Dec. 20, 1960 R. A. RANSOM 2,965,175

PIPE PULLER

Filed June 25, 1949 2 Sheets-Sheet 1

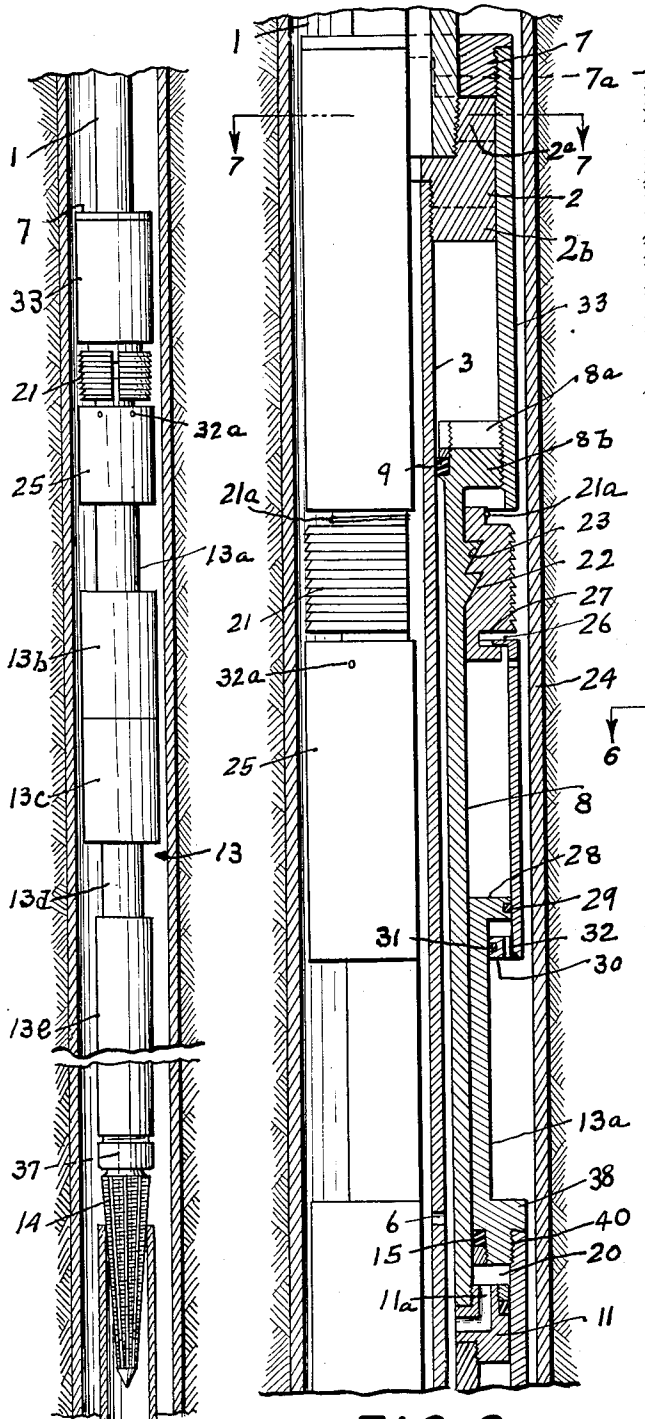

FIG. 1.

