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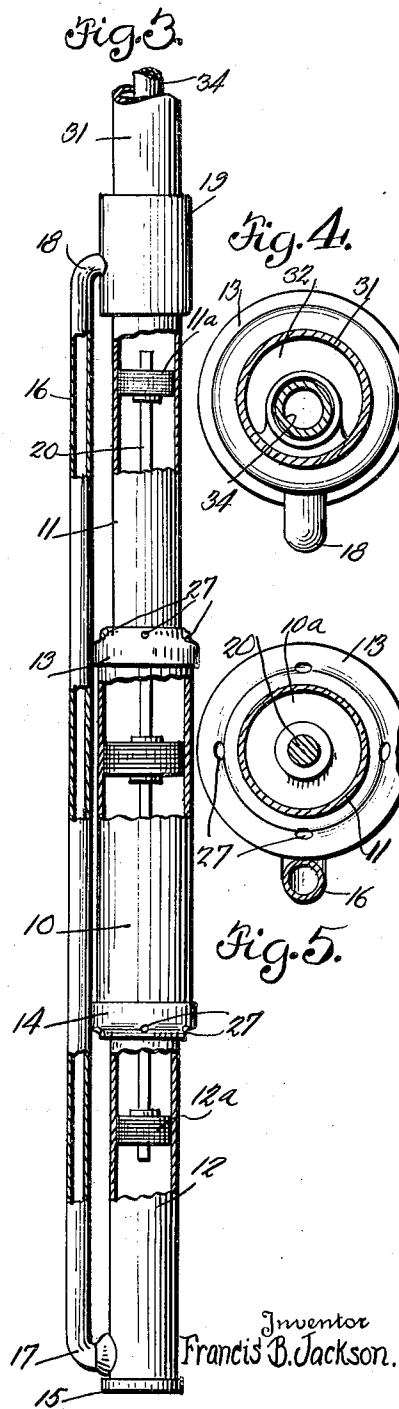
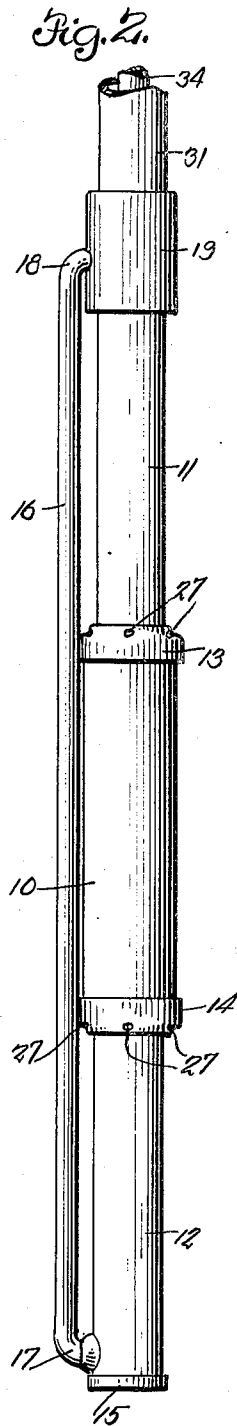
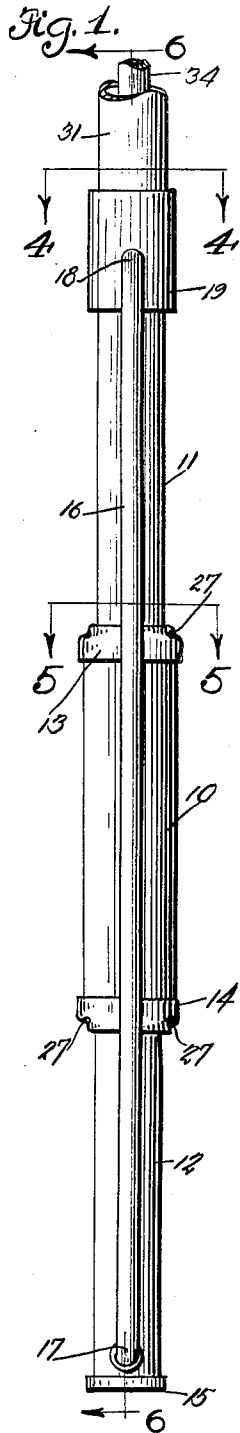
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WELL PUMPING APPARATUS

