April 14, 1931. J. E. ROARK 1,801,209

WELL PUMP EQUIPMENT

Filed June 5, 1929 2 Sheets-Sheet 1

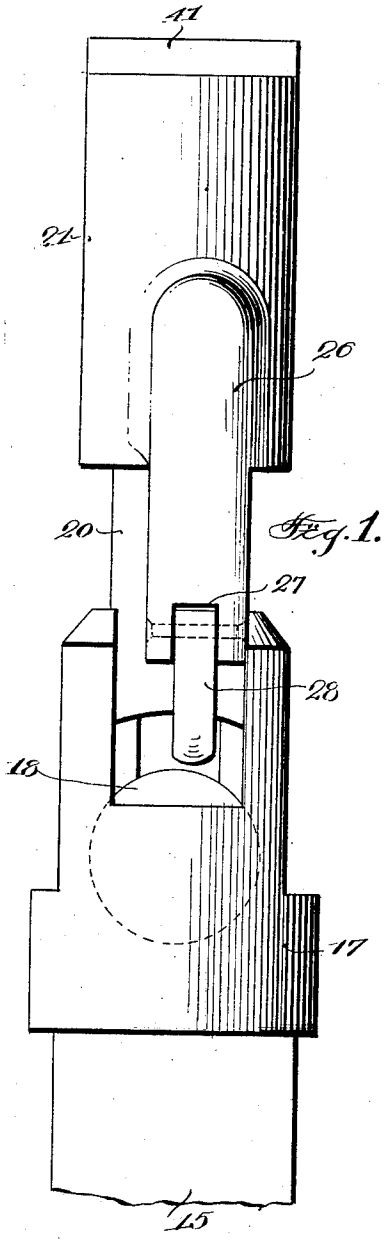


Fig. 1.

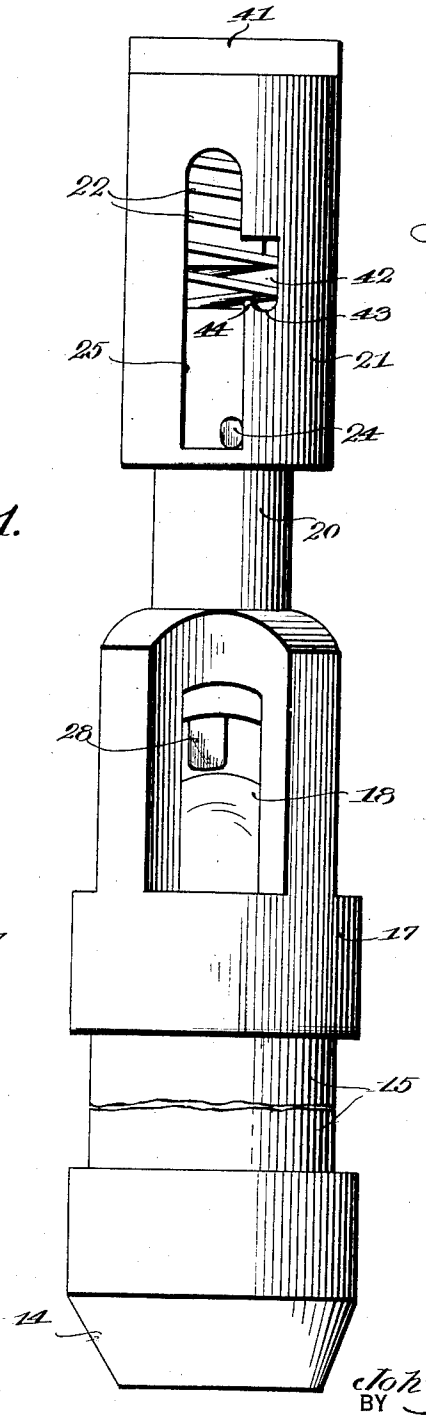


Fig. 2.

WITNESSES

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Filed June 5, 1929 2 Sheets-Sheet 2

Fig. 3.