FIG. 2

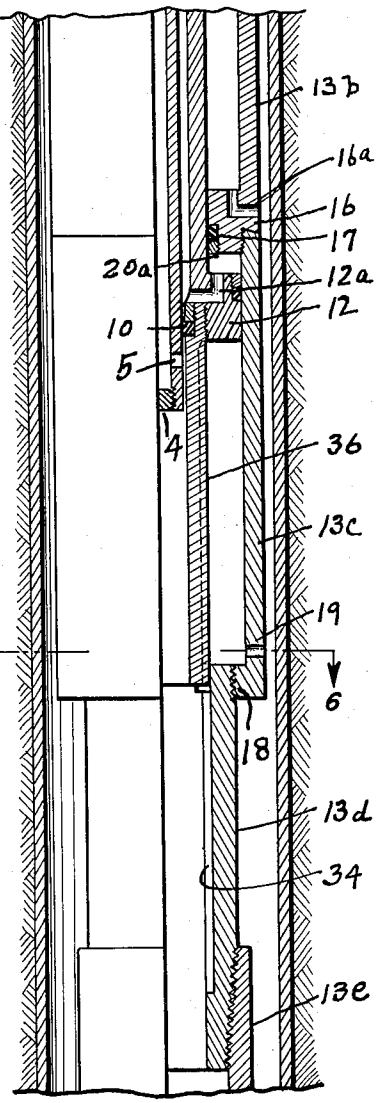

FIG. 3

INVENTOR.
Russell A. Ransom
BY
E. J. Hardway
ATTORNEY.

