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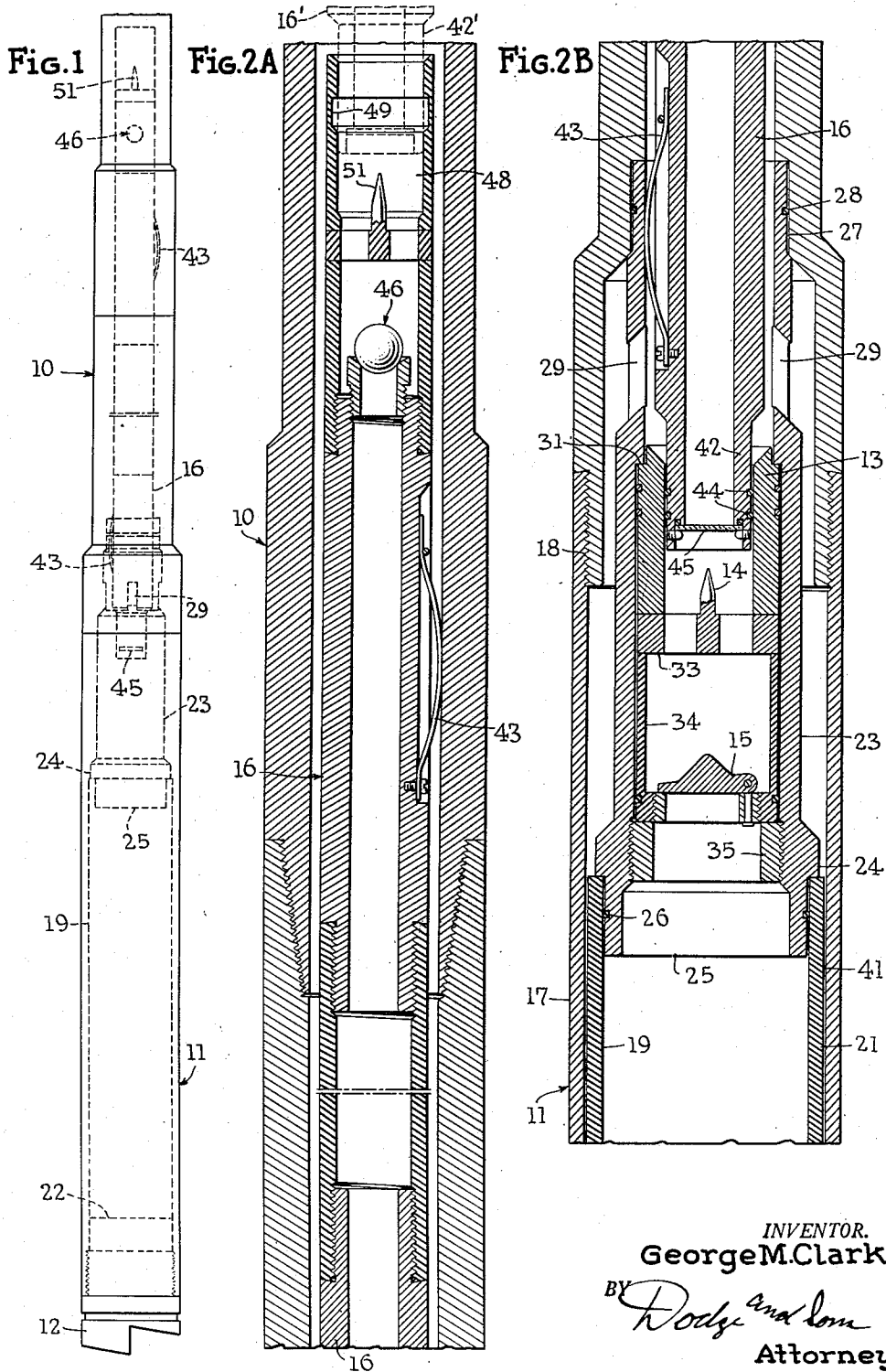
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2,696,257

