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W. W. WILLOUGHBY

1,956,112

PUMP

Filed April 19, 1932

2 Sheets-Sheet 1

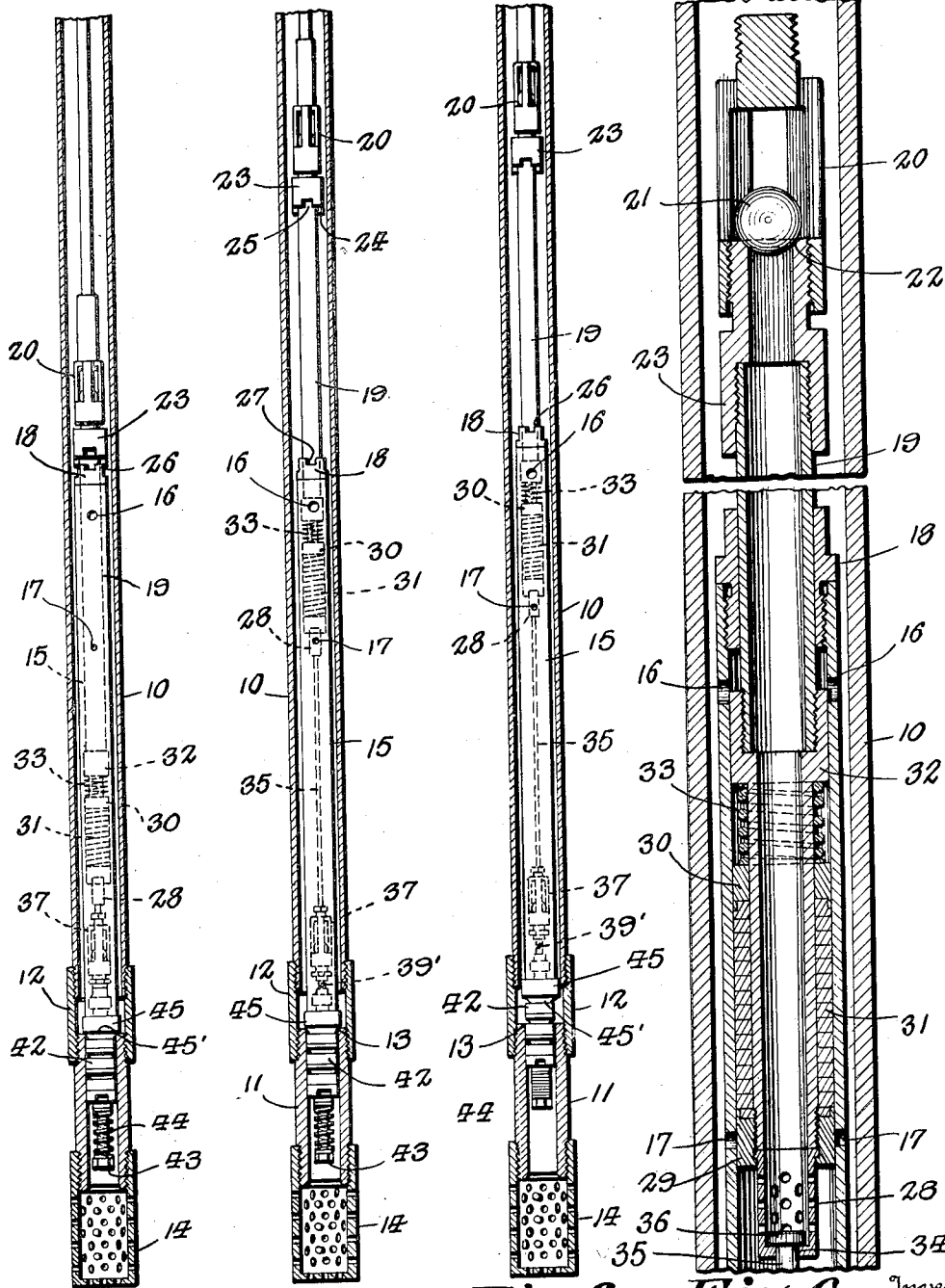


Fig. 1.

Fig. 2.

Fig. 3.

Fig. 6.

