

Sept. 13, 1949.

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2,481,637

COMBINED MILLING TOOL AND PIPE PULLER

Filed Feb. 23, 1945

2 Sheets-Sheet 1

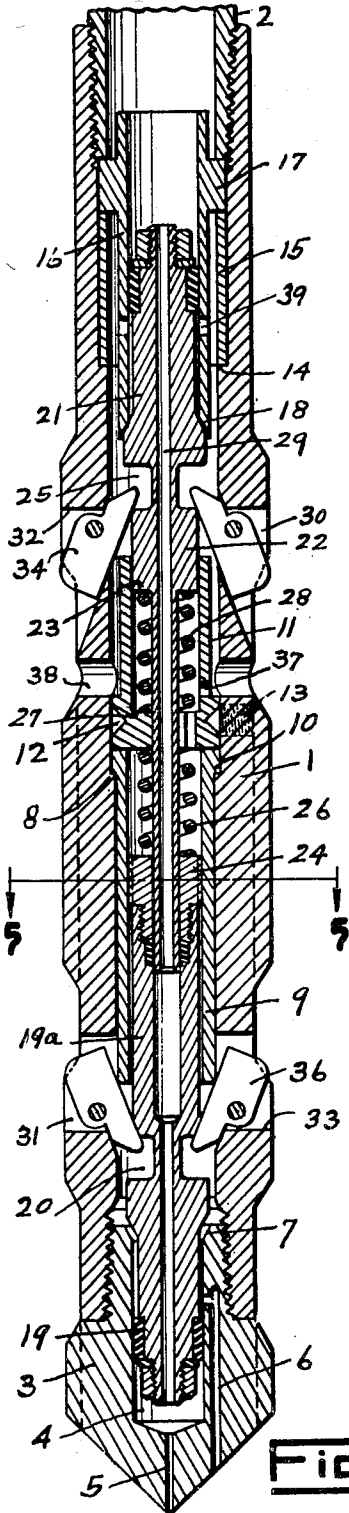


Fig. 1.

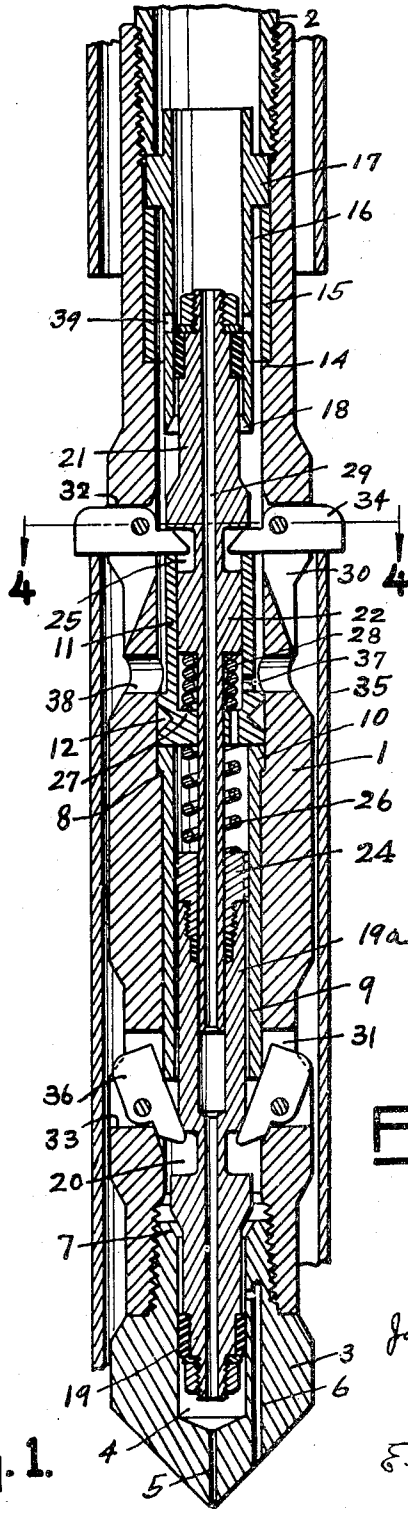


Fig. 2.

