Aug. 31, 1954 E. A. DUNN 2,687,778

HYDRAULIC SLIP SETTING MEANS

Filed June 16, 1952

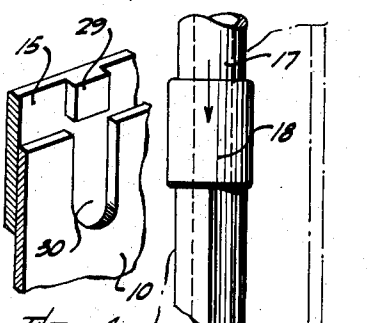


FIG. 4.

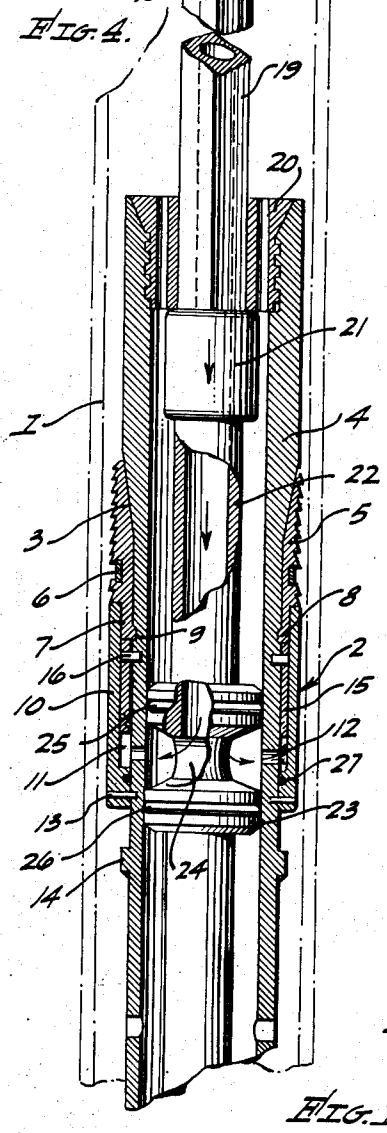


FIG. 1.

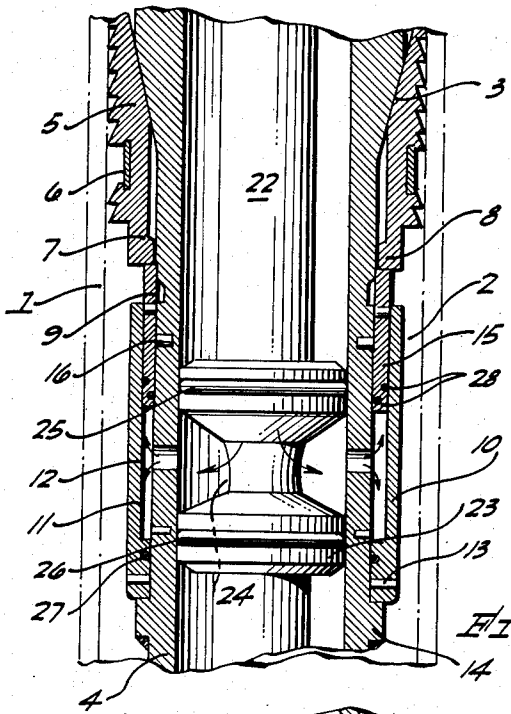


FIG. 3.

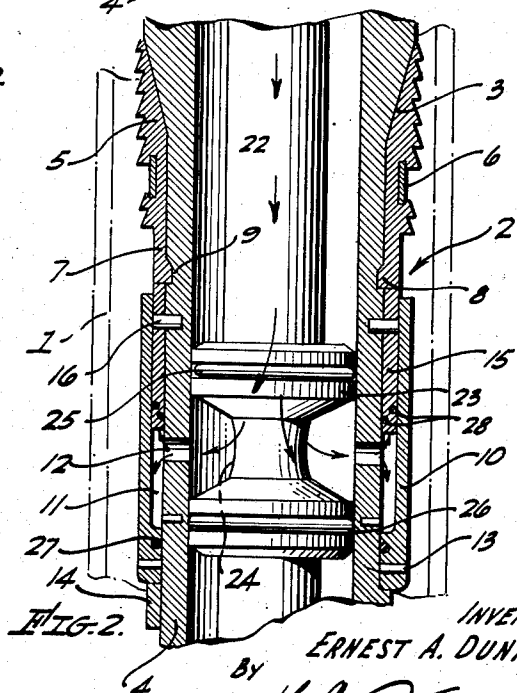


FIG. 2.