Filed Jan. 28, 1932

2 Sheets-Sheet 1



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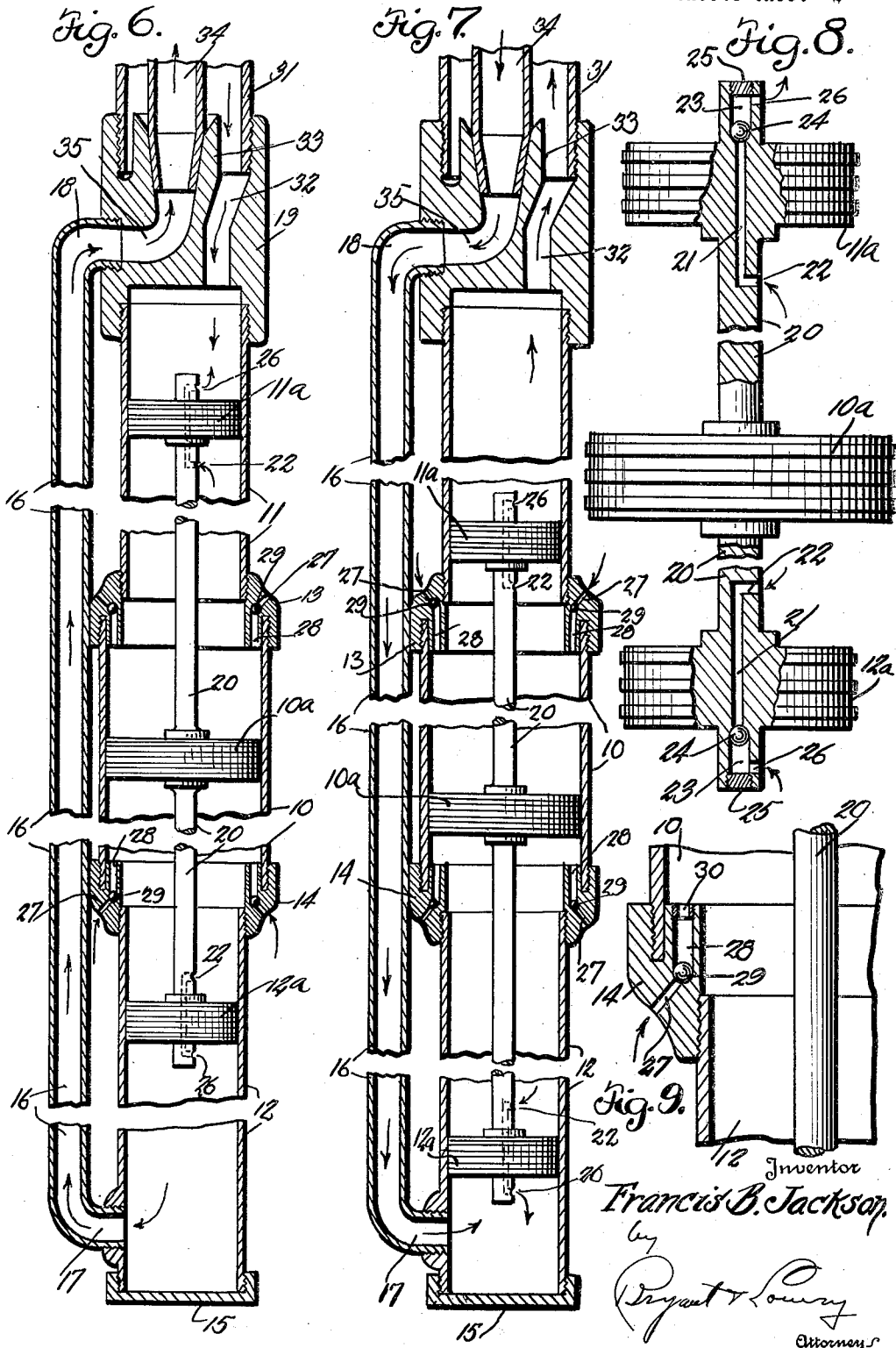
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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WELL PUMPING APPARATUS

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This invention relates to certain new and useful improvements in well pumping apparatus.

The primary object of the invention is to provide well pumping apparatus especially designed for use in deep wells for the pumping of fluid of any character, the apparatus operating in the absence of the usual pump or sucker rod that extends from the surface of the ground to the bottom of the well, the present pump structure being of the reciprocating type and operating for the pumping of fluid in each direction of movement as contrasted with the usual reciprocating pump that operates in one direction of movement only.

With the above and other objects in view that will become apparent as the nature of the invention is better understood, the same consists in the novel form, combination and arrangement of parts hereinafter more fully described, shown in the accompanying drawings and claimed.

