

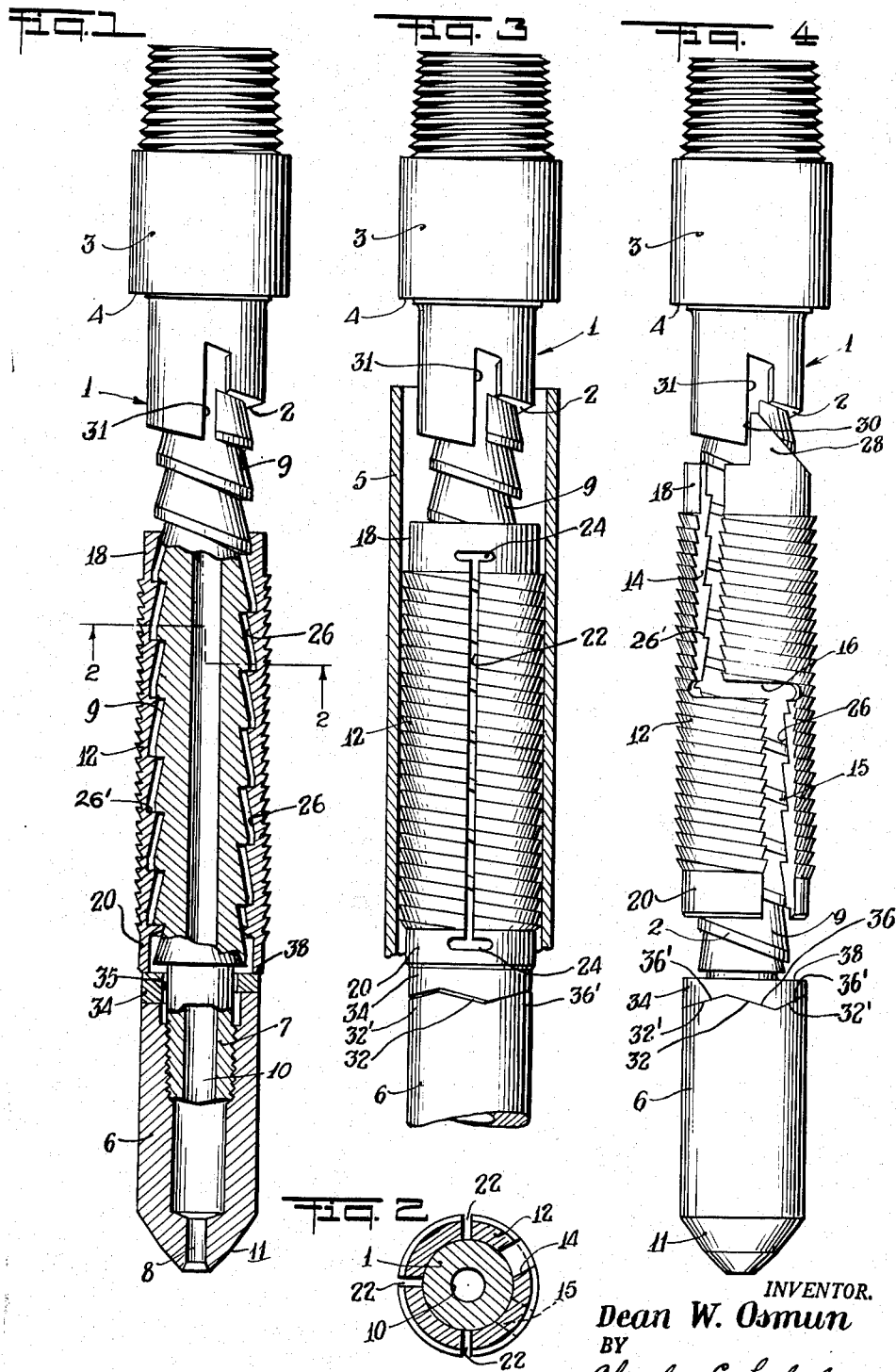
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GRAPPLE

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GRAPPLE

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9 Claims. (Cl. 294-93)

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This invention relates to a grapple, and more particularly to a grapple of the spear type adapted for use in recovering pipe from wells and constructed for ready engagement with and release from such pipe which has become stuck or disconnected in the well bore.

An important object of the invention is to provide a pipe pulling device embodying cooperable mandrel and expansible grapple means adapted for insertion in a pipe and engageable therewith to permit withdrawal of the pipe from the well, without damage to the pipe and also operable to release the engagement of the grapple with the pipe and withdrawal of the same therefrom whenever desired.

The invention also contemplates the provision of positive release means, operable upon rotation of the mandrel, to assure releasing movement of the parts.