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2 Sheets-Sheet 2

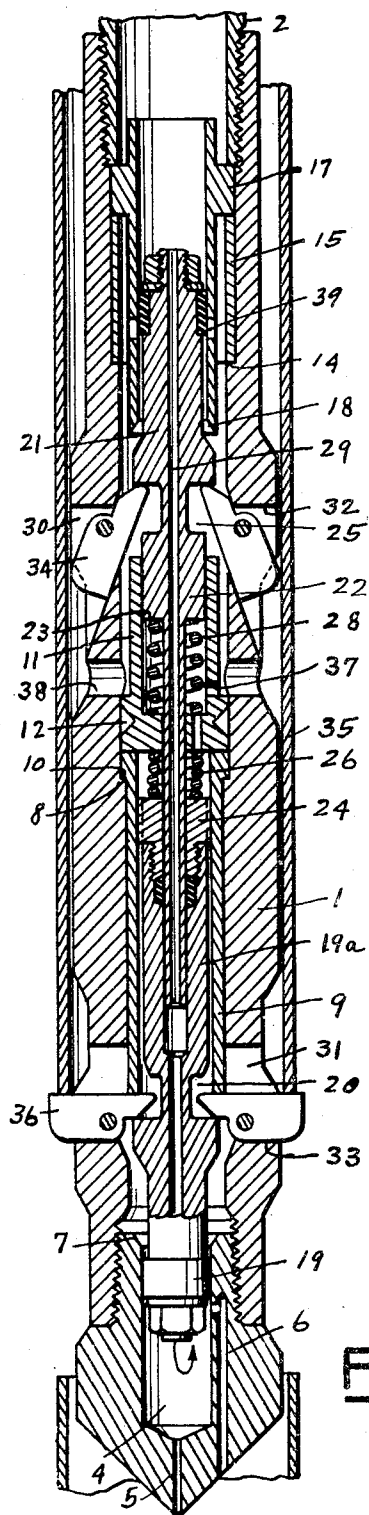


FIG. 3.

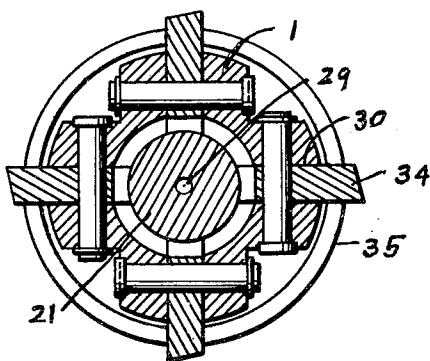


FIG. 4.

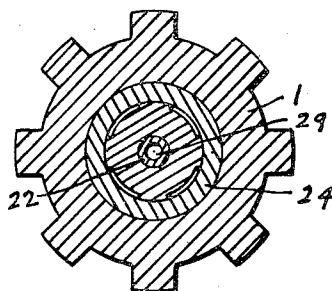


FIG. 5.

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2,481,637

COMBINED MILLING TOOL AND PIPE
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Application February 23, 1945, Serial No. 579,467

10 Claims. (Cl. 164—0.8)

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This invention relates to a combined milling tool and pipe puller.

An object of the invention is to provide a well tool of the character described shaped to be lowered into a pipe in a well and to cut by rotation to sever the pipe and to mill away the section, or a portion thereof, beneath the cut and, if desired, to pull the upper cutoff section from the well.

Another object of the invention is to provide a tool of the character described comprising a body having a series of blades or milling cutters thereon movable outwardly into active position, and having a series of grapples thereon movable outwardly into active position, with means for normally holding said blades and grapples inwardly, or inactive, and means whereby the blades and grapples may be forced, by hydraulic pressure, into active position in the desired sequence.

The invention also comprehends a novel method of cutting and removing stuck pipe from a well.

With the above and other objects in view this invention has particular relation to certain novel features of construction, operation and arrangement of parts, an example of which is given in this specification and illustrated in the accompanying drawings, wherein:

Figure 1 shows a vertical sectional view of the tool in inactive position.

Figure 2 shows a vertical sectional view of the tool showing the milling blades active.

Figure 3 shows a vertical sectional view of the tool showing the milling blades in inactive position and showing the grapples in engagement with a cutoff section of pipe.

Figure 4 shows a cross-sectional view taken on the line 4—4 of Figure 2, and

Figure 5 shows a cross-sectional view taken on the line 5—5 of Figure 1.

Referring now more particularly to the drawings, the numeral 1 designates a tubular body whose upper end may be internally threaded for connection to the lower end of an operating string of pipe 2, which extends to the ground surface.

Screwed into the lower end of the body there is a tubular downwardly tapering guide plug 3 having an internal cylinder 4. This plug has an axial, restricted channel 5 leading downwardly therethrough from the lower end of the cylinder 4, and also has a side channel 6 leading downwardly therethrough and whose upper end is inwardly turned into said cylinder. The up-

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per end of the cylinder 4 is flared forming a seat 7.

The lower portion of the passageway through the body is reduced in diameter forming an annular, upwardly facing, shoulder 8. Fitted within this reduced portion there is a lower tubular housing 9 whose upper end has an external, annular, shoulder 10 which rests on the shoulder 8.

Supported on the upper end of the housing 9 there is an upper tubular housing 11 whose lower end is provided with an external, annular, V-groove 12 and threaded radially through the wall of the body with its inner end projecting into said groove there is a set screw 13 which locks both of said housings in place.

