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Eggleston

[11] **3,800,876**

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[54] **METHOD FOR DISLODGING A PIPE STRING**

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Related U.S. Application Data

[62] Division of Ser. No. 137,220, April 26, 1971, Pat. No. 3,762,470.

[52] **U.S. Cl.** **166/301,** 166/63

[51] **Int. Cl.** **E21b 31/02,** E21b 7/00

[58] **Field of Search** 166/301, 63, 315, 277

[56] **References Cited**

UNITED STATES PATENTS

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[57] **ABSTRACT**

Described is a method used in freeing a pipe string stuck in the bore of a well. An inflatable packer and setting tool are run through the string to a position just below the lowermost free connection where the packer is inflated to sealingly close the upper end of the stuck fish. The fish is then separated from the remainder of the string. After the fish is freed from the stuck position the packer and fish are retrieved. The bouyant packer and setting tool are positioned by a weight depending from the packer on a preselected length of wire. The packer comprises a bladder member inflatable with fluid from the setting tool. The setting tool comprises a piston member in a cylinder, one end of which contains the inflating fluid, the other end of which is provided with gas generating means to force the fluid into the packer.

5 Claims, 5 Drawing Figures

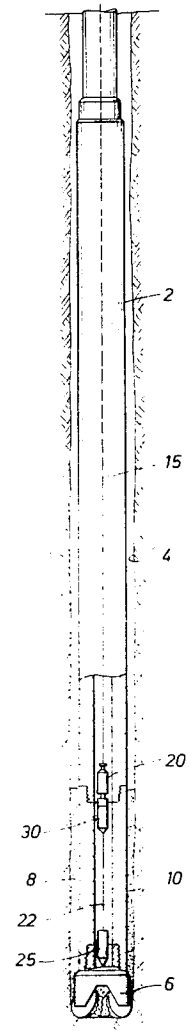


FIG. 1

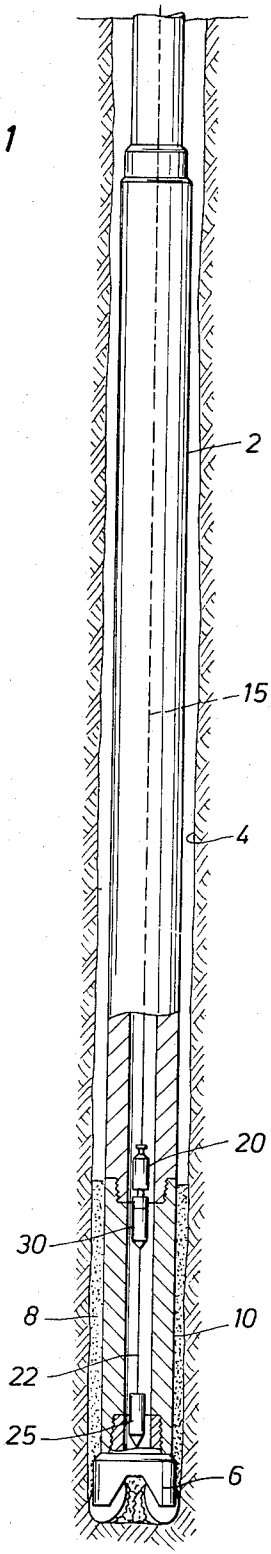

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FIG. 2

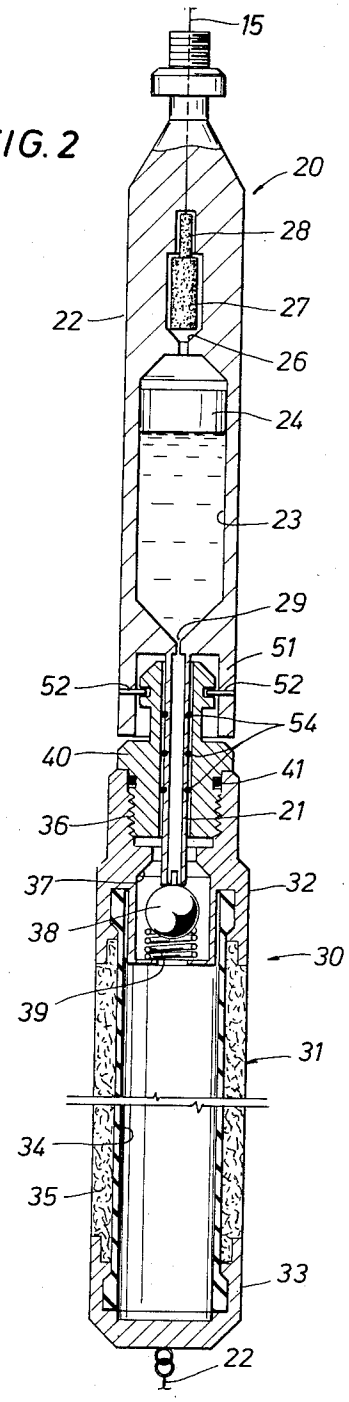

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FIG. 3

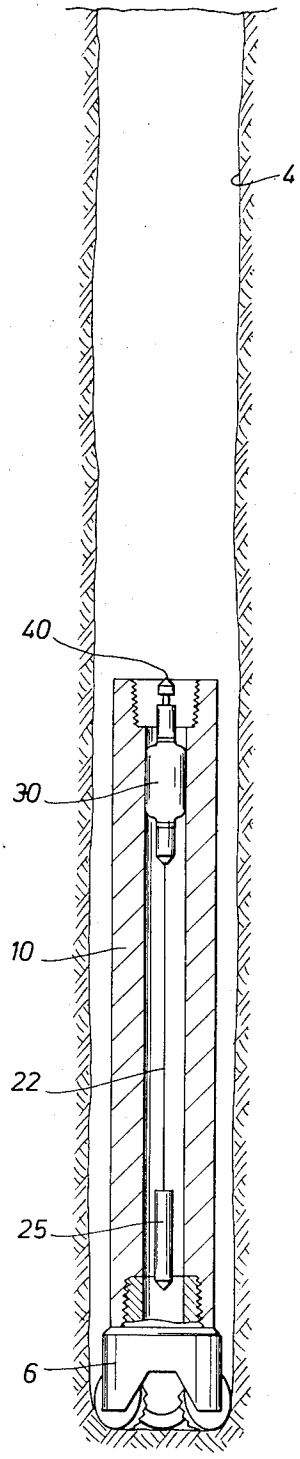


FIG. 4

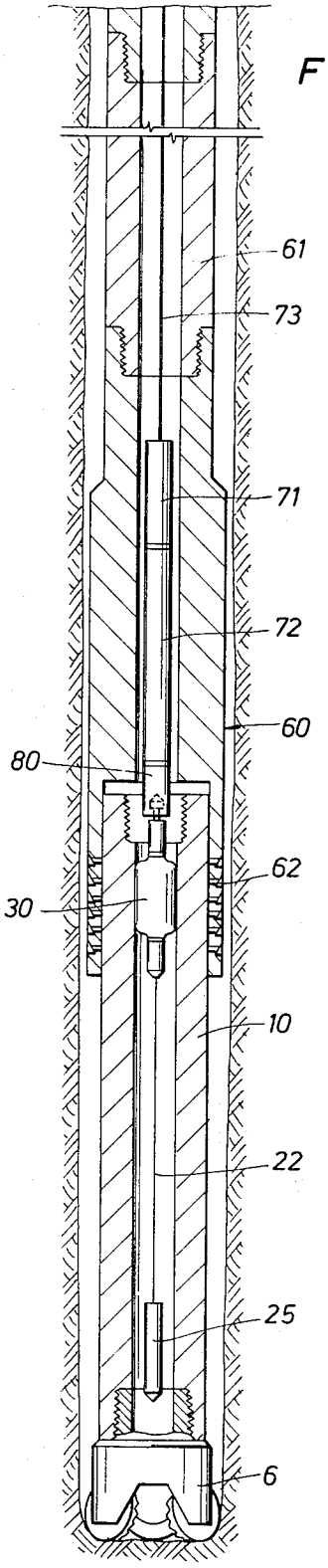
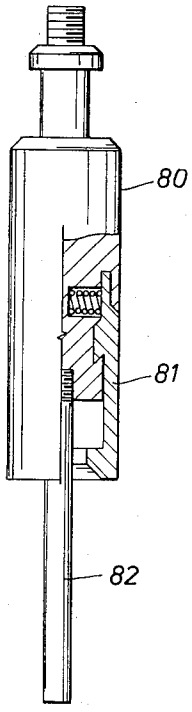


FIG. 5



METHOD FOR DISLODGING A PIPE STRING

This is a division, of application Ser. No. 137,220, filed Apr. 26, 1971, now U.S. Pat. No. 3,762,470.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention is related to petroleum drilling operations. More specifically, it concerns a device and method to prevent a stuck drill string from plugging during fishing operations.

