

March 15, 1938.

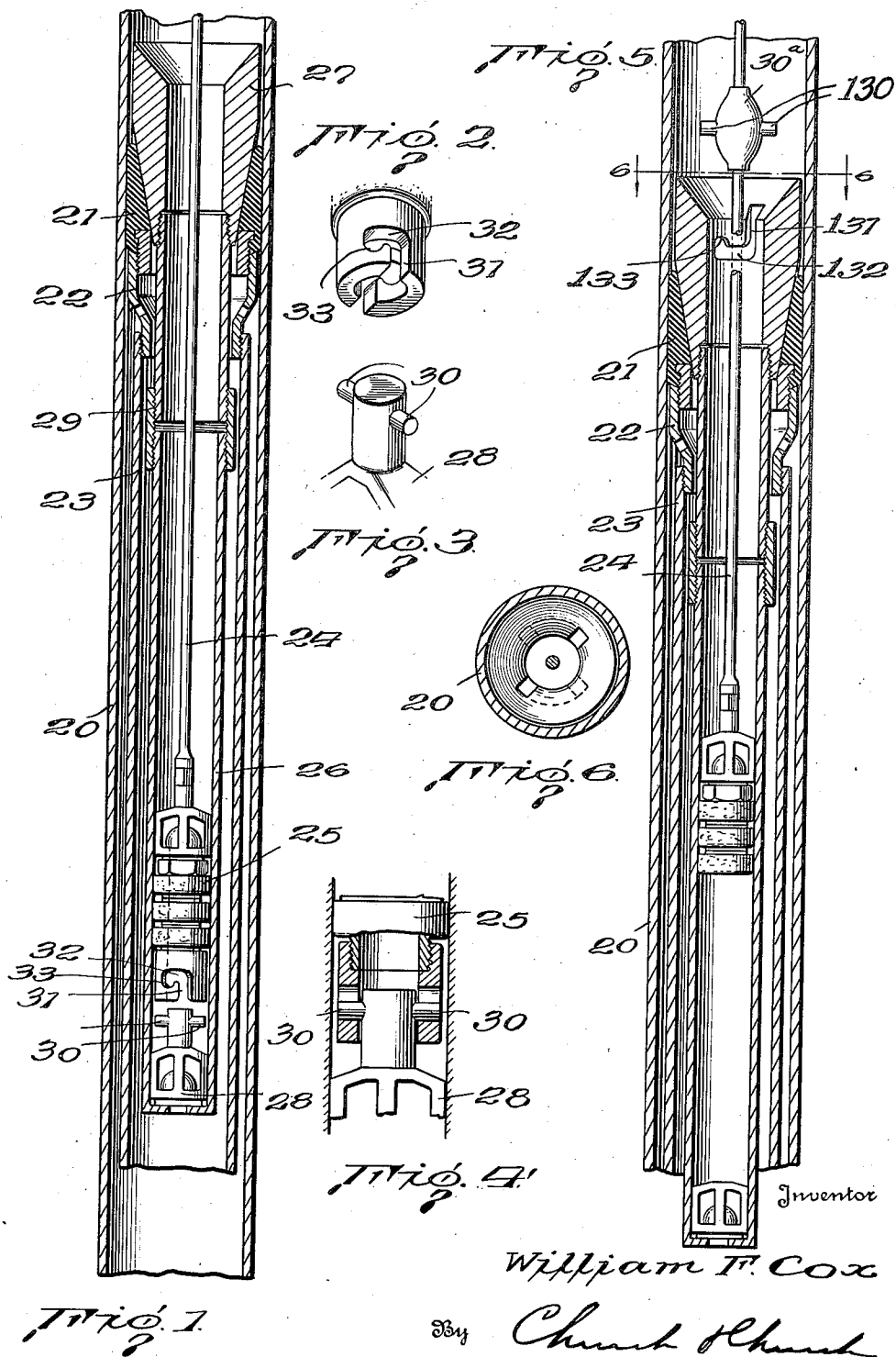
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2,111,176

