

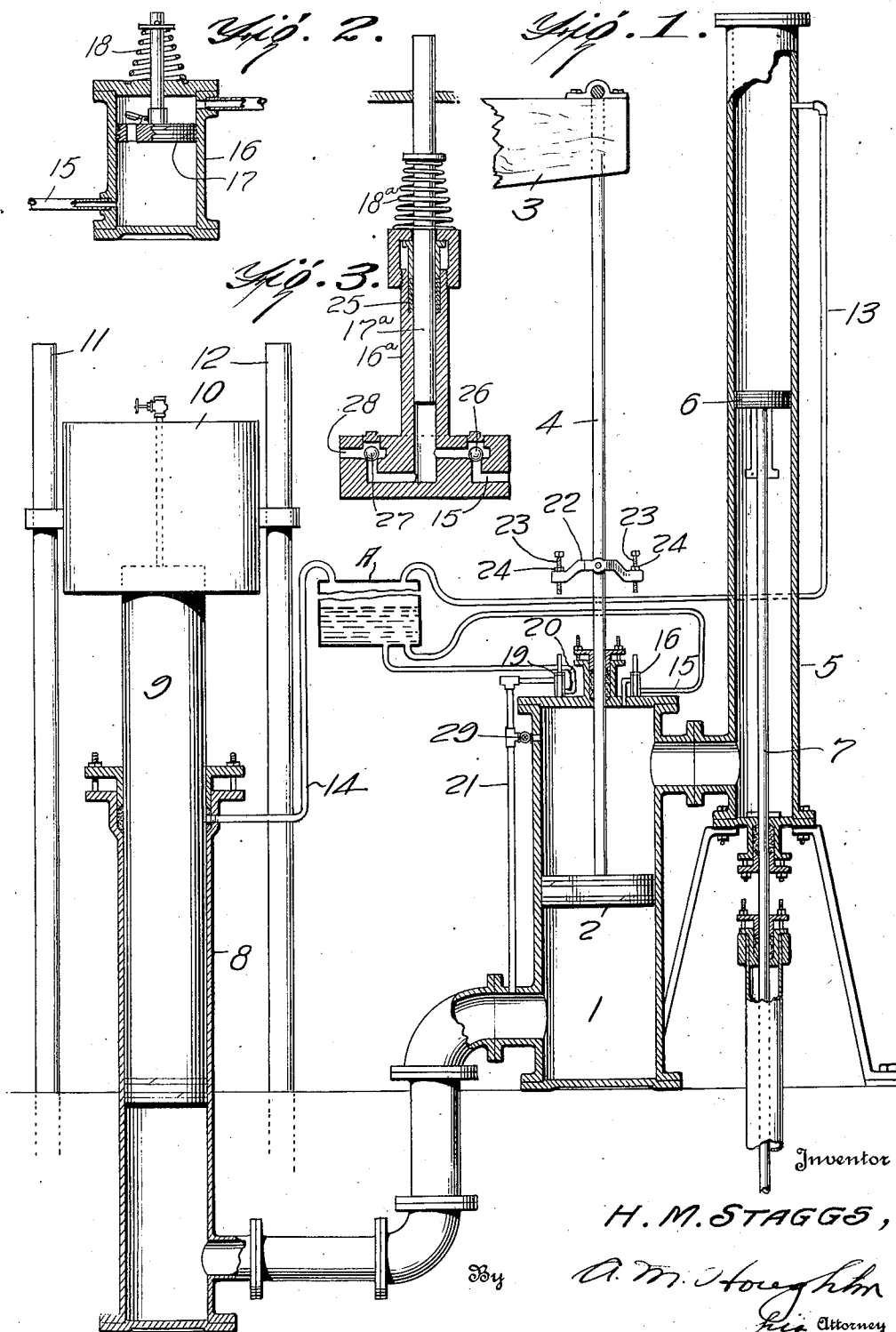
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HYDRAULIC LONG STROKE PUMP MECHANISM

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HYDRAULIC LONG-STROKE PUMP MECHANISM.

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This invention relates to hydraulic long stroke pump mechanism, and it comprises a pumping mechanism for wells, balanced by the hydraulic action of a fluid contained therein so that loads and strains which are imposed upon the pump operating mechanism in use are minimized and balanced. More specifically, my invention consists of a series of three intercommunicating cylinders adapted to contain fluid, a piston in one of said cylinders actuated by movement of the pump operating mechanism, a piston in a second cylinder, of less diameter than the first, connected to a pump rod, and a weighted piston in the third cylinder adapted to force fluid therefrom into said first cylinder when its piston is actuated to force fluid into the second cylinder and thus operate the pump, together with auxiliary pumping means in communication with a source of supply for replenishing fluid which has leaked past the pistons in the respective cylinders by continuously pumping fluid, in small quantities, back to the cylinders from such source of supply, any excess of fluid in the cylinders being withdrawn back to the source of supply.

