Oct. 13, 1942. J. KELLY ET AL 2,298,567

PUMP ANCHOR

Filed July 20, 1940

FIG. 1.

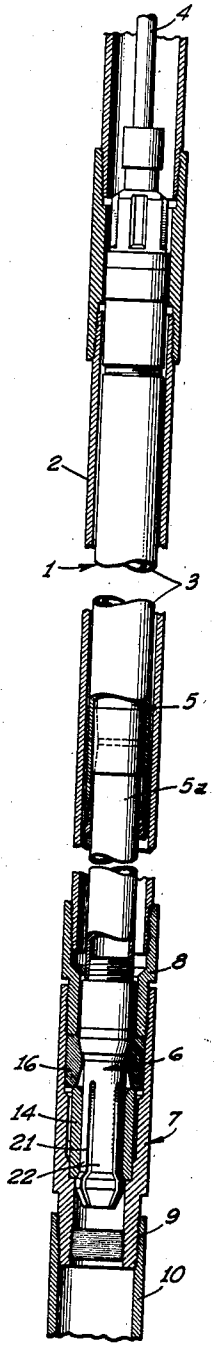


FIG. 2.

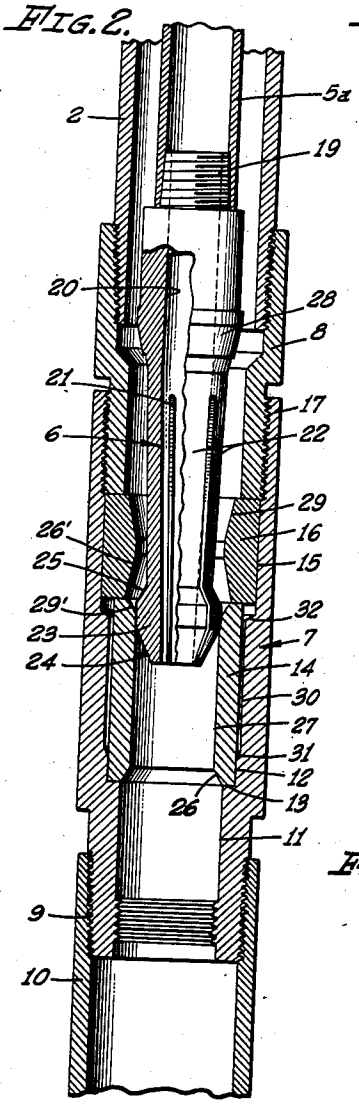


FIG. 3.

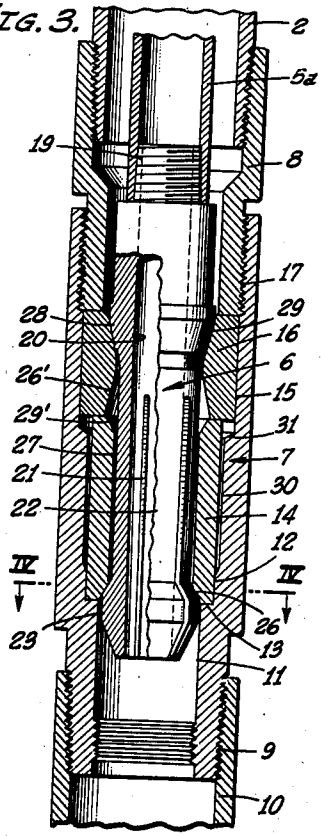


FIG. 4.

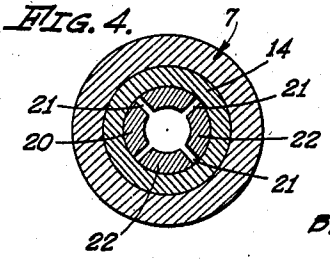
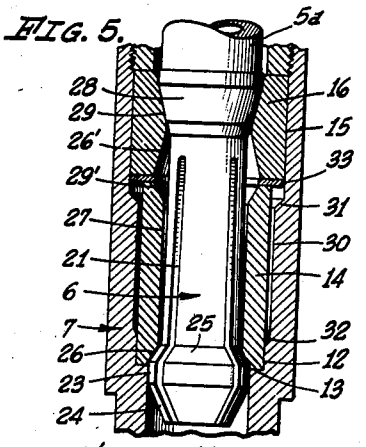


FIG. 5.



