Nov. 5, 1940. L. T. PEYTON ET AL 2,220,271

SPUDDING MACHINE

Filed June 30, 1939 2 Sheets-Sheet 1

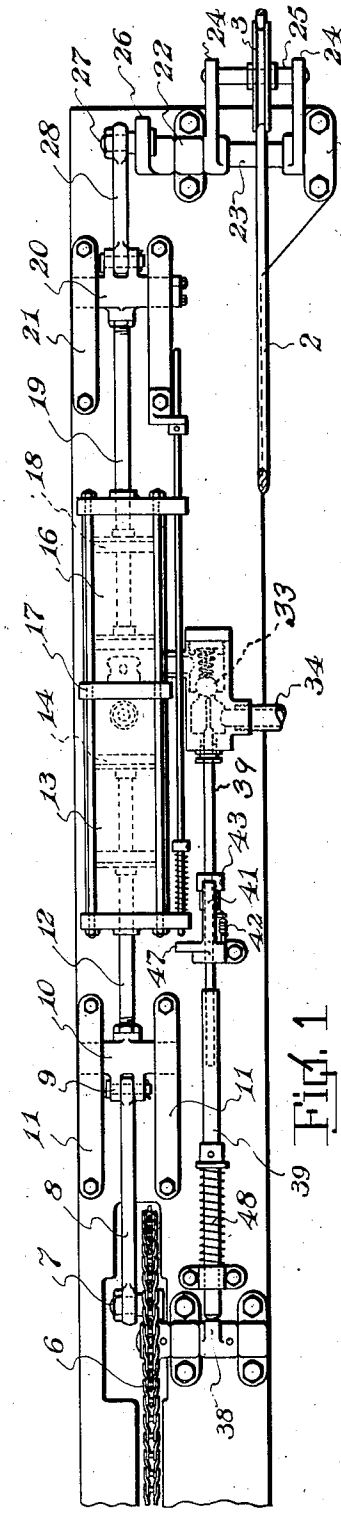


Fig. 1

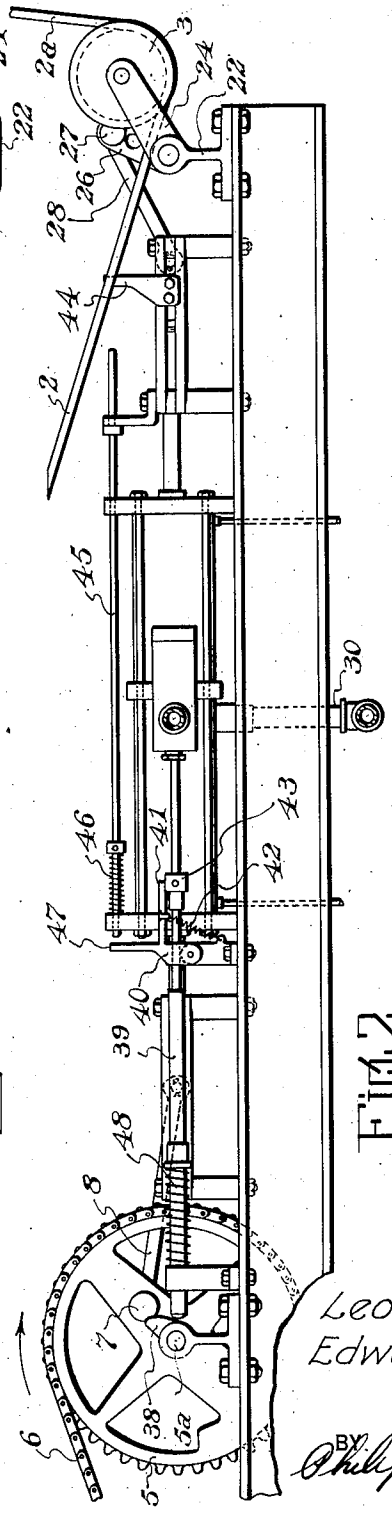


Fig. 2

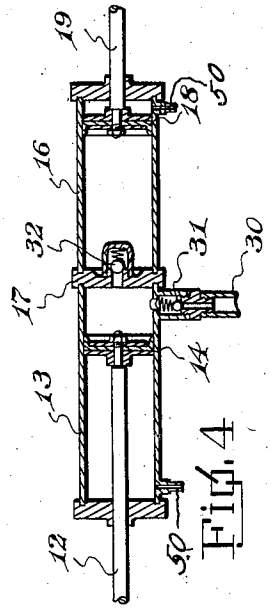


Fig. 4

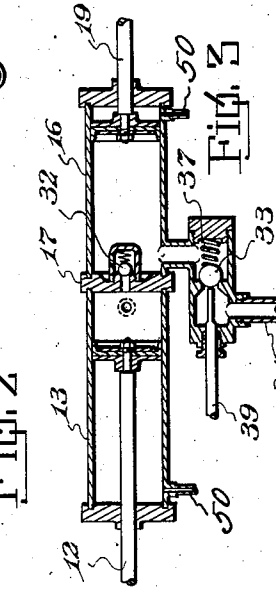


Fig. 3

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SPUDDING MACHINE

Filed June 30, 1939 2 Sheets-Sheet 2

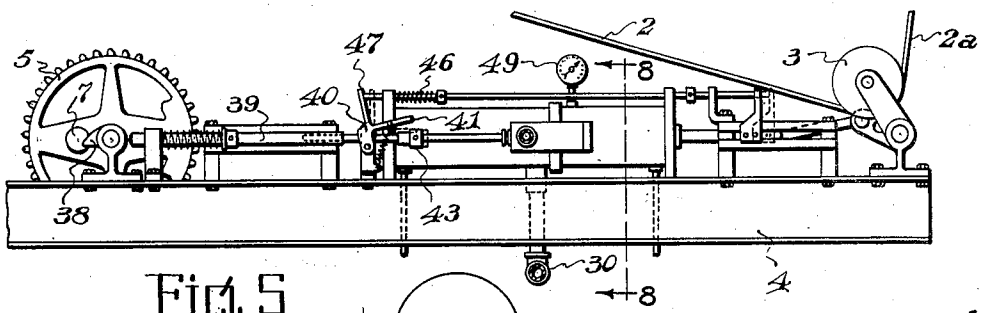



Fig. 5

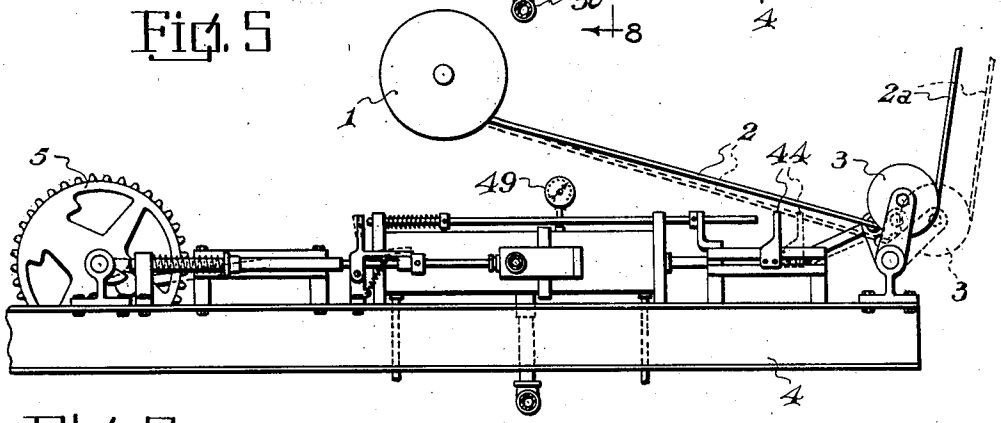



Fig. 6

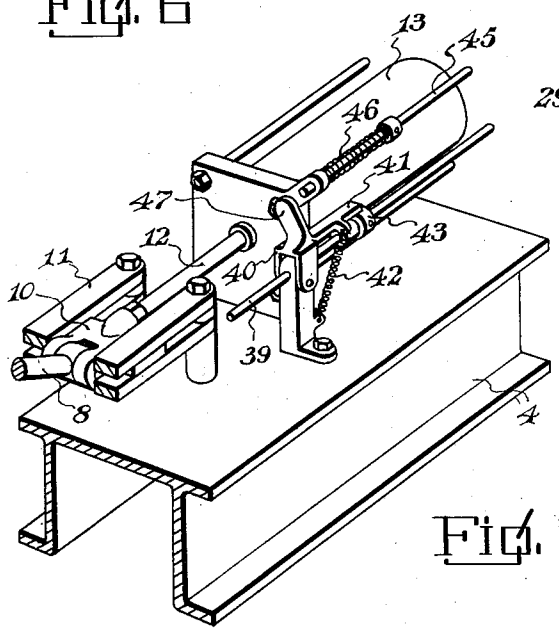



Fig. 7

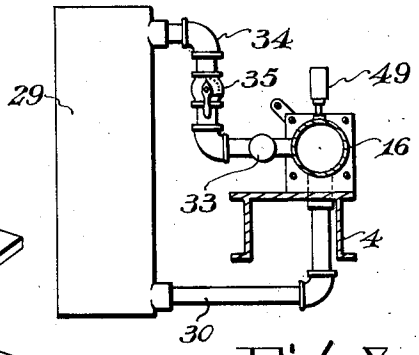



Fig. X

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# UNITED STATES PATENT OFFICE

2,220,271

## SPUDDING MACHINE

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Application June 30, 1939, Serial No. 282,298

10 Claims. (Cl. 255—5)

The invention relates to a fluid operated spudding machine, particularly hydraulic, and has for its object to provide a device of this character whereby the spudding sheave and spudding arm are oscillated in a bight of a cable for intermittently raising and lowering a drill bit in a well during a drilling operation.

A further object is to oscillate the spudding arm through the medium of piston and crank connection with a forwardly and rearwardly movable piston in a cylinder by intermittently applying fluid pressure on opposite sides of the piston.