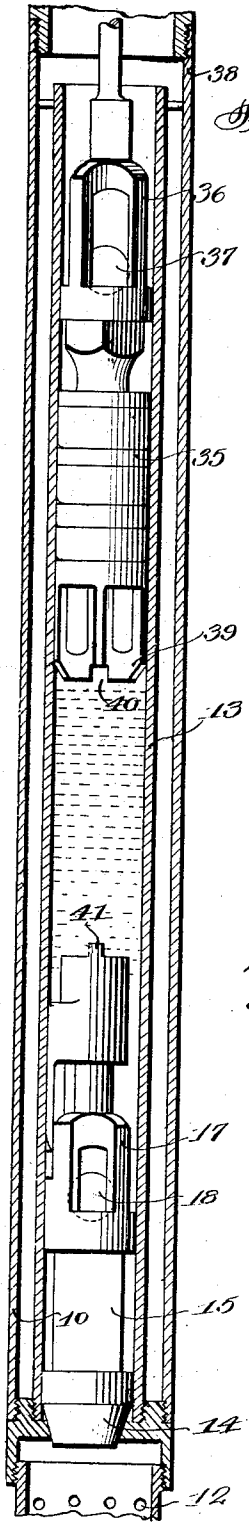


Fig. 1.

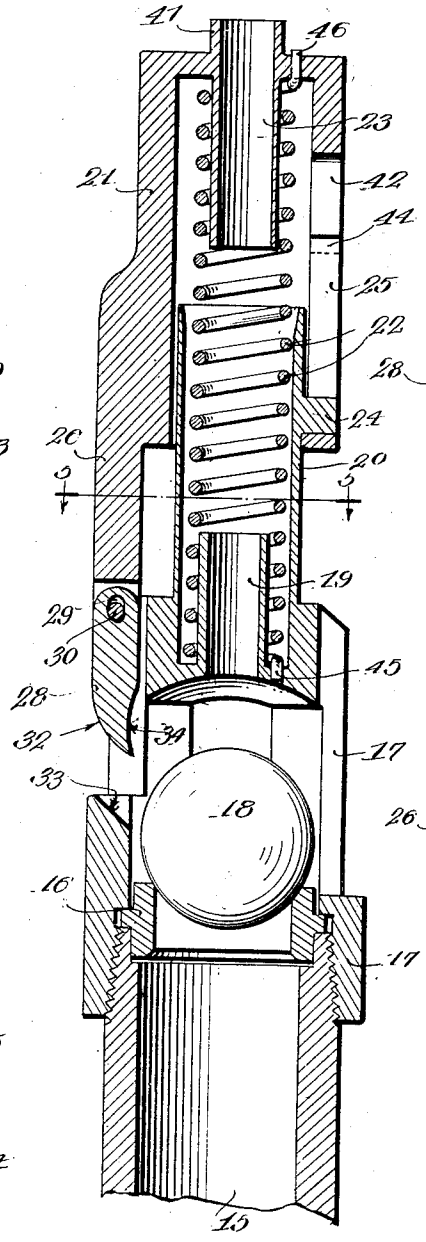


Fig. 5.

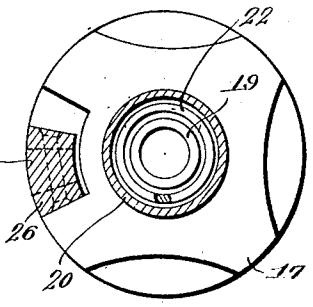
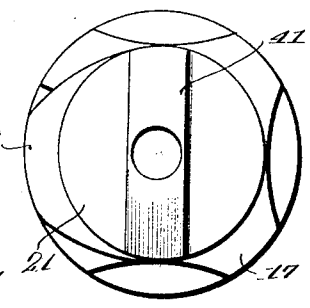


Fig. 6.



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UNITED STATES PATENT OFFICE

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WELL-PUMP EQUIPMENT

Application filed June 5, 1929. Serial No. 368,570.

This invention appertains to improvements in well pump equipment generally, and more particularly to a type of the same adapted for use in oil and other wells of great depth.

