

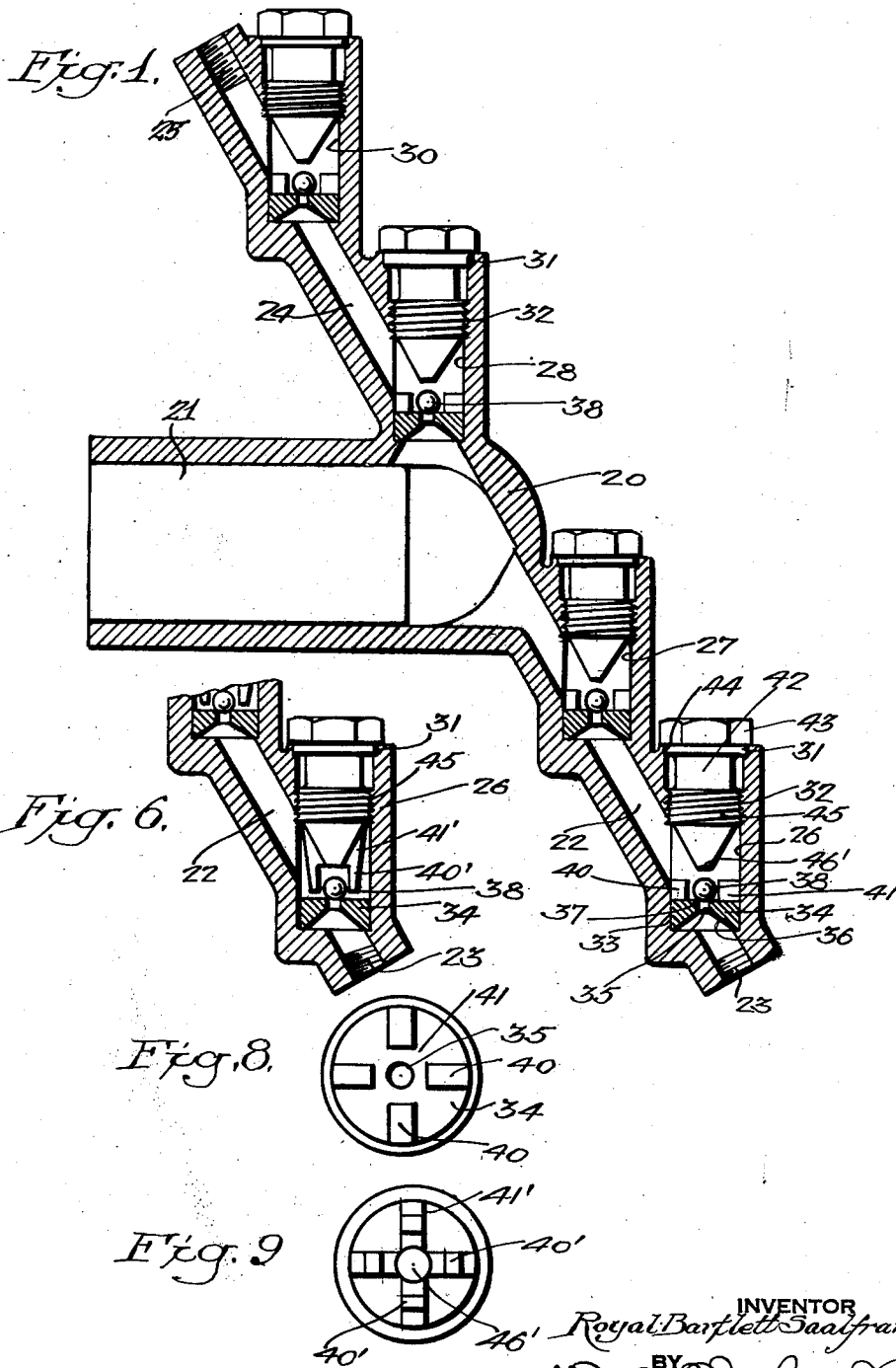
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PUMP AND VALVE UNIT

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PUMP AND VALVE UNIT

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The present invention relates to piston pumps especially of the metering type, and to valve units therefor.

A purpose of the invention is to facilitate the construction of pump and check valve assemblies, reducing the amount of time required, and avoiding the danger of formation of air pockets.

A further purpose is to employ low cost precision machining methods in manufacture of metering pump and valve units.

A further purpose is to facilitate the manufacture of the larger passages of pump and valve units by drilling through the normal openings such as the inlet, outlet and valve socket openings.

A further purpose is to arrange the inlet and outlet passages in prolongation so that they can be drilled as a single bore.

