

May 29, 1945.

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PULLING TOOL

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2 Sheets-Sheet 1

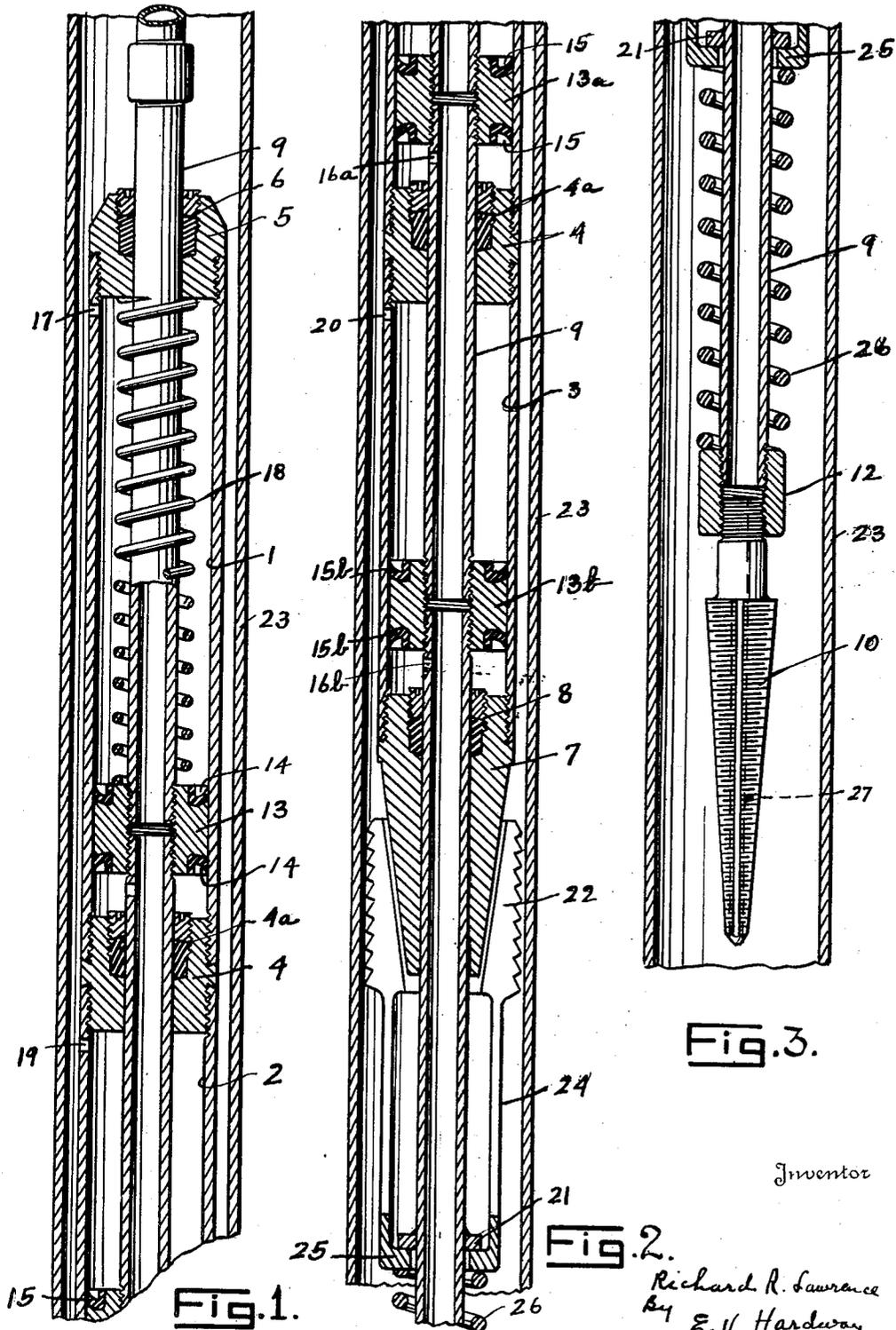


Fig. 3.

Fig. 2.

Fig. 1.

