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2,318,885

RETRIEVER

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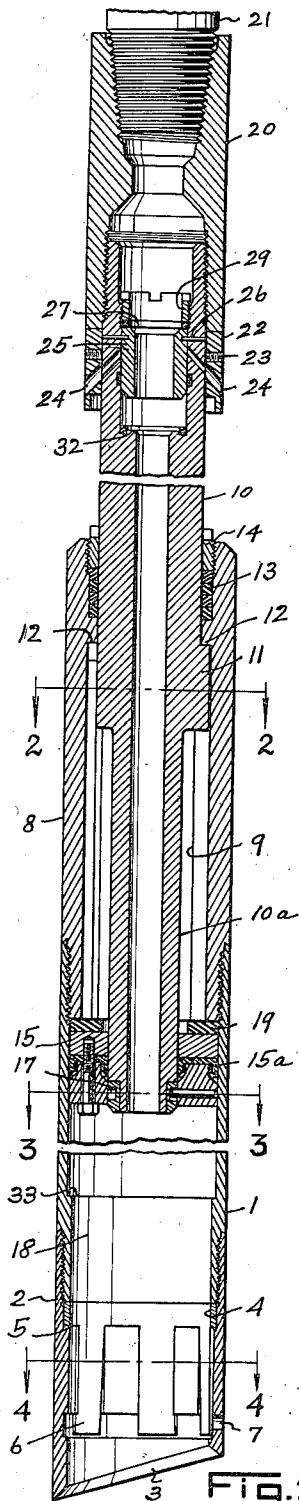


Fig. 1.

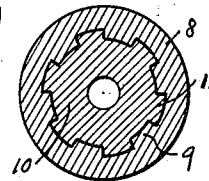
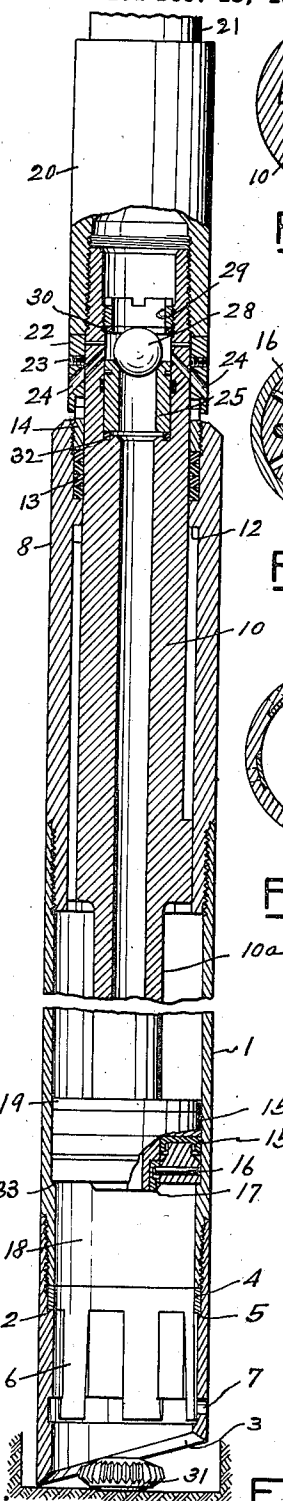


Fig. 2.

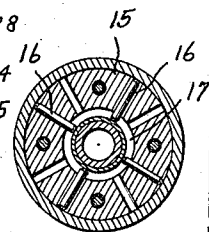


Fig. 3.

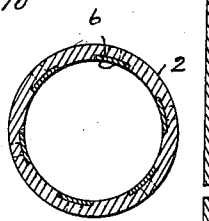


Fig. 4.

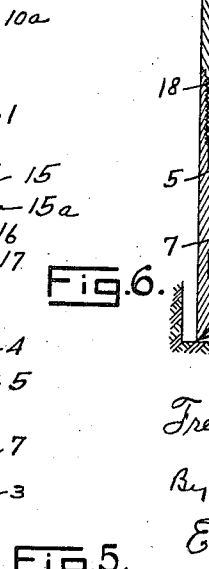


Fig. 5.

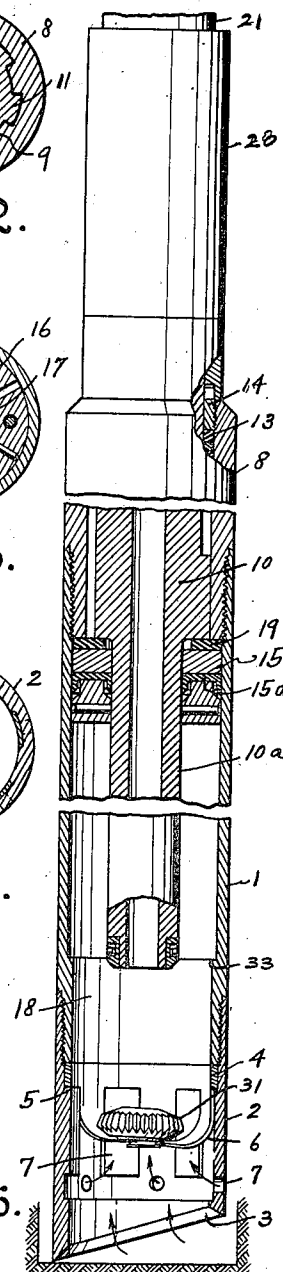


Fig. 6.