Seated on an inside, annular, shoulder 14, in the body there is a spacer sleeve 15 and within this sleeve, and spaced therefrom, there is an upper cylinder 16 having an external, annular, rib 17 which rests on the upper end of the spacer sleeve 15 and is clamped thereon by the lower end of the string 2. The lower end of this upper cylinder is formed with a downwardly flared seat 18.

Within the lower cylinder 4 there is a piston 19 whose upper end is flared to conform to the shape of the seat 7. The piston 19 has an upwardly extended stem 19a which extends up into the lower end of the housing 9 and this stem has a deep, annular groove 20 therearound.

In the upper cylinder 16 there is a piston 21 whose lower end is flared to conform to the shape of the seat 18. The piston 21 has a depending stem 22 whose lower end is reduced in diameter, forming an external, downwardly facing shoulder 23, and said reduced lower end extends on down and telescopes into the upper end of the stem 19a. On the upper end of the stem 19a and surrounding the reduced lower end of the stem 22 there is a stuffing box 24. Surrounding the stem 22 above the shoulder 23 there is a deep, annular, groove 25.

Mounted within the housing 9 and interposed between the stuffing box 24 and the lower end of the housing 11, and surrounding the stem 22, there is a coil, compression, spring 26; and seated on an inside shoulder 27 in the housing 11, and surrounding the stem 22, there is a coil, compression, spring 28 on which the shoulder 23 rests.

The stems 19a and 21 have an axial channel 29 which leads from the upper cylinder above the piston therein into the lower cylinder beneath the piston therein.

The body has the upper series or radial slots

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30 through the wall thereof and also has a lower series of radial slots 31 through the wall thereof. The upper ends of the slots 30 are radial forming the shoulders 32 and their lower ends taper downwardly and outwardly. The lower ends of the slots 31 extend radially forming the shoulders 33. There are, preferably, four slots of each series as shown in Figure 4.

Pivotaly mounted in the upper slots are the blades, or cutters, 34 whose ends are reduced in width and extend into the groove 25 and the upper sides of these extensions are beveled off, as shown. When in extended position the outer ends of these blades extend out beyond the pipe 35 to be cut and rest against the shoulders 32, which reinforce them, and their inner ends rest on, and are reinforced by, the upper end of the housing 11.

Pivoted in the lower slots 31 are the pipe grapples 36 whose inner ends are reduced in width and extended inwardly into the groove 20 and whose lower sides are beveled off, as shown. When extended these grapples extend out beyond the lower end of the cut off section of pipe and they rest against, and are reinforced by the shoulders 33, while their inner ends rest against and are reinforced by the lower end of the housing 9.

The tool may be assembled as shown in Figure 1 and let down into the pipe 35 in the well to the point where the cut is to be made. While being lowered the grapples and cutters will be held retracted by the pressure of the springs 26 and 28. As the tool is lowered the operating string of pipe 2 may fill with the well liquid through the channels 5 and 29.

Pressure may be applied to the liquid in the string 2 by a pump at the ground surface and this will force the plunger 21 downwardly and when the upper side of the groove 25 engages the inner ends of the blades 34 said blades will be forced outwardly into contact with the pipe 35 and as the tool is rotated the pipe will be severed. As the plunger 21 is forced downwardly the spring 28 will be compressed and the liquid in the upper housing 11 will be forced out through a side port 37 in said housing and on out through radial ports 38 in the body 1.

The cylinder 16 has one, or more, side ports 39 which are normally covered by the piston 21. When the piston 21 moves down far enough to fully expand the cutters 34 these side ports 39 will be uncovered and the liquid may pass on down and out through the slots 30 to cool the cutting blades and to carry away the cuttings.

The cutters 30 will now rest on the upper end of the section of pipe beneath, as shown in Figure 2 and as the tool is rotated the section beneath will be milled away until a sufficient window is formed.

Should it be desired to pull the cut off section above, the tool may be elevated until the blades 34 engage, and are retracted by the upper, or cut off section of pipe and the grapples 36 clear the upper end of the lower section of the pipe and the pressure in the cylinder 4 will elevate the piston 19 until the lower side of the groove 20 engages the extended inner ends of the grapples and forces their outer ends outwardly, all as shown in Figure 3. Upon upward movement of the tool the grapples will engage the lower end of the cut off section and said section may be pulled from the well.

When the piston 19 is elevated it will clear the upper end of the channel 6 and liquid may freely

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flow downwardly into the well beneath for flushing purposes.

As will be noted from an inspection of Figures 4 and 5 the body 1 is provided with external, vertical channels providing for the free return of the flushing liquid outside of the tool.

By relieving the pressure against the piston 21 the springs 26, 28 will retract the cutters and grapples so that the tool can be relocated, if desired, for another operation.

