Feb. 28, 1939. H. A. THOMPSON 2,148,516

DEEP WELL PUMP

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FIG. 1.

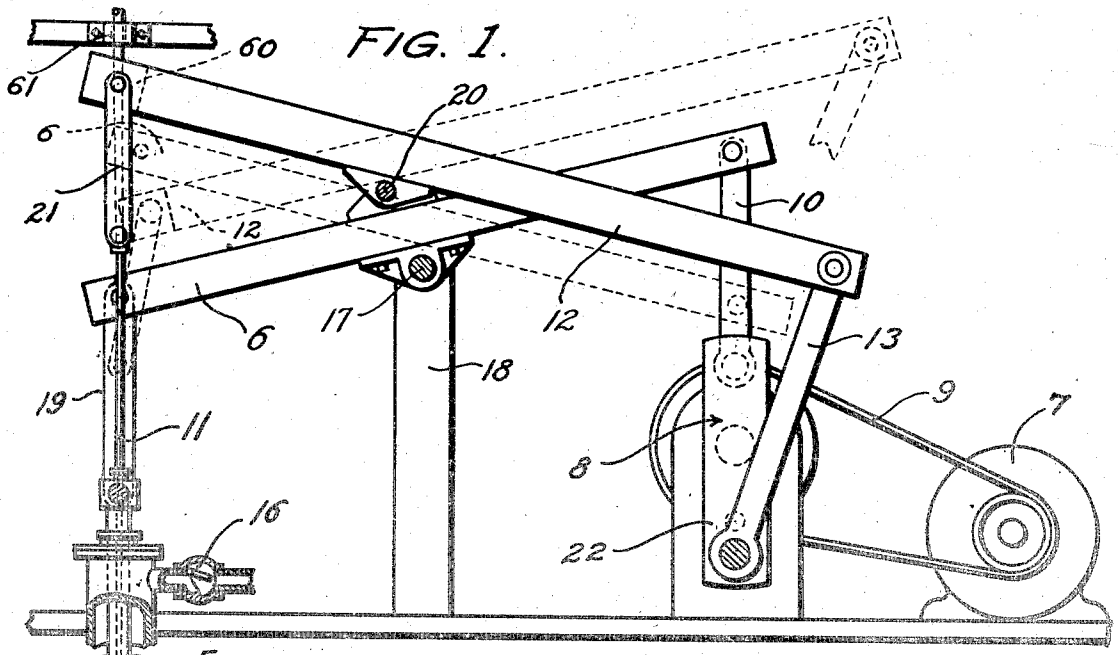

FIG. 2.

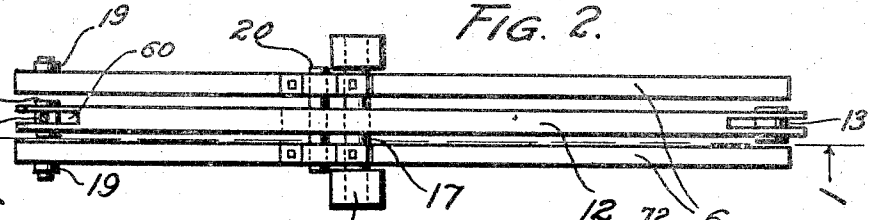

FIG. 3.

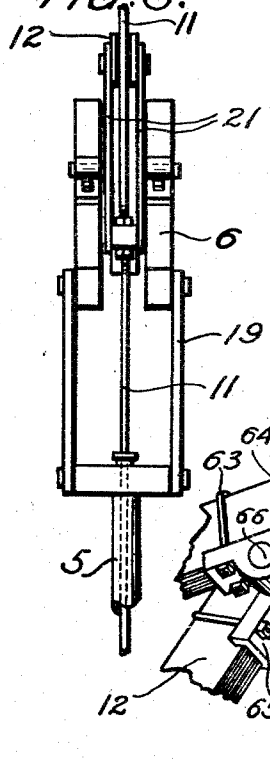

FIG. 13.

