April 16, 1946. T. H. BERRY 2,398,512

WELL DRILLING MACHINE

Filed Sept. 27, 1943 3 Sheets-Sheet 1

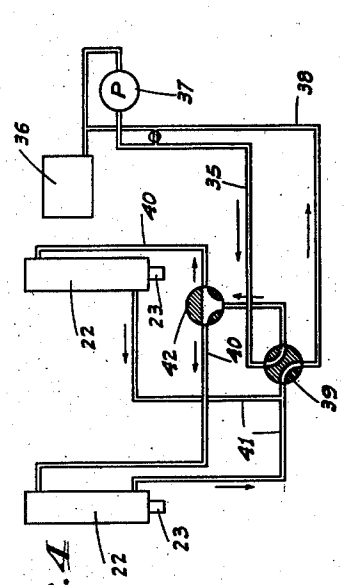


Fig. 4

Fig. 1

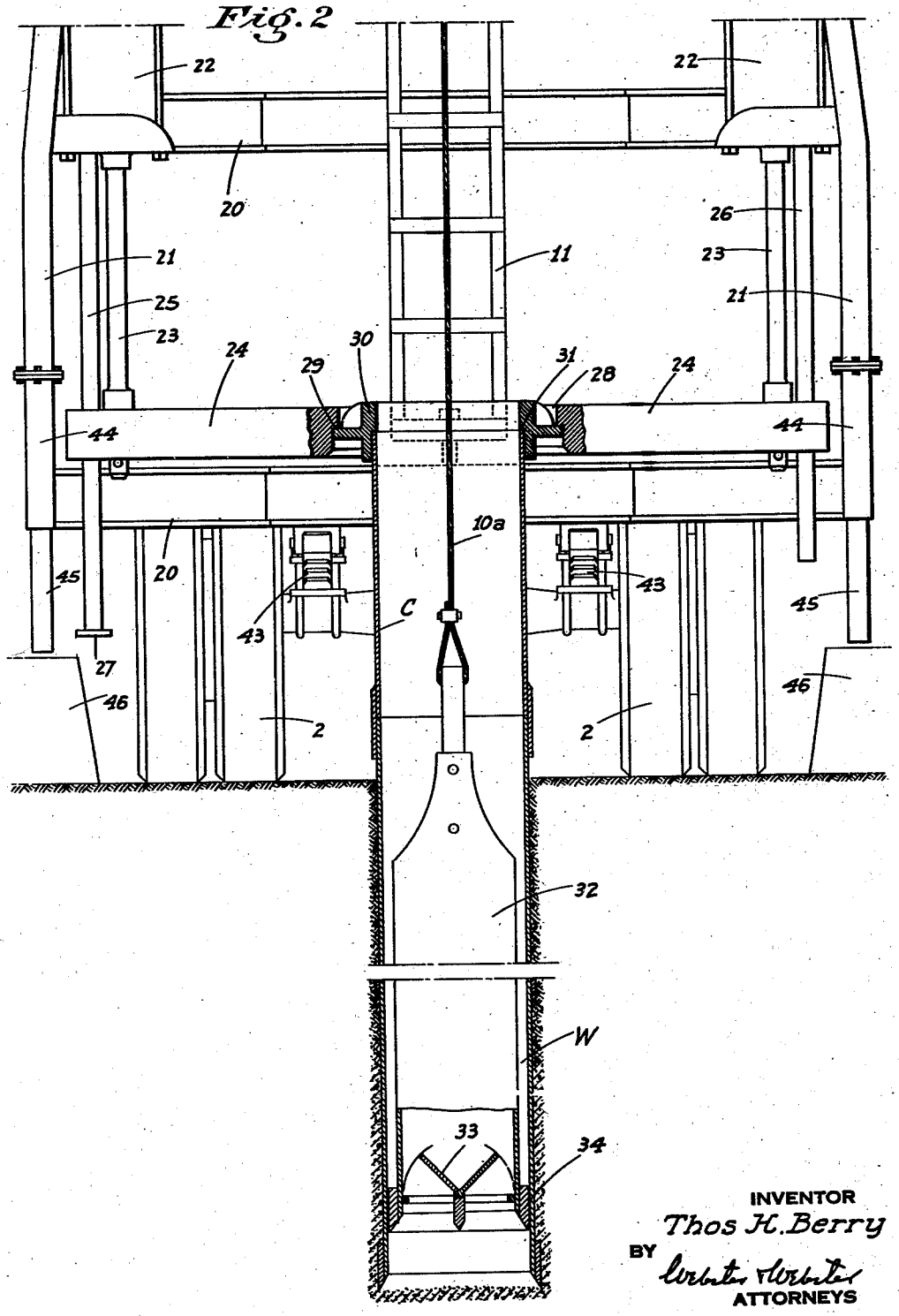
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Fig. 2



