Nov. 25, 1941. G. H. WILLIAMS 2,263,910

STANDING VALVE PULLER

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FIG. 1.

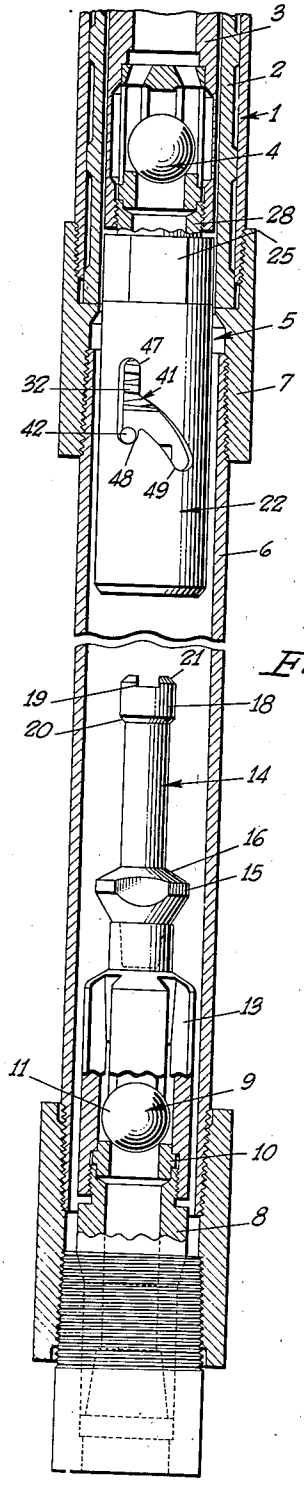


FIG. 2.

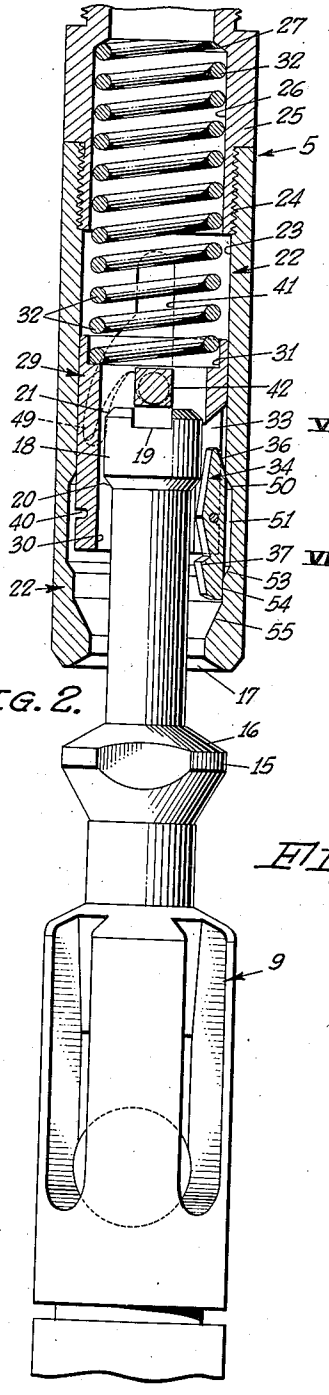
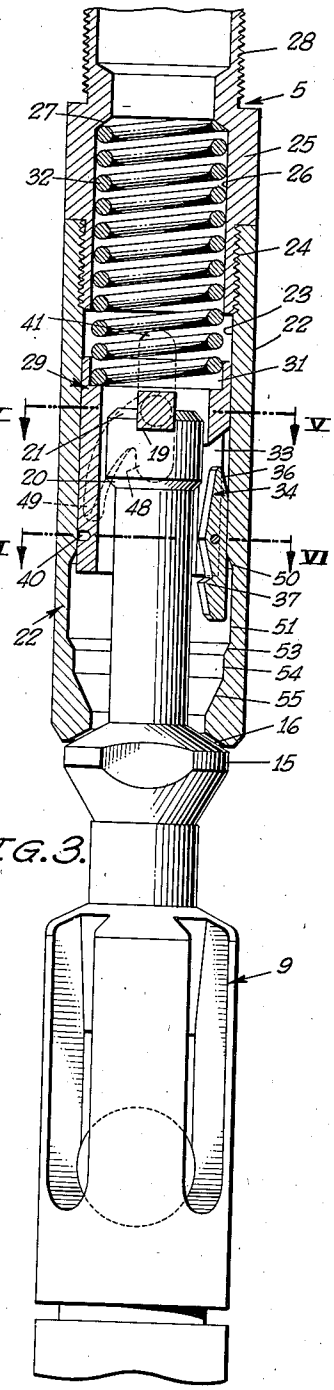


