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DEVICE FOR SINKING A DEEP OIL-WELL AND SIMULTANEOUSLY ELEVATING SANDS AND EARTHS

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Fig. 2.

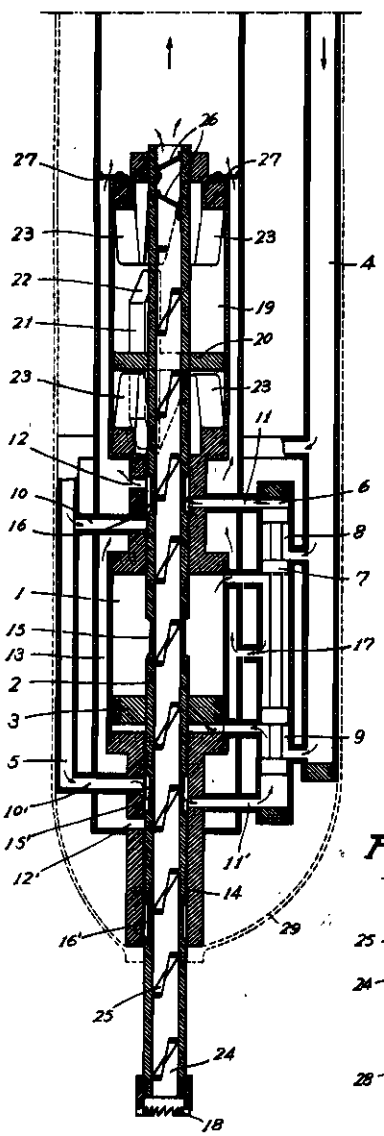


Fig. 1.

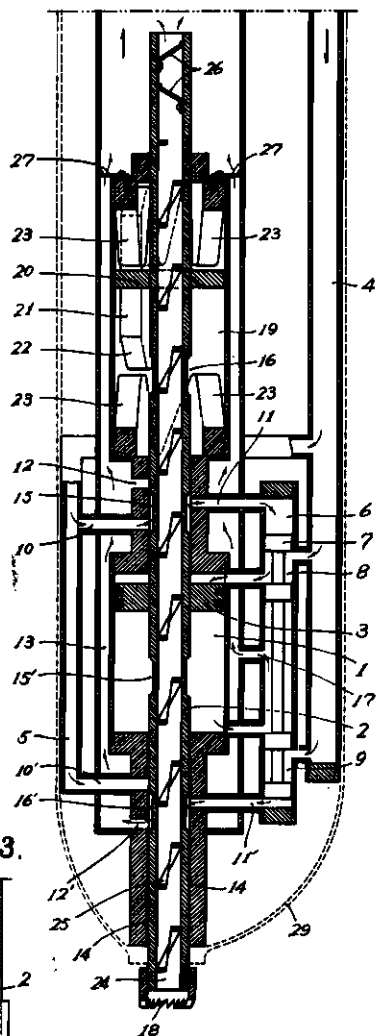
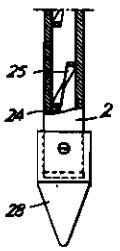


Fig. 3.



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DEVICE FOR SINKING A DEEP OIL-WELL AND SIMULTANEOUSLY ELEVATING SANDS AND EARTHS

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This invention relates to a device for sinking a deep oil-well and elevating sands and earths excavated from deeper stratum, and it comprises a pump cylinder, a piston in said cylinder, a tubular piston rod for said piston adapted for rotation in one direction as well as for reciprocation and having a drilling tool attached thereto and also provided with a spiral path in the hollow space therein for conveying sands and earths, and a system of pressure fluid for driving said piston rod and for conveying sands and earths discharged from said tubular piston rod.

The object of the invention is to provide a drilling device of simple construction and reliable operation and adapted for drilling in a deep stratum, not only in vertical direction, but also in any direction inclined to the vertical if desired, and for automatically discharging sands and earths excavated during the drilling operation, the sands and earths being elevated through the tubular piston rod.

In the accompanying drawings in which, one embodiment of the invention is shown by way of example:

Fig. 1 is a longitudinal section of the device constructed according to this invention.

Fig. 2 is a similar section with the piston displaced, and

Fig. 3 is a side elevation of a modified form of the drilling tool attached to the lower end of the piston rod.

