July 13, 1943. R. M. LILLY 2,324,096

WELL HOISTING DEVICE

Filed June 5, 1941

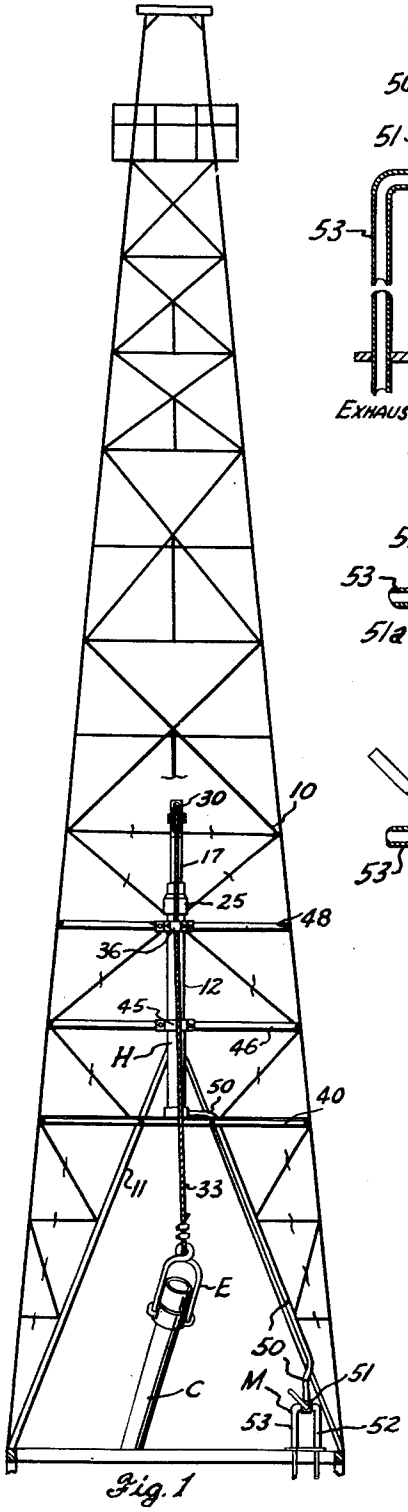


Fig. 1

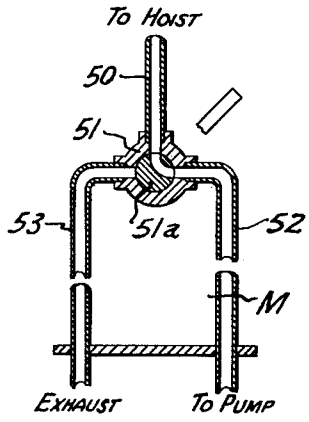


Fig. 3

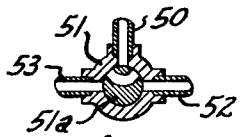


Fig. 4

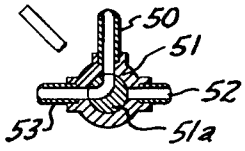


Fig. 5

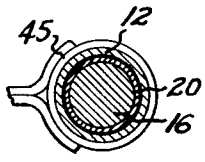


Fig. 6

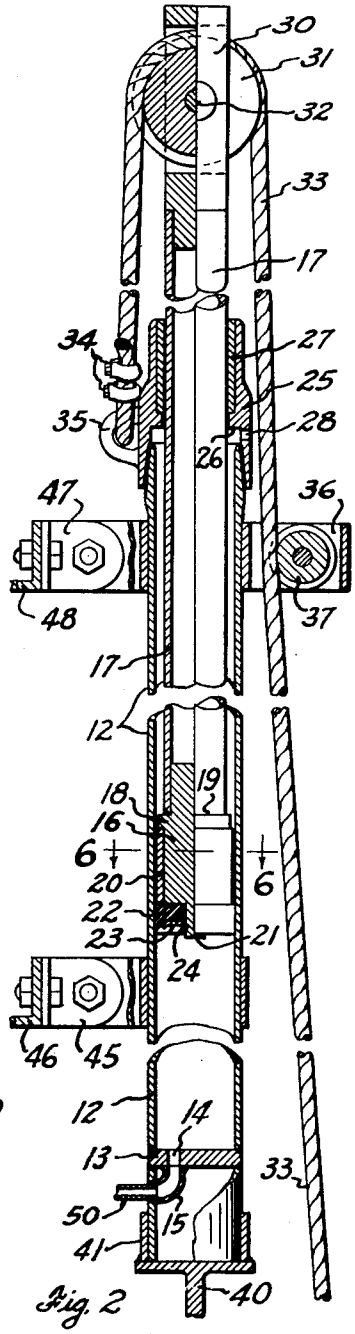


Fig. 2

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Patented July 13, 1943 2,324,096

UNITED STATES PATENT OFFICE

2,324,096

WELL HOISTING DEVICE

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Application June 5, 1941, Serial No. 396,735

5 Claims. (Cl. 214—1)

This invention relates to new and useful improvements in well hoisting devices.

In well drilling operations, in running well casing into the well bore, and in other well operations, some means must be provided for picking up drill pipe sections, casing and the like, from the pipe rack outside the derrick and lifting such pipe sections into the derrick where they will be ready for use. In the past, this work has been done by means of a derrick-line or catline and a cathead driven by the drilling hoist, which operation was both dangerous and slow. On most drilling rigs the catline operator is completely across the derrick from the pipe rack and cannot clearly observe all operations and manipulations on the pipe rack. Also, the catline operator does not have positive, complete control of the pipe or other material he may be lifting or lowering, since the drive between the catline and the cathead is purely a friction drive obtained by snubbing the catline around the rotating cathead. This snubbing of the stiff heavy catline is also a cause of fatigue to the operator and, where casing or other heavy pipe is being run into the well bore, can, as a result of fatigue, slow down and make dangerous all such operations.

It is, therefore, one object of this invention to provide an improved device for raising and lowering pipe and other material in and about a well derrick.

An important object of the invention is to provide an improved hoist, operable independently of the drilling machine, for raising or lowering pipe or other material in and about a derrick and wherein the operator of the lift or hoist is at all times in complete and positive control of the material being handled, whereby the hazards attendant such operations are minimized.