WELL PUMP

Filed June 25, 1936

3 Sheets-Sheet 1



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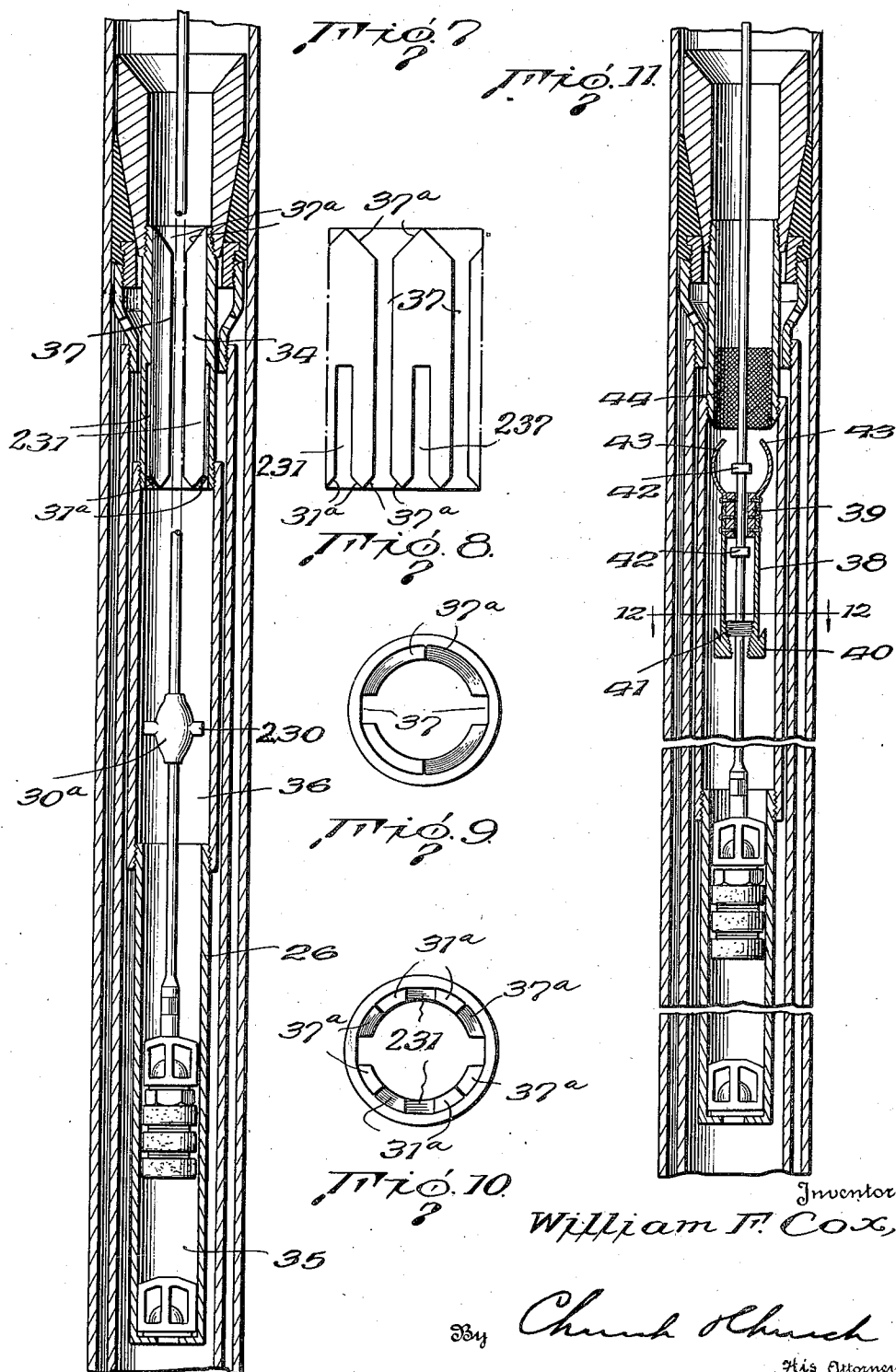
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UNITED STATES PATENT OFFICE

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WELL PUMP

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9 Claims. (Cl. 103—181)

This invention relates to improvements in pumps and particularly to pumps designed for flowing oil wells.

Not infrequently it is desirable to inspect and possibly replace or repair the essential operating elements of pumps of this type, in which event it is, of course, necessary to withdraw them from the well. Usually, the entire pump mechanism has been withdrawn from the well and under these circumstances all the liquid in the well casing, above the point at which the pump was positioned in the well, flows back in the well. This is rather disadvantageous, especially where the well is very deep and has a very low liquid level or is cased with rather large pipe. For instance, if the well is three or four thousand feet deep and the liquid level in the well is only three or four feet above the bottom, when pumping operations are first started, it is necessary to pump in the neighborhood of one hundred barrels of fluid to entirely fill the casing before it begins to flow out at the top of the well. This will usually be several hours pumping and, in some cases, might be several days production from the sand as where the production is so small that the well can be pumped only an hour or two a day before exhausting the oil which has accumulated in the sand subsequent to the last prior pumping operation.

