

UNITED STATES PATENT OFFICE

2,162,001

WELL PUMP

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Original application June 25, 1936, Serial No. 87,310. Divided and this application December 18, 1937, Serial No. 180,625

7 Claims. (Cl. 103—181)

This invention relates to improvements in pumps and, particularly, to oil well pumps of the type generally referred to as casing pumps wherein the oil flows to the surface through the well casing, as distinguished from the use of tubing within the casing for conveying the oil upwardly to the surface.

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 Usually, the entire pump mechanism has been withdrawn from the well and, under these circumstances, all the liquid in the well casing, above the point at which the pump was positioned in the well, flows back in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traveling valve which is suspended from and reciprocated in the working barrel of the pump by the sucker rod, can be withdrawn from the working barrel and from the well without disturbing the position of the pump in the well, thus maintaining the seal in the well at the pump so as to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of the invention is to provide a pump structure wherein, if desired, not only may the sucker rod and traveling valve be withdrawn from the well but, if desired, the working barrel, together with one of the well sealing elements, may also be withdrawn, leaving what is termed the packer,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 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 drawing—

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 illustrating a modified form of the invention;

Fig. 6 is a development or flattened view of the interior surface of the drain sleeve of the pump illustrated in Fig. 5;

Fig. 7 is a transverse sectional view on the line 7—7 of Fig. 5; and

Fig. 8 is a similar view on the line 8—8 of Fig. 5.

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.

The modified form of the invention illustrated in Figs. 5 to 8 is similar to that embodied in the previously described structure, in that the sucker rod 24 is adapted to be connected to the pump barrel through the interlocking connection between the traveling and standing 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 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 recesses 45. 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 through ports 50 in drain sleeve 22 but, as first set forth, it is possible in all instances to raise the rod and traveling valve without permitting such drainage. It will be understood that fluid above the pump can be drained past or below the pump

when it is desired to remove the entire pump structure from the well. In normally withdrawing the entire assembly, the barrel is first raised to disengage the mandrel 27 from the packer 21. This opens an annular space between the mandrel and packer through which fluid above the pump will pass and drain through the ports 50 in the drain sleeve. Thus the pressure above the pump is relieved and raising of the pump materially facilitated.

The present application is a division of applicant's pending application Serial No. 87,310, filed June 25, 1936, and reference is also made to applicant's pending application Serial No. 751,778, wherein the support and drain features are more fully described and claimed.

These applications have now eventuated into Patents Nos. 2,111,176 and 2,111,173, respectively.

What I claim is:

1. In a well pump, the combination of a working barrel, a packer sleeve surrounding the barrel, a mandrel on said barrel for radially expanding said sleeve, a standing valve and a traveling valve in the barrel, a sucker rod attached to the traveling valve for reciprocating the latter, and interlocking connections between said valves for supporting the working barrel on the sucker rod, said connections being releasable to free the traveling valve and rod from the standing valve, said traveling valve and rod being removable from the well independently of the barrel when freed.

2. In a well pump, a working barrel, means for supporting said barrel in the well, a standing valve secured in the barrel having laterally disposed projections thereon, a traveling valve, a sucker rod attached to said traveling valve for reciprocating the same in the barrel, and means on said traveling valve adapted to interlock with the projections on said standing valve whereby the barrel may be raised and lowered by the sucker rod, said interlocking means being releasable from said projections to free the rod from the standing valve, said rod and traveling valve when freed being removable from the well independently of the barrel.

3. In a well pump, the combination of a working barrel, a drain sleeve surrounding and adapted to be supported on the barrel, a packer on said sleeve, said barrel being movable longitudinally relatively to the sleeve and packer for expanding the latter, a standing valve secured in the barrel, a traveling valve in the barrel, a sucker rod for actuating the traveling valve, and releasable interlocking connections on said valves for supporting the barrel on said rod, said rod and traveling valve being removable from the well independently of the remaining structure when said elements are disengaged, and means for disengaging and removing said barrel from the sleeve to permit withdrawal of the barrel from the well independently of said sleeve and packer.

4. In a well pump, the combination of a working barrel, a drain sleeve surrounding and adapted to be supported on the barrel, a packer on said sleeve, said barrel being movable longitudinally relatively to the sleeve and packer for expanding the latter, a standing valve secured in the barrel, a traveling valve in the barrel, a sucker rod for actuating the traveling valve, means for supporting the barrel on the rod, and means for disengaging and removing the barrel from said sleeve to permit withdrawal of the barrel from the well independently of the sleeve and packer.

5. In a well pump, a working barrel having projections on its exterior, a drain sleeve surrounding said barrel, said sleeve having recesses in its interior surface in which said projections may engage to support the sleeve on the barrel, said sleeve also having slots extending the length of its interior surface through which said projections can pass, a packer on said sleeve, standing and traveling valves in the barrel, and a sucker rod for actuating said traveling valve, said barrel being movable to align said projections with the recesses and slots in the sleeve at the will of the operator.

6. In a well pump, the combination of a working barrel, means comprising a packing member for supporting the barrel in a well, a mandrel on the barrel for radially expanding the packer, a traveling valve in the barrel, a sucker rod carrying said valve for reciprocating the same, releasable means securing said rod to the barrel, and detachable means connecting the barrel to the

remaining pump structure, said rod and valve being removable from the pump and well independently of the barrel, and said rod, valve, barrel and mandrel being releasable as a unit from the remaining pump structure while in the well.

7. In a well pump, the combination of a working barrel, means comprising a packing member for supporting the barrel in a well, a mandrel on the barrel for radially expanding the packer, a traveling valve in the barrel, a sucker rod carrying said valve for reciprocating the same, means for supporting the barrel on the sucker rod, and releasable means connecting said barrel to the remaining pump structure, said barrel together with the mandrel carried thereby and the rod on which said barrel is supported being removable from the well as a unit independently of said remaining structure upon release of said connecting means.

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