2. Description of the Prior Art

During the drilling of an oil well, the drill pipe may at times become lodged in the well bore. To free the pipe from this lodged condition, it is often necessary to separate the drill string at a point immediately above the place where it has become lodged. Once the string has been separated, suitable "fishing tools," including such devices as "washover" tools and "overshots" are lowered down through the well bore and manipulated in an attempt to free the string. The portion of the string remaining in the hole following separation is generally termed a "fish" and the retrieval is referred to as a "fishing operation." After freeing the fish, it is necessary to latch back onto the fish for removal or continued drilling.

To separate the fish from the rest of the drill string, it is a conventional practice to locate the lowermost free pin and box connection in the drill string by employing a collar locator. The collar locator conventionally operates in combination with a string shot and primer cord device which is usually electrically activated from the well's surface. When the string shot and primer cord combination are triggered, a simultaneous reverse torque is imposed on the drill string from the surface, causing the drill string to separate at the desired pin and box connection.

Following the separation of the fish from the remainder of the drill string thereabove, the cuttings, sand, etc., in the drill fluid employed within the well, settle down and are often accumulated within and about the top portion of the fish. Furthermore, during the fishing operation, the sides of the bore around the lodged fish are often ground away by an overshot fishing tool which encircles and telescopes over the fish as it is rotated and advanced downwardly, causing further accumulation of cuttings, etc. This accumulation of debris sometimes prevents the fishing tools from engaging the threads at the top of the fish and it is often necessary to wash away the accumulated debris before the fishing operation may be successfully completed. Such a washing operation requires a special clean out tool and the time required to run the tool in and out of the hole and to wash away the debris.

SUMMARY OF THE INVENTION

In the present invention an inflatable packer is run through the drill string before separation from the fish. The packer includes an inflatable bladder type seal secured to a setting tool. The signal conventionally employed to activate the string shot and primer cord may also be employed to activate the setting tool which in turn inflates the packer bladder seal, causing it to expand into sealing engagement with the fish at the point of separation. The packer may be secured to the setting tool by shear pins which are severed when the packer is inflated to release the packer and setting tool from each other. The fluid or gas selected for use with the inflatable packer has a lower specific gravity than the drilling fluid used in the well. Thus, the inflated bladder is bouyant and has a tendency to rise in the fish. A weight may be attached to a wire extending downwardly from the packer to prevent it from exiting from the top of the fish. The length of the wire may be preselected and precisely determines the vertical position of the packer so that it comes to rest at the very top of the fish to block the entry of debris.

After the fish has been freed and it is reconnected with the drill string or fishing tool, the packer may be released and removed. This is accomplished by lowering a pulling tool through the string for engagement with the packer. The pulling tool is equipped with a prong which opens a spring-loaded valve in the packer to permit deflation of the bladder, releasing the packer. The pulling tool is also equipped with a latching device for engaging a fishing neck on the packer, allowing the entire packer to be removed from the drill string.

The present invention should eliminate the time and expense concomitant with the clean out methods currently utilized to wash debris out of plugged fish. Other objects and advantages of the invention will become apparent from the accompanying drawings and description which follow.

BRIEF DESCRIPTION OF THE DRAWING

In the accompanying drawings:

FIG. 1 is a vertical cross-section of the lower portion of a well bore showing a drill string which has become stuck in the bore and a packer, according to a preferred embodiment of the invention, disposed in the drill string prior to setting and prior to separation of the fish from the remainder of the string;

FIG. 2 is a detailed cross-section of a packer and setting tool according to a preferred embodiment of the invention, prior to setting of the packer;

FIG. 3 is a vertical cross-section of the well bore of FIG. 1 showing the fish after the remainder of the drill string has been removed and after the packer, according to a preferred embodiment of the invention, has been set;

FIG. 4 is a vertical cross-section of the well bore of FIGS. 1 and 3 showing the fish after it has been retrieved and the packer just prior to removal;

FIG. 5 is a partially sectioned elevation of a pulling tool which may be employed to release and retrieve the packer of FIGS. 1, 2, 3 and 4.

