Sept. 26, 1939. G. W. BOWEN 2,174,077

GRAPPLE

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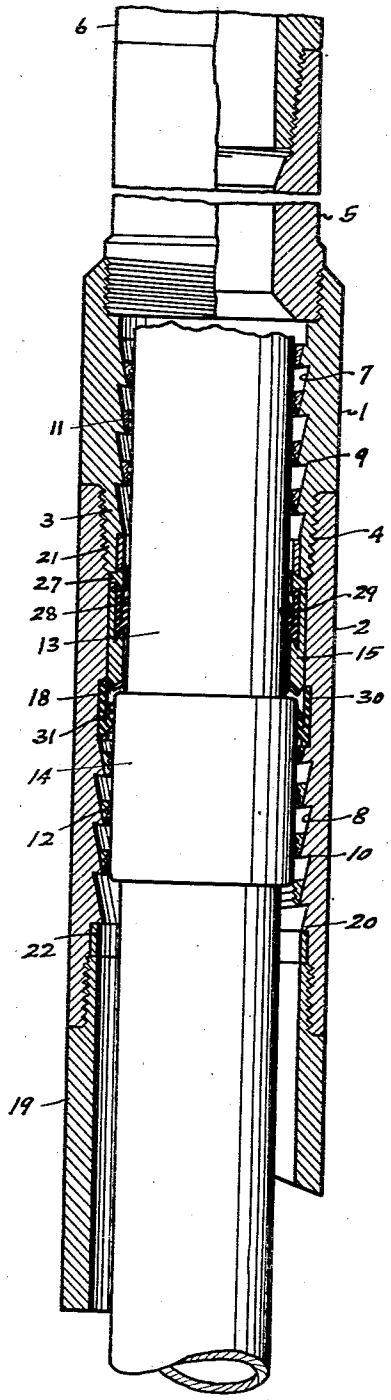


Fig. 1.

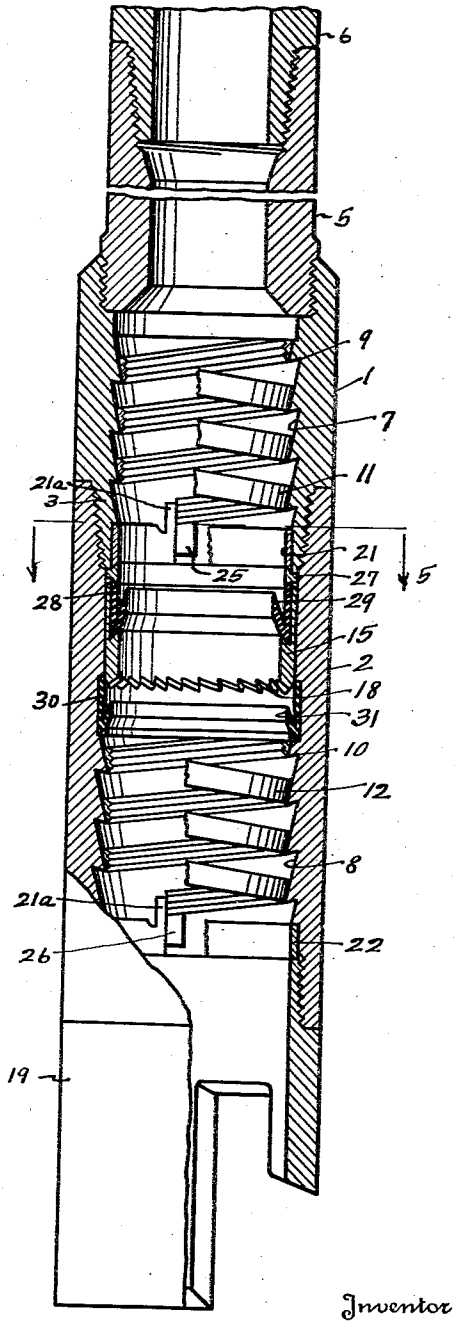


Fig. 2.

