June 28, 1949. J. A. ARMITAGE 2,474,453

HYDRAULIC FISHING TOOL

Filed Aug. 2, 1948 2 Sheets-Sheet 1

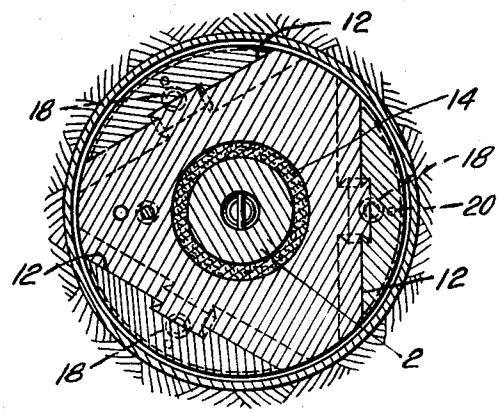


FIG. 3

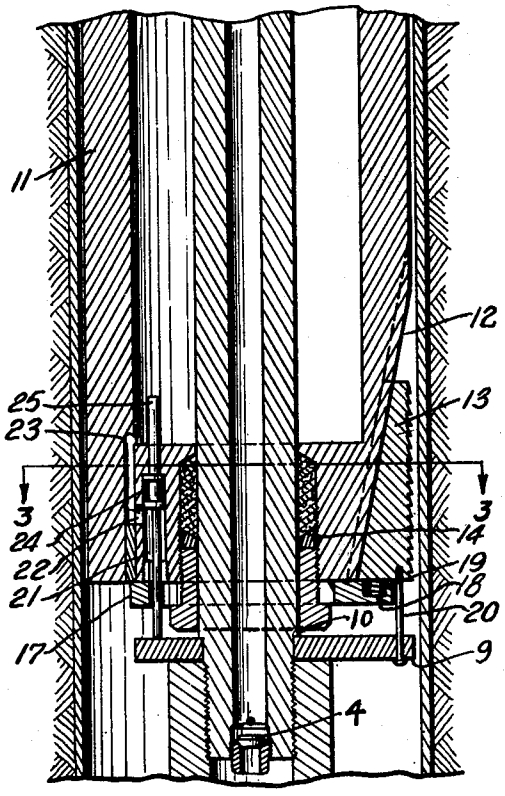


FIG. 1

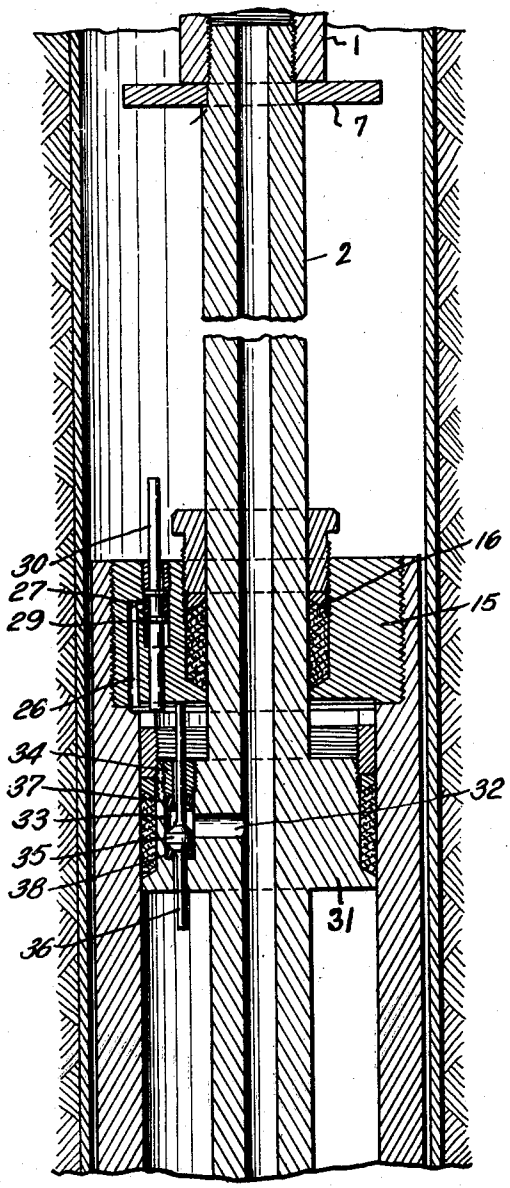


FIG. 2

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HYDRAULIC FISHING TOOL

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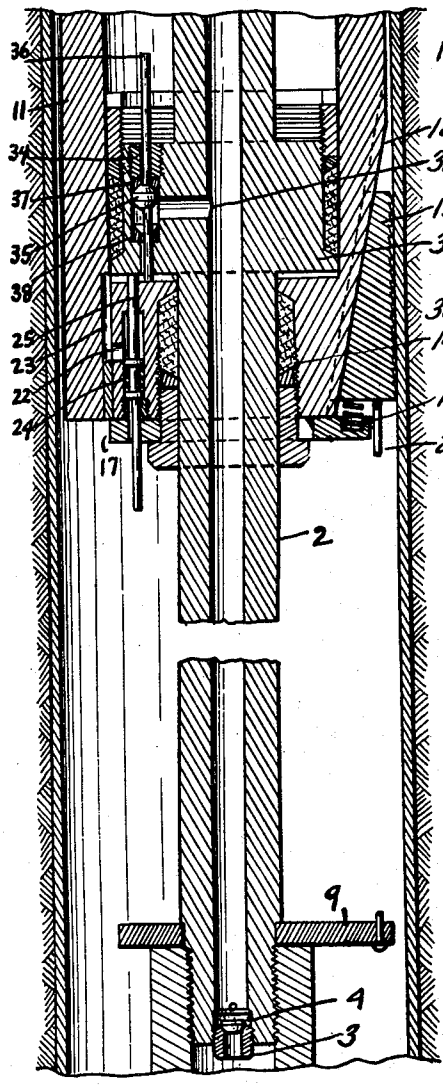


FIG. 4

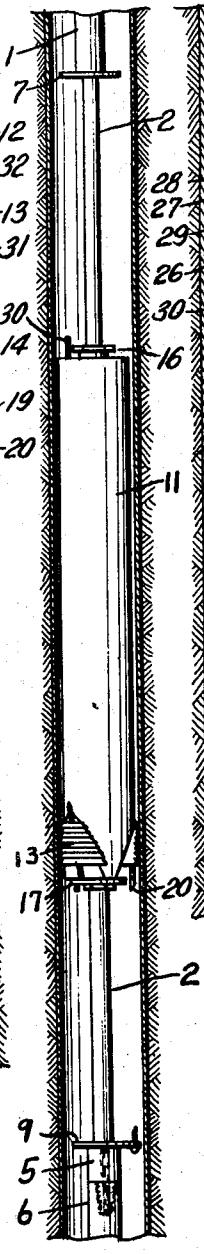


FIG. 6

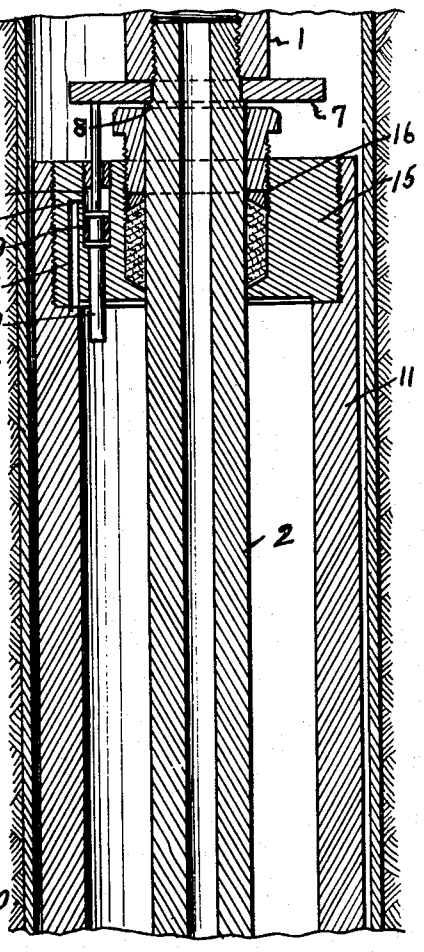


FIG. 5

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HYDRAULIC FISHING TOOL

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8 Claims. (Cl. 294—102)

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This invention relates to a hydraulic fishing tool.

It is an object of the invention to provide a tool of the character described specially designed for use in deep wells to remove objects which have become stuck in the well.

It is another object of the present invention to provide a tool of the character described which is operable by liquid pressure developed at the ground surface.