In the drawings:—

Figure 1 is a side elevational view of the pump casing;

Figure 2 is another side elevational view of the pump casing and illustrating the by-pass flow pipe in communication with one end of the cylinder;

Figure 3 is a side elevational view, partly in section illustrating the three connected pistons, the intermediate and end portions of the pump cylinders;

Figure 4 is a cross-sectional view taken on line 4—4 of Figure 1;

Figure 5 is a cross-sectional view taken on line 5—5 of Figure 1;

Figure 6 is a longitudinal sectional view taken on line 6—6 of Figure 1, showing the intermediate section of the pump cylinder of greater diameter than the section end sections, the connected pistons with a piston working in each cylinder section with the movement of fluid indicated by arrow lines when the pistons move downwardly;

Figure 7 is a longitudinal sectional view similar to Figure 6 with the pistons in position to be moved upwardly with the reverse

direction of flow of the pumped fluid indicated arrow lines;

Figure 8 is a fragmentary side elevational view partly in section of the piston assembly showing the check valve associated with each outer end piston; and

Figure 9 is a fragmentary detail sectional view showing the coupling rings between one end of the intermediate and end sections of the pump cylinder with a check valve set therein.

Referring more in detail to the accompanying drawings, the well pumping apparatus comprises a pump cylinder formed of three sections, the intermediate section 10 being of increased diameter relative to the upper and lower end sections 11 and 12 that are of the same diameter, the three sections of the pump cylinder being connected together by connector rings 13 and 14 arranged respectively at the upper and lower ends of the intermediate cylinder section 10. The ring connection between the ends of the cylinder sections is accomplished in the absence of the usual packing rings or gaskets and is designed to eliminate leakage at these points. The lower end of the cylinder section 12 is closed as at 15 and a by-pass flow pipe 16 that has a lower angle end connection 17 with a filter section 12 adjacent its lower end extends parallel to and adjacent the pump with the upper end thereof having an angle end connection 18 with a block or head 19 mounted upon the upper end of the cylinder section 11.

A piston 10a works in the intermediate cylinder section 10 and pistons 11a and 12a respectively work in the cylinder sections 11 and 12, the three pistons being relatively immovable and rigidly carried by a piston rod 20. As shown in Figure 8, each end of the piston rod has a longitudinal axial passage 21 therein extending through the associated pistons 11a and 12a, the inner end of each passage 21 having a lateral port 22 communicating with the interior of the pump cylinder at adjacent sides of the larger intermediate piston 10a, the outer end of the passage 21 outwardly of its respective piston being enlarged as at 23 and containing an inwardly

closing check valve 24 confined therein by the end plug 25, the enlarged chamber 23 having a side port 26 communicating with its associated cylinder section outwardly of the respective piston.

Each of the connecting rings 13 and 14 between the ends of the intermediate pump cylinder section 10 and the end cylinder sections 11 and 12 is provided with a circumferential series of ports 27 communicating with enlarged pockets 28 formed in the rings inwardly of the pump cylinder, a check valve 29 being arranged in each pocket 28 and confined therein by apertured screw plugs 30 as shown in Figure 9, the check valves 29 associated with the lower ring 14 closing in a downward direction while the check valves associated with the upper ring 13 close in an upward direction.

The pump cylinder head 19 carries an annular internally threaded flange in its upper end into which the lower end of the tubular casing 31 is threaded and said head is of hollow form providing a passage 32 forming communication between the upper end of the upper cylinder section 11 and the tubular casing 31. An internal boss 33 is arranged within the head 19 and has a tapered socket to receive the lower tapered end of the pipe 34, the lower end of the pipe communicating with the by-pass flow pipe 16 by way of the angle passage or port 35 formed in the boss 33.

The pump structure is especially designed for use in deep or shallow wells and operates in the absence of the usual sucker rod devices, the pumping operation being continuous as the pumping of fluid is accomplished in both directions of reciprocating movements of the piston assembly. By increasing the diameter of the intermediate cylinder section 10 relative to the end cylinder sections 11, the pumping capacity is increased. The motive power for the operation of the pump may be compressed air, fluid or natural gas under its own pressure, the latter having been found to be highly practical and efficient in the operation of the pump mechanism. The fluid to be pumped in the tubular casing 1 and pipe 34 seeks its level in these parts so that hydrostatic pressure therein and pressure on the pistons 11a and 12a are equal.

