A. S. MACKENZIE.

PUMP PLUNGER.

APPLICATION FILED MAY 31, 1919.

1,338,943. Patented May 4, 1920.

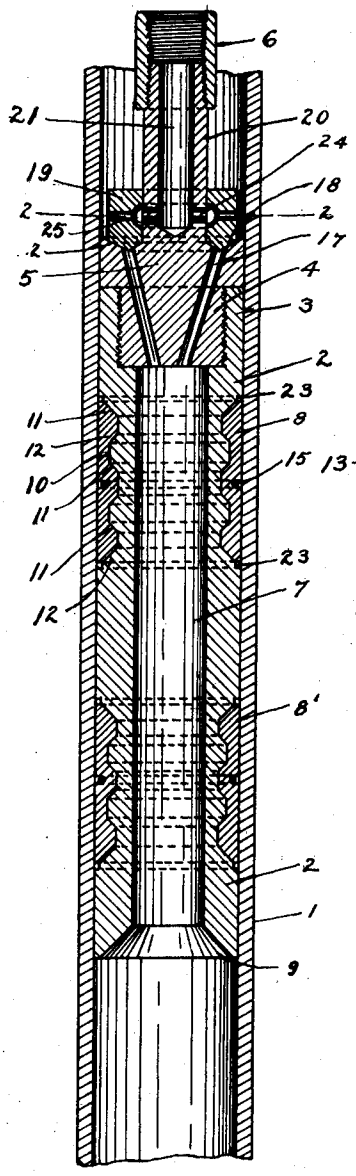


Fig. 1.

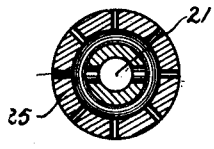


Fig. 2.

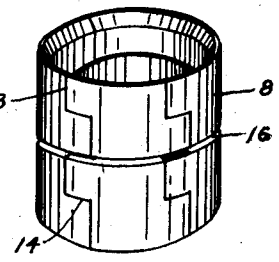


Fig. 3.

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ALEXANDER S. MACKENZIE, OF HOUSTON, TEXAS, ASSIGNOR TO TEXAS OIL WELL PUMP COMPANY, OF HOUSTON, TEXAS, AN ASSOCIATION.

PUMP-PLUNGER.

1,338,943. Specification of Letters Patent. Patented May 4, 1920.

Application filed May 31, 1919. Serial No. 300,834.

To all whom it may concern:

Be it known that I, ALEXANDER S. MACKENZIE, a citizen of the United States, residing at Houston, Harris county, Texas, have invented a certain new and useful Improvement in Pump-Plungers, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to an improvement in plungers for deep well reciprocating pumps. It has particular application to pumps of this character for use in oil or water wells where the liquid is mixed with sand.

One object of my invention is to provide a pump plunger which has an automatically expansible means to take up wear which may occur in the working parts due to sand or other abrasive substance, and to thus constantly maintain a tight fit between the plunger and the working barrel of the pump.

Another object is to provide a novel means of maintaining the plunger valve free of sand at all times so as to prevent its becoming clogged and thus retard or entirely prevent its action.

Other objects and advantages will be apparent from the more detailed description which follows and will be set forth with greater particularity in the claims.

Referring to the drawings forming a part of this specification and wherein like numerals are applied to like parts throughout the views, Figure 1 is a central longitudinal section through the working barrel and piston of my improved pump; Fig. 2 is a section of piston taken on the line 2—2 of Fig. 1; Fig. 3 is a perspective view somewhat enlarged showing the expanding sleeve employed in maintaining a tight fit between the plunger and the working barrel.

In Fig. 1 I have shown my improved plunger inserted within a working barrel 1 of the pump. The plunger 2 is cylindrical in shape, having an upper interiorly threaded portion 3, for attachment to the lower threaded end 4 of the valve member 5. Said valve member is threaded at its upper end for attachment by means of the coupling member 6 to a hollow sucker rod, not shown.