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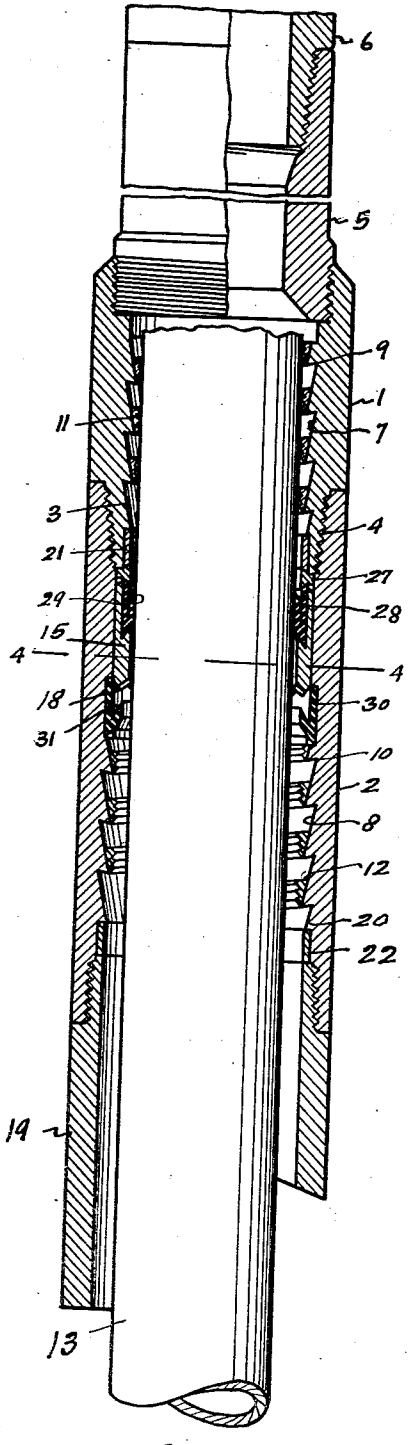


Fig. 3.

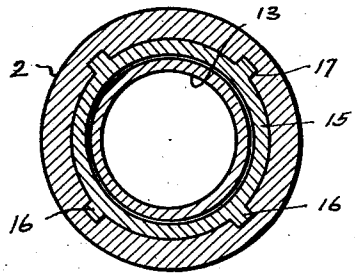


Fig. 4.

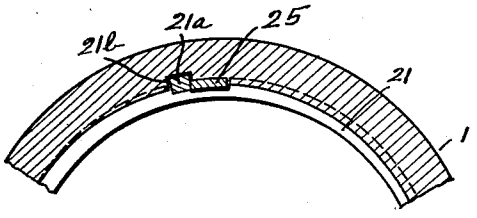


Fig. 5.

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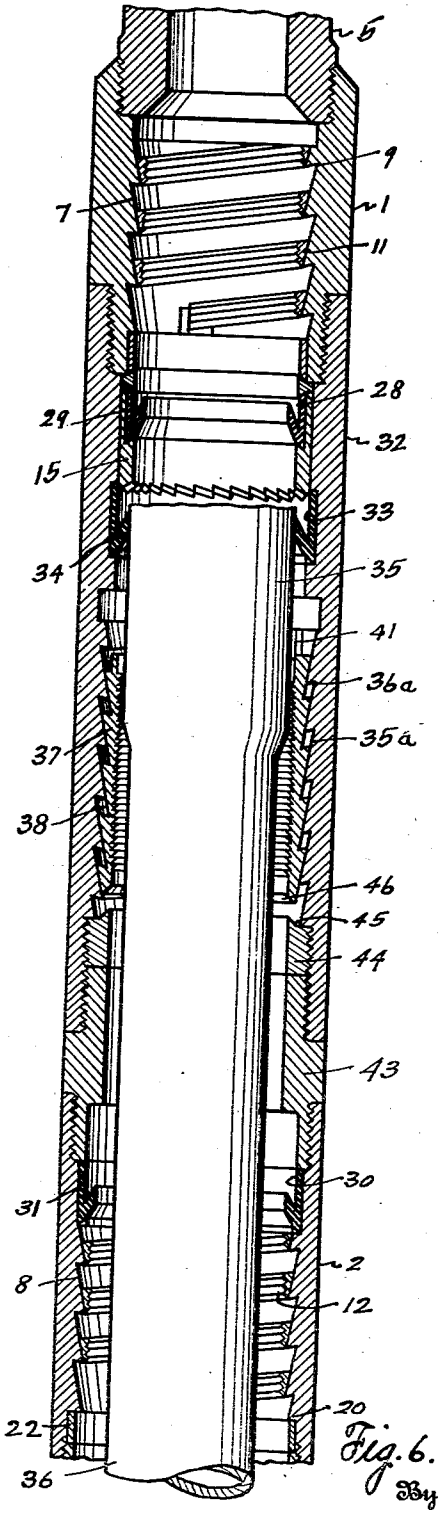


Fig. 6.