Dec. 20, 1960 R. A. RANSOM 2,965,175

PIPE PULLER

Filed June 25, 1949 2 Sheets-Sheet 2

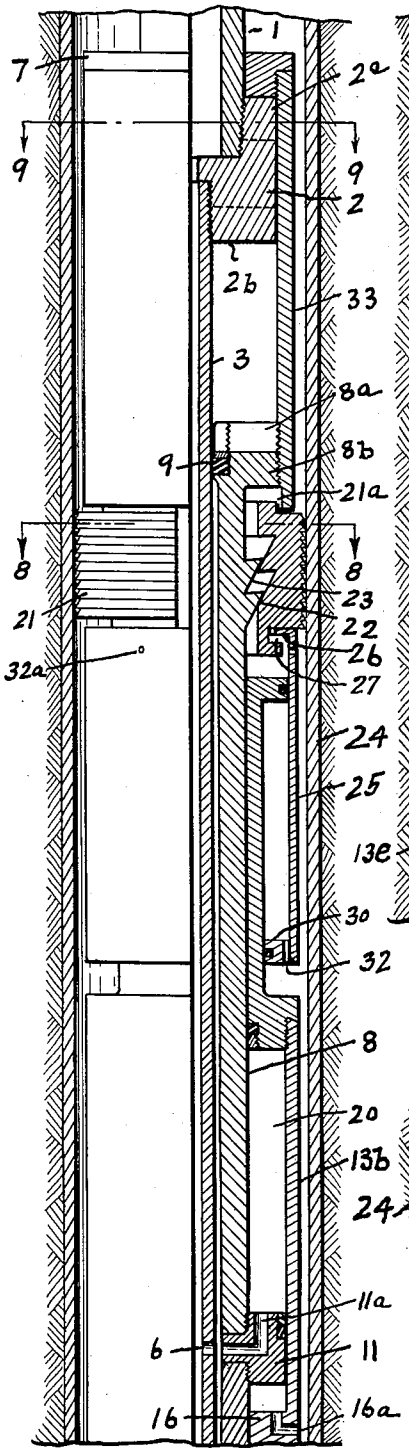

FIG. 4

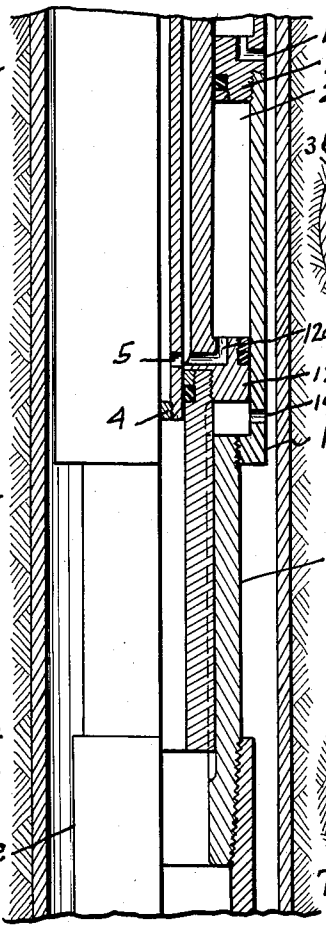

FIG. 5

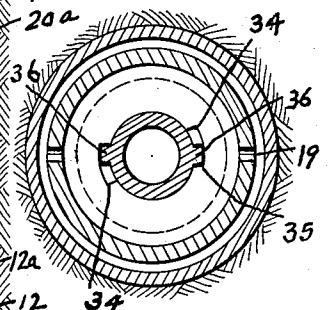

FIG. 6

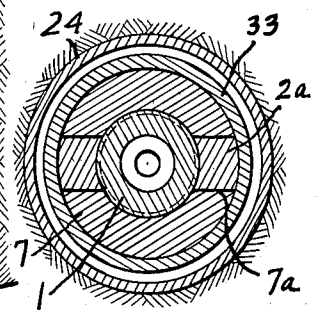

FIG. 9.

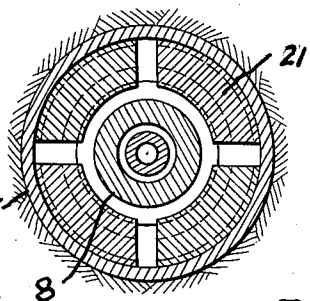

FIG. 8

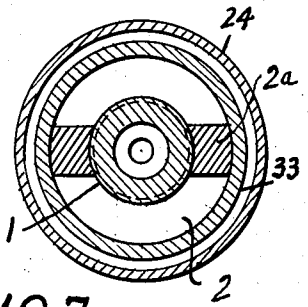

FIG. 7.

INVENTOR.
Russell A. Ransom
BY
E. V. Hardway
ATTORNEY

United States Patent Office 2,965,175
Patented Dec. 20, 1960

2,965,175

PIPE PULLER

Russell A. Ransom, Houston, Tex., assignor to Dailey Oil Tools, Inc., Houston, Tex., a corporation of Texas

Filed June 25, 1949, Ser. No. 101,276

20 Claims. (Cl. 166—98)

This invention relates to a pipe puller.

It is an object of the present invention to provide a tool of the character described that may be lowered into a well bore and engaged with a pipe stuck therein and by means of which fluid under pressure may be utilized to operate the tool to pull the pipe.

It is another object of the present invention to provide a pipe pulling tool with novel means thereon for anchoring the tool to the well casing during the pulling operation and which anchoring means may be readily released.

The invention embodies relatively movable parts, including means for connecting the parts together for simultaneous rotation or which may be disconnected to permit independent rotation of said parts.

Other objects and advantages will be apparent from the following specification which is illustrated by the accompanying drawings, wherein:

Figure 1 is an elevational view of the complete tool shown connected to a stuck pipe in a well and in inactive position;

Figure 2 is an elevational view partly in section of the upper end of the tool in inactive position;

Figure 3 is an elevational view partly in section of an intermediate section of the tool in inactive position;

Figure 4 is an elevational view partly in section of the upper end of the tool in active position;

Figure 5 is an elevational view partly in section of an intermediate section of the tool in active position;

Figure 6 is a cross-sectional view taken on the line 6—6 of Figure 3;

Figure 7 is a cross-sectional view taken on the line 7—7 of Figure 2;

Figure 8 is a cross-sectional view taken on the line 8—8 of Figure 4; and

Figure 9 is a cross-sectional view taken on the line 9—9 of Figure 4.

Referring now more particularly to the drawings, wherein like numerals of reference designate the same parts in each of the figures, the numeral 1 designates an operating string of pipe which extends to the ground surface, and secured on the lower end of this string there is a coupling member 2 which also serves the purpose of a clutch member and has the upper and lower transverse keys 2*a* and 2*b*.

There is a tube 3 whose upper end is secured to the coupling 2, and this tube is provided for the conduction of the operating fluid. The lower end of the tube is closed by the plug 4, and above said plug the tube is provided with the lower outlet ports 5. Said tube is also provided with a series of upper outlet ports 6. The purpose of these ports will be later explained.