JUDSON KELLY,
ERNEST W. OSTROM,
GLYNN H. WILLIAMS,
INVENTORS,

By Harold W. Mattingly

ATTORNEY

Patented Oct. 13, 1942 2,298,567

UNITED STATES PATENT OFFICE

2,298,567

PUMP ANCHOR

Judson Kelly, Rivera, Ernest W. Ostrom, Pasadena, and Glynn H. Williams, Huntington Park, Calif., assignors to Axelson Manufacturing Co., Los Angeles, Calif., a corporation of California

Application July 20, 1940, Serial No. 346,624

6 Claims. (Cl. 103—219)

Our invention relates to oil well pump anchors and has particular reference to an anchor which finds particular utility when employed for supporting pumps in wells by the lowermost part of such pumps.

In the oil producing industry it is common practice to pump the oil from the well by means of a reciprocating pump which includes two relatively reciprocating elements, one of which is stationarily secured near the bottom of the well and the other of which is reciprocated by means of sucker rods or other suitable power transmission devices. One type of such pumps is referred to in the trade as "rod type" or "insert" pumps and is inserted into the well through the string of flow tubing which extends to the ground surface from the location of the pump in the well.

When this type of pump is used, it is necessary that some means be employed to secure the stationary element of the pump to the tubing string when it is inserted to the desired location, and that such means be releasable to permit the withdrawal of the pump for repairs or for other purposes. The means employed must hold the stationary element of the pump securely to prevent movement between that element and the tubing when the other element is reciprocated relative thereto during normal pumping operations and, in addition, should form a seal between the pump and the tubing to prevent the escape of the pumped fluid back to the well. It is often desirable that such a pump be anchored at its lowermost part as, for example, when the inner or plunger element of the pump is that which is to be held stationary as is the case with pumps of the type referred to in the trade as the "travelling barrel type."

Anchor constructions heretofore employed for this purpose have included a pair of coacting seats carried by the pump and by the tubing to be engaged in sealing relation when the pump is lowered to the desired location, together with an anchor device, such as spring fingers or similar structures, to inter-engage the pump and the tubing and hold the coacting seats in such sealing relationship and secure the stationary element against movement during normal pumping operations.

It has been found, however, that after a pump has been in operation for a considerable period of time and particularly in instances in which it has been necessary to remove the pump from the tubing and replace the pump therein more or less frequently, the seats on the anchor structure and on the pump may become worn or pitted so that they no longer provide the necessary fluid-tight seal. Furthermore, the repeated engagement and dis-engagement of the spring fingers with the locking shoulder with which they are engaged serves to wear the locking shoulder sufficiently to not only no longer adequately secure the stationary element against movement, but also to so reduce the seating pressure which is applied thereby to the aforementioned seats as to fail to maintain the fluid seal between the pump element and the tubing string. When this condition occurs, it is necessary to remove and replace the entire anchor and seat structures.

It is therefore an object of our invention to provide an anchoring structure which is readily adaptable for pumps of this character and in which the seat and holding members are separable and are separately replaceable.

It is also an object of our invention to provide an anchor of the character set forth hereinbefore in which a reversible anchor ring is employed to permit either an upper or lower locking portion thereof, as desired, to be used for anchoring the pump within the tubing.

It is a further object of our invention to provide an anchor of the character set forth in the preceding paragraphs in which means is provided for adjusting the distance between a pump seat ring and the anchor ring, whereby refinishing of the seating surfaces is permitted.

It is also an object of our invention to provide a device of the character set forth hereinbefore in which the pump seat ring and the anchor ring are separate from an anchor shoe in which they are secured, thus permitting each of the parts to be manufactured from the material best suited for the function of each part and permitting the shoe to be made of less expensive material than that employed for the rings.

It is an additional object of our invention to provide a device of the character set forth hereinbefore which includes novel features of construction permitting inexpensive manufacture of the device and ready repair and replacement of worn parts and providing for simple and ready assembly and dis-assembly of the device.

Other objects and advantages of our invention will be apparent from a study of the following specification, read in connection with the accompanying drawing, wherein:

Fig. 1 is a fragmentary longitudinal section of an oil well pump of the "rod" or "insert" type secured in place within a tubing string by means of one form of anchoring device of our invention;

Fig. 2 is an enlarged fragmentary sectional view of the lower portion of the apparatus illustrated in Fig. 1 showing the relative positions occupied by the parts during the time the pump is being brought into sealing relation with the pump anchor;

Fig. 3 is a sectional view similar to Fig. 2 but illustrating the relative positions occupied by the parts after the anchoring and seating elements have been engaged with the corresponding elements on the tubing string to secure the pump to the tubing string;

Fig. 4 is a cross sectional view taken substantially along the line IV—IV of Fig. 3; and

Fig. 5 is a sectional view similar to Fig. 3 illustrating the manner in which the spacing between a pump seat ring and an anchor seat ring may be adjusted to take care of material which has been cut from these members by a re-seating or re-finishing operation.