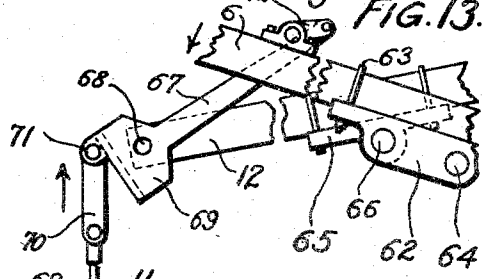

FIG. 12.

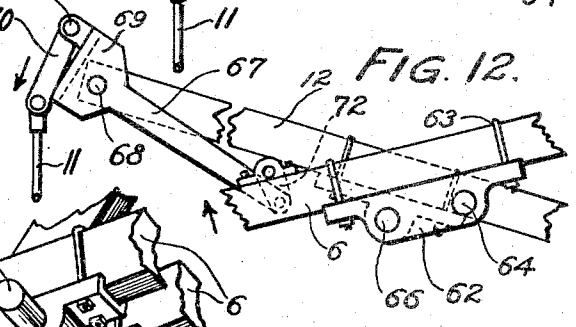

FIG. 11.

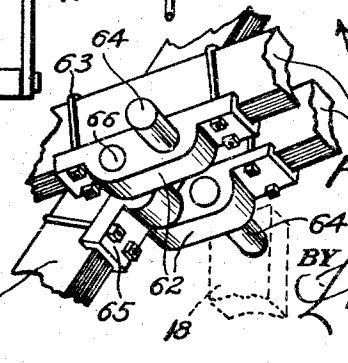

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FIG. 4.

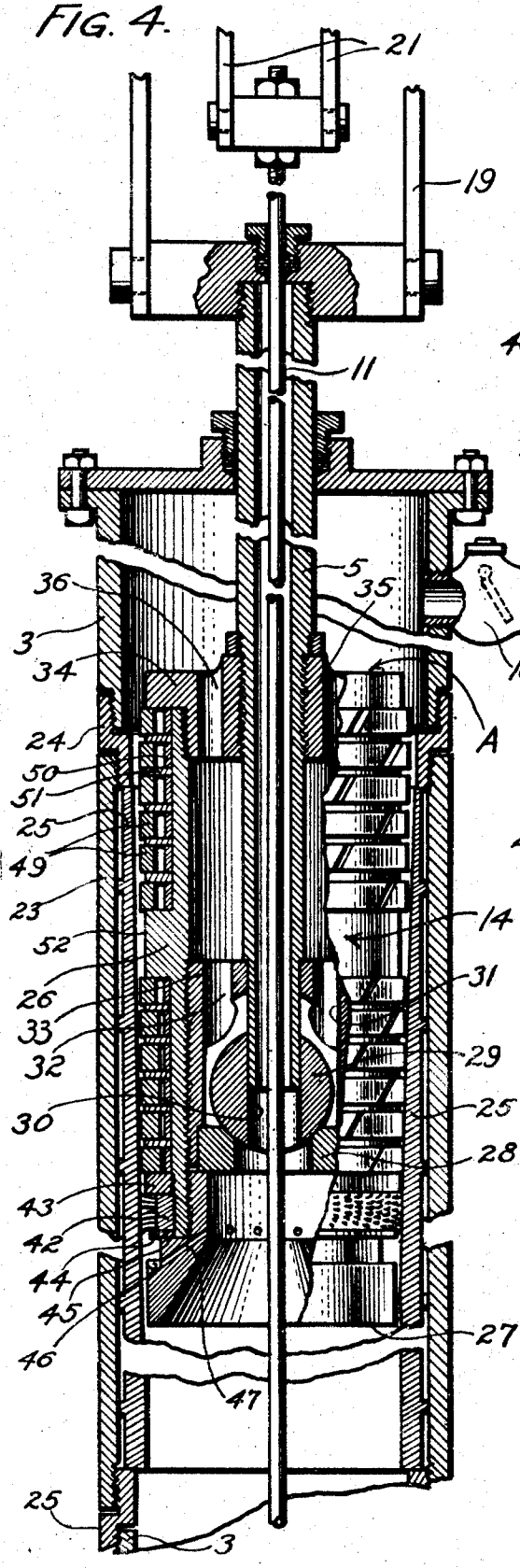
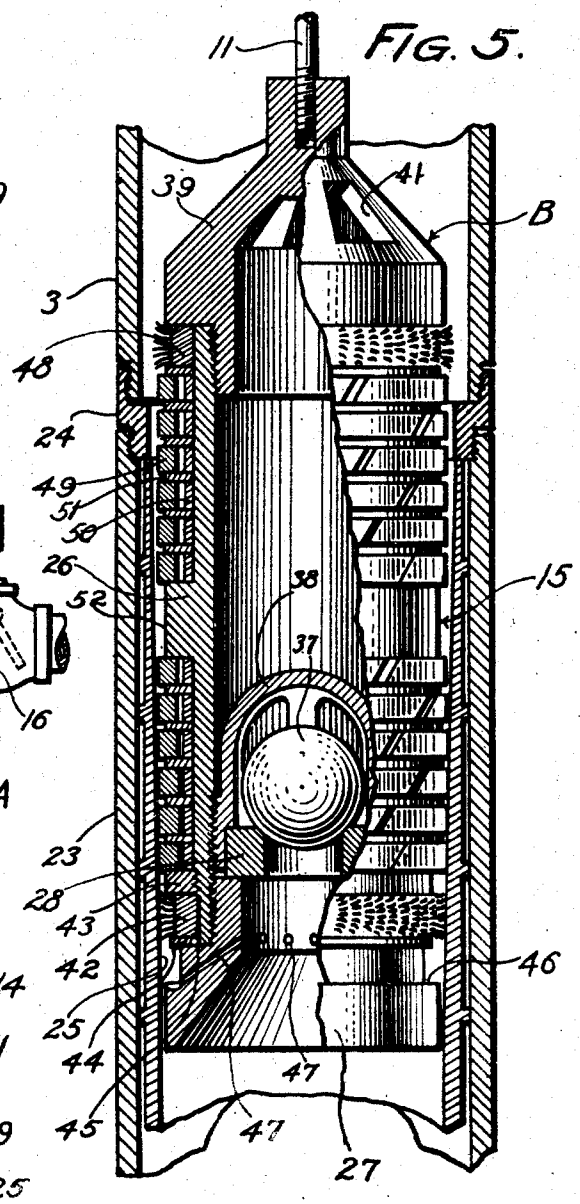