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Patented Aug. 31, 1954

2,687,778

UNITED STATES PATENT OFFICE

2,687,778

HYDRAULIC SLIP SETTING MEANS

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Application June 16, 1952, Serial No. 293,819

2 Claims. (Cl. 166—212)

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This invention relates to a means of hydraulically setting the slips on an oil well tool, such as a gravel packing tool, a washer, or other similar oil well tools, the purpose being to suspend the tool within the bore of a well and preferably within the casing of that well.

An object of my invention is to provide a novel means to hydraulically set the slips of an oil well tool, which consists of an external longitudinally slidable sleeve within one position thereof, projects over the lower end of the slips to hold the slips against outward movement, and also against longitudinal movement on the body of the tool.

Still another object of my invention is to provide a novel means to hydraulically set the slips of an oil well tool which consists of an external ring operating in sequence with the external sleeve, this external ring being hydraulically pressed against the bottom of the slips to force the slips upwardly and outwardly on their tapered seats to engage the casing or the bore of the well.

A feature of my invention is to provide a novel means of hydraulically setting the slips of an oil well tool, which consists in providing ports in the body of the tool with which a control piston is alignable to direct fluid under pressure directly into these ports, to hydraulically press the sleeve and the ring in opposite directions for the purpose previously stated.

Another feature of my invention is to provide an external sleeve and an external ring on the outside of the oil tool body, the sleeve and the ring being both slidable and in opposite directions, and to provide a hydraulic means of moving first the sleeve in one direction, and then the ring in another direction, thereby first releasing the slips for movement on the body of the tool and subsequently moving the slips under hydraulic pressure.

Other objects, advantages and features of invention may appear from the accompanying drawing, the subjoined detailed description and the appended claims.

In the drawing:

Figure 1 is a fragmentary longitudinal sectional view of a gravel packing tool embodying my invention, and in which the slips are in retracted position.

Figure 2 is a fragmentary longitudinal sectional view of the slip portion of an oil well tool embodying my invention, and showing the external sleeve in position to release the slips.

Figure 3 is a longitudinal sectional view similar to Figure 2, but showing the slips in set position engaging the casing.

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Figure 4 is a fragmentary perspective view of the ring and sleeve construction.

Referring more particularly to the drawing, the numeral 1 indicates the usual casing in an oil well and 2 indicates a cylindrical oil well tool, such as a gravel packing tool which is run into the well for the purpose of depositing a gravel layer or bed at the bottom of the well. The tool here shown deposits gravel in a bed at the bottom of a well, the gravel is carried in a stream of mud and water under pressure, all of which is usual and well known in the art. The gravel remains behind in a bed at the bottom of a well, while the mud and water return upwardly to the surface and are then recirculated.

Other tools, such as pressure washers and the like, may also employ my slip setting means.

An annular tapered seat 3 is provided on the outside of the body 4 of the tool 2 and a plurality of toothed slips 5 rest on the seat 3 and are held in assembled position against the seat by means of a circular spring 6. Each of the slips 5 are formed with a depending skirt 7 which is formed with an inwardly projecting flange 8. This flange fits into an annular groove 9 formed in the body 4, the flanges fitting into this groove in the retracted position of the slips as shown in Figure 2.

To positively hold the slips 5 in their retracted position until it is desired to set the tool in its position in the casing 1, I provide an external sleeve 10 which is mounted on the outside of the tool body 4 and is spaced from the outer surface of the body 4 to provide an annular pressure chamber 11. One or more ports 12 extend through the body 4 of the tool and into the chamber 11, thus enabling the hydraulic fluid to move into the chamber 11 to operate the sleeve 10, as will be further described.

When running into the well the sleeve 10 extends over the skirt 7 of the slips 5 to hold the flanges 8 in the groove 9, as shown in Figure 1 of the drawing. One or more shear pins 13 extend through the sleeve 10 and into the body 4, and this shear pin is of a proper diameter so that it will shear first when hydraulic pressure is exerted in the chamber 11, and thus insuring that the sleeve 10 will first push downwardly to the position shown in Figure 2, thus releasing the slips 5 and permitting them to be subsequently pushed upwardly and outwardly into set position. The sleeve 10 engages a stop 14 on the outside of the body 4, thus limiting the downward movement of the sleeve.

A slip setting ring 15 also surrounds the tool

body 4 and is positioned within the sleeve 10 and above the ports 12. A shear pin 16 of larger diameter than the pin 13 normally holds the ring 15 in its lower position, and when hydraulic pressure is exerted in the chamber 11 the sleeve 10 will first move downwardly after the pin 13 is sheared, then the pin 16 will shear after which the ring 15 will be pushed upwardly and the skirt 7 can move out of the groove 9 and the slips 5 can be pushed upwardly and outwardly on their seats 3.