In long stroke pumping mechanism considerable strain and load is imposed upon the walking beam, pitman, and other working parts of a derrick or pump jack. It is an object of this invention to reduce such strains by a system which permits a balancing of the forces and loads due to the rods and fluid within the mechanism itself. A further object is to provide a pumping mechanism wherein the force due to the weight of the rods receding into the well is transferred directly through a series of hydraulic cylinders in a self-contained counterbalance without imposing the loads on the walking beam of the mechanism. A still further object is to provide pumping mechanism which operates in a state of hydraulic balance and which utilizes cylinders of unequal size for increasing the stroke ratio of the pump.

Other and further objects will be apparent from the following description and drawing, in which

Figure 1 is a view, partly in vertical section, of the pumping mechanism comprising my invention;

Figure 2 is a detail sectional view of one of the auxiliary pumps for maintaining a

sufficient volume of fluid in the hydraulic cylinders of the pump; and

Figure 3 is a detail sectional view of a different form of auxiliary pump.

Referring more particularly to the drawing:

A main operating cylinder 1 carries a piston 2 therein which is reciprocated by movement of a walking beam 3, through the medium of a piston rod 4. The cylinder 1 communicates, at its upper end, with a cylinder 5 of smaller diameter in which a piston 6 is reciprocable. A pump rod 7 is actuated by movement of the piston 6. The cylinder 1 communicates, at its lower end, with the lower end of a cylinder 8. A piston 9 reciprocates in this latter cylinder and has mounted on its upper end a weight 10, guided in its movements by parallel upright members 11 and 12. Piping 13 and 14 leads from the upper ends of cylinders 5 and 8, respectively, to a source of fluid A, preferably a tank. A pipe 15, also communicating with the source of supply, leads to an auxiliary pump 16, mounted upon the head of cylinder 1. The auxiliary pump (Figure 2) comprises a cylinder and a piston 17 reciprocable therein, but normally held in position to project its stem through the upper end of the cylinder wall where it is engaged by the means hereinafter described to effect a return supply of fluid from the source of supply to the cylinders. The piston 17 may be held by any suitable means, for example by a spring 18 which surrounds its stem exterior of the cylinder as shown in Figure 2, although I do not restrict myself to the use of the specific means shown in the practice of my invention. The modified form of auxiliary pump shown in Figure 3 comprises a base and an upwardly extending cylinder 16^a within which a piston 17^a reciprocates, being spring pressed by a coiled spring 18^a which bears upon the upper end of the cylinder 16^a at one end and at its other end upon a washer which encircles the stem of piston 17^a. Conduits 15 and 28 comprise the inlet and outlet of the pump, and in the respective conduits ball valves 26 and 27 are mounted so that upon upward movement of the piston 17^a under the influence of spring 18^a ball 27 will seat and ball 26 will be raised to permit fluid to be sucked into the pump cylinder, and upon downward movement of the piston ball 26 will seat and ball 27 will be lifted to

permit the flow of fluid through outlet 28 under pressure.

A second pump 19, similar to that described, is mounted on the head of cylinder 1 and serves to draw fluid from the source of supply through pipe 20, and to force it through pipe 21 into the lower part of cylinder 1, whereas auxiliary pump 16 forces fluid into the upper end of the cylinder shown in Figure 1. The pipe 21 may be provided with a branch connection leading to the upper part of cylinder 1 and controlled by a valve 29.

A member 22 is clamped upon the rod 4 and carries at its ends vertically adjustable screws 23 and lock nuts 24.

In operation, movement of the walking beam upward raises the piston 2, thus forcing the fluid above it into the cylinder of smaller diameter and moving the piston 6 and pump rod through a substantially longer distance. At the same time the counterweight piston 9 moves downwardly to force fluid from its cylinder into the main cylinder, and thus assists the action of the walking beam in raising the piston 2. Upon return stroke, downward movement of the walking beam moves the piston 2 so that the fluid beneath it is forced back into the counterweight cylinder thereby raising the piston 9 and counterweight to their initial positions and at the same time permitting the fluid in the pump rod cylinder 5 to flow back into the main cylinder 1, above the piston, to assist in the downstroke of the piston 2.

