

Aug. 2, 1960

R. A. TAPPMAYER
WELL CASING BACK-OFF TOOL

2,947,520

Filed Dec. 28, 1953

5 Sheets-Sheet 1

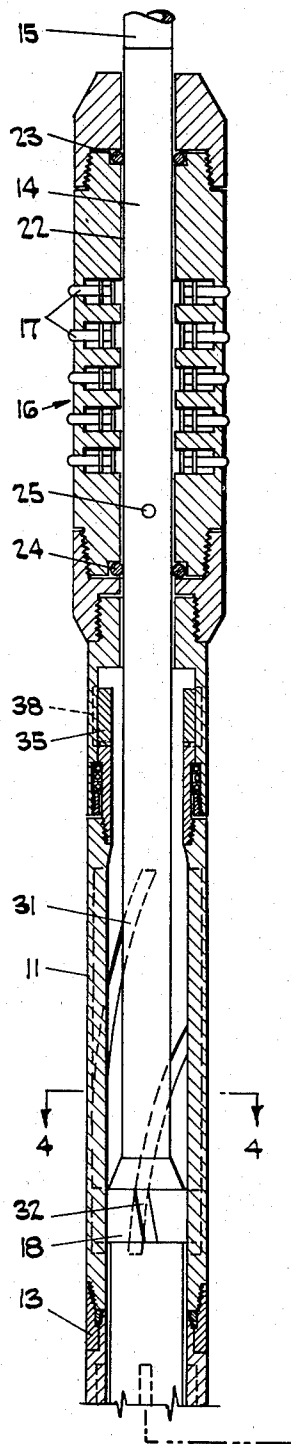


FIGURE 1

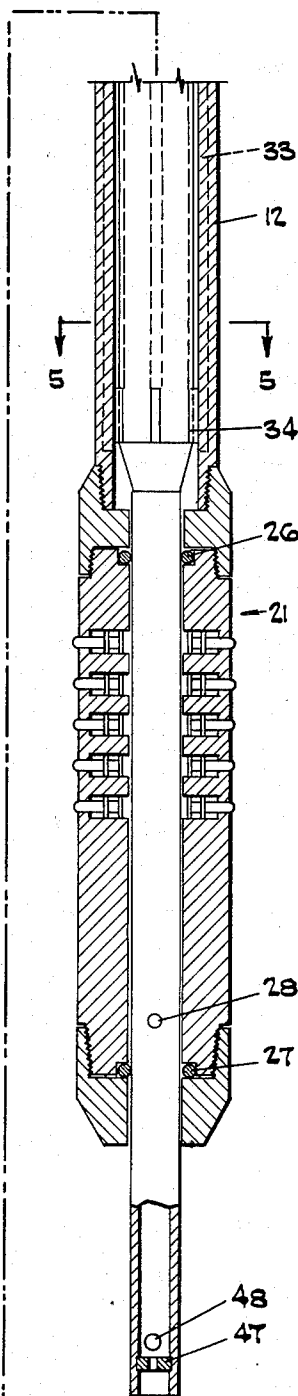


FIGURE 2

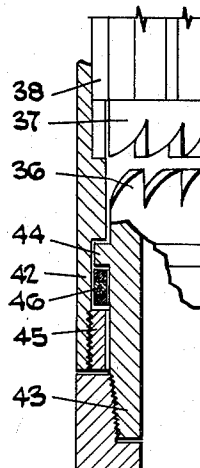


FIGURE 3

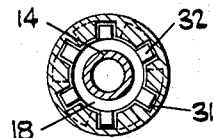


FIGURE 4

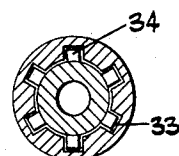


FIGURE 5

Inventor:
R. A. TAPPMAYER
By *J. H. McCarthy*
His Agent

Aug. 2, 1960

R. A. TAPPMAYER

2,947,520

WELL CASING BACK-OFF TOOL

Filed Dec. 28, 1953

5 Sheets-Sheet 2

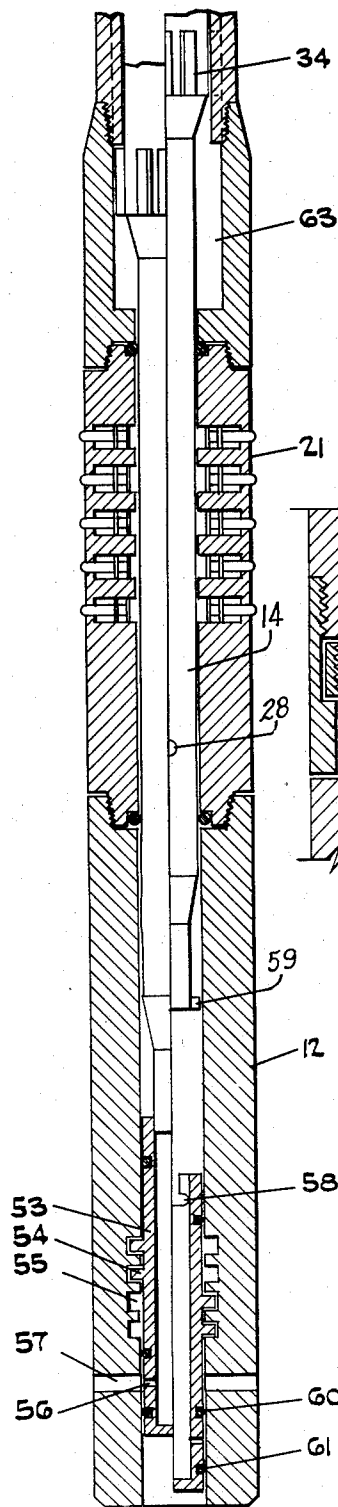
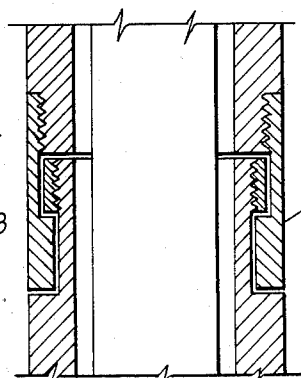


