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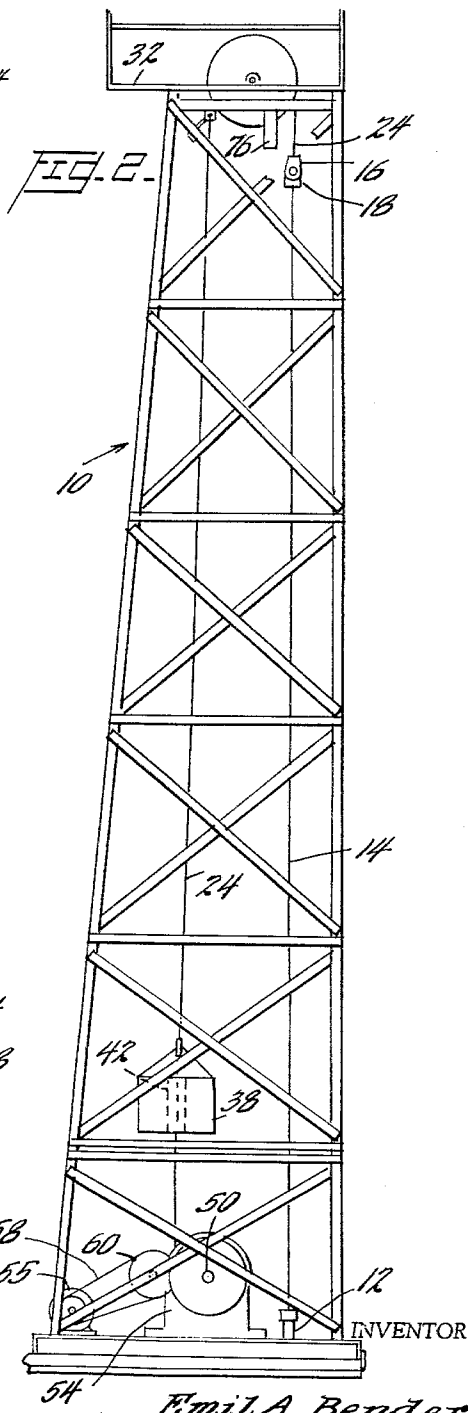
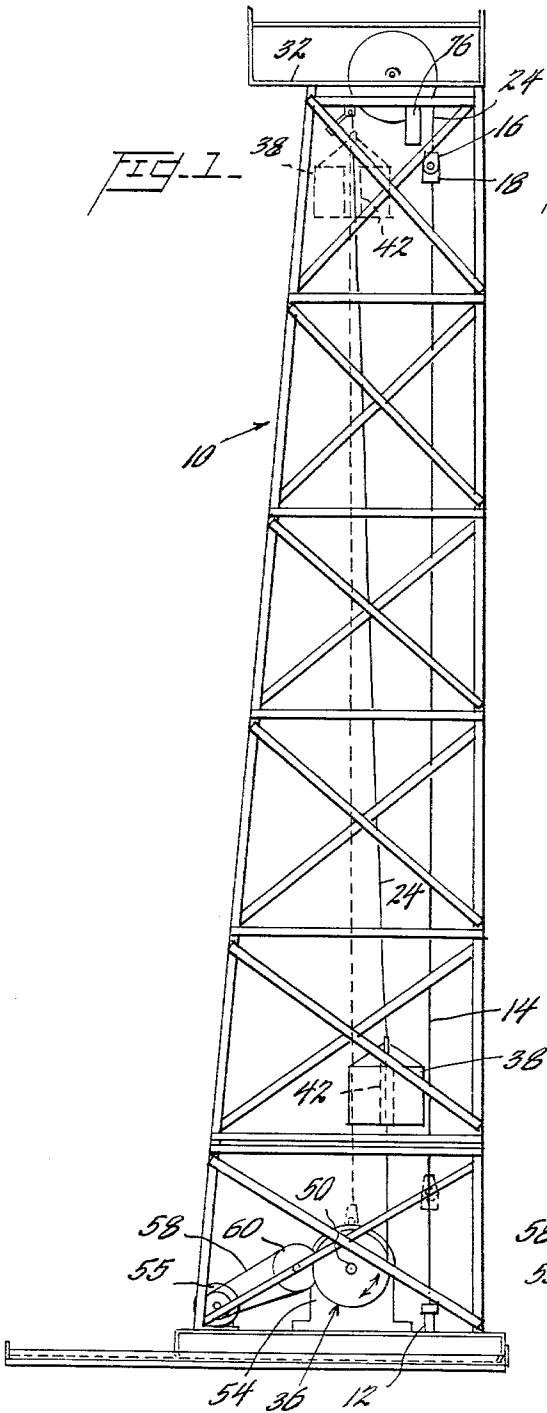
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3,248,958