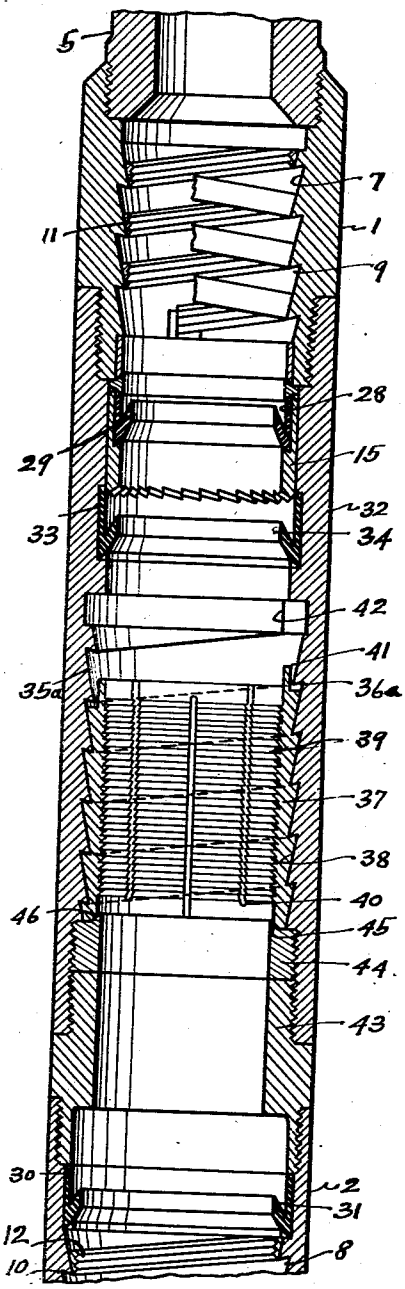


Fig. 7.

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UNITED STATES PATENT OFFICE

2,174,077

GRAPPLE

George W. Bowen, Houston, Tex.

Application December 7, 1937, Serial No. 178,591

10 Claims. (Cl. 294—102)

This invention relates to a grapple.

An object of the invention is to provide a grapple of the character described specially designed to telescope over, and engage the upper end of a pipe, or other object stuck in a well bore and whereby the stuck pipe or object may be withdrawn.

It is another object of the nvention to provide in a grapple novel means for forming a fluid tight seal between the grapple and the stuck object whereby washing fluid forced downwardly through the operating stem will be forced to pass downwardly through, rather than around, the pipe engaged by the grapple.

In carrying on well drilling operations a pipe in the well often becomes twisted or broken off leaving a portion of the pipe stuck in the well. The upper end of the pipe thus left in the well is often distorted so that the end of the pipe to be engaged by the grappling jaw can not enter the bowl containing such jaw or other pipe engaging means. It is an object of the present invention to provide in a grappling tool of the character described an inside milling tool provided to cut or mill off the obstructing portion of the broken off end of the pipe so as to prepare the pipe for entrance into the grappling tool to permit the engagement of the tool with the pipe.

The invention also embodies means for engaging and for forming a fluid tight joint with, the upper, enlarged, or bell shaped end of a pipe stuck in a well.

The invention embodies certain improvements over that type of grapple disclosed in my copending application Serial Number 21,180, filed May 13, 1935.

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—

Figure 1 shows a vertical, sectional view of the tool shown engaged with the coupling of the stuck pipe

Figure 2 shows a vertical, sectional view of the tool showing the grappling jaws in the upper and lower bowls, partly broken away, and shows also the miling tool therein.

