Feb. 13, 1940. W. T. ROBERTSON 2,190,535

PUMP

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Fig. 1

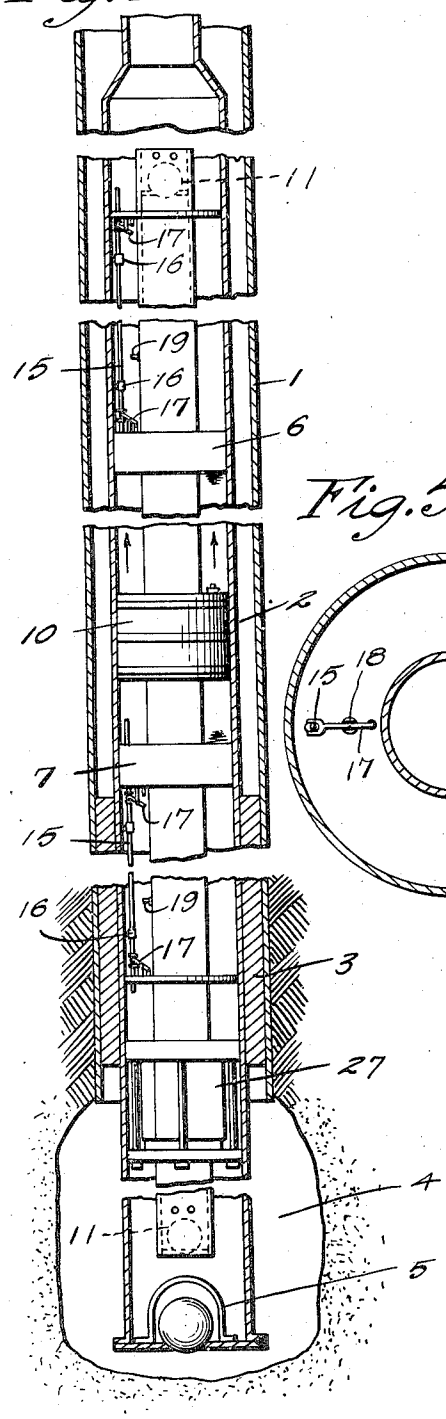


Fig. 5.

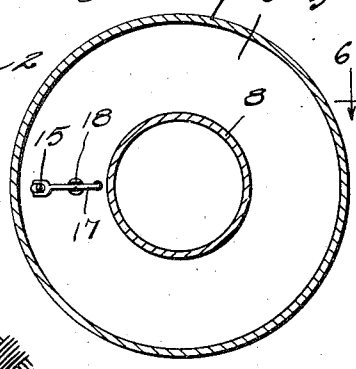
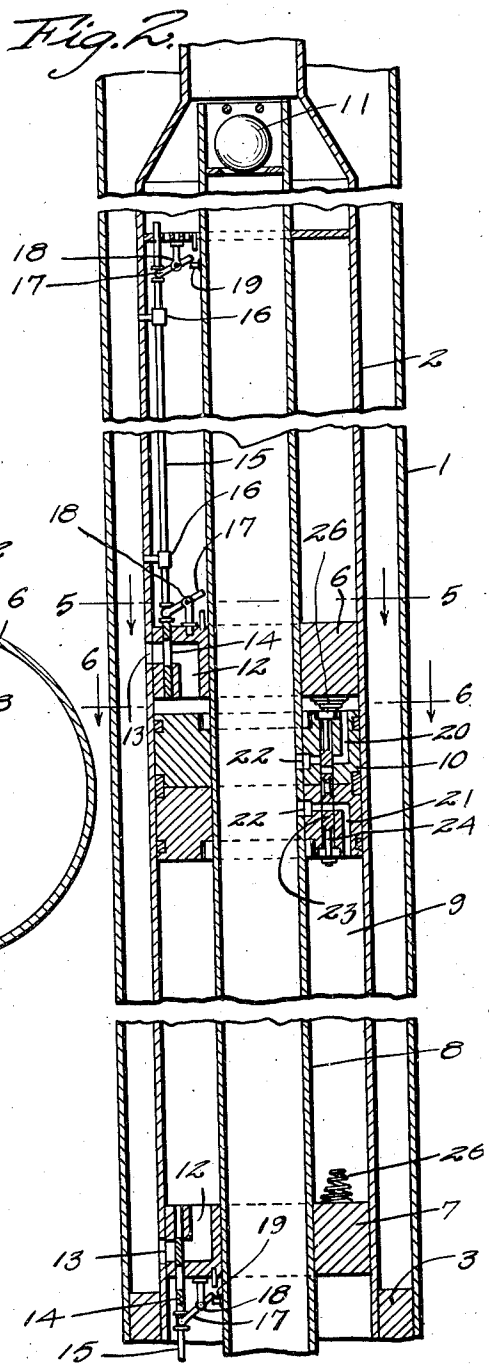


Fig. 2.



