H. P. MALONEY

DOUBLE-ACTING RECIPROCATING PUMP

Jan. 13, 1953
Filed April 20, 1948

Fig. 1.

Fig. 2.

3 Sheets-Sheet 1

Harry P. Maloney
INVENTOR.

BY

Attorneys
My invention relates to improvements in double acting, reciprocating pumps for pumping liquids and gases as required in oil wells, refrigeration plants, or other hydraulically driven use, and for hydraulic pressure purposes.

The principal object of my invention is to provide a pump of the type indicated for suspension in a well, or in a sealed unit of a refrigeration plant, or in a hydraulic lift for a bull-doser blade, and in which a single pump plunger and packing are arranged so that friction in the pump is reduced to a minimum, together with wear, and with high speed operation is rendered practicable with a low power driving source, all without sacrificing efficiency as regards output capacity.

Other and ancillary objects, together with the best nature of my improvements, will become readily apparent when the succeeding description and claims are read with reference to the drawings accompanying and forming part of this specification.

In said drawings:

Figure 1 is a view in side elevation of my improved pump in a preferred embodiment thereof;

Figure 2 is a view in vertical section taken on the line 2—2 of Figure 1;

Figure 3 is a view in transverse section taken on the line 3—3 of Figure 2;

Figure 4 is a similar view taken on the line 4—4 of Figure 2;

Figure 5 is another similar view taken on the line 5—5 of Figure 2;

Figure 6 is still another similar view taken on the line 6—6 of Figure 2;

Figure 7 is a fragmentary view in perspective of one of the packing rings;

Figure 8 is a view in vertical section illustrating a modified embodiment of my improved pump;

Figure 9 is a view in transverse section taken on the line 9—9 of Figure 8;

Figure 10 is a similar view taken on the line 10—10 of Figure 8;

Figure 11 is a fragmentary view in vertical section illustrating another modified embodiment of my improved pump.

Referring to the drawings by numerals, and first to Figures 1 to 7, in the preferred embodiment thereof, my improved pump comprises a pump cylinder 1 adapted to be disposed in upper right position and including a pair of upper and lower, aligned, half sections 2, 3 with inner ends 2′, 3′ coupled together as presently described, the upper section 2 being closed at its outer end by a cap-type head 4 threaded thereon, and the lower section 3 having an outer integral head 5.

A conical, axial, partitioning seat 6 in the outer end of the upper section 1, formed integrally with the head 4, tapers from the circumferential wall of said section 2 to said head 4. A similar partitioning seat 7 in the outer end of the lower section 3 integral therewith tapers from the circumferential wall of the section to the end 5 of said section. The seat 6 partitions the outer end of the upper section 1 and forms therewith around the same an annular collecting chamber 8 in the outer end of the upper section 2 and the seat 7 forms in a like manner a similar annular chamber 9 in the outer end of the lower section 3 and both seats 6, 7 form with the upper and lower sections 2, 3 a plunger chamber 10 with conical ends. Circumferentially spaced ports 11 in the seat 6 and similar ports 12 in the seat 7 establish communication between the collecting chambers 8, 9 and opposite ends of the plunger chamber 10.

A pump plunger 13 with a cylindrical hollow body 14 smaller in diameter than the plunger chamber 10, intermediate the ends of said chamber, and having tapered upper and lower ends 15, 16 is provided in said chamber 10 to reciprocate therein with said ends 15, 16 alternately seating in the seats 6, 7. A plunger rod 17 extends from the upper end of the pump plunger 13 out of the head 4 through an axial stuffing box 18 on said head 4 and is adapted to be reciprocated by a power drive, not shown. The pump plunger body 14 reciprocates in an annular packing assembly 19 interposed between the inner ends 2′, 3′ of the upper and lower sections 2, 3 of the casing 1, and which spaces said body from said sections a substantial distance and will now be described.