Figure 3 shows a vertical, sectional view of the tool in engagement with the stuck pipe only.

Figure 4 shows a cross-sectional view taken on the line 4—4 of Figure 3.

Figure 5 shows an enlarged cross sectional view taken on the line 5—5 of Figure 2.

Figure 6 shows a vertical sectional view of another embodiment of the invention showing the bell shaped end of a stuck pipe engaged by the tool, and

Figure 7 shows a fragmentary, vertical sectional view thereof shown in released position.

Referring now more particularly to the drawings wherein like numerals of reference designate similar parts in each of the figures, the numerals 1 and 2 designate upper and lower tubular bowls. These bowls are preferably connected together by a threaded reduced section 3 of one which is screwed into the threaded box 4 of the other.

A coupling 5 is threaded into the upper end of the upper bowl and serves to connect the operating string 6 to the grappling tool, said string 6 extending to the ground surface.

The inside walls of the upper and lower bowls, respectively, are formed with the helical downwardly and inwardly tapering faces 7, 8 terminating at their upper margins at the undercut, spiraled grooves 9, 10.

On these faces are the helical gripping jaws 11, 12 whose outer sides taper downwardly to conform to the shape of and to fit closely on the respective faces 7, 8. The inner sides of these jaws are toothed to effectively engage and grip the pipe 13, or the pipe coupling 14, as the case may be.

The inside diameter of the jaw 11 is somewhat less than the inside diameter of the jaw 12. Should the stuck pipe become broken off at a coupling or tool joint as 14 when the grappling tool is telescoped over the pipe the lower jaw 12 will engage said coupling, as is indicated in Figure 1. In many cases, however, the stuck pipe becomes broken or twisted off a short distance above the coupling in which event that portion of the stuck pipe extending above the coupling will project on up into the upper bowl 1 and be engaged by the upper jaw 11 as also indicated in Figure 1. If the coupling or tool joint is located too far beneath the upper end of the stuck object to enter the lower bowl, in such event, the upper jaw 11 only will engage the stuck object, as illustrated in Figure 3.

As the grappling tool is lowered over the stuck object the appropriate jaw will frictionally engage said object and will side upwardly on the corresponding face 7, or 8, so as to permit the required expansion of the jaw. Upon an upward pull then being exerted on the operating string 6 the bowl will move upwardly relative to the corresponsing jaw thus causing said jaw to be contracted, by the downwardly coverging face 7,

or 8, into secure engagement with the pipe 13 or the coupling 14 so that upon a further upward pull the stuck object may be dislodged and withdrawn from the well.

Fitted closely within the upper end of the bowl 2 there is a sleeve 15 having the external, vertical ribs 16 which fit in the inside, vertical grooves 17 of the bowl 2. The lower end of the sleeve 15 is formed with cutting teeth 18 thus forming said sleeve into a milling tool which is maintained against rotation relative to the bowl by the ribs 16. As hereinabove indicated when the pipe is broken or twisted off the upper end thereof is often deformed so that it will not enter the upper bowl 1. In such event the grappling tool may be rotated and the milling tool will mill off the obstructing portions at the upper end of the pipe and will thus prepare said end for entrance into the upper bowl 1.

Attached to the lower end of the lower bowl there is a conventional type of tubular wall hook 19 for the well known purpose and, as illustrated, the upper end of this wall hook is reduced and threaded into the lower end of the lower bowl 2 and above said lower end the bowl 2 is provided with an inside, annular shoulder 20.

