprising

a pump having a working cylinder closed at one end, an imperforate piston working therein, and valve controlled passages for conducting concrete to and from the other end of said cylinder; and means for flushing said pump cylinder, comprising a liquid reservoir; means for supplying liquid thereto; liquid conducting connections between said reservoir and the closed end of the pump cylinder, whereby movements of the piston while pumping concrete in the forward portion of the cylinder will draw liquid from the reservoir into the rearward closed end portion of the cylinder, and expel it therefrom back into the reservoir; and means for discharging excess liquid from the reservoir.

8. Concrete placement apparatus, comprising a pump having a working cylinder closed at one end, an imperforate piston working therein, and valve controlled passages for conducting concrete to and from the other end of said cylinder; and means for flushing said pump cylinder, comprising a liquid reservoir mounted adjacent the pump; means for supplying liquid to said reservoir; liquid conducting connections between said reservoir and the closed end of the pump cylinder, whereby movements of the piston while pumping concrete in the forward portion of the cylinder will draw liquid from the reservoir into the rearward closed end portion of the cylinder, and expel it therefrom back into the reservoir; baffle means in the reservoir disposed to prevent undue surging of the liquid therein under pump action; and an overflow pipe extending into the reservoir, arranged to maintain a predetermined liquid level therein.

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