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2,715,368

WELL PUMP PLUNGER

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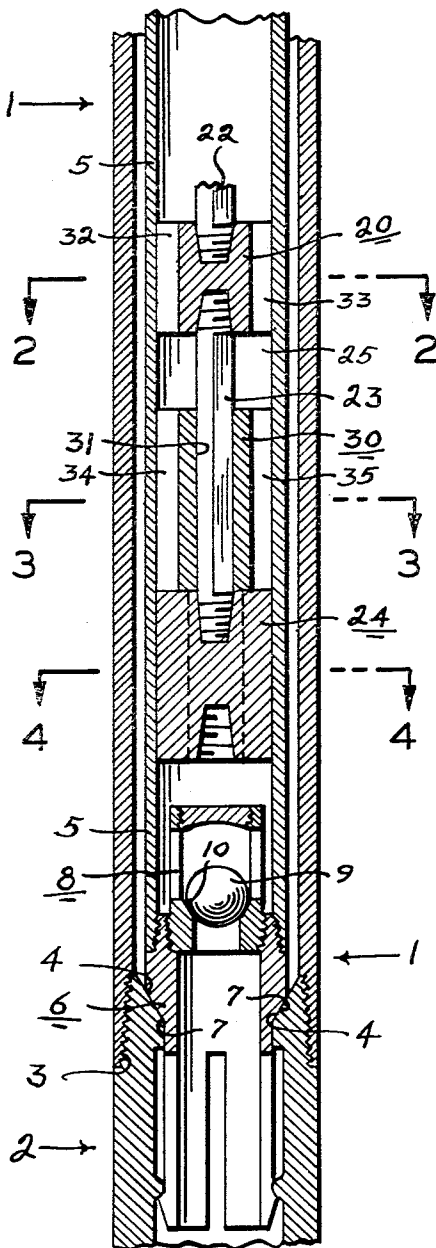


FIG. 1

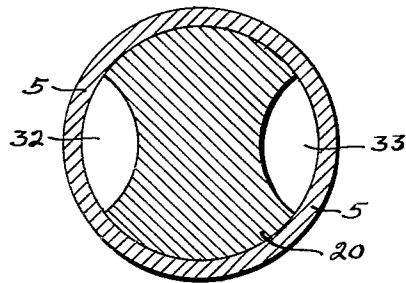


FIG. 2

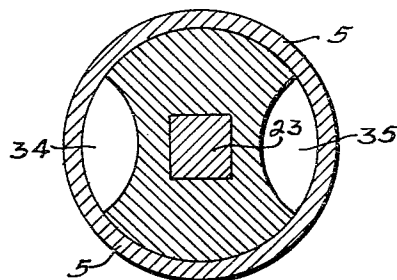


FIG. 3

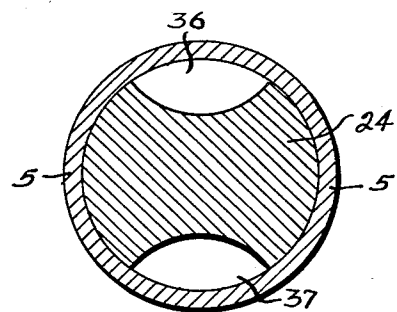


FIG. 4

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WELL PUMP PLUNGER

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2 Claims. (Cl. 103—225)

The present invention relates to well pumps, and more particularly to well pumps of the vertical reciprocating type, primarily designed for the purpose of raising oil from deep wells.

One important object of the invention is to provide an all metal vertically reciprocating deep well pump in which the parts receiving abrasive wear may be hardened to the extent that long lived durability may be obtained.

A further and equally important object is to provide a pump of this class, which is so designed that an upward and downward jarring action is provided for loosening the pump piston in the surrounding barrel, should the piston become frozen or stuck therein, due to periods of idleness causing gravitational deposits of extraneous matter entrained in the well fluid which is being pumped.

Quite often, the plungers or pistons of conventional traveling valve pumps become frozen or stuck in the pump liner within which they reciprocate. Some well fluids entrain so much extraneous matter, usually extremely fine sand, that pumping shut downs of even short duration, allow a sufficient amount of gravitational deposit to stick or freeze the plunger within the pump barrel liner. If there is no provision made for extricating such plungers, it becomes necessary to pull the whole tubing string, and also the sucker-rod string, from the well. Of course, such a pulling operation entails considerable expense, both in the cost of labor and in shut-down pumping time.