Assuming the piston assembly to be in the position in Figure 6 with relation to the cylinder sections, pressure is introduced to the upper end of the tubular casing 31 in the ground line, pressure upon the piston 11a moving the piston assembly downwardly to force the fluid in the lower end of the pump cylinder section 12 outwardly thereof and upwardly through the by-pass flow pipe 16, through the port 35 in the head 19 and outwardly through the pipe 34. During descending movement of the piston assembly, the piston 10a in the larger intermediate cyl-

inder section 10 closes the check valves 29 upon their seats in the lower connecting ring 14 and opens the check valves associated with the upper connecting ring for sucking in fluid from the well into the cylinder section 10. Also, during downward movement of the piston assembly the fluid in the cylinder between the two pistons 10a and 12a is forced through the passage 21 in the lower end of the piston rod 20 by way of the check valve 24 into the lower end of the cylinder 12 and outwardly thereof as previously described. Pressure upon the upper piston 11a closes the check valve 24 associated therewith so that the entire body of pressure is exerted upon the piston 11a. During upward movement of the piston assembly, the reverse operation takes effect as illustrated by the arrow lines in Figure 7, the check valves associated with the connector ring 13 being closed while the check valves associated with the lower connecting ring 14 are open permitting entry of fluid to be pumped into the cylinder. The fluid received into the cylinder during the downward stroke of the piston is forced upwardly through the passage 21 in the upper end of the piston rod 20, outwardly thereof into the cylinder above the piston 11a to be moved upwardly through the tubular casing 31 through using fluid pumped to operate the pump. As the piston structure produces a pumping action in both directions of reciprocative movements, a column of pumped fluid stands in the tubular casing 31 and pipe 34, connected at their lower ends by the pump cylinder which forms a U-structure and with the fluid columns balanced in the casing and pipe. Fluid always remains in the casing, pipe and pump cylinder and fluid in the well drawn into the cylinder alternately moves the fluid columns upwardly. The reciprocal movements of the pistons, first raises the fluid in one column and then in the other column, such action resulting in continuous pumping of the fluid.

While there is herein shown and described the preferred embodiment of the invention, it is nevertheless to be understood that minor changes may be made therein without departing from the spirit and scope of the invention as claimed.

I claim:—

1. In well pumping apparatus, a cylinder, three spaced connected pistons reciprocating therein, valve controlled inlets to the cylinder at opposite ends and outwardly of the extreme movements of the intermediate piston and valved passages through the end pistons, a head at the upper end of the cylinder, a pump casing and pipe attached to the head, the casing being in communication with the upper end of the cylinder and a by-pass flow pipe forming communication between the pump pipe and lower end of the cylinder.

2. In well pumping apparatus, a cylinder, three spaced connected pistons reciprocating therein, valve controlled inlets to the cylinder at opposite ends and outwardly of the extreme movements of the intermediate piston and valved passages through the end pistons, a head at the upper end of the cylinder, a pump casing and pipe attached to the head, the casing being in communication with the upper end of the cylinder and a by-pass flow pipe forming communication between the pump pipe and lower end of the cylinder, said cylinder being formed of three sections with the intermediate section of larger diameter than the end sections to increase the capacity of the pump.

3. In well pumping apparatus, a cylinder, three spaced connected pistons reciprocating therein, valve controlled inlets to the cylinder at opposite ends and outwardly of the extreme movements of the intermediate piston and valved passages through the end pistons, said cylinder being formed of three sections with the intermediate section of larger diameter than the end sections to increase the capacity of the pump, a ring connecting the outer ends of the intermediate section to the inner ends of the end sections and said valve controlled inlets comprising check valves carried by the rings and closing in movements towards the ends of the intermediate section and a pair of fluid pressure columns respectively communicating with the opposite ends of the cylinder.

4. In well pumping apparatus, a cylinder, three spaced connected pistons reciprocating therein, valve controlled inlets to the cylinder at opposite ends and outwardly of the extreme movements of the intermediate piston and valved passages through the end pistons, a head at the upper end of the cylinder, a pump casing and pipe attached to the head, the casing being in communication with the upper end of the cylinder and a by-pass flow pipe forming communication between the pump pipe and lower end of the cylinder, said cylinder being formed of three sections with the intermediate section of larger diameter than the end sections to increase the capacity of the pump, a ring connecting the outer ends of the intermediate section to the inner ends of the end sections and said valve controlled inlets comprising check valves carried by the rings and closing in movements towards the ends of the intermediate section.

5. In well pumping apparatus, a cylinder, three spaced connected pistons reciprocating therein, valve controlled inlets to the cylinder at opposite ends and outwardly of the extreme movements of the intermediate piston and valved passages through the end pistons, said cylinder being formed of three sections with the intermediate section of larger diameter than the end sections to in-

crease the capacity of the pump, the three pistons including a piston rod, the pistons rigid therewith and the valved passages through the end pistons consisting of a longitudinal axial bore in the piston rod at each end and having an inner lateral port end communicating with the cylinder outwardly of the intermediate piston and an inwardly closing check valve in the outer end of the bore and a pair of fluid pressure columns respectively communicating with the opposite ends of the cylinder.