Referring to the drawings, 1 designates a pump cylinder, within which is sildably and rotatably mounted a piston rod 2 having a piston 3 securely mounted thereto. 4 and 5 are pressure fluid supply pipes. Communicating with the supply pipe 4 is a valve box 6, in which is provided a slide valve 7 adapted to alternately connect said pipe 4 with the opposite sides of the piston 3 through ports 8 and 9 respectively. The pipe 5 is connected alternately with opposite sides of said slide valve 7 in the valve box 6 through passages 10, 11 and 16', 11' respectively. On the other hand, the opposite sides of the valve 7 are alternately connected to a discharge pipe 13 enclosing the pump cylinder 1 through the passages 11', 12' and 11, 12 respectively. Thus, when the upper side of the valve 7 communicates with the supply pipe 5, the lower side of the valve 7 communicates with the discharge pipe 13 as shown in Fig. 1, and vice versa as shown in Fig. 2. The piston rod 2 is provided with two pairs of reduced portions 15, 16 and 15', 16' where it is passed through sleeves 14 extending from the cylinder ends. Said passages 10, 11, 12 and 10', 11', 12' open into the sleeve 14. Upon sliding movement of the piston rod 2, communication of the passages 10 and 11 through the reduced portion 15 (Fig. 1) and communication of the passages 11 and 12 through the reduced portion 16 (Fig. 2) are alternately effected. When, on one hand, the reduced portion 15 in the piston rod 2 connects the passages 10 and 11 to force the pressure fluid into the valve box 6, the reduced portion 16' on the other hand connects the passages 11' and 12' to permit the pressure fluid from the other side of the valve box 6 to pass into the discharge pipe 13.

Assuming that the piston 3 is in the position shown in Fig. 1, in which the pipe 5 is in communication with the upper side of the valve 7 in the valve box 6 through the passages 10, 11 and the upper reduced portion 15 in the piston rod 2, when the pressure fluid is supplied through the pipes 4 and 5, said fluid acts upon the upper side of the valve 7 pressing down the same, whereby the pressure fluid in the lower side of the vlave 7 is forced into the discharge pipe 13 through the lower passages 11' and 12' which are connected through the lower reduced portion 15' in the piston rod 2. By the downward movement of said slide valve 7, the pipe 4 is connected through the port 8 with the cylinder space and the pressure fluid acts upon the upper side of the piston 3 depressing same, and the fluid in the lower space in the cylinder is forced through the port 17 into the discharge pipe 13. Thus the piston 3 with the piston rod 2 moves to the position shown in Fig. 2. In this position, the relation between the pipe 4 and the cylinder 1 and the relation between the pipe 5 and the valve box 6 and the discharge pipe 13 will be reversed, so that the piston 3 is lifted. In such manner, the piston rod 2 is reciprocated downwardly and upwardly.

The piston rod 2 is made hollow, and it carries a drilling tool detachably attached thereto, which is adapted to be driven to the bed by the shock of the reciprocating movement. A sleeve 19 is provided surrounding the upper portion of the piston rod 2, in which the rod 2 is provided with a fixed collar 20 which is provided on both faces with claws 21, each having inclined side faces 22 at its tip. Secured to the ends of the sleeve 19 are saw-toothed guide members 23. Said guide members 23 are adapted, when engaged by the inclined side faces 22 of said claws 21 upon reciprocation of the piston rod 2, to impart a rotary movement to the piston rod in one direction. In the hollow space 24 of the

piston rod 2, there is provided a spiral path 25 adapted to convey the sands and earths upwardly upon the reciprocating and rotary movement of the piston rod 2. In an upper part of the piston rod tube 24, there are provided check valves 26 for preventing the back flow of the sands and earths. The upper extremity of the piston rod tube 24 is open into the discharge pipe 13, so that sands and earths discharged from the tube 24 are conveyed upwardly by the returning pressure fluid flowing through the pipe 13. 27 are check valves provided in the upper portion of the discharge pipe 13, which are adapted to prevent sands and earths from falling into the lower part of the discharge pipe when the operation of the device is stopped.

For the purpose of convenience of allowing the device to fall freely, the entire device is preferably enclosed within a stream-line shaped shell as shown in dotted lines 29.

For the sake of convenience, the terms "upper" and "lower" or "upwardly" and "downwardly" have been used in accordance with the showing of the drawings, but it should be understood that in practice the device is adapted not only for drilling in vertical direction, but also for drilling in any direction inclined to the vertical by being inclined or placed horizontally.

From the foregoing, it will be seen that, according to this invention, upon supply of pressure fluid the tubular piston rod is reciprocated and, at the same time, is rotated in one direction, so that the drilling tool attached to the lower end of the piston rod is adapted to effect drilling action, and sands and earths excavated are automatically elevated through the spiral path in the tubular piston rod by the reciprocating and rotary movement of the latter. The pressure fluid employed for driving the drilling tool is returned through the space surrounding the pump cylinder, and serves to convey outwardly said sands and earths discharged from the tubular piston rod. Thus, the drilling and discharge of sands and earths are simultaneously effected by a single system of the pressure fluid. By the employment of the pressure fluid, the motive power can be transmitted to a remote point, so that the device is adapted for drilling in a deep oil-well. It is adapted not only for sinking a shaft, i. e. drilling vertically, but also for drilling transversely at a deeper stratum by conveniently giving an inclination to the device.

If desired, as shown in Fig. 3, a drilling tool 28 which entirely closes the end of the tubular piston rod 2 may be used instead of the open bit 18 in the previous example. In this case, of course, sands and earths are not automatically elevated through the tubular piston rod 2.

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