Another object of the invention is to provide an improved positively controlled fluid pressure operated hoist or lift, which is so arranged that the material being handled may be accurately stopped and held in, or lowered from, any desired position by such hoist by merely manipulating a valve, and wherein such operations are not dependent upon the snubbing of a rope on a friction drive as is the case in the usual cathead and catline operations.

A particular object of the invention is to provide, in combination with a derrick having a V-door through which pipe and other material is brought into the derrick, a pressure fluid operated hoist or lift secured to the derrick above the V-door and arranged to be used to lift and lower such pipe or other materials, whereby such pipe or other material may be lifted into or out of the derrick by the hoist at the same time that other operations are being performed by the drilling machine, thus effecting a saving of time in such operations.

A further object of the invention is to provide a device of the character described which is safe in operation, simple in construction and economical to build and operate, and which may be readily transported from location to location.

Additional objects and advantages of the invention will be apparent from a reading of the following description of a device constructed in accordance with the invention, and reference to the accompanying drawing, wherein:

Figure 1 is a view, largely diagrammatic, of a hoist constructed in accordance with the invention and showing the same in position on a well derrick,

Figure 2 is an enlarged view, partly in elevation and partly in section, of the hoist itself,

Figure 3 is a diagrammatic sectional view of the valve arrangement for controlling the operation of the hoist, showing the same in position for admitting pressure fluid to raise the hoist,

Figure 4 is a similar view showing the valve in position for cutting off all flow of fluids therethrough,

Figure 5 is another view similar to Figure 3, showing the valve in position to release pressure fluid from the hoist to permit its lowering, and

Figure 6 is a horizontal cross-sectional view taken on the line 6—6 of Figure 2.