Referring to the drawing, we have illustrated in Fig. 1 the preferred embodiment of our invention as applied to a "rod" type of pump 1 which is inserted within the interior of a string of flow tubing 2. The pump 1 is illustrated as being of the travelling barrel type including a tubular barrel 3 adapted to be reciprocated by means of sucker rods 4 relative to a stationary plunger 5 which is received within the barrel 3. The plunger 5 is connected at its lower end as by means of a pull tube 5a with an anchor sleeve 6 adapted to engage an anchor shoe 7 to hold the plunger 5 against movement as the barrel 3 is reciprocated relative thereto. The anchor shoe 7 may be secured to the lower end of the string of flow tubing 2 as by means of a collar 8 and may also have its lower end threaded as indicated at 9 to receive a collar 10 permitting the attachment of additional lengths of flow tubing, screens, and the like, if desired.

As is illustrated in Fig. 2, the anchor shoe 7 is provided with a longitudinally extending bore 11 permitting the upward flow of oil well fluid therethrough. The bore 11 is preferably enlarged as indicated at 12 to provide an annular shoulder 13 against which a lock member or anchor ring 14 may be clamped when such ring is placed within the enlarged bore 12. The upper end of the shoe 7 is preferably still further enlarged, as indicated at 15, to permit the insertion therein of a pump seat ring 16 and is threaded at its upper end as indicated at 17 to receive the threaded end of the aforementioned collar 8, thus permitting the collar 8 to bear against the upper surface of the seating ring 16 and clamp the seating ring 16 and the anchor ring 14 against the annular shoulder 13.

These elements are adapted to cooperate with the anchor sleeve 6 which is secured as by means of a threaded connection 19 to the lower end of the pull tube 5a. The anchor sleeve 6 is preferably provided with a longitudinally extending bore 20 permitting the upward flow of fluid therethrough and the lower end of this sleeve is preferably slotted longitudinally at a number of points, as indicated at 21, to provide a plurality of longitudinally extending spring fingers 22. Each of these fingers is provided with a head portion 23 defining an upwardly and outwardly tapering lower surface 24 which serves to guide the movement of the sleeve 6 downwardly through the seating ring 16 and anchor ring 14. Each of these head members preferably also includes an upwardly and inwardly directed tapered locking surface 25 which closely conforms to the angularity of a similarly tapered locking shoulder 26 defined by a beveled or countersunk portion provided in the lower end of a bore 27 extended through the anchor ring 14.

The anchor sleeve 6 is preferably so constructed that the undistorted position of the spring fingers 22 is such as to cause the circle defined by the locking surfaces 25 to be of a larger diameter than the circle defined by the locking shoulder 26. This permits the pump to be moved downwardly so as to carry the anchor sleeve 6 through the interior of the rings 14 and 16, the resiliency of the spring fingers 22 allowing these fingers to be moved inwardly a sufficient distance to permit the head portions 23 to pass the small diameter bore 27 of the anchor ring 14 in the manner illustrated in Fig. 2, so that when the pump has been moved to its final resting position, as illustrated in Fig. 3, the fingers may again move outwardly to bring the locking surfaces 25 into engagement with the locking shoulder 26 and prevent return upward movement of the plunger 5.

Because of the angularity of the surfaces 25 and 26, the amount of upward force which is normally applied to the plunger 5 by the reciprocation of the barrel 3 relative thereto is insufficient to dislodge the anchor sleeve 6 from its engagement with the anchor ring 14, but such that in case it is desired to remove the pump 1 from the tubing string 2, a somewhat greater upward force exerted by lifting upwardly on the sucker rods 4 will cause the spring fingers 22 to be moved inwardly to permit the locking surfaces 25 to be disengaged from the locking shoulder 26 so as to permit the removal of the pump upwardly through the tubing string.

Above the slots 21 we may provide a conical shoulder or seat 28 adapted to bear against a similar conical seating surface 29 formed on the seat ring 16. The length of the anchor ring 14 and seating ring 16 is preferably so adjusted relative to the distance between the aforementioned locking surface 25 and the shoulder or seating surface 28 as to cause the seat 28 to forcibly engage the seating surface 29 when the anchor sleeve 6 is locked in the position illustrated in Fig. 3 so as to provide a fluid seal between the pump 1 and the anchor shoe 7 and prevent downward flow of fluid past this point.