In the practice of pumping oil from deep wells, the working barrel of a pump is attached to the lower end of the well tubing, which usually reaches downwardly into the oil bearing sand strata, and mounted within the working barrel is a travelling plunger or piston carrying an upwardly opening valve and at the extreme lower end of the barrel a second upwardly opening valve is provided, the first-named valve being moved to open position and the last-named valve to closed position on the down-stroke of the plunger or piston and counterwise on the up-stroke thereof, the operation of the valves being automatically effected by the pressure of oil trapped in the working barrel and tubing. During the up-stroke of the plunger or piston, the trapped oil, above the travelling valve, is lifted upwardly of the tubing, while additional oil is drawn inwardly of the standing valve from the surrounding sand strata and on the down-stroke thereof the additional oil is forced upwardly of the working barrel through the travelling valve and into the tubing as is well understood.

In the operation of the pumping apparatus, and if for any reason the working barrel fails to work properly, repair or replacement of parts is only possible by the pulling of the entire tubing string while the same is full of oil, since heretofore no successful means has been devised whereby the standing valve at the bottom of the working barrel can be released to open position to permit the trapped oil to escape back into the sand strata. Thus, the withdrawal of the tubing string has only been accomplished by extreme hard labor, heavy expense, and excessive loss of time by reason of the tremendous pressure of the column of oil filling the tubing and with a subsequent great wastage of the oil and serious strain on the pumping machinery and derrick.

The primary object of the invention is, therefore, to provide a means capable of being readily and easily operated from the top of the well for moving the standing valve to open position, and to maintain the same in such position until all of the oil trapped in the working barrel and tubing of the pumping apparatus has drained back into the sand strata, whereby the otherwise undue strain is eliminated from the pumping machinery and derrick during the pulling of the sucker rods and plunger or piston and the tubing string from the well bore.

Another object of this invention is to provide a means of the class set forth, which may be readily and easily installed in position on otherwise standard equipment, and which will not in any way obstruct the flow of oil around the top of the standing valve, either when the pump is being regularly worked or when, through the operation of the means, the oil is being drained from the working barrel and tubing.

A further object of the invention is the provision of a means as aforesaid, which operates in a manner that it is not necessary at any time to rotate the sucker rods in a left-hand direction, either for draining the working barrel and tubing or for closing the standing valve, after the same has once been opened, hence any danger of parting the sucker rods is eliminated.

Another object of the invention is to provide a device as hereinbefore characterized, which permits of the draining of the tubing without raising or lowering the sucker rods to a certain point before the standing valve will be released or closed.

Among other objects, the invention provides for a simple cam or wedge means which gives sufficient power to lift the standing valve clear of its seat regardless of the pressure of the oil above the same; for a device

so constructed that should the sucker rods part the lower section thereof can be lifted from the tubing with a screw on socket or overshot type of fishing tool without interference; for a means which will not permit of the draining of the tubing should the sucker rods part while pumping since the travelling valve, in the plunger or piston, will hold the oil trapped in the tubing above the same; and a standing valve lifting means which is readily and easily operated by a combined downward and right-hand rotary movement of the plunger or piston to a locked operative position, when the valve will be lifted from its seat and maintained in open position until the completion of the drainage of oil from the working barrel and tubing, and automatically returned to inoperative position, to close the valve at the completion of the drainage operation by a second downward movement only of the plunger or piston.

With the foregoing and other equally important objects and advantages in view, the invention resides in the certain new and useful combination, construction and arrangement of parts as will be hereinafter more fully described, set forth in the appended claims, and illustrated in the accompanying drawings, in which:

Figure 1 is a side elevation of the actuating device as it appears when installed in position on the upper end of the cage of a standard form of standing valve;

Figure 2 is a view similar to that of Figure 1, but showing the opposite side of the same;

Figure 3 is a fragmentary vertical section through the lower end portion of a well tubing and through a working barrel positioned therein, showing the standing valve, the actuating means therefor and the pump plunger or piston in side elevation;

Figure 4 is an enlarged vertical section through the standing valve and the actuating means carried thereby;

Figure 5 is a horizontal section, taken on the line 5—5 of Figure 4; and

Figure 6 is a top plan view of the standing valve actuating means.