A further object of the invention is to provide a grapple having an expansible member possessing improved flexibility and strength, whereby the same is rendered more readily expansible and less likely to be broken in use.

The above and other objects and advantages of the invention will be apparent from the following detailed explanation of the preferred embodiment of the same when taken in conjunction with the drawings annexed.

In the drawings:

Figure 1 is an elevational view of the invention shown partly in section;

Figure 2 is a cross-sectional view taken on the line 2-2 of Figure 1, looking in the direction indicated by the arrows;

Figure 3 is a fragmentary side elevational view, showing the invention in engagement with a pipe and in releasing condition; and

Figure 4 is an elevational view of the invention with the grapple member in a different position on the mandrel and rotated 90° from the position shown in Figure 3.

The invention, briefly stated, comprises a tubular mandrel having an external spiralled and flared face and supporting thereon an expansible grapple member having an internal spiralled portion cooperatively associated with the external face of the mandrel. A guide nut secures the grapple member on the mandrel, and a releasing ring is disposed between the nut and the grapple member to assure a positive disengagement of the parts.

Referring to the drawings in greater detail, the numeral 1 indicates generally the mandrel which may be formed with a reduced portion having an external spiralled downwardly facing shoulder 2 and an enlarged head 3 providing a shouldered portion 4 for engagement with the upper end of a stuck pipe 5, when the grapple is inserted in the pipe. The head portion 3 is preferably threaded for connection to an operating string of pipe.

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A guide nut 6 is screwed onto the threaded lower end 7 of the mandrel, which nut has an outlet passage 8 for the passage of fluid therethrough, and also has a tapered lower end 11 serving to guide the grapple into the open end of the stuck pipe in the well.

The mandrel has an external spiralled downwardly flared face 9 extending from below the shouldered portion 4 to a point above the guide nut 6 and terminating in the external downwardly facing shoulder 2 and which face may be spiralled to the left as indicated in the drawings. The mandrel may be tubular in form having a central passage 10 therethrough to permit fluid to be forced through the mandrel when desirable from the operating string to which the grapple is attached.

The externally toothed grappling member 12 is of sleeve-like formation and is disposed on the mandrel whereon it is retained by the guide nut 6. The grappling member has a slot extending from end to end thereof, which slot is formed with an upper portion 14 and a lower portion 15, these portions being offset circumferentially of the grappling member and connected by a slot portion 16 extending therebetween, as indicated in Figure 4. It has been found that by offsetting this slot the tendency to distort or actually split the pipe has been greatly reduced. This same advantage could be realized by providing cooperable offset portion on the slips of a slip type grapple or a grapple with two or more independent coating slips. The grappling member is formed with end portions 18 and 20 of somewhat reduced diameter, and a plurality of slots such as indicated at 22 are provided at spaced intervals about the grappling member, these slots extending between the portions 18 and 20 and terminating within the ends of the grappling member. The end portions of the slots 22 may be widened or extended as seen at 24 in Figure 3 if desired to further add to the resiliency of the grappling member.

In tools of this type it has been the practice to slot the grappling member from opposite ends, the slots leading from one end of the grappling member terminating near the opposite end; but in use it has been found that this type of grappling member is too resilient and has a greater tendency to become broken or to hang on the upper end of the stuck pipe than the type of grappling member disclosed herein.

The grappling member 12 has an inside, spiralled, downwardly flared face 26 which conforms to the taper of and rides on the corresponding face 9 of the mandrel and an internal spiralled upwardly facing shoulder 26' opposing the external spiralled face 2 of the mandrel. At its upper end the grappling member has an upwardly extended portion 28 forming a vertically disposed shoulder 30, which engages a vertically disposed shoulder 31 on the spiralled

face 2 to prevent the upper end of the grappling member from becoming too tightly engaged against the face 2 to be readily released therefrom.

The guide nut 6 is formed at its upper end with alternately arranged sloping end surfaces such as those indicated at 32 and 32', and a release ring or cam 34 is disposed on the end portion 7 of the mandrel which ring has alternately arranged sloping end surfaces 36 and 36' thereon. The cooperating sloping surfaces 32 and 36 of the guide nut and release ring, respectively, are preferably arranged at a very small angle to the horizontal, sufficient to assure the separation and prevent sticking or freezing between the mandrel and the grapple member, but not to interfere substantially with relative rotation between these parts. This angle of the camming surfaces 32 and 36 is less than the helical angle or slope of the engaging surfaces 26' and 2 of the grappling member and the mandrel, which are in contact in the releasing condition of the tool, as shown in Figure 1. The guide nut and release ring thus form cam means by which release of the grappling member from the mandrel is assured in order to move the parts from releasing to catching position. The ring 34 has a flat upper surface 38 with which the lower end of the grappling member engages, when the grapple is in pipe releasing position. An opening 35 is formed in the release ring of a size somewhat larger in diameter than the diameter of the end 7 of the mandrel, so that the ring is freely movable on the mandrel when out of engagement with the grappling member.