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2,318,885

RETRIEVER

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10 Claims. (Cl. 294—86)

This invention relates to a retriever.

An object of the invention is to provide a tool of the character described for retrieving objects at the bottom of the well bore which interfere with drilling operations.

In carrying on drilling operations, objects are sometimes inadvertently dropped into the well bore; or drill parts or other parts of the equipment in the well sometimes become detached and drop to the bottom of the bore which interfere with further drilling operations. If the object in the well is of such a nature that it cannot be forced to one side out of the way, it must be recovered and withdrawn from the well.

It is an object of the present invention to provide a tool of the character described whereby said object may be entrapped in the tool and withdrawn.

A further object of the invention is to provide a tool of the character described having an entrapping chamber, open at its lower end, with means for suddenly relieving the pressure in said chamber to permit the inrush of the well liquid, under the influence of hydrostatic pressure, which will carry the object sought to be recovered into the entrapping chamber; and the invention also embodies retaining means for retaining the object within the chamber until it is withdrawn with the tool from the well.

The invention also embodies a novel valve assembly for controlling a circulating channel, or channels, through the operating string to which the tool is attached.

With the above and other objects in view the invention has particular relation to certain novel features of construction, operation and arrangement of parts, an example of which is given in this specification and illustrated in the accompanying drawing, wherein:

Figure 1 shows a vertical sectional view of the tool shown in inactive position.

Figure 2 shows a cross-sectional view taken on the line 2—2 of Figure 1.

Figure 3 shows a cross-sectional view taken on the line 3—3 of Figure 1.

Figure 4 shows a cross-sectional view taken on the line 4—4 of Figure 1.

Figure 5 shows a vertical sectional view of the tool as lowered into a well over the object sought to be recovered with the circulating valve assembly in open position and with the tool in readiness to be operated, and

Figure 6 shows a side elevation, partly in section, showing the object to be recovered entrapped within the entrapping chamber of the tool.

Referring now more particularly to the drawing wherein like numerals of reference designate the same parts in each of the figures, the numeral 1 designates a tubular barrel screwed onto the lower end of which there is a tubular guide 2 whose lower end is preferably flared, as at 3, and cut on the diagonal. A catcher, or retainer, is anchored within this guide. This retainer embodies a ring 4 which is countersunk into the inner wall of the guide 2 and which is clamped between the inside annular shoulder 5 in the guide and the lower end of the barrel 1. Depending from the ring 4, there is a plurality of relatively wide flat fingers 6 which are formed integrally with the ring 4 and which normally lie in countersunk portions of the inner wall of the guide 2 and which are located in front of and normally close the radial ports 7 through said guide. The fingers 6 are gradually thickened from their lower ends upwardly for a reason to be hereinafter stated.

The upper end of the barrel 1 is screwed onto the lower end of the cylindrical coupling member 8 which is provided with inside longitudinal splines 9.

Slidable in the coupling 8, there is a tubular mandrel 10 which is provided with relatively short external splines 11 which interfit with the splines 9 as shown in Figure 2.

Above the splines 11, the mandrel 10 is formed externally of a true cylindrical shape. The splines 9 extend from the lower end of the coupling 8, but terminate beneath the upper end thereof and the grooves, in the coupling 8 between the splines 9, terminate at their upper ends at the shoulders 12 against which the upper ends of the splines 11 abut when the mandrel is in its upper position, as shown in Figure 1, to prevent the separation of the mandrel and coupling.

There is a seal ring 13 around the mandrel within the upper end of the coupling which is retained in place, and which may be placed under the required compression, by the gland 14 which is screwed into the upper end of the coupling around the mandrel and abuts said seal ring.

The lower end of the mandrel is reduced in external diameter forming a piston rod 13a and a suitable piston 15 is attached, in a manner hereinafter explained, to the lower end of the piston rod and embodies a downwardly opening annular cup ring 15a.

The piston assembly is normally anchored to the lower end of the piston rod 13a by a suitable number of shear pins 16 which extend radially through the piston and whose inner ends project

into an external annular groove 17 of the piston rod. When these pins are sheared, the piston may slide upwardly on the rod 10a. The piston is located in the barrel 1 which contains an entrapping chamber 18 beneath the piston.

