Dec. 24, 1935. S. A. ERWIN 2,025,277

DEEP WELL PUMP

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Fig. 1

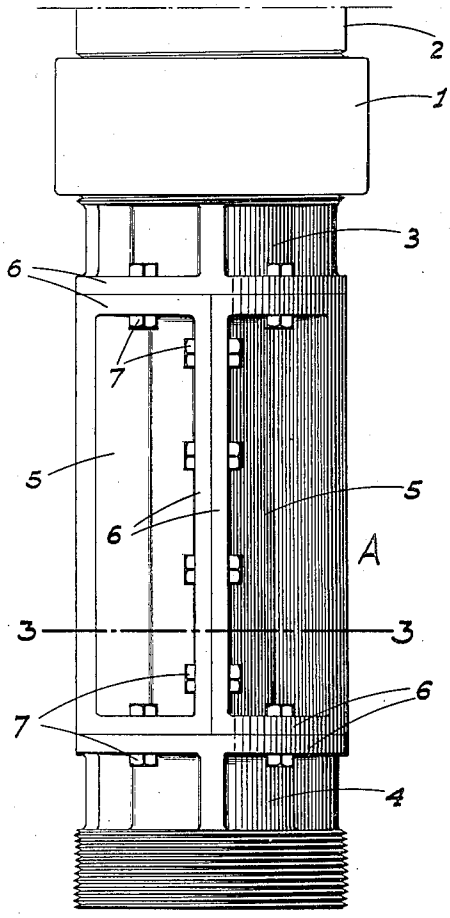


Fig. 2

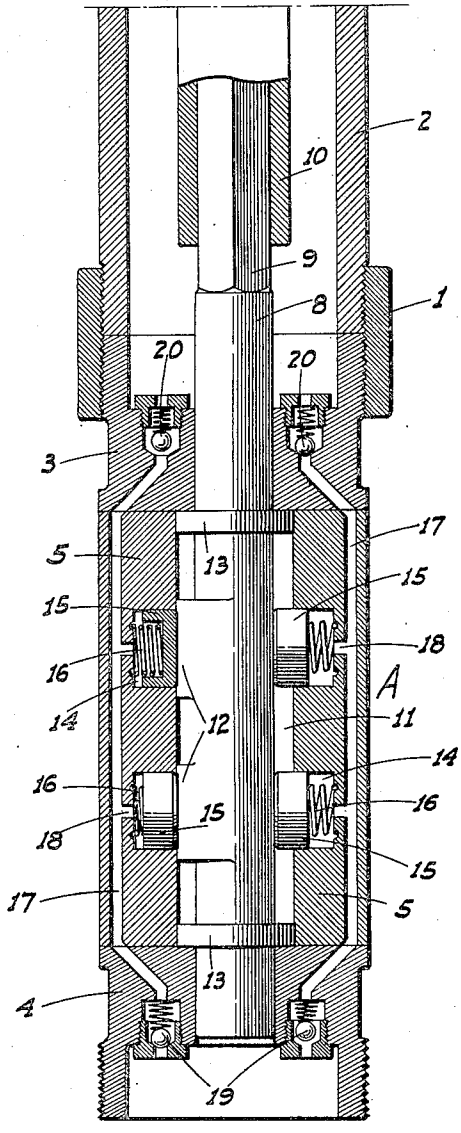
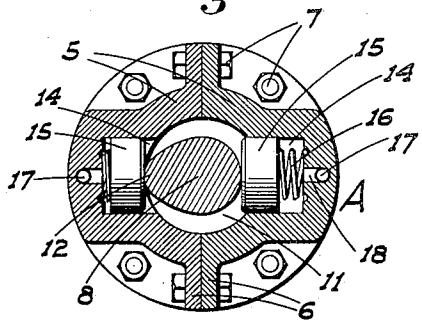


Fig. 3



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DEEP WELL PUMP

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4 Claims. (Cl. 103—155)