FISHING TOOL

Filed June 12, 1952

2 Sheets-Sheet 1



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Fig. 2C

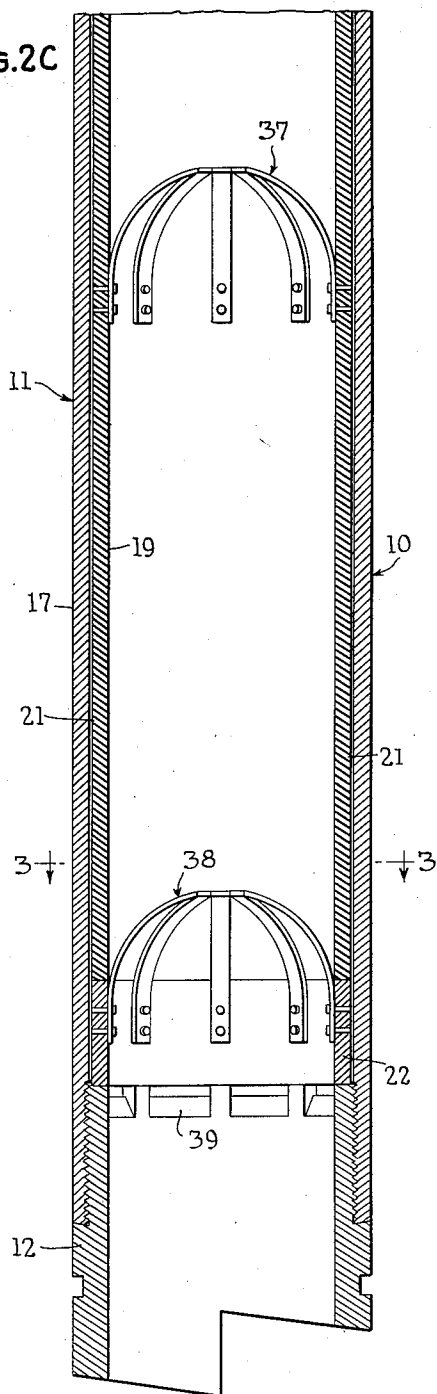


Fig. 4

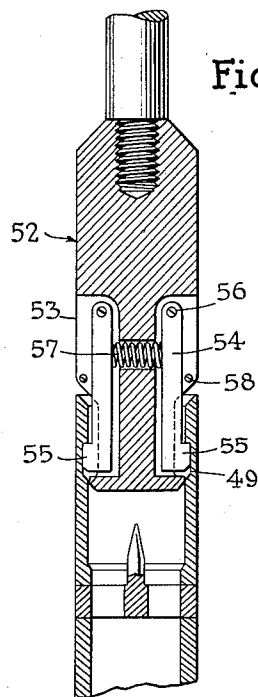
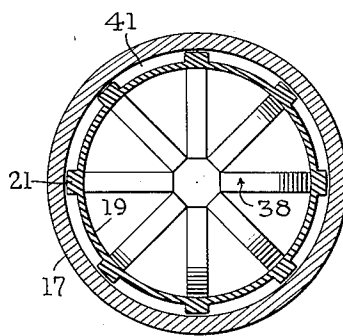


Fig. 3



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2,696,257

FISHING TOOL

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10 Claims. (Cl. 166—99)

This invention relates to a tool for use in recovering foreign objects from oil wells. Such tools are known as "fishing" tools and are used to recover broken or lost tools and the like from an oil well. Specifically this invention relates to a fishing tool of the type in which the object to be recovered is swept into a retaining basket by a surge of liquid under a high static pressure head.

Tools of this general type are known in the industry, but have, in the past, been subject to the limitation that only a single surge of pressure fluid could be obtained, unless all or a part of the equipment was raised to the surface. According to the present invention, a "fishing" tool is provided which can be operated to produce repeated surges of liquid to dislodge the object to be recovered without raising any equipment from the well hole between surges.

The tool comprises a retaining or "junk" basket which is attached to the lower end of a string of drill pipe. The upper end of the basket is closed against flow of circulated liquid downward therethrough by a one-way flow valve. A surge-producing air chamber is adapted to be pumped down through the string of pipe and is received by a seat provided on the basket. The air chamber comprises an elongated tubular member closed at its opposite ends against the influx of circulated liquid. The lower end of the tube is adapted to be opened when it is received by the seat on the retaining basket. When the lower end of the tube is thus opened a surge of liquid upward through the retaining basket is produced which pulls the "junk" into the retaining basket.