The piston 2 is bored longitudinally at 7 to accommodate a free upward current of liquid when the piston is in operation. The lower end of the piston is beveled outwardly at 9 to better serve this purpose. A tight sliding contact is maintained between the piston and the working barrel by means of a plurality of expanded sleeve members 8 and 8′, as shown in Fig. 1. There may be one or more of these sleeves as desired. In ordinary pumping one alone will be sufficient, but in extreme cases where the liquid is filled with large quantities of sand or other abrasive material two or more of these sleeves may be employed. I do not therefore wish to confine myself to any particular number.

These sleeves are seated within annular recesses 10 in the periphery of the plunger. In order that the sleeves may be automatically expansible to take up the wear between the working barrel and the plunger, the contacting faces between the sleeve and the plunger are inclined in both directions at each end, and at a point midway of the ends. By means of this provision there are three surfaces 11 inclined upwardly away from the center of the plunger and three similar surfaces 12 inclined downwardly away from the center of the plunger. It is obvious, of course, that there may be two or more of these beveled surfaces, but in this modification I have shown three. Between the inclined surfaces, the sleeve is cylindrical in shape.

In order that the close fit between the plunger and the working barrel may be maintained and still allow for the expansion of the sleeve, I have divided the sleeve longitudinally along regularly offset lines 13 into a plurality of parts. The manner in which the lines 13 of division are offset, as shown in Fig. 3, provides for maintaining a closure longitudinally of the sleeve when the same is expanded and thereby prevent the passage of fluid past the same when the sleeve is in expanded position. The manner of offsetting the lines as shown produces a plurality of horizontal sliding surfaces 14 which allow the sections of the sleeve to slide somewhat away from each other laterally and still maintain a tight closure along the horizontal portions. The effect of this method of longitudinally dividing the sleeve in this manner produces a sort of mortise between the sections of the sleeve and assists in maintaining the

sections in proper alinement, and, at the same time, prevents the opening of a longitudinal space for the passage of water when the sleeve is expanded. These sections are held in place in assembled position by means of a band of resilient wire 15 which fits tightly within a peripheral groove 16 within the outer surface of the sleeve. This spring allows a limited operative play of the parts but has sufficient resiliency to hold the sleeve assembled.

The valve member 5 at the upper end of the plunger forms at its lower end a threaded plug that closes the upper end of the passage 7 within the plunger but allows an upward flow of the liquid by means of a series of branching passages or channels 17 leading from the upper end of the passages 7 in an outwardly inclined direction to a beveled groove 18 in the upper face of the plug. The member 5 is reduced in diameter at 20 at its upper end for attachment to the coupling 6 and is bored longitudinally at 21 through this reduced portion to a point adjacent the upper end of the plug portion.

The valve consists of an annular ring 19 surrounding the reduced upper portion 20 and has its lower face 22 beveled to fit tightly within the groove 18, and thus serves to close the outlet to the upper ends of the passages 17 in the plug. This valve ring 19 has a limited upward movement on the down stroke of the plunger, the extent of its upward movement being determined by the coupling member 6 against which the ring is adapted to contact.

In the operation of this plunger, the downward stroke of same will cause a certain amount of friction between the outer face of the plunger and the working barrel. The friction upon the expanding sleeve 8′ will tend to force the same upwardly relative to the plunger and the contact of the sleeve along the beveled faces 11 of the plunger will force the sleeve outwardly into still closer contact with the side of the working barrel. When the plunger moves upward on the return stroke the action will be the same,—the friction between the working barrel and the sleeve will cause the sleeve to be forced downwardly relative to the plunger and the sliding contact between the sleeve, and the beveled surfaces 12 will again force the sleeve outwardly. In order to provide for a limited upward and downward stroke of the sleeve, the outer periphery of the plunger is grooved slightly at each end of the sleeve, as shown at 23, this groove being just sufficient to allow movement to accommodate the necessary expansion of the sleeve.

The downward stroke of the plunger will serve to raise the valve ring 19 from its seat and will allow the oil to move upwardly through the passage 7 and the branching ducts 17 into the space above the plunger. On the return stroke of the plunger the valve will drop back into its seat closing the passages 17 and raising the oil or other fluid within the pump barrel upwardly toward the surface.