In the drawing, the numeral 10 designates a well derrick of conventional type having a V-door 11 of the usual kind provided in one side. The hoisting device H is secured inside the derrick at the upper reduced end of the V-door.

The hoist includes an elongate cylinder 12, closed at its lower end by a closure head 13 which is welded to the cylinder to form a fluid tight joint. A port 14 is provided near one side of the closure head and a pipe elbow 15 communicating with said port is welded to the head, and extends through the cylinder wall below the head to form a fluid conductor whereby pressure fluid may be introduced into the cylinder.

A piston 16 is slidable within the cylinder and is reduced in diameter at its upper end and a tubular shaft 17 is secured thereto, as by welding. As is clearly shown in Figure 2, the external diameter of the shaft is substantially less than the bore of the cylinder 12, and the shaft extends upwardly and out of the upper end of the cylinder.

An external annular flange 18 is formed near the mid-portion of the piston, whereby an upwardly facing shoulder 19 is provided on the piston for a purpose which will be hereinafter explained. A cylindrical bronze bushing 20, having an external diameter substantially equal to the diameter of the bore of the cylinder surrounds the lower portion of the piston. This

bushing serves both as a guide and as a friction reducing element for the piston 16.

An axial stem 21 extends downwardly from the lower end of the piston and a replaceable resilient pump cup 22, of a kind frequently found in oil field pumps, is mounted on the stem abutting the lower end of the piston. The cup is held in place by a washer 23 which is retained on the stem by means of a spring clip ring 24 fitting within an annular groove formed on said stem.

The pump cup seals against the walls of the bore of the cylinder 12 and when pressure fluid is introduced into the cylinder through the port 14, such fluid acts upon the cup to displace the piston upwardly within the cylinder.

To prevent complete ejection of the piston and shaft from the cylinder, a retaining collar and guide 25 is secured to the upper end of the cylinder by means of screw threads. The upper portion of the bore of the collar is reduced in diameter whereby a downwardly facing shoulder 26 is formed in said collar. A bronze bushing 27 having a bore substantially equal to the external diameter of the shaft 17 is provided in the upper end of the collar 25 and acts as a guide for said shaft and to reduce the frictional engagement between the shaft and the collar. A vent hole 28 is formed in the wall of the collar, below the shoulder 26.

Since the shoulder 26 extends inwardly almost to the shaft 17 and since the shoulder 19 on the piston extends outwardly to a diameter substantially equal to the bore of the cylinder, it is obvious that said shoulders will engage each other to prevent displacement of the piston 16 from within the cylinder.

In its fully telescoped position, the shaft 17 extends upwardly a slight distance above the upper end of the collar 25. Further downward travel of the shaft is prevented by the engagement of the stem 21 on the piston 16 with the closure head 13. It will be seen, therefore, that the travel of the piston 16 and of the shaft 17 carried thereby is limited to the distance between the points of engagement of the shoulders 19 and 26 and of the stem 21 and head 13.

A sheave holder 30, having a sheave 31 rotatably mounted therein on a pin 32, is secured by screw threads to the upper end of the tubular shaft 17. A flexible line 33 is threaded through the sheave holder and has one end secured by clamps 34 to an eye 35 provided on the exterior of the collar 25. The line extends over the sheave 31 and downwardly adjacent the shaft 17 and cylinder 12 through a line guide 36 to the derrick floor. The line guide is provided with a roller 37 for the line to prevent the application of lateral force to the upper end of the shaft 17, which would tend to bend the shaft and prevent proper functioning of the hoist. The lower or free end of the line may be attached to elevators E, as shown in Figure 1, for use with pipe or casing, or may be left loose, as desired.

