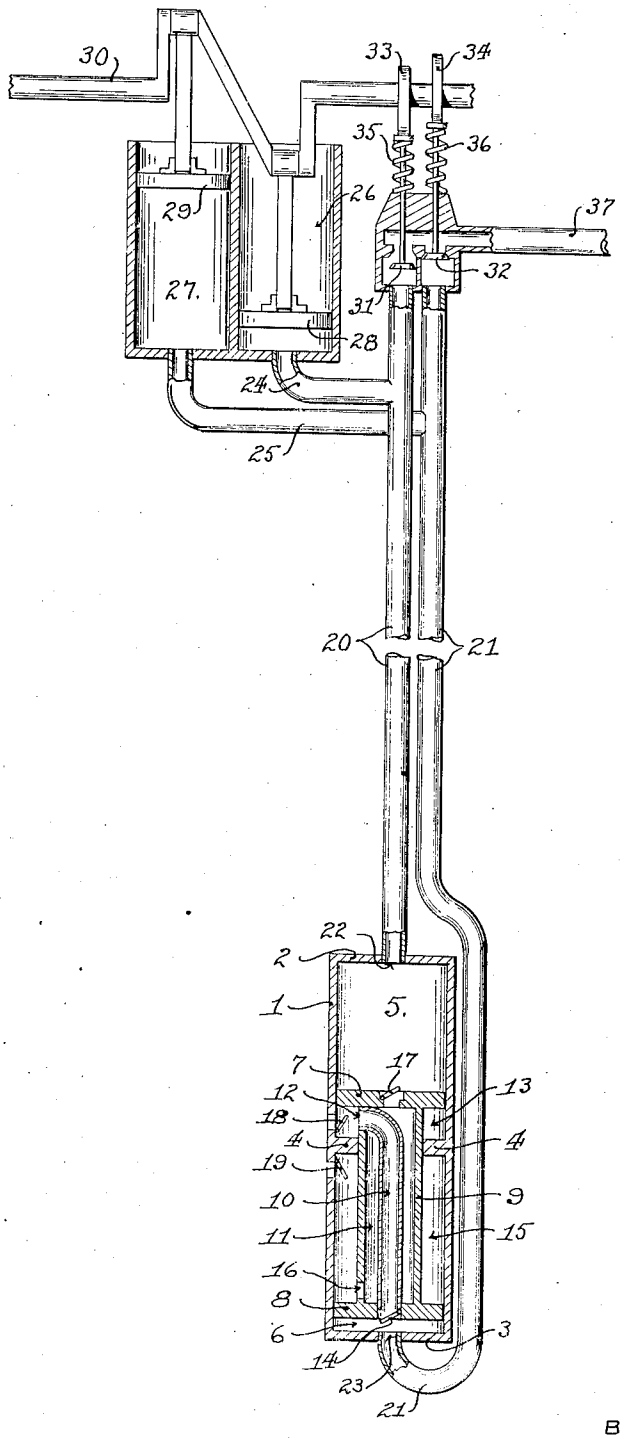
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W. G. COREY ET AL

RODLESS DEEP WELL PUMP

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RODLESS DEEP-WELL PUMP.

Application filed November 26, 1923. Serial No. 676,972.

To all whom it may concern:

Be it known that we, WILLIAM G. COREY, REMI C. KNIGHT, and LOUIS F. CHAMPION, citizens of the United States, residing, the said COREY, at Berkeley, in the county of Alameda and State of California, and the said KNIGHT and CHAMPION at Oakland, in said county and State, have invented certain new and useful Improvements in Rodless Deep-Well Pumps, of which the following is a specification.

Our invention relates to deep well pumps suitable for either water or oil wells.

The object of our invention is to do away with the sucker rods or other movable mechanical connection between the pump plunger in the well and the power mechanism at the surface of the ground, thereby eliminating the friction and wear and loss of stroke from stretch which results from the use of such mechanical connections. In deep wells, particularly, the friction of the sucker rods, and the necessity for frequent repair and replacement, add very materially to the cost of operating the well. The sucker rod also adds to the time and labor required to pull the pump for cleaning or repair.