WIRE LINE DEEP WELL PUMPING APPARATUS

Filed April 2, 1962

2 Sheets-Sheet 1



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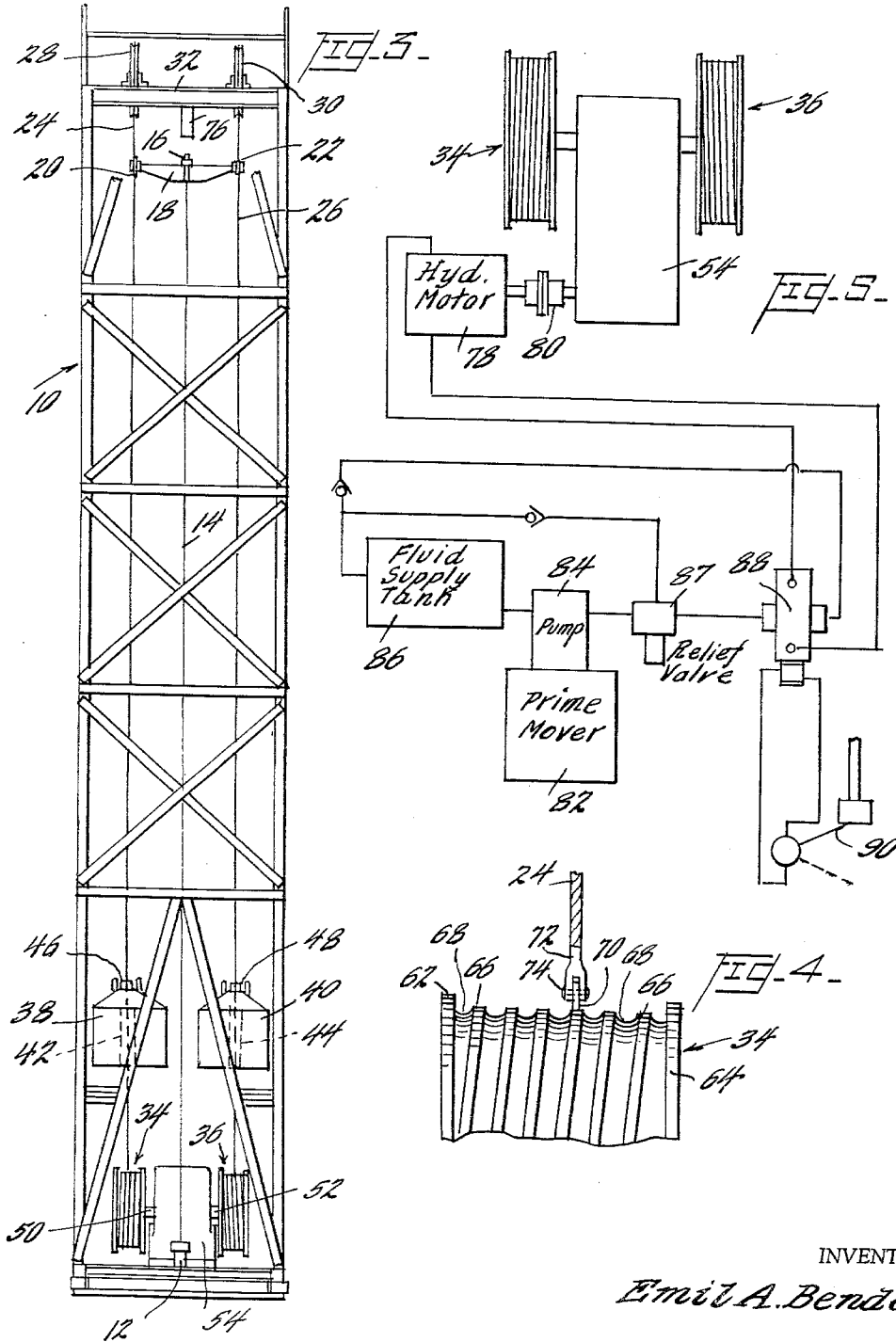
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WIRE LINE DEEP WELL PUMPING APPARATUS

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2 Sheets-Sheet 2



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3,248,958

WIRE LINE DEEP WELL PUMPING APPARATUS

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9 Claims. (Cl. 74—89.20)

This invention relates to a device for pumping oil from wells.