A further object is to operate the forward piston by the reciprocation of the rear piston, which rear piston intermittently takes in fluid forwardly thereof and intermittently transfers said fluid into the forward cylinder for forcing the forward cylinder forwardly for raising the drill bit and unloading valve means for allowing rearward movement of the forward piston, thereby allowing the drill bit to drop by gravity and means for allowing the fluid in the forward cylinder to be expelled therefrom.

A further object is to provide a fluid circuit between the cylinders and a reservoir and to provide valve means in said circuit whereby the impact of the tool may be varied.

A further object is to provide a hydraulic spudding machine having an oscillating spudding arm, which arm is rocked by hydraulic means, thereby giving a cushioning action.

A further object is to provide a hydraulic operating means for a spudding machine arm, said means including a reservoir in circuit with operating cylinders and pistons.

A further object is to provide the forward end of the rear cylinder with a loading valve, which valve opens on the rear movement of the rear piston and closes on the forward movement of the rear piston when the fluid is being forced through an unloading valve discharging into the forward cylinder behind the piston therein and closes upon rearward movement of the forward piston, thereby allowing the fluid to be expelled from the forward cylinder through an unloading valve, held open by valve control means during the rearward movement of the forward piston.

A further object is to provide a power wheel for reciprocating the rear piston and cam means in connection with the power wheel for controlling a push rod cooperating with the unloading valve of the forward cylinder for forcing the unloading valve to open position. Also to provide a trip arm in connection with the valve rod for holding the unloading valve and rod against rearward movement until the trip arm is released when the forward piston moves rearwardly to a predetermined position, and at which time the unloading valve seats.

A further object is to provide cross heads in cross head guides and connected to the pistons by piston rods and to the power wheel and crank arm of the spudding arm by connecting rods.

With the above and other objects in view the invention resides in the combination and arrangement of parts as hereinafter set forth, shown in the drawings, described and claimed, it being understood that changes in the precise embodiment of the invention may be made within the scope of what is claimed without departing from the spirit of the invention.

