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VALVE CONSTRUCTION

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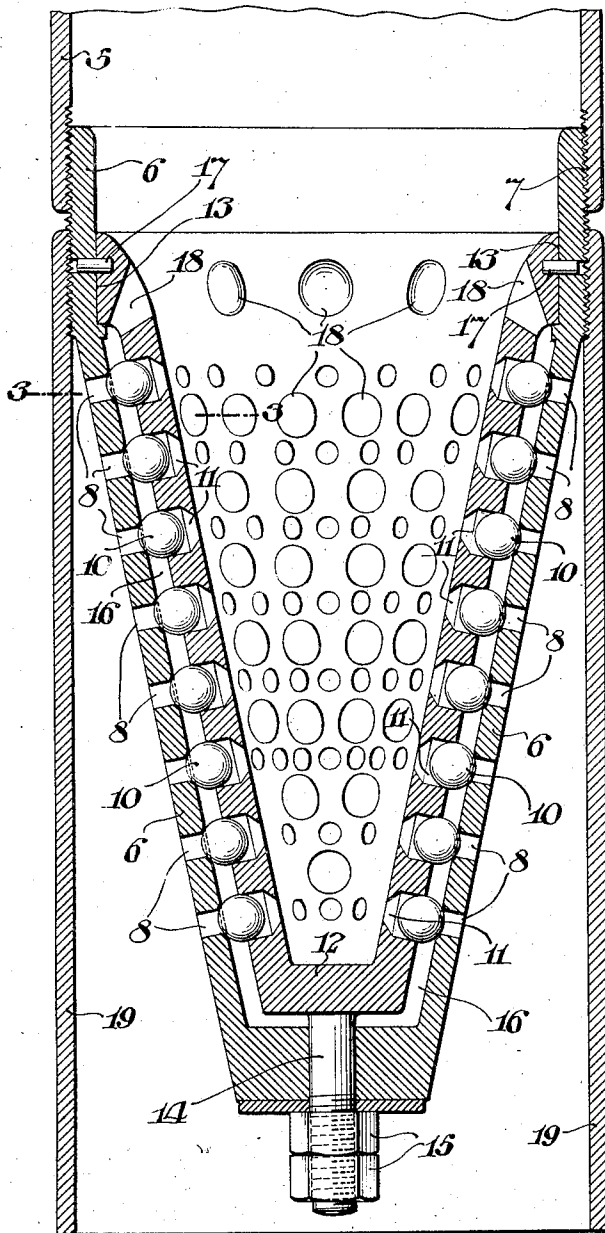


Fig. 1.

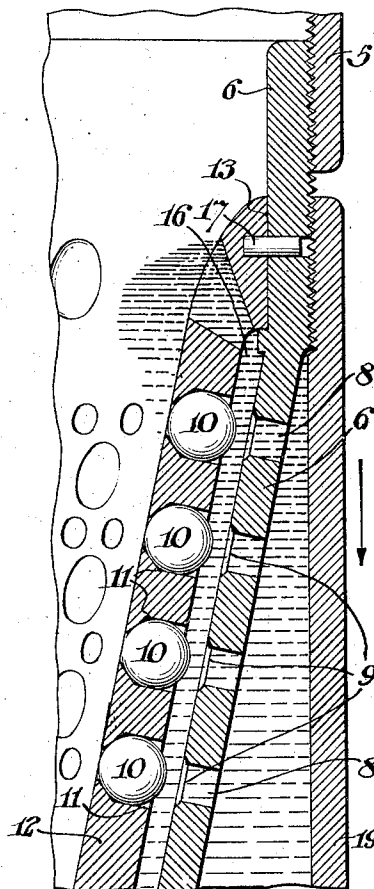


Fig. 2.

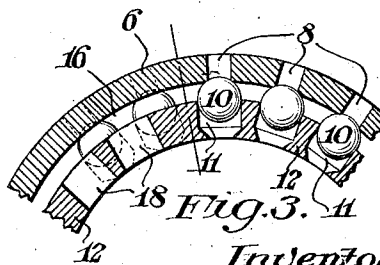


Fig. 3.

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VALVE CONSTRUCTION.

Application filed July 3, 1923. Serial No. 649,209.