As the piston 2 reaches the lower end of its stroke the screws or fingers 23 engage the pistons of the auxiliary pumps, forcing them downwardly. Upon their return stroke additional fluid is drawn from the reserve supply and forced into the main cylinder at each end. When the system is filled to capacity with the fluid the pistons in the pump rod and counterweight cylinders will be raised to a point where the overflow pipes 13 and 14 will be uncovered. When this occurs, any excess of fluid in the system will flow through the overflow pipes back to the source of reserve supply. Thus, a continuous supply of hydraulic fluid is maintained in the system under constant circulation to compensate for any losses which might occur.

From the foregoing it will be apparent that I have provided a simple and effective system for pumping where a short stroke of the operating mechanism results in a relatively long stroke of the pump, and in which a state of hydraulic balance is preserved to absorb shocks and relieve the pumping mechanism of undue strains and loads. This balance, as will be readily apparent, may be effected initially by completely filling the system with liquid and balancing the weight of the pump gear plus the weight of liquid on the pump side of piston 2 with a counter-

weight of sufficient heaviness. The reserve system, of course, maintains that balance against leakage losses.

What I claim is:—

1. A deep well pump operating mechanism comprising a main cylinder having a piston reciprocable therein, means connected to the piston for actuating the same, fluid passages in communication with the main cylinder on opposite sides of the piston, auxiliary cylinders, each connected to one of said passages, a piston disposed in one of said auxiliary cylinders having a connection to a well rod, means for establishing in each of said auxiliary cylinders a quantity of fluid limited in extent by said main cylinder piston, and weighted means in the other auxiliary cylinder for maintaining the total energy value of the contents of said auxiliary cylinders constant, whereby, in operation of said first named and main cylinder, a condition of balance may be maintained.

2. A deep well pump operating mechanism comprising a main pumping cylinder, a piston disposed therein, a piston rod connected to said piston, means attached to the piston rod for reciprocating the piston, an auxiliary cylinder connected to said main pumping cylinder on one side of the piston, a piston in said auxiliary cylinder adapted to actuate a pump rod, a fixed quantity of fluid interposed between said named pistons and limited thereby, a second auxiliary cylinder connected to the main pumping cylinder on the opposite side of the piston of the main pumping cylinder, a piston therein adapted to reciprocate in accordance with the reciprocation of said main pumping cylinder piston, a fixed quantity of liquid between said last named pair of pistons, and weighted means for equalizing the energy gained by the movement of the fluid in one auxiliary cylinder to the energy lost by a similar movement in the other auxiliary cylinder.

3. A deep well pump operating system comprising three cylinders, (a), a main cylinder containing a reciprocable piston, (b), an auxiliary cylinder communicating with said main cylinder a on one side of the piston, a piston in said auxiliary cylinder b, a quantity of liquid interposed between said pistons, and means to maintain said quantity at a constant value, (c), an auxiliary cylinder communicating with said main cylinder a and on the other side of said first piston also provided with a piston, a quantity of liquid interposed between said last named pistons, a reserve supply of liquid for the system, pump means communicating with the system and reserve supply to maintain said quantity at a constant value.

4. In a hydraulic pump system, the combination of a main cylinder with two auxiliary cylinders, each in communication with said main cylinder adjacent one of its ends, a pis-

ton in said main cylinder, auxiliary pumps at-
tached to said main cylinder and actuated by
the piston of said main cylinder for forcing
fluid to said main cylinder at each side of the
5 said piston, a container for a reserve supply
of fluid communicating with said auxiliary
pumps for maintaining the system complete-
ly filled, and means communicating with the
said auxiliary cylinders and reserve supply
10 for permitting flow of excess fluid from the
system back to the reserve supply.

5. In a hydraulic pump system the com-
bination of a main cylinder and auxiliary
cylinders, each in communication with said

main cylinder adjacent one of its ends, a pis- 1.
ton in said main cylinder, a rod actuating
said piston, an auxiliary pump mounted on
said main cylinder, means on said rod for
periodically actuating said auxiliary pump,
piping connecting said pump with a source 20
of supply of fluid, and with said main cylin-
der, and piping communicating with said
auxiliary cylinders and with said source of
supply for conducting excess fluid from said
system back to said source of supply. 25

In testimony whereof, I have hereunto af-
fixed my signature.

HORACE M. STAGGS.