If the fluid contains a large amount of sand or other foreign material the same will tend to settle around the valve ring 19 on the upward stroke of the plunger and may even lodge about the valve to such an extent that, when the plunger is again forced downwardly, the valve will be so tightly wedged as to allow very little, if any, fluid to find passage past the same. In order to overcome this tendency of the sand to lodge about the valve, the sucker rod is made hollow and the upper end of the valve member 20 is hollowed at 21 to allow water or other fluid to be pumped downwardly through the sucker rod to the neighborhood of the valve. The water finds an outlet from the inner passage 21 through laterally branching channels 24 to an annular groove 25 on the inner face of the valve ring 19 and from this groove branching ducts allow the water to find an exit outwardly around the outer periphery of the valve ring so as to agitate and stir up the sand thus preventing its lodging about the valve. As will be seen in Fig. 1, the valve ring will leave the passage 24 open on the down stroke of the plunger so that the flushing fluid will be forced directly outward into the sand tending to lodge around the valve seat and thus keep it agitated; and, on the upward stroke, when the valve ring has settled into its seat, the water will find an outlet through the ducts 26 so as to continue the agitation of the sediment tending to clog the valve.

The plunger constituting the subject matter of my invention serves to maintain a tight closure at all times between the plunger and the working barrel as it will be obvious that the expanding sleeves 18 will serve to automatically close the space between the plunger and working barrel and to take up wear of the same caused by the pressure of sand or other abrasive material, for a long period. The wear on the outer face of the plunger and the expanding rings will be about equal until the plunger has been worn down somewhat and then the expansion of the rings only will serve to maintain a tight closure. This will act for some time to close the space between the plunger and working barrel until the friction between the sleeve and the working barrel will be finally insufficient to cause the same to be forced either upward or downward with the working of the barrel, and when this occurs the plunger will have to be withdrawn and new sleeves substituted.

The particular formation of the valve member in this invention also does away

with the difficulty ordinarily experienced of clogging the barrel with the settling sand contained in the fluid being pumped. The combination of the sand-proof valve and the expanding sleeves serves to provide a plunger of much longer life than the ordinary plunger and in which the life of the working barrel will also be materially prolonged.

Having thus described my invention, the further objects and advantages of which will be clear without further description, what I claim as new and desire to protect by Letters Patent is:

1. In a pump, a plunger, a longitudinally divided sleeve thereon, oppositely beveled surfaces on both ends of said sleeve fitting on beveled surfaces on said plunger so that movement of said sleeve in either vertical direction will cause said sleeve to expand by frictional contact with said pump.

2. In a pump, a plunger, a central channel therein, branching ducts leading from said channels to a valve seat, a valve ring closing said channels, and means for discharging fluid through the upper part of said plunger and said valve for the purpose described.

3. In a pump, a plunger, a central channel therein, ducts leading from said channel through the upper end of said plunger, a valve ring closing said ducts, a hollow sucker rod on said plunger having discharge openings for projecting fluid through and around said valve ring to clear same of sand.

4. In a pump, a plunger, a plurality of peripheral recesses in said plunger, an expansible sleeve having interior projections fitted in said recesses, the contacting surfaces of said sleeve and plunger being so beveled adjacent both ends that a reciprocation of said plunger in either direction will cause a uniform outward movement of both ends of said sleeve.

5. In a pump, a plunger, an expanding sleeve thereon, a plurality of tapered surfaces on both ends of said plunger contacting with similar surfaces on said sleeve, so that the reciprocation of said plunger, cooperating with the inner surface of the pump barrel will cause said sleeve to move axially of said plunger in either direction and expand said sleeve.

6. In a pump, a working barrel, a plunger reciprocable therein and having a plurality of integral tapered surfaces thereon, a longitudinally divided sleeve thereon adapted to fit on said tapered surfaces and to be expanded equally at both ends by the reciprocation of said plunger, into tight contact with said working barrel on both the up and the down strokes of said plunger.

7. In a pump, a working barrel, a plunger therein, a longitudinally divided sleeve on said plunger and means on said plunger and said sleeve coacting with said working barrel to expand said sleeve at both ends on either stroke of the plunger.

In testimony whereof, I hereunto affix my signature this the 27 day of May, A. D., 1919.

ALEXANDER S. MACKENZIE.