The upper end of the tubular air chamber is sealed against the influx of liquid by a one way flow valve which opens to permit the escape of the air from the chamber when the surge of circulated liquid is caused by opening of the lower end.

A seat similar to the one on the junk basket is provided at the upper end of the tubular surging producing member and is adapted to receive and open a second tubular member similar to the first when a second surge is desired. A series of tubular members may be pumped down through the string of drill pipe so that repeated surges may be produced. In this way the operator can operate the "fishing" tool so that he is assured that the "junk" is freed and swept into the retaining basket.

A second advantage, characteristic of the "fishing" tool built according to this invention is the fact that circulation may be carried on continuously during the fishing operation, whereby shale, sand and other formation is washed from the junk.

A preferred embodiment of the invention will be described having reference to accompanying drawings in which:

Figure 1 is a side elevation of the lower end of a string of drill pipe provided with a retaining basket in accordance with this invention, and showing in dotted lines the interior outline of the basket and the tubular member received in the upper end thereof.

Figures 2A, 2B, and 2C when arranged one above another in the order stated, constitute an axial section of the retaining basket and a cooperating air tube. Certain portions are broken away to facilitate illustration of the device.

Figure 3 is a sectional view taken on line 3—3 of Figure 2C.

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Figure 4 shows a portion of an air tube and the retrieving tool by which it may be drawn to the surface.

The general arrangement of the apparatus is best shown in Figure 1. The lower end of a string of drill pipe is generally indicated by the reference numeral 10. Threaded securely to the lower end of the string of drill pipe 10 is a junk retaining basket 11 which is in turn provided at its lower end with a shoe 12. At the upper end of the basket 11 and in the bore thereof there is provided an annular seat which is generally indicated by the reference numeral 13. Located centrally of the seat is a punch member 14.

Flow through the seat 13 is controlled by a check valve 15 which is located between the seat 13 and the interior of the junk basket 11. The seat 13 is arranged to receive the lower end of elongated tubular air chamber 16.

The cooperation of these parts will be better understood by reference to the more detailed showing in Figures 2A, 2B and 2C.

The body of the junk basket 11 comprises two spaced concentric cylindrical sleeves 17 and 19. The outer cylindrical sleeve 17 is threaded on to the lower end of the string of drill pipe 10 as is shown at 18. The inner cylindrical sleeve 19 is provided on its outer surface with a plurality of longitudinal ribs 21 (see Figure 3). Butting against the lower end of the inner sleeve 19 is a spring supporting collar 22. The upper end of the inner sleeve 19 is provided with a cylindrical sleeve-like extension 23 which has a shoulder 24 provided near its lower end. The shoulder 24 butts against the sleeve 19 which encircles a portion 25 of reduced diameter. Suitable sealing means is provided between the sleeve 19 and the portion 25, such as the O ring 26.

The upper end of the extension 23 is received in a counterbore 27 provided in the bore of the string of drill pipe 10. Flexible O ring 28 provides a seal between the counterbore 27 and the upper end of the sleeve 23. The sleeve 23 is provided with plurality of radial ports 29.

The cylindrical extension 23, the inner sleeve 19, and the collar 22 are confined between the string of drill pipe 10 and the shoe 12 which is threaded into the lower end of the sleeve 17.

The cylindrical extension 23 is provided with an inner annular shoulder 31. The shoulder 31 engages a shoulder provided at the upper end of the annular seat member 13.

Immediately below the seat member 13 there is provided a spider 33 which supports at its center the punch 14. A cylindrical valve body 34 is also received in the bore of the extension 23 and engages the lower surface of the spider 33. The seat member 13, the spider 33, and the valve body 34 are maintained in co-operating relationship by retaining nut 35 which is threaded into the extension 23. Check valve 15 is supported in the valve body 34 and prevents downward flow through the interior of the retaining basket 11.

The inner surface of the sleeve 19 is provided at approximately midlength with a set of curved retaining springs 37 fastened thereto. A similar set of retaining springs 38 is carried by the collar 22.