The primary object of the invention, therefore, is to provide a well pumping mechanism wherein the primary operating unit, i. e., the traveling valve which is suspended from and reciprocated in the working barrel of the pump by the sucker rod, can be withdrawn from the working barrel and from the well without disturbing the position of the pump in the well, thus maintaining the seal in the well at the pump so as to prevent previously pumped fluid standing in the well above the pump returning to the sand formations.

Another object of the invention is to provide a pump structure wherein, if desired, not only may the sucker rod and traveling valve be withdrawn from the well but, if desired, the working barrel, together with one of the well sealing elements, may also be withdrawn, leaving what is termed the packer, the drain sleeve and the shell in position in the well.

A further object of the invention is to provide a pump structure in which the various units before mentioned may be withdrawn without disturbing the position of the other parts of the well and, at the same time, the sucker rod, which operates a traveling valve, is utilized as is common

practice in lowering the entire pump structure in the well at the time the pump is installed.

With these and other objects in view, the invention consists in certain details of construction and combinations and arrangements of parts, all as will hereinafter be more fully described, and the novel features thereof particularly pointed out in the appended claims.

In the accompanying drawings—

Figure 1 is a vertical sectional view of a pump embodying the present improvements, the pump being illustrated in the position it occupies under normal working conditions;

Fig. 2 is a perspective view of the lower extremity of the traveling valve;

Fig. 3 is a similar view of the upper portion of the standing valve;

Fig. 4 is a detail sectional view illustrating the two valves interlocked, the position they occupy when the entire pump is raised or lowered in the well;

Fig. 5 is a vertical sectional view of a modified pump structure;

Fig. 6 is a cross-sectional view on the line 6—6 of Fig. 5;

Fig. 7 is a vertical sectional view illustrating a still further modification of the invention;

Fig. 8 is a development or flattened view of the interior surface of the connecting nipple for the pump in Fig. 7;

Fig. 9 is a plan view of the upper end of said nipple;

Fig. 10 is a bottom end view of said nipple;

Fig. 11 is a vertical view of another modified form of the invention;

Fig. 12 is a transverse section on line 12—12 of Fig. 11;

Fig. 13 is a perspective view of the upper section of the tubular member used for the working barrel of the pump of Fig. 12;

Fig. 14 is a perspective view of one of the gripping members for raising the pump shown in Fig. 12;

Fig. 15 is a vertical sectional view illustrating still another form of the invention;

Fig. 16 is a development or flattened view of the interior of the drain sleeve of the pump of Fig. 15;

Fig. 17 is a sectional view, on the line 17—17 of Fig. 15; and

Fig. 18 is a sectional view, looking upward, from the plane indicated by line 18—18 of Fig. 15.

The usual well casing is indicated at 20 in the several views and in accordance with ordinary practice the casing is sealed adjacent the upper

end of the pump by a packer 21 carried at the upper end of the drain sleeve 22 which, in turn, is mounted on the upper end of the shell 23. As is well understood in the art, the entire pump unit is installed by lowering it into the well on the sucker rod 24 until the shell 23 comes to rest on its support in the well. The working barrel 26 of the pump which carries a tubular mandrel 27 at its upper end is then permitted to move downward with respect to the shell whose movement has been arrested and the mandrel enters and expands the packer into sealing engagement with the well casing.

In the form of the invention illustrated in Figs. 1 to 4, when the pump is being lowered or installed in the well, the traveling valve 25 at the lower end of sucker rod 24 is coupled to the standing valve 28 (Fig. 4) secured in the lower end of the working barrel 26 and mandrel 27 is spaced somewhat above the packer 21 which is then contracted. At the same time, the shoulder formed by collar 29 is engaged against the lower end of drain sleeve 22 so that the entire pump is suspended or supported on the sucker rod. However, as previously mentioned, when shell 23 comes to rest in the well, the working barrel moves downwardly with respect thereto, so that the mandrel will expand the packer as shown. It then only remains to free the two valves to initiate pumping operations. In this form of the invention the two valves are coupled or interlocked by the provision of what is termed a bayonet joint or J-tool assembly. That is, one valve is provided with pins or lugs 30 adapted to engage in slots in the other valve, said slots having a vertical entrance or throat 31, and a transverse portion 32 terminating in a depression or socket 33. As will be apparent, the two valves are disconnected by slightly lowering the sucker rod and traveling valve after the mandrel and barrel have come to rest, thus moving the pins 30 out of the sockets 33, then rotating the sucker rod to position the pins in the inner ends of throat portions 31 of the slots in the traveling barrel, whereupon the traveling valve and sucker rod can be freed from said standing valve. While pumping, the reciprocatory movement of the sucker rod is limited to the normal working stroke of the valve 25. However, should it be desirable to pull or raise the valve 25 out of the well, it is only necessary to fully withdraw the sucker rod, as the bore of the barrel and mandrel is unobstructed. This will leave the packer sealed and the standing valve, being seated, no liquid above the pump can drain out below the pump structure remaining in the well. When the sucker rod and valve 25 are returned to the well, they will be guided into the working barrel by the beveled inner surface of mandrel 27.

