

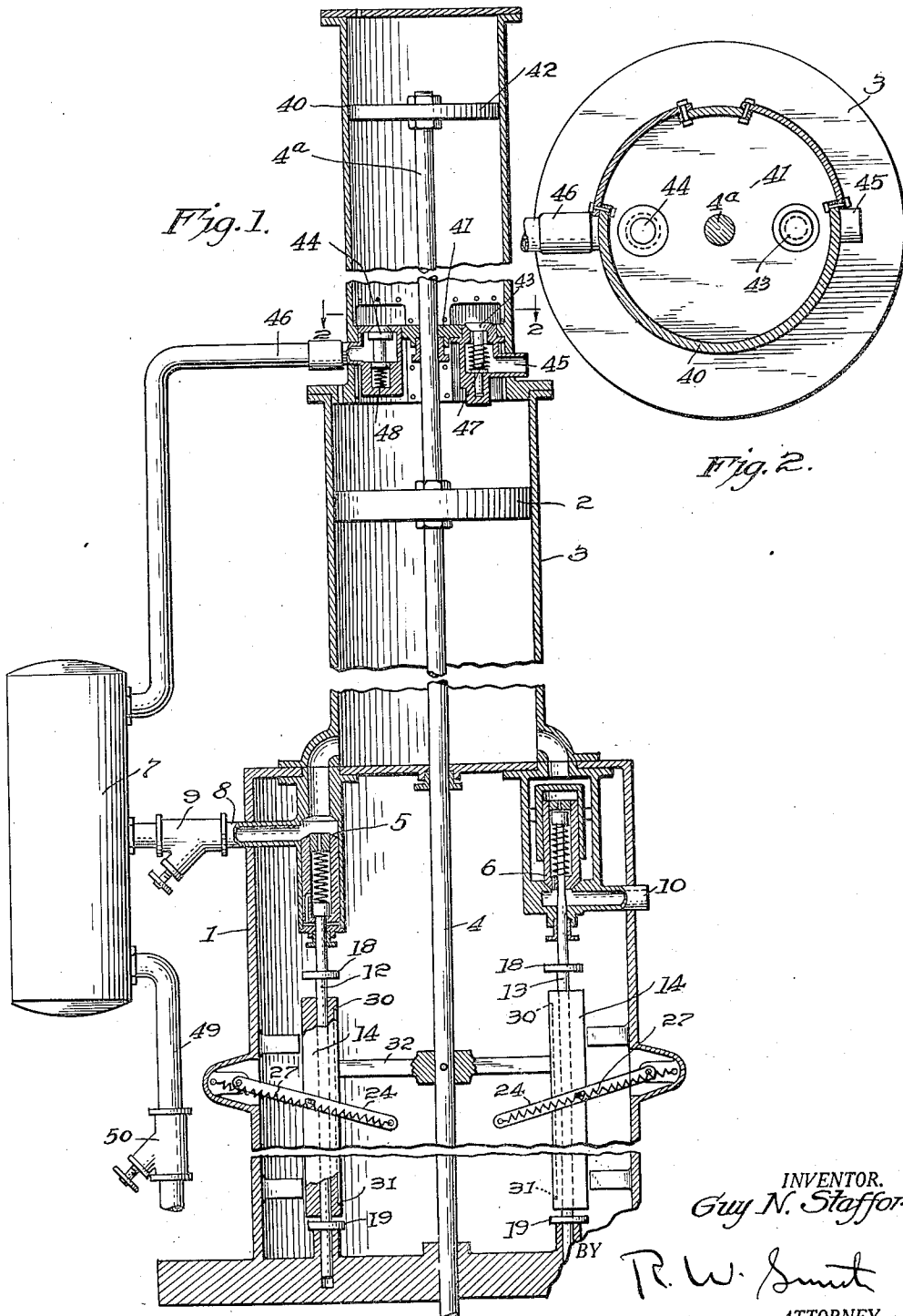
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PUMP OPERATING MECHANISM

Filed Nov. 10, 1930



UNITED STATES PATENT OFFICE

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PUMP OPERATING MECHANISM

Application filed November 10, 1930. Serial No. 494,597.