In the use of rod pumping systems for deep wells, results are inefficient, due to stretch in the rods, which may amount to three or four feet. Since the longest possible stroke in a walking beam system, for instance, is less than ten feet the effective stroke is reduced to less than seven feet. Besides dead weight, the rod length is also increased by the stretching action, due to frequent reversal. To overcome this condition, various proposals have been advanced, including hydraulic pumping systems, but these have objectionable features, and have failed to find acceptance, largely because of inefficient use of power, and the need for frequent replacement of vane type oil pumps. In addition, there is no way to counterbalance these hydraulic units, and there is a decided loss of power due to the fact that all of the energy of the down stroke is wasted.

It is therefore a general object of the present invention to overcome the aforementioned difficulties.

More particularly, it is an object to provide a winch system for pumping operations which provides efficiency of operation, including optimum utilization of power.

In still greater particular it is an object to provide a pumping system which is conservative of energy usually wasted in down strokes.

Yet another specific object is to provide a novel drum which is adapted for winding of the line on a drum in two different directions in a single cycle of operations.

Otherwise expressed, it is an object to provide a system in which a cycle of windup and payout is accomplished without reversal of drum direction, and a related object is to accomplish such result, accompanied by a cooperating level-wind feature.

Yet another object is to provide a smooth, cyclic system of winding operation, in which abrupt changes are minimized.

These and other objects, which will be apparent, are attained by the present invention, a preferred form of which is described in the following specification, as illustrated in the drawings, in which:

FIGURE 1 is a skeletonized side-elevation view of an oil derrick, showing the pump hoist system, with the drum fully wound and the wire pumping line at fully elevated position, the several parts being shown in phantom, in the position they occupy when the drum is completely unwound,

FIGURE 2 is a view similar to FIGURE 1, showing the parts shortly after reversal of the direction of rotation of the drum, and descent of the pumping line commencing,

FIGURE 3 is an elevational view of the assembly of FIGURE 1, as seen from the left of that figure,

FIGURE 4 is a fragmentary front-elevation view of a portion of a drum of the general type employed in the devices of FIGURES 1 to 3, showing the grooving arrangement and cable anchorage, and

FIGURE 5 is a schematic view of a layout for an alternative power source, in association with the drums, the latter shown in plan view, in general outline.

Referring to the drawings by characters of reference, there is shown in FIGURES 1 to 3, in skeletonized form, a conventional oil derrick, indicated as a whole by the numeral 10.

Leading through a pipe 12 to the pump elements within the well, which form no part of the present invention is

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a polish rod 14, the upper end of which is secured, as by a clamp 16, medially of a cross bar 18, to the ends of which are secured, by clamps 20, 22, the terminal ends of a pair of cables 24, 26, leading to the windup drums, presently to be described. The rod 14 is preferably of suitable length that the cross bar 18 may utilize most of the full height of the derrick for a pumping stroke.

The lines 24, 26 are trained over a pair of sheaves 28, 30, mounted on a suitable supporting structure 32, at the top of the derrick, the sheaves being coaxial, and spaced apart sufficient to comport with the location of the pair of drums 34, 36, at the base of the derrick, to which they are secured, in a manner to be presently described.

A pair of counterweights 38, 40, which may be of cylindrical form, have axial bores 42, 44, through which they are mounted on the respective lines 24, 26 being secured in side-by-side position thereon by means of upper clamps 46, 48.

The drums 34, 36 are mounted on, and keyed for rotation with the ends 50, 52 of a shaft, extending from a gear reduction unit 54, carried on a removable skid platform, which may be slid into and out of the confines of the derrick. The drums may be powered by an electric motor 55, connected through a belt or chain drive 58 to an input pulley 60 of the gear reduction unit.