My invention relates to improvements in valve construction. The object is to provide an improved valve construction which shall have a relatively large capacity and quick action and relatively small momentum in the operation of its moving parts.

Referring to the drawings which illustrate, merely by way of example, a suitable embodiment of my invention;

Fig. 1 is a view in vertical section.

Fig. 2 is a fragmentary vertical section on an enlarged scale.

Fig. 3 is a fragmentary horizontal section on the line 3, 3, on the same scale as that of Fig. 1.

Similar numerals refer to similar parts throughout the several views.

In the example illustrated, the valve construction is shown as applied to the foot or lower end of a tube or pipe, which is adapted to have a vertical reciprocation, and therefore the construction is adapted to perform the functions of a foot valve.

It will be in connection with such use or application that the invention will first be specifically described.

The part marked 5, is the lower end of a reciprocating pipe or tube such as is used in the class of pumps described in patent to Trump & Friedrichs No. 1,349,394, dated Aug. 10, 1920. In such pump it is extremely important to have a valve construction of large capacity and quick action, and at the same time, a construction that will be free from momentum of heavy moving parts. In other words the construction and operation of the reciprocating tube pump is such that, due to the rapidity of its reciprocating movements and the great stresses resulting from such movements and in connection with high head or high lift or both, it is extremely important that the valve construction act quickly and with relatively large volume, both to permit and to interrupt flow and without undue shock and jar to the moving parts. The solution for this problem has been found in eliminating the large single moving valve element and substituting a number of small ports, and cooperating valve elements, each of which need have an extremely small movement, while the aggregate valve port opening will be ample for the maximum demand of the pump.

To the end of the tube 5 is secured the shell or chambered body 6 by threaded en-

gagement, as at 7. This body 6 is shown tapering toward its lower end and provided with a plurality of ports 8 from top to bottom and entirely around its side walls, as shown. These ports 8 are provided with valve seats, as at 9, at their inner margins adapted to cooperate with the valve elements or valve balls 10. These balls 10 are held in position with a range of movement to open and close the ports 8, to the housings or recesses 11 in an inner shell or chambered body 12 of shape corresponding somewhat to that of the outer shell or body 6. This body 12 is fitted within body 6, as shown for example in Fig. 1, that is the cylindrical parts above the corresponding tapering formations, fitting one within the other, as at 13, and a bolt or stem 14, connected to the bottom of body 12, projects through the bottom of body 6 and is secured by the nuts 15. The assembly of the bodies 6 and 12 is such as to provide a space, as at 16, between the walls of said two bodies.

It will be understood of course that the housing 11 must register substantially with the valve seats 9, so that the ball valve elements 10 will move with certainty to and from their respective valve seats. This is readily accomplished by drilling the ports 8, after the bodies 6 and 12 are assembled; the ports or holes 8 being extended or projected into the body 12, and these holes will afterwards be enlarged to the necessary dimensions to form the housings 11.

These housings 11, it will be noted, are slightly inclined to the horizontal, in order that the valve elements 10 will normally lie on the valve seats, that is in the closing position when at rest, due, or partly due, to the action of gravity, when the pressure on the inside of the ports 8 is equal to or greater than the pressure outside of said ports.

Suitable means are provided, such for example as the pins 17, for locking the bodies 6 and 12 in proper relative positions.

The body 12 is also provided with a number of unobstructed ports 18, sufficient in the aggregate to care for the maximum possible flow through the openings 8 past valves 10. The shell or cylinder 19 may be provided substantially as shown, to extend downwardly and around the elements 6 and 12 in order to protect the same.

In operation:

When the tube 5 is reciprocated the fol-

lowing action takes place: The lower end of this tube, it will be understood is immersed; upon its downward movement, the water passes through the ports 8, the valve elements 10 moving from their seats into the housings 11, due to the force of the inrushing water. The water passes from ports 8 into space 16 thence through ports 18 upwardly in tube 5. This action continues during the downward movement of tube 5. Upon the reverse movement of tube 5, that is, the upward movement of tube 5, the water within the tube will normally cooperate with the elements 10 to cause them to seat on their respective seats 9, so that no water can flow from tube 5 back to the well. It will be noted that the movement of each element 10 from open to closed position and vice versa, is extremely short and that therefore there is practically no momentum, or shock, or jar upon the reversal of the tube 5, and yet the aggregate of the openings controlled by the valve elements, is such as to permit a comparatively large volume of flow upon the downstroke of tube 5. As this movement is short and is distributed through a large number of valve elements, it follows that there is practically no inertia, as of a large body, to overcome and the opening and closing of the ports 8, are, as a result, extremely rapid.