It is a further object of the invention to provide a fishing tool of the character described which may be engaged with the stuck object and successively operated to exert successive pulls on the engaged object until said object has been released to be withdrawn to the ground surface.

Other objects and advantages will be apparent from the following specification which is illustrated by the accompanying drawings, wherein:

Figure 1 is a vertical, sectional view of the lower end of the tool while being lowered into operative position.

Figure 2 is a vertical, sectional view of the upper end thereof.

Figure 3 is a cross-sectional view taken on the line 3—3 of Figure 1.

Figure 4 is a vertical, sectional view of the lower end of the tool engaged with the well casing and in operative position.

Figure 5 is a vertical, sectional view of the upper end thereof, and

Figure 6 is a side elevation of the complete tool in operative position in the well casing and shown engaged with the object to be removed.

Referring now more particularly to the drawings wherein like numerals of reference designate the same parts in each of the figures, the numeral 1 designates the operating string which is of tubular formation and which extends to the ground surface.

Connected to the lower end of this string there is a tubular mandrel 2 whose lower end is provided with a valve seat which is controlled by an upwardly opening valve 4.

Connected to the lower end of the mandrel 2 there is a grapple 5 of any selected type and which is engageable with the stuck object 6.

Secured on the upper end of the mandrel there is a disc 7 which is clamped between the lower end of the operating string 1 and a supporting shoulder 8 on said mandrel and secured on the lower end of the mandrel there is a disc 9 which is clamped between the upper end of the grapple 5 and the downwardly facing shoulder 10 on the mandrel.

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The numeral 11 designates a cylinder whose lower end is provided with downwardly converging tapering faces 12 and slidably mounted on these faces and having dovetailed connections therewith there are the wedge shaped slips 13 whose outer surfaces are provided with downwardly pitched teeth which are engageable with the well casing when in the position illustrated in Figure 4.

The lower end of the cylinder 11 is closed and is provided with a conventional stuffing box 14 around the mandrel 2 and screwed into the upper end of the cylinder there is a cylinder head, or plug, 15 in which a stuffing box 16 is mounted which surrounds the mandrel.

The lower end of the cylinder has a ring 17 welded thereto and this ring is provided with the seats 18 in its upper face to receive coil springs, as 19.

When the tool is in inoperative position, as shown in Figures 1 and 2, to be lowered into the well the slips are held in their lower, or inoperative, position, by means of the rods 20 which are attached, at their lower ends, to the disc 9, and at their upper ends to the respective slips thus maintaining the springs 19 under compression.

The lower end of the cylinder also has passageways 21 extending upwardly from the lower end of the cylinder and terminating within said lower end and these passageways have lateral ports 22 and ducts 23 leading therefrom and terminating within the cylinder adjacent said lower end.

Located within each passageway 21 there is a piston type valve 24 which is mounted on a valve stem 25 whose upper end is extended up into the cylinder 11 and whose lower end is extended beneath said cylinder. The lower extended end of the rod is of reduced diameter so as to provide clearance whereby the liquid beneath the cylinder 11 may pass upwardly through the passageway 21, port 22 and passageway 23 when the valve 24 is in its upper position. When said piston valve is moved to its lower position the passageway 21 will be closed. The cylinder head 15 is provided with a passageway 26 leading from within the cylinder and having an upper end side port 27 which communicates with a passageway 28 that leads on up through the cylinder head 15.

There is a piston valve 29 in each passageway 28 and said passageway 28 is of sufficient depth to allow the piston valve 29 to move into one position to close the port 27 and into another position to clear said port.

Each valve 29 is mounted on a valve rod 30

which is reciprocable through the piston head 15 and whose lower end extends beneath said piston head and whose upper end extends above the piston head.

The upper end of each piston rod 30 is reduced in diameter so as to allow clearance to the end that when the valve 29 is in its lower or open position liquid may flow from within the cylinder 11 through the passageway 26, the port 27 and the passageway 28 and into the well casing above.

On the mandrel 2 within the cylinder 11 there is a piston 31 which is in sealed relationship with the walls of the cylinder.

As stated the mandrel is tubular and leading from the passageway therethrough laterally through the piston 31 there are passageways, as 32, whose outer ends terminate in bores 33 whose lower ends extend beneath the corresponding passageways 32 and screwed into whose upper ends there are the tubular plugs 34.