The packing assembly 19 comprises a pair of upper and lower, annular, packing rings 20 of leather, or the like, interposed between the inner ends 2′, 3′ of said sections 2, 3 with a flat, metal packing ring 21 interposed between the pair and in which the body 14 of the pump plunger 13 reciprocates with a working fit. An internally flanged coupling ring 22 is threaded onto the inner end 3′ of the lower section 3 and engages a circumferential flange 24 on the inner end 2′ of the upper section 20, so that said inner ends of said sections 2, 3 are coupled together with the packing assembly 19 clamped therebetween to form a tight seal between said ends of said sections. Annular ribs 25 on the packing rings 20 are provided to bite into the pair of packing rings 20, and annular grooves 26 are formed in the inner ends 2′, 3′ of said sections 2, 3 to provide for the packing rings 20 being squeezed into said grooves to facilitate forming a tight seal. The
upper and lower packing rings 20 are provided with internal upturned and downturned annular lips 27, 28, respectively, which are flexible so as to each frictionally grip the body 14 of the pump plunger 13 during one stroke of said plunger while the lip flexes out of frictional gripping relation to said plunger. Air vent ducts 22 are provided in the inner end 3' of the section 3 for the escape of air pressure when the sections 2, 3 are being coupled together and resulting from compression of said rings 20. Annular, internal, grooves, as at 30, may be provided in the sections 2, 3 for the lips 27, 28 to expand into during opposite strokes of the plunger 13 so that during said opposite strokes the lips 27, 28 function alternately to free the body 14 of the plunger 13.

Circumferentially spaced series of guide lugs 31 on the body 14 of the plunger 13, adjacent the ends 15, 16 thereof, space said body from the sections 2, 3 to guide said plunger 13 in a straight line, said lugs working against said sections upon opposite sides of the packing assembly 19.

A pair of intake nipples 32 extend out of the outer end 5 of the section 3 upon diametrically opposite sides thereof with inwardly opening flap valves 33 therein for controlling communication between the same and the collecting chamber 9. A similar pair of intake nipples 34 extend out of diametrically opposite sides of the section 2 and the upper collecting chamber 8 with inwardly opening flap valves 35 for controlling communication between the same and said collecting chamber 9. Thus, with the pump submerged in the liquid in a well, the same may take liquid into both chambers 8, 9.

A pair of output nipples 36 extend out of opposite sides of the section 3 from the lower collecting chamber 9 with outwardly opening flap valves 37 therein controlling output from said lower collecting chamber 8, and a pair of similar output nipples 38 extend out of the head 4 from the upper collecting chamber 8 with outwardly opening flap valves 39 for controlling output from said chamber 8.

An output nipple 40 extends out of the lower seat 7 and the outer end 5 of the lower section 3 in the axis of said section and is connected in a cross output line 41 having outwardly opening discharge flap valves 42 therein upon opposite sides of said nipples 40. The cross output line 41 is connected by elbows 43 to the 7, 28 function alternately to free the body 14 of the plunger 13.

so that liquid is drawn into said chamber 8 and into the plunger chamber 10 above the packing assembly 19. In the downstroke of said plunger 13 compression takes place in the plunger chamber 10 below said assembly 19 and consequently in the lower collecting chamber 9, whereby liquid is forced out of the output nipples 40, 36 past the valves 42, 37 into the cross output line 41 and the output lines 44. Similarly, in the upstroke of the pump plunger 13, compression takes place in said chamber 10 above the packing assembly 19 and consequently in the upper collecting chamber 8, whereby liquid is forced out of said chamber 10 above said assembly 19 and is also forced out of said chamber 8 past the valves 39 into the suspension output lines 41 to be discharged, together with the liquid from the output lines 44, at the surface of the well.

The upper and lower collecting chambers 8, 9 trap sediment and prevent the same from entering the plunger chamber 10. Also, as the plunger 13 approaches its limits of movement compression in said chambers 8, 9 is accelerated so that high turbulence is created in said chambers facilitating complete evacuation therefrom of sediment collected therein. As will now be apparent, friction in the described pump is reduced to a negligible factor, comparatively speaking, because of the clearance 55 provided between the pump plunger body 14 and the wall of the plunger chamber 10 and so that the pump is adapted to withstand long use, and is susceptible of comparatively high speed operation by a low power motor drive or the like.