A further purpose is to employ straight diagonal inlet and outlet passages with vertically downwardly extending valve sockets terminating in valve seat recesses, the valve seats in the recesses extending across the passages so that the valve seats close the otherwise straight passages at each valve.

A further purpose is to provide lateral limiters for each valve on the seats or on the plugs in the sockets.

A further purpose is to drill interconnecting passages for the inlet and outlet from the pump cylinder through the valve sockets.

A further purpose is to employ separate valve units having diagonally extending passages and vertically downwardly extending sockets, held together by interconnecting clamps.

Further purposes appear in the specification and in the claims.

In the drawings I have chosen to illustrate a few only of the numerous embodiments in which my invention may appear, choosing the forms shown from the standpoints of convenience in illustration, satisfactory operation and clear demonstration of the principles involved.

Figures 1, 2 and 7 are sections of variant forms of the invention taken transversely to the cylinder and longitudinally of the inlet and outlet passages.

Figures 3 and 6 are fragmentary sections of still further variants corresponding in position to Figures 1, 2 and 7.

Figure 4 is a fragmentary elevation of one of the valve units of Figure 3 looking in the direction of the arrow A.

Figure 5 is a fragmentary elevation of the structure of Figure 3 showing the clamps, the view being transverse to the axis of the inlet passage from above, in the direction of the arrow B.

Figure 8 is an enlarged top plan view of the valve seat of Figures 1, 2 and 3.

Figure 9 is an enlarged bottom plan view of the valve plug of Figure 6.

Describing in illustration but not in limitation and referring to the drawings:

In the prior art, metering pumps have been developed as shown in Milton Roy Sheen U. S. Patents 2,263,429

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and 2,367,893 which employ a plurality of check valves in the inlet passage and a plurality of check valves in the outlet passage. The manufacture of such pumps has been complicated by the necessity of employing a series of 5 cored passages or of gaining access for machining of the passages through a cover plate. Either practice is expensive.

By the present invention the production costs are decreased and the device is simplified by permitting machining through normal openings such as the inlet, outlet and socket openings, and at the same time by providing increased protection against the possibility of entrapment of air through the presence of unintended pockets in the passages. No downwardly extending pocket is 15 provided in which air could be trapped.

In the preferred embodiment of the invention the inlet and outlet passages are straight but diagonal to the horizontal, while the valves and valve seats are located in downwardly extending valve sockets which are diagonal to the passages. In the best example of this construction, both the inlet and outlet passages extend in 20 prolongation of one another.

The passages may if desired be formed by bores which are in prolongation of the valve sockets and therefore 25 which can be drilled through the valve sockets.

The inlet and outlet passages, when diagonally extending, are provided with seats in seat recesses which extend across and close the passages except for the valve openings.

Lateral limitations are provided on the valves either by lugs on the seat or on the valve plug, while upward limitations on the valves are provided either by the bottom or by a rim on the valve plug.

The valve units notwithstanding the diagonal direction of the passages can desirably be made in separate components to be clamped together.

As shown in Figure 1, the pump comprises cylinder 20 having a piston 21 reciprocating under the action of any suitable drive not shown. In this form the axis of the piston is in the plane of the paper, while in the other forms the piston axis is transverse thereto. Inlet to the pump is provided through a diagonally upwardly extending inlet passage 22 from an inlet connection 23 and outlet is provided through a diagonally upwardly extending outlet passage 24 to an outlet connection 25. The pump 45 will normally operate on liquid supplied and withdrawn through these connections.

It will be noted that in this form the inlet and outlet passages are straight and in prolongation of one another and that, with the piston removed, the outlet passage is 50 drilled through the inlet passage as a straight bore.

At a plurality of spaced points in the inlet passage, in series with one another, are located vertically downwardly extending valve sockets 26 and 27, and similarly at a plurality of spaced points in the outlet passage 24 in series with one another are located a plurality of vertically downwardly extending valve sockets 28 and 30. Each of the valve sockets has a sealing recess 31 near its upper end and a female thread 32 below the same. Each of the valve sockets terminates in a valve seat recess 33 which extends diagonally across the inlet or outlet passage as the case may be.

The valve seat recesses receive valve seats 34, which are preferably all alike, and are preferably of disc shape, having central valve openings 35, upwardly converging inlet openings 36 to the valve openings, and seats 37 at the top. Each seat is engaged by a check valve 38, preferably a ball, as shown. The valve normally opens vertically upward, so that return is provided by gravity, usually rendering a return spring unnecessary.

The balls are laterally restrained by radially inwardly extending lugs 40, best seen in Figure 8, which have an

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internal diameter larger than the ball and adequately large to provide freedom, with spaces 41 between to permit flow of liquid upwardly when the balls are off their seats.

