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3,318,387

DRILLING METHOD AND APPARATUS

Filed Sept. 28, 1964

2 Sheets-Sheet 1

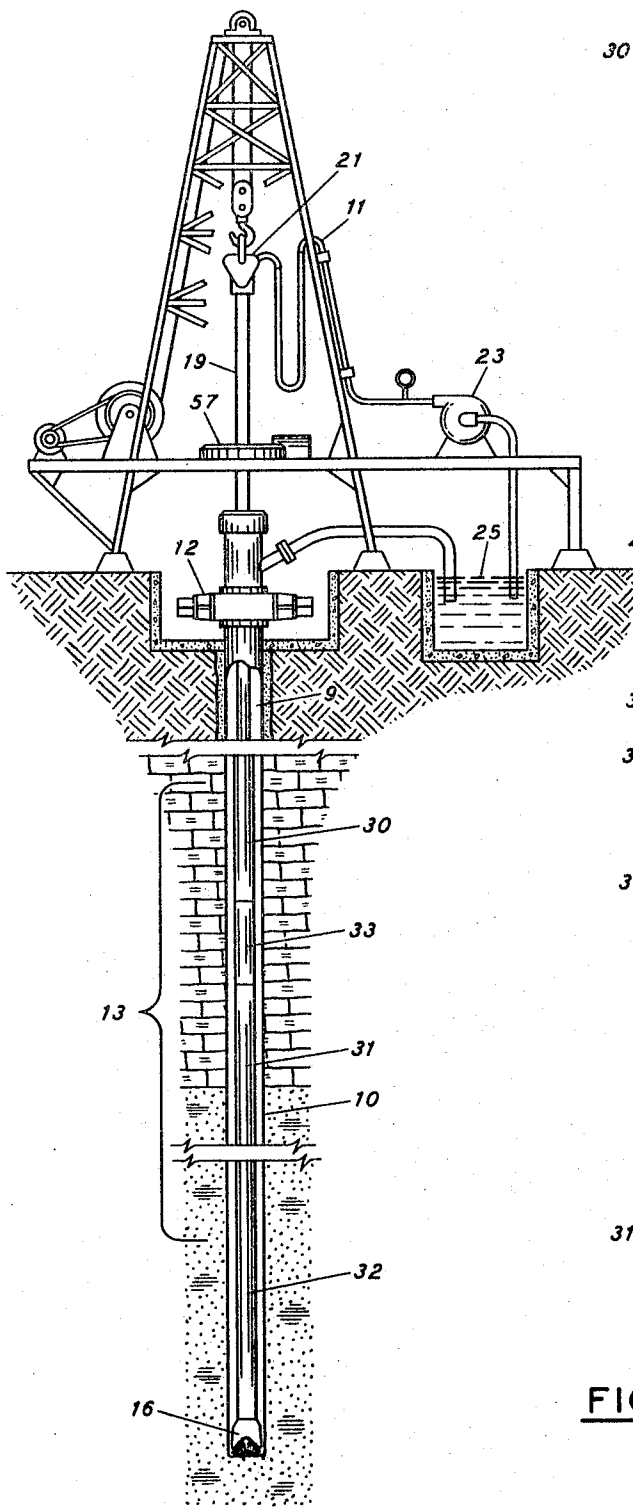


FIG. 1

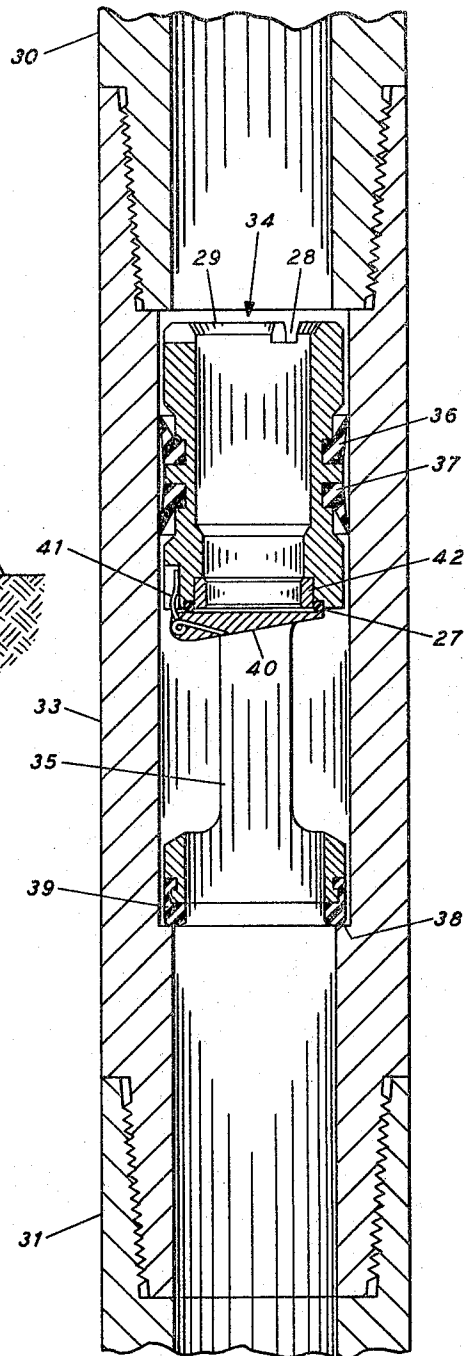


FIG. 2

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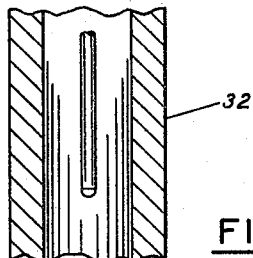
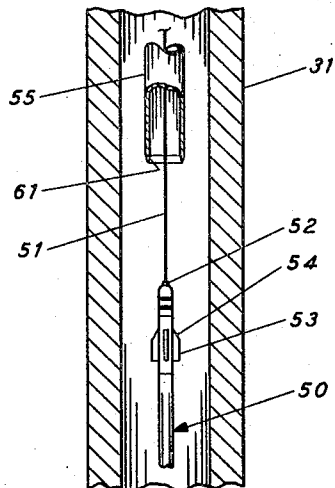
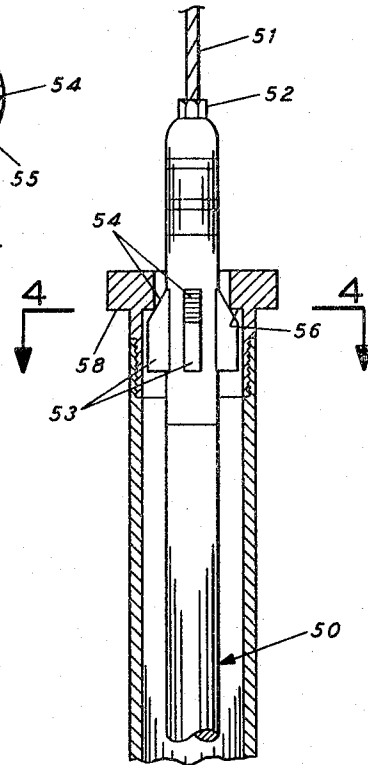
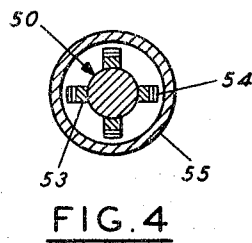
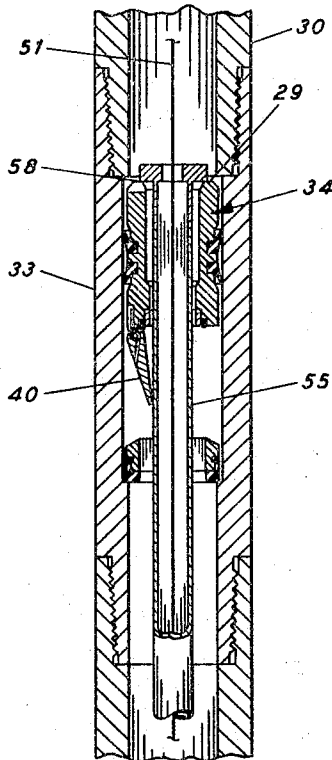


FIG. 5

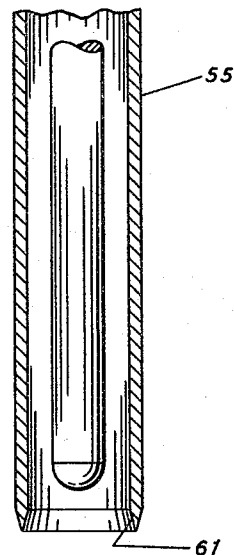


FIG. 3

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DRILLING METHOD AND APPARATUS
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Research Company, a corporation of Delaware
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2 Claims. (Cl. 166-224)

This invention relates to well drilling and more particularly, this invention relates to methods and apparatus for performing operations through a drill string in a well which has penetrated high pressure formations and where there is possibility of a blowout.