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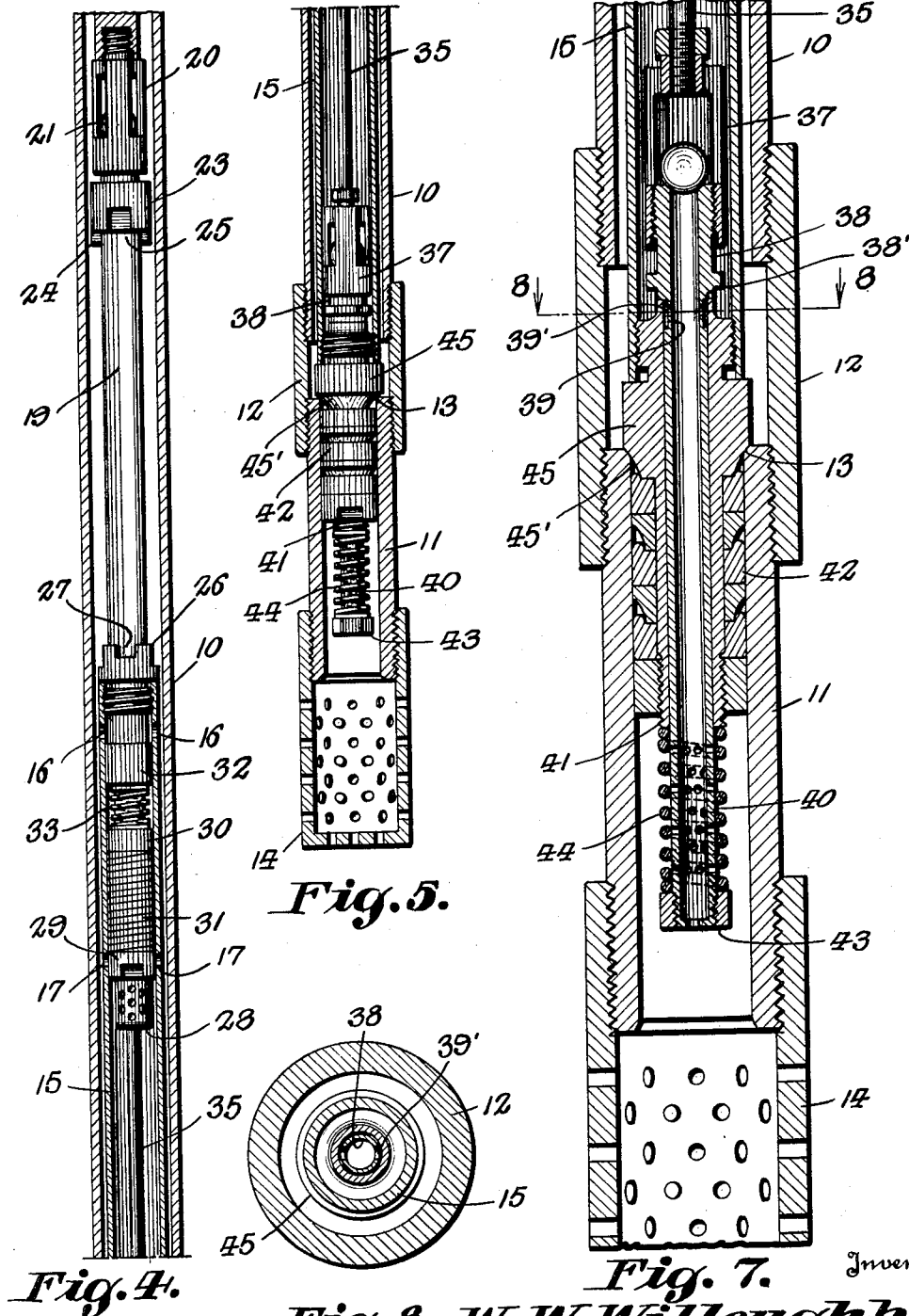


Fig. 5.

Fig. 7.