Wm. T. Robertson INVENTOR

BY Victor J. Evans & Co.

ATTORNEYS

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Fig. 3.

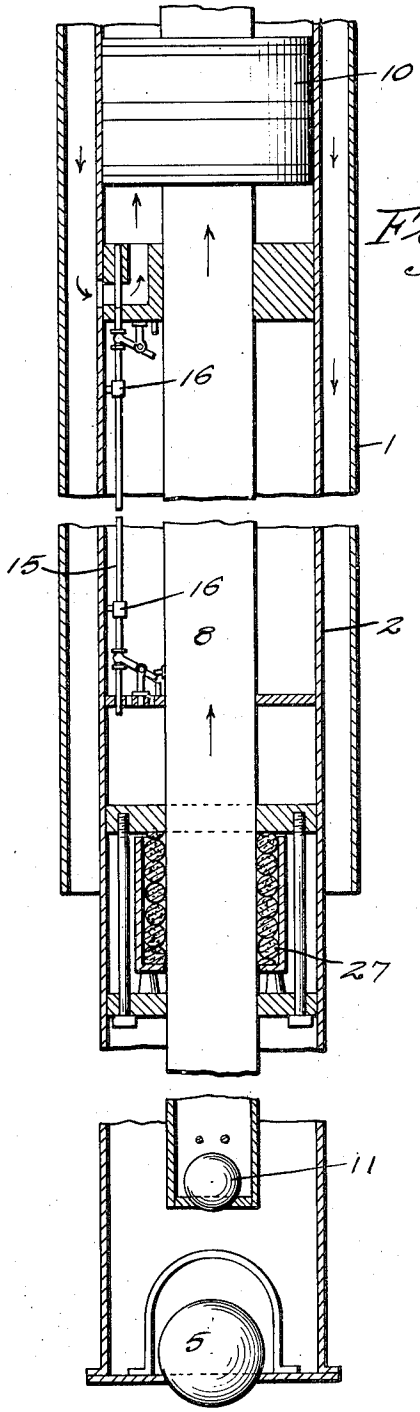


Fig. 4.

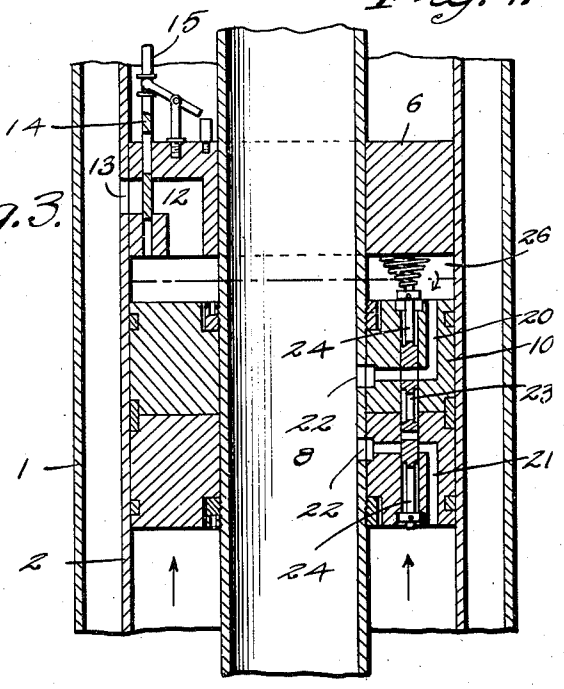
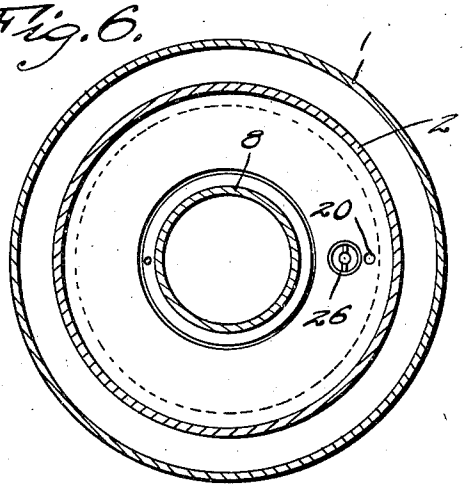


Fig. 6.