In the drawings:

Figure 1 is a top plan view of the spudding machine.

Figure 2 is a side elevation of the spudding machine, showing the spudding arm in forward position for raising the spudding tool and the operating cam in position for unseating the unloading valve of the forward cylinder.

Figure 3 is a horizontal sectional view through the cylinders.

Figure 4 is a vertical longitudinal sectional view through the cylinders.

Figure 5 is a side elevation of the spudding machine, showing the spudding sheave arm in rear position for dropping the spudding tool and the unloading valve rod tripped for allowing the unloading valve to seat.

Figure 6 is a side elevation of the spudding machine showing the position of the sheave arm, in dotted line, when the tool is off the bottom of the well and the unloading valve in the front cylinder is opened for allowing the weight of the tool and the cable to cause or allow the tool to drop.

Figure 7 is a detail perspective view of the rear end of the rear cylinder, showing the valve rod trip mechanism.

Figure 8 is a transverse sectional view through the machine, showing the reservoir and fluid circuit.

Referring to the drawings, the numeral 1 designates a conventional form of stationary rotatable bull wheel controlled in the usual manner for controlling the cable 2. The cable 2 extends forwardly and under the spudding sheave 3 and thence upwardly in the usual manner over a crown block of a derrick and thence downwardly into a well and is provided with the usual drilling bit, which is raised and lowered for the drilling operation. The above is conventional structure

and the spudding sheave is oscillated as shown in dotted and full lines in Figure 5 for enlarging or contracting the size of the bight 2*a* in the cable which causes a raising or lowering of the drill bit. Heretofore, this operation has been accomplished by mechanical means other than fluid operated, and the present device is designed to operate the same hydraulically or by fluid, so there is a cushioning action during the operation.

The spudding machine is carried by a base structure 4 and is operated by a power wheel 5, which may be driven in any suitable manner, for instance by a chain 6 as shown in Figure 2. One side of the power wheel 5 is provided with a wrist pin 7, to which is connected the rear connecting rod 8. The other end of the rear connecting rod 8 is connected at 9 to the rear cross head 10, which is slidably mounted in cross head guides 11. Connected to the rear cross head is a piston rod 12, which piston rod extends into the rear cylinder 13 and is provided with a piston 14, which is reciprocated within the cylinder as the power wheel 5 is rotated. A forward cylinder 16 is connected to the cylinder 13 by a partition 17 and slidably mounted in the cylinder 16 is a piston 18 having a piston rod 19 connected to the forward cross head 20, which cross head is slidably mounted in cross head guides 21.

Rockably mounted in bearing brackets 22 at the forward end of the base 4 is a shaft 23 having secured thereon spaced spudding arms 24 and rotatably and axially movable on a shaft 25, connecting the ends of the arms 24 is the grooved spudding sheave 3. The sheave 3 moves axially as the cable is wound onto and from the bull wheel 1. One end of the shaft 23 is provided with a crank arm 26 having a wrist pin 27, and the front connecting rod 28 connects the wrist pin 27 and the front cross head 20, therefore it will be seen that as the piston 18, in the front cylinder 16, is reciprocated the shaft 23 will be rocked and the spudding arms 24 with the sheave 3 will be oscillated for enlarging or contracting the bight 2*a* for imparting a raising and lowering operation on the drilling tool.

The lower forward end of the rear cylinder 13 is connected to a reservoir 29 at the lower end thereof by a pipe 30 having a check valve 31 therein, said check valve being so arranged, that upon rearward movement of the piston 14 fluid, for instance oil, is sucked into the rear cylinder and upon the forward movement of the piston 14 the oil is forced into the forward cylinder 16 past the unloading valve 32 so said fluid will act on the rear side of the piston 18 and force said piston forwardly for rocking the spudding arms 24 forwardly for a drill raising operation. The rear side of the forward cylinder 16 is provided with an unloading valve 33, which when unseated allows the oil or fluid to be forced through the pipe 34 and back into the upper end of the reservoir 29 for completing the circuit. Pipe 34 is provided with a valve 35, which is of conventional structure and may be regulated for controlling the volume of flow and at the same time allowing the increasing or decreasing of the force of impact of the drill in the bottom of the well.

