

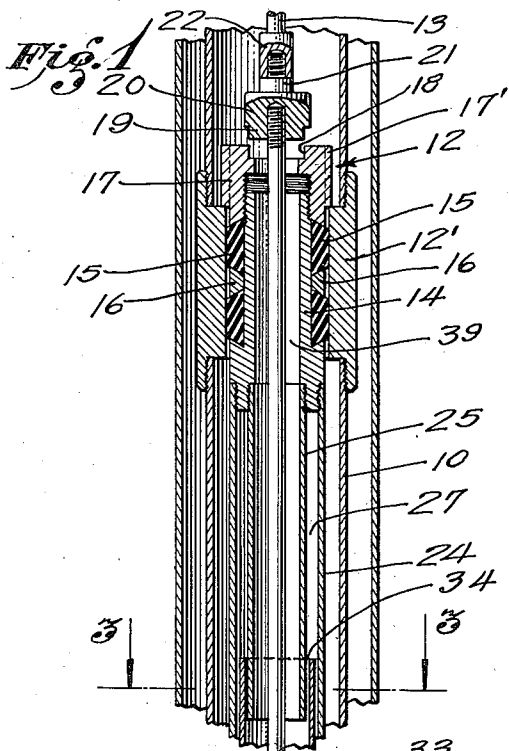
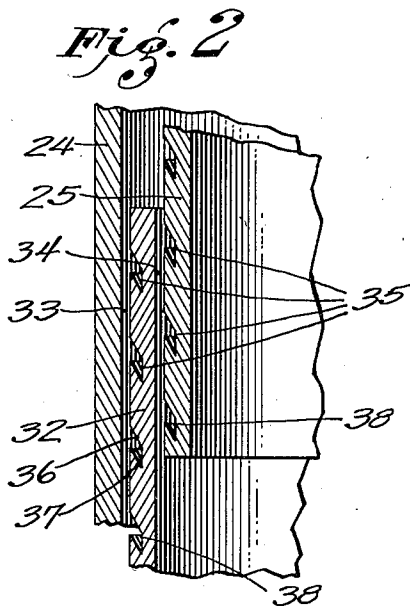
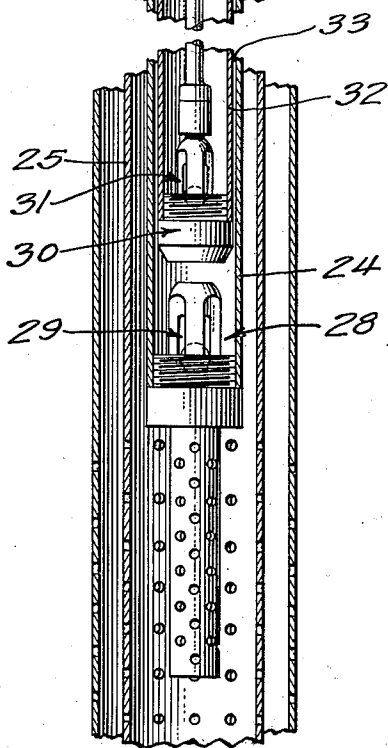
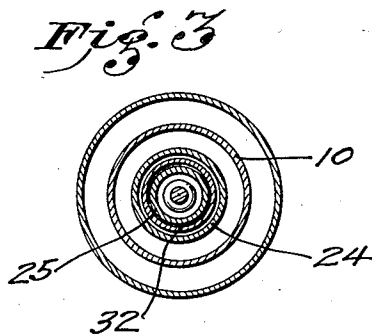
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C. M. O'LEARY

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SLIPPAGE REDUCTION PUMP

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INVENTOR
CHARLES M. O'LEARY
BY James M. Abbett
ATTORNEY

UNITED STATES PATENT OFFICE

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SLIPPAGE REDUCTION PUMP

Charles M. O'Leary, Los Angeles, Calif.

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1 Claim. (Cl. 103—181)

This invention relates to deep well pumps and particularly pertains to slippage reduction pumps. This application is a continuation in part of my abandoned application entitled Slippage reduction pump, Serial No. 625,872, filed July 29, 1932.

In the operation of deep wells, such for example as oil wells in which it is characteristic for sand from the formation to mix with the oil being drawn from the well, it is desirable to provide a pumping structure which may be mounted within the casing at the depth of flow of the well or at any other suitable point, and which will operate to elevate the liquid from the well without requiring that the reciprocating parts shall be tightly packed with relation to each other, or that they shall have movement with relation to each other which will act to cause excessive wear of the parts due to the granular, gritty material which may be suspended within the liquid, the structure comprising a reciprocable plunger which moves within a pump cylinder and has a relationship therewith to insure that the fluid being moved thereby will form its own seal between the cylinder and the piston without requiring any physical contact between said members, said members being further formed with means for agitating the fluid comprising the seal so that there will not be any accumulation of sediment or gritty material between the surfaces of the moving parts which would tend to abrade the surfaces or pack them in a manner to render the device inoperative.

