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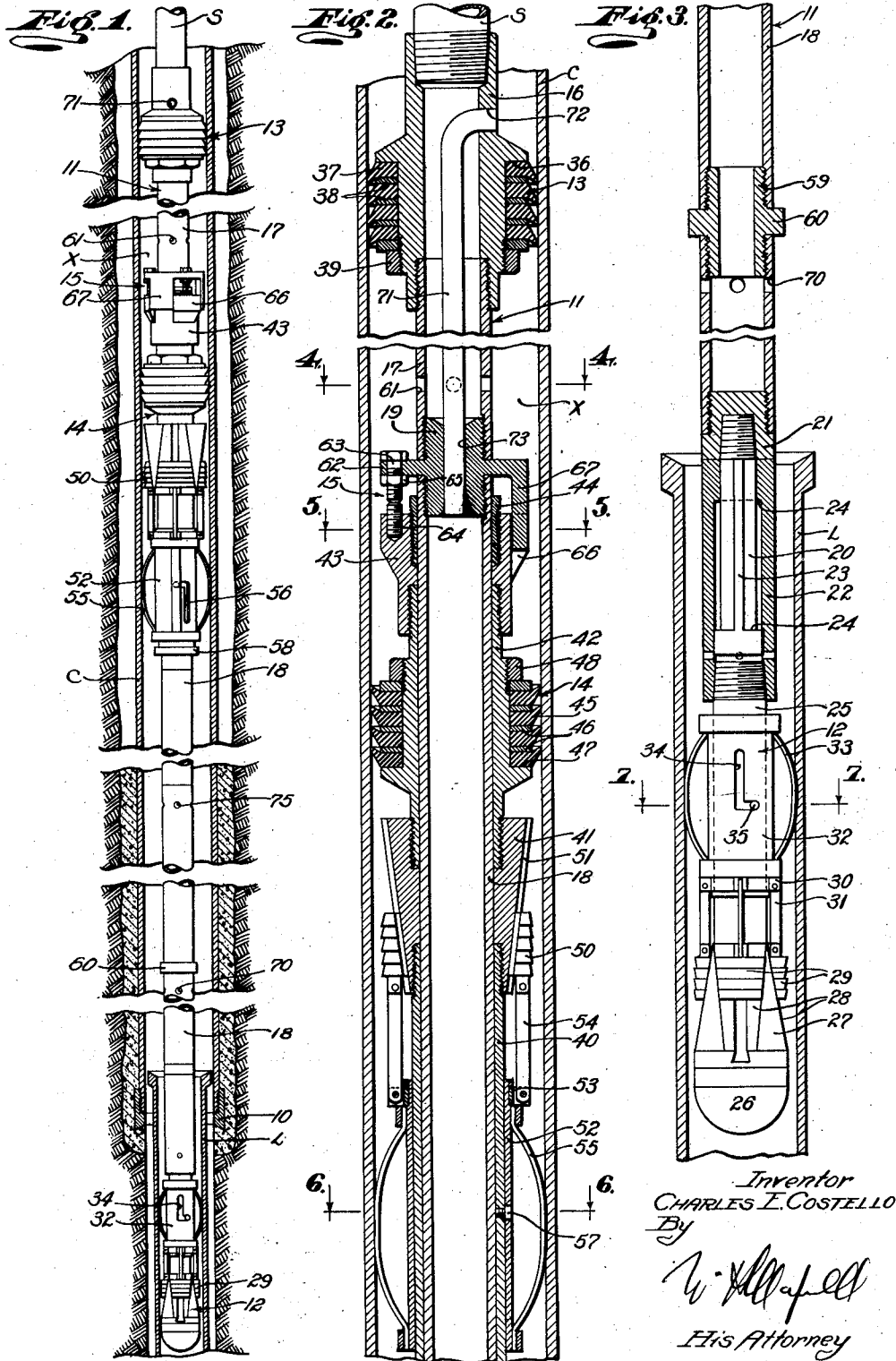
C. E. COSTELLO

2,190,442

TOOL USEFUL FOR REMOVING OBJECTS FROM WELLS

Filed May 10, 1938

2 Sheets-Sheet 1



Inventor
CHARLES E. COSTELLO
By
W. H. Hall
His Attorney

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C. E. COSTELLO

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2 Sheets-Sheet 2

Fig. 4.

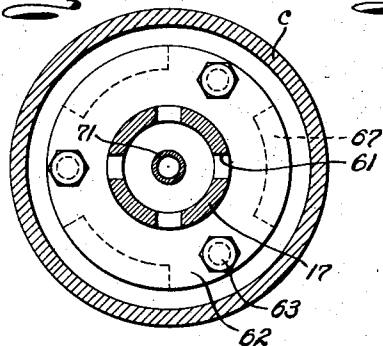


Fig. 5.

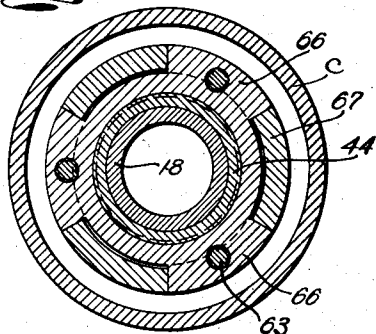


Fig. 6.