As seen in FIGURE 3, the drums 34 and 36 have helical grooves for winding guides, and in the embodiment shown, these appear as of opposite hand on the respective drums. Of particular importance is the anchorage of the cables on the drums, as shown in enlarged detail in FIGURE 4, in the case of drum 34. The drum has conventional end flanges 62, 64, and its winding surface is provided with a helical land 66, and an associated helical groove 68. Centrally of the drum, between the end flanges, a bracket 70 is secured to the land 66, and the cable 24 has a terminal clevis 72, which is pivotally connected to the bracket 70 by a pin 74. By this arrangement, the cable 24, in either direction of rotation of the drum, may move from an unwinding operation, immediately and directly into a rewinding operation, with full utilization of the grooves, and without reversal of drum rotation. The manner in which this mode of action conforms to the general cycle of operations will now be detailed.

As shown in FIGURE 1, the drums are fully wound from rotation in the direction indicated by the clockwise end of the arrow, the cross bar 18 is at its high point (end of pumping stroke) and counterweights 38, 40 are at their lowest level. At this stage, the cross bar 18 contacts a limit switch 76, which reverses the direction of rotation of the motor 56. Rotation is now counterclockwise, in a direction to unwind the cable from the drum, and this unwinding is occasioned by the fact the pump system outweighs the counterweights, and therefore descends under the action of gravity. In this action, the drums are working with the motor, and therefore a counter electromotive force is generated in the motor which may be used to salvage much of the kinetic energy in the moving parts of the system by use of the motor as a generator, in a manner well known in the electrical art.

When the cables are fully unwound from the drums, the several moving parts of the system are in the general positions shown in dash lines in FIGURE 1, and this situation is also illustrated in FIGURE 4. Assuming, in FIGURE 4, that the cable has unwound from the grooves to the left of center, continued rotation of the drum in the same direction will cause the cable to wind on the grooves to the right of center. It will be noted that if the cable were anchored at either end of the drum, the grooves would be available in only one direction of rotation.

The rewinding effects a raising of the pump system and

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a lowering of the counterweights, and the back load on the motor is introduced shortly after the anchored end of the cable has passed the position shown in dash lines in FIGURE 1. It should be noted that the counterweights are moved laterally an appreciable distance between the positions they occupy in FIGURES 1 and 2, respectively, and their inertia serves to bring about a preliminary load on the motor, which minimizes the shock of eventual absorption of the load due to a direct pull on the lines.

At the completion of the raising of the drawbar, one cycle is complete, and the subsequent cycle is initiated by reversal of the motor.

Preferably the grooves on the drums 34, 36 are arranged in opposite hand, so that the cables 24, 26 remain symmetrical about a central, vertical line, and among other things, avoid eccentric loading on cross bar 18.

In FIGURE 5, the drum system is shown as powered by a hydraulic system, wherein 78 indicates a hydraulic motor, connected to the gear reduction unit through a coupling 80. A prime mover 82 operates a pump 84, to drive fluid from a supply tank 86 through the lines shown, which include a pressure relief valve 87, to the hydraulic motor, the action being controlled by a reversing valve 88, actuated by a limit switch 90, which is contacted by the cross bar 18, in the same manner as the limit switch 76. Should it be necessary or desirable to modulate the polish rod stroke, time delay or sequence valves, or volume control valves, may be added to the system.

While a certain preferred embodiment of the pump apparatus has been shown and described, various modifications will be apparent, in the light of this disclosure, and the invention should not, therefore, be deemed as limited, except insofar as shall appear from the spirit and scope of the appended claims.

I claim:

1. A wire line pump apparatus for oil wells or the like, comprising a portable platform carrying a reduction gear unit and a prime mover coupled to said unit, a shaft having terminal ends extending from opposite sides of said unit, a cable-winding drum with flanged ends mounted on each of said shaft ends, said drums having helical grooves and lands, arranged in opposite hands, a bracket carried by each drum medially of its end flanges, a pair of cables with their ends pivotally attached to the respective said brackets, a counterweight having a through opening received on each of said cables, and a cross bar connecting the outer ends of said cables, said cables adapted for support on a pair of sheaves, and said cross bar adapted for connection to a polish rod of a pump, and a limit switch, responsive to contact by said cross bar for reversing said prime mover.