The grapple is assembled by turning the mandrel to the left relative to the grappling member to run the grappling member up on the mandrel to the position shown in Figure 4, in which position the shoulder 30 will be in engagement with the shoulder 31. The release ring or cam 34 is placed on the end portion 7 of the mandrel and the guide nut 6 is screwed in place on this threaded end. After the tool has been thus assembled, the mandrel is rotated to the right, and the grappling member thereby screwed down the mandrel into engagement with the releasing ring, as seen in Figures 1 and 2, in which condition the grapple is ready for insertion into the stuck pipe. The grapple may then be run into the well and will be guided by the tapered end 11 of the guide nut 6 into the upper end of the pipe 5 to be pulled.

With the grappling member in releasing condition as seen in Figure 3, the outer toothed surface of the grappling member will frictionally engage the pipe 5 but can be readily inserted in the open end of the same. When the grapple is in position in the pipe the operating string is rotated to the left to move the mandrel downwardly in the grappling member and disengage the same from the releasing ring.

An upward pull on the operating string to which the grapple is attached results in bringing the spiralled tapering face 9 of the mandrel into engagement with the inside tapering face 26 of the grappling member, and the grappling member will thereby be expanded into secure engagement with the pipe to be pulled. The pipe may then be withdrawn by the further exertion of upward pull on the operating string. In the event, however, that the pipe cannot be moved by the grapple, the weight of the operating string, or a part of the weight of the same

may be allowed to bear downwardly on the grapple moving the same downwardly until the spiralled faces 9 and 26 are separated. A right hand rotation of the grapple will then serve to bring the grappling member down into contact with the releasing ring, which in turn brings the opposing cam surfaces of the ring and guide nut together, resisting further downward movement of the grapple with respect to the mandrel. In this position the spear may then be pulled straight out of the pipe. Continued right hand rotation of the spear during the withdrawing movement may be employed as an aid in keeping the tool in fully released position.

It is often desirable in carrying out operation with a grapple of the kind disclosed herein, to re-engage the pipe with the grapple after the same has been released. The movement of the parts of the grapple from releasing to catching position is, however, frequently hindered or prevented by locking or freezing of the parts in the released condition, as seen in Figure 1 of the drawings, and it is for the purpose of assuring separation of the grappling member from the mandrel under such circumstances that the releasing ring and guide nut structure has been provided.

When the tool is in the releasing condition as seen in Figure 1, and it is desired to re-engage the grapple with the pipe, the mandrel is rotated to the right, causing the camming surfaces 32 and 36 of the guide nut and releasing ring, respectively, to separate from each other, which causes the release of the mandrel from the grappling member. The grapple can then be brought into gripping engagement with the pipe by an upward pull on the operating string in the manner previously described.

As seen in Figure 1, the end portion 7 of the mandrel is slightly longer than the depth of the threaded counterbore, in the nut 6, into which this end portion is fitted, so that the release ring 34 is never tightly clamped between the mandrel and the nut.

It will thus be seen that the invention as described above provides an improved grapple structure having increased strength and expansibility in the grappling member, and positive release means whereby sticking of the tool in the pipe is obviated.

The drawings and description disclose what is now considered to be a preferred form of the invention, but it is to be understood that this is by way of illustration only, and that numerous changes in the structures and arrangement of the various parts may be made without departing from the spirit of the invention or the scope of the appended claims.

This application is a continuation-in-part of copending application, Serial Number 783,135, filed October 30, 1947, by this applicant for a grapple now Patent No. 2,518,430.

What is claimed as new and desired to secure by Letters Patent is:

1. A pipe grapple comprising, a mandrel, a sleeve-like expansible grappling member disposed on said mandrel, means on said mandrel operatively engageable with said grappling member to expand the same, said grappling member having a slot extending from end to end through said grappling member, said slot having portions spaced circumferentially of said grappling member.

2. A pipe grapple comprising, a mandrel, a sleeve-like expansible grappling member disposed

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on said mandrel, means on said mandrel operatively engageable with said grappling member to expand the same, said grappling member having a slot extending completely through the member from end to end thereof, said slot having portions offset circumferentially of said grappling member, and a slot portion extending circumferentially of said grappling member joining said offset portions.