This invention relates to pumps for oil wells, and particularly to one especially designed for use in deep wells. When oil ceases to flow of itself from the well, the well is put on the pump. The pumps now almost universally used for this purpose are of the vertically reciprocating plunger type, submerged in the oil and connected to the surface walking beam by a string of steel rod. When such string extends a certain length, or from about forty-five hundred feet up, the weight of the same is such that most of the stroke of the walking beam is absorbed by the rod, due to the stretching of the same and but little of the stroke is imparted to the pump plunger. In fact under such depth conditions it has been found that the stroke of the pump plunger is so small that it can serve no useful purpose. Also even when pumps can be thus used, the reciprocations must take place so slowly as to cut down the output per hour considerably. As a result many deep wells which still have sufficient oil in the bottom to be worth recovering have been abandoned for lack of pumping equipment suitable for the purpose.

The principal object of my invention is to provide for the economical and efficient recovery of such oil deposits, by the provision of a pump adapted to operate by rotation rather than by longitudinal movement of the string of rod. While of course the torque factor instead of stretch then enters into the case, this is no bar to the efficient operation of the string of rod or the pump driven thereby, as witness the fact that drilling operations are successfully performed by rotation of the string and the resistance offered by the drill and tending to increase the torque is greater than that offered by the pump.

A further object of the invention is to produce a simple and inexpensive device and yet one which will be exceedingly effective for the purpose for which it is designed.

These objects I accomplish by means of such structure and relative arrangement of parts as will fully appear by a perusal of the following specification and claims.

In the drawing similar characters of reference indicate corresponding parts in the several views:

Figure 1 is a side elevation of my improved pump as constructed in the preferred form.

Figure 2 is a sectional elevation of the same.

Figure 3 is a cross section on the line 3—3 of Figure 1.

The pump comprises a cylindrical body A of such diameter that it may be readily inserted in the well casing, and adapted at its upper end to be connected by a sleeve coupling 1 to and suspended from piping 2 leading to the surface as usual, and through which the oil from the pump passes, as will be seen.

For convenience and ease of manufacture this body is preferably formed of upper and lower one-piece heads 3 and 4 respectively and which contain the valves of the pump, and the plunger or pump containing unit between the heads and which is formed of a pair of diametrally split duplicate sections 5. The heads and the sections 5 are provided along their contacting faces with cooperating flanges 6, rigidly connected together by bolts 7. The flanges are arranged so that the bolts are recessed within the circumferential plane of the body so as not to possibly catch against the well casing or be sheared off by contact with other external objects.

A shaft 8 extends from above the upper head 3, through said head and the unit 5 and into the head 4, being journaled in both heads. The upper end of the shaft is squared as at 9 or otherwise made non-circular and is slidably engaged by the socket 10 on the adjacent end of the string of rod. This string extends through the piping 2 in sections to the top of the well as usual and is rotated at its upper end by suitable means which form no part of this invention, since any standard mechanism such as is now used for drilling purposes may be employed. By connecting the rotating string to the shaft with a sliding fit, said shaft remains floating and vertical thrust strains between the shaft and the pump body are eliminated.

The unit 5 has a longitudinal bore 11 of greater diameter than the shaft, or sufficiently large to allow of the free rotation of cams 12 which are formed on and project radially from the shaft on one side. The shaft is centered in the unit 5 independently of the head bearings, so that no shearing strain is placed on the bolts 7, by flanges 13 on said shaft engaging the wall of said bore 11 at its ends. The flanges also engage the adjacent surface of the heads so that the shaft is held against longitudinal movement in the pump unit.

The body sections 5, in the horizontal planes of the cams are blind bored outwardly from the bore 11 to form vertically and circumferentially spaced sets of radial cylinders 14 in which plungers 15 reciprocate. With the rotation of the cam shaft the cams successively engage each set of plungers, forcing them inwardly of the cylinders. Springs 16 in the cylinders back of the plungers force the same outwardly of the cylinders or toward the axis of the shaft when the cams leave

said plungers. The cam actuated movement of the plungers is the discharge stroke of the same while the spring actuated movement thereof is the suction stroke.