High pressure formations are often encountered when drilling a well. As is known in the art, control must be maintained over wells drilled into areas where high pressure strata may be located. If control over the well is not maintained, blowout of the well caused by the high pressure formations can occur. Maintaining control is a particularly difficult problem when for some reason such as attempting to remove a broken or stuck section of drill pipe from the hole by wire line means, the drill string is opened. If a pressure surge occurs during such an operation, blowout may occur resulting in loss of control of the well.

In a broad aspect the present invention provides a method and apparatus for conducting operations through a drill string in a manner so that the drill string can be quickly and readily closed to the upward flow of high pressure fluid should such a blowout occur. More particularly, in accordance with the invention, a sub containing a downwardly opening flapper valve is incorporated into the drill string at a suitable location. A wire line service tool such as is used in fishing or other well operations, having a substantially smaller outside diameter than the diameter of the opening in the flapper valve is provided with lug means mounted on its exterior. A sleeve is arranged around the tool in a manner so that the tool is fully movable from within the sleeve. The major portion of the sleeve is insertable into the opening in the flapper valve. A shoulder is provided on the upper end of the sleeve and is contactable with the lug means of the tool for hanging the sleeve on the tool. Flange means which will not pass through the opening in the flapper valve are provided on the exterior of the upper end of the sleeve. Thus when operating in accordance with the invention, the wire line tool and the sleeve hung thereon are run into the well, and the sleeve is inserted into the opening in the flapper valve to hold the flapper valve open. The wire line tool is lowered through the sleeve and the open flapper valve and may be lowered to a desired depth to perform operations in the well. If the well begins to surge or if blowout occurs, the wire line tool is pulled up the hole. As it passes through the flapper valve it picks up the sleeve allowing the flapper valve to close to shut off the drill string to control the surge from the well.

It is a main object of this invention to provide a method and apparatus for use in drill string wire line operations in wells where high pressure conditions may exist to permit wire line work through the drill string while maintaining control of the well to prevent a blowout or pressure surge from the well.

Further advantages and objects of the invention will become apparent from the following detailed description read in light of the accompanying drawings which are made a part of this specification and in which:

FIGURE 1 is a diagrammatic view and illustrates an arrangement of apparatus assembled in accordance with the present invention;

FIGURE 2 is a sectional view and illustrates a downwardly opening flapper valve operably connected in a drill string;

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FIGURE 3 is a view partially in section and illustrates a wire line tool having a sleeve arranged thereon;

FIGURE 4 is a sectional view taken at line 4-4 of FIGURE 3;

FIGURE 5 is a view, partially in section and illustrates apparatus assembled in accordance with the present invention.

Referring now to the drawings and in particular to FIGURE 1, a well 10 is shown penetrating the earth. The well is drilled by means of rotary table 57 turning drill string 13 to cause bit 16 to advance into the earth. Drilling fluid is supplied from mud sump 25 by pump 23 through Kelly bar 19 and swivel 21 by means of hydraulic line 11. A conventional blowout preventer 12 is connected at the well head for use in controlling pressure surges in the annulus 9. The drill string indicated generally by the numeral 13 is made up of a number of interconnected pipe sections such as 30, 31, and 32. A sub 33 containing a flapper valve is connected into the drill string at a suitable location.

In accordance with the invention a drill string having a flapper valve incorporated therein is used for drilling in areas where high pressure formations may exist. In particular the flapper valve is incorporated into a drill string in which wire line servicing operations are to be performed in wells which may penetrate high pressure formations. In these instances there is a possibility of blowout occurring during the wire line operation because, of necessity, the upper end of the drill string 13 is opened to permit insertion and running of the wire line equipment. If a pressure surge occurs at the time the drill string is opened and, if the operations are not being conducted in accordance with the invention, control of the well may be lost and a blowout can occur.