FIG. 5.



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DEEP WELL PUMP

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FIG. 6.

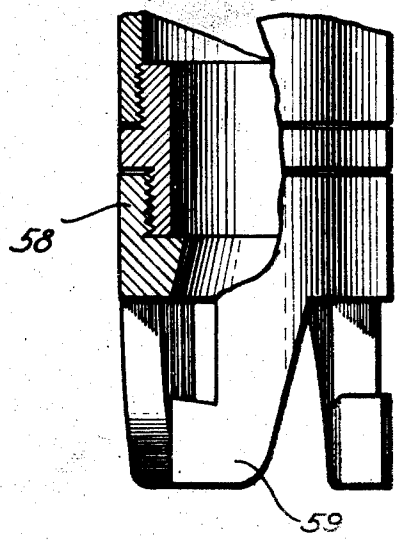


FIG. 8.

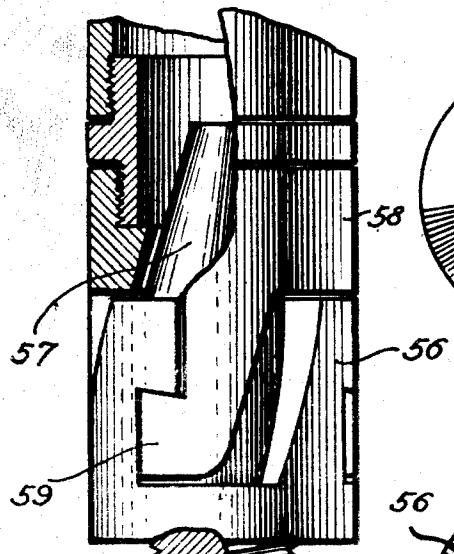


FIG. 9.