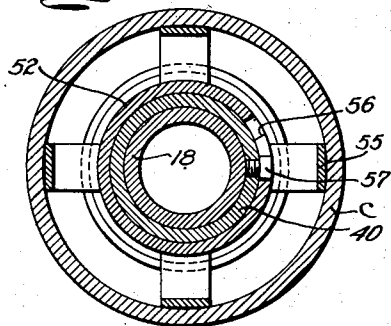


Fig. 7.

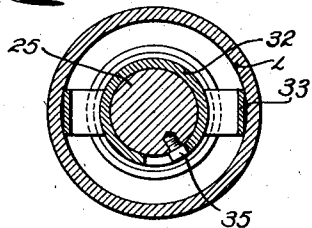


Fig. 8.

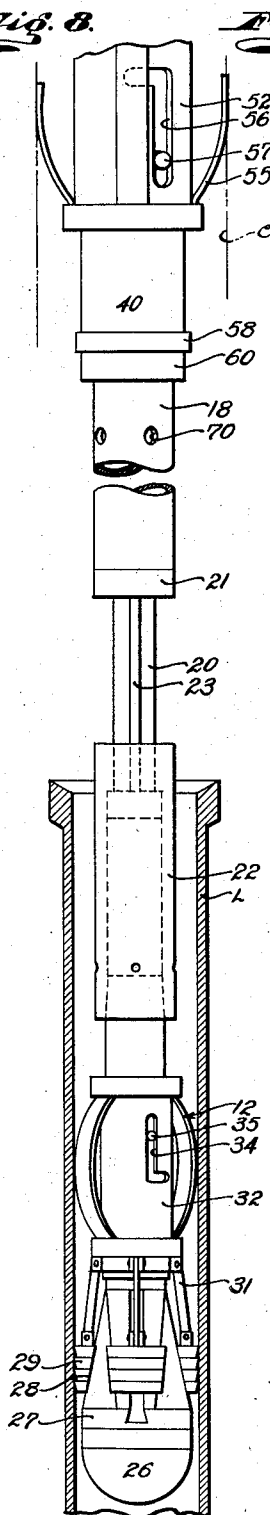
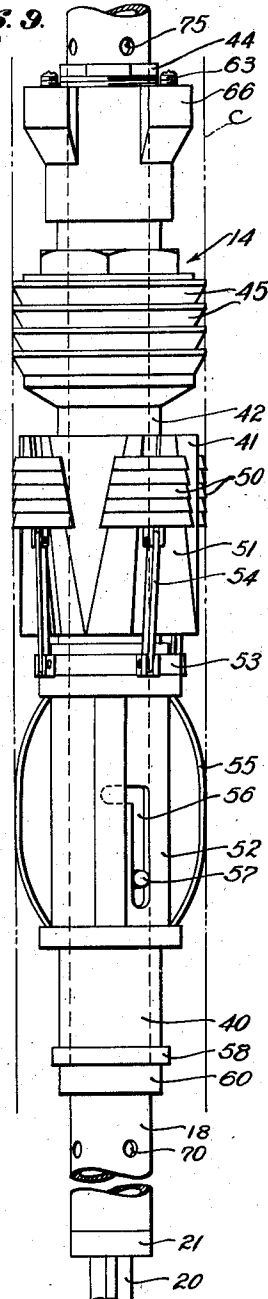


Fig. 9.



Inventor
CHARLES E. COSTELLO
By *W. H. Haffell*
His Attorney

UNITED STATES PATENT OFFICE

2,190,442

TOOL USEFUL FOR REMOVING OBJECTS
FROM WELLS

Charles E. Costello, Bakersfield, Calif., assignor
of one-fourth to William B. Collins and one-
fourth to Walter W. Boggs, both of Los An-
geles, Calif., and one-fourth to John W. Cos-
tello, Inglewood, Calif.

Application May 10, 1938, Serial No. 207,042

16 Claims. (Cl. 166—1)

This invention relates to a well tool and relates more particularly to a tool useful in removing or recovering objects from wells. A general object of the invention is to provide a practical dependable and particularly effective tool useful in recovering objects from wells.

Another object of this invention is to provide a fluid pressure operated tool capable of exerting a great force or pull on an object caught or lodged in a well to free or pull the same loose.

Another object of the invention is to provide a tool of the character mentioned that is capable of imposing or applying a heavy up pull on an object in the well without subjecting the fishing string, the hoisting equipment, the well derrick or the other well equipment to heavy strains or forces, the pulling forces being confined to the tool and the object in the well.

Another object of the invention is to provide a well tool of the character mentioned that may be operated to recover an object from the well without putting heavy tension on the fishing string so that the string may conform to irregularities in the well and is not liable to break under tension and little friction is set up between the string and the well casing or well wall, even though the well is crooked.

Another object of this invention is to provide a tool of the character mentioned in which fluid under pressure is pumped down through a tubular fishing string to act on a piston element connected with the fish or caught object through the medium of a grappling device to pull the object free for ready withdrawal from the well.

Another object of this invention is to provide a tool of the character mentioned in which the well lining or well casing is utilized as the cylinder for the fluid pressure operated piston element.

Another object of this invention is to provide a tool of the character mentioned embodying a sealing means or packing assembly cooperating with the well casing to act as a piston therein and connected with a suitable fishing tool or grappling tool for engaging the fish and embodying a second sealing means or packing assembly cooperating with the interior of the well casing to seal therewith at a point spaced from said piston element to define a pressure chamber or cylinder into which fluid under pressure is introduced to move the piston element upwardly and thus free the fish.