In the pump shown in Figs. 5 and 6, the interlocking connection for supporting the entire structure on the sucker rod 24 while still permitting independent withdrawal of said rod and the traveling valve 25, is directly between the rod and the mandrel 27. That is, the bayonet slot is formed in the inner surface of the mandrel as indicated at 131, 132, 133, and the lugs, or pins 130 are formed on an enlargement 30^a on the sucker rod. The parts are shown in their normal working or pumping positions and it is apparent that the rod 24 and traveling valve 25 may be withdrawn from the well without disturbing other portions of the structure. As will be understood, however, when the pump is installed in the well, or if it is desired to remove

the entire structure, it is only necessary to lower the pins 130 into the slots 131 and turn the sucker rod until the pins 130 engage in the sockets 133 at the inner extremities of said slots.

Referring to Figs. 7 to 10, the working barrel 26 is formed in a tubular member having a constricted bore at its upper and lower ends, 34, 35, and a relatively enlarged bore at its intermediate portion 36. The lower constricted portion serves as the working barrel and the pins 230 are formed on the sucker rod 24 at a point within the intermediate enlarged portion 36. The inner surface of upper constricted portion 35 is formed with recesses 231 in which said pins 230 engage when the entire pump is supported on the sucker rod. Said inner surface is also provided with slots 37 extending the entire length of section 34 and by moving pins 230 into registry with said slots, the sucker rod and traveling valve can be removed from the pump and raised to the surface. To facilitate movement of the pins 230 into the slots and recesses, the ends of the slots are flared as at 37^a and the entrances to the recesses are formed likewise as indicated at 31^a.

In the modification of Figs. 11 to 14, the working barrel is likewise formed in a tubular member having its upper and lower portions of reduced diameter but the interlocking connections take the form of spring fingers 38 yieldingly urged radially inward on a block 39 loose on the sucker rod at a point within the enlarged intermediate portion of the tubular member. The lower ends of fingers 38 are provided with lugs 40 threaded on their inner surfaces and preferably provided with hook-shaped shoulders on their exterior. A tapered threaded member 41 on the sucker rod screws into the threads on the several lugs, the movement of member 41 into and out of the lugs being limited by stops 42 fixed on the sucker rod engaging block 39. Also secured to block 39 are spring bow guides 43 adapted to enter the upper constricted portion 34 of the tubular member. The inner surface of said portion is preferably roughened as at 44 so as to resist rotary motion of the bow guides and block 39, when said guides are positioned therein. With this arrangement, the sucker rod and traveling valve can be withdrawn without disturbing the remaining pump structure by reason of the fact that the lugs in contracted position can pass through the upper reduced portion of the tubular member. However, in lowering the pump into the well or in raising the entire structure, it is supported on the sucker rod through lugs 40 engaging against the inclined shoulder formed by the lower end of upper section 34. This is accomplished by raising the bow guides 43 into the roughened portion of the upper section 34 and then revolving sucker rod 24 in a direction to advance the threaded conical member 41 into the lugs so as to move the latter radially outward to a position where they can be brought into engagement with the lower end of section 34.

The modification of Figs. 15 to 18 is of the type illustrated in Fig. 1, in that the interlocking connection is between the two valves 25, 28. However, in this instance, the working barrel and mandrel may be raised with the sucker rod and traveling valve, or, if desired, only the rod 24 and valve may be removed. For this purpose, the inner surface of the drain sleeve 22 is formed with recesses 45 and slots 46, flared at their entrances as at 47, 48, and the barrel is formed with lugs 49 on its exterior adapted to seat in

said recesses when the entire structure is to be raised or to pass through said slots if the barrel and mandrel are to be removed from the shell and raised to the surface. With the parts in normal operating position, as shown, the rod 24 and traveling valve, alone, can be raised to the surface without disturbing the remaining structure, due to the fact that the two valves are disconnected at 30, 31. However, if it should be desirable to pull the barrel and mandrel with the rod and valve, leaving the shell in position, the two valves are first interlocked and the barrel then turned by rotating the sucker rod until the lugs 49 engage in slots 46. Of course, when the barrel and mandrel are thus withdrawn the seal of the packer is broken and the shell is also entirely open, so that fluid will drain back but, as first set forth, it is possible in all instances to raise the rod and traveling valve without permitting such drainage.