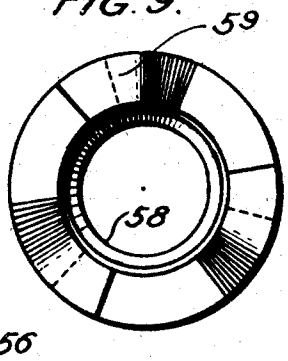


FIG. 10.

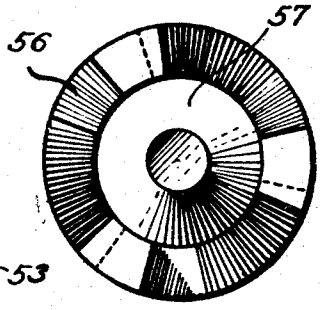
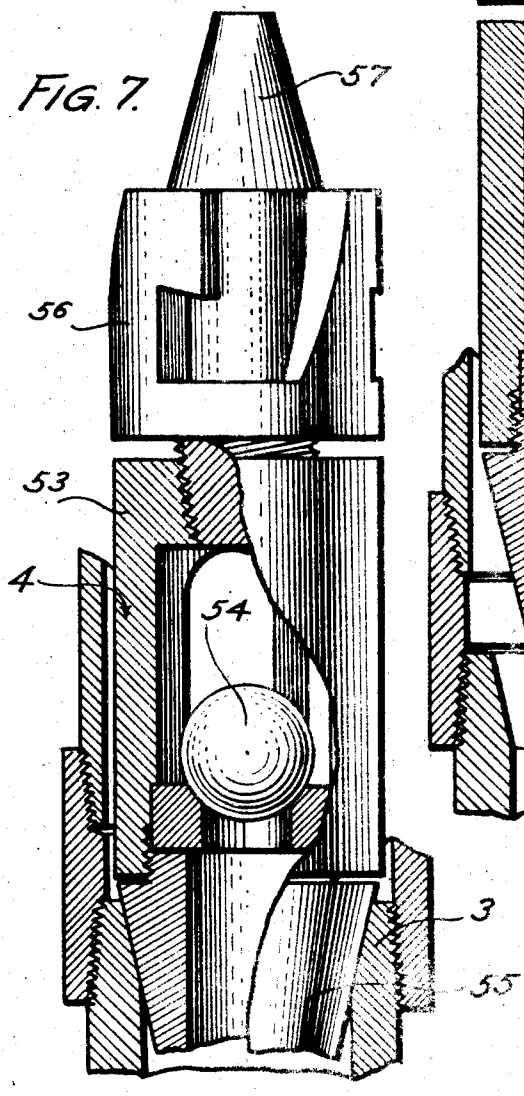
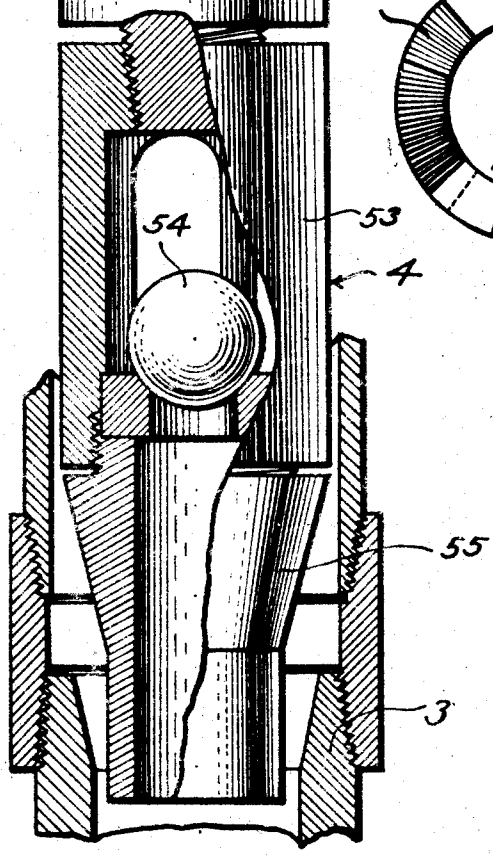


FIG. 7.





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Patented Feb. 28, 1939 2,148,516

UNITED STATES PATENT OFFICE

2,148,516

DEEP WELL PUMP

Henry A. Thompson, Los Angeles, Calif., assignor of one-half to Corbett H. McGee, Los Angeles, Calif.