Another object of this invention is to provide a well tool of the character mentioned in which the cylinder-defining packing element is anchored

or secured to the well casing by a gripping means to form a stationary head or closure for the end of the fluid pressure space or cylinder that receives the fluid under pressure for actuating the piston element.

Another object of this invention is to provide a tool of the character mentioned in which a single tubular string may serve to carry the tool, to control and to manipulate the several mechanisms of the tool, to conduct the actuating fluid pressure to the tool and to withdraw the tool and the recovered object from the well.

Another object of this invention is to provide a tool of the character mentioned that embodies a novel arrangement of ports and passages that facilitates the quick and easy running of the tool into and out of the well and the draining of fluid from the fishing string as it is withdrawn from the well.

Another object of this invention is to provide a tool of the character mentioned in which the means for anchoring the packing element to the casing, and the grappling tool or fishing tool may both be fully controlled by simple manipulations of the fishing string.

A further object of this invention is to provide a tool of the character mentioned that is positive in operation and capable of exerting a very heavy up pull or force on an object in the well and, therefore, is particularly useful in recovering well liners and other objects that may be very tightly lodged or sanded in wells.

The various objects and features of my invention will be fully understood from the following detailed description of a typical preferred form and application of my invention, throughout which description reference is made to the accompanying drawings, in which:

Fig. 1 is a longitudinal sectional view of a portion of a typical well showing the tool of the present invention therein with the grappling device extending into the fish or liner. Fig. 2 is an enlarged longitudinal detailed sectional view of the upper portion of the tool in the well casing showing the parts in the normal or unactuated positions. Fig. 3 is an enlarged longitudinal detailed sectional view of the lower portion of the tool showing the grappling device in elevation and in position in the fish or liner. Figs. 4, 5 and 6 are enlarged transverse detailed sectional views taken as indicated by lines 4—4, 5—5 and 6—6, respectively, on Fig. 2. Fig. 7 is an enlarged transverse detailed sectional view taken as indicated by line 7—7 on Fig. 3. Fig. 8 is a side elevation of the lower portion of the

tool showing the grappling device in the actuated condition and illustrating the fish or liner in vertical cross section, and Fig. 9 is a side elevation of the intermediate portion of the tool showing the gripping means or anchoring means of the packing assembly in the actuated condition.

In Fig. 1 of the drawings I have illustrated a portion of a typical well lined by a water string or casing C. The usual shoe 10 on the lower end of the casing C and the lower part of the casing are cemented in the well bore. A liner L extends downwardly in the well from the casing C and projects into the open or uncased lower portion of the well. In accordance with the usual practice the liner L extends some distance upwardly in the casing C. It may be assumed that the liner L is caught or sanded in the well to be difficult of removal by the usual means.

In the following detailed description the tool of the present invention will be described as employed to withdraw or recover the liner L from the well. It is to be understood that this description is not to be taken as limiting or restricting the use or application of the invention and that the invention is to be construed as covering any features or modifications that may fall within the scope of the claims.

The improved tool of the present invention may be said to comprise, generally, a tubular body or mandrel 11, a grappling device or fishing tool 12 on the mandrel 11 for gripping the liner L, a piston element 13 on the mandrel 11 operable in the well casing C, a sealing or packing means 14 around the mandrel 11 adapted to be anchored to and to seal with the casing C at a point spaced from the piston element 13 and thereby provide a pressure chamber X below the piston element 13, and a releasable connection 15 between the mandrel 11 and the packing means 14 releasable by the action of fluid pressure on the piston 13 to permit the control or actuation of the fishing tool 12 by the mandrel 11 subsequent to the actuation of the packing means 14.

The mandrel 11 constitutes the carrier for the various other parts of the tool and forms a conduit for conducting fluid, as will be more fully described. The mandrel 11 is proportioned to pass through the casing C and to enter the liner L with substantial clearance. In the preferred construction illustrated the mandrel 11 includes an upper member 16 threaded to the lower end of the string S. The member 16 is in the nature of a tubular sub or coupling and forms the body of the piston element 13, as will be hereinafter described. The mandrel 11 further includes a tubular upper section 17 threaded into the lower end of the member 16, a lower section 18 and a sub or coupling member 19 connecting the sections 17 and 18. The sections 17 and 18 of the mandrel 11 may each be formed of one or more connected lengths of pipe or tubing and in practice the sections may be of the same diameter. It is to be noted that the upper end of the tubular mandrel 11 is connected through the member 16 with the lower end of the operating string S to receive fluid therefrom.

The grappling tool or fishing tool 12 is connected with the lower end of the mandrel 11 and is operable to grip the fish or liner L. In the particular use or application of the invention illustrated, where the fish or liner L is in the form of a tubular object, the fishing tool 12 is in the nature of a spear adapted to enter the liner. It is to be understood that other forms of grap-

pling tools or fishing tools may be connected with the lower end of the mandrel 11 to adapt the tool for recovering objects of various shapes and natures. It may be preferred to connect a suitable jarring device between the lower end of the mandrel 11 and the tool 12. In the drawings I have illustrated a jarring tool comprising a stem 20 connected with the lower end of the mandrel section 18 by a coupling 21 and a tubular member 22 surrounding or receiving the stem 20. Splines 23 connect the stem 20 and the member 22 for relative longitudinal movement and hold them against relative turning. Opposing shoulders 24 are provided on the stem 20 and the member 22 to be brought together to produce a jarring action. The lower end of the coupling 21 may engage against the upper end of the member 22 to provide a jarring action.