The invention is illustrated by way of example in the accompanying drawing in which:—

Figure 1 is a view in longitudinal vertical section and elevation showing the structure with which the present invention is concerned.

Fig. 2 is an enlarged fragmentary view showing the manner in which the corresponding surfaces of the moving parts are prepared to cause them to produce a disturbance in the liquid which is between them whereby suspended solids in said liquid will be agitated to prevent it from settling upon the parts and unduly abrading the same.

Fig. 3 is a view in transverse section through the pump and the casing structure as seen on the line 3—3 of Fig. 1.

Referring more particularly to the drawing, 10 indicates a well tubing which has been suitably set within a well bore. A plurality of perforations are formed through the tubing wall and through which fluids from the oil bearing formation may pass into the tubing. A friction lock and packing device 12 is mounted upon a pump rod 13 and is designed to be expanded into the tubing 10 at a desired point in lock or anchor

shoe 12' as will be hereinafter described. The friction lock device includes a cylindrical body member 14 which is of an outside diameter materially less than the inside diameter of the tubing 10. Mounted upon this cylindrical body is a plurality of expandable packing rings 15 separated from each other by spacers 16. A nut 17 having laterally extending limiting means 17' is freely mounted on the pump rod 13 and is formed with a transverse slot 18 across its upper face which slot may be engaged by a transverse key member 19 secured to a fitting 20 formed as a part of a pin connection 21 which is in turn engaged by a box coupling member 22 of an upper pump section 13. It will be seen that when the member 19 is moved down into register with the slot 18 rotation of the rod will cause the threaded nut 17 to move on to the upper threaded end of the cylindrical member 14 and will compress the packing rings 15 to cause them to expand and engage the inner face of the anchor shoe 12' and seal off the upper portion of the tubing 10 from the area within which pumping operations are to take place.

Depending from the cylindrical member 14 of the friction lock packing device is a standing barrel 24 and a hanging sleeve 25 which is circumscribed by the standing barrel and is concentric therewith. The standing barrel is threaded onto the outer face of the cylindrical body member 14 and the hanging sleeve is threaded on to the inner face. The barrel and sleeve thus combine to form an annular pumping chamber 27 closed at its upper end by the cylindrical body member 14 and opened at its lower end in a manner to be hereinafter described. The standing barrel is provided at its lower end with a standing valve structure 28 which is threaded into the end of the standing barrel and carries a foot valve 29 by which fluid is admitted into the lower end of the standing barrel but which prevents fluid from passing out through the standing valve structure when the valve is closed. The length of the standing barrel may be as desired depending upon the intended length of pump stroke in the device.

The hanging sleeve 25 may be of any desired length but is preferably shorter than the standing barrel a distance substantially equal to the length of the stroke of the pump, and if desired the hanging sleeve may be of a length which is itself substantially equal to the stroke of the pump. Disposed below the open mouth of the hanging sleeve 25 is a working valve structure 30. This valve is fitted with a foot valve member 31 which will permit fluid to pass upwardly

through the valve structure 30 but will prevent it from flowing downwardly therethrough. The body portion of the working valve structure 30 extends downwardly a desired distance and is of an outside diameter substantially less than the inside diameter of the standing barrel. Mounted upon the body of the valve structure 30 and extending upwardly therefrom is a working barrel 32. The inside diameter of the working barrel 32 is greater than the outside diameter of the hanging sleeve 25 and the outside diameter of the working barrel 32 is of lesser diameter than the inside diameter of the standing barrel 24. In fact, the working barrel is intended at all times to move into the annular pump chamber 27. Its wall is of a thickness to divide the pump chamber 27 equally into an outer annular space 33 and an inner annular space 34, these spaces being sufficiently wide to insure that the inner face of the standing barrel and the outer face of the working barrel will not contact, and the inner face of the working barrel and the outer face of the hanging sleeve will not contact.

Attention is directed to Fig. 2 of the drawing where it will be seen that the outer faces of the hanging sleeve 25 and the working barrel 32 are formed with annular grooves 35 which are cut into the faces of these members and circumscribe the same. These grooves are equally spaced throughout the length of said surfaces and are preferably made with downwardly inclined upper and bottom faces 36 and 37, and a back face 38 which is concentric and parallel with the outer surface of the member in which it is cut. These grooves provide means for agitating the liquid which passes up and down between the reciprocating parts. The result will be that there will not be an opportunity for accumulation or settlement of sediment or gritty material, such as sand, between these parts since the agitation of the liquid will maintain the particles in motion and cause them to move in suspension with the liquid.