This invention is an operating mechanism for a reciprocating member such as a deep well pump, and is an improvement upon the invention disclosed in my copending application Ser. No. 488,835, filed Oct. 15, 1930.

My aforementioned copending application discloses means for reciprocating pump rods or the like by a piston which is adapted for fluid pressure reciprocation in a cylinder; and the present invention provides for counter-balancing reciprocation of the pump rods and regulating the down-stroke, by compressing a fluid which may then be utilized to provide a part of the fluid pressure for elevating the pump rods.

More particularly it is the object of the invention to operate the pump rods by a piston reciprocating in a work cylinder and adapted for elevation by fluid pressure and subsequent depression by the weight of the pump rods, with a second piston reciprocated by the first piston and adapted to draw fluid into a compression cylinder on the up-stroke and compress the fluid on the subsequent down-stroke, so that the compressed fluid tends to balance the weight of the pump rods for controlling the down-stroke, and may provide a part of the fluid pressure directed against the operating piston on the subsequent working stroke.

Further objects of the invention will be readily understood from the following description of the accompanying drawings, in which:

Fig. 1 is an axial section through the device.

Fig. 2 is a transverse section on the line 2—2 of Fig. 1.

The present invention is particularly applicable to a device such as is disclosed in my aforementioned copending application, comprising a guide frame 1 which may be mounted over the mouth of a deep well, with a piston 2 adapted for reciprocation in a cylinder 3 which is mounted on frame 1, and a depend-

ing piston rod 4 axially alining with and connected to the sucker rods (not shown) of a usual pump which is mounted in the well.

The piston is reciprocated by fluid pressure, preferably compressed air, and for this purpose intake and exhaust valves 5 and 6 communicate with the lower end of cylinder 3, preferably at diametrically opposite points, with a pipe 8 for the fluid pressure leading from a supply reservoir 7 to intake valve 5 and provided with a suitable throttle 9, and the exhaust valve 6 preferably discharging to the atmosphere through a pipe 10.

The valves 5 and 6 are preferably automatically opened and closed, for elevating piston 2 in its cylinder 3 by the fluid pressure and then exhausting the fluid pressure from the cylinder so that the weight of the string of sucker rods lowers the piston; and for this purpose the reciprocating movement of piston rod 4 may control the valves, which are preferably adapted for quick opening and closing movement when actuated by the reciprocating piston rod.

As an instance of this arrangement the valves 5 and 6 may have depending valve stems 12 and 13 parallel to and at opposite sides of piston rod 4, with valve 5 adapted to close and valve 6 adapted to open by upward movement of their respective valve stems, and said valves 5 and 6 adapted to respectively close and open by downward movement of their valve stems; and the valve stems may be elevated and depressed at the respective ends of the stroke of piston 2, by abutments 14 which are slidable in frame 1 and which when elevated or depressed are adapted to engage upper collars 18 or lower collars 19 of the valve stems. The abutments 14 may be elevated or depressed by springs 27, which are connected to levers 24 so that the springs are shifted to operative position at one side or the other beyond dead center when a cross-arm 32 of piston rod 4, by engaging either upper

shoulders 30 or lower shoulders 31 of abutments 14, initiates vertical movement of the abutments so as to swing the levers 24 in one direction or the other.

As the piston 2 approaches the upper end of its cylinder the intake valve 5 is thus closed and exhaust valve 6 is opened, so that upward travel of the piston is arrested and it starts its return stroke due to the weight of the suspended sucker rods; and in similar manner as the piston approaches the lower end of its cylinder the intake valve 5 is opened and the exhaust valve 6 is closed, so that fluid pressure is again gradually built-up in cylinder 3 for first slowly starting and then accelerating the upward travel of the piston.

In order to conserve energy and control the descent of piston 2, the present invention provides for compression of fluid on the down-stroke of the piston, with the fluid which is thus compressed preferably collected in reservoir 7 so as to form a part of the fluid pressure for elevating the piston on its subsequent working stroke.