Surrounding the lower end of the operating string 1, coupling 2 there is a clutch member 7 having the transverse key-way 7*a* in its under side. When the tool is in inactive position, the key-way 7*a* is unseated from the transverse key 2*a* and turned at an angle thereto, and when the tool is in position to be engaged with the stuck pipe, that is, when it lands on the stuck pipe and is

being engaged therewith, the key 2*b* may be seated in a transverse key-way 8*a* in the upper end of the tubular power stem 8 beneath. This power stem surrounds and is spaced from the tube 3 and is sealed at its upper and lower ends with said tube by means of the annular seals 9 and 10.

The power stem 8 is formed of upper, intermediate, and lower sections, connected by means of the upper and lower annular couplings 11, 12, and the lower section has a slideable splined connection with the tension string of the tool, said string being a tubular structure slidably surrounding power stem 8 and designated generally by the numeral 13 and comprising the upper, intermediate, and lower sections 13*a*, 13*b*, 13*c*, 13*d*, and 13*e*.

The pipe-engaging tool 14 is attached to the lower end of this string. In the present illustration this tool is shown as a tapering tap, although any selected type of pipe-engaging tool or pipe grapple may be employed. The lower end of the section 13*a* is externally enlarged, as indicated at 38, and below this enlarged portion 38 the section 13*a* is provided with an externally threaded portion 40, which is screwed into the intermediate section 13*b* beneath, above the coupling 11, and is sealed with the power stem 8 by means of the seal 15. The next succeeding section 13*c* is coupled to the section 13*b* by means of an annular coupling 16 above the coupling 12, which is sealed with the stem 8 by means of the seal 17 and which has a relief port 16*a* leading out from the string above; while the sections 13*c* and 13*d* are connected by means of an internal, annular flange 18 at the lower end of the section 13*c*, and above this flange there is a relief port 19 through the wall of the section 13*c*. The tension string sections 13*b* and 13*c* form cylinders, the section 13*b* having an inwardly projecting movable cylinder head thereon formed by the lower portion 40 of the section 13*a*, and the section 13*c* having an inwardly projecting movable cylinder head thereon formed by the coupling 16. The sections 13*b* and 13*c*, thus provide expansible chambers 20 and 20*a*. The couplings 11 and 12 project outwardly from the power stem and sealingly engage the inner walls of the cylinders formed by the respective sections 13*b* and 13*c* and form stationary pistons against which fluid pressure is directed to move the sections 13*b* and 13*c* longitudinally relative to the pistons.

The couplings 11, 12 have pressure channels 11*a*, 12*a* leading outwardly therefrom and through which pressure fluid through the tube 3 and ports 6 and 5 may be delivered into the expansible chambers 20, 20*a*.

The externally threaded lower end portion 40 of the section 13*a*, and the coupling 16, form cylinder heads on the sections 13*b* and 13*c* respectively, against which the pressure fluid may act to impart an upward pull to the tension string, to the pipe-engaging tool 14 and to the stuck pipes.

There are the casing-engaging jaws 21 which are arcuate in cross-section and which are spaced apart around the upper end of the power stem 8, said casing-engaging jaws having upwardly flared, inside faces 22, and the stem having corresponding upwardly flared faces 23, so that upon downward movement of the stem relative to the jaws said jaws will be expanded into contact with the surrounding well casing 24. The upper ends of the jaws are held together by a surrounding, annular spring element 21*a*.

To set the stem 8 and hold it against downward movement in the casing during the pulling stroke, there must be relative movement of a small amount between the stem 8 and the jaws 22. When the fluid pressure is exerted in the tool, the stem moves downwardly slightly until it is secured to the casing by the jaws 22. This action takes place before the sections 13, which are secured to the fish by the grapple 14, move upwardly,

While the tool is being lowered into the well, the jaws **22** merely hang on the stem **8**, but they cannot ride downwardly with the stem during the initial exertion of fluid pressure if they are to set the stem in the casing. Accordingly, it is obvious that some means has to be supplied to hold the jaws **22** up, temporarily, during the initial downward movement of the stem **8**, and this means will now be described.