What I claim is:

1. A tool of the character described shaped to be inserted into a pipe in a well and comprising, a body, a cutter pivoted thereon, a grapple pivoted thereon, yieldable means normally holding the cutter and grapple retracted inwardly, means arranged to be actuated by fluid, under pressure, and effective to rotate said cutter on its pivot outwardly to sever said pipe, upon rotation of the tool, and also effective to rotate the grapple, on its pivot, outwardly into active position into engagement with the lower end of the severed pipe section above.

2. A tool of the character described comprising, a body, a cutter pivoted on the body to move outwardly into active position to sever the pipe or inwardly into inactive position, a pipe engaging device pivoted on the body to move outwardly into active, or engaging position underneath the cut off pipe section above, or inwardly into inactive position, yieldable means in the body normally holding the cutter and pipe engaging device inwardly, or in inactive position, independent means in the body arranged to be actuated by fluid, under pressure, for moving the cutter and pipe engaging device outwardly.

3. A cutting and pulling tool comprising, a body, a cutter and a grapple pivoted to rotate on the body, an upper and a lower cylinder in the body, a piston in each cylinder, means operatively connecting one piston with the cutter, means operatively connecting the other piston with the grapple, yieldable means arranged to hold the cutter and grapple retracted and means for controlling the application of fluid, under pressure, to the pistons to move the cutter and grapple outwardly into active position.

4. A tool of the character described comprising a cutter body, a cutter pivoted thereon to move outwardly into active position or inwardly into retracted position, a grapple pivoted on the body to move outwardly into active position or inwardly into retracted position, yieldable means normally holding the cutter and grapple retracted, cylinders in the body, pistons in the cylinders, means operatively connecting the pistons with the cutter and grapple respectively, means for controlling the application of fluid, under pressure to the pistons to actuate the cutter and grapple outwardly into active position, said cylinders having ports normally closed by the respective pistons but which are arranged to be opened when the pistons are actuated to relieve the pressure fluid from the respective cylinders.

5. A tool of the character described comprising a cutter body shaped to be lowered into a stuck pipe in a well, a cutter mounted thereon and movable outwardly into active position or inwardly into inactive position, an upper cylinder in the body having a relief port, a piston in the cylinder operatively connected with the cutter and normally closing said port, a grapple pivoted on the body and movable outwardly into active position and inwardly into retracted position, a lower cylinder in the body having a relief port, a

piston in the lower cylinder operatively connected with the grapple and normally closing said last mentioned port, means for applying fluid under pressure to the pistons to move the same to actuate the cutter and the grapple into active positions and to uncover said ports to permit relief of the operating fluid from the cylinders.

6. A tool of the character described insertable into a stuck pipe in a well and comprising, a body, a cutter pivoted thereon, a grapple pivoted thereon, yieldable means normally holding the cutter and grapple retracted, means arranged to be actuated by fluid, under pressure, and effective to rotate said cutter and grapple in succession, on their pivots, outwardly into active position whereby the cutter will sever the pipe, upon rotation of the tool and the grapple will engage the lower end of the severed section upon upward movement of the tool, said tool having a channel for the flow of flushing fluid downwardly there-through.

7. A tool of the character described adapted to cut by rotation and comprising, a body shaped to be lowered into a pipe in a well, a cutter mounted thereon and movable outwardly into active or cutting position or inwardly into retracted position, a grapple mounted on the body and movable outwardly into active position underneath the lower end of the cut off pipe section or inwardly into retracted position, means for supporting the grapple in active position and means under the control of an operator effective to actuate the cutter or grapple into active position.

8. A tool of the character described comprising, a body shaped to be lowered into a pipe in a well, a cutter mounted thereon and movable outwardly into active position or inwardly into retracted position, a grapple mounted on the body and movable outwardly into active position or inwardly into retracted position, means underneath the grapple to support it when it is in active position and means arranged to be actuated by fluid under

pressure effective to actuate the cutter or grapple into active position.

9. A pipe cutting and pulling tool adapted to cut by rotation and shaped to be lowered into a pipe in a well and comprising, a body, a cutter thereon movable outwardly and adapted to cut a window through the pipe upon rotation of the tool, means for moving the cutter outwardly, a grapple on the body, said cutter being mounted so as to be retracted by the severed section of pipe above upon upward movement of the tool, means for moving the grapple outwardly through said window and into position to engage the severed section above upon further upward movement of the tool.

10. A pipe cutting and pulling tool adapted to cut by rotation and shaped to be lowered into a pipe in a well and comprising, a body, a cutter thereon movable outwardly and adapted to cut a window through the pipe upon rotation of the tool, means for moving the cutter outwardly, a grapple on the body, means for moving the grapple outwardly whereby, upon movement of the tool in the pipe to bring the grapple opposite the window, said grapple will be projected out through the window and into position to engage the severed section above upon upward movement of the tool.

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