Vertical oil passages 17 lead upwardly through the heads and the sections 5 back of the corresponding sets of cylinders and communicate with the latter by lateral passages 18. Intake to the lower ends of the passages 17 is controlled by upwardly opening spring closed check valves 19 of suitable character mounted in the lower head 4, which is recessed from the bottom up to surround and protect said valves. Similarly the flow from the upper ends of the passages 17 is controlled by upwardly opening spring closed check valves 20 mounted in the head 3 and which of course prevent any return or back flow into said passages from above the head.

The head 4 is threaded on its lower end so that another pumping unit, or an intermediate length of piping may be connected thereto if desired to increase the output, or when a number of the pumps are mounted at different stages, to boost the discharge.

In operation with the rotation of the cam shafts, the various plungers are alternately reciprocated to draw oil into the passages 17 through the intake valves 19, and to then force the oil from said passages and through the outlet valves 20 and into the interior of the piping 2, from which the oil is gradually raised to the surface with the continued operation of the pump.

The capacity of the pump depends rather on the number of plungers used than on the size or length of the stroke thereof, both of which dimensions are naturally limited on account of the limitations imposed by the size of the ordinary well. Therefore, though I have shown two vertical sets of plungers, it is obvious that more sets, or more plungers in each set may be used, the latter feature being determined solely by the length of the pump body without affecting the operation of the pump in the slightest.

From the foregoing description it will be readily seen that I have produced such a device as substantially fulfills the objects of the invention as set forth herein.

While this specification sets forth in detail the present and preferred construction of the device, still in practice such deviations from such detail may be resorted to as do not form a departure from the spirit of the invention, as defined by the appended claims.

Having thus described my invention what I claim as new and useful and desire to secure by Letters Patent is:

1. A deep well pump comprising a body to be inserted into a well and adapted at its upper end for suspended connection to the adjacent end of a string of pipe, a rotary shaft journaled in the body, circumferentially spaced sets of vertically spaced pumps in the body and including reciprocatory pump plungers, the pumps delivering to the string of pipe and means including said shaft to reciprocate all said plungers in predetermined order with the rotation of the shaft.

2. A deep well pump comprising a body to be inserted into a well and adapted at its upper end for suspended connection to the adjacent end of a string of pipe, vertically spaced cylinders formed radially in the body and terminating short of the outer periphery thereof, plungers in the cylinders, means including a rotary shaft to reciprocate said plungers, a liquid flow passage through the body from end to end and separately communicating with the back end of the cylinders, said passage delivering to the string of pipe, an upwardly opening check valve in said passage below the cylinders, and another upwardly opening check valve in said passage above the cylinders.

3. A deep well pump comprising a body to be inserted into a well and adapted at its upper end for suspended connection to the adjacent end of a string of pipe, a rotary shaft projecting through and journaled in the end portions of the body, the latter between the end portions being formed with an enlarged bore, flanges on the shaft engaging said bore immediately adjacent said end portions to hold the shaft against longitudinal movement and relieve the journals of lateral thrust, radially disposed cylinders in the body open to the bore but closed at their outer end, plungers slidable in the cylinders, springs acting on the plungers to force them into the bore, and toward the shaft, cam means on the shaft to engage and move the plungers in the opposite direction with the rotation of the shaft, and valved passage means through the body from end to end and communicating with the cylinders to control the upward flow of oil pumped to the reciprocation of the plungers.

4. A deep well pump comprising a body to be inserted into a well and adapted at its upper end for suspended connection to the adjacent end of a string of pipe, a rotary shaft projecting through and journaled in the end portions of the body, the latter between the end portions being formed with an enlarged bore, flanges on the shaft engaging said bore immediately adjacent said end portions to hold the shaft against longitudinal movement and relieve the journals of lateral thrust, cam means on the shaft in the bore between the flanges, and pump means in the body operated by the rotation of said cams and delivering into the string of pipe.

SHANNON A. ERWIN.