If the stuck or frozen plunger is of a type which includes resilient media for sealing with the pump liner, the sealing elements are usually destroyed in loosening the plunger from the liner.

The pump of the present invention is so designed that there are no resilient sealing elements employed, and further, there is embodied in the plunger a "lost-motion" mechanism which is capable of obtaining both an upward and a downward jarring action against the deposited extraneous material.

Since no resilient sealing media is used in the pump plunger of the present invention, there is nothing destroyed or damaged by forcibly jarring the plunger loose.

A further object of the present invention is to provide in a reciprocable pump plunger, a vertically sliding valve body in lieu of the conventional ball valve, or the conventional poppet-type check valve, said body being of sturdy construction capable of withstanding severe percussive blows.

The above mentioned slidable valve body acts, on the up-stroke of the plunger, as a means for preventing downward passage of well fluid through the plunger, and during any period of shut-down time, the body prevents the gravitational deposit of a dangerous amount of extraneous matter upon a plunger head therebelow.

The present invention is an improvement over United States patent numbered 2,229,519, which was issued on January 21, 1941, to myself as co-inventor with my brother James A. Pate.

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Another object of the invention is to provide a simple pump plunger capable of accomplishing the objects and purposes hereinabove set forth.

Other objects will be apparent from the following description when taken in conjunction with the accompanying single sheet of drawings, wherein:

Figure 1 is a vertical sectional view of a conventional pump barrel, barrel liner, and foot or standing valve, the pump plunger of the present invention being shown operatively positioned within said liner;

Figures 2, 3 and 4 are horizontal sectional views, taken respectively along the lines 2—2, 3—3, and 4—4 of Fig. 1, the outside pump barrel wall having been deleted.

Like characters of reference designate like parts in those figures of the drawings in which they occur.

In the drawings:

The reference numeral 1 indicates, as a whole a conventional tubular deep well pump body or barrel, having the lower end of its bore reduced in diameter by a foot fitting 2, which is attached thereto by threads 3. The upper end of the fitting 2 has a conically tapered seat surface 4.

The reference numeral 5 indicates a conventional tubular pump barrel liner, having a fitting 6 threadedly connected to its lower end, said fitting having a conically tapered exterior downwardly presented surface 7, adapted to seat upon the surface 4 of the foot fitting 2. A conventional foot-valve or standing-valve cage 8 is threadedly connected to the upper end of the fitting 6, and contains a ball valve 9 adapted to seat upon a conically tapered seat 10 carried by the cage. The various structural elements which are above described, and which are indicated by the reference numerals 1 through 10, are all conventional to deep well vertically reciprocable pumps.

The pump plunger of the present invention is adapted to be reciprocatably mounted within the liner 5 above the cage 8.

This pump plunger mechanism, per se, consists substantially of a solid upper plunger head 20, the upper end of which is provided with a threaded socket adapted to connect the lower end of a conventional lifting-rod or sucker-rod section 22. The section 22 is the lower section of a rod string, not shown, but which extends upwardly to the earth's surface.

The pump barrel 1 at its upper end, not shown, is equipped to threadedly connect the lower end of the lowermost section of a conventional production tubing string, not shown, but which extends upwardly to the earth's surface. The upper end of the pump barrel 1 is threadedly connected to the upper end of the barrel liner 5, so that the liner 5 actually constitutes a removable part of the pump body, since it is held rigidly in co-axial relation to the barrel 1.

The lower end of the upper plunger head 20 is provided with a threaded socket adapted to receive the upper end of a solid link or rod 23, which is polygonal in cross-section. The lower end of the rod 23 is threadedly connected to a similar socket in the upper end of a solid lower plunger head 24. The head connecting link or rod 23 may be made of any desired length, so that the annular space 25 around the rod 23, and lying between the adjacent ends of the two heads 20 and 24, will be of a desired length.

A tubate sleeve valve 30 is provided within the liner 5 and around the guide rod 23, and the valve 30 is provided with an axial through bore 31 which is polygonal in form so as to have a working slidable fit with the polygonal rod 23. The valve is consequently held against axial rotation on the rod 23. Exteriorly, the valve 30 has a working sliding fit within the pump liner 5, so that it may freely slide between the two heads 20 and 24. The lower end of the valve 30 is machined to coincide

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with and perfectly fit upon the upper machined end of the lower head 24.