The grappling tool or fishing tool 12 includes a body 25 threadedly connected with the lower end of the jarring tool member 22. A bull nose or head 26 is provided on the lower end of the body 25 and a cone 27 is provided on the body above the head 26. The cone 27 has a plurality of spaced downwardly and outwardly inclined ways 28. Slips 29 are slidably keyed to the ways 28 and are toothed to grip the interior of the fish or liner L. A ring 30 surrounds the body 25 and pivoted links or reins 31 connect the slips 29 with the ring. A friction means or tail piece is provided to control the slips 29. This means includes a sleeve 32 surrounding the body 25 above the ring 30. The sleeve 32 is turnable on the body 25 and has a swivel or rotatable connection with the ring 30. Outwardly bowed springs 33 are provided on the sleeve 32 to frictionally engage the interior of the fish or liner L. An L slot or J slot 34 is provided in the sleeve 32 and a pin 35 on the body 25 operates in the slot. The lateral branch or arm of the J slot 34 extends rearwardly from its lower end, with respect to the right hand direction of rotation. The pin 35 normally cooperates with this lateral arm of the slot 34.

The tool 12 may be operated to grip the interior of the liner L by turning the body 25 to the right to move the pin 35 out of the lateral arm of the slot 34 whereupon the body 25 is moved upwardly to actuate the slips 29. Upon upward movement of the body 25 the inclined ways 28 force the slips 29 outwardly into effective gripping engagement with the interior of the liner L or fish. It is to be noted that the body 25 of the fishing tool 12 is positively connected with the mandrel 11 of the tool through the splined jarring tool to be controlled by movement of the mandrel.

The piston element 13 is secured or fixed to the mandrel 11 and is operable under the influence of fluid under pressure below it to move the mandrel and the fishing tool 12 upwardly. The piston element 13 is provided on the upper portion of the mandrel 11 and in the simple preferred form of the invention illustrated the connecting member 16 forms the body of the piston element. The member 16 has a downwardly facing annular shoulder 36. The piston element 13 includes a series of alternate packing cups 37 and spacers 38 surrounding the member 16 below the shoulder 36. The uppermost cup 37 bears upwardly against the shoulder 36. A nut 39 is threaded on the member 16 and engages upwardly against the lowermost spacer 38 to hold the cups 37 and spacers 38 in position and to hold the assembly under the desired compression.

sion. The packing cups 37 are formed of a suitable flexible and resilient material and the cups face downwardly to expand outwardly into tight sliding and sealing cooperation with the interior of the casing C by fluid pressure introduced under the piston element 13. It is to be noted that the piston element 13 slidably seals with the interior of the casing C and that the casing constitutes the cylinder element of the device.

The sealing or packing means 14 is spaced between the grappling tool or fishing tool 12 and the piston element 13. In the preferred construction the packing means 14 is carried on or surrounds what I have termed the lower section 18 of the mandrel 11 and is initially connected with the mandrel by the releasable connection 15. In accordance with the invention the packing means 14 is in the nature of a tubular assembly arranged around the tubular mandrel 11. The packing means 14 includes a tube 40, a cone 41 threaded on the upper end of the tube 40 and a carrier member 42 threaded to the upper end part of the cone 41. A head 43 is threaded on the member 42 and carries a packing gland 44 for sealing about the mandrel 11. Following the release of the connection 15 the mandrel 11 is turnable and movable longitudinally relative to the assembly of the tube 40, the cone 41, the member 42 and the head 43.

It is to be understood that the invention is not to be construed as limited to the employment of the particular class of packing or sealing elements for the piston element 13 and the means 14 illustrated in the drawings and described above, as the invention contemplates the employment of multiple or single packers or sealing elements of any suitable character in the piston element 13 and the means 14.

The packing means 14 further includes a group or assembly of packing cups 45 and spacers 46. The cups 45 and the spacers 46 are ring-like members and surround the member 42. The spacers 46 are interposed between the adjacent cups 45. The lowermost cup 45 bears on an upwardly facing shoulder 47 on the carrier member 42 and a nut 48 is threaded on the member 42 to clamp against the uppermost spacer 46. The cups 45 face upwardly and their peripheral parts are adapted to seal with the inner wall of the well casing C. The packing cups 45 are formed of flexible resilient material and are effective to seal against fluid under pressure above them. The packing cups 45 of the means 14 are spaced below the piston element 13 to define the cylinder or pressure chamber X.

The packing means 14 further includes a gripping means or slip assembly for holding the packing cups 45, the carrier member 42, the tube 40, etc., against downward movement when pressure is introduced to the chamber X to actuate the piston element 13. In the typical embodiment of the invention illustrated the slip assembly includes slips 50 slidably keyed to downwardly and inwardly inclined ways 51 on the cone 41. The slips 50 are toothed and their teeth are formed to cooperate with the interior of the casing C to prevent downward movement of the cone 41 and associated parts. A sleeve 52 is turnably and slidably arranged around the tube 40 below the cone 41. A ring 53 is rotatably supported in a groove in the upper portion of the sleeve 52. Pivoted links or reins 54 connect the slips 50 with the ring 53. Outwardly bowed leaf springs 55 are provided on the sleeve 52

and are adapted to frictionally engage the interior of the casing C to resist movement of the sleeve with respect to the casing.