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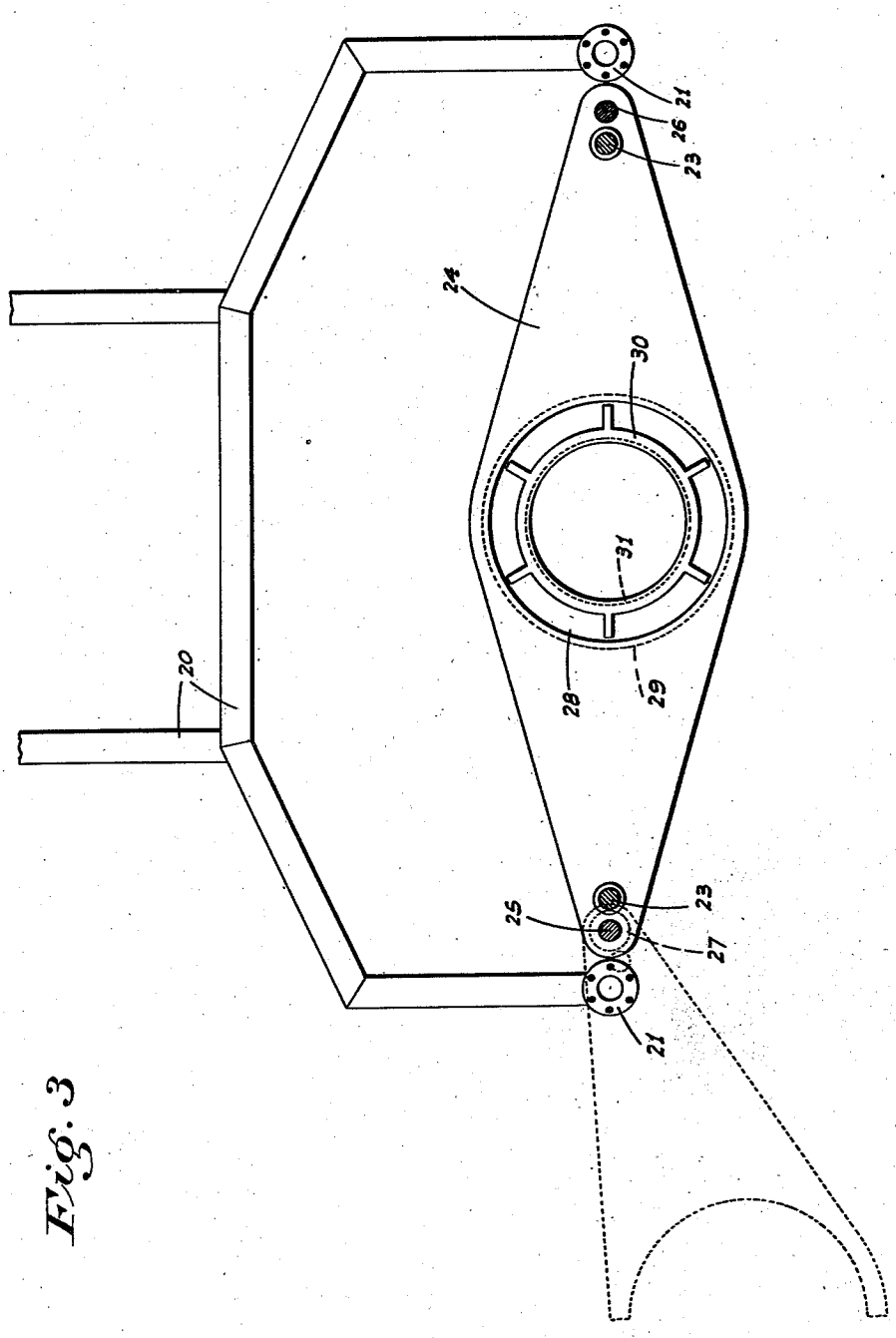