FIGURE 13

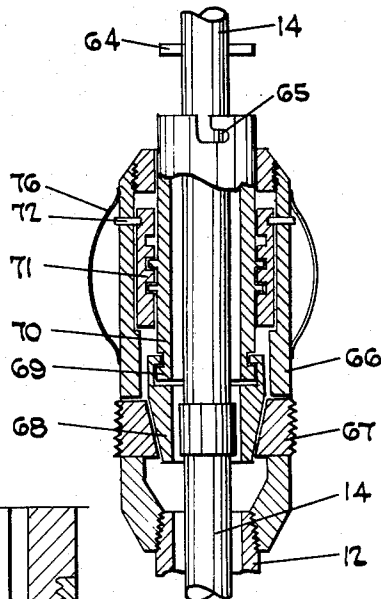


FIGURE 7

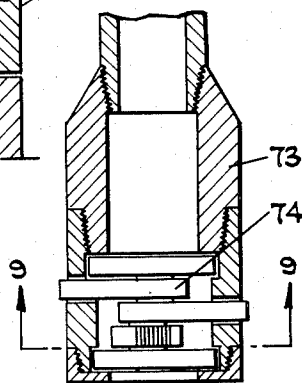


FIGURE 8

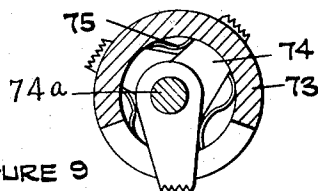


FIGURE 9

FIGURE 6

Inventor:
R.A.TAPPMAYER
By *J. H. McCarthy*
His Agent

Aug. 2, 1960

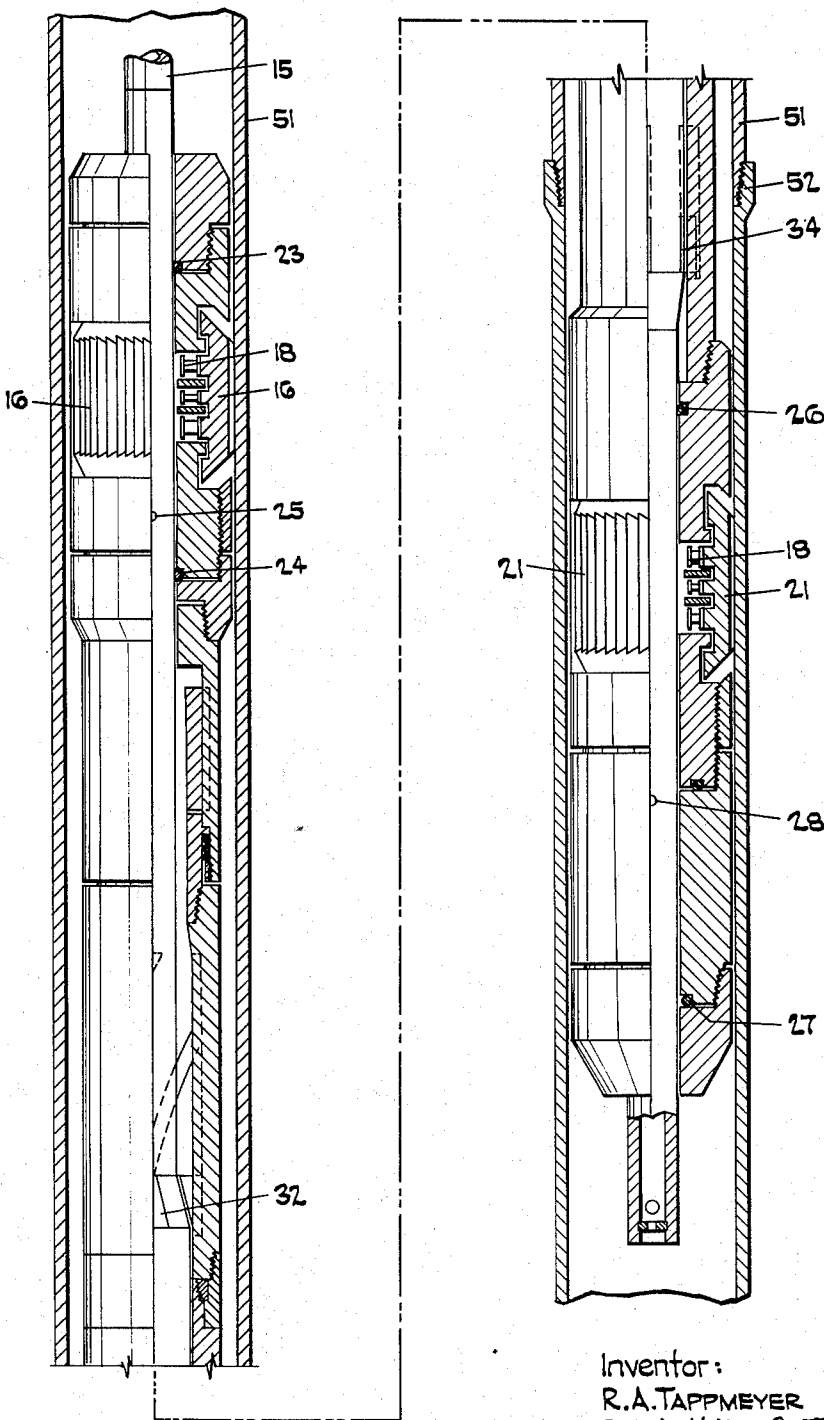
R. A. TAPPMAYER

2,947,520

WELL CASING BACK-OFF TOOL

Filed Dec. 28, 1953

5 Sheets-Sheet 3



Inventor:
R.A. TAPPMAYER
By *J. H. McCarthy*
His Agent

Aug. 2, 1960

R. A. TAPPMAYER

2,947,520

WELL CASING BACK-OFF TOOL

Filed Dec. 28, 1953

5 Sheets-Sheet 4

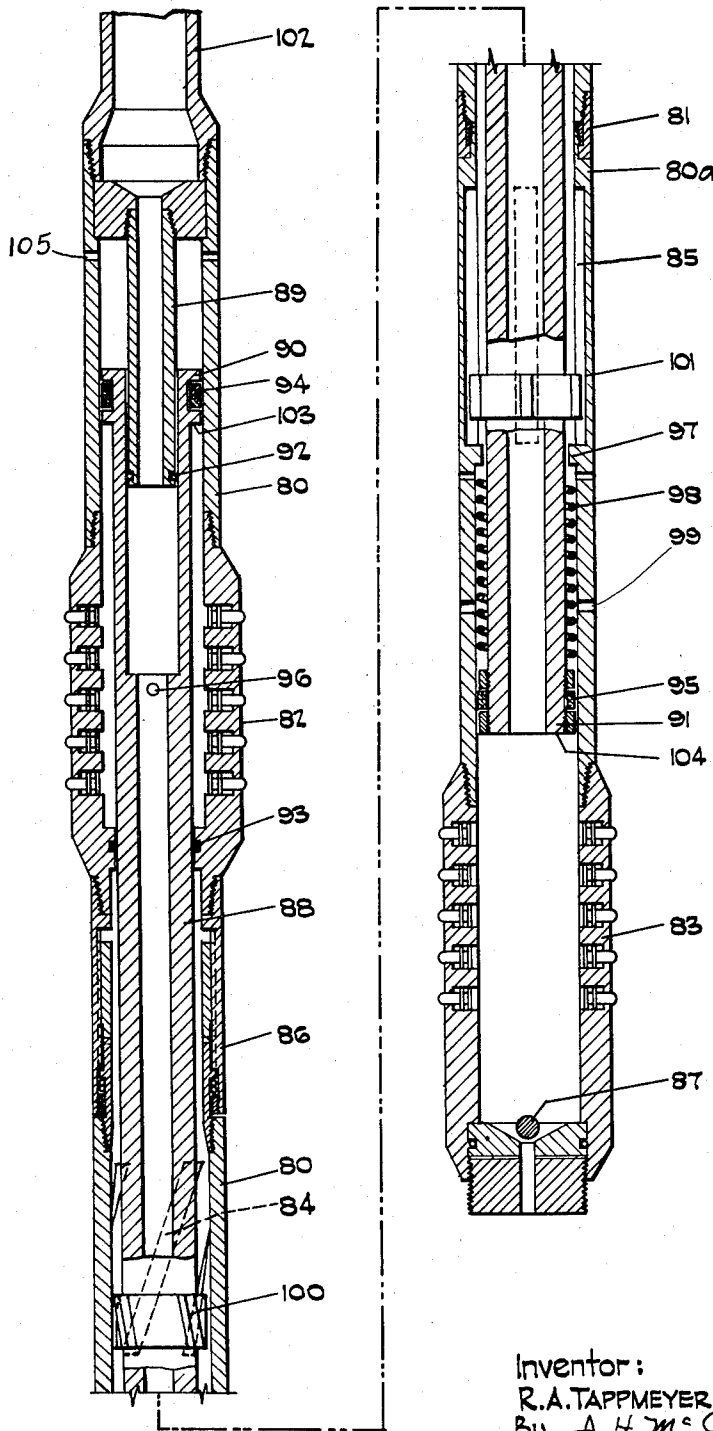


FIGURE II

Inventor:
R.A. TAPPMAYER
By *A. H. McCarthy*
His Agent

Aug. 2, 1960

R. A. TAPPMAYER

2,947,520

WELL CASING BACK-OFF TOOL

Filed Dec. 28, 1953

5 Sheets-Sheet 5

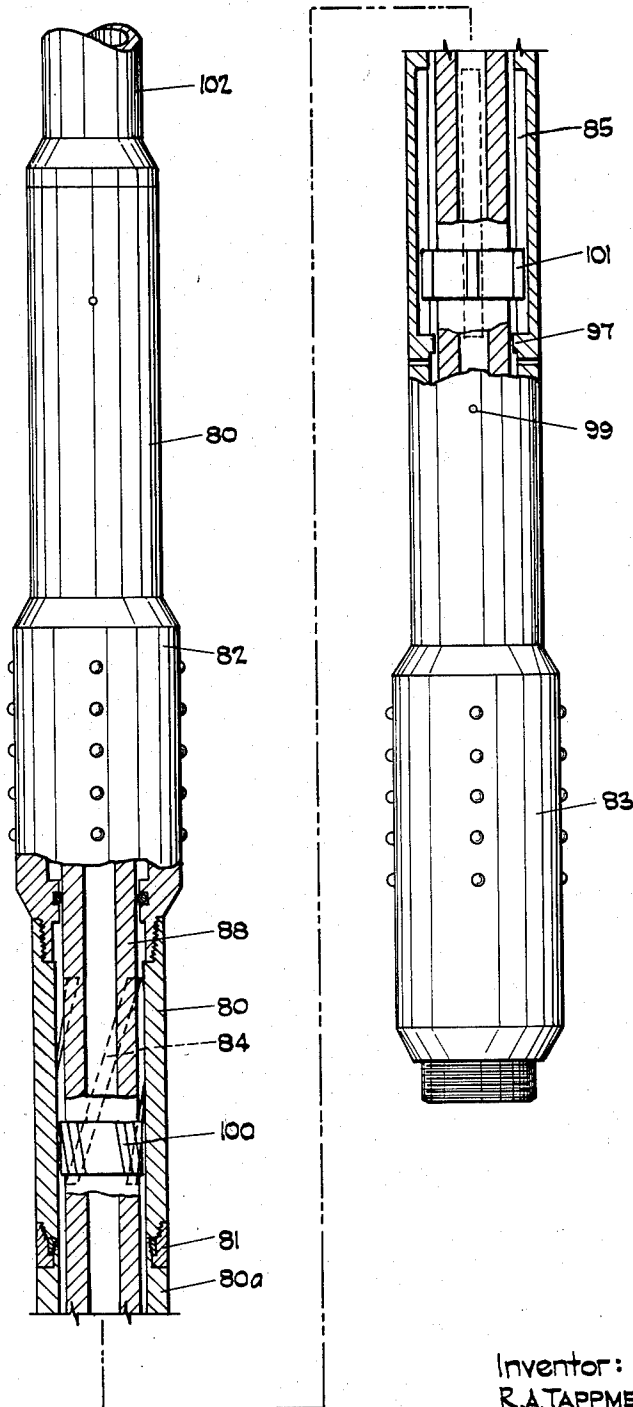


FIGURE 12

Inventor:
R.A. TAPPMAYER
By *J. H. McCarthy*
His Agent

1

2,947,520

WELL CASING BACK-OFF TOOL

Ronald A. Tappmeyer, Corpus Christi, Tex., assignor to Shell Oil Company, a corporation of Delaware

Filed Dec. 28, 1953, Ser. No. 400,416

2 Claims. (Cl. 255—35)

This invention relates to a new and useful well tool and pertains more particularly to a device for unscrewing the threaded joints of two sections of a tubular string, such as a well casing, while it is positioned at a considerable depth within a well borehole.

After an oil well has been drilled, the well borehole is normally cased by inserting into said borehole a number of sections of pipe which are coupled together end to end to form a tubular casing string. This casing string is normally secured in the well borehole by means of injecting cement into the annular space between the borehole wall and the outer surface of the casing string at various levels within the borehole.

In many oil fields, such as in the East Texas field, there has arisen a serious problem of casing leaks opposite shallow fresh water sands which lie at depths at 100 to 500 feet or more from the surface. These leaks are caused by corrosive action on the outside of the well casing.