Application January 4, 1937, Serial No. 118,938

4 Claims. (Cl. 103—200)

This invention relates to and has for an object the provision of a deep well pump which constitutes improvements in the art and will be superior to deep well pumps as heretofore used, in point of a larger pumping capacity, reliability of performance, more even torque and consequent elimination of counterbalancing means, accessibility of parts for repair and renewal thereof, effective elimination of sand, and longer life due to dividing the pumping operation between separate pumping means located adjacent to the top and bottom of the well respectively.

Another object of the invention is to provide a deep well pump of the character described, wherein the efficiency thereof is greatly increased by reason of the provision of a pump unit within and adjacent to the top of the well, and a similar pump unit at the bottom of the well, and separable operating means which simultaneously operate said pump units, said pump units being also adapted for independent operation.

A further object of this invention is to provide a deep well pump of the character described, having a novel and efficient pump plunger or piston construction and arrangement, including a pump barrel liner having a tapered bore for expanding and contracting rings in said plungers, whereby to insure an effective sealing action of said rings.

I have shown in the accompanying drawings a preferred form of apparatus embodying my said improvements, subject to modification within the scope of the appended claims without departing from the spirit of my invention.

Referring to the drawings:

Fig. 1 is a fragmentary sectional view of the pump of this invention as when installed in a well, the sectioned portions of the walking beam structure being taken on the plane of line 1—1 of Fig. 2.

Fig. 2 is a top plan view of the walking beam operating means for the pump.

Fig. 3 is a front elevation of the means shown in Fig. 2.

Fig. 4 is an enlarged fragmentary sectional view of the upper pump unit.

Fig. 5 is an enlarged fragmentary vertical section of the lower pump unit.

Fig. 6 is a side elevation partly in section of a fishing tool for removing the foot valve of the pump.

Fig. 7 is an enlarged view, partly in elevation and in section of the foot valve of the pump.

Fig. 8 is an enlarged side elevation partly in section of the foot valve and fishing tool as when hooked up.

Fig. 9 is a bottom plan view of the fishing tool, and

Fig. 10 is a top plan view of the foot valve unit.

Fig. 11 is a fragmentary perspective view of another means for fulcruming the walking beams, Fig. 12 is a fragmentary side elevation of said fulcrum means and a straight line motion means, and Fig. 13 is a view similar to Fig. 12 with the parts in a different position.

One form of the deep well pumping apparatus of this invention, as shown in the accompanying drawings, generally comprises a well tubing 3 having a removable foot valve 4 and containing adjacent to the upper and lower extremities of the well an upper pump unit A and a lower pump unit B. The upper unit will be located, for example, about thirty feet from the top of the well and is operated by a tubular sucker rod 5, actuated by a walking beam 6. A motor 7 or other prime mover, actuates a crank shaft 8 through a belt drive means 9, and said crank shaft is connected with the walking beam 6 by a connecting rod 10.

The lower pump unit 4 is located at the bottom of the well, and is actuated by a sucker rod 11 which is slidable freely in the tubular sucker rod 5 and connected with a walking beam 12. This beam 12 is connected with the crank shaft 8 by means of the connecting rod 13. With this arrangement, the pump units will be simultaneously operated so that when the plunger or piston 14 of the upper pump A is making its upward or pumping stroke, the piston or plunger 15 of the lower pump unit B will be making its return or down stroke, and vice versa. During this operation the oil or other fluid in the well will be caused to flow through the valved outlet 16 at the top of the well.

It will now be seen that the lifting and pumping load is divided between the pump units A and B, whereby to increase the flow from the well. Furthermore, the two pump units actuated by the walking beams as hereinbefore noted, provide for a smoother pumping operation with comparatively short plunger strokes, and with less torque, whereby counterbalancing means is unnecessary and a small, inexpensive and economically operated prime mover may be used.