We achieve this object, in our present invention, by transmitting the power from the surface of the ground to the pump at the bottom of the well by means of columns of fluid, the fluid being supplied from the well itself by the operation of the pump. Two columns of fluid are employed, forming in effect a closed circuit, in which the fluid is caused to oscillate by a succession of alternating impulses set up by suitable power means at the surface, and this oscillation of the fluid is employed to operate the pump at the bottom of the well. Moreover, in the preferred form of our invention hereinafter described we employ the same columns of fluid, both for transmitting power to the pump, and for conveying the pumped well fluid from the pump to the surface, so that only two conduits leading from the pump to the surface are necessary. These may take the form of two strings of tubing within the well, or, if desired, the well casing suitably packed off at the pump, may be employed in place of one tubing string.

It is our intention, in the following specification, to describe our invention in its simplest form, with the understanding that any suitable or desirable mechanical construction may be followed in carrying out the principles of the said invention as set forth in the claims hereto appended.

With this in view our invention will now be fully described with reference to the accompanying drawing, in which the figure represents, in partly diagrammatic form, a part-sectional elevation of a simple form of apparatus embodying the principles of our invention.

In the drawing, the reference numeral 1 designates the pump barrel, located at or near the bottom of the well. Said barrel has closed heads 2 and 3, and an intervening transverse partition or head 4 dividing it into upper and lower working cylinders 5 and 6 respectively. Pistons 7 and 8, operating respectively within the cylinders 5 and 6, are connected by a hollow stem 9 which passes through the intervening head 4, suitable packing, not shown, being provided at this point to prevent leakage past said head 4.

The connecting stem 9 is provided with two ducts 10 and 11, the duct 10 being shown, for purposes of illustration, as a pipe carried within said stem, and the duct 11 as the remaining portion of the interior of said stem. The duct 10 leads from a port 12 in the side of the stem 9 communicating with the lower portion 13 of the upper cylinder 5, to a check valve 14 in the lower piston 8 leading into the lower cylinder 6 below said piston 8. The duct 11 connects the upper portion 15 of said lower cylinder 6, by means of a port 16 in the stem 9, with the upper cylinder 5 above the upper piston 7, a check valve 17 being carried in said upper piston 7. Inlet valves 18 and 19 are provided respectively for the lower portion 13 of the upper cylinder 5 and the upper portion 15 of the lower cylinder 6, said valves being positioned in the side walls of said cylinders near the intervening head 4.

Conduits or pipes 20 and 21 lead from apertures 22 and 23 in the end heads 2 and 3 of the respective cylinders 5 and 6. Said pipes 20 and 21 are carried up through the well to the surface of the ground, and are connected by branches 24 and 25 with respective power pump cylinders 26 and 27. Pistons 28 and 29, operating in said power cylinders 26 and 27, are impelled by a crank shaft 30 which is understood to be driven by any suitable power means not shown in the drawing. The discharge pipes 20 and 21

are provided respectively with valves 31 and 32, opened by cams 33 and 34 mounted on the shaft 30, and closed by springs 35 and 36, both said valves communicating with a common discharge pipe 37.

The operation is as follows: Assuming that the entire system is filled with the well fluid, and that the surface pump or power piston 29 is moved downwardly by means of power applied to the shaft 30, the discharge valve 32 will be held closed by its spring 36 during this portion of the movement of said shaft 30, so that the fluid expelled from the power cylinder 27 passes through the pipes 25 and 21 into the lower working cylinder 6 of the pump barrel 1, forcing the pistons 8 and 7 and their connecting stem 9 upwardly, the lower check valve 14 being closed by the pressure of the fluid in said cylinder 6. The upward movement of the upper piston 7 forces fluid out of the upper working cylinder 5 and up through the pipe 20, and the branch 24 into the power cylinder 26, whose piston 28 is being moved upwardly by the crank shaft 30. At the same time, the fluid within the upper or pumping portion 15 of the lower working cylinder 6 is forced out, by the piston 8, through the port 16, and the connecting duct 11, into the upper working cylinder 5, and this additional fluid also passes up through the pipe 20. The discharge valve 31 being held open by its cam 33, this additional fluid passes out through said valve to the discharge pipe 37. During this stroke, also, fresh fluid is drawn from the well into the lower or pumping portion 13 of the upper working cylinder 5 through the check valve 18 by the upward movement of the piston 7.