Some of the remedial measures tried in the field include: (1) squeeze cementing, (2) setting straddle packers with a gas bypass in the case of pumping wells, (3) cutting the casing off below the leak and splicing with new casing by employing an overshot-type patch tool, and (4) backing off, that is, unscrewing, the casing below the leak and stabbing into the casing string with new casing. Obvious difficulties are apparent in the application of any one of these listed remedial measures. The latter two, whereby new casing is secured opposite the corroded section, are the most satisfactory from the standpoint of long-term correction.

Since the method of backing off or unscrewing the casing below the leak and stabbing into the casing string with new casing is the cheaper of the last two above-named remedial measures, it is the primary object of this invention to provide a back-off tool for unscrewing the threaded joints of two sections of well casing which may be positioned at a considerable depth within a well borehole.

If torque is applied to the top of a well casing, to unscrew or back-off a certain portion of the well casing at a desired depth, there is no means or method of determining exactly at what point, that is, at what threaded joint, the well casing will be broken to permit one portion of the casing string to be separated from the rest. The casing string may separate or become unscrewed at any one of the threaded joints either at or above or below the desired depth. Additionally, if substantial corrosion has taken place so as to weaken the casing string at a certain point, torque applied to the top of the casing string may cause the string to be broken or twisted off at the corroded point. It is, therefore, another object of the present invention to provide a device adapted to be inserted into a casing string to a predetermined depth so as to straddle the threaded joint or coupling of two sections of said string in order to unscrew a predetermined joint at the desired level.

2