There is an external coupling **25**, whose upper end surrounds the lower end of the jaws **21** and welded thereon is a sectional, inwardly extended flange **26** which projects into external, horizontally disposed notches **27** in said jaws to loosely connect the jaws to the coupling, and the lower end of said coupling **25** works over an external annular flange **28** on the upper end of the section **13***a*, and is sealed therewith by a seal ring **29**, or other suitable packing means. The lower end of the coupling **25** has an inside sectional ring **30** welded therein and which is sealed with the section **13***a* by a seal ring **31**, or other suitable packing means and which is provided with a relief port **32**. As is well known to those skilled in this art, the flange **28**, seal ring **29**, ring **30**, seal ring **31** and relief port **32** function as a dash-pot like the dash-pot shown at **40** of the U.S. patent to Lawrence No. 2,537,413, and it serves the same function as that described in said Lawrence patent col. 5, lines 23 to 35. The upper end of the coupling **25** is also provided with a relief port **32***a*.

The clutch member **7** is threaded into the upper end of a tubular housing **33** which surrounds the coupling member **2** and whose lower end is screwed onto the externally enlarged upper end **8***b* of the power stem **8**.

In operation the tool is assembled, as shown in Figures 1, 2, and 3, and is lowered into the well casing. It should be here noted that the section **13***d* of the tension string has internal longitudinal key-ways **34**, whose upper ends are laterally turned, in a circumferential direction, thus providing the notches, or seats **35**, **35** and the lower end of the power stem **8** is provided with the keys **36** which are located in said keyways and whose lower ends may be seated in said notches to prevent the telescoping of said power stem into the tension string. When the tool is in this position, the port **5** will be beneath the seal **10**, and, if desired, washing fluid may be forced downwardly through the operating string of pipe and on down through the tube **3** and out through the port **5** and on down through the tension string so as to furnish flushing fluid into the well about the upper end of the stuck pipe, if necessary, and in this connection it should be here stated that the pipe-grappling tool **14** has a fluid channel **37** extending therethrough from the upper to the lower end thereof to permit the flow of this flushing fluid. The port **5** in this position also allows the tool to fill with well fluid while going in.

When the pipe-engaging tool, or grapple, **14** lands on the stuck pipe, the operating string of pipe **1** may be lowered and the key **2***b* seated in the transverse key-way **8***a*, thus clutching the operating string with the power stem **8**, and the entire tool may then be manipulated or turned as desired, and if a tapering tap is employed, such as shown in Figure 1, the tool may be turned in a clockwise direction to screw said tap securely into the pipe to be pulled, or if another type of pipe-engaging tool is employed the tool may be suitably manipulated to cause it to engage with the stuck pipe.

An upward pull may be then taken on the string **1**, and, if necessary, said string may be turned until the key **2***a* is seated in the key-way **7***a*, in the position shown in Figure 4, and this upward movement will carry the port **5** above the packing **10** and in communication with the channel **12***a*.

Pressure may be then applied to the chambers **20**, **20***a* and this pressure will first force the power stem **8** downwardly a sufficient distance to move the jaws **21** outwardly and into engagement with the casing **24**, the jaws and the external coupling **25** being held against downward movement with the stem **8** by the frictional resistance of the packing means **29** and **31** between the coupling **25** and the section **13***a* of the tension string and continuation of the pressure will thereafter move the tension string **13** upwardly, thus exerting an upward pull on the stuck pipe and may release it from its stuck position.