As here shown, the walking beam 6 for the upper pump unit A is fulcrumed at 17 on a stand 18, and is connected with the tubular sucker rod 5 by means of a yoke link 19. The other walking beam 12 is fulcrumed at 20 on the upper side of the beam 6, and is connected with the sucker rod 11 by means of the links 21. To provide for an increased leverage of the beam 12, since it has the heavier working load, the crank throw 22

of the shaft 8 is made longer than the throw connected with the beam 6, and the fulcrum 20 is located forwardly of the fulcrum 17.

The pump units A and B are nearly identical as to construction and each comprises a barrel 23 joined to the tubing by the offset couplings 24 which define shoulders that engage the ends of a tubular liner 25. This liner has a tapered bore in which the pump piston (14 or 15) has a working fit. The pistons 14 and 15 of the units A and B are substantially identical and each comprises a tubular body 26 having an internally threaded lower end in which a tubular intake member 27 is screwed. Seated against the inner end of this member is an annular valve seat 28. The piston 14 has a ball check valve 29 having a central opening 30 whereby the valve is slidably supported on the tubular sucker rod 5 and movable into and out of engagement with the seat 28. A bushing 31 is screwed into the bore of the piston body 26, and engages and holds the seat in place as shown in Fig. 4. This bushing has a spider 32 supporting a collar 33, through which the lower end of the rod 5 is extended. It is thus seen that the sucker rod 11 extends freely through the valve opening 30 without interfering with the operation of the valve or the piston 14. A flanged nut or cap 34 is screwed into the bore of the body 26 of piston 14 and has a threaded connection 35 with the tubular sucker rod whereby to screw the piston to said rod. This nut or cap 34 is provided with openings 36 to permit the passage of the oil through the piston 14.

The piston 15 of the pump unit B has a ball check valve 37 of the usual type, held in place by the cage 38 and operating against the seat 28. A cap 39 is screwed into the upper end of the body 26 of the piston 15 and has a threaded connection 40 with the sucker rod 11, whereby to secure said piston to said rod. The cap 39 has openings 41 to permit passage of oil through the piston 15.

A feature common to the pistons of both pump units is an annular sand brush 42 surrounding the lower end of the piston body 26, and held in place between a nut 43 and flat split ring 44 which latter rests on a shoulder 45. This brush could be formed as a split and resilient piston ring to insure an effective sweeping action on the liner 25. Sand will collect in the annular pocket 46 below the brush and will be induced through the passages 47 by the flow of oil through the piston whereby the sand will be carried off with the stream of oil pumped out of the well. The piston 15 for the pump unit B is provided with a sand brush 48 at its upper end, arranged to prevent the entry of sand between the liner 25 and said piston. As here shown the pistons of both pump units have a plurality of split piston rings 49, seated in especially formed "grooves". These "grooves" are formed by setting flat and split spring rings 50 and 51 vertically and horizontally around the piston body 25, between the shoulders formed by the central flange 52 and the cap 34 and nut 43. The piston rings 49 are seated between the horizontal rings 51, which latter are spaced by the vertical rings 50. By this arrangement the rings 49 are seated in tensioned "grooves" and therefore are caused to be "free", yet under tension throughout the contact surfaces thereof, whereby to more closely engage the bore of the liner 25. As the bore of the liner 25 is tapered, it is seen that the rings are expanded and contracted during the strokes of the piston and are prevented from "freezing" or sticking in the grooves. It is now seen that the pistons 14 and 15 are constructed so that wear on the parts will be minimized and replacement thereof when necessary may be readily effected.

The foot valve 4 is formed with a tubular body 53, having a ball check valve 54 therein, and a conical lower end 55 which is frictionally seated in the well tubing as shown in Fig. 7. At its upper end the body 53 is formed to receive a bayonet coupling member 56, threadedly connected therewith, and said member is formed with a conical centering projection 57 on its upper end. A fishing tool 58 having hook like projections 59 is provided to facilitate removal of the foot valve, the hook like projections 59 adapted to be interlocked with the member 56 upon appropriate turning of the tool.