Another object of this invention is to provide a back-off tool adapted to straddle a threaded joint of a well casing and to be either hydraulically or mechanically actuated to rotate the section of the well casing above said joint, thereby unscrewing it from the fixedly positioned section of well casing below said joint.

These and other objects of this invention will be understood from the following description taken with reference to the attached drawing, wherein:

Figure 1 is a view, partly in cross-section, of the upper portion of a back-off tool constructed in accordance with the present invention.

Figure 2 is a vertical view, partly in cross-section of the lower portion of said back-off tool.

Figure 3 is an enlarged detailed view of the ratchet section of the present back-off tool.

Figure 4 is a cross-sectional view taken along the line 4—4 of Figure 1.

Figure 5 is a cross-sectional view taken along the line 5—5 of Figure 2.

Figure 6 is a longitudinal view, partly in cross-section, illustrating an alternative valve construction at the lower end of the present back-off tool, the left half of the drawing showing the valve in its open position and the right half of the drawing showing the valve in its closed position.

Figure 7 is a view, partly in vertical cross-section, of a mechanically-actuated slip assembly to be used in conjunction with the present back-off tool.

Figure 8 is a view, partly in vertical cross-section, of a mechanically actuated slip assembly to be mounted on the present tool.

Figure 9 is a view taken along the line 9—9 of Figure 8.

Figure 10 is a view, partly in elevation and partly in section, of a mechanically-actuated back-off tool according to the present invention provided with hydraulically operated upper and lower slip assemblies.

Figures 11 and 12 are views in vertical cross-section of modifications of the present back-off tool which are hydraulically-actuated and provided with slip assemblies which are set hydraulically.

Figure 13 is an enlarged detailed view, taken in cross-section, of the swivel joint 13 of Figure 1.