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2 Sheets-Sheet 2

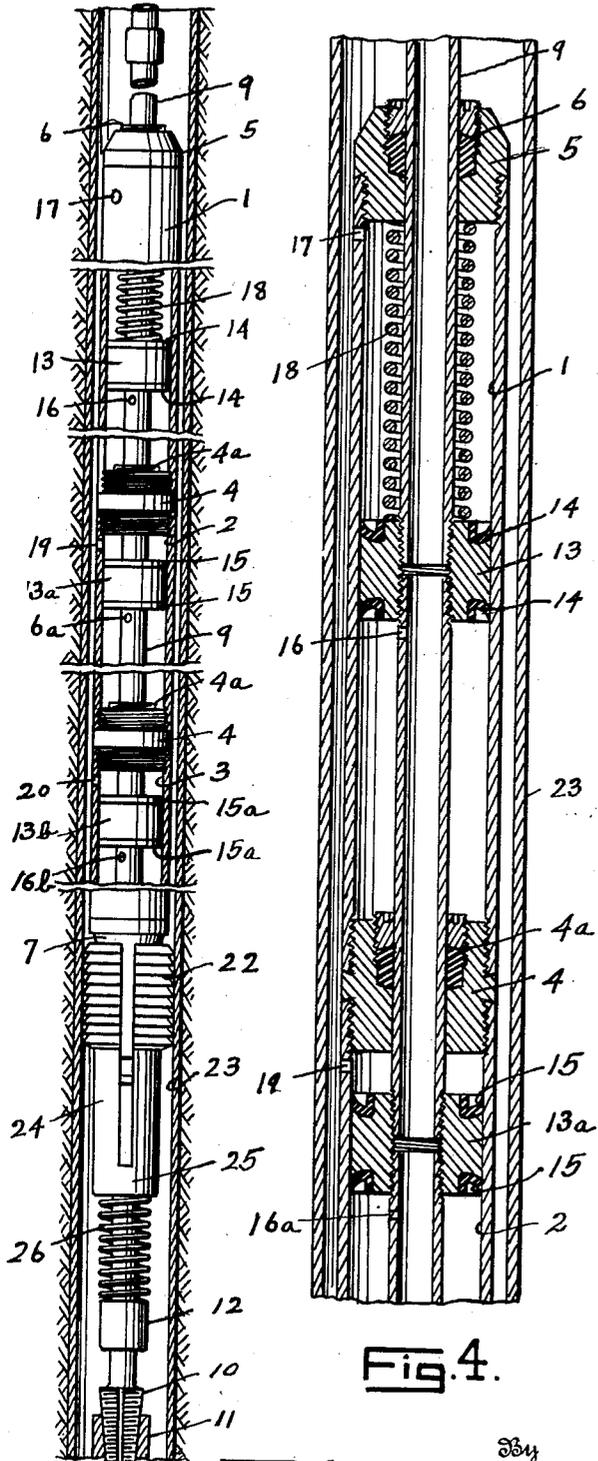


Fig. 4.

Fig. 6.

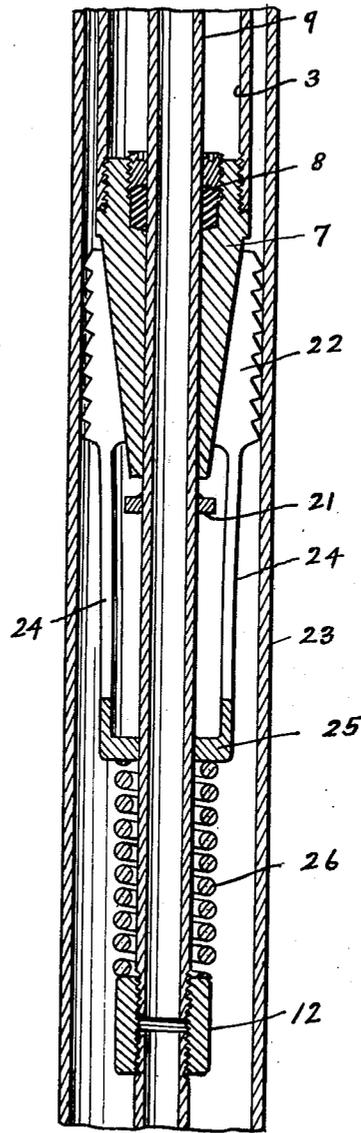


Fig. 5.

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PULLING TOOL

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8 Claims. (Cl. 294—86)

This invention relates to a pulling tool and has particular relation to a tool which has been designed to be hydraulically operated.

An object of the invention is to provide a pulling tool of the character described specially designed for pulling stuck pipe or other stuck object from a well.

A further object of the invention is to provide a tool of the character described embodying a grapple engageable with a pipe or other stuck object in a well bore, a series of cylinders with anchoring means for anchoring the cylinders to the well casing with pistons in the cylinders connected with the grapple and designed to be actuated by liquid under pressure in the cylinders to exert a pull on the grapple and on the stuck object to dislodge the latter whereby it can be removed from the well bore.