DESCRIPTION OF PREFERRED EMBODIMENTS

Referring first to FIG. 1, there is shown the lower end of a drill string 2 within the lower end of a well bore 4 as drilling takes place. A bit 6 is attached to the lower end of the drill string 2. The drill string 2 has become stuck in the well bore due to the buildup of cuttings and other materials 8 around its lower end. To remedy this situation it is necessary to separate the drill string at its deepest free connection and to remove the upper part of the drill string. The lower or lodged portion 10 of the drill left in the hole is sometimes referred to as a "fish." To free the fish 10 it is necessary through the use of special tools to remove or dislodge a portion of the material 8. If nothing is done to prevent such from happening, the fish will become plugged with drill cuttings or other debris, loosened in an effort to free the fish,

making it difficult, if not impossible, to retrieve the fish **10** once it has become unlodged.

When the string **2** becomes stuck in the well bore the first step, according to the present invention is to lower, by means of a wire cable **15**, a setting tool **20** and packer device **30** into the drill string. Attached to the lower end of the packer **30** by wire **22** is a weight **25**. The length of the wire is preselected so that when weight **25** rests at the bit **6** with the wire **22** in a taut position the packer **30** will be near the top of fish **10**. This may be accomplished by determining the length of the fish prior to lowering of the packer **30**. A collar locator may be utilized for this purpose.

To separate fish **10** from the upper part of string **2** it is the conventional practice to lower a special shaped explosive charge, sometimes referred to as a string shot, to the level of the deepest free connection where it is exploded. The explosive shock in conjunction with the surface applied reverse torque causes the connection in which the explosive charge is located to unscrew, breaking the connection and allowing the separation of the upper portion of the string **2** from the fish **10**. This string shot may be run simultaneously with the packer **30** and both may be triggered by the same signal. The string shot may be discharged and the packer **30** may be set almost simultaneously.

Referring now to FIG. **2**, a detailed description of setting tool **20** and packer **30** will be given. The packer **30** is of the inflatable type and may comprise an inflatable bladder **31** connected between upper and lower cylindrical end members **32, 33**, respectively. The bladder **31** may comprise an inner tube **34** of rubber or other suitable material and an outer sheath **35** of some other material having a higher coefficient of friction for gripping the walls of the pipe in which it is to be set. The upper end piece **32** may be provided with threads **36** by which a fishing neck **40** may be attached. An O-ring **41** seals this connection. The end piece **32** also provides a conical seating surface **37** for sealing engagement with a ball **38** when the ball **38** is not engaged by the tubular pin member **21** of the setting tool **20**. When it is not so engaged, the ball **38** is biased into sealing engagement with the seat **37** by the spring **39** to prevent the escape of fluid from the bladder **31**. There are a number of inflatable packers commercially available which might be adapted for use with the present invention. For example, see U. S. Pat. No. 2,781,854.

The setting tool **20** may comprise a cylindrical body **22** in which is provided a cylindrical cavity **23**. A piston member **24** is mounted for longitudinal movement within the cylindrical cavity **23**. Opening into the cylindrical cavity **23** at its upper end or chamber is a small cavity **26** which holds a power charge **27** and igniter **28**, the igniter being attached to the wire **15**. The lower end or chamber of cylindrical cavity **23** opens through an orifice **29** into the tubular pin member **21**. A depending skirt member **51** may carry shear pins **52** by which the setting tool **20** may be connected to the fishing neck **40**. The tubular pin **21** is long enough to unseat the ball **38** from its seat **37** allowing communication between the cylindrical cavity **23** and bladder **31** through the orifice **29** and tubular pin **21**. O-rings **54** provide a seal between the pin **21** and the cylindrical passageway through the fishing neck **40**.

Prior to running the setting tool **20** and packer **30** into the fish, the bladder **31** and the cylindrical cavity **23** may be substantially filled with a liquid or gas having a specific gravity less than the drilling fluid used in the well. This inflation fluid is at a pressure which does not appreciably expand the bladder **31**. When the setting tool **20** and packer **30** are in their proper location the power charge **27** is ignited through the wire **15** and igniter **28** causing a rapid release of gas against the upper end of the piston **24**, compressing the fluid in cylinder **23** and forcing it through the orifice **29** and tubular pin **21** into bladder **31**. As this additional inflation fluid is transferred to the packer **30** the bladder **31** is expanded to the desired diameter for engagement with the walls of the fish **10**. Another method of inflating the packer may be by chemical means. For example, the combination of water and calcium carbide will produce the desired inflation and bouyancy. Calcium carbide, when reacted with water, gives off lime and acetylene gas.

