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J. A. PATE ET AL
RELEASING PUMP PLUNGER

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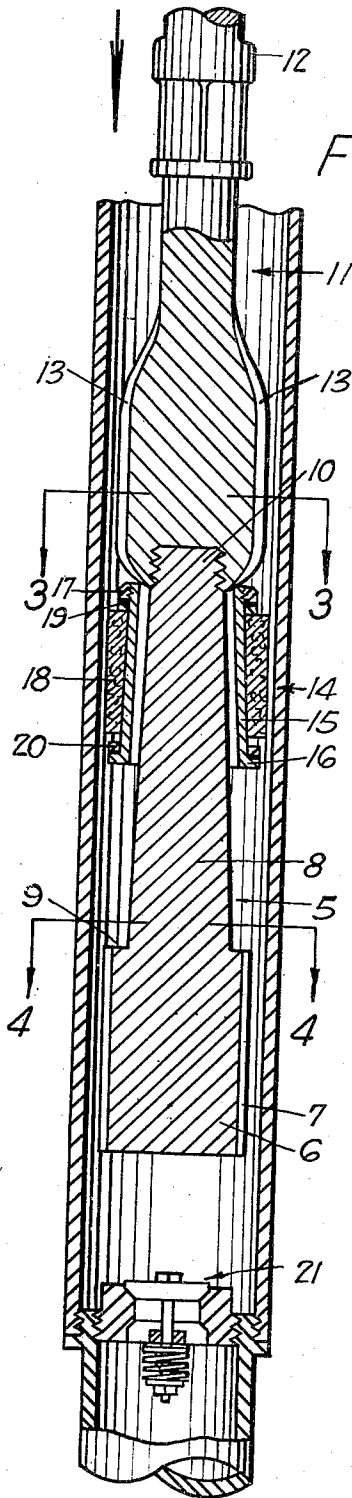


FIG. 1.

FIG. 2.

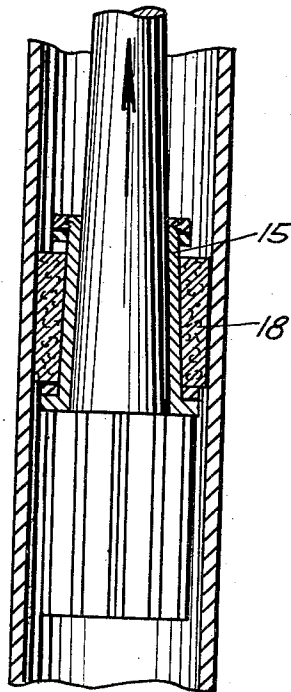


FIG. 3.

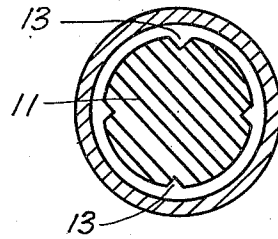
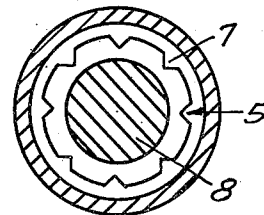


FIG. 4.



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RELEASING PUMP PLUNGER

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7 Claims. (Cl. 103—225)

The invention relates to a plunger assembly for use in oil, water, or sand pumps, and also for use as a swab.

The greatest difficulties with pumps using the usual type plunger assembly are the sticking of the plunger and the sticking of the traveling valves due to sand and other foreign matter settling on top and around the plunger and the valves.

The chief object of this invention is to eliminate the use of traveling valves on the plunger assembly and yet to afford a sufficient fluid flow area past the plunger to prevent the lodging of sand or foreign matter on the plunger.

Other objects of the invention are: to provide a plunger which will create better suction than plungers of present design; and which has fewer working parts than plunger assemblies of present design.

Other objects of the invention will be fully apparent from a consideration of the following detailed description of the invention when read in connection with the accompanying drawing, which forms a part of this application. The drawing is to be considered illustrative only.

Referring to the drawing:

Figure 1 is a side sectional view of the plunger assembly within a working barrel, showing the plunger passing downward in the barrel;

Figure 2 is a fragmentary section of the plunger within a barrel and shows the plunger traveling upward in the barrel;

Figure 3 is a sectional view taken along the line 3—3 of Figure 1; and

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

Like characters of reference designate like parts in all the figures.

The invention includes a lower plunger carrying guide member 5, the lower end 6 of which is substantially cylindrical, and is provided with a plurality of longitudinal slots 7, which extend throughout its length. The upper portion 8 of this member 5 is tapered from the shoulder 9 to its opposite end 10 which is threaded to receive the lower end of a second guide member 11. The member 11 is also suitably threaded at its upper end to receive the lower end of a sucker rod 12. The lower end of the member 11 is of larger diameter than its upper end and is longitudinally slotted as at 13 to provide additional fluid passage between the member and the barrel. At its extreme lower end the member 11 convergently tapers to a diameter sub-

stantially the same as the diameter of the upper end of the member 5.