With the above and other objects in view the 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—

Figures 1, 2 and 3 show vertical sectional views of the upper, intermediate and lower ends respectively of the tool shown in inactive position and shown located in the well casing which is shown also in section.

Figures 4 and 5 show upper and intermediate sections of the tool in active position and shown in vertical section as located in the well casing which is also shown in section, and

Figure 6 shows a side elevation of the puller, partly in section, and in active position.

Referring now more particularly to the drawings wherein like numerals of reference designate similar parts in each of the figures, the numerals 1, 2 and 3 designate upper, intermediate and lower cylinders. Only three of said cylinders are shown, although any selected number may be employed. The cylinders are connected by inside couplings 4 containing stuffing boxes 4a.

Screwed into the upper end of the upper cylinder 1 there is a head 5 containing a stuffing box 6 and screwed into the lower end of the lower cylinder 3 there is a jaw expander 7 containing a stuffing box 8. The outer surface of the expander 7 tapers downwardly and inwardly.

An operating string of tubing 9 extends from the ground surface down through the stuffing boxes 6, 4a and 8 and connected to its lower end there is a grapple 10. Any type of grapple may be used designed to engage with the object to be pulled. In the illustration it is shown as a tapering tap designed to be screwed into the stuck pipe, or other stuck object, as 11. It is attached to the operating string by means of an enlarged coupling 12.

Fixed upon the operating string, within the

respective cylinders, are the upper and lower pistons 13, 13a, 13b which are provided with the external, annular upwardly and downwardly opening cup rings 14, 14, 15, 15 and 15a, 15a.

The operating string of pipe has the upper and lower outlet ports 16, 16a, 16b immediately beneath the respective pistons.

The upper cylinder 1 is somewhat longer than the cylinders beneath and interposed between the head 5 and the upper piston 13. There is a strong coil spring 18 which normally holds the pistons at the lower ends of their respective cylinders.

The upper ends of the cylinders have the outlet ports 17, 19 and 20.

Secured onto the operating string and beneath the jaw expander 7 there is a ring or flange 21.

The numeral 22 designates slip jaws whose inner sides are tapered to correspond to the external taper of the expander 7 and whose outer sides are toothed to engage the well casing 23. These slip jaws are attached to the upper ends of the flexible arms 24 and the lower ends of these arms are formed integrally with an annular anchor 25 which closely surrounds the operating string 9 beneath the ring 21.

A strong coil spring 26 is interposed between the coupling 12 and the anchor 25 and surrounds the operating string 9.

The tool may be assembled and lowered into the well as indicated in Figures 1, 2 and 3 and the grappling tool 10 may be engaged with the stuck object as indicated in Figure 6. While being so lowered the spring 18 will hold the respective pistons at the lower ends of the cylinders.

An operating liquid, under pressure, may then be forced down through the operating string 9 and through the ports 16, 16a and 16b and the pressure fluid in the cylinder beneath the pistons will operate against the upper ends of the couplings 4 and against the upper end of the expander 7 to move the cylinders downwardly forcing the expander 7 between the jaws 22, said jaws being, meanwhile, held elevated by the spring 26.

The jaws will thus be expanded into engagement with the well casing, as shown in Figures 5 and 6. An increase of pressure beneath the pistons will now cause said pistons to move upwardly causing a corresponding upward movement of the operating string 9, the grapple 10 and the stuck object engaged by said grapple. The liquid in the cylinders above the pistons may escape out through the cylinder ports 17, 19 and 20. The pistons have a relatively large area against which the pressure fluid may operate and inasmuch as the cylinders are anchored by the slip jaws 22 against downward movement this pressure will exert a tremendous upward pull so that in most cases the stuck object will be readily dislodged so that it can be pulled out.

The power of the puller may be multiplied by increasing the number of cylinders and pistons and in the event the stuck object cannot be pulled with the tool having a given number of cylinders and pistons additional cylinders and pistons may be added in accordance with the requirements of the situation.

While the tool is in pulling position, as shown in Figures 5 and 6, the spring 28 will be under compression and will operate to hold the slip jaws 22 in close engagement with the well casing; but while being lowered into the well the flange 21 will engage the anchor 25, as shown in Figure 2, and will hold the slips in their inactive position to prevent their premature engagement with the casing 23.