Referring to the drawings, wherein like characters of reference designate corresponding parts throughout the several views thereof, the embodiment of the invention, as illustrated therein by way of example, is generally constituted in an outer tubing section 10, rising from an anchor 11 which has inlet holes 12 in its side wall for the ingress therethrough of oil from the sand strata engaged thereby. Disposed in spaced relation within the tubing section 10 and concentrically thereof is a working barrel 13, which rises from its point of attachment with the anchor 11, and provides a space between the same and the tubing section 10 to form a sand trap.

Seating downwardly of an opening formed centrally of the upper end wall of the anchor 11 is a tapered collar or nose 14 which is secured at the lower end of a short tube section 15. Resting on the upper end of the tube section 15 is an annular member or valve seat 16, which is clamped in position by an interior shouldered portion formed at the lower end of a cage 17, the latter being threaded onto the tube section 15, substantially as shown in Figure 4. Resting on the upper side of the valve seat 16 is a ball valve 16 which is housed within the cage 17 when the latter is secured in position on the tube section 15.

Rising from an opening formed centrally of the upper side of the valve cage 17 is a tubular extension 19, which is surrounded by a larger and longer tubular extension 20. The upper end of the extension 20 is slidably engaged by a cylindrical member or body 21, which is normally tensioned in an upward direction thereon by a coiled spring 22 extending between the upper end of the valve cage 17 and the upper end wall of the member or body 21, the lower end of the spring 22 being engaged over the smaller tubular extension 19 and the upper end thereof over a tubular extension 23 depending from an opening formed centrally through the upper end wall of the member or body 21. A pin or stud 24 is projected laterally from the upper end portion of the tubular extension 20 and is engaged in a vertically elongated slot 25 formed in the side wall of the member or body 21, the length of the slot 25 permitting of a corresponding distance of movement of the latter relatively to the tubular extension 20.

Depending from the member or body 21, and offset to one side of the same is an arm 26, which is disposed between adjacent vertical leg portions of the valve cage 17 and has its lower end bifurcated, as at 27, to receive the upper end of a cam or wedge member 28. The engaged end of the member 28 is provided with a transversely extending opening 29 for the engagement therethrough of a pivot pin 30 extending crosswise of the bifurcation 27. The opening 29 is preferably elongated in an upward direction to allow the upper rounded end 31 of the member 28 to bear against the shoulder, formed at the lower end of the arm 26 at the upper end of the bifurcation 27 therein, so that all strain, incident to the pivotal movements of the member 28, is removed from the pivot or pin 30. The lower end of the member 28 is inwardly curved, as at 32, at its outer side, and, when the cylindrical member or body 21 is moved downwardly of the tubular extension 20, this curved portion 32 strikes a downwardly and inwardly inclined surface 33, formed in the upper edge of the lower annular portion of the cage 17 and between the

vertical leg portions disposed at the opposite sides of the arm 26, and is swung inwardly of the cage 17 and into lifting engagement with the ball valve 18. The inner side of the member 28 is preferably formed with a concavity, as as 34, whose lower end meets the inwardly curved extremity so as to form a seat therein for the ball valve 18 and to otherwise facilitate the engagement of the member 28 therewith.

Slidably mounted in the upper end portion of the working barrel 13 is a plunger or piston 35 which carries a valve cage 36 at its upper end to house the usual ball valve 37. The upper end of the cage 36 is provided with a usual sucker rod socket 38 while the lower end of the plunger 35 carries an open cage structure 39 which has its lower end formed to provide a diametrically extending kerf or slot 40 arranged therein for engagement with a similarly disposed rib or lug 41 formed at the upper side of the cylindrical member or body 21.