Inasmuch as the seating surface 29 and the locking shoulder 26 may become pitted and worn as a result of a number of removals and insertions of the pump from the tubing string 2, we prefer to form the seating ring 16 with another seating surface 29' formed on the opposite end thereof and the anchor ring 14 with another locking shoulder 26' formed on the opposite end of that member. By this expedient it is possible to very quickly renew the seating and anchor surfaces by merely unscrewing the collar 8 from the threaded connection 17, removing from the interior of the anchor shoe 7 the members 14 and 16, and then replacing these members in an inverted position so as to bring the new surfaces 26' and 29' into operative relation with the locking surface 25 and the anchor sleeve seat 28, respectively.

We have found that this reassembly operation may be facilitated if the upper portion of the enlarged bore 12 is still further enlarged, as indicated at 30, to provide adequate clearance between the anchor ring 14 and the walls of this bore. This reassembly operation may be further facilitated by forming the transition be-

tween the various diameter bores by means of conical or tapered surfaces 31 and 32.

After the seating and anchoring surfaces have been renewed by the above described reversal of the rings 14 and 16 and sufficient additional wear has been imposed upon the new surfaces so as to render them no longer fit for the purpose for which they are intended, it is necessary that the rings 14 and 16 be either replaced with new rings or that the seating surfaces and locking shoulders thereof be renewed. It will be appreciated that the renewal of these surfaces as by machining or grinding will, in effect, move the cooperating surfaces 29 and 26 closer to each other so that if the re-finished members were again re-installed within the anchor shoe 7 in the manner illustrated in Fig. 3, the seat 28 would no longer be held in snug engagement with the seating surface 29 and would in all probability fail to establish the required fluid seal at this point.

This condition may be readily corrected in the manner illustrated in Fig. 5 by interposing between the rings 14 and 16 a spacing member or washer 33 having a thickness equal to the amount by which the coacting surfaces 26 and 29 have been moved toward each other by the grinding or refinishing operation. It will be observed that this spacing member serves to re-establish the desired spaced relation between these coacting surfaces and that such spacer may be inserted by reason of the threaded engagement between the shoe 7 and the collar 8 so that even though the rings 14 and 16 are spaced from each other, they may be clamped in such spaced relation by means of the collar 8. This construction, therefore, serves as a means for adjusting the relative spacing between the seating surface 29 and the locking shoulder 26 so as to permit the distance between these surfaces to be made to conform to the corresponding distance between the locking surface 25 and the seat 28.

From the foregoing it will be observed that we have provided an anchor structure for use on "rod" or "insert" types of pumps, and that the structure described hereinbefore provides for the ready renewal not only of the seating surfaces but also of the surfaces which when inter-engaged serve to lock the stationary pump element to the tubing string by the mere reversal of the parts upon which these surfaces are formed. The renewal of the locking surfaces in this fashion permits the same parts of the device to be used a great deal longer than has been heretofore possible with the prior constructions which required the replacement of the entire pump seating and anchor seating unit whenever the surfaces thereon became worn or damaged.

It will also be appreciated that the structure described hereinbefore includes a means for adjusting the spacing between the coacting seating surfaces so as to permit that spacing to be adjusted to conform to the spacing between the surfaces formed on the pump element and intended to coact therewith.

The foregoing construction includes features permitting the dis-assembly, reversal of parts, and re-assembly of the structure to be made readily and without the use of special tools, and the construction described hereinbefore is particularly adapted for inexpensive manufacture.

Attention is directed to the fact that the pump seat ring and the bore in the anchor shoe in which it is received are preferably made as disclosed with diameters different from that employed on the anchor ring so that it is impossible to assemble the device if the anchor ring and the pump seat ring are interchanged. This permits the seating surfaces to be renewed through reversal of the members by a person having but little mechanical skill and insures against improper re-assembly of the device.

It will be furthermore noted that by making the pump seat ring and the anchor ring as separate parts and separate from the anchor shoe, each of the rings may be made of the material best suited to perform the functions of each of these rings and the shoe may be made of a still different material. Since the material required for the rings is generally more expensive than that required for the shoe, a reduction in cost is thus obtained through reducing the quantity of expensive material employed in the device.

While we have shown and described the preferred embodiment of our invention, we do not desire to be limited to any of the details of construction shown or described herein, except as defined in the appended claims.

We claim:

1. In a structure for anchoring pumps in tubing in a well, means on said tubing defining a seating surface, means on said pump defining a seating shoulder engageable with said seating surface, an anchor member on said pump having means thereon projecting outwardly therefrom and spaced from said shoulder, a separate reversible lock member on said tubing including a pair of oppositely directed anchor seats, and means detachably securing said lock member on said tubing in such position as to dispose one of said anchor seats in such location as to engage said projecting means and detachably hold said pump in said tubing in a position engaging said seating surface with said seating shoulder, whereby removal and reversal of said lock member places the other of said anchor seats in a position to so engage said projecting means.