It happens that, due to the momentum of the column of water traveling up through pipe 5, the water continues to travel upwardly after the movement of pipe 5 is reversed, that is, after it begins to descend. If the reciprocating movements are sufficiently rapid, there may be a continued upward movement of water through pipe 5. The upward strokes therefore tend merely to boost or accelerate the upward flow. In such case, the valve elements open only when the pressure outside the ports 8 is greater than the pressure inside said ports. When these pressures are equalized the valves close by the action of gravity.

It will be understood however that the action of the valve elements is not necessarily dependent upon a reciprocating movement of the body containing the ports and valve seats with which the valve elements cooperate.

The construction is equally applicable to a stationary structure containing a valve controlled chamber, in which there is a variation of pressure within said chamber. Devices of this class are described in a number of patents to Humphrey, for reciprocating column pumps, for example, Patent No. 1,037,009 dated Aug. 27, 1912 and Patent No. 1,243,296 dated Oct. 16, 1917. In these pumps a column of water is made to reciprocate in a stationary play pipe; the initial movement of the outstroke being caused by the expansion of a primary medium. The

momentum of the water column, after the normal expansion of the primary medium, causes a diminution of pressure to the rear of the column which in turn causes the introduction of fresh water through a non-return valve structure. The return stroke of the water column and the force of the momentum thereof is utilized in compressing a fresh primary charge. The rise in pressure resulting from the return stroke also causes the closure of the non-return valve or valves. Where the valve comprises a large moving part, considerable time is required to cause the closure, and the force of the moving volume of water also causes considerable shock to the moving parts. It will thus be seen that the construction in accordance with the present invention is admirably adapted for the conditions last above recited, and for overcoming the objections referred to.

What I claim is:—

1. In a valve construction, the combination of a shell formation provided with a plurality of apertures extending through the wall thereof, said apertures having valve seats associated therewith, ball valves adapted to cooperate with said seats, and means surrounded by the said shell formation providing housings independently thereof for said ball valves.

2. In a valve construction, the combination of a conical shell formation provided with a plurality of apertures extending through the wall thereof, said apertures having valve seats associated therewith, ball valves adapted to cooperate with said seats, and means surrounded by the said shell formation providing housings independently thereof for said ball valves.

3. In a foot valve, the combination of a pair of shells, one positioned within the other, each shell provided with a plurality of ports, the ports of the outer shell provided with valve seats and the inner shell provided with housings for valve elements, and valve elements adapted to move to and from the valve seats.

4. In a valve construction, the combination of a pair of shells, one positioned within the other, each shell provided with a plurality of ports, the ports of the outer shell provided with valve seats and the inner shell provided with housings for valve elements, and valve ball elements adapted to move to and from the valve seats.

5. In a valve construction, the combination of a pair of shells, one positioned within the other, each shell provided with a plurality of ports, the ports of the outer shell provided with valve seats and the inner shell provided with housings for valve elements, valve elements adapted to move to and from the valve seats, and means for assembling the shells to secure proper register between the valve seats and the housings.

tween the respective housings and valve seats.

6. In a valve construction, the combination of a pair of chambered formations one formation projecting into the other, each provided with a plurality of ports, the ports of one formation registering substantially with the ports of the other formation, one formation provided with valve seats surrounding its ports, the other formation provided with valve housings communicating with its ports, and valve ball elements movable in said housings to and from said valve seats.

7. In a reciprocating valve structure, the

combination of a pair of chambered formations one formation projecting into the other, each provided with a plurality of ports, the ports of one formation registering substantially with the ports of the other formation, one formation provided with valve seats surrounding its ports, the other formation provided with valve housings inclined to the horizontal and communicating with its ports, and valve ball elements movable in said housings, in response to reciprocations of the structure, to and from said valve seats.

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