3. A pipe grapple comprising, a mandrel, a sleeve-like expansible grappling member disposed on said mandrel, means on said mandrel operatively engageable with said grappling member to expand the same, said grappling member having a plurality of elongated slots, one of said slots extending completely through the member from end to end thereof and having circumferentially offset portions, and a circumferentially extending slot portion connecting said offset portions.

4. A pipe grapple comprising, a mandrel, a sleeve-like expansible grappling member disposed on said mandrel, means on said mandrel operatively engageable with said grappling member to expand the same, said grappling member having an elongated slot extending completely through the member from end to end thereof, said slot having portions terminating at circumferentially spaced points on said grappling member.

5. A pipe grapple comprising, a mandrel, a sleeve-like expansible grappling member disposed on said mandrel, means on said mandrel operatively engageable with said grappling member to expand the same, said grappling member having a plurality of elongated slots at spaced intervals about the circumference of said grappling member, one of said slots extending completely through the member from end to end thereof, and certain of said slots terminating at both ends within the ends of said grappling member.

6. A pipe grapple comprising, a mandrel, means on the mandrel for connecting the same to an operating string and having an external, spiralled, tapering face terminating in a downwardly facing shoulder, a sleeve-like expansible grappling member around the mandrel frictionally engageable with a surrounding pipe to resist relative movement between the pipe and member, said member having an internal, spiralled, tapering face terminating in an upwardly facing shoulder, said mandrel being movable in the member upon exertion of an upward pull on the string to engage said faces to expand said member into gripping engagement with said pipe, said mandrel being also movable downwardly in said member to disengage said faces, a guide nut on the mandrel and rotatable therewith, a ring around the mandrel between the nut and said member, said shoulders being cooperable upon rotation of the mandrel in the member in one direction to clamp said ring between the nut and said member and hold the mandrel and member against relative rotation, said ring and nut having cooperating faces positioned to disengage upon rotation of the mandrel in the member in the other direction.

7. A pipe grapple comprising, a mandrel having an external, spiralled, tapering face terminating in a downwardly facing shoulder, a sleeve-like expansible grappling member around the mandrel frictionally engageable with a surrounding pipe to resist relative movement between the pipe and member, said member having an internal, spiralled tapering face terminating in an upwardly facing shoulder, said mandrel being movable in the member to a catching position to engage

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said faces and expand said member into gripping engagement with said pipe, a guide nut on the mandrel and rotatable therewith a ring around the mandrel between the member and the nut, said mandrel being movable by rotation in one direction in said member to a releasing position to disengage said faces, said shoulders being cooperable in said releasing position to clamp said ring between said member and said nut to hold said mandrel and member against relative rotation, said nut and ring having engaging faces positioned to disengage upon rotation of the mandrel in the other direction.

8. A pipe grapple comprising, a mandrel having an external, spiralled, tapering face terminating in a downwardly facing shoulder, a sleeve-like expansible grappling member around the mandrel frictionally engageable with a surrounding pipe to resist relative movement between the pipe and member, said member having an internal, spiralled, tapering face terminating in an upwardly facing shoulder, said mandrel being movable upwardly in the member to a catching position to engage said faces and expand said member into gripping engagement with said pipe, a guide nut on the mandrel and rotatable therewith, said guide nut having an upwardly facing cam surface a ring around the mandrel between said member and said nut and having a downwardly facing cam surface, said mandrel being rotatable in one direction in said member to a releasing position to disengage said faces and engage said shoulders, said shoulders being cooperable in said releasing position to clamp said ring between said member and nut and hold said member and mandrel against relative rotation, said cam surfaces being engageable in said releasing position and disengageable upon rotation of said mandrel in the other direction.

9. A pipe grapple comprising, a mandrel having an external, spiralled, tapering face terminating in a downwardly facing shoulder, a sleeve-like expansible grappling member around the mandrel frictionally engageable with a surrounding pipe to resist relative movement between the pipe and member, said member having an internal, spiralled, tapering face terminating in an upwardly facing shoulder, said mandrel being movable in the member to a catching position to engage said faces to expand the member into gripping engagement with said pipe, said mandrel also being movable upon rotation in one direction in said member to a releasing position to disengage said faces and engage said shoulders, said shoulders being cooperable in said releasing position to hold said mandrel and member against relative rotation, and releasing means between the mandrel and member and operable upon rotation of the mandrel in the other direction to release the mandrel and member from said releasing position.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,996,068	Hindertiler	Apr. 2, 1935
2,075,248	Wickersham et al.	Mar. 30, 1937
2,184,681	Osmun et al.	Dec. 26, 1939
2,191,000	Thomas	Feb. 20, 1940
2,491,392	Osmun	Dec. 13, 1949
2,518,430	Osmun	Aug. 8, 1950