6. In well pumping apparatus, a cylinder, three spaced connected pistons reciprocating therein, valve controlled inlets to the cylinder at opposite ends and outwardly of the extreme movements of the intermediate piston and valved passages through the end pistons, a head at the upper end of the cylinder, a pump casing and pipe attached to the head, the casing being in communication with the upper end of the cylinder and a by-pass flow pipe forming communication between the pump pipe and lower end of the cylinder, said cylinder being formed of three sections with the intermediate section of larger diameter than the end sections to increase the capacity of the pump, the three pistons including a piston rod, the pistons rigid therewith and the valved passages through the end pistons consisting of a longitudinal axial bore in the piston rod at each end and having an inner lateral port end communicating with the cylinder outwardly of the intermediate piston and an inwardly closing check valve in the outer end of the bore.

7. In well pumping apparatus, a cylinder, three spaced connected pistons reciprocating therein, valve controlled inlets to the cylinder at opposite ends and outwardly of the extreme movements of the intermediate piston and valved passages through the end pistons, said cylinder being formed of three sections with the intermediate section of larger diameter than the end sections to increase the capacity of the pump, a ring connecting the outer ends of the intermediate section to the inner ends of the end sections and said valve controlled inlets comprising check valves carried by the rings and closing in movements towards the ends of the intermediate section, the three pistons including a piston rod, the pistons rigid therewith and the valved passages through the end pistons consisting of a longitudinal axial bore in the piston rod at each end and having an inner lateral port end communicating with the cylinder outwardly of the intermediate piston and an inwardly closing check valve in the outer end of the bore and a pair of fluid pressure columns respectively communicating with the opposite ends of the cylinder.

8. In well pumping apparatus, a cylinder, three spaced connected pistons reciprocating

- therein, valve controlled inlets to the cylinder at opposite ends and outwardly of the extreme movements of the intermediate piston and valved passages through the end pistons, a head at the upper end of the cylinder, a pump casing and pipe attached to the head, the casing being in communication with the upper end of the cylinder and a by-pass flow pipe forming communication between the pump pipe and lower end of the cylinder, said cylinder being formed of three sections with the intermediate section of larger diameter than the end sections to increase the capacity of the pump, a ring connecting the outer ends of the intermediate section to the inner ends of the end sections and said valve controlled inlets comprising check valves carried by the rings and closing in movements towards the ends of the intermediate section, the three pistons including a piston rod, the pistons rigid therewith and the valved passages through the end pistons consisting of a longitudinal axial bore in the piston rod at each end and having an inner lateral port end communicating with the cylinder outwardly of the intermediate piston and an inwardly closing check valve in the outer end of the bore.
9. In well pumping apparatus, a pump cylinder having connected pistons reciprocating therein, a pump casing and inclosed pipe respectively communicating with opposite ends of the cylinder, and the intermediate portion of the cylinder and extreme pistons having valved controlled ports therein whereby pressure alternately introduced to the casing and pipe will effect pumping operation of the pistons in both directions of reciprocating movements, the connection between the casing, pipe and cylinder including a head on the cylinder for the support of the casing and pipe and having a passage therein between the casing and upper end of the cylinder and a by-pass flow pipe forming communication between the aforesaid pipe and lower end of the cylinder.
10. In deep or shallow well pumping apparatus, a pump cylinder, three spaced connected reciprocating pistons therein, hydrostatic tubes in communication with opposite ends of the cylinder, valve controlled inlets to the cylinder outwardly of the extreme movements of the intermediate piston and valved controlled passages through the two end pistons whereby fluid pressure alternately through the hydrostatic tubes will effect reciprocation of the pistons and pumping action thereby in both directions of reciprocating movements.
11. In deep or shallow well pumping apparatus, a pump cylinder, three spaced connected reciprocating pistons therein, hydrostatic tubes in communication with opposite ends of the cylinder, valve controlled inlets to the cylinder outwardly of the extreme movements of the intermediate piston and valved controlled passages through the two end pistons whereby fluid pressure alternately through the hydrostatic tubes will effect reciprocation of the pistons and pumping action thereby in both directions of reciprocating movements, and said cylinder having an enlarged intermediate section to increase capacity of the pump.
- In testimony whereof I affix my signature.
- FRANCIS B. JACKSON.

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