For securing the hoist inside the derrick, an I-beam 40, having a cup shaped receptacle 41 for the lower end of the cylinder 12, is secured at its ends to the derrick legs and to the struts forming the frame of the V-door, in the position shown in Figure 1. A bracket 45, having a clamp for the cylinder pivotally secured thereto, is secured by bolts to the derrick girt 46 next above the I-beam, and thus supports the mid-portion of the cylinder. An upper bracket and clamp 47, of the same type, is bolted to the next higher derrick girt 48 and engages the upper end of the cylinder 12. The line guide 36 and roller 37 are carried by this bracket and clamp. It will be readily seen that the hoist is securely fixed to the derrick and supported thereby above the V-door.

A pipe or conductor 50 is connected to the elbow 15 at the lower end of the cylinder and extends downwardly along the V-door frame to a valve manifold assembly M located on the derrick floor. The lower end of the pipe is connected to one of the flow openings of a three-way, two-port valve 51, diagrammatically illustrated in Figure 3. One of the other flow openings of the valve has connected therewith a pipe or conductor 52 which leads to a pump, such as a boiler feed water pump, or other source of pressure fluid (not shown). The other opening has connected therewith a pipe or conductor 53, which serves as a vent or exhaust line and leads to a water tank or other place of disposal of the exhausted pressure fluid.

In operation, the free end of the line 33, which may have the elevators E connected thereto is attached by means of said elevators, or other means, to the casing C preparatory to lifting the casing from the pipe rack, which is outside the derrick, into the derrick where it is to be run into the well bore.

The valve 51 is moved to the position shown in Figure 3 to connect the pipes 50 and 52, thus permitting pressure fluid from the pump or other source (not shown) to flow from the supply pipe 52 through the valve to the pipe 50. The pressure fluid then flows through the pipe 50, elbow 15 and port 14 into the bore of the cylinder 12. As the fluid enters the cylinder, it forces the piston 16 and shaft 17 upwardly in the cylinder, thus elevating the sheave 31. Since one end of the line 33 is fastened to the eye 35 on the collar 25, it is obvious that upward movement of the sheave will draw the free end of the line upwardly a distance equal to twice the distance through which the sheave moves. In this manner, the casing C is rapidly and safely lifted into the derrick.

When the casing or other material has been lifted to the desired position, the valve plug 51a is moved to the position illustrated in Figure 4. In this position the ports of the plug are located between the flow openings and the valve is closed, shutting off all flow through the pipes 50, 52 and 53. Therefore, the pressure fluid which has entered the cylinder 12 to lift the piston and shaft will be retained in the cylinder to hold the shaft in its elevated position.

To lower the casing or other material, the valve plug is turned to the position shown in Figure 5, opening a flow passage from the pipe 50, through the valve, and to the exhaust pipe 53. The pressure fluid within the cylinder is thus allowed to drain out through the exhaust pipe, permitting the piston 16 and shaft 17 to move downwardly in the cylinder, whereupon the free end of the line 33 is lowered to lower the casing as desired. Obviously, the casing may be held at any desired elevation by merely moving the valve to the closed position shown in Figure 4.

Any fluids which may have accumulated in the cylinder above the piston pump cup, together with the air therein, will drain out of the upper portion of the cylinder through the vent hole 28 in the collar 25.

It is noted that the line guide 36 and roller 37 maintain the line 33 in close proximity to the upper end of the cylinder, whereby the stresses on the shaft 17 extending above the collar 25

are balanced in so far as lateral stresses are concerned. This prevents bending of the shaft and other undue strain which would be possible were the line not so confined, since, obviously, if the line left the sheave 31 at a sharp angle a large bending stress would be set up on the shaft.

The valve manifold assembly M may be located on the derrick floor at any desired position, though it is preferably placed near the V-door at a point out of the way of damage and where it will not interfere with normal operations.

It will be seen that a device has been provided which is simple in structure and operation, yet which eliminates a number of hazards incident to well operations.