In the modified embodiment of my invention shown in Figures 8 to 10, the pump plunger 48 is provided with flat ends 40 and the collecting chambers and the seats of the preferred embodiment of the invention are dispensed with. However, the pump plunger 48 works in a packing assembly 50 identical with the packing assembly 19, is spaced from the pump cylinder 51 by said assembly 50 and by end series of radial lugs 52 working against the wall of said cylinder, all in the manner and for the same purpose as in the preferred embodiment of the invention. Intake nipples 53 with inwardly opening flap valves 54 are provided in the outer end of the lower section 56 of the pump cylinder 51 and the outlet nipples 57 with inwardly opening flap valves 58 are provided in the outer end of the upper section 58 of said cylinder. Also, an output nipple 59 is provided in the outer end of the lower section 56 and a pair of output nipples 60 in the outer end of the upper section 58 with outwardly opening flap valves 61, so that in this embodiment of the invention, the pump is also double acting. The output nipple 55 is connected to a cross output line 62 which is connected by output lines 63 to the output nipples 60 and to suspension pipe lines 65 as all described with reference to the preferred embodiment of the invention. As will be seen, in this embodiment of my invention, the pump plunger 13, suction and compression chambers are provided in the cylinder 51 above and below the packing ring assembly 50.

In the embodiment of the invention shown in Figure 11, spaced apart, metal, packing rings 64 are mottled into the pump cylinder 65 for all metal contact with the pump plunger 66 which is spaced from said cylinder 65 for the same purpose as in the other described embodiments of my invention.

The foregoing will, it is believed, suffice to im
part a clear understanding of my invention, without further explanation.

Manifestly, the invention, as described, is susceptible of modification, without departing from the inventive concept, and right is herein reserved to such modifications as fall within the scope of the appended claims.

Having described my invention, what is claimed as new is:

1. In a pump of the class described, a pump cylinder adapted to be disposed upright and including a pair of aligned upper and lower half sections having confronting inner ends, a packing ring assembly interposed between said ends of the sections and forming therewith a plunger chamber, means coupling the inner ends of said sections together and clamping said assembly between said ends, a pump plunger in said chamber of smaller diameter than the same spaced from the wall of the chamber by said assembly, a plunger rod extending from one end of said plunger out of the outer end of one section for reciprocating said plunger, and means to introduce liquid into the outer ends of said sections and discharge the same therefrom under suction and compression in said ends respectively, said assembly including a pair of packing rings with upturned and downturned flexible lips projecting into the chamber and extending axially along the plunger in the space between the plunger and the inner wall of the chamber and each frictionally gripping said plunger during movement of the plunger in one direction while the other exerts out of friction gripping engagement with said plunger, and circumferentially spaced guide lugs on said plunger adjacent opposite ends thereof suitably engaging said wall and preventing side play of said ends when said ends are remote from said assembly.

2. In a plunger-type pump, a pump cylinder adapted to be disposed upright and having end heads, a pair of conical circumferentially ported hollow partitions in opposite ends of said cylinder coaxial therewith and tapering from the inner wall of the cylinder to said heads with said ends of the cylinder comprising said partitions, said partitions forming internally conical plunger seals in the ends of the cylinder and together with said cylinder and heads forming annular sediment trapping chambers in the ends of the cylinder communicating with said cylinder through said ports, a reciprocating plunger in said cylinder having conical ends for fitting in said seats and movement into and out of said seats alternately by reciprocation of the plunger, a packing ring assembly in the transverse center of said cylinder in which said plunger reciprocates between said partitions and whereby each conical end effects through said ports compression and suction in one of the chambers alternately as said end moves into and out of said chamber, means to introduce liquid into said chambers under suction effected in the chambers, and means to discharge liquid from said chambers under compression effected in the chambers.

HARRY P. MALONEY.

REFERENCES CITED

The following references are of record in the file of this patent:

**UNITED STATES PATENTS**

<table>
<thead>
<tr>
<th>Number</th>
<th>Name</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>99,403</td>
<td>Cardwell</td>
<td>Feb. 1, 1870</td>
</tr>
<tr>
<td>456,643</td>
<td>Wait</td>
<td>July 28, 1891</td>
</tr>
<tr>
<td>528,382</td>
<td>Worthington</td>
<td>Oct. 30, 1894</td>
</tr>
<tr>
<td>1,027,941</td>
<td>Hildebrand</td>
<td>May 28, 1912</td>
</tr>
<tr>
<td>1,380,303</td>
<td>Deavor</td>
<td>June 7, 1921</td>
</tr>
</tbody>
</table>

**FOREIGN PATENTS**

<table>
<thead>
<tr>
<th>Number</th>
<th>Country</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>3,256</td>
<td>Great Britain</td>
<td>July 26, 1881</td>
</tr>
</tbody>
</table>