

Nov. 17, 1931.

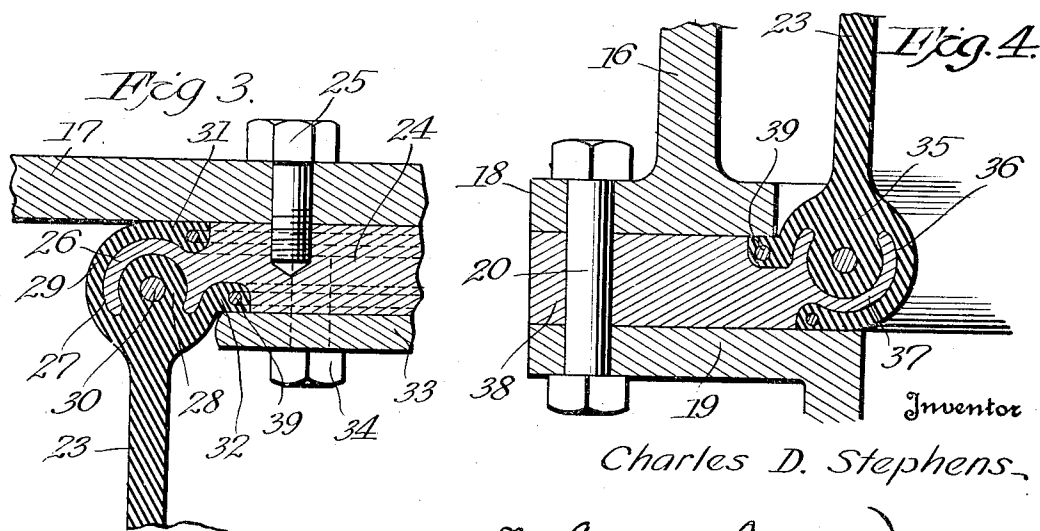
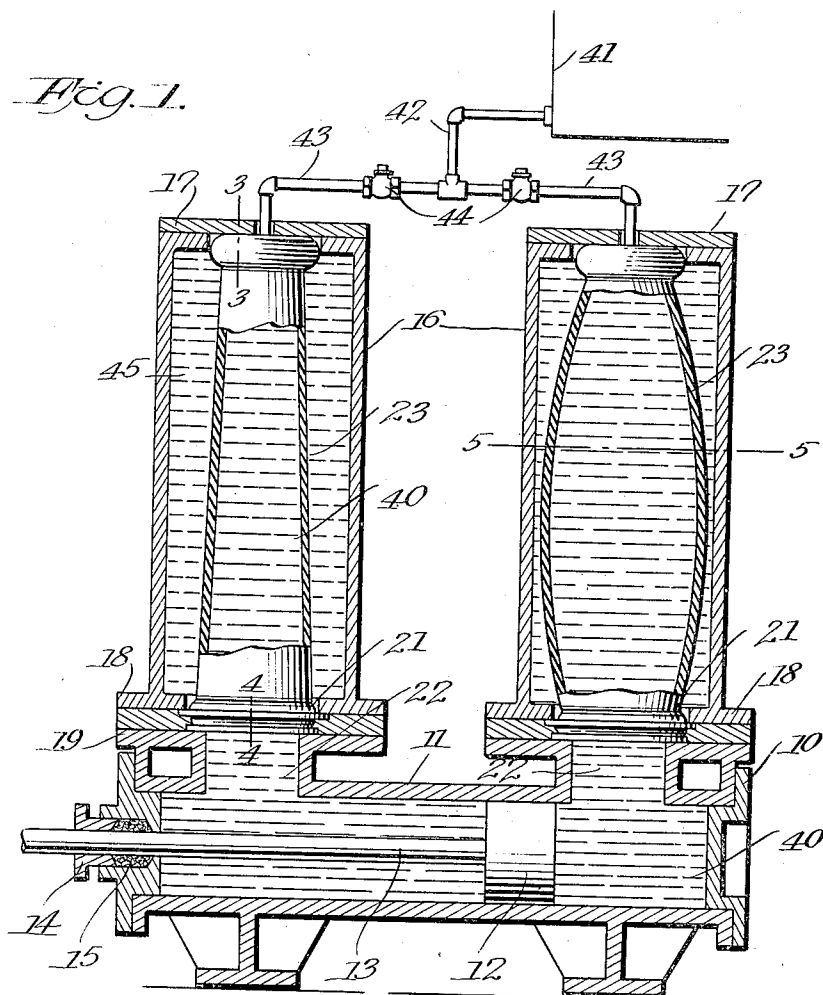
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1,832,257