In FIGURE 2, a sectional view is shown illustrating a flapper valve contained in a sub 33 which is connected between drill pipes 30 and 31. The downwardly opening flapper valve contained in sub 33 is indicated generally by the numeral 34. The downwardly opening flapper valve comprises a generally tubular body 35 having portions cut away to allow movement of flap 40. Seals 36 and 37 provide a fluid-tight connection between the exterior of the tubular member 35 and the interior of the sub 33. A shoulder 38 is formed in the sub 33 for seating the tubular member 35. A suitable shock absorber 39 cushions the tubular member on the shoulder 38. A flap 40 is provided to close off flow through the tubular member. The flap 40 is arranged to be normally closed by means of resilient member 41. The flap can be opened by downward pressure. A seat 42 and an O-ring 27 are provided to seat and seal the flap in the closed position. The upper shoulder 29 has slots 28. The flapper valve 34 is held in place in the drill string by means of the shoulder provided by pipe section 30.

Referring now to FIGURES 3 and 4, a wire line servicing tool represented generally by numeral 50 is shown. There are a large number and variety of tools that are useful in accordance with the present invention. The tool must be suitable for insertion in a drill string and must be able to pass through the opening in a suitable flapper valve. Examples of useful tools include wash-over tools, free-point tools and string-shooting tools. As generally shown in FIGURE 3 a wire line 51 is connected by suitable means such as nut 52 to the upper end of a tool 50. Lug means 53 are rigidly mounted on the upper portion of the tool 50. The lug means have a sloping upper portion as indicated by 54. A sleeve 55 is slidably arranged around the tool 50. The sleeve 55 is of a suitable length to extend to a position below the tool 50. A shoulder 56 is provided on the interior of the upper end of the sleeve 55 and is arranged to be contactable with the sloping shoulder 54 of lug means 53 of the sleeve.

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The sleeve 55 is provided with a flange 58 on the exterior of its upper end. The flange 58 is formed in a suitable manner for contacting and seating on the upper shoulder 29 of the flapper valve 34.

In FIGURE 5 the sub 33 is shown connected between two drill pipes 30 and 31. The flapper valve 34 is positioned on the inside of sub 33. The sleeve 55 is shown after it has been inserted through the opening in the flapper valve 34. The flange 58 of the sleeve 55 is seated on the shoulder 29 of the flapper valve and the tubular sleeve 55 extends through the flapper valve 34 and holds the flap 40 in an open position. The slots 28 in the shoulder 29 of the flapper valve 34 facilitate mud flow through the flapper valve when the sleeve is seated therein.

The servicing tool 50 is then lowered through sleeve 55 by means of wire line 51. The tool 50 is easily moved down or up the well and may be utilized to perform a desired operation in the well. If a pressure surge should occur in the well the tool 50 can be removed from the well by the wire line 51 and, as it passes up the well through sleeves 55, the lug means 53 will contact the shoulder 56 and pick up the sleeve and remove it from the flapper valve. The sloping shoulder 54 of the lug means 53 and the slightly flared portion 61 at the lower end of the sleeve cooperated to insure that the tool 50 will not hang up on the sleeve and cause the flapper valve to be closed prematurely. As the sleeve is pulled up the hole and out of the valve 34 the flap 40 will be closed and the well pressure surge can be controlled.

Although only the preferred embodiment of apparatus has been described in detail, the present invention is not to be limited to only the preferred embodiment but rather only by the scope of the claims appended below.

Having described the invention, I claim:

1. Apparatus for use during operations in a well comprising a flapper valve means having a central opening, a flap adapted to open downwardly covering said opening, means for mounting said flapper valve means in a drill string, a wire line tool of smaller diameter than the

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opening in said flapper valve means, lug means on the exterior of said tool means, a sleeve arranged around said tool, said fishing tool being freely movable within said sleeve and the said sleeve being insertable into the opening of said flapper valve means, shoulder means on the upper end of said sleeve contactable with the lug means on said tool for hanging said sleeve on said tool, flange means on the upper end of said sleeve which will not pass through the opening in said flapper valve means, and means for running said tool and said sleeve carried thereon into the drill string and through the opening in said flapper valve.

2. Apparatus for use during operations in a well comprising a flapper valve having a central opening, a flap covering said opening and adapted to open downwardly, means for mounting said flapper valve in a drill string, a wire line tool of smaller diameter than the opening in said flapper valve, lug means on the exterior of said tool means, a sleeve arranged around said fishing tool, said fishing tool being freely movable within said sleeve and the major portion of said sleeve being freely insertable into the opening of said flapper valve, shoulder means on the upper end of said sleeve contactable with the lug means on said tool for releasably retaining said sleeve around said tool, flange means on the exterior of the upper end of said sleeve which will not pass through the opening in said flapper valve, and means for running said tool and said sleeve carried thereon into the drill string and through the opening in said flapper valve.

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