Fig. 3

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2,398,512

WELL DRILLING MACHINE

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Application September 27, 1943, Serial No. 503,996

6 Claims. (Cl. 255—5)

This invention relates in general to improvements in a well drilling machine, and in particular the invention is directed to, and it is an object of the invention to provide, a well drilling machine including a novel arrangement to facilitate the driving of the well casing during the drilling operation.

A further object of the invention is to provide a well drilling machine which includes, together with a drilling rig having a mast and a power actuated cable supported bailer depending therefrom, a truck supporting end on which the rig is fixed, and means to lift one end of the truck and apply the dead weight of said one end of the truck on the upper end of the casing whereby said weight, plus the reaction force from lifting the bailer, drives the casing effectively and relatively rapidly.

A further object is to provide a well drilling machine, as in the preceding paragraph, in which the truck includes a rigid frame having a transversely spaced pair of hydraulic jacks mounted thereon and arranged in operative connection with opposite ends of a yoke adapted to seat atop a well casing; said jacks being simultaneously operative to raise the weight of the adjacent end of the truck off of its wheels whereby said weight is applied through the jacks and yoke to the well casing.

Another object is to provide a novel fluid pressure control system for the above hydraulic jacks.

Also an object of the invention is to provide a well drilling machine which includes a pivotally mounted mast adapted to fold from a normal upstanding position to a down position lengthwise of the machine; there being power actuated mechanism arranged to erect said mast from a folded position.

A further object of the invention is to provide 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 drawings similar characters of reference indicate corresponding parts in the several views:

Figure 1 is a side elevation of the improved well drilling machine.

Figure 2 is an enlarged fragmentary rear end view, partly in section, showing the machine in use.

Figure 3 is a fragmentary plan view of the extension frame and the casing engaging yoke.

Figure 4 is a diagrammatic view of the valve regulated fluid pressure system employed to control the hydraulic jacks.

Referring now more particularly to the characters of reference on the drawings, the numeral 1 indicates the main frame of a truck, and which frame is supported adjacent its rear end by spring-mounted transversely spaced wheels 2 and adjacent its forward end by transversely spaced wheels 3; the truck being of conventional construction and including a drive engine enclosed in a hood 4.

A walking beam type well drilling rig is mounted on the truck frame 1 and includes, as usual, a bed frame 5, and an engine 6 arranged in driving relation to a cable drum 7 and a crank assembly 8, which latter reciprocates a walking beam unit 9; the cable 10 being reeved from drum 7 over the walking beam unit and thence extends upwardly over a pulley (not shown) journaled on the upper end of a normally upstanding mast 11.

The rig includes an upstanding frame 12, and the mast 11 is pivoted adjacent but short of its lower end, as at P, to the rear end portion of said upstanding frame 12 for forward swinging or downward folding movement whereby the mast can be lowered for transport of the machine from place to place. The mast is elevated from a lowered position by means of a longitudinally extending hydraulic ram 13 mounted beneath the bed frame 5 in a position with its piston rod 14 projecting forwardly.

A cable 15 is connected between the forward end of the piston rod 14 and thence extends rearwardly about a small pulley 16 on the rear end of the bed frame 5 and passes from said pulley upwardly to connection with the mast at 17 below the pivot point of the same. The forward end of the piston rod 14 includes a head 18 suitably supported and guided by ways 19.

The upstanding frame 12 of the rig is fitted with a rearwardly projecting extension frame which comprises a number of vertically spaced frame members 20 somewhat U-shaped in plan and open to the rear, as shown in Fig. 3, said members being connected by rear end corner posts 21.