The upper surface of the shoe 12 is provided with plurality of ports 39 whereby a flow path is afforded between the bore of shoe 12 and the annular space 41 defined between the sleeves 17 and 19. Liquid circulating downward through the string of drill pipe 11 is caused to flow outward through the radial ports 29 to the annular space 41 and inward through the ports 39.

The air chamber 16 comprises a plurality of tubular sections which are separable. Any number of sections may be employed, so that a chamber of desired size is obtained. The lowermost end 42 of the air chamber 16 has a diameter which corresponds to that of the annular seat 13. A pair of toric rings 44 provide a seal between the seat 13 and the end 42 of air chamber 16.

Spaced apart sets of bow springs 43 are provided on the outer cylindrical surface of air chamber 16. These bow springs 43 react between the air chamber 16 and

the inner surface of the drill pipe, whereby the chamber 16 is centered.

A frangible disc 45 closes the lower end of the air chamber 16. The upper end of the air chamber is closed by a ball check valve assembly 46 which closes against the influx of liquid and opens to permit reverse flow.

The upper end of air tube 16 has a counterbore 48 having a diameter which corresponds to the diameter of the annular seat 13. An annular groove 49 is provided in counterbore 48 for reasons which will be more fully developed. A punch 51 similar to the punch 14 projects upward into counterbore 48. As is shown in dotted lines in Figure 2A, this counterbore is adapted to receive the lower end 42' of a second air chamber 16'.

As shown in Figure 4, a retrieving tool 52 is employed to raise the air chambers to the surface of the well after they have served their purpose. This retrieving tool 52 comprises a body portion 53 upon which are pivoted two spring pressed dogs 54. The dogs 54 are provided with protecting bosses 55 which are arranged to engage the groove 49 provided in the counterbore portion of the air chamber 16. The pins 56 on which the dogs 54 are pivoted are of such strength that they will be sheared if an upward thrust exceeding the strength of the Halliburton wire line by which the retrieving tool is raised and lowered is required to raise the air chamber 16. When these pins are sheared, spring 57 forces the dogs 54 outward against the stop pins 58. This action causes the protecting bosses 55 to be withdrawn from the groove 49, thus freeing the retrieving tool.

In operation the junk basket 11 is secured to the lower end of the string of drill pipe 10 at the surface of the well. This assembly is lowered until the bottom has been reached. Rotation of the string of drill pipe and circulation of liquid downward through the string of drill pipe are then started. Rotary movement of the string of drill pipe 11 causes the shoe 12 to cut into the sand and shale or other formation which may exist on top of the junk. The circulation of liquid flowing inward through the ports 39 washes this sand and shale away.

Shoe 12 serves to loosen and center the junk. When the operator is satisfied that the junk has been properly loosened and centered, rotation of the string of drill pipe 11 is stopped and circulation of liquid is discontinued. An air chamber 16 is then inserted into the upper end of the string of drill pipe 11 and circulation is resumed. The radial clearance between air chamber 16 and drill pipe 10 is such that the circulation of liquid causes the air chamber 16 to be moved downward through the string of drill pipe. The air chamber upon reaching the annular seat 13 is telescopically received thereby and sealed by the coaction of the rings 44 with the seat 13. After the seal has been made, downward motion of the air chamber 16 continues until the punch 14 breaks the frangible disc 45 and the tube is arrested by coming in contact with the upper surface of the seat 13. When the disc 45 is ruptured liquid surges from the junk basket 11 past the valve 35 into the air chamber 16. The entire volume of the chamber 16 is effective to produce this surge because the check valve 46 is unseated by the rush of liquid into the air chamber 16. The provision of the check valve 46 also lessens the possibility that the surge of liquid into the air chamber 16 might carry the air chamber 16 upward and out of contact with the seat 13.

It will be noticed that after the surge has been produced the circulation of liquid through the string of drill pipe 11 can be continued whereby further washing of the junk can be carried out. A second surge can be produced without the necessity of raising any equipment to the surface of the well by the simple expedient of pumping down a second air chamber 16'. In fact any number of surges can be produced until the operator's supply of air tubes of chamber 16 is exhausted. When the operator is satisfied that the junk has been washed into the retaining basket 12 above springs 37 and 38, the drill string may be raised to the surface of the well. If a number of air chambers 16 have been used, it may be desirable to retrieve them by use of the retrieving tool 52 prior to drawing the equipment to the surface.