It may be necessary, in order to release the stuck pipe to take a second pull and in such case the key **2***a* is unseated from the upper key-way **7***a* and by letting down on the string **1** and turning it to carry the key out of alignment with the keyway. This carries the port **5** beneath the packing **10** and out of communication with the channel **12***a*. An upward pull is then taken, as before, to carry the parts into the position indicated in Figures 2 and 3. The operating string is then turned to align the key **2***a* with, and to seat it in, the key-way **7***a*, thus carrying the port **5** into communication with the channel **12***a*. Fluid pressure is then applied downwardly through the string **1** and the tube **3** as before, and into the chambers **20**, **20***a*, and another pull in that manner taken as before.

What I claim is:

1. A pulling tool of the class described, comprising, inner and outer tubular members telescopically connected for relative axial movement, said inner tubular member being normally closed at its inner end, longitudinally spaced annular seal means mounted on the respective members to seal between said members, means to introduce pressure fluid between said tubular members between said seal means to produce said relative axial movement, grapple means carried by said outer member connectible to an object to be pulled upwardly in the well bore, and well wall-engaging anchor means mounted on said inner member.

2. A pipe puller comprising, a tubular tension string, a grappling tool connected to the string, a tubular power stem within and telescopically connected to the string for axial movement relative to the string, longitudinally spaced annular seal means mounted on and forming with the string and stem a pressure chamber between them, means for anchoring the stem to a well pipe, means for supplying liquid under pressure to the chamber to produce relative axial movement between the string and stem, and a coupling loosely connecting the tension string with the anchoring means.

3. A pipe puller comprising, a tubular tension string, means carried thereby for attaching the string to an object in a well to be pulled, a tubular power stem telescopically connected to the string for axial movement relative to the string, longitudinally spaced seal means mounted on and forming with the string and stem a pressure chamber between them, means operable by relative axial movement of the stem and string to anchor the power stem to a surrounding well casing, a tube extending from a source of liquid under pressure downwardly through said power stem and adjustable to one position to supply liquid under pressure to the power stem and to another position to supply liquid under pressure to said chamber to produce relative axial movement between the string and stem.

4. A pipe puller comprising, a tubular tension string, a grappling tool on the lower end of said string, a tubular power stem within and telescopically connected to the tension string for axial movement relative to the string, longitudinally spaced seal means mounted on and forming with the string and stem a pressure chamber between them, means for supplying liquid under pressure to said chamber to produce relative axial movement between the string and stem, means operable by movement of the stem in the string for anchoring the stem to a surrounding well pipe, interlocking means turnable to one position to lock the string and stem against relative axial movement while the tool is being lowered into a well, said interlocking means being releasable to allow

limited axial movement of the string and stem relative to each other.

5. A pipe puller comprising, a tubular tension string, a grappling tool on the lower end of said string, a tubular power stem within and telescopically connected to the string for axial movement relative to the string, longitudinally spaced seal means mounted on and forming with the string and stem a pressure chamber between them, means operable by movement of the stem in the string for anchoring the stem to a surrounding well pipe, a tube extending from a source of liquid under pressure downwardly, through the power stem and provided with an outlet port for the delivery of liquid under pressure to the chamber to produce relative axial movement between the string and stem in a direction to move the stem and grappling tool upwardly.

6. A pipe puller comprising, a tubular tension string, a grappling tool on the lower end of the string, a tubular power stem in and telescopically connected to the tension string for axial movement relative to the string, longitudinally spaced annular seal means mounted on and forming with the string and stem a pressure chamber between them, means operable upon relative axial movement between the string and stem for anchoring the stem against downward movement relative to a surrounding well pipe, a tube extending from a source of fluid under pressure downwardly through the power stem and in communication with said chamber and through which fluid under pressure may be delivered to the chamber to produce relative axial movement between the string and stem in a direction to exert an upward pull on said string.

7. A pipe puller comprising, a tubular tension string, a grappling tool on the lower end of the string, a tubular power stem within and telescopically connected to the string for axial movement relative to the string, longitudinally spaced annular seal means mounted on and forming with the string and stem a pressure chamber between them, means operable upon relative axial movement between the string and stem for anchoring the stem against downward movement relative to a surrounding well pipe, a tube extending from a source of fluid under pressure downwardly through the power stem and in communication with said chamber and through which fluid under pressure may be delivered into the chamber to produce relative axial movement between the string and stem in a direction to exert an upward pull on the string, an operating string to which the upper end of the tube is connected, said operating string and tube being movable to lower or upper positions relative to said stem and means for clutching the operating string to the stem in either of said positions.