A pair of heavy-duty, inverted hydraulic jacks 22 are mounted perpendicular in the extension frame 20 in transversely spaced relation and adjacent the rear end of said extension frame. The piston rods 23 project downwardly

from the hydraulic jacks 22 and are detachably connected at their lower ends with the end portions of a horizontal, transversely extending yoke 24 guided for vertical movement on vertical guide rods 25 and 26 respectively, the rod 25 being longer than the rod 26 and including a stop 27 at its lower end.

As will be apparent, when the yoke 24 is lowered against the stop 25, said yoke has escaped the rod 26 whereby, when the piston rods 23 are detached from said yoke, the latter may be swung about the guide rod 25 to the position shown in dotted lines in Fig. 3.

The yoke 24 is formed with a central opening 28, including a downwardly facing shoulder 29 against which an annular, casing driving head 30 engages; said head being adapted to engage about the upper end of the well casing C, and includes an internal shoulder 31 against which the upper edge of said casing abuts.

The cable 10 includes a depending work reach 10a onto the lower end of which the bailer 32 is secured, such bailer including, at its lower end as usual, a valve 33 and an annular cutting shoe 34. The well which is dug by the bailer 32, and into which the casing C is driven, is indicated generally at W.

The fluid pressure system for the hydraulic jacks 22 is shown diagrammatically in Fig. 4, and comprises the following:

Fluid pressure is introduced into a supply conduit 35 from a reservoir 36 by means of a motor driven pump 37. The numeral 38 represents a fluid return conduit. The conduits 35 and 38 are connected to a manually controlled four-way valve 39 whose outlets are connected with branched conduits 40 and 41 respectively; the branches of conduit 40 leading to the upper end of jacks 22, while the branches of conduit 41 lead to the lower end of jacks 22. It will be seen that by manipulation of four-way valve 39 fluid pressure can be fed to the upper or lower ends of the jacks 22, which are double-acting, for the purpose of advancing or retracting, respectively, the piston rods 23.

A biasing valve 42 is interposed in conduit 40 at the branch thereof, whereby the proportion of fluid pressure fed to the respective jacks 22 may be manually regulated, and which regulation may be necessary to vary the stroke of piston rods 23 so as to maintain yoke 24 horizontal.

Operation

In operation of the above described well drilling machine, the head 30 of yoke 24 is engaged with the upper end of the well casing C and the jacks 22 are actuated so as to effect a relative projection or advance of the rods 23. However, the resistance of the well casing C to penetration into the ground prevents ready lowering of the yoke 24, and consequently the entire well drilling machine is lifted at its rear end by said jacks 22 about the axis of the front wheels 3 until the weight of said machine is relieved from the truck springs 43.

With the entire weight of the rear end of the machine resting on the upper end of the casing C, the bailer 32 is reciprocated in the usual manner in said casing through the medium of the walking beam unit 9, whose operation is controlled from a lever L mounted on one side of the extension frame 20 adjacent the valves 39 and 42. With each upward movement of the bailer, the reaction force of lifting said bailer and breaking its suction from the bottom of the well, together with the weight of the machine, are applied to the head of casing C, which effectively and readily drives the same into the well. In short, with each reciprocation of the bailer 32 a material reaction force supplements the weight of the machine already on the casing, resulting in the casing being driven with relative ease.

When an additional section of casing is to be added, the jacks 22 are energized so as to retract the rods 23 and elevate the yoke 24. Then the bailer is raised above the elevated yoke and an additional, relatively short section of casing is disposed in place under the yoke for driving downward.

When the well drilling machine is being set up preparatory to drilling the well, and at certain other times, it is desirable that a leveling mechanism be employed, and which comprises the following:

At the lower end and at opposite corners of the extension frame 20, and at the forward ends of the truck frame 1, there are perpendicular hydraulic cylinders 44, each of which includes a downwardly projecting rod or ram 45 adapted to engage a block 46 seated therebelow on the ground. Each cylinder 44 is actuated by a fluid pressure control system, indicated generally at 47, and which includes a manual control valve 48.