2. In a structure for anchoring pumps in tubing in a well, an anchor member on said pump having means thereon projecting outwardly therefrom, means on said pump defining a seating shoulder spaced from said projecting means, a separate reversible lock member on said tubing including a pair of oppositely directed anchor seats, a separate reversible pump seat member having a pair of oppositely directed seating surfaces thereon, and means detachably securing said lock member and said pump seat member on said tubing in such relative positions as to engage one of said anchor seats with said projecting means and detachably hold said pump in said tubing in a position engaging said seating shoulder with one of said seating surfaces, whereby removal and reversal of said lock member and said pump seat member places the others of said anchor seats and said seating surfaces in positions to so engage said projecting means and said seating shoulder, respectively.

3. In a structure for anchoring in a string of tubing in a well a pump having means defining a seating shoulder and carrying an anchor member having means projecting outwardly therefrom spaced from said shoulder, an anchor device comprising: an anchor shoe including means for attachment to said string of tubing and including means defining a seating surface; a separate reversible lock member on said shoe including a pair of oppositely directed anchor seats;

and means detachably securing said lock member on said shoe in such position as to dispose one of said anchor seats in such location as to engage said projecting means and detachably hold said pump in said tubing in a position engaging said seating surface with said seating shoulder, whereby removal and reversal of said lock member places the other of said anchor seats in a position to so engage said projecting means.

4. In a structure for anchoring in a string of tubing in a well a pump having means defining a seating shoulder and carrying an anchor member having means projecting outwardly therefrom spaced from said shoulder, an anchor device comprising: an anchor shoe including means for attachment to said string of tubing; a separate reversible lock member on said shoe including a pair of oppositely directed anchor seats; a separate reversible pump seat member having a pair of oppositely directed seating surfaces thereon; and means detachably securing said lock member and said pump seat member on said shoe in such relative positions as to engage one of said anchor seats with said projecting means and detachably hold said pump in said tubing in a position engaging said seating shoulder with one of said seating surfaces, whereby removal and reversal of said lock member and said pump seat member places the others of said anchor seats and said seating surfaces in positions to so engage said projecting means and said seating shoulder, respectively.

5. In a structure for anchoring in a string of tubing in a well a pump having means defining a seating shoulder and carrying an anchor member having means projecting outwardly and spaced from said shoulder, an anchor device comprising: an anchor shoe including means for attachment to said tubing and having a shouldered bore extending therethrough, said bore being enlarged at a point spaced from said shoulder to define a small diameter portion and a larger diameter portion; a separate lock member having an anchor seat thereon disposed in one of said bore portions and having a diameter substantially equal thereto; a separate pump seat member having a seating surface thereon disposed in the other of said bore portions and having a diameter substantially equal thereto; and securing means carried by said anchor shoe for clamping said pump seat member and said lock member against the shoulder in said bore, the length of said members being so adjusted as to dispose said seating surface and said anchor seat in such spaced relation that engagement of said projecting means with said anchor seat detachably holds said pump in said tubing in a position engaging said seating shoulder with said seating surface.

6. In a structure for anchoring in a string of tubing in a well a pump having means defining a seating shoulder and carrying an anchor member having means projecting outwardly therefrom and spaced from said shoulder, an anchor device comprising: an anchor shoe including means for attachment to said tubing and having a shouldered bore extending therethrough, said bore being enlarged at a point spaced from said shoulder to define a small diameter portion and a larger diameter portion; a separate reversible lock member disposed in one of said bore portions and having a diameter substantially equal thereto, said lock member having a pair of oppositely directed anchor seats thereon; a separate reversible pump seat member disposed in the other of said bore portions and having a diameter substantially equal thereto, said pump seat member having a pair of oppositely directed seating surfaces thereon; and releasable securing means carried by said anchor shoe for detachably clamping said pump seat member and said lock member against the shoulder in said bore, the length of said members being so adjusted as to dispose one of said seating surfaces and one of said anchor seats in such spaced relation that engagement of said projecting means with said one anchor seat detachably holds said pump in said tubing in a position engaging said seating shoulder with said one seating surface, whereby removal and reversal of said lock member and said pump seat member places the others of said anchor seats and said seating surfaces in positions to so engage said projecting means and said seating shoulder, respectively.

JUDSON KELLY.
ERNEST W. OSTROM.
GLYNN H. WILLIAMS.