A releasable pin and slot connection is provided between the sleeve 52 and the tube 40 to control the slips 50 of the packing means 14. An inverted L slot or J slot 56 is provided in the sleeve 52 and a pin 57 on the tube 40 co-operates with the slot 56. The lateral arm of the J slot 56 is at the upper end of the slot and extends forwardly relative to the right hand direction of rotation. The pin 57 normally cooperates with the lateral arm of the slot 56 to hold the sleeve 52 in a position where the slips 50 are at the lower ends of their ways 51 and are retracted from the casing C. When the tube 40 is turned to the left and then moved downward the pin 57 moves out of the lateral arm of the slot 56 and then downwardly in the slot and this movement is accompanied by downward movement of the cone 41 relative to the slips 50 and the inclined ways 51 force the slips outwardly into gripping engagement with the casing C. The springs 55 resist downward movement of the sleeve 52 and the slips 50 during the downward movement of the tube 40 and the cone 41. It will be noted that the slips 50 are adapted to cooperate with the casing C to prevent downward movement of the packing means so that the cups 45 of the packing means form a closure or head for the lower end of the cylinder or pressure chamber X.

The slip assembly and the control therefor of the means 14 described above are merely typical and are not to be taken as restricting the invention to the employment of these particular constructions.

It is preferred to provide a stop collar 58 on the lower end of the tube 40 to limit movement of the sleeve 52 on the tube. The invention preferably includes means for stopping or limiting upward movement of the mandrel 11 through the packing means 14 following the release of the connection 15. In the case illustrated this stop means comprises a coupling member 59 interposed in the mandrel section 18 and provided with a projecting flange 60 adapted to engage the lower end of the tube 40 of the packing means 14 or the stop collar 58 thereon.

Port means is provided to admit fluid under pressure to the pressure chamber X to actuate or move the piston element 13 upwardly. The coupling member 19 described above serves to close off the interior of the tubular mandrel 11, that is, it forms a partition across the interior of the mandrel. The port means for admitting fluid to the chamber X includes one or more ports 61 in the wall of the mandrel section 17 above the coupling member 19. Fluid from the ground surface may flow down through the string S to pass through the member 16 and the mandrel section 17 and to discharge from the ports 61 into the pressure chamber X.

The releasable connection 15 is provided to connect the packing means 14 with the mandrel 11 so that the slips 50 may be controlled and actuated by manipulation of the string S and the mandrel 11. The connection 15 is in the nature of a frangible connection and is operable to transmit rotation as well as longitudinal movement. The connection 15 includes an annular flange 62 on the connecting member 19. The flange 62 is spaced above the head 43. Frangible screws 63 are passed through openings in the flange 62 and are threaded into sockets 64 in

the head 43. Nuts 65 may be threaded on the screws 63 to engage the under side of the flange 62. In accordance with the invention the screws 63 are formed to fail or break under a predetermined longitudinal strain set up or produced by the fluid under pressure in the chamber X acting on the piston element 13 and the set or stationary means 14 and moving the piston 13 upwardly with respect to the packing means 14. In practice the screws 63 may have annular grooves cut in them at points spaced between their ends so that they are weakened to fail at these points. Following the actuation of the slips 50 pressure applied to the fluid in the chamber X acts against the piston element 13 to move the mandrel 11 upwardly with respect to the packing means 14 and this force and movement breaks the screws 63.

The releasable connection 15 includes clutch elements for transmitting turning forces between the mandrel 11 and the packing means 14. A plurality of circumferentially spaced clutch ears or lugs 66 is provided on the head 43 and clutch jaws 67 depend from the flange 62 and are received between the lugs 66. The jaws 67 cooperate with the lugs 66 for the positive transmission of turning forces between the mandrel 11 and the sealing or packing means 14. The engaging lugs 66 and jaws 67 relieve the frangible screws 63 of all turning forces and prevent the premature fracturing of the screws during the release and actuation of the slips 50. Following the breaking of the screws 63 upward movement of the mandrel 11 with respect to the packing means 14 moves the jaws 67 out of engagement with the lugs 66. This frees the mandrel 11 from the packing means 14 so that the mandrel may be turned and moved longitudinally with respect to the packing means to actuate the tool 12 as described above.

The invention provides a novel by-pass means for by-passing fluid past or around the piston element 13 and the packing means 14 when the tool is run into and out of the well. The by-pass means includes one or more lateral ports 70 in the lower section 18 of the mandrel 11. The ports 70 are preferably spaced below the stop flange 60. The by-pass means further includes a by-pass pipe 71 extending longitudinally through the upper mandrel section 17. The pipe 71 extends upwardly into the member 16 and its upper end is received in a lateral opening 72 in the wall of the member 16. The upper end of the pipe 71 communicates with the well or well casing C at a point above the sealing cups 37 of the piston element 13. The lower end portion of the pipe 71 extends through or into an opening 73 in the member 19. The lower end of the pipe 71 communicates with the interior of that portion of the mandrel 11 below the member 19. The pipe 71 is considerably smaller in diameter than the mandrel 11 and passes through the mandrel and the member 16 with substantial clearance, leaving ample space for the passage of fluid therethrough. During longitudinal movement of the tool through the casing C fluid is free to flow through the by-pass pipe 71 in a counter direction and thus by-passes past or through the piston element 13 and the packing means 14. When the tool is run into the well, fluid enters the ports 70, and flows through the mandrel 11 and the pipe 71 to discharge above the piston element 13. When the tool is pulled

71 and the mandrel 11 to discharge from the ports 70.