Countersunk into the reduced section 3, and secured against rotation relative thereto there is the upper, inside ring 21 and countersunk into the lower end of the lower bowl, and clamped between the shoulder 20 and the upper end of the wall hook 19 there is the inside ring 22. The rings 21, 22 have upstanding fingers, as 21*a*, which lie in the inside vertical grooves 21*b* in the pin 3 and the rings 21, 22 have the vertical notches as 23, and the lower ends of the jaws 11, 12 have the depending integral lugs 25, 26 which extend downwardly into said respective notches in front of the fingers 21*a*. The lower ends of the jaws will thus be anchored against rotation relative to the corresponding bowls but will be allowed a limited amount of vertical movement, with respect thereto. If the stuck object, when engaged, can not be pulled from the well it is then desirable to detach the grapping tool and remove it. This can be accomplished by rotating the tool to the right and at the same time exerting an upward pull thereon. If the tool is rotated to the right and pulled upwardly the jaw in engagement with the stuck object will be slightly expanded by the pressure of its corresponding finger 21*a* against the lug 25 or 26 so that while said jaw may remain in contact with the stuck object it will not grip it so securely but that it may be released therefrom by a right hand rotation and upward movement of the tool and if the tool is rather rapidly rotated to the right and at the same time pulled slowly upwardly the jaw will be caused to ride upwardly on its contacting face, 7, or 8, as the case may be and into the spiraled groove at the upper margin of said face and will thereby be held in expanded position until released from the stuck object.

Clamped between the upper end of the sleeve 15 and the lower end of the pin 3 there is an inside ring 27 whose inner side is flared inwardly and interlocks, or dove-tails with the lower end of the ring 21.

Countersunk into the upper end of the sleeve 15 there is an inside, upwardly opening cup-ring having the outside lip 28 adapted to fit closely with the inside of said sleeve and the inside lip 29 adapted to fit closely about the pipe 13. The outside lip 28 has a dove-tailed connection with the sleeve 15 and ring 27 as more accurately shown in Figure 2. When the grappling tool is fitted over the pipe 13, as shown in Figure 3 it may be desirable to force water downwardly through the operating string and through said pipe and return the same up on the outside of the pipe so as to wash the pipe loose. The cup-ring or packing 28, 29 will form a fluid tight seal about the pipe 13 so that the washing fluid will be forced downwardly through the pipe rather than downwardly around it.

Countersunk into the bowl 2 beneath the milling tool there is an upwardly opening cup-ring comprising the outer lip 30 adapted to fit closely against the inner wall of said bowl and the inner lip 31 adapted to fit closely about the coupling or tool joint. This packing or cup-ring is provided to form a fluid tight seal about the coupling or tool joint 14 for the purpose hereinabove indicated.

Referring now to the embodiment disclosed in Figures 6 and 7, there is an intermediate tubular bowl 32 interposed between the upper bowl 1 and the lower bowl 2 and the milling tool 15, containing the packing 28, 29, is located in this intermediate bowl and beneath the milling tool and countersunk into the wall of the intermediate bowl 32 there is a similar cup shaped packing having the outer lip 33 and the inner lip 34 to surround the enlarged, or bell shaped, upper end 35 of the pipe 36 to form a fluid tight joint therewith. Beneath this last mentioned packing the inside wall of the intermediate bowl is formed with the helical downwardly and inwardly tapering face 35*a* terminating at its upper margin at the under cut spiralled groove 36*a*.

On the face 35*a* there is a sleeve shaped gripping jaw 37 whose outer surface has the helical, downwardly converging tapering face 38 which rides on the face 35*a* and which has the inside pipe engaging teeth 39. This gripping jaw has the longitudinal slots 40, alternate slots extending from opposite ends of the sleeve and terminating near the other end as shown in Figure 7 to give the jaws the required expansibility. The upper end of the sleeve 37 has the upwardly extended stop 41, engageable with a stop 42 extending inwardly from the bowl 32 so that when the sleeve 37 reaches the upper limit of its movement on the face 35*a*, said stops will engage to prevent the sleeve from being screwed up too tightly. The lower bowl 2 is connected to the intermediate bowl 32 by means of the inside coupling 43. Screwed into the lower end of the bowl 32 there is an inside ring 44 which is clamped into position by the coupling 43 and whose upper end has the upwardly and inwardly tapering face 45 against which the inside downwardly and outwardly tapering face 46, at the lower end of the sleeve 37, engages when said sleeve is in its lower position as shown in Figure 7. The grappling jaw, or sleeve, 37 is provided to engage the bell shaped upper end of a stuck pipe as 36 in case said stuck pipe has been broken off immediately beneath the coupling connecting the sections of pipe. The enlarged portion of the upper end of the section of pipe 36 is too large to enter the milling tool 15 and the grappling jaw 11 and is too small to be engaged by the lower jaw 12 and hence the diameter of the grappling jaw 37 is somewhat larger than that of the jaw 12, but the upper end of the pipe 36 will pass through the jaw 37.