With the equipment as thus constructed and arranged, and it is desired to drain off a column of oil in the tubing string rising upwardly from the lower section or sand trap 10, the plunger 35 is lowered until it abuts the upper end of the cylindrical member or body 21, when its weight will force the latter downwardly against the tension of the coil spring 22. With the downward movement of the member or body 21, the cam or wedge 28 is swung inwardly of the lower valve cage 17 and lifts the standing ball valve 18 off its seat 16, when the oil within the working barrel below the plunger 35 will drain outwardly of the anchor openings 12 and back into the sand strata.

To sustain the standing valve 18 in open position pending the withdrawal of the sucker rod, the plunger 35 carried at the lower end thereof, upwardly of the well tubing, the cylindrical member or body 21 is to be given a slight turn in the right-hand direction by the engagement of the rib or lug 41 with the kerf or slot 40 in the lower end of the plunger 35. This turning movement may be readily accomplished by the operator, at the top of the well, applying a wrench or the like to the sucker rod extending upwardly from the attaching socket 38. As the member or body 21 turns with the plunger 35, the pin or stud 24, on the tubular extension 20, is engaged in a recess 42 opening into the slot 25 at the right-hand side of the upper end thereof. The lower wall of the recess 42 is curved as at 43, and merges into an upwardly directed lip 44 at its side opening into the slot 25, so that the pin or stud 24 will seat in the curved portion and be retained therein against accidental displacement by the lip 44.

As shown in Figure 4, the lower end of the spring 22 is angularly bent, as at 45, for engagement in an opening formed in the upper wall of the standing valve cage 17 between the inner and outer tubular extensions 19 and 20, while the upper end thereof is similarly bent, as at 46, for seating engagement in an opening in the top or end wall of the cylindrical member or body 21. As the result of this manner of mounting the spring 22, and upon the imparting of the right-hand turning movement to the body or member 41 to move the pin or stud 24 into the recess 42, the same will be placed under tension spirally and will tend to withdraw the pin or stud from the recess as soon as the turning movement of the sucker rod is stopped, but this is prevented by the lip 44 at the lower inner side of the recess behind which the pin or stop engages when seated in the lower curved end of the recess. With the parts thus locked together, the spring 22 will be held under compression, and the cam or wedge 28 will be retained in standing valve lifting position.

Just as soon as the standing valve 18 is opened, the oil in the working barrel 13 will start to drain outwardly of the valve seat 16 and the anchor 11 and back into the sand strata. Now, to permit of the drainage of the entire column of oil from the tubing above the plunger 35, the latter will be lifted by a partial withdrawal of the sucker rod upwardly of the tubing and until the plunger disengages from the upper end of the bore of the working barrel 13, when, due to the greater diameter of the tubing the oil will be free to pass downwardly and around the plunger and into the working barrel where it flows out of the valve seat 16 and the anchor 11. When it is desired to again start a pumping operation, the plunger 35 will be lowered into the working barrel 13, and will be allowed to strike the lug or rib 41, at the upper end of the cylindrical member or body 21, which will result in a rebounding action of the plunger or member or body 21, and an upward expansion of the spring 22, the force of which action being sufficient to cause the pin or stud 24 to disengage from the lip 44 of the recess 42. At the instance of such disengagement, the torsional effect of the spring 22 will now act to rotate the cylindrical member or body 21 to the left, relatively to the plunger or piston 35 and the sucker rod carrying the same, and withdrawal of the pin 24 from the recess or stud 22, when the spring 22 will expand to its full restricted length. This expansion of the spring 22 forces the cylindrical member or body 21 in an upward direction, and causes the arm 26 of the latter to withdraw the cam or wedge member 28 from its lifting engagement with the standing valve 18, which now returns to closed postion on the seat 16.

By this automatic release of the pin or stud 24 from the recess 42, the turning of the sucker rod connecting the plunger 35, in a left hand direction, by the operator at the top of the

well, is avoided, so that there will be no danger of the sucker rod sections becoming loosened or separated, such as would otherwise possibly occur since these sections are generally coupled together by right-hand threads.