As the piston 15 moves upwardly under the influence of the liquid pressure from beneath, as hereinafter explained, the cup ring 15a will be expanded by the pressure, thus forming a seal between the piston and the inner wall of the barrel 1 as well as between the piston and the piston rod 10a.

On the piston there is a yieldable bumper 19, of annular shape and surrounding the piston rod.

Screwed onto the upper end of the mandrel 10, there is a coupling 20 by means of which the tool is coupled to the operating string 21 which extends to the ground surface. Abutting the lower end of the coupling 20 and fitting closely around the mandrel, there is a short sleeve 22 which may be held in place by the set screws 23. Leading outwardly through the mandrel and sleeve, there are the circulating channels 24, which are normally closed by an inside tubular sleeve valve 25, which is pinned in upper position to close said channels by the shear pins 26. This valve has an inside downwardly tapering seat 27 to receive and support a ball valve 28 when the latter is dropped through the operating string. The sleeve valve 25 is limited in its upward movement by an inside tubular gland 29 screwed into the upper end of the mandrel and whose lower end is provided with an annular packing ring 30 to form a seal between it and the sleeve valve 25 when said last mentioned valve is pinned in its upper position.

In use the tool is assembled as shown in Figure 1, and lowered into the well with the piston 15 at the upper end of the entrapping chamber 18. Fluid may be circulated downwardly through the operating stem and through the tool to keep the chamber 18 washed clean and free from obstructions. The interfitting splines 9 and 11 form clutch means for rotating the coupling 8 and barrel 1 should it become necessary to rotate the same to properly locate it over an object, such as a drill cutter 31, lost in the well. When the tool reaches bottom, the ball valve 28 may be dropped from the ground surface through the operating string 21 and it will land on the seat 27 and upon application of liquid pressure exerted from the pumps through the operating string 21, the pins 26 will be sheared and the sleeve valve 25 will be moved downwardly until it lands on the inside annular upwardly facing seat 32 beneath as indicated in Figure 5. In this position the sleeve valve 25 will have cleared the channels 24 so that circulation may be maintained downwardly through the operating string 21 out through said channels and back up through the well bore around the operating string. Thereupon, the operating string and mandrel may be lowered thus lowering the piston 15 relative to the barrel 1 until the piston lands on an inside annular shoulder 33 adjacent the lower end of said barrel. As the piston is lowered to the position indicated in Figure 5, a partial vacuum will be created in the barrel and coupling 8 above the piston. As the piston is lowered, the liquid in the barrel beneath will be correspondingly displaced, the piston overcoming the hydrostatic head pressure. This pressure will, of course, be determined in accordance with the depth of the liquid in the well. A sufficient number of shearable pins 16 are used to with-

stand this pressure without shearing while the piston is being lowered. The depth of the liquid in the well will be known to the operator so that the required number of pins 16 may be used to withstand the pressure without shearing. When the piston lands on the shoulder 33, its downward movement is at once stopped and upon further downward movement of the operating string and mandrel, the pins 16 will be sheared and the piston released. The hydrostatic pressure in the well operating against the lower end of the piston will immediately move said piston upwardly until it is stopped by the lower end of the coupling 8, as illustrated in Figure 6. The pressure of the well fluid will usually be sufficiently high to move the piston up very suddenly and with great force and hence the shock absorber or bumper 19 is used to absorb the shock when the piston strikes the lower end of the coupling 8 and to prevent injury to said coupling and piston. The pressure in the entrapping chamber 18 beneath the piston, is, consequently, suddenly lowered and the well liquid rushes into said chamber with sufficient force to carry the object such as 31 up into the entrapping chamber 18. At the same time the pressure of the well liquid acting through the ports 7 and against the flexible fingers 6 causes the lower free ends of said fingers to move inwardly into the path of the in-rushing current from beneath. The sudden in-rush of the liquid through the opening at the lower end of the guide 2 will carry the object 31 up above said fingers before they are forced inwardly and the in-rushing current against their lower ends will force the free ends inwardly and upwardly into the position shown in Figure 6, thus entrapping the object 31 in the entrapping chamber and preventing its escape therefrom. It will be noted that the fingers 6 are relatively wide so as to present a wide surface to the in-rushing current of liquid and they become gradually thinner toward their free ends so that they will bend inwardly on a gradual curvature as indicated in Figure 6. These fingers are formed of suitable in-elastic material so that when they are bent inwardly into entrapping position by the inflowing current, they will remain in that position and will prevent the escape of the entrapped object.

The tool with the entrapped object therein may then be withdrawn from the well.

The drawing and description are illustrative merely while the broad principle of the invention will be defined by the appended claims.

What I claim is:

1. A retriever shaped to be lowered into a well bore and having an entrapping chamber at the lower end thereof open to the well bore, means for increasing the volume of the chamber while the tool is in the well to allow the sudden inrush of the well liquid into the chamber to carry an object in the well into the chamber and entrapping means arranged to be actuated into active position, by said liquid, to entrap the object in said chamber.