Fitted within each bore 33 there is a double acting valve 35 which is fixed on a valve stem 36. One end of this stem works through an axial passageway in the plug 34 and extends beyond the piston 31 and the other end of the stem works through a passageway in the piston 31 and extends beyond said passageway. These passageways are larger than the stem so as to provide sufficient clearance for the flow of liquid therethrough.

At opposite ends of each bore 33 there are the seats 37, 38 against which the valve seats, alternately, to alternately open and close said respective passageways.

When the equipment is assembled to be lowered into the well the slips 13 are held in their lower, or inactive, position by means of the rods 20 and as the tool is lowered into the well the valves 4 will open to allow the entrance of the well liquid into the mandrel 2. Each valve 24 will also be open to allow the passage of liquid into the cylinder 11 beneath the piston 31 and each valve 35 will be seated beneath the corresponding passageway 32 to allow the liquid to pass through the piston 31 and into the cylinder above it. The tool may be lowered on down until the grapple 5 is in position to engage the stuck object 6. As illustrated this grapple consists of a threaded tapering tap which may be screwed into the stuck object 6; however, any conventional type of grappling tool may be used.

Upon engagement of the grapple with the stuck object liquid may be forced under pressure down through the operating string of pipe and through the mandrel and out through passageways 32 and thence up through the passageways through the plugs 34 into the space between the piston 31 and the cylinder head 15.

It will be noted from an inspection of Figure 2 that when in this position the valve 35 will be held in their lower position to clear the passageways 32 by reason of the contact of the upper ends of stems 36 with said head 15 and the valves 29 will be held in upper position to close the ports 27 by reason of the contact of the piston 31 with the lower ends of the piston rods 30.

The pressure of the liquid will therefore move the cylinder 11 upwardly and the rods 20 will be broken thus freeing the springs 19 and the slips 13 will be forced upwardly into contact with the well casing, as shown in Figure 4, so as to support the tool. The cylinder 11 will be thereby anchored against downward movement but will be permitted to move upwardly and upon a continuation of said pressure the cylinder 11 will be moved upwardly. Eventually the upper end of each piston rod 30 will contact with the disc 7 whereupon the piston valves 29 will be moved downwardly, as shown in Figure 5, to open the ports 27; the lower end of the cylinder will approach the piston 31 and the upper end of each piston rod 25 will contact said piston and move the piston valve 24 downwardly to close the port 22, as shown in Figure 4. At the same time the lower end of each piston rod 36 will be contacted by the lower end of the cylinder, as shown in Figure 4, and the corresponding valve 35 will be lifted to clear the corresponding passageway 32 and to close the passageway above through the plugs 34.

Pressure will now be admitted into the space between the piston 31 and the lower end of cylinder 11 and said cylinder being anchored against downward movement, the piston and the mandrel 2 will be forced upwardly thus exerting a pull on the stuck object 6 and moving said object upwardly until the piston 31 reaches the upper end of said cylinder thus reversing the position of the valves 29 and 35, as indicated in Figure 2 and at the same time the position of the valve 24 will be reversed by the disc 9 coming into contact with the lower end of the piston rods 25 thus opening the port 23.

The pressure of the operating fluid will now be between the cylinder head or plug 15 and the piston 31 and the cylinder 11 may be again forced upwardly, the liquid in the cylinder beneath the piston 31 being relieved through the ducts 23 and passageways 21.

If a single pull does not release the stuck object, the cycle of operation may be repeated, if necessary, thus exerting successive pulls on the stuck object until it has been dislodged.

It is to be understood, of course, that as the stuck object is moved upwardly, by successive pulls, the fishing tool as a whole, including the operating string 1, will be elevated relative to the well casing.

What I claim is:

1. A fishing tool comprising, a tubular operating string of pipe including a mandrel, a cylinder through which the mandrel works and forming a closed chamber about the mandrel, a piston on the mandrel and fitted in the cylinder, the piston having a passageway for fluid leading from within the string and terminating in the chamber on opposite sides of the piston and the cylinder having fluid passageways through its ends, valves arranged to control the piston and cylinder passageways and means for reversing the position of all of said valves, when the piston reaches the limit of its movement in either direction.