2. A wire line pump apparatus for oil wells or the like, comprising a reduction gear unit and a prime mover coupled to said unit, a shaft having terminal ends extending from opposite sides of said unit, a cable-winding drum with flanged ends, mounted on each of said shaft ends, said drums having helical grooves and lands, arranged in opposite hands, a bracket carried by each drum medially of its end flanges, a pair of cables with their ends pivotally attached to the respective said brackets, a counterweight having a through opening received on each of said cables, and a cross bar connecting the outer ends of said cables, said cables adapted for support on a pair of sheaves, and said cross bar adapted for connection to a polish rod of a pump, and a limit switch, responsive to contact by said cross bar for reversing said prime mover.

3. A wire line pump apparatus for oil wells or the like, comprising a reduction gear unit and a prime mover coupled to said unit, a shaft having terminal ends extending from opposite sides of said unit, a cable-winding drum with flanged ends mounted on each of said shaft ends, said drums having helical grooves and lands, a bracket carried by each drum medially of its end flanges, a pair of cables with their ends pivotally attached to the re-

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spective said brackets, a counterweight having a through opening received on each of said cables, and a cross bar connecting the outer ends of said cables, said cables adapted for support on a pair of sheaves, and said cross bar adapted for connection to a polish rod of a pump, and a limit switch, responsive to contact by said cross bar for reversing said prime mover.

4. A wire line pump apparatus for oil wells or the like, comprising a reduction gear unit and a prime mover coupled to said unit, a shaft having terminal ends extending from opposite sides of said unit, a cable-winding drum, with flanged ends mounted on each of said shaft ends, said drums having helical grooves and lands, a pair of cables with their ends pivotally attached to the respective said drums, medially of their end flanges, a counterweight having a through opening received on each of said cables, and a cross bar connecting the outer ends of said cables, said cables adapted for support on a pair of sheaves, and said cross bar adapted for connection to a polish rod of a pump, and a limit switch, responsive to contact by said cross bar for reversing said prime mover.

5. A wire line pump apparatus for oil wells or the like, comprising a reduction gear unit and a prime mover coupled to said unit, a shaft having terminal ends extending from opposite sides of said unit, a cable-winding drum, with flanged ends, mounted on each of said shaft ends, said drums having helical grooves and lands, a pair of cables with their ends pivotally attached to the respective said drums, medially of their end flanges, a counterweight attached to each of said cables, and a cross bar connecting the outer ends of said cables, said cables adapted for support on a pair of sheaves, and said cross bar adapted for connection to a polish rod of a pump, and a limit switch, responsive to contact by said cross bar for reversing said prime mover.

6. A wire line pump apparatus for oil wells or the like, comprising a reduction gear unit and a prime mover coupled to said unit, a shaft having terminal ends extending from opposite sides of said unit, a cable-winding drum with flanged ends, mounted on each of said shaft ends, a pair of cables with their ends pivotally attached to the respective said drums, medially of their end flanges, a counterweight attached to each of said cables, said cables adapted for support on a pair of sheaves, and being connected by a cross bar and said cross bar adapted for connection to a polish rod of a pump, and a limit switch, responsive to contact by said cross bar for reversing said prime mover.

7. A wire line pump apparatus for oil wells or the like, comprising a reduction gear unit and a prime mover coupled to said unit, a shaft having terminal ends extending from opposite sides of said unit, a cable-winding drum with flanged ends, mounted on each of said shaft ends, a pair of cables, with their ends pivotally attached to the respective said drums, medially of their end flanges, a counterweight attached to each of said cables, said cables adapted for support on a pair of sheaves, and being connected by a cross bar and said cross bar adapted for connection to a polish rod of a pump.

8. A wire line pump apparatus for oil wells or the like, comprising a mounted shaft carrying a pair of drums, power means to rotate said drums, a pair of cables, secured at one terminal end to the respective said drums, medially thereof, a counterweight carried by said cables, means to attach a polish rod of a pump to the opposite terminal end of said cables, and a limit switch responsive to contact by said means, to reverse said power means.

9. In combination, an oil derrick carrying a pair of sheaves at its upper end, and a platform at its lower end, a pair of drums rotatably mounted on said platform, power means to rotate said drums, a pair of cables secured to said drums, medially of their length, and trained over said sheaves, a counterweight carried by said cables, a cross bar connecting the ends of said cables exteriorly of said derrick, a polish rod supported from said cross

bar, and a limit switch carried by said derrick, said limit switch causing said power means to reverse upon contact of said cross bar with said limit switch, upon said cross bar reaching a predetermined position.

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