PUMP

Filed May 15, 1929

2 Sheets-Sheet 1



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Fig. 2

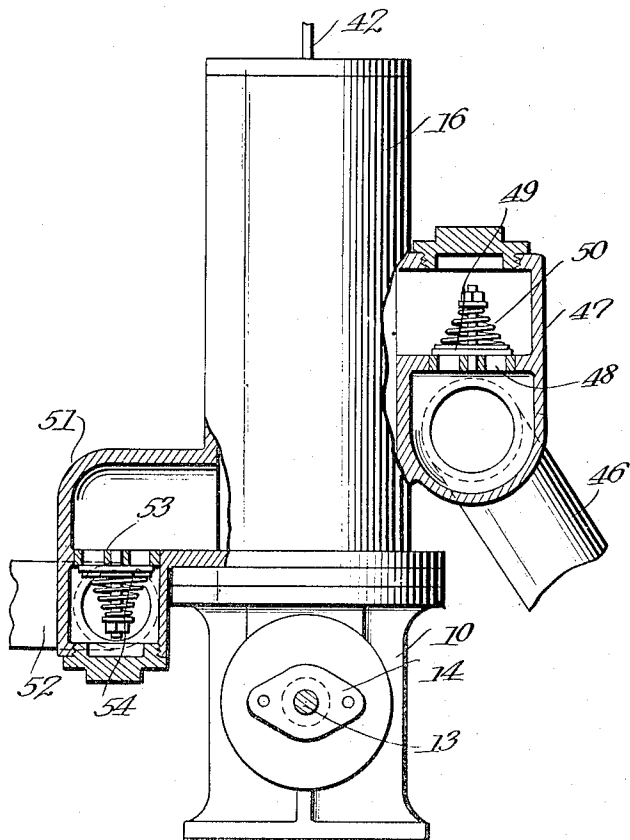


Fig. 6.

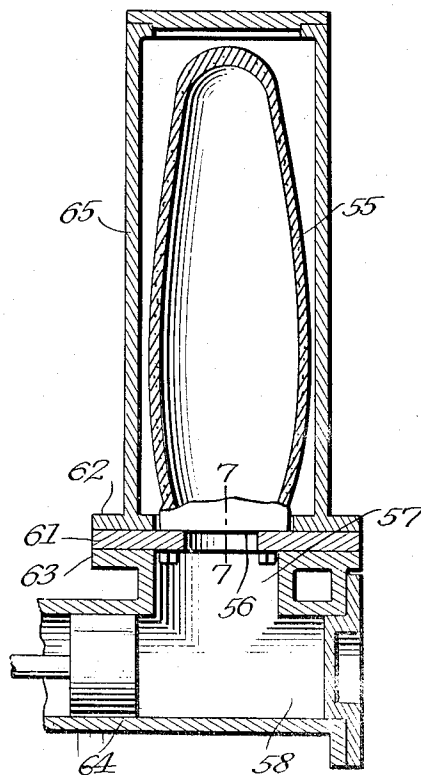


Fig. 5.

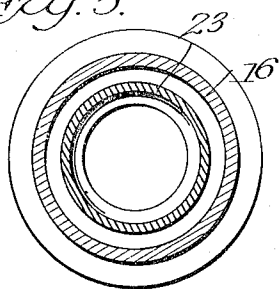
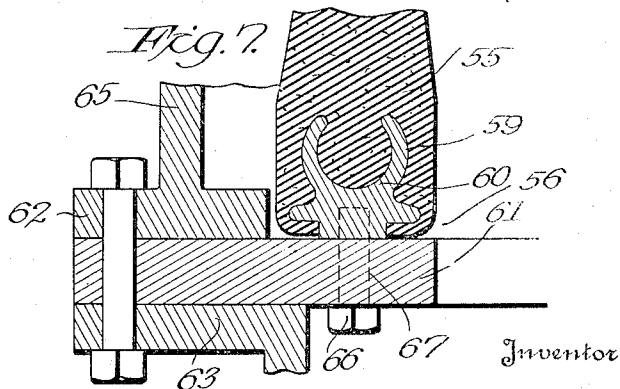


Fig. 7.



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UNITED STATES PATENT OFFICE

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PUMP

Application filed May 15, 1929. Serial No. 363,213.