A preferred embodiment of the invention has been described in detail, however no limitation to the precise structure shown is intended except as may be expressed in the appended claims.

What is claimed is:

1. A fishing tool comprising in combination a retaining basket for connection to a string of drill pipe; a check valve between the interior of the basket and the bore of said drill pipe and arranged to inhibit flow from said bore to said basket and permit flow in the reverse direction; means affording a by-pass flow path from said bore to the interior of said basket; a seat between said valve and the entrance to said flow path; an elongated tubular member defining therein a closed chamber and having an end thereof adapted to be received by said seat said member being insertable into and removable from the bore of said drill pipe; sealing means in said end closing said chamber against the influx of liquid circulated through said bore; and seal breaking means effective to render said sealing means ineffective to close said chamber after said seat receives said end of the tubular member.

2. The combination defined in claim 1 and valve means at the end of said member opposite to the end received by said seat; said valve means sealing said chamber against the influx of liquid and permitting reverse flow.

3. The combination defined in claim 1 and valve means at the end of said member opposite to the end received by said seat; said valve means sealing said chamber against the influx of liquid and permitting reverse flow; a second seat adjacent said valve means; a second tubular member similar to said elongated member adapted to be received by said second seat.

4. The combination defined in claim 1 in which said tubular member comprises a plurality of interconnected sections.

5. The combination defined in claim 1 and valve means at the end of said member opposite to the end received by said seat; said valve means sealing said chamber against the influx of liquid and permitting reverse flow; and an annular extension having a circumferential groove in its inner surface provided on the end of said member opposite to the end received by said seat.

6. A fishing tool comprising in combination a junk basket for connection to a string of drill pipe, said basket comprising inner and outer spaced sleeve elements, the upper end of said inner sleeve element slidably received in a counterbore in said drill pipe; and having a plurality of radial apertures; a shoe carried by said outer sleeve element and butting against the lower end of said inner element, said shoe and said inner element defining at their juncture a plurality of radial ports; a check valve adjacent the upper end of said sleeve element arranged to permit flow from the interior of said basket to the bore of said drill pipe and to inhibit reverse flow; a seat in the upper end of said inner sleeve above said check valve; an elongated tubular member having its lower end adapted to be received by said seat; means sealing the lower end of said member against the influx of liquid; means coacting between said seat and said lower end of said tubular member when received by said seat and effective to rupture said sealing means as a result of said coaction.

7. The combination defined in claim 6 and a second seat provided at the upper end of said tubular member; a one way flow valve adjacent said second seat and arranged to prevent the influx of liquid into said tubular member; a second tubular member similar to the first adapted to be received by said second seat; and means effective to rupture the seal at the lower end of said second member when it is received by said second seat.

8. A fishing tool comprising in combination with a string of drill pipe; a seat assembly mounted in said drill pipe; an elongated tubular member having therein an air chamber, said member being received in said drill pipe and moved therethrough by the circulation of liquid into sealing relation with said seat assembly; means sealing said chamber against the influx of liquid; and means effective to rupture said sealing means when said member is received by said seat assembly.

9. The combination defined in claim 8 and means affording a by-pass flow path around said assembly when said member is received thereby; a seat provided on said tubular member and arranged to receive a second tubular member similar to the first; and one way flow means between the seat provided on said tubular member and the air chamber therein and arranged to inhibit the influx of liquid to said air chamber and permit reverse flow.

10. A fishing tool comprising in combination with a string of drill pipe; a junk retaining basket attached to lower end thereof said basket including spaced, inner and outer sleeves, said inner sleeve having associated therewith two axially spaced sets of radial apertures, a one way flow valve in the bore of said inner sleeve between said sets of apertures, said valve permitting flow from said basket to the bore of said drill pipe and inhibiting reverse flow; a seat in the bore of said sleeve intermediate said valve and the upper set of apertures; an elongated tubular member having therein an air chamber, said member being disposed in the bore of said pipe above said basket and movable into sealing engagement

with said seat by the flow of liquid through said pipe; closure means to seal the lower end of said air chamber against the influx of liquid and means acting after said member is in sealing engagement with said seat to rupture said closure means.

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