Wm. T. Robertson
INVENTOR

BY Victor J. Evans & Co.
ATTORNEYS

Patented Feb. 13, 1940

2,190,535

UNITED STATES PATENT OFFICE

2,190,535

PUMP

William T. Robertson, Okemah, Okla.

Application September 20, 1938, Serial No. 230,856

4 Claims. (Cl. 103—46)

This invention relates to pumps especially adapted for deep oil wells and has for the primary object the provision of a device of this character which may be successfully operated by fluid pressure such as air or gas under a desired pressure from a source and which employs the exhaust of the fluid pressure to aid in lifting the liquid or oil from the well and which consists of a minimum number of parts, and may be easily installed and will successfully operate at the bottom of a deep well without disturbing the sands of the well.

With these and other objects in view, this invention consists in certain novel features of construction, combination and arrangement of parts to be hereinafter more fully described and claimed.

For a complete understanding of my invention, reference is to be had to the following description and accompanying drawings, in which

Figure 1 is a fragmentary vertical sectional view illustrating a pump installed in a well and constructed in accordance with my invention.

Figure 2 is a fragmentary vertical sectional view illustrating a piston of the pump starting on its downward stroke.

Figure 3 is a view similar to Figure 2 showing the piston starting on its upward stroke.

Figure 4 is a fragmentary vertical sectional view illustrating the pistons and the exhaust valves thereof.

Figure 5 is a sectional view taken on the line 5—5 of Figure 2.

Figure 6 is a transverse sectional view taken on the line 6—6 of Figure 2.

Referring in detail to the drawings, the numeral 1 indicates a well casing adapted to extend from the surface of a well to a point adjacent the bottom. Located in the lower portion of the well casing is a pump cylinder 2 connected at its upper end with an oil conveying pipe (not shown) and which extends to the surface of the well. A packer 3 is arranged between the cylinder 2 and the well casing 1 adjacent the lower end of the latter to close the well casing to the bottom or producing pit 4 of the well. The cylinder 2 extends into the pit 4 and carries at its lower end a standing valve 5 which will permit the oil to enter the cylinder.

Upper and lower heads 6 and 7 are mounted in the cylinder and are suitably secured on the latter and slidably support a tubular pump element 8. The heads 6 and 7 provide in the cylinder a piston chamber 9 in which operates a power piston 10 being detachably mounted on the tubular pump element. Check valves 11 are located in the pump element adjacent the ends thereof and both unseat in an upward direction. The piston 10 is of sectional formation, the sections being suitably connected. The upper and lower heads 6 and 7 have formed therein intake passages 12 which communicate with ports 13 formed in the cylinder, thus establishing communication between the intake passages 12 and the space between the cylinder and the well casing above the packer 3. Intake valves 14 of the slidable type control the intake passages 12 and are connected to rods 15 slidable in brackets 16 mounted on the cylinder. Pivotally connected to said rods 15 are levers 17 pivotally mounted, as shown at 18. The free ends of the levers lie in the path of movement of lugs 19 carried by the pump element 8. The intake passages are alternatingly opened and closed with respect to each other during the reciprocation of the pump element.

The piston 10 has exhaust passages 20 and 21 opening outwardly through opposite faces of the piston and also communicating with ports 22 formed in the pump element 8. The exhaust passages are alternatingly opened and closed by a valve 23 of the slidable type and provided with oppositely extending stems 24 which project beyond opposite faces of the piston to be contacted by springs 26 mounted on the heads 6 and 7. The power piston is reciprocated or driven by fluid pressure obtained from the well casing or through some medium (not shown) connected with the ports 13 and the reciprocation of the piston brings about reciprocation of the pump element 8 which lifts the oil from the well. The fluid pressure exhausted from the cylinder by way of the exhaust passages 20 and 21 into the pump element aids in lifting the oil from the well.