2. A retriever shaped to be lowered into a well bore and having an entrapping chamber open to the well bore, means in the tool movable to increase the volume of the chamber while the tool is in the well, to allow an object in the well to be swept into the chamber by the inrush of the liquid from the well and entrapping means arranged to be actuated into active position by the inflowing liquid, and effective to entrap and re-

tain the object in said chamber while the tool is being withdrawn from the well.

3. A tool of the character described shaped to be lowered into a well bore and having a chamber therein open to the well bore, a piston in the chamber, means operable from the ground surface through which the piston may be moved downwardly, when the tool lands on bottom to create a partial vacuum in the tool above the piston, means for releasing the piston to the hydrostatic pressure of the liquid in the well to allow the piston to move, independent of the piston moving means, upwardly under the influence of said pressure to cause an inflow of well liquid into the chamber to carry an adjacent object into the chamber by the inflowing current.

4. A tool of the character described shaped to be lowered into a well bore and having a chamber therein open to the well bore, a piston in the chamber, means operable from the ground surface through which the piston may be moved downwardly, when the tool lands on bottom to create a partial vacuum in the tool above the piston, means for releasing the piston to the hydrostatic pressure of the liquid in the well to allow the piston to move upwardly under the influence of said pressure to cause an inflow of well liquid into the chamber to carry an adjacent object into the chamber by the inflowing current and entrapping means arranged to be moved to active position by the inflowing liquid to entrap and retain said object in the chamber while the tool is being withdrawn from the well.

5. A tool of the character described shaped to be lowered into a well bore and having an entrapping chamber open to the well, means in the tool movable, while the tool is in the well, to increase the volume in the chamber to allow an object in the well to be swept into the chamber by the inrush of the liquid from the well and means having a slidable and non-rotatable connection with the chamber walls for connecting said movable means to an operating string.

6. A tool of the character described shaped to be lowered into a well bore and having a barrel containing an entrapping chamber and open at its lower end, a tubular mandrel having a slidable and non-rotatable connection with the barrel, a tubular operating string connected to the mandrel, a piston in the barrel connected to the mandrel and movable downwardly with the mandrel, means connecting the piston to the mandrel, releasable upon downward movement of the mandrel to allow the piston to move upwardly under the influence of the hydrostatic pressure of the liquid in the well to cause an inflow of well liquid into the chamber to carry an adjacent object into the chamber by the inflowing current.

7. A tool of the character described shaped to be lowered into a well bore and having a barrel containing an entrapping chamber and open at its lower end, a tubular mandrel having a slid-

able and non-rotatable connection with the barrel, a tubular operating string connected to the mandrel, a piston in the barrel connected to the mandrel and movable downwardly with the mandrel, means connecting the piston to the mandrel, releasable upon downward movement of the mandrel to allow the piston to move upwardly under the influence of the hydrostatic pressure of the liquid in the well to cause an inflow of well liquid into the chamber to carry an adjacent object into the chamber by the inflowing current and entrapping means movable to active position under the influence of the inflowing liquid to entrap and retain said object in the chamber.

8. In a well tool having a tubular operating string provided with a circulating channel through the wall thereof; a tubular sleeve valve in the string, releasable means for maintaining said valve in position to close the channel, and means shaped to be lowered through the string and to close the passageway through the valve whereby the valve will be moved downwardly by the pressure of the column of liquid in the string to open the channel to permit the outflow of the liquid from the string.

9. A tool of the character described shaped to be lowered into a well bore and having a barrel containing an entrapping chamber and open at its lower end, a tubular mandrel having a slidable and non-rotatable connection with the barrel, a tubular operating string connected to the mandrel, a piston in the barrel connected to the mandrel and movable downwardly with the mandrel, means for opening the string above the piston to the well bore upon downward movement of the mandrel, means connecting the piston to the mandrel, releasable upon downward movement of the mandrel to allow the piston to move upwardly under the influence of the hydrostatic pressure of the liquid in the well to cause an inflow of well liquid into the chamber to carry an adjacent object into the chamber by the inflowing current.

10. A tool of the character described shaped to be lowered into a well bore and having a barrel containing an entrapping chamber and open at its lower end, a mandrel having a slidable connection with the barrel, an operating string connected to the mandrel, a piston in the barrel connected to the mandrel and movable downwardly with the mandrel, means connecting the piston to the mandrel releasable upon downward movement of the mandrel to allow the piston to move upwardly under the influence of the hydrostatic pressure of the liquid in the well to cause an inflow of well liquid into the chamber to carry an adjacent object into the chamber by the inflowing current and entrapping means movable to active position under the influence of the inflowing liquid to entrap and retain said object in the chamber.

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