The plunger proper, which will be designated as a whole by the numeral 14, comprises a thin walled, tapered, inner sleeve 15, the inner taper of which conforms identically in size and shape to the taper of the lower end of the member 8 from the shoulder 9 upward. This sleeve 15 has its uppermost end internally beveled to form a seat for the lower end of the guide 11, the lower end of which serves to limit the upward movement of the plunger 14 on the guide 5. When the plunger is at the upward end of its limited movement on the guide 5, as shown in Figure 1, the slots 13 afford communication between the space above the plunger, through the space between the sleeve and the member 8, and the space below the plunger. The sleeve 15 is provided with an annular shoulder 16 at its lower end. The outer surface of the sleeve 15 is highly polished between the shoulder 16 and its upper end. At its extreme upper end the sleeve 15 is threaded to receive a nut 17.

Intermediate the nut 17 and the shoulder 16, the sleeve 15 carries a sealing member 18 which is formed of a resilient material. Internally the sealing member 18 is tapered to conform to the exterior taper of the sleeve 15 from the upper end downward. Externally the sealing member 18 is cylindrical and is normally of slightly less diameter than the interior of the working barrel of the pump. An annular spacer 19 is provided to fit tightly the external surface of the sleeve 15 immediately adjacent the nut 17, and if deemed desirable an additional spacer, not shown, may be provided to fit the external surface of the sleeve 15 immediately below the spacer 19. A similar spacer 20 is provided for the lower end of the sleeve 15, and fits the external surface of the sleeve immediately above the shoulder 16, and likewise, an additional spacer, not shown, may be provided for this end of the sleeve. The purpose of these spacers is to determine the portion of the sleeve 15 over which the sealing member 18 must operate. When the plunger is first assembled two spacers 20 may be used on the lower end of the sleeve 15 and none on the upper end. This would limit the movement of the sealing member 18 on the sleeve 15 to the space between the uppermost surface of the uppermost spacer 20 and the lowermost surface of the nut 17. As the exterior surface of the sealing member 18 became worn one of the spacers 20 would be removed and a spacer 19 would be placed on the upper end of

the sleeve 15. Due to the taper of the sleeve 15 this would force the sealing member 18 to move over a surface slightly larger in diameter than that surface over which it moved when it was first placed on the sleeve 15. Likewise, as further wear took place the remaining spacer 20 might be removed, and an additional spacer 19 be placed on the upper end of the sleeve, forcing the sealing element 18 farther downward on the sleeve. The spacers 19 and 20 are of the same thickness, and are also of the same width. The exterior diameters are substantially the same while their interior diameters conform in size to that portion of the sleeve on which they are intended to fit. The length of the sealing element 18, is, of course, always slightly less than the distance between the adjacent spacers 19 and 20, which permits a longitudinal movement of the sealing element on the sleeve, which movement in a downward direction expands the resilient sealing member, and in an upward movement permits the sealing member to contract.

Operation

In Figures 1 and 2 are shown the plunger assembly in the working barrel of a pump. The working barrel is, of course, provided with any suitable type check valve 21 at its lower end, which is adapted to open permitting the inflow of fluid during the upward stroke of the plunger, and which immediately closes as soon as the upward travel of the plunger stops. During the upward travel of the plunger the sealing member 18 is forced downward on the sleeve 15, as shown in Figure 2, which movement expands the sealing member into perfect contact with the inner surface of the pump barrel, creating a vacuum within the barrel below the plunger and drawing the fluid into the lower end of the barrel through the valve 21. When the upward travel of the plunger ceases and the downward travel begins the contact of the sealing element 18 with the pump barrel causes the sealing element to be forced upward on the sleeve 15, permitting it to contract and assume a size slightly smaller than the interior of the working barrel. During the downward travel of the plunger, then, the sealing element 18 is in the position shown in Figure 1, and fluid is free to pass upward around the plunger between the outer surface of the element 18 and inner walls of the barrel. Fluid is also permitted to pass freely through the space between the inner surface of the sleeve 15 and the outer surface of the guide member 8, and into the grooves 13, into the space above the plunger. Thus, as the plunger passes downward in the barrel the fluid passing upward through the spaces just mentioned serves to thoroughly remove any sand, sediment, or other foreign matter which might possibly have settled on the upper end of the plunger or on the nut 17. As the plunger reaches the lower end of its stroke and begins its upward travel the resistance of the fluid above it again forces the sealing member 18 to assume the position shown in Figure 2, and the operation is repeated.