In operation, when the piston is in its uppermost position, as shown in Figure 2, the intake valve of the upper head 6 is opened, admitting fluid pressure such as air or gas to act on the piston to drive the same downwardly, the exhaust passage 20 of the piston being closed and the exhaust passage 21 of said piston being open so that any fluid such as air or gas below the piston is forced into the pump element 8 aiding in lifting the fluid. As the pump element is forced downwardly on the down stroke of the power piston the check valves 11 unseat and as the pump element moves upwardly the check valves 11 close lifting the liquid. The pump element is forced upwardly on the upstroke of the

power piston, the fluid pressure then acting on the power piston by way of the intake passage of the lower head 7, the upper intake passage 12 at this time being closed. During the up stroke of the power piston the exhaust passage 21 is closed and the exhaust passage 20 is opened so that the air or gas in the upper part of the cylinder may escape to the pump element for aiding in lifting the oil from the well. The exhaust valve 23 is shifted into its different positions by the stems thereof alternatingly contacting the springs on the upper and lower heads. The opening and closing of the intake valves is by the lugs 19 engaging the free ends of the levers 17 as said power piston nears the limit of its strokes.

Arranged between the cylinder 2 and the pump element 8 is an adjustable packing gland 27.

What is claimed is:

1. A deep oil well pump comprising a cylinder located in a well and terminating in close proximity to the bottom of said well and including a standing valve, upper and lower heads mounted in said cylinder, valve actuating means carried by the said heads, a tubular pump element slidably supported by said heads, a check valve carried by said pump element, a power piston operating in said cylinder between the heads and secured to said pump element, said power piston having exhaust passages therein communicating with the cylinder through the upper and lower faces of the piston and with the tubular element respectively, sliding valves carried by the piston and positioned transversely of the passages and protruding beyond the upper and lower faces of the pistons, said valves being cooperatively connected so that one of the exhaust passages will always be open to the cylinder through one face of the piston and the other of the passages will be closed to the cylinder through the opposite face of the piston and as the piston reciprocates between the heads, the valve actuating means will engage the said valves to close the opened passage and to simultaneously open the other of the said passages, and means for alternatingly admitting fluid pressure to opposite sides of the power piston for the reciprocation of the power piston.

2. A deep oil well pump comprising a cylinder located in a well and terminating in close proximity to the bottom of said well and including a standing valve, upper and lower heads mounted in said cylinder, a tubular pump element slidably supported by said heads, a check valve carried by said pump element, a power piston operating in said cylinder between the heads and secured to said pump element, means for alternatingly admitting fluid pressure to opposite sides of the power piston for the reciprocation of the power piston, said piston including exhaust means for exhausting the fluid pressure from the cylinder into the pump element.

3. A deep oil well pump comprising a cylinder located in a well and terminating short of the bottom of the well and including a standing valve, spaced heads mounted in said cylinder and forming therebetween a piston chamber, a tubular pump element slidably supported by said heads, a check valve for said pump element, a power piston operating in said chamber and secured on said pump element and provided with exhaust passages opening outwardly through opposite faces of the pistons and communicating with the interior of thhe pump element, a slidable exhaust valve for alternatingly opening and closing said exhaust passages, resilient means carried by said heads to be contacted by the exhaust valve as the piston nears the limit of its strokes in opposite directions for shifting the position of the exhaust valves to alternatingly open and close said exhaust passages, said heads having intake passages, intake valves for alternatingly opening and closing said intake passages, and the latter adapted to be connected to a fluid pressure supply, and means for operating the intake valves.

4. A deep oil well pump comprising a cylinder located in a well and terminating short of the bottom of the well and including a standing valve, spaced heads mounted in said cylinder and forming therebetween a piston chamber, a tubular pump element slidably supported by said heads, a check valve for said pump element, a power piston operating in said chamber and secured on said pump element and provided with exhaust passages opening outwardly through opposite faces of the pistons and communicating with the interior of the pump element, a slidable exhaust valve for alternatingly opening and closing said exhaust passages, resilient means carried by said heads to be contacted by the exhaust valve as the piston nears the limit of its strokes in opposite directions for shifting the position of the exhaust valves to alternatingly open and close said exhaust passages, said heads having intake passages, intake valves for alternatingly opening and closing said intake passages and the latter adapted to be connected to a fluid pressure supply, rods slidably mounted in said cylinder and connected to thhe intake valves, pivotally mounted levers carried by said cylinder and connected on said rods, and lugs carried by the pump element to engage said levers for alternatingly opening and closing the intake valves.

WILLIAM T. ROBERTSON.