Use of the catline or derrick-line and cathead is entirely eliminated in operations which involve picking up drill pipe, casing or other objects from the pipe rack walk and lifting them to the derrick floor, or from the derrick floor to the pipe rack. The operator of the hoist H is in a position commanding full view of all operations which he may be performing with the hoist, and is in complete and positive control of the operations at all times. This is a definite improvement over operations involving the use of the catline and cathead, where the operator is necessarily completely across the derrick from the V-door, and where he is controlling the lifting of the objects with the catline by snubbing the catline for a friction drive around the cathead. The catline operator is also subject to fatigue, since the stiff, heavy catline must be picked up, lifted and turned around the cathead, and each joint of pipe or other object handled must be lifted by pulling on the catline to maintain the frictional engagement of the line with the cathead so that the object can be lifted. The action is similar to that of an over-running friction clutch.

Such operations are not only tiring to the operator and dangerous, but there is a time delay between operations which can be avoided by use of my hoist. The hoist operator can lift a joint of pipe or other object and bring it through the V-door onto the derrick floor while the drilling machine is being used to spin-up and tighten the joint which has been previously lifted into the derrick. Consequently, there is always a new joint of pipe ready for use. This will obviously save a considerable amount of time in running a string of casing or other pipe in a well.

Also, the number of clutching and de-clutching operations necessary to run a string of casing with some types of drilling machines will be materially reduced by use of my lift or hoist, by eliminating the use of the catline for many of the operations.

Likewise continuous use of the catline causes its end to twist and kink, and frequently the cathead operator will pull one of these kinks through the rope guide or catline sheave. This is destructive of the catline, which is an expensive piece of rope.

The above description of the invention is explanatory only, and changes in details of the construction illustrated may be made by those skilled in the art, within the scope of the appended claims, without departing from the spirit of the invention.

What I claim and desire to secure by Letters Patent is:

1. The combination with a well derrick having an inverted V-door of an auxiliary pressure fluid operated hoist secured to said derrick at the apex of said inverted V-door for lifting objects through said V-door.

2. An auxiliary well hoist including, a derrick having an inverted V-door, an elongate tubular stationary member secured to the derrick at the apex of the inverted V-door, an elongate travelling member telescoping said stationary member and having a sheave at its upper end, a flexible line extending over the sheave on the travelling member and having one end fixed to the stationary member and the other end free, whereby the movement of the travelling member causes movement of the free end of the line, means for applying pressure fluid within the stationary member to cause the travelling member to move, and means on the stationary member through which the free end of the flexible line is movable, said means preventing the application of a lateral bending force to the travelling member by said line.

3. An auxiliary well hoist including, a base comprising a braced derrick inverted V-door, supports comprising derrick girts above the V-door, and erect extensible telescoping members operable by pressure fluid mounted on the base at the apex of the inverted V-door and secured to the supports for raising and lowering a flexible line, whereby objects may be raised and lowered by means of said line.

4. In combination with a drilling rig having a derrick with an inverted V-door and a draw-works, a pressure fluid operated auxiliary hoist secured to said derrick immediately above and at the apex of said inverted V-door for raising and lowering objects through said V-door, said hoist being operable independently of the draw-works of the drilling rig.

5. A well hoist including, a base comprising a braced derrick inverted V-door, supports comprising derrick girts above the V-door, an elongate cylinder mounted on the base at the apex of the inverted V-door and secured to the supports, said cylinder having its lower end closed and its upper end open, an elongate shaft telescoping the open end of the cylinder and having a piston on one end movable longitudinally within the cylinder and having a sheave on its opposite end outside the cylinder, a fluid inlet in the closed end of the cylinder for admitting pressure fluid to the cylinder to move the piston and shaft longitudinally of the cylinder to extend and retract the shaft and sheave above the upper end of the cylinder, a flexible line extending over the sheave and having one end fixed to the stationary cylinder and its other end free to move, a guide member at the upper end of the cylinder through which the free movable portion of the flexible line is directed for preventing the application of a bending force to the shaft as the same is extended and retracted, means for supplying pressure fluid to the cylinder to cause the shaft to move, whereby the free end of the flexible line is raised and lowered, and means for controlling the admission of such pressure fluid to said cylinder, whereby the movements of the shaft and line may be positively controlled.

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