Referring to Figures 1 and 2 of the drawing, the present back-off tool comprises an elongated tubular housing having upper and lower sections, 11 and 12, respectively, secured together by means of a swivel joint 13 which permits relative rotational movement of one section with regard to the other. Slidably mounted for axial movement within the tubular housing comprising sections 11 and 12 is an inner tubular member 14 of smaller diameter adapted to be attached at its upper end to the lower end of a tubing string 15 which extends to the surface of the well.

The upper section of the tubular housing 11 is provided with a slip assembly 16 of any suitable type known to the art, which may be either actuated by hydraulic or mechanical means. The slip assembly illustrated in Figure 1 comprises a plurality of plungers 17 adapted to be forced radially into gripping contact with the casing by a hydraulic pressure fluid applied to the inner surface of the plungers 17. As shown in Figure 10, a plurality of plungers 18 may be secured to a single wall-contacting member of the slip assembly 16. The lower section of the tubular housing 12 is also provided with a slip assembly 21 which is similar in construction to the slip assembly 16. The annular space 22 between the inner wall of the upper section of tubular housing 11 and the outer surface of the inner tubular member 14 is closed above and below the upper slip assembly 16 by means of ring seals 23 and 24. A port 25 is provided

through the wall of the inner tubular member 14 at a point between the two ring seals 23 and 24 to permit the pressure fluid to be forced into the annular space 22 outside the member 14 so as to actuate the slip assembly 16. In a like manner, the lower slip assembly 21 is provided with ring seals 26 and 27 while the inner tubular member 14 is provided with a port 28 at a point between the seals 26 and 27.

Cut in the inner surface of the upper section of tubular housing 11 at a point above the swivel section 13 and below the slip assembly 16 are a plurality of spiral grooves 31 which extend for a substantial length within the housing. Mounted on the outer surface of the inner enlarged lower end 18 of the tubular member 14 and extending radially therefrom are a plurality of splines 32 set at a slight angle to the vertical so as to cooperate with the spiral grooves 31. Thus, the grooves 31 of the housing 11 and the splines 32 form a spiral or helical section whereby the inner tubular member 14 carrying the splines 32 transmits a rotary torque to the outer housing 11 upon relative axial motion of the two elements with regard to each other.

Below the swivel joint 13 vertical grooves 33 are cut in the inner wall of the lower section of tubular housing 12 and short vertical splines 34 are attached to the outer surface of the inner tubular member 14 and extend therefrom so as to cooperate with the grooves 33. Thus, the grooves 33 and splines 34 form a vertical spline section adapted for axial or vertical movement without permitting any rotational movement of the elements 12 and 14 with regard to each other. The cross-sectional views of the splined sections are shown in Figures 4 and 5, respectively.

At a point between the upper slip assembly 16 and the splined section 31-32, the upper section of the tubular housing is provided with a ratchet section assembly 35 which is shown in enlarged detail in Figure 3 of the drawing. The ratchet assembly comprises a unidirectional swivel joint having upper and lower tubular sets of teeth 37 and 36, respectively, which are adapted to selectively engage and disengage each other, depending upon the direction in which the inner tubular member 14 is rotated. The upper teeth 37 may be splined to the inner wall of the upper section of the tubular housing 11 as at 38 to permit slight vertical movement. The teeth 36 and 37 of the ratchet assembly 35 are formed so that the assembly 35 provides a rigid rotational connection between the upper slip assembly 16 and the spiral-splined section 31-32 when the splined section is rotated to unscrew a well casing (left-hand rotation), and permits free rotation by ratcheting when the spiral-splined 31-32 is rotated to tighten the casing joint (right-hand rotation). If desired, the ratchet assembly may be spring-loaded so as to ensure positive engagement of the ratchet at all times.

As a section of well casing is unscrewed by the present back-off tool, the length of the casing increases by the length of the threaded joint. To obviate the unwanted movement of the slip assemblies 16 and 21 on the inner walls of the well casing, the tubular housing 11-12 is provided at a point between the upper and lower slip assemblies 16 and 21, respectively, with an extension or expansion joint. As shown in greater detail in Figure 3, the extension joint may be located adjacent the ratchet assembly 35 and may comprise sections 42 and 43 of the housing 11 which are constructed to overlap each other and are provided with shoulders 44 and 45 adapted to engage each other when no compressible pad 46 is used. The shoulders 44 and 45 are also designed so as to move apart from each other a distance equal to at least the threaded joint of the well casing and the space between the shoulders 44 and 45 is preferably filled with a compressible pad 46 which would normally support the suspended weight of the tool when it is run into the well and permit additional

compression to compensate for the increase in casing length caused by the unscrewing of the casing joint.

The lower end of the inner tubular member 14 is provided with a valve seat 47, preferably a seat for a ball valve upon which a ball 48 may be positioned. The ball 48 may not be in the back-off tool when it is run into a well. If it is desired to circulate fluid through the tool prior to unscrewing the casing, the ball 48 may be withheld when the tool is run into the well, and later dropped from the surface through the tubing string 15 and inner tubular member 14 to its seat 47 after the fluid circulation has finished.

During the operation of unscrewing a corroded upper section of a well casing from the lower section of well casing which has been cemented in place in the well, the depth of the desired back-off point of the casing, that is, the particular threaded collar which it is desired to unscrew is first located by one of the many tools well known to the art. Assuming that the depth of the desired back-off point or threaded joint of the casing has been located, the present back-off tool illustrated in Figure 1 of the drawing is run into the well, inside the casing 51, on the lower end of a tubing string 15 as shown in Figure 10 of the drawing. If the ball valve 48 has been withheld from the tool, it is then dropped down the tubing string 15 so that it passes through the tool and seats on valve seat 47. The back-off tool is positioned in the well casing 51 so that the lower slip assembly 21 is below the casing joint 52 to be unscrewed and upper slip assembly 16 is above the casing joint to be unscrewed.