FIG. 3.



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FIG. 4.

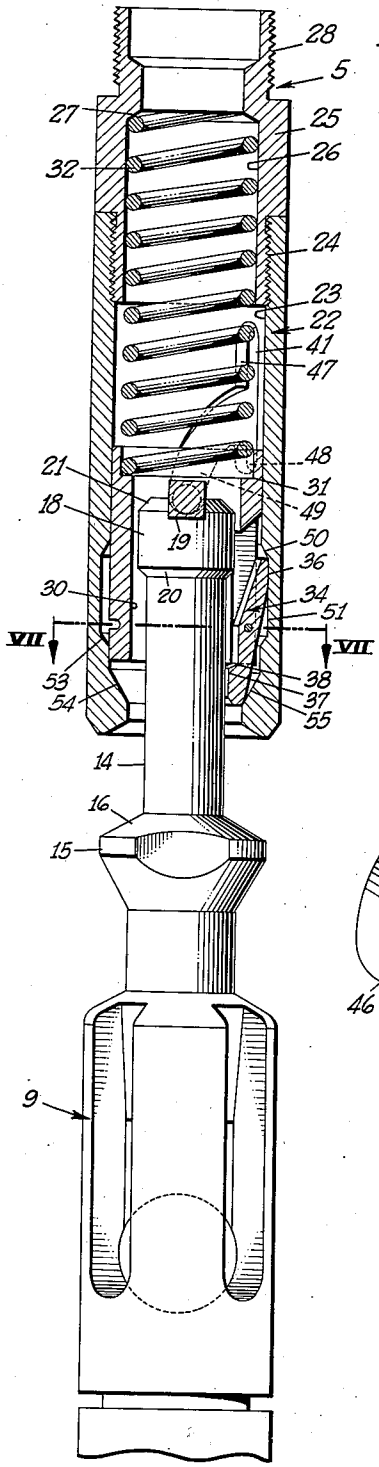


FIG. 5.

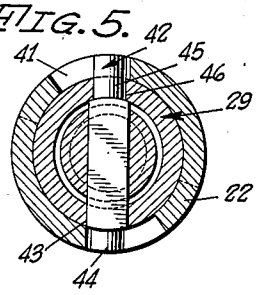


FIG. 6.

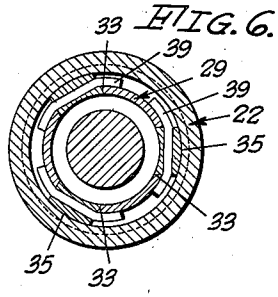


FIG. 7.