By proper control of the cylinders 44 and rams 45, the machine can be initially levelled preparatory to drilling the well, and can also be maintained level at any desired stage of the well drilling operation. However, during such time as the rods 23 of jacks 22 are relatively advanced so as to raise the machine at its rear end to apply the weight thereof to the casing C, the pair of rams 45 at said rear end of the machine are clear of the corresponding blocks 46.

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 well drilling rig comprising a truck carrying well drilling equipment, a supporting frame at one end of the truck, a yoke mounted for vertical movement in said frame, means mounted on the frame and engaging said yoke for moving the yoke relative to said frame or vice versa, said means being operable to first move the yoke vertically to position it above a well casing seated in a well, means to then reverse the movement of said yoke to bring it into engagement with the casing and whereby with the continued operation of such means the resistance offered by the casing will then function to cause the frame and adjacent end of the truck to lift and pivot about the end of the truck opposite the frame as an axis, and to thereby throw the weight of the lifted end of the truck and equipment mounted thereon against the casing, a vertically reciprocating drilling element mounted for movement through the casing and operable through power means mounted on the truck whereby when the element is lifted a reactive force is generated against the frame and yoke, such reactive force, together with the weight of the truck and equipment bearing

against the casing thus functioning to drive the casing into the well.

2. A well drilling rig comprising a truck supporting well drilling equipment, a supporting frame at one end of the truck, an inverted hydraulic jack mounted in the frame, a yoke connected to the lower end of the piston rod of the jack whereby the yoke may be raised or lowered relative to the frame with the action of the jack, means to operate the jack to lift the yoke above a casing set in a well, means to then reverse the action of the jack to bring the yoke into contact with the top of the casing, the resistance of the casing then causing the adjacent frame to rise, with the continued operation of the jack, pivoting about the opposite end of the frame as an axis, whereby the weight of the lifted end of the frame and equipment will bear against the casing, a vertically reciprocating drilling element mounted for movement through the casing and operable through power means mounted on the truck whereby, when the element is lifted, a reactive force is generated against the frame and yoke, such reactive force, together with the weight of the truck and equipment, bearing against the casing, functioning to drive the casing into the well.

3. A well drilling machine comprising a frame vertically liftable at one end, said frame carrying well drilling machinery and being adapted to tilt about its other end as an axis when said one end is lifted whereby the weight of the frame and machinery thereon will exert a force tending to force the lifted end downwardly, a drilling element suspended from the frame adjacent said end for reciprocating drilling movement, means to reciprocate said suspended drilling element, said drilling element, upon upward reciprocation thereof, producing a downward reaction force in the frame at said one end, a well casing driving member adapted to be mounted on the casing above ground, the suspended drilling element being positioned to work through the casing, and means connected between the casing driving member and the frame operative to lift the frame at said one end whereby to impart the weight thereof, together with said downward reaction force, to the casing through the medium of the casing driving member; said well casing driving member being a yoke extending beyond opposite sides of the casing, and said frame lifting means being a pair of hydraulic jacks connected with opposite ends of the yoke.

4. A well drilling machine as in claim 3 including an upstanding frame portion adjacent said one end, and means between the upstanding frame portion and yoke to guide the latter upon relative vertical movement between the yoke and said frame portion.

5. A well drilling machine as in claim 3 including an upstanding frame portion adjacent said one end, and means between the upstanding frame portion and yoke to guide the latter upon relative vertical movement between the yoke and said frame portion; said guide means comprising a pair of vertical guide rods slidably projecting through opposite end portions of the yoke; the jacks being detachably connected to said yoke.

6. A well drilling machine as in claim 3 including an upstanding frame portion adjacent said one end, and means between the upstanding frame portion and yoke to guide the latter upon relative vertical movement between the yoke and said frame portion; said guide means comprising a pair of vertical guide rods slidably projecting through opposite end portions of the yoke, said rods being free at their lower ends and one rod terminating at its lower end in a horizontal plane some distance above the lower end of the other rod, and a stop element on the lower end of said other rod, the jacks being detachably connected to said yoke.

THOMAS H. BERRY.