In operation, when the rear piston 14 moves rearwardly, fluid is sucked into the forward end of the rear cylinder 13 through pipe 30 and check valve 31. When the piston 14 reaches the rear end of the cylinder 13, the piston 18 is adjacent the rear end of the cylinder 16. When the piston 14 starts forwardly in cylinder 13 the check valve 31 closes and the fluid in the cylinder 13 is then forced through the unloading valve 32 into the cylinder 16 and acts on piston 18 forcing the same forwardly, for rocking the spudding arms forwardly. The piston 18 is forced rearwardly by the weight of the drill and cable in the well, hence it will be seen that as the piston 14 moves rearwardly in the cylinder 13 at substantially the same time as the piston 18, the fluid in the cylinder 16 will be forced through the pipe 34 back to the reservoir, provided the unloading valve 33 is open. This valve is normally maintained seated by means of an expansion spring 37.

The power wheel shaft 5*a* is provided with a cam 38 positioned to engage the end of a valve controlled rod 39 which extends forwardly and engages the check valve 33. The unloading check valve 33 is unseated to allow the piston 18 to start its rearward movement, but maintained seated by the expansion spring 37 when the fluid is being transferred from cylinder 13 to cylinder 16 through the loading valve 32. It will be noted that it will be necessary to maintain the valve 33 open until the fluid is expelled from the cylinder 16, and to accomplish this result a hinged trip bracket 40 is provided, which bracket is provided with a forwardly extending arm 41, normally forced downwardly by means of a spring 42 so the arm 41 will engage behind the adjustable collar 43 carried by the rod 39 and will hold the rod in forward position, and the rod will maintain the unloading valve 33 unseated.

The valve 33 is maintained unseated until the trip bracket is tripped at the rearward movement of the piston 18, and to trip the bracket 40 the cross head 20 is provided with an upwardly extending arm 44 in the path of a push rod 45 which is normally forced forwardly by an expansion spring 46. When the arm 44 engages the trip rod 45, said trip rod is forced rearwardly until its rear end engages the arm 47 of the trip bracket 40 and rocks said arm 41 upwardly out of the path of the collar 43, thereby releasing the valve controlled rod 39 so it is forced rearwardly by the expansion spring 37 of the check valve 33; it being understood that the cam 38 is out of engagement with the rear end of the push rod 39 during the tripping operation. Push rod 39 is preferably provided with a shock absorber spring 48.

Although the cylinders 13 and 16 have been shown and described as axially arranged, it is obvious they may be arranged as separate cylinders in parallel or other relation and a pipe connection used between the same for a transfer operation, from one cylinder to the other.

From the above it will be seen that a spudding machine is provided which is fluid or hydraulically operated, thereby giving a cushioning operation on the strokes thereof, thereby relieving the strain on the cable, and at the same time insuring a positive oscillation of the spudding sheave. It will be noted that oil has been referred to as the fluid used, however other fluids could be used if desired. Oil is preferable as it is readily obtained at the scene of operation, and when used the tank is preferably opened at its upper end to allow escape of gas therefrom. If desired the forward cylinder 16 may be provided with a conventional form of pressure gauge 49.

Cylinders 13 and 16 are provided with drain pipes 50, one of which leads from the rear end of the rear cylinder and the other from the front end of the front cylinder, and any oil which may leak past the pistons in either cylinder will be forced from the cylinders through these lines

and may be carried either to the reservoir 29 or to a vessel where it could be put back into the reservoir, therefore it will be seen that the pistons will not become air bound. These lines 50 also act as breathers as well as oil expellers.