In operation of the present invention it is intended that the deep well pump here shown shall perform its pumping action without requiring the use of any tight fitting packing between the reciprocating parts of the pump. When the pump is to be used the assembled structure, including the working valve structure 30, the working barrel 32, the hanging sleeve and the standing barrel, together with the friction lock packing device 12, are lowered into the well on the string of pump rod 13. When the pump structure has been inserted within the well casing to the anchor shoe 12' as limited by the lateral stops 17' on nut 17 the fitting 20 is moved downwardly so that the key member 19 will engage the transverse slot 18 on the nut 17 so that the pump string may be rotated to screw the nut 17 upon the lock device and compress the packing members 15 and upon the cylindrical body 14 of the friction lock device. This will cause the packing members to expand, sealing off the upper portion of the well casing from the area within which pumping operations are to be carried on. It will be understood, however, that a central opening or passageway 39 extends through the cylindrical body member of the friction lock device and communicates with the hanging sleeve 25 so that liquid within that sleeve can be drawn upwardly through the friction lock device and into the well tubing. After the friction lock device 12 has been set in position the pump is ready to be operated. The fric-

tion lock apparatus is expanded to a diameter slightly larger than the inside diameter of the pump lock shoe and must be spudded into the lock shoe. If the seal should not hold then it is necessary to engage 19 and 18 and rotate the rod 13 to expand the friction lock.

Pumping is accomplished by moving the working barrel 24 and its valve structure 30 as the pump rod 13 is lifted. This will cause the valve member 31 to close entrapping the fluid of the well above it and will tend to lift this fluid upwardly through the central passageway in the hanging sleeve 25. Due to the sectional area of the passageway 27 being greater than the sectional areas of the spaces 33 and 34 upon opposite sides of the working barrel the liquid will have greater freedom of flow upwardly through the center of the hanging sleeve than it will have upwardly through the space 34 between the hanging sleeve and the working barrel and downwardly through the space 33 between the working barrel and the standing barrel.

It will be understood that the working barrel telescopes over the hanging sleeve and within the standing barrel and that as the working barrel is lifted with relation to the hanging sleeve and the standing barrel the overlap between the lower end of the hanging sleeve and the upper end of the working barrel will increase thus increasing the length of the passageway 34. The only amount of fluid that can leak by is the volume of fluid in the chamber 27 on the beginning of the upstroke. The pressure in chamber 27 is equal to the tubing pressure, but as the working barrel progresses upwardly the pressure increases due to the attempt to force it by the small clearance of the tubes. Therefore, if the pressure in the chamber 27 is greater than the tubing pressure, the only loss by leak will be the volume of fluid displaced by the working barrel 32. When the upstroke of the working barrel 32 and the working valve structure 30 has been concluded, the pump rod 13 will move downwardly carrying the valve structure 30 and the working barrel 32 downwardly, tending to move the working barrel from its overlapping relation to the hanging sleeve 25. At the same time the foot valve 29 will be closed and the working valve 31 will be opened so that fluid can flow through the valve structure 30 and into the working barrel 32. It will be seen that the working barrel 32 will in this case serve as a bucket for the upflowing fluid so that upon a successive upstroke of the working barrel and the valve this fluid will be forced into the hanging sleeve 25 due to the lifting action of the working valve structure, and the resistance to leakage offered by the fluid within the concentric passageways 33 and 34. Also, fluid will flow back into chamber 27 setting up a continuous agitation of the fluid between the tubes 24, 25 and 32 on the displacement and suction strokes of the working barrel 32.

In order to insure that granular material will not deposit on any of the moving parts it is desirable that the outside diameter of the working barrel valve structure shall substantially equal the outside diameter of the working barrel into the end of which it is screwed. As has been previously explained, the circumscribing grooves 35 have been provided in the outer faces of the working barrel and the hanging sleeve to insure that the liquid forming the seal between the contiguous faces of the standing barrel, hanging sleeve, and working barrel will be maintained in motion tend-

ing to produce suspension of the solid particles in the liquid.

It will thus be seen that the structure here disclosed provides means whereby a pump structure may be readily positioned for operation within a deep well and may thereafter be efficiently used to pump liquid from the well even though the liquid contains granular and gritty material which would cut out the packing of most types of deep well pumps now being used.

While I have shown the preferred form of my invention as now known to me it will be understood that various changes may be made in the combination, construction, and arrangement of parts by those skilled in the art without departing from the spirit of the invention as claimed.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

A pump structure comprising a tubular standing barrel the lower portion of which forms a pump chamber, a tubular hanging sleeve within, and spaced from, the upper portion of said barrel and forming between the same and the barrel an annular fluid packing area closed at its upper end and opening downwardly within the barrel, a foot valve on the barrel at the lower end of the pump

chamber, a rod depending through the sleeve, a tubular working barrel, and a valve at the lower end of the working barrel, said working barrel being connected at its lower portion to said rod and having an outside diameter less than the inside diameter of the standing barrel and having an inside diameter greater than the outside diameter of the hanging sleeve, said working barrel having an upper open end extending upwardly into the said fluid packing area in spaced relation to both the hanging sleeve and the working barrel and forming therewith inner and outer, constantly open annular channels communicating at their upper ends with said fluid packing area, the inner channel communicating at its lower end with the space within the working barrel, and the outer channel having unrestricted communication at its lower end with the pump chamber of the standing barrel below the working barrel whereby said channels have their lower ends opening downwardly above the respective valves and directly in the flow stream of the pump so that the fluid in the channels and in the fluid packing area is subjected to constant turbulence during operation of the pump.

CHARLES M. O'LEARY.