2. A fishing tool comprising, a tubular operating string of pipe including a mandrel, a cylinder through which the mandrel works and forming a closed chamber about the mandrel, a piston on the mandrel and fitted in the cylinder, the piston having a passageway for fluid leading from within the string and terminating in the chambers on opposite sides of the piston and the cylinder having fluid passageways through its ends, valves arranged to control the piston and cylinder passageways and means for reversing the position of all of said valves, when the piston reaches the limit of its movement in either direction to apply pressure to one side of the piston and simultaneously relieve the pressure from the other side of the piston alternately.

3. A fishing tool comprising, a tubular operating string of pipe which includes a tubular mandrel, a cylinder through which the mandrel works and which forms a closed chamber about the mandrel, a piston on the mandrel and fitted in the cylinder, said piston having a passageway for fluid leading from within the string and terminating in the cylinder chamber on opposite sides of the piston, the cylinder having fluid passageways through its ends to allow discharge of fluid from within the cylinder in advance of the piston, valves controlling said cylinder passageways and means for reversing the position of all of said valves, when the piston reaches the limit of its movement in either direction.

4. A fishing tool comprising, a tubular operating string of pipe including a mandrel, means on the lower end of the mandrel for engaging an object stuck in a well, a cylinder through which the mandrel works and forming a closed chamber about the mandrel, a piston on the mandrel and fitted in the cylinder, the piston having a passageway for fluid leading from within the string and terminating in the chamber on opposite sides of the piston and the cylinder having fluid passageways through its ends, valves arranged to control the piston and cylinder passageways, means for reversing the position of all of said valves, when the piston reaches the limit of its movement in either direction and grappling means on the cylinder engageable with the walls of a well and shaped to allow upward movement of the cylinder but to prevent downward movement of the cylinder.

5. A fishing tool for wells comprising, a tubular operating string of pipe including a mandrel, a grapple on the lower end thereof, a cylinder through which the mandrel works and forming a closed chamber about the mandrel, wall engaging means on the cylinder arranged to prevent downward movement of the cylinder, but to allow upward movement thereof, a piston on the mandrel and fitted in the cylinder, the piston having a passageway for fluid leading from within the string and terminating in the chamber on opposite sides of the piston and the cylinder having fluid passageways through its ends, valves arranged to control the piston and cylinder passageways and means for reversing the position of all of said valves, when the piston reaches the limit of its movement in either direction to apply pressure to one side of the piston and simultaneously relieve the pressure from the other side of the piston alternately.

6. A fishing tool for wells comprising, a tubular operating string of pipe which includes a tubular mandrel, a cylinder through which the mandrel works and which forms a closed chamber about

the mandrel, a piston on the mandrel and fitted in the cylinder, means for applying fluid, under pressure, from the string into the cylinder on the opposite sides of the piston, alternately, means on the cylinder engageable with the walls of the well and adapted to allow only upward movement of the cylinder, the cylinder having fluid passageways at its ends to allow relief of fluid from within the cylinder in advance of the piston, means automatically controlling the application and relief of said pressure, means for reversing the position of the controlling means, when the piston reaches the limit of its movement in either direction and a grapple on the mandrel engageable with an object stuck in the well.

7. A fishing tool comprising, a tubular operating string of pipe including a mandrel, means on the lower end of the mandrel for engaging an object stuck in a well, a cylinder through which the mandrel works and forming a closed chamber about the mandrel, a piston on the mandrel and fitted in the cylinder, means for controlling the application of fluid pressure from the string into the cylinder on opposite sides of the piston, alternately, means on the cylinder engageable with the walls of the well and adapted to allow only upward movement of the cylinder, said cylinder having fluid passageways at its ends, valves arranged to control the cylinder passageways and means for reversing the position of said valves when the piston reaches the limit of its movement in either direction.

8. A fishing tool comprising, a tubular operating string of pipe including a mandrel, means on the lower end of the mandrel for engaging an object stuck in a well, a cylinder through which the mandrel works and forming a closed chamber about the mandrel, a piston on the mandrel and fitted in the cylinder, means for controlling the application of fluid pressure from the string into the cylinder on opposite sides of the piston, alternately, slips on the cylinder engageable, when in active position, with the walls of the well and adapted to allow only upward movement of the cylinder, means initially retaining said wall engaging means in inactive position to allow the tool to be lowered into the well, said retaining means being releasable upon initial application of said fluid pressure to allow said engaging means to move to active position, said cylinder having fluid passageways at its ends, valves arranged to control the cylinder passageways and means for reversing the position of said valves when the piston reaches the limit of its movement in either direction.

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No references cited.