Exteriorly, the upper head 20 is provided with two diametrically opposed channels 32 and 33 which extend from end to end thereof for the passage of well fluid upwardly in the liner 5 past the head. The sleeve valve 30 is exteriorly provided with two similarly spaced end to end channels 34 and 35 for the similar passage of well fluid.

The lower head 24 is provided with two diametrically opposed end to end grooves 36 and 37 which are similar to the channels 34 and 35 in the valve 30, except that they are staggered circumferentially ninety degrees from the channels 34 and 35. Due to the staggered relationship of the channels 34—35 and the grooves or passages 36—37 (Fig. 4), the valve 30 is adapted to close the upper ends of the grooves 36—37 when it is at the lower end of its travel along the rod 23, or in other words, when the valve is seated upon the head 24 (Fig. 1).

With the above described plunger reciprocally mounted in the pump liner 5, upward lifting movement of the sucker-rod string will, of course, lift the plunger away from the foot valve 9. Such upward movement of the plunger acts to create a suction in the lower portion of the liner, which raises the ball 9 off its seat and draws well fluid into the liner through the seat 10. During this upward stroke of the plunger, the sleeve valve 30 remains seated upon the lower head 24, and the fluid passages 36—37 are consequently closed by the valve. The result is, that any well fluid residing in the pump liner 5 above the plunger, or in the tubing string thereabove, will be lifted by upward movement of the plunger.

When the rod string and plunger are next lowered, the foot valve 9 is forced to its seating position, and downward movement of the plunger through the fluid in the lower end of the liner 5 above the foot valve, acts to un-seat and raise the sleeve valve 30 along the guide rod 23. This upward movement of the valve 30 allows the fluid in the bottom of the liner to pass upwardly through the channels 34—35 in the valve and 32—33 in the upper head 20. To pump the well, this lifting and then lowering cycle is repeated, as is usual with all conventional vertically reciprocating well pumps.

Should idleness in the pumping operation allow a settling of entrained extraneous matter, the deposit thereof must take place in the channels 32—33, the space 25, and the channels 34—35 in the valve, all of which is above the lower head 24. In order to loosen and dissipate such a deposit, the rod string may be repeatedly jarred downwardly and then upwardly to produce a churning effect in the fluid in the lower portion of the liner 5. This churning motion is possible, because there is always a fluid space left in the liner between the lower head 24 and the foot valve 9, and consequently, it is always possible to lower the heads slightly with relation to the valve 30. The least initial vertical movement of

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the heads with relation to the valve 30 is sufficient to get the churning of the fluid started, which means that the deposit can always be dissipated without injury to the pumping equipment. Due to the fact that no resilient sealing elements are used in the present plunger, there is nothing to be torn up or damaged in getting the plunger loose from deposited material.

Obviously the invention is susceptible to some change or alteration without defeating its practicability, and I therefore do not wish to be confined to the preferred embodiment shown in the drawings and described herein, further than I am limited by the scope of the appended claims.

I claim:

1. A plunger for well pumps of the vertically reciprocating type, including: a solid upper head adapted to be connected to the lower end of a pumping rod-string; diametrically opposed longitudinal channels in the surface of said head and extending from end to end thereof; an elongated depending rod connected to the lower end of said head, said rod being polygonal in cross-section; a solid lower head carried by the lower end of said rod; diametrically opposed end to end external channels along the surface of said lower head, said channels being staggered with relation to the channels in the upper head; a tubular sleeve valve slidably disposed on said rod and held against rotation with relation thereto; diametrically opposed end to end channels in the surface of said valve, said channels circumferentially spaced to conform to the first mentioned channels to form continuations thereof when the valve is at the upper end of its travel, said valve adapted to close the upper ends of the channels in the lower head when it is at the lower end of its travel.

2. A plunger for vertically reciprocating well pumps, including: two solid heads adapted to reciprocate in a pump barrel, said heads having two diametrically opposed end to end channels in the surface of each head; a solid externally polygonal rod for holding said heads in vertical spaced relation to each other, and for radially positioning the heads so as to stagger the channels carried thereby; and a sleeve valve mounted on said rod between the two heads for vertical reciprocation with relation thereto, said rod guiding the travel of said valve and preventing its rotation, said valve adapted to close the lower channels when it is at the lower end of its travel, said valve having two end to end grooves in its surface spacedly disposed for communicating with the channels in the upper head.

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