The present invention relates to pumps and more especially to improved means for preventing the working fluid from coming into contact with the pump cylinder and piston.

One of the important objects of the invention is to provide a simple, efficient and economical pump having means for causing the circulating of the working fluid through the pump and which is admirably suited for use in the drilling process of oil wells, pumping chemicals and liquids containing grit and other impurities through a pump casing and all cases where it is desired that the circulating liquid be separated from the actuating fluid in the piston cylinder,

A further object consists in providing an expansible, hollow or cylindrical member preferably of rubber or other suitable flexible and resilient material, for causing the pulsation or surging of the circulating or working fluid, which member is in direct communication with the piston cylinder, so as to be responsive to the movement of the piston in order to effect, upon its displacement, the circulating of the working fluid through the pump casing.

Another object comprehends the provision of means for anchoring the flexible hollow member to the interior of the casing, which means preferably comprises a supporting element which is embedded within an end portion of the expansible member in any suitable manner such as by being moulded or vulcanized thereto.

A still further object is to provide means for insuring a tight seal being formed at the points of connection of the expansible hollow member with the casing.

Other objects and advantages will become apparent from the following description when taken in conjunction with the accompanying claims and drawings.

Referring to the drawings, in which is disclosed a preferred embodiment of the invention,

Figure 1 is a central horizontal cross-sectional view of a pump embodying my invention.

Figure 2 is an end view of Figure 1, with parts in section for clearance of illustration.

Figure 3 is a sectional view taken substantially along the line 3—3 of Figure 1.

Figure 4 is a sectional view taken substantially along the line 4—4 of Figure 1.

Figure 5 is a sectional view taken substantially along the line 5—5 of Figure 1.

Figure 6 is a sectional view of a modified form of the invention.

Figure 7 is a sectional view taken substantially along the line 7—7 of Figure 6.

Referring to the drawings in which like numerals indicate like parts in the several views, 10 generally denotes a pump casing which is preferably composed of a horizontally disposed cylinder 11, in which is reciprocally mounted a piston 12, the rod 13 of which extends through a gland 14 and packing 15 positioned at one end of the cylinder so as to be operatively connected to any suitable prime mover, not shown.

Associated with the cylinder 11 are the spaced chambers or water boxes 16 having the end plates or closure 17 secured thereto. Each of the chambers 16 is provided with an annular lower flange 18, that is connected to a complementary formed flange 19 on the cylinder 11 by the retaining bolts 20 (Fig. 4). An opening 21 in the bottom of each of the chambers 16 aligns with a complementary opening 22 in the cylinder 11, that is located adjacent the end stroke of the piston 12. The communication established by the openings 21 and 22 between the cylinder 11 and the chambers 16 are each closed by an expansible, hollow or cylindrical member 23 preferably of rubber or other suitable flexible and resilient material.

The expansible member 23 is of such a length as to be substantially coextensive with each of the chambers 16 and may have its upper end closed and connected to the adjacent wall of the end plate 17 by a disc 24, which is secured to the end plate by the screws 25 (Fig. 3). The disc 24 is preferably provided with a peripheral flange 26 having an annular recess 27 arranged to receive a complementary, enlarged, beaded end portion 28 of the expansible member 23. The flange 26 is embedded within the outer curved skirt or lip 29 of the expansible member 23

in any suitable manner, such as by being moulded or vulcanized thereto under heat and pressure. An annular locking ring 30 may be suitably secured to the flange 26 and embedded in the enlarged, beaded portion 28, so as to further insure a firm and permanent connection between the parts.

In order to prevent the escape of fluid past the expansible member 23, at its point of connection to the end plate 17, the ends 31 and 32 of the skirt 29 are confined between the adjacent wall of the end plate and a plate 33, which is secured to the disc 24 by the bolts 34, thus providing a clamping means which will insure a tight seal being formed when the parts are assembled.

The lower opened end of each of the expansible members 23 is similarly secured to the chambers 16 and in order that this may be effected, the member 23 has an enlarged annular bead 35 provided with a recess 36, which receives a complementary portion 37 of a metallic ring 38, which ring is clamped between the flanges 18 and 19 by the bolts 20 (Fig. 4). The beaded end portions of the expansible members 23 may further be reinforced by the small metal rings 39, that are embedded therein.