Fig. 8. W. W. Willoughby

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## UNITED STATES PATENT OFFICE

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PUMP

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Application April 19, 1932, Serial No. 606,235

4 Claims. (Cl. 103—221)

This invention relates to pumps for deep wells, and more particularly to such pumps as are used in connection with oil wells, wherein the pump, including a pumping barrel with its accompanying plunger and valves, rests on a substantially oil-tight seat in the lower portion of the casing.

At times it becomes necessary to raise such pumps to the top of the casing, at the surface of the ground, for the purpose of making repairs, etc., and when this is done the column of oil above the pump rushes down into the well with such force as to disturb the sand therein, resulting in an objectionable condition well known to those familiar with the oil well industry. It is, therefore, the principal object of the present invention to provide a pump of the type mentioned which will have means for permitting the oil thereabove to recede into the well at such a slow rate of speed, prior to the removal of the pump, as to prevent disaster.

Other objects and advantages will be apparent from the following description when taken in connection with the accompanying drawings.

In the drawings:

Figure 1 is a longitudinal section of the casing, showing the pump in position for pumping.

Figure 2 is a similar sectional view showing the first step in drawing the pump from the well.

Figure 3 is a similar sectional view showing the final operation in lifting the pump, wherein the valves are unseated to permit the fluid to pass back into the well.

Figure 4 is a sectional view of the pumping piston.

Figure 5 is a sectional view of the lower or standing valve.

Figure 6 is an enlarged longitudinal section through the upper portion of the pump, Figure 7 is a similar view through the lower portion thereof, and Figure 8 is a transverse sectional view on the line 8—8 of Figure 7.

Referring particularly to the accompanying drawings, 10 represents the lower section of the well casing, to the lower end of which is connected the short section 11, by means of the coupling 12, said section 11 having, at its upper end, the seat 13, and having a perforated cap 14 connected to its lower end.

Disposed within the well casing is the working barrel 15, which has its ends interiorly threaded, as shown. In the upper end of this barrel are openings 16 through which oil may pass during the pumping operation, and also formed in said barrel, at a suitable distance below said openings, are smaller openings 17 spaced

at approximately equal distances around the barrel.

Threaded into the upper end of the barrel 15 is a bushing 18, through which is slidably disposed the plunger tube 19, the upper end of which has mounted thereon the valve cage 20, within which is disposed the ball valve 21 resting on the seat 22. On the plunger tube, below the valve cage, is a fixed collar 23, the lower end of which is provided with ribs and recesses 24 and 25, for cooperating with the similar elements 26 and 27, on the beforementioned bushing 18, for facilitating the unscrewing of the latter, from the barrel, and screwing the same thereinto. Disposed against the lower end of the plunger tube 19, is the open flanged end of a perforated cap 28, said cap being held in place by the collar 29, screwed onto the end of the plunger tube. Loosely engaged on the plunger tube 19, in spaced relation to said collar, and thereabove, is a collar 30, which has a recess in its lower face for the reception of one end of a coil packing 31, encircling the said tube, between said collars, the other end of the packing being seated within another similar recess in the upper face of the collar 29. On the plunger tube, above the collar 30, is a fixed collar 32, and encircling the tube, between these collars, is a coil spring 33, which serves to tightly compress the packing between the collars 29 and 30. The parts designated by the characters 29 to 33, both inclusive, comprise the pump plunger. In the lower end of the perforated cap 28 is an opening 34 and slidable through this opening is the upper end of a rod 35, having a head 36 on its upper end, within the cap, which prevents said end from being drawn from the cap.

The lower end of the rod 35 is detachably secured in the end of a valve cage 37. Threaded into the lower end of this valve cage is the upper end of a tube 38, the said upper end being enlarged to produce a shoulder 38'. Immediately beneath this shoulder the tube 38 is grooved, as shown at 39, and within this groove are the perforations 39'. In the lower end of the tube 38 are the perforations 40. Loosely mounted on this tube is a sleeve 41 on which are positioned the flexible cups 42, and held on the lower end of the said tube, by means of the perforated cap 43, is a coil spring 44, the upper end of which bears against the lower end of the sleeve 41. The upper end of this sleeve is enlarged as shown at 45, the lower portion of this enlargement having the tapered portion 45' which rests on the seat 13 of the section 11 and an upper portion of the said

enlargement being threaded into the lower end of the pump barrel 15. It will be seen that the spring 44 will hold the shoulder 38', at the upper end of the tube 38, in oil-tight engagement with the upper end of the sleeve 41, and that the perforations 39' will thus be normally closed by said sleeve.