While we have described and illustrated a specific embodiment of our invention, we are aware that numerous alterations and changes may be made therein and we do not wish to be limited except by the prior art and by the scope of the appended claims.

We particularly wish to call attention to the fact that a change in the shape of the lower end

of the member 11 could easily be made without changing the principle of the invention. This applies equally well to the shape of the lower end of the member 5.

We claim:

1. A pump comprising: a barrel; a valved bottom for the barrel; a reciprocable solid plunger rod having an upwardly and inwardly tapered portion intermediate its ends, and a shoulder at each end of said tapered portion; a tapered sleeve having an internal bore to fit closely the lower end of the tapered portion of said plunger rod and slidably mounted thereon, and having a shoulder surrounding each of its ends; and a resilient expansible sealing member mounted intermediate the shoulders of said sleeve and adapted for limited axial movement thereon; whereby as the rod is moved in one direction the sealing element moves to the small end of the sleeve and contracts, and the sleeve moves to the small end of the tapered portion of the rod affording a by-pass for fluid between the rod and sleeve and between the sealing element and the pump barrel; and as the rod moves in the opposite direction the sleeve is forced to the large end of the tapered portion of the rod closing the space between rod and sleeve, and the sealing element is forced to the large end of the sleeve and is thereby expanded to seal against the walls of the barrel.

2. A pump comprising: a barrel; a valved bottom for the barrel; an expansible sealing element within the barrel; a tapered sleeve on which said sealing element is axially slidable, said sleeve adapted to expand said sealing element as the sealing element slides in one direction with relation thereto, and to permit its construction as said element slides in the opposite direction with relation thereto; an intermediately tapered solid plunger rod on which said tapered sleeve is axially slidable; and shoulders carried by said rod and said sleeve for limiting the axial movement of the sleeve and sealing element thereon, respectively.

3. A pump comprising: a barrel; a one-way valve in the lower end of the barrel; and a plunger in the barrel including an intermediately tapered solid plunger rod, a similarly tapered sleeve mounted for limited axial movement on the tapered portion of said plunger rod, and an expansible sealing element mounted for limited axial movement on said sleeve and adapted to be expanded to seal against the barrel wall when positioned at the large end of said sleeve, and to contract to a smaller size than the interior of said barrel when positioned at the small end of said sleeve.

4. A plunger assembly for a pump comprising: a solid plunger rod having an intermediate tapered portion; a similarly tapered sleeve mounted for limited axial movement on the tapered portion of said plunger rod; and an expansible sealing element mounted for limited axial movement on said tapered sleeve; the forced movement of said sealing element to one end of said sleeve forcing its exterior expansion, and forced movement to the opposite end of said sleeve permitting its contraction; the forced movement of said sleeve to the large end of the tapered portion of said rod adapted to close the space between the two, and the forced movement of the sleeve to the small end adapted to open a by-pass between rod and sleeve affording passage for fluid from one end of the barrel past the plunger to the other end of the barrel.

5. A plunger assembly for a pump comprising:

5 a solid plunger rod having a tapered portion intermediate its ends and a shoulder at each end of said tapered portion; a similarly tapered sleeve mounted for axial movement on the tapered portion of said rod, and adapted when positioned at the small end of said tapered portion to afford fluid passage through its bore, and when positioned at the large end of said tapered portion to seal against the tapered portion and the adjacent shoulder thus preventing the passage of fluid through its central bore; and an expansible sealing element surrounding said sleeve and mounted thereon for limited axial movement, said sealing element being normally of a size less than the interior of said barrel and adapted to be expanded to seal against the interior wall of said barrel when moved to the large end of said tapered sleeve.

10 6. A plunger for a barrel pump comprising: a sleeve tapered inside and outside; a solid operating rod having a portion of its outer surface tapered at the same angle as the inside surface of said sleeve, and on which said sleeve is adapted

to slide; and a resilient annular expansible sealing element mounted on said sleeve, said sealing element adapted to be expanded by the tapered outer surface of said sleeve as the element moves toward the larger end thereof, and to contract as it moves toward the smaller end thereof, and also adapted to move said sleeve axially on said rod in the same direction in which the packing moves on its sleeve.

15 7. A plunger for a barrel pump comprising: a solid tapered operating rod; an externally and internally tapered sleeve mounted for limited axial movement on said rod; and an internally tapered annular expansible packing element mounted for limited axial movement on said sleeve, whereby as the plunger moves downward the packing element moves upward to the small end of said sleeve and contracts, and at the same time serves to move said sleeve upward to the small end of said rod, thus opening an annular passage between the sleeve and the rod.

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