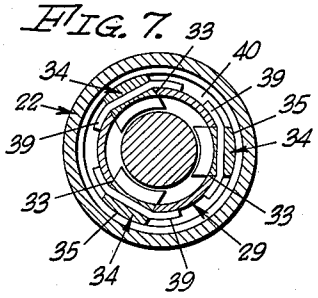
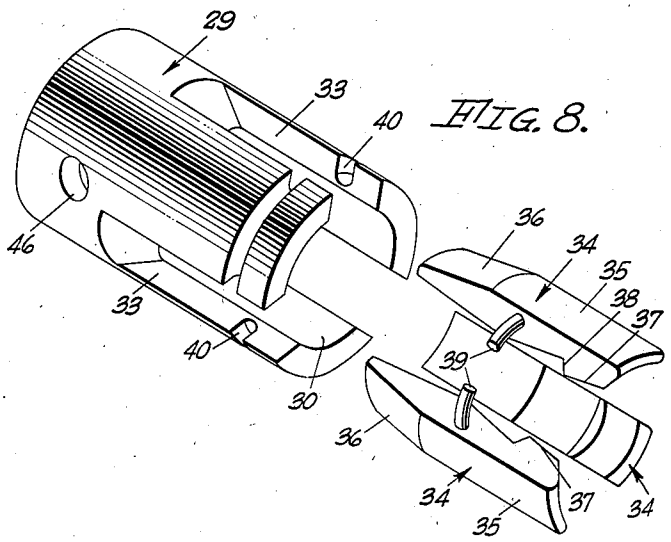


FIG. 8.



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Patented Nov. 25, 1941 2,263,910

UNITED STATES PATENT OFFICE

2,263,910

STANDING VALVE PULLER

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Application July 11, 1938, Serial No. 218,721

3 Claims. (Cl. 294—116)

My invention relates to oil well pumps and has particular reference to a valve puller which may be connected upon the lower end of a pump plunger to selectively engage or disengage a standing valve to be lowered by or elevated with the plunger.

In the oil well pump structures it is the common practice to employ a standing valve removably located at the lower end of the pump barrel and provide upon the pump plunger a connector or "valve puller" which may be engaged with the standing valve to permit withdrawal of the standing valve from its seat in the barrel whenever it is desired to remove the standing valve for inspection, repair or replacement, and to permit the insertion of the standing valve back into its seat in the pump barrel by coupling the same to the pump plunger prior to the insertion of the plunger into the pump and then disconnecting the plunger from the valve after the valve has been properly seated in the pump.

Prior devices of this character have usually included a pin or box located upon the lower end of the pump plunger to engage a cooperating box or pin on the standing valve by means of a bayonet connection, arranged in such manner that during the ordinary pumping operations the plunger will approach the standing valve but not engage it while when it is desired to remove the valve the pump plunger is lowered beyond the limit of its ordinary downward stroke to engage the bayonet joint and couple the plunger and valve together. It frequently occurs, however, that due to slippage between the connections of the pumping mechanism with the polished rod of the pump, the plunger is permitted to descend in normal pumping strokes to a point so low that the plunger coupling inadvertently engages the standing valve and the pin and bayonet slot connections used on these constructions engage and pound upon each other to the destruction of either the plunger and coupling or the standing valve. When such injury occurs to either the coupling or the standing valve stem or pins, it is necessary to remove the plunger and fish out the injured valve, a laborious and costly operation.

It is therefore an object of my invention to provide a standing valve and puller and coupling therefor so constructed as to permit inadvertent striking of the standing valve and coupling without injury to either of them.

Another object of my invention is to provide a standing valve and puller of the character set forth wherein engagement of the coupling and standing valve is positive in its action and avoids inadvertent coupling of these members.

Another object of my invention is to provide a standing valve and puller therefor in which the coupling between the standing valve and the puller is accomplished by means of a plurality of dogs or slips as distinguished from bayonet slot and pin connections heretofore employed.

Another object of my invention is to provide a standing valve and puller of the character set forth wherein the members are provided with cooperating rugged abutments to interengage with each other to relieve the coupling or connecting parts thereof from injury.