To set the slips 16 and 21 against the inner wall of the casing 51, hydraulic pressure fluid is applied to the tubing string 15 at the surface by some convenient means, such as a pump. Pressure fluid is transmitted to the plunger elements 17 or 18 (Fig. 10) of the slip assemblies 16 and 21 through fluid ports 25 and 28 in the wall of the inner tubular member 14. The applied pressure fluid is maintained within the housing of the slip assemblies 16 and 21 by the ring seals 23, 24, 26 and 27.

To unscrew the joint 52 of the casing 51 after the slips 16 and 21 have been set, the tubing string 15 is raised at the surface or wellhead by any suitable means, such as a hoist (not shown). The splines 32 and 34 which are rigidly secured to the inner tubular member 14 move upwardly in their respective mating grooves 31 and 33 of the splined sections. Since the splined section or grooves 31 are helical and splined section or grooves 33 are vertical, a rotational motion is established between the splined upper and lower sections of the tubular housing 11 and 12 about the swivel joint 13. The lower section 12 of the tubular housing is rigidly affixed to the inner wall, usually cemented lower portion, of the casing through slip assembly 21 and therefore does not rotate. Due to the direction of the spiral of the grooves 31 in the upper section 11 of the housing, the housing rotates in a left-hand direction. Since the upper slip assembly 16 rigidly secures the upper section of the tubular housing to the inner wall of the well casing 51, the left-hand rotational movement is transmitted through the splined ratchet assembly 35 to impart a left-hand rotational force to the well casing 51.

When the inner tubular member 14 reaches the limit of its upward travel, as limited by the length of the grooves 31 and 33 in which the splines 32 and 34 move, it is lowered to its original starting position. The lowering of inner tubing member 14 would tend to reverse the direction of rotation of all elements above the swivel joint 13. However, the ratchet assembly 35 permits right-hand rotation of the splined housing section 31-32 below the ratchet assembly and allows the upper slip assembly 16 to remain stationary on the downstroke. Reciprocation of the tubing string 15 and inner tubular member 14 can be repeated as often as necessary to unscrew one section of the casing 51 from the lower section. The

5

extension joint of Figure 3, including the compressible pad 46, compensates for the increase in casing length as the casing joint 52 is unscrewed. After the casing has been unscrewed, the slip assemblies 16 and 21 are released by releasing the hydraulic fluid pressure at the surface of the well. The back-off tool may then be withdrawn from the well together with the tubing string 15.

Instead of employing the ball-type standing valve 48, as shown in Figure 1 of the drawing, the standing valve may be of the sleeve-type, as shown in Figure 6, which requires right-hand rotation to close and left-hand rotation to open. The sleeve-type valve, as illustrated in Figure 6, comprises a short tubular member closed at its lower end and having threads 54 on the outer surface thereof adapted to meet with threads 55 on the inner wall of the tool housing 12. The tubular sleeve member 53 is provided with a fluid port 56 while a fluid port 57 is provided through the wall near the lower end of the tool housing 12.

When the sleeve valve 53 is in its uppermost position, as shown in the left-hand portion of Figure 6, ports 56 in the sleeve valve 53 are opposite the fluid ports 57 in a tool housing 12, permitting circulation of fluid through the tool. The upper end of the sleeve valve 53 is provided with a J-slot 58 while the lower end of the inner tubular member 14 is provided with a mating dog or pin 59. Rotation of the sleeve valve 53 for closing or opening the ports 56 is accomplished by rotating the tubing string 14 from the surface. The J-slot 58 and its mating dog 59 are designed so that they may be readily engaged or disengaged at will to permit vertical movement of the tubing string 14. Right-hand rotation of the tubing string 14 causes the valve 53 to move downward with respect to the tool housing 12 which permits O-ring sealing elements 60 and 61 to form a seal between the sleeve 53 and housing 12 in a fluidtight manner. In order to permit rotation of the inner tubular member 14 with respect to the tubular housing 12, the bore of the housing 11 and 12 is enlarged below the grooved sections, as at 63, so that the splines 32 and 34 on the inner tubular member 14 may be positioned in enlarged bore sections, as at 63, when the mating dog 59 is engaged in the J-slot 58 of the standing sleeve valve 53.

While the present backoff tool has been described hereinabove as being provided with hydraulically-actuated slip assemblies 16 and 21 (Figure 1), it is realized that the present tool may be readily provided with mechanically-actuated slips as shown in Figure 7 of the drawing. The operation of the present back-off tool for unscrewing one length of well casing from another is the same after the slips have been set against the casing regardless of whether mechanically-actuated or hydraulically-actuated slips are employed. The mechanism for engaging the slips with the casing is entirely mechanical with slips of the type illustrated in Figure 7.

When mechanically-actuated slips are employed instead of hydraulically-actuated slips for the lower slip assembly 21 of Figure 1, the inner tubular member 14 is provided with dogs or pins 64 adapted to engage in J-slots 65 in the top of the tool assembly (Figure 7). A mechanical slip assembly may comprise a slip housing 66 forming a part of the tool housing 12 and being provided with a plurality of slips 67 adapted to be forced radially from said housing 66 by means of a wedge 68. The wedge 68, in turn, is secured by means of a swivel joint 69 to a sleeve 70, which is adapted to threadedly engage an outer threaded sleeve 71. The outer threaded sleeve 71 is rigidly affixed to the slip housing 67 by shear pins 72.