In the normal or pumping operation of the device, the pump plunger reciprocates within the barrel 15, filling the casing with oil and driving the same to the top of the well, during which pumping operation the plunger moves within such limits as not to rise entirely above the perforations 17. Meanwhile, the rod 35 slides idly within the perforated cap 28 and the lower portion of the plunger tube 19, as will be readily seen from an inspection of the drawings. Those portions of the device designated by the numerals 37 to 45', both inclusive, constitute what will be known as the standing valve.

When it is desired to draw the pump from the well, the operator pulls upwardly on the plunger tube so that the head 36 of the rod 35 will engage the end of the perforated cap 34. A continued upward pull then causes the rod 35 to raise the tube 38 of the standing valve against the force of the spring 44, which raises the shoulder 38' out of contact with the upper end of the tapered portion 45' of the enlargement 45, so that the openings 39 are uncovered, whereupon the oil in the barrel will pass inwardly through said openings into the tube 38 and thence outwardly through the openings 40 and through the perforated member 14 into the well. This upward movement of the plunger is continued until it passes above the openings 17, whereupon the oil in the casing will recede through said openings into the pump barrel, thence through the openings 39, into the bottom of the well, in the manner already described, it being understood that the openings 17 and 39 are of a size to prevent such a rapid recession of the oil as to be disastrous in the manner recited at the beginning of these specifications. The plunger is then held in this position until the oil in the casing has receded to such a degree that the weight of the oil column on the pump barrel is insufficient to hold the same in its position at the bottom of the casing nor cause disaster, whereupon the pump is raised to the surface.

What is claimed is:

1. In a deep well pumping device, a casing, a pumping barrel therein, a plunger in said barrel, said barrel having openings normally closed by the plunger during the working stroke thereof and arranged to be uncovered upon an upward pull of the plunger beyond its working stroke to permit the fluid to gravitate from the casing into the barrel, a standing valve in said barrel

below said plunger, said standing valve including a slidable perforated member normally closed from communication with said barrel, and means operated upon said upward pull on the plunger to open said perforated member, and permit the fluid to gravitate from the barrel and through the perforated member into the well.

2. In a deep well pumping device, a casing, a pumping barrel therein, a plunger in the said barrel, said barrel having openings adjacent its upper end, said openings being normally closed by the plunger during the working stroke thereof and to be opened by an upward pull thereon, a standing valve in the barrel below said plunger, said standing valve including a sleeve, a perforated tube slidable in the sleeve and extending beyond an end thereof, resilient means for holding the sleeve in covering relation to a portion of the perforations of one end of said tube, and connections between the plunger and said perforated tube for moving said tube into uncovered position upon said upward movement of said plunger beyond its working stroke, whereby to permit the fluid to flow through said standing valve.

3. In a deep well pumping device, a casing, a barrel therein, a plunger in said barrel, said barrel having openings normally closed by said plunger during the working stroke and arranged to be uncovered upon an upward pull thereof beyond its working stroke, a standing valve in the lower portion of the barrel and casing including a sleeve, a perforated tube slidable through said sleeve, a spring on the perforated tube normally holding said sleeve in closing relation to certain of the perforations at the upper end of said tube, and connections between the plunger and said perforated tube for moving the same upwardly to uncover the said upper perforations thereof upon upward movement of said plunger beyond its working stroke.

4. In a deep well pumping device, a casing, a barrel therein, a plunger in said barrel, said barrel having openings normally covered by said plunger during the working stroke thereof and arranged to be uncovered upon an upward movement of said plunger beyond its working stroke, a standing valve in said barrel below said plunger and extending into the casing therebelow, said standing valve including a sleeve, a perforated tube slidable through said sleeve and normally closed thereby, resilient means for holding said sleeve in closing relation to the perforations of said tube, and means carried by said plunger and connected with said perforated member for moving the latter into uncovering relation to said perforated member upon upward movement of said plunger beyond its working stroke.

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