It is preferred to provide means whereby fluid may drain from the fishing string or operating string S when the string and tool are withdrawn from the well. This means includes one or more lateral ports 75 in the wall of the lower mandrel section 18. The ports 75 are located to be below the tube 40 when the parts are in the unactuated positions and to be in communication with the chamber X when the mandrel 11 has reached the upper portion of its stroke relative to the packing means 14. In practice the distance between the ports 75 and the stop flange 60 is equal to or slightly greater than the distance between the stop flange 58 and the gland 44 of the means 15 so that the ports 75 communicate with the chamber X when the stop flange 60 is in engagement with the lower end of the tube 40 or its stop collar 58. When the ports 75 are in communication with the pressure chamber X fluid from the string S is free to flow out through the ports 61 into the chamber X and then in through the ports 75 into the mandrel 11 to discharge into the casing or well through the ports 70.

In the operation of the tool the mandrel 11 may be connected with the lower end of the operating string S with the several parts in the positions illustrated in Figs. 1 to 7, inclusive, of the drawings. The tool is run into the well on the operating string S to the point where the grappling tool 12 is within the fish or liner L. The position of the liner L in the well is predetermined and the string S is readily lowered to a position where the tool 12 is within the liner. During the downward movement of the string of tools through the well casing C the fluid in the well is free to by-pass upwardly through the ports 70 and 75, the mandrel 11 and the pipe 71 to above the piston element 13 and the fluid in the well does not interfere with the free movement of the tool through the casing.

When it is desired to actuate the tool the string S is turned to the left to move the pin 57 out of the lateral arm of the slot 56 and the string S is then allowed to settle so that the pin moves downwardly in the slot 56. This downward movement is accompanied by downward movement of the cone 41, and the ways 51 of the cone force the slips 50 out into gripping engagement with the interior of the casing C. If desired the fluid in the string S and chamber X may be put under pressure to act on the packing means 14 to move or to assist in moving the cone 41 downwardly and effect the actuation of the slips 50 as just described. The slips 50 gripping the interior of the casing C hold the several elements of the sealing means or packing means 14 against downward movement. The fluid in the string S and the chamber X is then put under pump pressure. The pressure in the chamber X acts upwardly against the piston element 13 and tends to move the piston element and the mandrel 11 upwardly with respect to the packing means 14, the latter being held against downward movement by the slips 50. Sufficient pressure is put on the fluid in the chamber X to break or fracture the screws 63 and following the fracturing of the screws 63 the mandrel is free to move up under the action of the pressure on the piston element 13. When the screws 63 have been broken or parted the pressure is removed from the fluid in the string S and the chamber X. In this connection it is to be observed that the ports 61 at all times

maintain a free communication between the chamber X and the string S so that the pressure in the chamber X may be relieved when necessary or desirable.

Subsequent to the actuation of the slips 50 and the release of the connection 15, as just described, the string S is turned to the right to move the pin 35 out of the lateral arm of the slot 34 and is then moved upwardly to actuate the slips 29. The release of the connection 15, as described above, frees the mandrel 11 from the packing means 14 so that the mandrel may be freely manipulated to actuate the slips 29. The slips 29 are forced out by the inclined ways 28 to obtain a firm grip on the interior of the fish or liner L.

Following the actuation of the fishing tool or grappling tool 12 the fluid in the string S and the chamber X is again put under pressure. In practice a high pump pressure may be applied to the fluid. The pressure on the fluid in the chamber X acts upwardly against the piston element 13 and thus acts upwardly on the mandrel 11. The grappling tool 12 serves to connect the mandrel 11 with the fish or liner L and transmits the heavy up force from the mandrel to the liner or fish. The pressure on the fluid in the chamber X may be increased until a sufficiently strong up-pull is put on the liner L or fish to pull the same free. It will be understood how a very heavy up strain or pull may be put on the fish or liner L by applying appropriate pressure to the fluid in the chamber X. When the fluid pressure acting on the piston element 13 moves the mandrel 11, the tool 12 and the liner L upwardly, the mandrel moves up through the packing means 14.

The upward movement of the mandrel 11, the tool 12 and the fish or liner L may continue until the ports 75 come into communication with the chamber X and the stop flange 60 comes into engagement with the lower end of the tube 40 or its stop collar 58. The extent of upward movement of the mandrel 11, or the stroke of the piston element 13 and the mandrel, is determined by the length of the lower section 18 of the mandrel and this movement may be as great as desired. The upward movement of the fish or liner L resulting from the application of the fluid pressure to the piston element 13 frees the fish or liner from the well. Accordingly, when the mandrel 11 has reached the upper end of its stroke the heavy pump pressure may be removed from the fluid in the chamber X and the string S. The string S and the entire tool assembly may then be withdrawn from the well to recover the fish or liner L.

