A concrete pump which comprises an elongated hollow housing in which a valve element reciprocates. The valve element includes a pair of transversely extending tubes and a pair of concrete guiding chambers. The valve element moves between two positions. In the first position a first guide chamber is opposite a first pump cylinder and guides concrete from an upright conduit associated with the first pump cylinder into the first pump cylinder and a first tube is opposite a second pump cylinder and guides concrete from the second pump cylinder into a discharge line associated with the second pump cylinder. At the second position a second guide chamber is opposite the second pump cylinder and guides concrete from an upright conduit associated with the second pump cylinder into the second pump cylinder and the second tube is opposite the first pump cylinder and guides concrete from the first pump cylinder into the discharge line associated with the first pump cylinder.
CONCRETE PUMPING MACHINE

This is a continuation-in-part of my co-pending application Ser. No. 334,050 filed Feb. 20, 1973, now abandoned.

This invention relates to a machine for pumping heavy abrasive materials such as concrete or the like.

An object of this invention is to provide a concrete pump in which a single reciprocating valve element controls flow of concrete from a hopper to each of two pump cylinders and from the pump cylinders to a distributing line.

A further object of this invention is to provide such a machine in which the valve element moves inside a housing and in which readily removable wear plates support the valve element inside the housing.

The above and other objects and features of the invention will be apparent to those skilled in the art to which this invention relates from the following detailed description and the drawings, in which:

FIG. 1 is a view in side elevation of a concrete pumping machine constructed in accordance with an embodiment of this invention;

FIG. 2 is a view in side elevation of the concrete pumping machine on an enlarged scale with parts broken away to reveal details of construction, a portion of a distribution manifold and of a discharge pipe being shown in association therewith;

FIG. 3 is a view in section taken on the line 3-3 in FIG. 2;

FIG. 4 is a view in section taken on the line 4-4 in FIG. 3;

FIG. 5 is a view in section taken on an enlarged scale generally on the line 5-5 in FIG. 3;

FIG. 6 is a view in section taken on the line 6-6 in FIG. 5;

FIG. 7 is a view in section taken on the line 7-7 in FIG. 5;

FIG. 8 is a view in section taken on the line 8-8 in FIG. 5;

FIG. 9 is a view in section taken on the line 9-9 in FIG. 5;

FIG. 10 is a view in side elevation taken in the direction of the arrows 10-10 in FIG. 5;

FIG. 11 is a view in section taken on the line 11-11 in FIG. 5;

FIG. 12 is a view in section taken generally on the same line as FIG. 5 but showing a valving element in a displaced position;

FIG. 13 is an exploded perspective view of the valving element associated elements and a portion of a housing thereof;

FIG. 14 is a rear elevational view of the valving element; and

FIG. 15 is a view in section taken on the line 15-15 in FIG. 5.

In the following detailed description and the drawings, like reference characters indicate like parts.

In FIGS. 1 and 2 is shown a concrete pump 20 constructed in accordance with an embodiment of this invention. The pump 20 includes a concrete hopper 22 from which concrete 23 (FIG. 2) can pass through upright conduits 24 and 26 (FIG. 4). The conduits 24 and 26 are attached to a housing 27. The housing 27 is an elongated box-like structure including an upper panel 28 (FIG. 5) having openings 29 and 31 in communication with the conduits 24 and 26, respectively, a front panel 32 (FIG. 8), a rear panel 33, and a bottom panel 34. The front panel 32 is provided with openings 36 (FIG. 9) and 37 (FIG. 7), and the rear panel 33 is provided with openings 38 (FIG. 9) and 39 (FIG. 7). Axes of the openings 31, 36 and 38 are coplanar, as shown in FIG. 9. In addition, axes of the openings 29, 37, and 39 are coplanar, as shown in FIG. 7. Wear plates 41 (FIG. 13), 42, 43 and 44 are attached to the inner faces of the upper panel 28, the front panel 32, the rear panel 33, and the bottom panel 34, respectively. Each of the wear plates is attached to the associated housing wall by fasteners 46 as shown in FIGS. 5 and 15. The upper wear plate 41 (FIG. 12) is provided with openings 47 and 48 aligned with the openings 29 and 31 and the conduits 24 and 26, respectively.