Above each seat and valve is a plug 42 having a nut 43 at the upper end, a sealing shoulder 44 below the nut engaging in the sealing recess 31, and male threads 45 lower down which engage with the female threads 32. Still lower each plug conically converges at 46 to clear the passage 22 or 24, and terminates at the bottom in a preferably flat stop 46' which is located somewhat above the normal seating position of the ball and which restrains upward movement of the ball.

In operation it will be understood that the valve seat recesses and the sockets are drilled and tapped through the socket openings, while the inlet and outlet passages are drilled through the inlet passage. The seats and balls are assembled through the socket openings and then the plugs are installed. The diameter of the threads will of course be larger than the diameter of the seats.

If desired, the plugs 42' can be shortened as shown in Figure 2, with corresponding shortening of the sockets 28' and in this case more abrupt tapers will desirably be employed at 44', the construction otherwise being similar to that of Figure 1.

The construction of Figures 1 or 2 on both the inlet and outlet sides can be made by separating the cylinder 20' from successive valve units 47 each including a portion of the straight passage and one of the sockets, and interconnected to the cylinder and to one another by metal-to-metal seals 48 as shown in Figure 3. Each of the metal-to-metal seals preferably includes a flat outer portion and a tapering conical inner portion as shown. To secure together the individual valve units, the most remote valve unit from the cylinder has wings 50 containing openings 51 through which clamp rods 52 parallel to the respective inlet and outlet passages extend on either side of the passages, being threaded at 53 into the pump cylinder, and the units being compressed to the pump cylinder by clamping nuts 54 threaded on the ends of the rods remote from the cylinder.

While in Figure 1 the inlet and outlet passages are in prolongation of one another, in Figure 2 the outlet passage is not in prolongation of the inlet passage. In Figures 3, 4 and 5 it is intended to indicate that either condition may prevail as desired. In either case the inlet should connect with the bottom of the cylinder as shown.

In some cases it may be desirable to provide the lateral limitation on the valve by lugs 40' at radially spaced points on the bottom of the plug allowing freedom for the ball as shown in Figures 6 and 9, the spaces 41' between the lugs permitting free flow of liquid in open position of the valve.

It may be desirable in some cases to make an irregularly shaped inlet or outlet passage by bores drilled through the valve sockets. This is shown in Figure 7, in which each valve socket 26², 27², 28² or 30², preferably somewhat wider in proportion to the other dimensions than in the other forms, is in line with a diagonally upwardly extending portion 55 of the inlet or outlet passage and a vertically downwardly extending portion 56 communicating with the next portion 55 through a bottom 57 of the valve socket, and containing a valve seat recess 33', in this case shouldered to receive a shouldered seat having lugs provided with upward extensions as

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shown. In this form each of the plugs has a diagonal annular shoulder 60 at the edge of its bottom face, a portion of which aligns with the ball and acts as a stop for upward motion of the ball suitably located above the ball.

In operation, the various other forms, once produced as described, function similar to that of Figure 1.

It will be evident that in the various forms shown, the valve seat is preferably located in a well or socket which is preferably vertically downwardly extending and in the best form extends diagonally across a diagonally upwardly extending inlet or outlet passage.

It will be evident that in order to avoid entrapment of air in the pumping, all of the passages and other recesses avoid downwardly extending hollows or pockets which lack continuous upward flow.

It will further be evident that in the preferred embodiments all passages can be drilled through normal inlet, outlet and socket openings of the valves.

It will further be evident that where preferred the valve units can be made separately to permit disassembly for inspection, cleaning or replacement of individual units.

In view of my invention and disclosure variations and modifications to meet individual whim or particular fancy will doubtless become evident to others skilled in the art, to obtain all or part of the benefits of my invention without copying the structure shown, and I, therefore, claim all such insofar as they fall within the reasonable spirit and scope of my claims.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:

1. In a valve assembly, a valve body having a through passage extending diagonally upward in a straight line, a plurality of vertically downwardly extending valve sockets at a plurality of spaced points extending downwardly into and across the passage, separate valve seat discs having valve openings and each positioned at the bottom of one of the sockets obstructing the passage except for the valve opening, a ball check valve on each seat and a plug closing each socket above the seat, the plug forming a stop for limiting the upper motion for the check valve.

2. A valve assembly according to claim 1, in which the plug has a tapered lower end which conforms at the side to the direction of the diagonal passage.

3. A valve assembly according to claim 1, in which the plug has a tapered lower end in combination with limiting lugs at a plurality of spaced points around each ball check valve.

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