The mechanical slip illustrated in Figure 7 is set by right-hand rotation of the inner tubular member 14, with pin 64 engaged in slot 65, which effects similar motion of the threaded sleeve 70 which mates with threaded

6

sleeve 71. The shear pins 72 prevent the threaded sleeve 71 from moving with respect to the slip housing 66. Both the housing 66 and the threaded sleeve 71 are prevented from rotating with the tubular member 14 by friction springs 76 which expand from the housing 66 to contact the inner wall of the well casing. Thus, with the dogs 64 positioned in the J-slots 65, right-hand rotation of the tubular member 14 and the threaded sleeve 70 produces downward vertical movement of the sleeve 70 relative to sleeve 71 and slip housing 66. This downward motion is transmitted to the wedge 68 which in turn forces the slips 67 outwardly against the casing wall. After the slips 67 are set against the casing with a predetermined amount of torque applied to the inner tubular member 14 from the surface, the dogs 64 are released from the J-slot 65.

When the slips 67 have been set in a manner previously described, two sections of well casing may be unscrewed by vertical reciprocation of the inner tubular member as previously described with regard to the back-off tool illustrated in Figure 1 of the drawing. To release the back-off tool after the well casing has been unscrewed, the inner tubular member 14 is lowered to engage the dogs 64 in the J-slot 65 and the tubing is then rotated. This additional rotation of the tubing 14 to the right actually sets the slips 67 tighter against the well casing until sufficient force is applied between the threaded sleeve 71 and the housing 66 to shear the shear pins 72. The sleeve 71 is then free to move upwardly with an upward pull on the inner tubing member 14 which removes the wedge 68 from between the slips 67 releasing them from the casing wall. Since only right-hand torque holds the slips 67 of the other slip assembly firmly wedged against the casing, release of this torque with release of the upper slip assembly 67 permits withdrawal of the tool from the well casing.

To replace the hydraulically-operated lower slip assembly 16 of Figure 1, a mechanically-actuated slip of the type shown in Figures 8 and 9 may be employed. This slip assembly comprises a housing 73 having a plurality of slips 74 eccentrically-mounted on a shaft 74a adapted to be expanded radially therefrom and kept in contact with a well casing by means of leaf springs 75. The slips 74 contact and wedge against the casing when the unscrewing action is imparted to the casing by vertical reciprocation of the inner tubular member 14 of the present tool. At other times, the slips 74 may be readily moved vertically within the well casing.

While the main purpose of the present back-off tool is to unscrew one section of a well casing from another, when said well casing is located at considerable depth within a well, it is to be realized that the present tool can be readily adapted for screwing together the threaded joints of two sections of well casing by merely reversing the action of the ratchet assembly 41 and by making the grooves 31 of the upper section of the tubular housing 11 spiral in the opposite direction.

An alternative construction of the present back-off tool is shown in Figures 11 and 12 of the drawing which illustrate back-off tools that are entirely operated by hydraulic pressure fluid. The hydraulically-operated back-off tool of Figure 11 is similar to the mechanically-actuated back-off tool of Figure 1 in that it comprises an outer tubular housing 80—80a, the upper and lower sections being connected by means of a swivel joint 81 and the housing being provided with upper and lower slip assemblies 82 and 83, respectively. The housing 80—80a is also provided with spiral grooves 84, vertical grooves 85, a ratchet assembly 86 and a valve 87.

An inner tubular member 88 is mounted for sliding axial movement within the housing 80—80a. Instead of the upper end of the tubular member 88 being connected to a tubing string 15 as shown in Figure 1, the upper and lower ends of the inner tubular member 88 are enlarged to form pistons 90 and 91 at either end of

said member. Fixedly secured within the upper part of the bore of the housing 80 is a small diameter tube 89. The diameter of the tube 89 is of a size such that it passes readily through the opening in the top of piston 90 and into the enlarged bore of the upper part of the inner tubular member 88. A ring seal 92 prevents the escape of pressure fluid between the tube 89 and the inner tubular member 88 while a second ring seal 93 prevents the escape of pressure fluid between the inner tubular member 88 and the housing 80. In a like manner, the pistons 90 and 91 are provided with suitable sealing rings 94 and 95, respectively, which prevent the escape of pressure fluid past the pistons. A fluid port 96 is provided through the wall of the inner tubular member 88 to admit pressure fluid to the annulus 97 between the inner tubular member and the housing 80 to actuate and set the upper slip assembly 82 against the well casing. The lower slip assembly 83 is actuated by pressure fluid passing through the small diameter tube 89 and the inner tubular member 88.

A shoulder 97 is formed on the inner wall of the housing 80a at a point below the vertical grooves 85 and above the lower slip assembly 83. A compression spring 98 is arranged around the inner tubular member 88 between the shoulder 97 and the upper face of the lower piston 91 so as to normally force the inner tubular member to its lowermost position. A fluid port 99 is provided in the wall of the housing 80a at a point just below the upper limit of travel of the lower piston 91 so that when the piston 91 is at its uppermost position the space within the lower end of the housing 80a is in communication with the space outside thereof through the fluid port 99. Likewise, fluid ports 105 provide communication between the annulus formed by members 80 and 89, above piston 90, and the outside of housing 80. As in the case of the back-off tool illustrated in Figure 1, the inner tubular member 88 of the hydraulically-operated back-off tool of Figure 11 is provided with upper and lower splines 100 and 101, respectively, similar to splines 32 and 34 of Figures 1 and 2, which are adapted to move vertically within the spiral and vertical grooves 84 and 85, respectively.

The operation of the hydraulically-operated back-off tool is as follows: The housing 80—80a of the back-off tool is secured to the lower end of a tubing string 102 and lowered to the desired depth within the well casing. The pressure fluid is applied from the surface through the tubing string 102 and passes through the fluid port 96 into the hydraulic slip assembly 82 to set the slip against the wall of the casing. The fluid also passes down through the inner tubular member 88 to the bottom of the housing 80a to set the lower hydraulic slip assembly against the well casing. At the same time, the inner tubular member 88, which is essentially a free floating piston within the housing 80—80a, is subjected to the hydraulic pressure fluid from the surface. The force exerted by this pressure fluid is applied against the effective pressure areas 103 and 104 on the lower surface of pistons 90 and 91 to move the pistons upwardly.