Inner walls of the housing 27 outboard of the wear plates 41, 42, 43 and 44 are protected by tubular guides 54 and 56 (FIGS. 5 and 12), each of which is of rectangular cross-section with walls of the guides 54 and 56 being aligned with the wear plates as shown in FIGS. 5 and 12. Flanges 57 and 58 (FIG. 13) of the guides 54 and 56, respectively, overlie the ends of the panels of the housing and are attached thereto by fasteners 61 (FIG. 10).

Pump cylinders 62 and 63 (FIG. 3) are attached to the housing 27 with the pump cylinder 62 in communication with the opening 39 (FIG. 7) and the pump cylinder 63 in communication with the opening 38 (FIG. 9). A pump piston 64 (FIG. 3) works in the pump cylinder 62, and a piston pump 66 works in the pump cylinder 63. A hydraulic cylinder 67 (FIG. 2) is aligned with the pump cylinder 63, and a piston 68 which works in the hydraulic cylinder 67 is attached to the pump piston 66 by a piston rod 69. A hydraulic cylinder 71 is aligned with the pump cylinder 62 (FIG. 3) and a hydraulic piston 72 (FIG. 2), which works in the hydraulic cylinder 71, is connected to the pump piston 64 by a piston rod 73 (FIG. 3). The hydraulic cylinders serve to power the pump pistons.

A discharge manifold 76 is attached to the housing 27 with an arm 77 of the discharge manifold 76 being in communication with the opening 37 (FIG. 7) and an arm 78 of the discharge manifold 76 being in communication with the opening 36 (FIG. 9). The arms 77 and 78 are connected together, as shown in FIG. 3, and discharge into a pipe 79, which can extend to a position at which concrete is to be discharged.

Flow of concrete from the hopper 24 through the housing 27 to the discharge manifold 76 is controlled by a valve element or slide 81 (FIGS. 5, 12, 13 and 14). The valve element 81 is a weldment including a bottom plate 82 (FIG. 13), a top plate 83, a front plate 84, and a rear plate 86 (FIG. 14). Tubes 87 and 88 (FIG. 13) extend from the rear plate 86 to the front plate 84 and form conduits through the valve element. End caps 91 and 92 (FIG. 5) are attached to ends of the front plate 84 and the rear plate 86. Transverse wall plates 93 and 94 cooperate with the end caps 91 and 92, respectively, to define chambers 96 and 97 adjacent opposite ends of the valve element. When the valve element is in the FIG. 5 position, concrete from the conduit 26 (FIG. 9) is directed through an opening 99 in the rear plate 86 into the pump cylinder 63 so that, as the pump piston 66 (FIG. 3) is retracted, concrete from the hopper 22 is drawn into the pump cylinder 63. At the same time, the tube or conduit 87 (FIG. 7) of the valve element is aligned between the pump cylinder 62 and the dis-
charge arm 77 so that, as the pump piston 64 (FIG. 3) is advanced toward the housing 27, concrete is pumped from the pump cylinder 62 into the discharge pipe 79.

When the valve element 81 is moved to the FIG. 12 position, concrete is directed from the conduit 24 through an opening 101 in the rear plate 86 into the pump cylinder 62 as the pump piston 64 is withdrawn, and concrete is pumped from the cylinder 63 by the pump piston 66 through the tube 88 into the discharge manifold 76.

The valve element 81 is moved between the FIG. 5 and FIG. 12 positions by operation of hydraulic cylinder assemblies 104 and 105 (FIG. 3). Details of construction of the cylinder 104 are shown in FIG. 15. The cylinder 104 is carried by a transverse plate 201 which is attached to the flange 57 of the tubular guide 54 by the fasteners 61. A bushing 202 is mounted in a countersunk central bore 203 in the plate 201. An annular inner end cap 204 is mounted on the bushing 202. A tubular body 206 is mounted on the inner end cap 204. A piston 1041 moves inside the body 206. An outer end cap 207 is mounted on the body 206. Tension bolts 208 extend through bores 209 and 211 in the end caps 204 and 207, respectively. Inner ends of the tension bolts 208 are mounted in threaded sockets 212 in the plate 201. Nuts 213 threaded on outer ends of the tension bolts 208 hold the members of the hydraulic cylinder assembly 104 in assembled relation. The cylinder assembly 105 (FIG. 3) is similar in construction and will not be described in detail. The piston 1041 (FIG. 15) is mounted on a piston rod 106 which works in the cylinder assembly 104. A plate 107 is attached to the piston rod 106 by a nut 108 and is attached to the valve element 81 by fasteners 109 which are threaded into sockets in the end cap 92. Cup-shaped sliding seal members 111 and 112 are mounted between the plate 107 and the end cap 92 and serve to minimize movement of concrete into the guide member 54. However, as shown in FIG. 5, a lower portion 1071 of the outer end of the guide member 54 is open so that any concrete which penetrates past the seal members 111 and 112 can be discharged through the open end portion of the guide member 54. As shown, the end cap 92 is in the form of a frustum of a pyramid and sides of the end cap 91 hold sides of the sliding seal member 111 in engagement with inner faces of the guide member 56. In similar fashion, a piston (not shown) works in the cylinder 105. Cup-shaped sliding seal members 121 and 122 (FIG. 5) are mounted on the end cap 91 and bear on the inside of the guide 56.