Before lowering this form of the tool into the well, the jaw 37 is turned in the bowl 32 until its lower end is spaced above the inside ring 44, as shown in Figure 6, and is then lowered into the

well over the stuck pipe 36. The packing 33, 34 will form a fluid tight seal about the upper end of the stuck pipe, as shown in Figure 6, and the jaw 37 will engage the enlarged upper end 35 of said stuck pipe. An upward pull may then be taken and the bowl 32 will move upwardly relative to the jaw 37, the face 35 sliding on the face 36 and contracting said jaw into secure engagement with the stuck object. If the stuck pipe can not be pulled, it is then desirable to release the grapple from it and this is accomplished by turning slowly to the right and pulling upwardly on the operating string 6. This will cause the face 46 to seat against the face 45 and expand the lower end of the jaw 37 and the upper margin of the spiralled face 38 will seat in the under cut groove 36*a*, thus expanding said jaw 37 throughout its length as shown in Figure 7 so that the stuck pipe will be released and by a continued upward pull and rotation to the right the tool may be released from the stuck pipe and withdrawn.

The drawings and description disclose what is now considered to be a preferred form of the invention by way of illustration only, while the broad principle of the invention will be defined by the appended claims.

What I claim is:

1. A grappling tool comprising upper and lower bowls, grappling means in the bowls and an annular milling tool between the grappling means.

2. A grappling tool comprising a tubular body shaped to be telescoped over an object, upper and lower grappling means in the body arranged to engage the telescoped object, and a milling tool in the body between said grappling means.

3. A grappling tool comprising upper and lower bowls connected together and shaped to receive a cylindrical object, grappling means in the respective bowls, the upper grappling means being of a smaller inside diameter than that of the lower grappling means and an annular milling tool located between the grappling means.

4. A grappling tool comprising upper and lower bowls connected together and shaped to receive a cylindrical object, grappling means in the respective bowls, the upper grappling means being of a smaller inside diameter than that of the lower grappling means, an annular milling tool located between the grappling means, annular packing arranged to form a fluid tight seal around the object engaged by the upper and lower grappling means.

5. A grappling tool comprising upper and lower bowls connected together and shaped to receive a cylindrical object, grappling means in the upper bowl, sealing means shaped to form a fluid tight seal between the object engaged by said grappling means and corresponding bowl, grappling means in the lower bowl of greater inside diameter than the upper grappling means and sealing means arranged to form a seal between the lower bowl and the object engaged by the lower grappling means.

6. A grappling tool comprising a tubular body shaped to be telescoped over a stuck pipe in a well, a plurality of grappling means spaced apart in the body, the inside diameter of each grappling means being greater than the inside diameter of the grappling means above and sealing means, associated with the respective grappling means for forming seals between said body and the stuck pipe.

7. A grappling tool comprising a tubular body shaped to be telescoped over the upper end of a pipe stuck in a well bore, upper, intermediate, and lower grappling means, increasing in diameter from above downwardly and mounted in the body, and an annular milling tool mounted in the body and sealing means positioned below the milling tool and arranged to form a seal between the body and the stuck pipe.

8. A grappling tool comprising upper and lower bowls connected together and shaped to receive a cylindrical object, the upper bowl being of smaller inside diameter than that of the lower bowl, an annular tool located between the bowls, said bowls having spiralled, tapering seats, spiralled flexible pipe gripping members on said seats, means for retaining said gripping members against rotation relative to the bowls.

9. A grappling tool comprising upper and lower bowls connected together and shaped to receive a cylindrical object, the upper bowl being of smaller inside diameter than that of the lower bowl, an annular tool located between the bowls, said bowls having spiralled, tapering seats, spiralled flexible pipe gripping members on said seats, means for retaining said gripping members against rotation relative to the bowls, annular packing arranged to form a fluid tight seal between the cylindrical object and the bowls.

10. A grappling tool comprising a tubular body shaped to be telescoped over the upper end of a pipe stuck in a well bore, upper, intermediate, and lower releasable grappling means, increasing in diameter from above downwardly and mounted in the body.

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