If it should be desired to release the tool and withdraw it the pressure may be reversed, that is, liquid under pressure may be forced by the pump, down through the casing and into the cylinders above the pistons through the ports 17, 19 and 20. This will cause relative upward movement of the cylinders thus releasing the slip expander 7 from the slip jaws and permitting them to disengage the casing. If the stuck object has been loosened it may be then pulled out with the puller but if it could not be dislodged the grapple 10 may be released from the stuck object and the puller withdrawn from the well.

The grapple 10 may be provided with a channel 27 leading therethrough from end to end so that when the tool is lowered into the well the operator can, at any time desired by him, establish circulation through the bore of the well by forcing drilling liquid downwardly through the tubing 9 and through the channel 27 which will return up to the ground surface through the well casing 23 and around the tool.

What I claim is:

1. A pipe puller adapted to be lowered into a well and comprising, a tubular operating string having an outlet port, a cylinder mounted to move longitudinally on the string and whose lower end is closed, a piston in the cylinder fixed on the string above the port, a grapple on the string beneath the cylinder and means for anchoring the cylinder to the walls of the well whereby the grapple will be moved upwardly upon application of fluid under pressure into the cylinder.

2. A pipe puller adapted to be lowered into a well and comprising, a tubular operating string, a cylinder thereon whose lower end is closed, a piston fixed on the string and located in the cylinder, a grapple on the string beneath the cylinder, means for anchoring the cylinder to the wall of the well bore, said string having an outlet port into the cylinder whereby fluid under pressure may be forced downwardly through the string into the cylinder to move the piston, string and grapple upwardly.

3. A pipe puller adapted to be lowered into a well and comprising, a tubular operating string, a cylinder thereon whose lower end is closed, a piston fixed on the string and located in the cylinder, a grapple on the string beneath the cylinder, means for anchoring the cylinder to the wall of the well bore, said string having an outlet port into the cylinder whereby fluid under pressure may be forced downwardly through the string into the cylinder to move the piston, string and grapple upwardly and a yieldable member normally holding the piston in its lower position in the cylinder.

4. A pipe puller adapted to be lowered into a

well and comprising, a tubular operating string, a cylinder thereon whose lower end is closed, a piston fixed on the string and located in the cylinder, a grapple on the string beneath the cylinder, means for anchoring the cylinder to the wall of the well bore, said string having an outlet port into the cylinder whereby fluid under pressure may be forced downwardly through the string into the cylinder to move the piston, string and grapple upwardly, said cylinder having an outlet port at its upper end for the exhaust of liquid therefrom as the piston moves upwardly.

5. A pipe puller adapted to be lowered into a well and comprising, a tubular operating string, a plurality of aligned cylinders thereon whose lower ends are closed, pistons fixed on the string and located in the respective cylinders, a grapple on the lower end of the string beneath the cylinders, means for anchoring the cylinders to the wall of the well bore, said string having outlet ports leading into the cylinders for the admission of fluid under pressure from the string into the cylinders to elevate the pistons, string and grapple.

6. A pipe puller adapted to be lowered into a well and comprising, a tubular operating string, a plurality of aligned cylinders thereon whose lower ends are closed, pistons fixed on the string and located in the respective cylinders, a grapple on the lower end of the string beneath the cylinders, means for anchoring the cylinders to the wall of the well bore, said string having outlet ports leading into the cylinders for the admission of fluid under pressure from the string into the cylinders to elevate the pistons, string and grapple, said cylinders having outlet ports above the pistons.

7. A pipe puller adapted to be lowered into a well and comprising, a tubular operating string, a plurality of aligned cylinders thereon whose lower ends are closed, said string extending axially through the cylinders and sealed with the lower ends thereof, pistons fixed on the string and located in the respective cylinders, a grapple on the string beneath the cylinders, means for anchoring the cylinders to the wall of the well bore, said string having outlet ports into the cylinders beneath the pistons whereby an operating fluid under pressure may be admitted into the cylinders to elevate the pistons, said cylinders having relief ports above the pistons.

8. A pipe puller adapted to be lowered into a well and comprising, a tubular operating string, a cylinder thereon whose lower end is closed and provided with a depending jaw expander, a piston fixed on the string and located in the cylinder, a grapple on the string beneath the cylinder, yieldable means for holding the piston and string in lower position relative to the cylinder, slip jaws around the expander, means on the string for holding said jaws in the lower position relative to the expander, said string having an outlet port into the cylinder for the admission of fluid under pressure from the string into the cylinder whereby the piston, string and grapple will be moved upwardly relative to the cylinder and a yieldable member for moving said slip jaws upwardly, upon upward movement of the string, whereby the jaws will be expanded, by said expander, into engagement with the walls of the well bore to anchor the cylinder against downward movement.

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