Hydraulic connections, not shown, can serve to move the pump piston 64 (FIG. 3) inwardly and the pump piston 66 outwardly when the valve element 81 is in the FIG. 5 position. When the pump pistons have reached the ends of their strokes, the valve element is moved to the FIG. 12 position by operation of the cylinders 104 and 105, and the direction of pump piston movement is reversed so that pumping of concrete is substantially continuous.

The concrete pumping machine illustrated in the drawings and described above is subject to structural modification without departing from the spirit and scope of the appended claims.

Having described my invention, what I claim as new and desire to secure by letters patent is:

1. A concrete pump which comprises an elongated hollow valve housing, there being a pair of spaced up-right conduits attached to an upper panel of the housing and communicating with the inside of the housing, a pair of pump cylinders attached to a side panel of the housing and communicating with the inside of the housing, and a pair of spaced discharge lines attached to an opposed side panel of the housing and in communication with the inside of the housing, each of the pump cylinders and each of the discharge lines being aligned with one of the upright conduits, a valve element reciprocally mounted inside the housing, said valve element including a pair of transversely extending tubes and a pair of guide chambers, each of said guide chambers having an upper inlet and a side opening, outer walls of the guide chambers forming end walls of the valve element, means for moving the valve element between a first position at which a first one of the guide chambers is opposite a first one of the pump cylinders and guides concrete from the upright conduit aligned with said first pump cylinder into said first pump cylinder and a first one of the tubes is opposite the second one of the pair of pump cylinders and guides concrete from said second pump cylinder into the discharge line aligned with said second pump cylinder and a second position at which the second one of the guide chambers is opposite the second pump cylinder and guides concrete from the upright conduit aligned with the second pump cylinder into the second pump cylinder and a second one of the tubes is opposite the first pump cylinder and guides concrete from the first pump cylinder into the discharge line aligned with the first pump cylinder, means for moving the piston in the first pump cylinder away from the housing when the valve element is in the first position to draw concrete into the first pump cylinder and toward the housing when the valve element is in the second position to pump the concrete into the discharge line associated with the first pump cylinder, means for moving the piston in the second pump cylinder away from the housing when the valve element is in the second position to draw concrete into said second pump cylinder and toward the housing when the valve element is in the first position to pump the concrete into the discharge line associated with the second pump cylinder, the means for moving the valve element including a hydraulic cylinder, means for mounting the hydraulic cylinder on the housing at an end thereof, a piston rod actuated by said hydraulic cylinder and attached to one of the end walls of the valve element for moving the valve element between the first and second positions, and seal elements mounted on the end walls of the valve element to resist passage of concrete outwardly of the end walls, there being openings in the valve housing outboard of the valve element for discharge of concrete which passes the end walls.

2. A concrete pump as in claim 1 wherein the means for mounting the hydraulic cylinder includes a transverse bar mounted on the housing at said end thereof, the bar is spaced above a bottom wall of the housing, there is a guide opening in the bar, and the piston rod extends through and is guided by said guide opening.

3. A concrete pump as in claim 1 wherein the valve housing is substantially rectangular in cross section, there is a flat guide plate attached to an inner bottom face of a bottom wall of the housing underlying and supporting the valve element, there are guide sleeves of rectangular cross section mounted in end portions of the valve housing to guide end portions of the valve ele-
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5. A concrete pump as in claim 3 wherein flat guide plates are attached to inner faces of side walls and of a top wall of the valve housing inboard of the guide sleeves and outer ends of the guide plates abut inner ends of the guide sleeves.

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