8. A pipe puller comprising, a tubular operating string, a tubular power stem around and telescopically connected to the operating string, a tubular tension string around and telescopically connected to the power stem for axial movement relative to the stem, a grappling tool on the lower end of the tension string, longitudinally spaced annular seal means mounted on and forming with the tension string and stem a pressure chamber between them, said stem having a passageway leading from the interior of the stem into said chamber, means operable by relative movement between the stem and the tension string for anchoring the stem against downward movement relative to a surrounding well pipe, said operating string having an opening therein and being movable in the stem to a position to establish communication between said opening and said passageway to introduce fluid under pressure from the operating string into said chamber to produce relative axial movement between the tension string and stem to exert an upward pull on said tension string.

9. A pulling tool of the class described, comprising, inner and outer tubular members telescopically connected for relative axial movement, longitudinally spaced annular seal means mounted on the respective members to seal between said members, means to introduce pressure fluid between said tubular members between said seal means

to produce said relative axial movement, grapple means carried by said outer member connectible to an object to be pulled upwardly in the well bore, and well wall-engaging anchor means mounted on said inner member.

10. A pulling tool of the class described, comprising, inner and outer tubular members telescopically connected for relative axial movement, said inner tubular member being normally closed at its lower end, longitudinally spaced annular seal means mounted on the respective members to seal between said members, means to introduce pressure fluid between said tubular members between said seal means to produce said relative axial movement, grapple means carried by said outer member connectible to an object to be pulled upwardly in the well bore, and well wall-engaging anchor means mounted on said inner member.

11. A pulling tool of the class described, comprising, inner and outer tubular members telescopically connected for relative axial movement, said inner tubular member being normally closed at its lower end, longitudinally spaced annular seal means mounted on the respective members to seal between said members, means to introduce pressure fluid between said tubular members between said seal means to produce said relative axial movement, grapple means carried by said outer member connectible to an object to be pulled upwardly in a well bore, and fluid pressure-actuated well wall-engaging anchor means mounted on said inner member.

12. A pulling tool of the class described, comprising inner and outer tubular members telescopically connected for relative axial movement, valve means for closing or opening the lower end of said inner member, longitudinally spaced annular seal means mounted on the respective members to seal between the members, means to introduce pressure fluid between said tubular members between said seal means to produce said relative axial movement, grapple means carried by said outer member connectible to an object to be pulled upwardly in a well bore, and well wall-engaging anchor means mounted on said inner member.

13. The combination defined in claim 12 in which said anchor means are fluid pressure actuated.

14. A pulling tool of the class described, comprising, an inner tubular stem, an outer cylinder mounted to move longitudinally on said stem and having sealing means at its upper end surrounding the stem to seal off the cylinder, a seal member fixed on said stem to sealingly engage the inner wall of said cylinder, means normally closing the bore of said stem below the seal member, a port in said stem for transmitting pressure fluid from said stem into said cylinder between said sealed upper end and said seal member, grapple means on said cylinder for connecting it to an object to be pulled upwardly in a well bore, and anchor means mounted on said stem radially expansible into gripping engagement with the wall of said well bore.

15. A pulling tool of the class described, comprising, inner and outer tubular members telescopically connected for relative axial movement, said inner tubular member being normally closed at its inner end, longitudinally spaced annular seal means mounted on the respective members to seal between said members, means to introduce pressure fluid between said tubular members between said seal means to produce said relative axial movement, grapple means carried by said outer member connectible to an object to be pulled upwardly in a well bore, and fluid pressure-actuated well wall-engaging anchor means mounted on said inner member.