During upward movement of the string S and the tool through the casing C fluid is free to bypass down through the pipe 71 the mandrel 11 and out through the ports 70. Accordingly, the fluid standing in the casing C does not impede the upward movement of the tool assembly through the casing. As the string S is withdrawn from the well the fluid standing in it is free to discharge through the ports 61 into the chamber X and to then pass in through the ports 75 into the mandrel 11 to ultimately flow through the ports 70 into the well or casing C.

If at any time during the operation it appears desirable or necessary to withdraw the device from the well, the pressure in the chamber X may be relieved by merely stopping the pumps supplying the pressure to the string S whereupon simple manipulations of the string S will release

the tool 12 and the packing means 14. The string S may then be raised to remove the tool or device from the well. As above described fluid is freely by-passed through the pipe 71, the mandrel 11 and the ports 70 during the removal of the tool or device from the well.

The present invention provides a tool operated by fluid under pressure to apply a very heavy up force or pull on an object caught or sanded in a well without endangering the fishing string 10 by severe tensile strains. The tool utilizes the well lining or casing C as the cylinder of the fluid pressure actuated piston element 13 and utilizes the casing as a stationary abutment for the packing means 14 defining the lower end of the cylinder. The tool is such that it may be fully controlled and operated by simple manipulations of the single operating string S. The frangible connection or releasable connection 15 provides for the easy and rapid actuation of the slip assembly of the packing means 14 and following its release allows free rotary, as well as longitudinal movement of the mandrel 11 with respect to the packing means. The tool is adapted for use in freeing and removing objects of various kinds from wells and may be used with or may embody grappling tools and fishing tools of various natures.

Having described only a typical preferred form and application of my invention, I do not wish to be limited or restricted to the specific details herein set forth, but wish to reserve to myself any variations or modifications that may appear to those skilled in the art or fall within the scope of the following claims:

Having described by invention, I claim:

1. A tool useful in removing an object from a well comprising two spaced elements adapted to seal with the wall of the well to define a chamber in the well, means connected with one of the elements for gripping the said object, means for holding the other element against movement, and means for introducing fluid pressure to said chamber to act on the first mentioned element to move said object.

2. Apparatus useful in removing an object from a well comprising a tubular string to be run into the well, two elements for sealing with the wall of the well and vertically spaced apart to define a pressure chamber, one of said elements being secured to the string, means operable to hold the other element against movement, a device on the string for connecting the same with the object, and means putting the string in communication with said chamber whereby fluid pressure may be applied to the first mentioned element to move said object.

3. Apparatus useful in removing an object from a well comprising a tubular string to be run into the well, two elements for sealing with the wall of the well and vertically spaced apart to define a pressure chamber, the upper element being movable with the string, the lower element and string being relatively shiftable, a connection between the string and said lower element releasable by a longitudinal strain, means operable by manipulation of the string for holding the said lower element against downward movement, means placing the string in communication with the said chamber whereby fluid pressure may be introduced to the chamber to release said connection, and means for connecting the string with the said object whereby the introduction of pressure to the chamber may act on the upper element to raise the said object.

4. Apparatus useful in removing an object from a well comprising a tubular string to be run into the well, two elements for sealing with the wall of the well and vertically spaced apart to define a pressure chamber, the upper element being movable with the string, the lower element and string being relatively shiftable, a connection between the string and said lower element releasable by a longitudinal strain, means operable by manipulation of the string for holding the said lower element against downward movement, means placing the string in communication with the said chamber whereby fluid pressure may be introduced to the chamber to release said connection, and a grappling tool connected with the string and operable by manipulation thereof to connect with the said object whereby the introduction of fluid pressure to the chamber subsequent to the release of said connection moves the said object upwardly.

5. A tool for use on a tubular well string for removing an object from a well comprising a mandrel to be connected with the string, a piston element on the mandrel for sealing with the wall of the well, packing means shiftable carried by the mandrel to grip and seal with the wall of the well and spaced below the piston element to define a pressure chamber in the well, means associated with the mandrel for gripping said object, and means for introducing fluid pressure from the string to the chamber to move the piston element, mandrel and object upwardly.

6. A tool for use on a tubular well string for removing an object from a well comprising a mandrel to be connected with the string, a piston element on the mandrel for sealing with the wall of the well, packing means shiftable carried by the mandrel to seal with the wall of the well below the piston element to provide a chamber in the well, means operable by manipulation of the mandrel for holding the packing means against downward movement, a grappling device connected with the mandrel for engaging said object, and means for introducing fluid pressure from the string to the chamber to exert an upward force on the piston element, mandrel and object.

7. A tool for use on a tubular well string for removing an object from a well comprising a mandrel to be connected with the string, a piston element on the mandrel for sealing with the wall of the well, packing means shiftable carried by the mandrel to seal with the wall of the well below the piston element to provide a chamber in the well, means operable by manipulation of the mandrel for holding the packing means against downward movement, means for by-passing fluid past the piston element and packing means during movement of the tool into and out of the well, a grappling device connected with the mandrel for engaging said object, and means for introducing fluid pressure from the string to the chamber to exert an upward force on the piston element, mandrel and object.