Other objects and advantages of my invention will be apparent from a study of the following specifications, read in connection with the accompanying drawings, wherein—

Fig. 1 is a vertical sectional view taken through a typical oil well pump illustrating the normal or seated position of the standing valve and illustrating the plunger coupling member in place upon the lower end of the plunger;

Fig. 2 is an enlarged vertical sectional view of my plunger coupling or puller and my standing valve and illustrating the position of these members as they approach each other for coupling engagement;

Fig. 3 is a view similar to Fig. 2 but illustrating the relative position of the parts when the coupling member has been moved down to abutting relation with the standing valve.

Fig. 4 is a view similar to Figs. 2 and 3 and illustrating the position of the parts when the dogs or slips are in valve engaging position.

Fig. 5 is a horizontal sectional view taken along line V—V of Fig. 3;

Fig. 6 is a horizontal sectional view taken along line VI—VI of Fig. 3;

Fig. 7 is a horizontal sectional view taken along line VII—VII of Fig. 4; and

Fig. 8 is an exploded view of the slip carrier and slips illustrated in Figs. 1 through 7.

Referring to the drawings, I have illustrated in Fig. 1 a typical reciprocating plunger type of oil well pump, which includes a pump barrel 1 equipped with the usual pump liners 2, within which reciprocates a pump plunger 3 carrying near its lower end a working valve 4. Secured to the lower end of the plunger 3 is a valve puller indicated generally at 5. An extension 6 of the barrel coupled as by means of a bushing or collar 7 to the main portion of the barrel 1 has at its lower end a shoe 8 into which is seated a standing valve indicated generally at 9.

The standing valve 9 includes a suitable ball seat 10 engageable by a ball valve 11 operating within a vertically extending cage 13, the upper end of which is of reduced diameter and has connected thereto an upwardly extending coupling pin 14 by which the valve puller 5 may be coupled to the standing valve when desired. The pin 14 is illustrated as having an enlargement 15 thereon, the upper surface 16 of which provides an upwardly and inwardly beveled abutment to be engaged by the lower end 17 of the valve puller 5, as will be more fully described hereinafter.

Above the abutment 16 the stem 14 extends upwardly and is finished with a slightly enlarged head 18, in the upper surface of which is formed a transverse recess 19, the junction between the head 18 and the stem 14 being formed preferably as a beveled or tapered shoulder 20 while the upper end of the head 18 is preferably beveled or tapered inwardly as indicated at 21.

The valve puller 5 is preferably constructed to include a body member 22 (see Fig. 2) having a relatively large internal bore 23 extending longitudinally therethrough, the upper end of the body 22 being threaded as indicated at 24 to engage a bushing or adapter 25, likewise formed with a relatively large internal bore 26 terminating at an annular shoulder 27 immediately below the upper end of the bushing or adapter 25. The upper end 28 of the adapter 25 may be threaded to engage the lower end of the plunger 3 to hold the working valve 4 in place therein.

Slidably mounted in the bore 23 of the body 22 is a slip carrier 29, preferably constructed as a tubular member having an internal bore 30 somewhat larger in diameter than the diameter of the head 18 of the standing valve stem to permit the upper end of the standing valve stem to be telescopically received therein, the upper end of the slip carrier 29 being provided with an annular recess 31 which may constitute the lower seat for a relatively stiff compression spring 32, the upper end of which spring abuts upon the shoulder 27 on the bushing or adapter 25. The slip carrier 29 is therefore normally urged downwardly within the body 22. The slip carrier is provided with a plurality of longitudinally extending radial slots 33 (see Fig. 8), in each of which is mounted a dog or slip 34. The dogs or slips 34 are preferably formed from short lengths of suitable metal, the outer surface 35 of which is rounded as indicated in Fig. 8 to form with and form a continuation of the circumference of the slip carrier 29 while the upper end of the outer surface thereof is tapered inwardly as indicated at 36. The inner face of each of the slips is provided with an inwardly extending portion 37 to provide a gripping shoulder 38 presented to the interior of the slip carrier 29. The slips 34 are pivotally mounted upon the slip carrier 29 as by providing each of the slips with a short wire pin 39 adapted to be received in an annular groove 40 formed upon and extending about the slip carrier 29, thus permitting the ready insertion of the slips into the carrier 29 and the ready removal of individual slips therefrom without disturbing the remaining slips.