The invention having been set forth what is claimed as new and useful is:

1. A spudding machine comprising an oscillating sheave carrying arm, a front cylinder, a rear cylinder, a power wheel, a piston in the rear cylinder, a drive connection between the power wheel and the piston in the rear cylinder, a piston in the forward cylinder, a drive connection between the piston in the forward cylinder and the spudding arm, means whereby fluid is sucked into the forward end of the rear cylinder upon rearward movement of the rear piston, means whereby the forward piston will move rearwardly when the rear piston moves rearwardly for expelling fluid from the forward cylinder and means whereby fluid is transferred from the rear cylinder to the forward cylinder upon forward movement of the rear piston.

2. A device as set forth in claim 1 including a check valve between the rear cylinder and the forward cylinder and unseated upon forward movement of the rear cylinder, a loading check valve carried by the forward end of the rear cylinder and an unloading check valve carried by the rear end of the forward cylinder.

3. A device as set forth in claim 1 including a loading check valve carried by the forward end of the rear cylinder, an unloading check valve carried by the forward end of the rear cylinder and discharging into the forward cylinder, an unloading check valve carried by the rear end of the forward cylinder and means for opening said last named check valve when the forward piston moves rearwardly and means for closing said last named check valve when the forward piston approaches its rearward position.

4. A device as set forth in claim 1 wherein the connection between the power wheel and the rear cylinder and the spudding arm and the forward cylinder comprises connecting rods, wrist pin connections between the spudding arm and connecting rod, wrist pin connection between the power wheel and connecting rod, cross heads to which said connecting rods are connected and piston rod carried by the cross heads and extending into the cylinders and connected to the pistons therein.

5. A spudding machine comprising an oscillating spudding arm, a spudding sheave carried by said arm, a power cylinder, a power piston within said cylinder, a driving connection between said power piston and the spudding arm whereby the spudding arm is oscillated as the piston is reciprocated, a fluid intake and transfer cylinder, an intake and transfer piston within said last named cylinder, a power wheel, a driving connection between the power wheel and the intake and transfer piston and means whereby upon rearward movement of the pistons fluid is expelled from the power cylinder and sucked into the intake and transfer cylinder and upon forward movement of the pistons fluid is transferred from the intake and transfer cylinder to the power cylinder.

6. A device as set forth in claim 5 wherein an unloading check valve is provided at the rear end of the power cylinder and means controlled by the power wheel for unseating said valve upon rearward movement of the power piston and seating said valve as the power piston approaches its rear position.

7. The combination with a spudding machine for oscillating a spudding arm and comprising a power cylinder, an intake and transfer cylinder, a power piston in the power cylinder, an intake and transfer piston in the transfer cylinder, a check valve between said cylinders, an intake check valve at the forward end of the transfer cylinder, of a check valve at the rear end of the power cylinder, a power wheel, a driving connection between the power wheel and the transfer piston, a driving connection between the power piston and the spudding arm, a cam driven by the power wheel, a push rod operated by said cam and adapted to unseat the unloading valve carried by the rear end of the power cylinder when the power piston moves rearwardly and means controlled by the power piston for allowing said last named valve to seat when the power piston approaches its rear position.

8. A device as set forth in claim 7 wherein a hinged trip bracket maintains the push rod in forward position and the valve unseated on rearward movements of the pistons, a second push rod cooperating with the hinged trip bracket and means controlled by the power piston for engaging the second trip rod when the power piston approaches its rearward position for tripping the bracket and releasing the first mentioned push rod and allowing the valve to seat.

9. A device as set forth in claim 7 including a fluid reservoir, a pipe connection between the reservoir and the cylinders for completing a fluid circuit and valve means in said pipe connection whereby the flow of fluid may be retarded or increased in volume.

10. A spudding machine having an oscillating spudding arm, piston means for oscillating said arm, a transfer cylinder, a piston in said transfer cylinder and means whereby fluid is sucked into the transfer cylinder and forced into the first mentioned cylinder for moving the arm in one direction and valve control means for allowing the unloading of fluid from the first mentioned cylinder and the rearward movement of the first mentioned piston and the spudding arm under the influence of upward strain on the spudding arm.

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