The tool 2, such as a gravel packing tool, is suspended on the usual drill pipe 17, which terminates in a collar 18, all of which is usual and well known. A square pipe section 19 is threaded into the collar 18 and extends downwardly into the tool 2 through a head 20 on the upper end of the tool. A coupling 21 is attached to the lower end of the pipe section 19, and a tube 22 is threaded into this collar at its upper end and is fixedly attached to the piston 23 at its lower end. The drill pipe 17, the pipe 19 and the tube 22 all are tubular in form so as to provide a circular passage through which fluid can pass into the piston 23. The piston 23 is provided with laterally extending ports 24 through which the fluid can flow into the ports 12 for the purpose of actuating the sleeve 10 and the ring 12, as previously described.

In the position of the piston 23, shown in the drawings, only mud and water are circulated downwardly through the drill pipe 17 and, consequently, it is a watery substance which exerts the hydraulic pressure on the sleeve 10 and the ring 15. The piston 23 is moved to another position to deposit gravel, all of which is usual and well known in the art. The piston 23 is also provided with upper and lower O rings 25 and 26, thus packing off the piston above and below the ports 12. The sleeve 10 is also provided with a packing ring 27 adjacent its lower end to prevent leakage downwardly past the sleeve. The ring 15 is also provided with packings 28 to prevent leakage past this ring.

In operation the tool 2 is run into the well with the body 4 thereof resting on the collar 21. In this position the piston 23 is so spaced within the tubular body 4 that its outlet ports 24 are in alignment with the holes 12 in the wall of the tool body 4. Hydraulic pressure is now exerted in the drill pipe 17 which first causes the pin 13 to shear and then presses the sleeve 10 downwardly against the stop 14, as shown in Figure 2. Continued exertion of hydraulic pressure will now shear the pin 16, causing the ring 15 to be pushed upwardly, thus pressing the slips 5 upwardly and outwardly on their seats 3 to engage the casing 1, as shown on Figure 3. The tool is now held within the casing 1 against accidental longitudinal movement and the piston 23 can be moved as required to another position, for the purpose of either opening other ports for washing purposes, or depositing gravel through other ports in the tool not shown, but which are usual and well known in the art.

Under certain conditions it is found that the slips 5 will move outwardly in their raised position so that the top of the ring 15 tends to slide between the slip 5 and the body of the tool. To overcome this, I provide a lug 29 on the ring, which projects outwardly therefrom. The sleeve

10 is formed with a slot 30 extending downwardly from the top thereof into which the lug 29 moves when the sleeve is in its raised position, as previously described.

Having described my invention, I claim:

1. A hydraulic slip setting means, including an oil well tool, a tubular body on said tool, slips mounted on the outside of said tubular body and movable longitudinally of the body into set position, a slip setting means comprising a ring slidably mounted for longitudinal movement on the outside of said tubular body, said ring bearing against the bottom of said slips, a sleeve the upper end thereof fitting the outside of said ring and spaced from the tubular body to provide a chamber, the lower end of said sleeve fitting the outside of said body said body having a hole through the wall thereof communicating with said chamber whereby fluid under pressure may pass into the chamber to press said sleeve downwardly, said sleeve projecting over the lower end of the slips in the raised position of the sleeve, a pipe extending into said body to suspend the same, a piston on the lower end of said pipe and within said body, said piston fitting closely within the body and said piston having a port extending laterally thereof and alignable with said hole to permit fluid to pass from said pipe through the piston and through said hole, a shear pin extending through the sleeve and into the body, a second shear pin extending through the ring and into the body, the second named shear pin being greater in diameter than the first named shear pin, whereby said sleeve will be actuated first and said ring will be actuated secondly.

2. A hydraulic slip setting means, including an oil well tool, a tubular body on said tool, slips mounted on the outside of said tubular body and movable longitudinally of the body into set position, a skirt depending from the slips, said tubular body having a groove therein, an inwardly projecting flange on each skirt extending into the groove, a slip setting means comprising a ring, slidably mounted for vertical movement on the outside of said tubular body, said ring bearing against the bottom of the skirts, a sleeve, the upper end thereof surrounding the ring and the lower end of the sleeve engaging and being movable vertically on the tubular body, said sleeve projecting over the slip skirts in one position of the sleeve, said sleeve being spaced from the tubular body to provide a chamber, said body having a hole through the wall thereof communicating with said chamber whereby fluid under pressure may pass into the chamber to press said sleeve downwardly and said ring upwardly in sequence, a shear pin extending from the sleeve into the body, a second shear pin extending from the ring into the body, said first named shear pin being of lesser diameter than the second named shear pin to permit the sleeve to be actuated before the ring on application of hydraulic pressure.

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