As will be understood by those skilled in this art, it is desirable in the operation of plunger pumps to permit the plunger on its down stroke to approach as closely as possible to the standing valve and for this reason it is necessary, during the normal pumping operations, to provide an unobstructed entrance opening into the valve puller 5 to permit the upper end of the standing valve stem to be received within the puller 5. Thus the dogs 34 should normally be restrained in their retracted position, as illustrated particularly in Fig. 2. This is accomplished by providing a limiting device for restraining the downward movement of the slip carrier 29, this restraining mechanism being illustrated as including a substantially Y-shaped slot 41 on diametrically opposite sides of the body 22 into which project opposite ends of a pin 42. As is illustrated particularly in Fig. 5, the pin 42 comprises a short length of squared stock material projecting through a squared opening 43 in one side wall of the slip carrier 29, the extreme outer end of the pin which projects outwardly of the opening 43 being rounded as indicated at 44 to present a round surface to the slot 41 while the opposite end of the pin 42 is rounded as indicated at 45 to pass through a round hole 46 on the opposite side of the slip carrier 29 and to present a rounded surface to the opposed slot 41 in the body.

The Y slots 41 have a stem portion 47 and one branch 48 preferably in vertical alignment with the stem portion 47, while the other branch 49 of the Y extends at a considerable angle to the stem portion 47 to act as a cam when the pin 42 is in the branch 49 and the plunger is lowered into engagement with the valve, to cause a slight left handed rotation of the body 22 (and of course the plunger 3) to align the pin 42 with the vertical branch 47 or 48 of the Y slots.

It will be noted that the lower extremity of the branch 48 is at a considerably higher level of the branch 49 so that when the pin is seated in the branch 48 the slip carrier 29 will be held in an elevated position in the body 22. The interior surface of the body 22 is provided with a downwardly and outwardly tapering shoulder 50 extending to an enlargement 51 of the bore 23, at the lower end of which enlargement is formed a downwardly and inwardly extending shoulder 53.

The length of the recess 51 is slightly less than the length of the untapered outer surface of the slips 34 so that when the slip carrier 29 is in its normal position the outer surface of the slips 34 will bridge the recess 51 and engage the interior of the bore 23 on opposite sides of the recess. Thus pivotal movement of the slips 34 when in this position is positively prevented and the engaging end 37 of the slips is held in outwardly spaced relation to the head 18 on the standing valve stem. By employing this construction, it will be apparent that inadvertent inward extension of the slips 34 is positively prevented so that there is no danger of the ends of the slips striking upon the upper end of the head 18 and being broken by such contact.

At this point it should be noted that the interior surface of the body 22 below the shoulder 53 extends vertically through a short distance 54 and then tapers inwardly and downwardly as indicated at 55, providing on the lower end of the body 23 a thickened or enlarged portion, providing a rugged abutment surface 17 which may strike upon the abutment surface 16 without damage to either the standing valve or the puller. Thus in the normal stroke of the plunger the lower end of the puller may approach very closely to the standing valve without fear of injury to either the puller or the valve since, should they strike each other, the force of the blow will be taken up by the abutments 16 and 17 and will

not be appreciably transmitted to any of the other parts of the device. Of course, the normal downward limit of the plunger stroke should be such as not to bring the pin 42 into contact with the upper surface of the standing valve stem 14 so as to avoid undue wear on the pin 42. However, should the stroke be inadvertently lengthened and should the pin 42 strike the upper surface of the stem 14, the only effect thereof will be to elevate the slip carrier 29 in the body 22; that is, the pin 42 will be slid upwardly into the stem 47 of the slot 41 against the force of the spring 32 and immediately upon the beginning of the upward stroke the pin will again seat in the branch 48 of the slot 41 to again limit the downward movement of the slip carrier 29 to its normal position and prevent release of the dogs 34 from their retracted position and preventing the inadvertent coupling of the puller to the standing valve.