The upward movement of the pistons 90 and 91 causes the inner tubular member 88, together with splines 100 and 101, to move upwardly thus imparting a left-hand rotational motion to the spirally-grooved section 84 of the housing 80 relative to the vertically-splined section 85. Since the vertically-splined section 85 is rigidly affixed to the lower slip assembly 83 and the spirally-grooved section 84 is rigidly affixed to the upper slip assembly 82 through the ratchet section 86, left-hand rotational motion is also transmitted to the well casing in which the tool is located. When the packing ring 95 of the lower piston 91 moves upwardly past ports 99, a pressure loss occurs in the tool and in the tubing string 102 which indicates to an operator at the surface that the piston 91 has reached the limit of its upward travel.

The hydraulic pressure is then fully released by the

operator at the surface and the pistons 90 and 91 together with the inner tubular member 88 return to their lower or initial position aided by the spring 98. The ratchet section 86 permits free right-hand rotation between the upper and lower slip assemblies 82 and 83, respectively, when the pistons 90 and 91 move downwardly. This cycle of periodically applying pressure fluid to the upper end of the tubing string is repeated until the well casing is unscrewed. When this has been accomplished, the pressure fluid is released at the surface and the tool is free to be removed.

Under most operating conditions, when it is desired to employ a hydraulically-operated back-off tool, a tool similar to that shown in Figure 11 may be employed with the only difference being that the ratchet section 86 may be omitted, as shown in Figure 12. Since hydraulic pressure fluid is released at the surface to permit the pistons 90 and 91 to drop to their lower position, release of the pressure fluid also releases the upper and lower slip assemblies 82 and 83 from the walls of the well casing, thus, preventing right-hand rotation between the upper and lower slip assemblies 82 and 83, respectively, without the need for employing a ratchet assembly 86.

I claim as my invention:

1. An apparatus adapted to be secured to the lower end of a pipe string and lowered into a cased well bore-hole for unscrewing a predetermined upper portion of a well casing at a selected threaded joint, said apparatus comprising inner and outer elongated tubular body members concentrically mounted for limited axial movement with regard to each other, the inner tubular body member being attached to said pipe string, closure means at the lower end of said inner body member normally closing the lower end thereof at least during operation of said apparatus for retaining a pressure fluid therein, upper and lower hydraulically-actuated slip assemblies carried in spaced relationship on said outer body member, passage means through the wall of the inner tubular body member, said slip assemblies including axially-spaced annular seal means surrounding said inner tubular body member at points above and below the fluid passage means at all times and radially-extendible slips actuatable by pressure fluid from the inner tubular body member through said passage means and being adapted to engage continuously said well casing above and below the selected casing joint to be unscrewed upon application of hydraulic pressure to said inner body member against said normally closed closure means, an axially extendible joint in said outer body member intermediate the upper and lower slip assemblies, a swivel joint in said outer body member intermediate the upper and lower slip assembly, the inner wall of said outer body member having a helically-grooved section above said swivel joint and a vertically-grooved section below said swivel joint, upper and lower spline means fixedly secured to said inner body member and positioned within the helical and vertical grooves in said upper and lower sections, respectively, of said outer body member, and a ratcheting tubular pipe coupling forming means for permitting transmission of left-hand rotation of said helically-grooved section to said upper slip assembly and for preventing transmission of right-hand rotation of said helically-grooved section to the upper slip assembly and being connected in said outer body member intermediate the upper slip assembly and the helically-grooved section of said outer body member.

2. An apparatus adapted to be secured to the lower end of a pipe string and lowered into a cased well bore-hole for unscrewing a predetermined upper portion of a well casing at a selected threaded joint, said apparatus comprising inner and outer elongated tubular body members concentrically mounted for limited axial movement with regard to each other, said inner member being attached to said pipe string, valve means carried at the lower end of said inner body member normally closing

the lower end thereof during operation of said apparatus for retaining a pressure fluid therein, hydraulically-actuated upper and lower slip assemblies carried in spaced relationship on said outer body member, passage means through the wall of the inner tubular body member, said slip assemblies including axially-spaced annular seal means surrounding said inner tubular body member at points above and below the fluid passage means at all times and radially-extendible slips actuatable by pressure fluid from the inner tubular body member through said passage means and being adapted to engage continuously said well casing above and below the selected casing joint to be unscrewed upon application of hydraulic pressure to said inner body member against said normally closed valve means, an axially extendible joint in said outer body member intermediate the upper and lower slip assemblies, a swivel means in said outer body member intermediate the upper and lower slip assembly, the inner wall of said outer body member having a helically-grooved section above said swivel joint and a vertically-grooved section

below said swivel joint, upper and lower spline means fixedly secured to said inner body member for sliding movement in engagement with the helically and vertically grooved sections, respectively, of said outer body member, and a ratcheting tubular pipe coupling forming means for permitting transmission of left-hand rotation of said helically-grooved section to said upper slip assembly and being connected in said outer body member intermediate the upper slip assembly and the helically-grooved section of said outer body member, and means for applying a hydraulic pressure fluid through said pipe string and said passage means to actuate said slip assemblies.

References Cited in the file of this patent

UNITED STATES PATENTS

1,110,639	Moore	Sept. 15, 1914
1,479,132	Gianella	Jan. 1, 1924
1,617,303	Dougherty	Feb. 8, 1927
1,647,961	Dougherty	Nov. 1, 1927