The interior of the cylinder 11 and the expansible members 23 are supplied with any suitable actuating or transmission fluid 40, such as water, air, oil or the like, from a tank or reservoir 41, which communicates with the flexible members 23 through the pipe 42 and the branch connections 43, that extend through the top of the end plate 17 into the interior of the expansible members 23. The valves 44 in the branches 43 regulate the flow of the fluid to the flexible members 23 and are so positioned as to be conveniently operated in order to replenish any of the fluid that might be lost due to leakage at any point within the cylinder or the expansible members.

The working or circulating fluid 45, such as water or the like, is introduced into each of the chambers 16 through a pipe 46, which communicates with an inlet valve casing 47 having a valve seat 48 and a normally closed valve 49, that is arranged to be raised from its seat against the tension of a spring 50, by the suction created within the chambers 16, during the operation of the piston 12. The circulating fluid 45 leaves the chambers 16 through an outlet valve casing 51, which communicates with a pipe 52 that conducts the fluid to any suitable point of use from where it may be returned to the casing through the pipe 46. The valve casing 51 is similarly provided with a valve seat 53, normally closed by a spring-pressed valve 54. Each of the outlet valve casings 51 is preferably positioned adjacent the bottom of the chambers, in order to preclude the possibility of trapping any residue or other foreign

matter within the chamber during the operation of the pump.

The lower end of each of the expansible members 23 is preferably of larger inside and outside diameters than its upper end, so that the members 23 may be bodily inserted into the chambers 16 from the lower end thereof. Moreover, in order to insure a proper operation of the pump, the area of the ports 22, which communicate the cylinder 11 with the interior of the expansible members 23, is substantially of the same area as that of the piston 12.

The operation of the pump is as follows. Assuming that the cylinder 11 and expansible members 23 have been filled with the proper amount of actuating fluid 40 and the working fluid 45 is confined in each of the chambers 16 between the inner wall thereof and the adjacent outer wall of the expansible members 23, it will be seen that upon the reciprocation of the piston 12, that the actuating fluid will be alternately delivered and withdrawn from each of the chambers 23, so as to cause the expansible members to pulsate or be moved outward and away from their normal position and then returned again to their normal position, thus displacing the liquid 45 and forcing it to flow into and out of the chambers 16, due to the sequential actuation of the inlet valve 50 and the outlet valve 53. It will be observed that the pressure exerted by the expansion of the members 23 will cause the automatic operation of the outlet valve 53, allowing the working fluid to escape from the chambers 16, while the return of the member 23 to its normal position due to the escape of the working fluid, creates a suction in each chamber 16, which, in turn, opens the inlet valve 50 so as to replenish the supply of the working fluid.

Should, for any reason, the actuating fluid 40 escape from the expansible members 23 or the cylinder 11, a fresh supply may readily be introduced into the flexible members through the pipes 43. While the valves 44 are shown so as to be manually actuated, any suitable automatic means may be employed for effecting this operation. By reason of the tight seal or joint formed between the ends of the flexible members 23 and their points of connection with each of the chambers, positive means are provided for preventing these parts from becoming loose or worn and thus causing an impairment or less in efficiency in the operation of the pump.

The modification of the invention illustrated in Figures 6 and 7, is substantially similar to the form previously described with the exception that the expansible member 55, which is made of rubber or any other suitable flexible and resilient material, is composed of a single piece having closed sides and upper end portions and an open lower portion 56, which communicates through the

passage 57 with the interior of the piston cylinder 58. The open end portion 56 of the flexible member preferably terminates in a beaded recess 59, in which is embedded a metallic retaining lug or member 60, preferably of the particular shape as shown in Figure 7. The lug 60 is supported on a ring 61 confined between the flanges 62 and 63 of the piston cylinder 64 and the water box 65 respectively. The lug 60 is secured in position by the screws 66 which extend through the ring 61 and engage the threaded recesses 67 formed therein.

Obviously, the invention may be associated with a single chamber in which is confined the working fluid or any number of chambers in which are mounted expansible members that communicate with the cylinders, so as to be responsive to the differential pressure created by the reciprocating of the pistons to impart a pulsating movement to the working fluid in order to force the same into and through the chambers. Moreover, the pump may be constructed so that the actuating fluid 40 will surround the hollow expansible member 23, while the circulating or pumped fluid 54 will pass inside of and through the said expansible member 23 and be controlled by suitable inlet and exhaust valves. It will be observed that the expansible hollow member 23 constitutes a wall or partition for separating the actuating fluid from the circulating or pumped fluid.