During the other half of the revolution of the crank shaft 30, the valve 31 is held closed by its spring 35 and the valve 32 is held open by its cam 34. Fluid is therefore forced from the power cylinder 26 down through the pipes 24 and 20, into the upper working cylinder 5, thereby moving the pistons 7 and 8 downwardly, and forcing the fluid from the lower working cylinder 6 back through the pipes 21 and 25 into the power cylinder 27. Additional fluid is also forced from the lower or pumping portion 13 of the upper working cylinder 5 through the port 12 and the duct 10 into the lower working cylinder 6, and thence up through the pipe 21 and through the open discharge valve 32 into the discharge pipe 37. At the same time, fresh fluid is drawn from the well into the upper or pumping portion 15 of the lower working cylinder 6 through the inlet valve 19.

Thus it will be seen that the reciprocating movement of the working and pumping pistons 7 and 8 is caused solely by the alternating impulses of the columns of fluid within the pipes 20 and 21, said impulses being set up by the action of the pistons 28 and 29 in the power cylinders 26 and 27. At each stroke or impulse, however, an additional quantity of fluid is added to the upwardly moving fluid column from the pumping cylinder 13 or 15, as the case may be, and this additional fluid, which causes an increase in the velocity of the upwardly moving column, passes out through the open discharge valve 31 or 32 into the discharge pipe 37. The fluid issuing into said discharge pipe 37, therefore, is only equal to the displacement of the pistons 7 and 8 within their respective pumping cylinders 13 and 15, and the power necessary to raise this fluid to the surface is transmitted from the power cylinders 26 and 27 to the working cylinders 5 and 6 by the fluid columns in the pipes 20 and 21. By thus combining the pumped fluid with the power fluid in the upwardly moving column, any leakage of the power fluid is automatically compensated by an equivalent quantity of the pumped fluid. This method also simplifies the construction of the apparatus, and does away with the necessity for a separate pipe or conduit for the pumped fluid from the pump to the surface.

We claim:

1. A pumping apparatus comprising a barrel having a working cylinder and a pumping cylinder axially aligned therewith, said pumping cylinder having a fluid inlet; a piston operable in each cylinder; a connecting stem between said pistons, having a fluid passage from said pumping cylinder to said working cylinder; means for supplying fluid under fluctuating presssure to said working cylinder to reciprocate said pistons, the fluid pumped from said pumping cylinder flowing through said passage and being added to the working fluid; and means for separating from said working fluid an amount of fluid equal to the pumped fluid added thereto.

2. A pumping apparatus comprising a working barrel; a transverse partition therein dividing it into two cylinders; a piston operable in each cylinder, each piston having a working face and a pumping face; a connecting stem between said pistons, said stem having fluid passages connecting the pumping face of each piston with the working face of the other; means for admitting the fluid to be pumped to the pumping face of each piston; means for supplying fluid under pressure alternately to the working faces of said pistons to cause the reciprocation thereof, the pumped fluid flowing through said connecting passages and being added to the working fluid, and means for conducting the combined fluids away from said barrel.

3. A pumping apparatus comprising a working barrel; a transverse partition there-

in dividing it into two cylinders; a piston operable in each cylinder, each piston having a working face and a pumping face; a longitudinally divided hollow stem connecting said pistons and passing slidably through said partition, said stem having two fluid passages respectively connecting the working face of each piston with the pumping face of the other; oppositely disposed check valves respectively controlling said passages; means for supplying fluid under pressure alternately to the working faces of said pistons to cause the reciprocation thereof, the pumped fluid flowing through the passages of said stem and being added to the working fluid; and means for conducting the combined fluids away from said barrel.

4. A pumping apparatus comprising a barrel having a working cylinder and a pumping cylinder axially aligned therewith, said pumping cylinder having a fluid inlet; a piston operable in each cylinder; a connecting stem between said pistons having a fluid passage from said pumping cylinder to said working cylinder; means for supplying fluid under fluctuating pressure to said working cylinder to reciprocate said pistons, the fluid pumped from said pumping cylinder flowing through said passage and being added to the working fluid; and means for conducting the combined fluids away from said working cylinder.

In testimony whereof we have signed our names to this specification.

WILLIAM G. COREY.
REMI C. KNIGHT.
LOUIS F. CHAMPION.