The possibility of the slot 40 at the lower end of the plunger 35 engaging with the lug or rib 41 at the upper end of the member 21, during the quick lowering and raising of the plunger to and from striking engagement with the member 21, in this latter operation of the parts to effect the release of the member 21 from locked condition and the subsequent withdrawal of the cam or wedge 28 from standing valve lifting position, is minimized by the nicety of fit of the slot 40 and the lug or rib 41, the engagement of which must be accomplished by slow turning movements imparted to the plunger 35 to bring the same into proper alinement through the length of the sucker rod by an operator at the top of the well.

By repeating the foregoing described operation, it will be readily apparent that the standing valve can be opened or closed at the will of the operator, and that by thus being able to drain off a column of oil from the working barrel 13 and the tubing 10, the withdrawal and replacement of the tubing string and the sucker rod and plunger from and to normal working postion in a well will be greatly facilitated and a great saving in well operating cost will be effected.

Without further description, it is thought that the features and advantages of the invention will be readily apparent to those skilled in the art, and it will of course be understood that changes in the form, proportion and minor details of construction may be resorted to, without departing from the spirit of the invention or its scope as claimed.

I claim:

1. A device for opening the standing valve to effect the draining of the trapped oil from a well tubing, comprising a vertically movable member mounted within the working barrel at the lower end of the tubing and on the upper end of the standing valve cage, spring means normally sustaining said member in an elevated inoperative position, said member being operable in a downward direction against the tension of said spring means by the final movement of a down stroke of the plunger to lift the valve to open position, and means for locking said member in valve lifting position upon a partial right hand turning movement being imparted to the plunger, said locking means being automatically released by the action of said spring means upon the striking of said member by the plunger on a subsequent down stroke thereof, said spring means also acting to return said member to normal position simultaneously with the release by it of the locking means and whereby the standing valve will be permitted to close.

2. A device for opening the standing valve to effect the draining of trapped oil from a well tubing, comprising a tubular extension rising within the working barrel from the upper end of the standing valve cage, a second tubular extension rising from the upper side of the said standing valve cage and concentrically within said first named tubular extension, a vertically movable member mounted on said extension, spring means housed within the space between said tubular extensions and normally acting to sustain said member in an elevated inoperative position, said member being operable in a downward direction against the tension of said spring means by the final movement of a down stroke of the plunger to lift the valve to open position, and means for locking said member in valve lifting position upon a partial right hand turning movement being imparted to the plunger.

3. A device for opening the standing valve to effect the draining of trapped oil from a well tubing, comprising a tubular extension rising within the working barrel from the upper end of the standing valve cage, a vertically movable member mounted on said extension, spring means for normally sustaining said member in an elevated inoperative position, said member being operable in a downward direction against the tension of said spring means by the final movement of a down stroke of the plunger to lift the valve to open position, and cooperative locking means carried by said extension and said member for holding the latter in valve lifting position upon a partial right hand turning movement being imparted to the plunger, said locking means being automatically released by the action of said spring means upon the striking of said member by the plunger on a subsequent down stroke thereof, said spring means also acting to return said member to normal position simultaneously with the release by it of the locking means and whereby the standing valve will be permitted to close.

4. A device for opening the standing valve to effect the draining of trapped oil from a well casing including the working barrel and pump plunger in the tubing, comprising a tubular extension rising within the working barrel from the upper end of the standing valve cage, a vertically movable member mounted on said extension, spring means housed within said extension for normally sustaining said member in an elevated inoperative position, said member being operable in a downward direction against the tension of said spring means by the final movement of a down stroke of the plunger to lift the valve to open position, cooperative locking means carried by said extension and said

member for holding the latter in valve lifting position, and interengageable means carried by the opposed faces of said member and the plunger whereby a partial turning of the plunger will operatively set said locking means, said locking means being automatically released by the action of said spring means upon the striking of said member by the plunger on a subsequent down stroke thereof, said spring means also acting to return said member to normal position simultaneously with the release by it of the locking means and whereby the standing valve will be permitted to close.

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