16. A pulling tool adapted to be lowered and raised within a well bore on a pipe and including, a tubular mandrel suspended from said pipe, a piston on said mandrel, a tubular housing surrounding the mandrel and mounted thereon for limited movement relative thereto, and having a cylinder within which the piston is movable, sealing means between one end of the bore

of the cylinder and the exterior of the mandrel, said housing being adapted to have its lower end connected with a stuck object within the well, anchoring means for anchoring the mandrel within the well pipe, a circulating valve at the lower end of the tubular mandrel for controlling flow of fluid from the mandrel to the area therebelow, means for establishing communication between the interior of the mandrel and one end of the cylinder in the housing, whereby when the circulating valve is closed pressure fluid from a source external to the well bore may be directed from the mandrel into the cylinder between the cylinder end and the piston on the anchored mandrel to impart movement to the housing to exert an upward pull upon the object.

17. A pulling tool including, a tubular mandrel suspended from a pipe and having a plurality of pistons on its external surface, a housing surrounding that portion of the mandrel having the pistons thereon and formed with cylinders therein within which the pistons are movable upon relative movement of the housing and mandrel, said housing being adapted to be connected with a stuck object within a well, anchoring means for anchoring the mandrel and pistons against movement in the well, means for introducing a pressure fluid into each cylinder between one end of the cylinder and its respective piston whereby the pressure of said fluid imparts movement to the housing relative to the anchored mandrel to thereby exert an upward pull on the stuck object, and sealing means between the exterior of the mandrel and that end of each cylinder into which pressure fluid is introduced.

18. A pulling tool as set forth in claim 17, wherein the anchoring means comprises gripping slips carried by the housing and co-acting slip-expanding surfaces formed on the mandrel, whereby setting and releasing of the slips may be accomplished by axial movement of the mandrel relative to the housing.

19. A pulling tool for wells comprising anchoring and grapple carrying parts telescopically connected and reciprocable longitudinally relative to each other, said grapple carrying part having one end projecting downwardly from said anchorable part and a grapple on said end, means connecting the upper end of said anchorable part to a tubular suspension member independently of said grapple carrying part thereby leaving said grapple carrying part free to reciprocate relative to said anchorable part and connecting means and said suspension member, a fluid pressure actuated jack interconnecting said anchorable and grapple carrying parts and operate by fluid under pressure to forcibly lift said grapple carrying part relative to the anchorable part, said connecting means, anchorable part and grapple carrying part having intercommunicating fluid conducting passageways providing a pressure fluid conduit extending from the interior of the suspension member to the interior of said anchorable and grapple carrying parts and to said jack to carry pressure fluid for actuating said jack, said anchorable part carrying outwardly movable pressure actuatable anchoring means for anchoring said anchorable part in a well.

20. A pulling tool including, a tubular mandrel suspended from a pipe and having a plurality of pistons on its external surface, a housing surrounding that portion of the mandrel having the pistons thereon and formed with cylinders therein within which the pistons are movable upon relative movement of the housing and mandrel, said housing being adapted to be connected with a stuck object within the well, anchoring means for anchoring the mandrel and pistons against movement in the well, means for introducing a pressure fluid into each cylinder between one end of the cylinder and its respective piston whereby the pressure of said fluid imparts movement to the housing relative to the anchored mandrel to thereby exert an upward pull on the stuck object, and sealing means between the exterior of the mandrel and that end of each cylinder into which pressure fluid is introduced, and said anchoring means comprising gripping slips carried by the housing and coacting slip-expanding surfaces formed on the mandrel, whereby setting and releasing of the slips may be accomplished by axial movement of the mandrel relative to the housing.

References Cited in the file of this patent

UNITED STATES PATENTS

2,190,442	Costello	Feb. 13, 1940
2,270,648	Church	Jan. 20, 1942
2,329,939	Phipps	Sept. 21, 1943
2,352,423	Church	June 27, 1944
2,377,249	Lawrence	May 29, 1945
2,537,413	Lawrence	Jan. 9, 1951