Now, however, when it is desired to couple the puller with the standing valve, the plunger may be deliberately lowered until the abutments 16 and 17 engage each other, and the sucker rod string rotated a few times to the right. This lowering of the plunger will bring the pin 42 into abutment with the upper surface of the stem 14 while the rotation of the sucker rod string will rotate the puller 5 in such manner as to bring the pin into alignment with the recess 19. At this time the effect of the spring 32 will immediately force the pin 42 downwardly into the recess, interengaging the slip carrier and the standing valve. Now while holding a slight right-hand torsional strain in the sucker rod string, the string may be lifted to elevate the plunger and due to the right-hand torsion exerted thereby the pin 42 will tend to shift into the branch 49 of the Y-shaped slot 41, thus permitting the slip carrier 29 to descend to its lowermost position, as shown in Fig. 4.

When the slip carrier 29 descends to the position shown in Fig. 4, the lower ends of the dogs or slips 34 will engage the inwardly sloping shoulder 55 on the body 22 and the slips will be pivoted about their axes 39 to project the engaging fingers and shoulders thereon below the head 18, such pivotal action being permitted at this time because the upper or sloping ends of the slips 34 are now opposite the enlargement or recess 51 in the body. Now continuing the elevation of the sucker rod string will draw the gripping shoulders 38 of the slips upwardly into engagement with the shoulder 20 on the stem head 18 and the standing valve will be pulled out of its seat and drawn upwardly with the plunger 3.

It will be noted at this point that once the slips have been set into valve-engaging position, the effect of the spring 32 will be to hold the slips down against the shoulders 55 in tightly gripping relation with the standing valve while any resistance which may be exerted to the lifting out of the standing valve will, by reason of the tapered shoulder 55, tend to draw the dogs into tighter gripping relation with the standing valve.

To release the standing valve from the puller, all that is necessary is to move the standing valve and puller toward each other. For example, when the standing valve has been elevated to the ground surface, it may be released by merely pressing the standing valve inwardly of the puller which will cause the stem of the valve to press upwardly upon the pin 42 to retract the slip carrier into the body 22 to elevate the dogs 34 from the shoulder 55. As the dogs move upwardly, their tapered upper ends will engage the shoulder 50 at the upper end of the recess 51 and the dogs will be positively reversely rotated upon their pivots 39 to their retracted positions, as shown in Fig. 2. Such upward movement of the pin 42 will, by reason of its engagement with the curved branch 49 of the slot 41, rotate the slip carrier relative to the body 22 to re-align the pin 41 with the vertical branch 48 of the Y slot so that, upon release of the force which has been pressing the slip carrier upwardly, the slip carrier will move down to its limited or normal position, locking the slips in their retracted position and permitting the removal of the standing valve from the puller.

As will be understood from the foregoing description, the insertion of the standing valve by means of the plunger may be readily accomplished by re-inserting the same standing valve or another at the ground surface as by inserting the stem 14 to engage the pin 42 and release it from the vertical branch of the Y slot and then allowing the pin to move into the curved branch 49 to re-engage the dogs 34 with the valve. The plunger may then be lowered into the tubing string until the standing valve is seated upon the shoe 8 in the pump. Upon seating the valve the plunger will have been moved downwardly so far as to engage the abutments 16 and 17 on the valve and puller, which operation is accompanied by a retraction of the pin 42 along the curved branch of the Y slot and into alignment with the vertical branch thereof so that a mere upward lift on the sucker rod string will re-engage the pin 41 with the vertical branch 48 of the Y slot, at which time the dogs will have released the valve stem 14 and the plunger may then be put into its normal pumping operations.