For this purpose a cylinder 40 may be mounted on cylinder 3 and may be separated therefrom by a partition wall 41, and a piston 42 which is mounted on an extension 4a of the piston rod 4 is adapted for reciprocation in cylinder 40.

Inlet and discharge valves 43 and 44 communicate with cylinder 40, preferably through the wall 41, and the inlet valve 43 is connected to a supply pipe 45 and the discharge valve 44 is connected to a discharge pipe 46. The valves 43-44 are normally spring seated, and valve 43 is adapted to open responsive to suction in cylinder 40 on the up-stroke of piston 42, so that air is drawn into the cylinder through the pipe 45 which preferably opens to the atmosphere, and on the down stroke of the piston the air is compressed in cylinder 40 so as to open the valve 44 for discharge through pipe 46.

The springs for normally closing valves 43 and 44 are shown at 47 and 48, and the spring 48 for the discharge valve 44 may offer such resistance to opening movement of the discharge valve that the compression of fluid in cylinder 40 appreciably retards the downward travel of piston rod 4-4a; and the discharge pipe 46 preferably communicates with reservoir 7 for supplying the compressed fluid thereto, with the discharge valve 44 forming a check valve for preventing return of the compressed fluid to cylinder 40, and the parts being so arranged that the pressure in pipe 46 is greater than that which it is necessary to maintain in the reservoir 7, which is supplied with compressed fluid through a pipe line 49, leading from any suitable source of supply (not shown) and regulated by a suitable valve 50.

As an instance of this arrangement the cross-sectional area of cylinder 40 may be appreciably less than that of cylinder 3, so that the pressure in pipe 46 resulting from the downward movement of piston 42 responsive to the weight of the suspended sucker rods, is greater than the pressure which need be supplied to cylinder 3 for elevating the sucker rods; and the pressure supplied to reservoir 7 through pipe 49 is less than that which is required for elevating piston 2 and is therefore also less than the pressure in pipe 46, so that the pressure from pipe 46 may freely enter the reservoir where it is utilized to build-up the pressure from the source of supply to that which is required for elevating the piston 2 in its cylinder.

It will thus be seen that compression of fluid in cylinder 40 tends to retard the down-stroke of the mechanism so as to control the speed of reciprocation of the sucker rods, and also provides a part of the necessary pressure for elevating piston 2 on its working stroke. The reciprocating sucker rods are thus counterbalanced and the speed of reciprocation is controlled; and the mechanism may be operated with great economy in the pressure which it is necessary to utilize from the source of supply.

I claim:

1. In combination, a vertically suspended operating element adapted for downward movement by its own weight, fluid pressure actuated means for elevating the operating element, means for compressing fluid by the downward movement of the operating element, and means for utilizing the compressed fluid as a part of the pressure for elevating the operating element.

2. In combination, a vertically suspended operating element adapted for downward movement by its own weight, fluid pressure actuated means for elevating the operating element, a fluid pressure reservoir for the elevating means, means for compressing fluid by downward movement of the operating element, and means for supplying the compressed fluid to the reservoir.

3. In combination, a vertically suspended operating element adapted for downward movement by its own weight, fluid pressure actuated means for elevating the operating element, a fluid pressure reservoir for the elevating means, means operated by downward movement of the operating element for compressing fluid to a pressure greater than that required to actuate the elevating means, and means for supplying said compressed fluid to the reservoir for building-up the pressure therein to that which is required for actuating the elevating means.

4. In combination, a vertically suspended operating element adapted for downward movement by its own weight, fluid pressure

actuated means for elevating the operating
element, a reservoir, means for supplying
compressed fluid to the reservoir at a pres-
sure less than that which is needed to actuate
5 the elevating means, means operated by
downward movement of the operating ele-
ment for compressing fluid to a pressure
greater than that required to actuate the ele-
vating means, and means for supplying said
10 compressed fluid to the reservoir for build-
ing-up the pressure therein to that which is
required for actuating the elevating means.

In testimony whereof I have affixed my
signature.

15 GUY N. STAFFORD.

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