8. A tool for use on a tubular well string for removing an object from a well comprising a mandrel to be connected with the string, a piston element on the mandrel for sealing with the wall of the well, packing means shiftable carried by the mandrel to seal with the wall of the well below the piston element to provide a chamber in the well, a connection between the mandrel and the packing means releasable by a predetermined vertical force, means associated with the packing means operable by movement trans-

mitted from the mandrel through said connection to hold the packing means against downward movement, means for introducing fluid pressure from the string to said chamber to apply a longitudinal force to the connection to release the same, and a grappling device connected with the mandrel to engage said object whereby the introduction of fluid pressure to the chamber subsequent to the release of the connection moves the piston element, mandrel and object upwardly.

9. A tool for use on a tubular well string for removing an object from a well comprising a mandrel to be connected with the string, two vertically spaced elements for sealing with the wall of the well to provide a chamber, the upper element being secured to the mandrel, the lower element and mandrel being relatively shiftable, means associated with the lower element for holding the same against downward movement whereby the mandrel may be moved in the well with respect to the lower element, a device connected with the mandrel for securing said object to the mandrel, and means for passing fluid pressure from the string to said chamber to act on the upper element to raise the object.

10. A tool for use on a tubular well string, for removing an object from a well comprising a mandrel to be connected with the string, two vertically spaced elements for sealing with the wall of the well to provide a chamber, the upper element being secured to the mandrel, the lower element and mandrel being relatively shiftable, means associated with the lower element for holding the same against downward movement whereby the mandrel may be moved in the well with respect to the lower element, a device connected with the mandrel for securing said object to the mandrel, means for conducting fluid pressure from the string to the chamber to act on the upper element and free said object for removal from the well, and means for by-passing the fluid in the well past said element during movement of the tool through the well.

11. A tool for use on a tubular well string, for removing an object from a well comprising a mandrel to be connected with the string, two vertically spaced elements for sealing with the wall of the well to provide a chamber, the upper element being secured to the mandrel, the lower element and mandrel being relatively shiftable, means associated with the lower element for holding the same against downward movement whereby the mandrel may be moved in the well with respect to the lower element, a device connected with the mandrel for securing said object to the mandrel, means for conducting fluid pressure from the string to the chamber to act on the upper element and free said object for removal from the well, and means for conducting fluid from the string to the well below the lower element when the tool is withdrawn from the well.

12. Apparatus useful in removing an object from a well comprising a tubular string to be run into the well, two elements for sealing with the wall of the well and vertically spaced apart to define a pressure chamber, the upper element being movable with the string, the lower element and string being relatively shiftable, a connection between the string and said lower element releasable by a longitudinal strain, said connection including a part designed to fail under a predetermined tensile strain, means operable by manipulation of the string for holding the said lower element against downward movement, means

placing the string in communication with the said chamber whereby fluid pressure may be introduced to the chamber to release said connection, and means for connecting the string with the said object whereby the introduction of pressure to the chamber may act on the upper element to raise the said object.

13. A tool for use on a tubular well string for removing an object from a well comprising a mandrel to be connected with the string, a piston element on the mandrel for sealing with the wall of the well, packing means shiftably carried by the mandrel to seal with the wall of the well below the piston element to provide a chamber in the well, a connection between the mandrel and the packing means releasable by a predetermined vertical force, said connection including a part for transmitting vertical forces designed to fail under a predetermined vertical strain, and cooperating members for transmitting turning forces disengaged by relative vertical movement between the mandrel and packing means, means associated with the packing means operable by movement transmitted from the mandrel through said connection to hold the packing means against downward movement, means for introducing fluid pressure from the string to said chamber to apply a longitudinal force to the connection to release the same, and a grappling device connected with the mandrel to engage said object whereby the introduction of fluid pressure to the chamber subsequent to the release of the connection moves the piston element, mandrel and object upwardly.

14. A tool for use on a tubular well string for removing an object from a well comprising a mandrel to be connected with the string, a piston element on the mandrel for sealing with the wall of the well, packing means shiftably carried by the mandrel to seal with the wall of the well below the piston element to provide a chamber in the well, a connection between the mandrel and the packing means releasable by a predetermined vertical force, means associated with

the packing means operable by turning and longitudinal movement of the mandrel to hold the packing means against downward movement in the well, means for conducting fluid pressure from the string to said chamber to impose a vertical force on the connection to release the same, and a grappling device connected with the mandrel and operable by manipulation thereof to grip said object whereby fluid pressure in the chamber acting on the piston element is transmitted to said object.

15. A tool for use on a tubular well string to free an object in a well, the well having a casing, the tool comprising a mandrel to be connected with the string, a piston element movable with the mandrel and adapted to seal with the casing, a sealing means shiftably related to the mandrel and sealing with the casing below the piston element to provide a chamber in the casing, slip means associated with the sealing means and operable by movement thereafter to grip the casing and hold the sealing means against downward movement, a frangible connection between the mandrel and sealing means whereby the mandrel may be manipulated to actuate the slip means, means on the mandrel for connecting the same with the object, and means for admitting fluid pressure from the string to the chamber to break said connection and thereafter raise the object.

16. Apparatus for removing an object from a well including a tubular well string, two vertically spaced elements for sealing with the wall of the well to define a fluid chamber, means connected with one of the elements for grappling the object in the well, means for engaging the wall of the well to hold the other element against movement, and means maintaining the said chamber in communication with the string whereby fluid pressure may be introduced to said chamber from the string to act on the first mentioned element to move said object and whereby said fluid pressure may be removed from the said chamber at will.

CHARLES E. COSTELLO.