It is to be understood that the forms of the invention herewith shown and described are merely illustrative of preferred embodiments and that such changes and modifications thereof may be made as fall within the purview of one skilled in the art without departing from the spirit of the invention and the scope of the appended claims.

I claim:

1. In a pump of the class described, the combination of a casing having a piston cylinder and an angularly disposed chamber, a flexible hollow expansible member in said chamber and having one end closed and its opposite end communicating with said cylinder, the opened end portion of said flexible member having an annular flange, means secured to said chamber and embedded in said flange for anchoring the flexible member in the chamber, said cylinder and flexible member having confined therein an actuating fluid, a circulating fluid in said chamber, said chamber having inlet and outlet control means for regulating the flow of the circulating fluid, and a piston for causing the expansion and contraction of the flexible member and the flow of the circulating fluid into and through said chamber.

2. In a pump of the class described, the combination of a casing having a longitudinal piston cylinder and spaced vertically disposed chambers, a flexible hollow member

mounted in each of said chambers and having an open end communicating with the cylinder, said cylinder and flexible members having confined therein an actuating fluid, a circulating fluid in each of said chambers, and a piston for causing the expansion and contraction of said flexible members whereby to force the circulating fluid through said chambers.

3. In a pump of the class described, the combination of a casing having a longitudinal piston cylinder and spaced vertically disposed chambers, a piston in said cylinder, a flexible hollow member mounted in each of said chambers and having an open end communicating with the cylinder adjacent the end strokes of the piston, means for securing the end portions of each of the flexible members to the interiors of the chambers, said cylinder and flexible members having confined therein an actuating fluid, a circulating fluid in each of said chambers, and means for controlling the flow of the circulating fluid through said chambers, said piston serving to cause the expansion and contraction of said flexible members whereby to force the circulating fluid through said chambers.

4. In a pump of the class described, the combination of a casing having a longitudinally disposed piston cylinder, a piston in said cylinder, a pair of spaced vertically disposed chambers communicating adjacent the end strokes of the piston with said cylinder, a flexible hollow member in each of said chambers and arranged to close the communication of said cylinder with the chambers, means securing the lower end of each of said flexible members to its chamber, said cylinder and flexible members having confined therein an actuating fluid for causing the expansion of said flexible members, a circulating fluid in each of said chambers, and inlet and outlet means associated with said chambers for controlling the flow of the circulating fluid, said piston serving to cause the circulating fluid to pass into and through said chambers.

5. In a pump of the class described, the combination of a casing having a longitudinal piston cylinder and spaced vertically disposed chambers, a piston in said cylinder, a flexible hollow member mounted in each of said chambers and having an open end communicating with the cylinder adjacent the end strokes of the piston, means for securing the open end portions of said flexible members to the casing, said cylinder and flexible members having confined therein an actuating fluid for causing the expansion of said flexible members, a circulating fluid in each of said chambers, and inlet and outlet valves associated with said chambers for controlling the circulating fluid, said piston serving to cause the flexible members to be alternately expanded and contracted so as to force the

circulating fluid into and through each of the chambers.

5 6. In a pump of the class described, the combination of a casing having a longitudinal piston cylinder and spaced vertically disposed chambers, a piston in said cylinder, a flexible hollow member mounted in each of said chambers and having an open end communicating with the cylinder, said cylinder and flexible members having confined therein
10 an actuating fluid, means extending through said chambers and communicating with said flexible members for supplying the actuating fluid to the cylinder and flexible members,
15 and a circulating fluid in each of said chambers, said piston serving to cause the expansion and contraction of said flexible members whereby to force the circulating fluid through said chambers.

20 7. In a pump casing, an expansible hollow member having an open end provided with an annular recess, and a pair of spaced skirt portions, a retaining element carried by said casing and having one end thereof moulded
25 in said recess, and clamping means for securing said retaining element in position, said skirt portions being confined between said retaining element and said clamping means so as to provide a tight joint between the parts.

30 8. In a pump of the class described, the combination of a casing having a piston cylinder and a pair of circulating fluid chambers, inlet and outlet means associated with said chambers, a flexible hollow member mounted
35 in each of said chambers and having an open end communicating with said cylinder, said cylinder and flexible members having confined therein an actuating fluid, and a piston movable in said cylinder to cause alternate contraction and expansion of said members to draw circulating fluid through said
40 inlet means into said chambers and force the same out of said chambers through said outlet means.

45 In testimony whereof I have hereunto set my hand.

CHARLES D. STEPHENS.

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