From the foregoing description it will be apparent that any slippage of the connections for the polished rod which would permit the plunger on its down stroke to descend so far in its barrel as to bring the puller into abutment with the standing valve will merely result in the hammering of the relatively thick lower end of the puller body 22 upon the relatively heavy portion or enlargement 15 on the standing valve but such operation will not result in the release of the dogs 34 nor in the coupling together of the puller and the standing valve. Moreover, upon such operation the upper end of the standing valve stem will not break, shear or otherwise damage the pin 42 even though the pin is repeatedly struck by the stem. The pin will merely be lifted in the vertical portion of the Y slot against the force of the spring 32 so that even though the inadvertent pounding or hammering of the plunger upon the standing valve is not detected for an appreciably long period of time, no serious damage or injury can occur.

Further, by forming the pin of squared cross section and by forming the recess 19 of squared cross section and preferably with a depth approximately equal to one-half of the thickness of the pin, it follows that wear upon the pin which may be occasioned by such inadvertent or accidental hammering will not result in severance of the pin. That is, if the pin upon striking the upper end of the stem is not disposed in alignment with the slot, substantially the entire flat upper surface of the stem will engage the pin so that any wear will be uniformly distributed over a relatively large wearing surface on the

pin while, if the pin should engage almost, but not quite, in alignment with the slot or recess 19, any wear which can occur on the sides of the pin from striking the corners of the slot cannot penetrate more than half way through the thickness of the pin structure. It has been found in actual experience that such inadvertent hammering of the pin over appreciably long periods of time have resulted in considerable wear on the pin but in no case has the pin been worn completely through, thus assuring that when the improper operation has been detected the structure is still sufficiently operative to permit the puller to successfully grasp and life the standing valve for repairs or replacements. Moreover, even though the pin should completely wear through, the total result would only be the release of the slip carrier 29 and the positive gripping of the standing valve by the puller so that the damaged puller and the standing valve will be readily recovered by the mere lifting of the plunger to the ground surface.

While for simplicity I have illustrated and described the member carrying the engaging dogs as being secured to the end of the plunger and have provided the stem upon the standing valve, it will be apparent to those skilled in this art that the positions thereof may be reversed, the stem being secured to the end of the plunger and the dog or slip carrying member may be secured to the standing valve.

I claim:

1. In a device for pulling a standing valve having a stem projecting upwardly therefrom, a puller including a body member having a longitudinal bore therein to telescopically receive the upper end of the stem, a slip carrier slidably mounted in said bore for longitudinal movement therein, a plurality of slips on said carrier, means on said body engageable with said slips when said carrier is in a lower position in said bore for projecting said slips into said bore into engaging relation with said stem, means on said body member engageable by said slips when said carrier is in an elevated position for positively retracting said slips out of stem engaging position, and spring means normally urging said carrier toward its lowermost position.

2. In a device for pulling a standing valve having a stem projecting upwardly therefrom, a puller including a body member having a longitudinal bore therein to telescopically receive the upper end of the stem, a slip carrier slidably mounted in said bore for longitudinal movement therein, a plurality of slips on said carrier, means on said body engageable with said slips when said carrier is in a lower position in said bore for projecting said slips into said bore into engaging relation with said stem, means on said body member engageable by said slips when said carrier is in an elevated position for positively retracting said slips out of stem engaging position, spring means normally urging said carrier toward its lowermost position, and means for normally holding said carrier in its elevated position releasable by relative rotation between said body member and said carrier.

3. In a device for pulling a standing valve having a stem projecting upwardly therefrom, a puller having a longitudinal bore therein to telescopically receive the upper end of the stem, a plurality of slips movable between an extended position projecting radially inwardly of said bore to stem engaging position and a retracted non-engaging position, means mounting said slips for movement between said positions including a slip carrier sleeve having slip receiving recesses formed therein and having an annular groove extending thereabout, and pivot pins extending from opposite sides of each of said slips removably engaged in said groove.

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