In the operation of the pump, the crank shaft, when operated by the prime mover, will alternately rock the walking beams 6 and 12, whereby, for example, to raise the piston 15 of the lower pump unit B while the piston 14 of the upper pump unit A is moved downward on its return stroke, and vice versa. In this way the pumps A and B are alternately operated to raise the oil and cause the flow thereof out of the well and the pumping load is divided between said pumps whereby to increase the life of the pumping apparatus and increase the flow from the well, with a smooth torque and without employing counterbalancing devices. This arrangement also permits of the use of a small amount of power and provides for a more economical pumping of a well, due to the counterbalancing effect of the two pumping units and the smooth, even operation thereof, from a single prime mover. The upper unit A will relieve the load on the lower unit B, and vice versa, in being alternately operated to pump, while the pistons of both units are simultaneously moved in opposite directions.

Any suitable means may be employed to effect a straight line motion of the sucker rod 11, and as here shown, may comprise the upward extension of the sucker rod through a slot 60 in the beam 12, together with a fixed guide 61 on some stationary part of the rig and through which said sucker rod is freely slidable.

Instead of arranging the beams 6 and 12 as shown in Figs. 1, 2 and 3, I may arrange them as shown in Figs. 11, 12 and 13, wherein the beams 6 are supported on castings 62 and affixed thereto by U bolts 63, and said castings are provided with pintles 64, which are journaled in the stands 18. On the beam 12, which is located between the beams 6, is a similar casting 65, having pintles 66 journaled in the casting 62, as particularly shown in Fig. 11, it being noted that the fulcrum of the beam 12, though located forwardly of the pintles 64, is co-planar with the latter when the beams are in horizontal position. The forward location of the fulcrum of the beam 12 provides for greater leverage and otherwise accomplishes the advantages ascribed to the beam 12 of the arrangement of Figs. 1, 2 and 3, but in an improved manner, due to the castings and the location of the two fulcrums in the same plane instead of one above the other. As a means for effecting a straight line motion with this fulcrum means, I provided a U shaped lever 67 which is pivoted as at 68 on the beam 12, and has a head 69 at one end, to which links 70 are pivoted, as at 71. These links are connected with the sucker rod 11, and the other ends of the lever are pivoted to

shackles 72 on the beams 6. With this arrangement the beams 6 operate to rock said lever so that the angle of the head 69 is changed while the beam 12 is rocked, whereby the sucker rod 11 will travel in a straight line at all times.

I claim:

1. A deep well pump comprising independent pump units adapted to be positioned adjacent to the upper and lower extremities of a well, independent sucker rods for operating said pump units and means for simultaneously raising and lowering said rods for effecting the pumping stroke of one pump unit while the other is making its return stroke and vice versa, said means including walking beams, a crank shaft having offset throws connected with and for operating said beams, and a prime mover for operating said crank shaft, one of said walking beams having its fulcrum point located on and out of alinement with the fulcrum point of the other beam.

2. A deep well pump comprising independent pump units adapted to be positioned adjacent to the upper and lower extremities of a well, independent sucker rods for operating said pump units and means for simultaneously raising and lowering said rods for effecting the pumping stroke of one pump unit while the other is making its return stroke and vice versa, said means including walking beams, a crank shaft having offset throws connected with and for operating said beams, and a prime mover for operating said crank shaft, one of said walking beams having its fulcrum point located on and out of alignment with the fulcrum point of the other beam, and said crank shaft having one throw longer than the other.

3. A deep well pump comprising independent pump units adapted to be positioned within a well, independent sucker rods for operating said units and means for simultaneously raising and lowering said rods and effecting the pumping stroke of one pump while the other pump is making its return stroke, and vice versa, including a stand, a walking beam, a casting on said beam, having pintles mounted on said stand, another walking beam fulcrumed on said casting at a point forwardly of said pintles, and means for rocking said beams.

4. A deep well pump comprising independent pump units adapted to be positioned within a well, independent sucker rods for operating said units and means for simultaneously raising and lowering said rods and effecting the pumping stroke of one pump while the other pump is making its return stroke, and vice versa, including a stand, a walking beam, a casting on said beam, having pintles mounted on said stand, another walking beam fulcrumed on said casting at a point forwardly of said pintles, a lever pivoted on the last named walking beam and having a head at one end thereof, rings connecting said head with the sucker rod of one pump unit, means for pivotally connecting the other end of said lever with the first named walking beam and means for rocking said beams.

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