Reference is made to applicant's pending application Serial No. 751,778, wherein the support and drain features are more fully described and claimed.

What I claim is:

1. In a well pump, the combination of a working barrel, means comprising a shell and a packer for supporting said working barrel in the well, a packer expanding mandrel carried by the barrel, a traveling valve slidable in said barrel, a suspension member for reciprocating said valve in the barrel, and interlocking means carried by said suspension member and barrel for lowering and raising the pump as a unit in the well, said means being releasable to free said suspension member and valve from the pump whereby said member and valve may be removed from the well independently of the remaining pump structure.

2. In a well pump, the combination of a working barrel, a shell carried by the barrel, a packer carried by the shell, a packer expanding member on the barrel, a traveling valve, a sucker rod for reciprocating said valve in the barrel, and interlocking elements associated with said sucker rod and barrel for raising and lowering said shell, barrel and valve as a unit in the well, said interlocking elements being releasable to free the valve and sucker rod and permit their removal from the barrel.

3. In a well pump, a working barrel, a drain sleeve surrounding said barrel, means for supporting said sleeve on the barrel, a packer mounted on said sleeve, a mandrel on the barrel for expanding said packer, a standing valve and a traveling valve in the barrel, a sucker rod for actuating said traveling valve, and releasable interlocking elements on said rod and mandrel for supporting the mandrel on the rod, said rod and traveling valve being removable from the well independently of the remaining structural elements when said interlocking elements are released.

4. In a well pump, the combination of a tubular member, the lower portion of said member forming the working barrel of the pump, the bore of said member above the barrel portion being of enlarged diameter, a sucker rod extending into said barrel portion, a traveling valve on said rod in the barrel portion, and interlocking ele-

ments on said sucker rod and the upper portion of said tubular member for supporting said member on the rod, said elements being disengageable to permit withdrawal of the rod and valve from said tubular member.

5. In a well pump, the combination of a tubular member, one end portion thereof forming the working barrel of the pump, interior shoulders on said tubular member, a mandrel attached to the opposite end of said member, said mandrel having a central bore communicating with the bore of the tubular member, a sucker rod extending through said mandrel into the working barrel, a traveling valve on said rod in the barrel, and lateral projections on said sucker rod above said valve engageable with the interior shoulders on the tubular member for supporting the pump in the well, said rod and valve being removable from the well independently of said tubular member and mandrel.

6. In a well pump, a tubular member, the bore in said member being of reduced diameter at its end portions, the lower end portion forming the working barrel of the pump, a sucker rod extending through said member into the barrel portion, a traveling valve on said rod in the barrel, and means on said rod in the intermediate portion of the tubular member engageable with the reduced upper end portion to support the pump in a well, said rod together with said supporting means and valve being removable from the well independently of the tubular member.

7. In a well pump, a tubular member, the bore in said member being of reduced diameter at its end portions, the lower end portion forming the working barrel of the pump, a sucker rod extending through said member into the barrel portion, a traveling valve on said rod in the barrel, and means on said rod in the intermediate portion of the tubular member engageable with the reduced upper end portion to support the pump in a well, said reduced upper end portion having passages therein through which said supporting means can be withdrawn to free said rod from said tubular member.

8. In a well pump, a tubular member, the bore in said member being of reduced diameter at its end portions, the lower end portion forming the working barrel of the pump, a sucker rod extending through said member into the barrel portion, a traveling valve on said rod in the barrel, and an enlargement on said rod in the intermediate portion of the tubular member engageable with the reduced upper end portion of said member to support the pump in a well, said reduced upper end portion having passages therein through which said enlargement can be withdrawn to free the rod from the tubular member.

9. In a well pump, a tubular member having its bore at its opposite ends of reduced diameter, the lower end portion forming the working barrel of the pump, a sucker rod extending through said barrel into said barrel portion, a traveling valve on said rod in said barrel portion, and radially movable members on the rod in the intermediate portion of said member engageable with the upper reduced end portion of said member for supporting the pump in a well.

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