When the packer is properly inflated, the increased pressure will cause the shear pins **52** to fail, automatically releasing the setting tool **20**. As the setting tool **20** is released, the pin **21** is retracted through the fishing neck **40** from contact with ball **38** allowing the ball to again contact the seat **37** and preventing the escape of fluid from bladder **31**. The setting tool **20** and the upper part of the drill string are then removed from the well so that the fish and packer will appear as in FIG. **3**. As shown in FIG. **3**, the packer **30** is then in a sealing position at the upper end of the fish **10** blocking entry of drill cuttings or any other debris which might plug the fish. Suspended below the packer is wire **22** and weight **25**. As stated before, the wire **22** is measured exactly to position the packer at a predetermined distance from the weight **25**. The weight **25** is of an amount sufficient to offset the bouyancy of the packer **30** and to provide additional force to release wireline tools above the packer **30**. The fishing neck **40** should be in a position to allow debris to be washed away from it prior to screwing the fish back together or catching it with an overshot.

Once it is freed from its stuck condition, it is necessary to retrieve the fish **10**. There are several methods for retrieving such a fish. One is through the use of a tool called an overshot **60** as shown in FIG. **4**. The overshot tool is lowered on a pipe string **61** and telescopically engages the upper end of the fish **10**. Slip members **62** carried by the overshot **60** wedgingly engage the fish **10** and allow it to be pulled out of the hole.

The fish may also be advantageously removed by retrieving the packer **30** and reattaching to the upper threaded end of the fish with the drill string **2**. This type of retrieval is facilitated by use of the present invention since the upper threads of the fish have been protected by the packer **30** and are capable of being rejoined with the drill string. The packer **30** may be removed by lowering a pulling tool **80** through the string **61** and overshot **60** to packer **30**. As viewed in FIG. **5**, the pulling tool **80** may comprise a set of spring-loaded latches **81** for engaging the fishing neck **40** of packer **30**. Projecting from the lower end of the pulling tool **80** is a pressure equalizing prong **82**. The prong **82** is adapted for insertion through the fishing neck passageway to depress the ball **38**, allowing escape of inflation fluid from the packer to release the packer for retrieval. To supply the necessary force to depress the packer ball and force the latches **81** into engagement with the fishing neck **40**, sinker bars **71** and wireline jars **72** may be attached to the wireline **73** on which the pulling tool **80** is low-

ered. Once the pulling tool has engaged the fishing neck, the deflated packer **30** is easily retrieved by pulling upwardly on the wireline **73.**

If the amount of weight and the length of wire below the packer are not feasible, other means of positioning the inflatable packer may be utilized. The packer could be positioned with its fishing neck exactly at the top of the fish by the use of a collar locator. It is very important to position the fishing neck of the packer in the top of the backed off fish in order to be able to wash any debris off of the fishing neck prior to screwing the fish back together or catching it with an overshot.

Although more than one embodiment of the invention have been described herein, many other modifications will be apparent to those skilled in the art. The foregoing specification and accompanying drawings are for descriptive purposes only and are not to be considered as limiting in any way. The scope of the invention is intended to be limited only by the claims which follow.

I claim:

1. A method of dislodging a pipe string, the lower portion of which is stuck in a well bore comprising the steps of: running an inflatable packer through said pipe string to a point just below the lowermost free connection in said pipe string; inflating said packer with a fluid to sealingly close the upper end of said lower portion; separating said lower portion from the remainder of said pipe string above said lowermost free connection; and freeing said lower portion from its stuck condition.

2. A method of dislodging a pipe string as set forth in claim **1** and the additional steps of: running a retrieval tool into said well for engagement with said freed lower portion; deflating said packer; and retrieving said packer and said lower portion from said well bore.

3. A method of dislodging a pipe string as set forth in claim **1,** characterized in that prior to running said packer through said pipe string a weight is attached, by a wireline, to said packer for dependence therefrom.

4. A method of dislodging a pipe string as set forth in claim **3,** characterized in that said wireline is cut so that its length plus the length of said weight and said packer substantially equals the length of said lower portion.

5. A method of dislodging a pipe string as set forth in claim **3,** characterized in that the fluid for inflating said packer is selected so as to render said packer bouyant in a drilling fluid present in said well bore.

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