Dec. 31, 1968 E. J. THIBODEAUX 3,419,040

DRILL PIPE VALVE HAVING MEANS FOR RENDERING IT TEMPORARILY INOPERATIVE

Filed Dec. 27, 1966

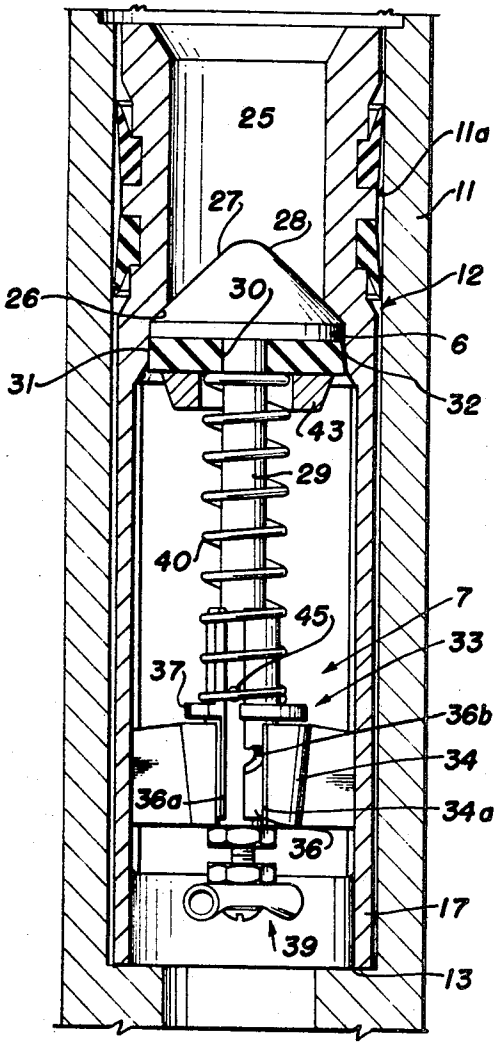

Fig. 1

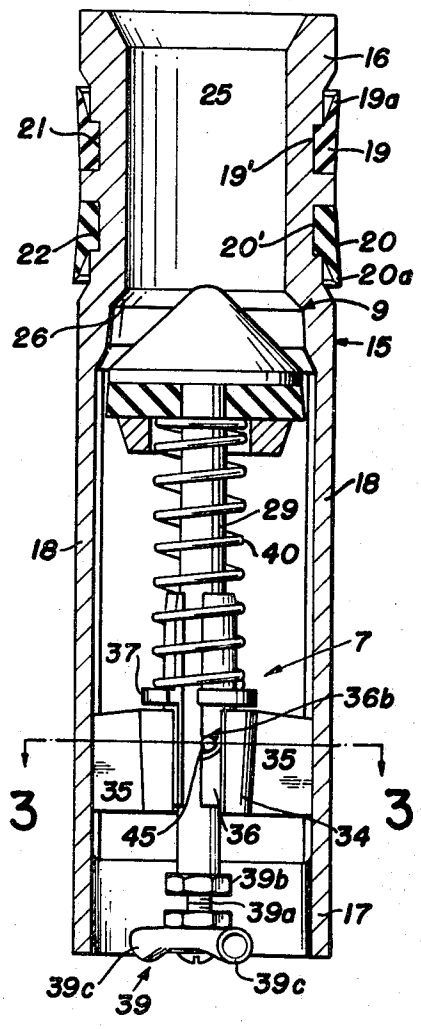

Fig. 2

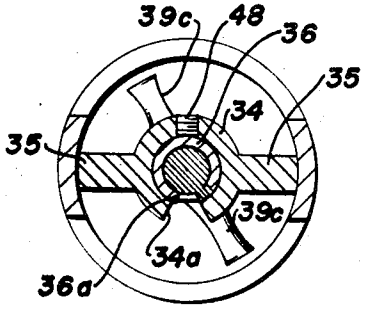

Fig. 3

EDWARD J. THIBODEAUX
INVENTOR.

BY Hayden & Pravel

ATTORNEYS

United States Patent Office 3,419,040
Patented Dec. 31, 1968

3,419,040

DRILL PIPE VALVE HAVING MEANS FOR RENDERING IT TEMPORARILY INOPERATIVE

Edward J. Thibodeaux, 2532 Fawnwood Road, Marrero, La. 70072

Filed Dec. 27, 1966, Ser. No. 604,934
3 Claims. (Cl. 137—515.7)

ABSTRACT OF THE DISCLOSURE

A drill pipe valve having an arrangement so that the valve may be temporarily locked in position away from its seat as the drill pipe is lowered into the well bore to enable the drilling fluid to flow past the valve and fill successive joints of pipe as they are added into the well string and then lowered into the well bore.

BACKGROUND OF THE INVENTION

Field of the invention.—The present invention relates particularly to a valve that is to be incorporated in strings of drill pipe for accomplishing several functions. Drill pipe valves commonly called "drill pipe float valves" close in an upward direction and open in a downwardly direction to permit downward flow of fluid therethrough. It is generally positioned adjacent the lower end of the drill string in close proximity to the drill bit, and when closed, prevents upward flow of fluid through the drill pipe to thereby minimize what is commonly referred to as blowouts. The drill pipe valve of the present invention is provided with an arrangement so it may be locked in an open position and then inserted in position in the drill pipe so that as the drill pipe is lowered into the well bore joint by joint each joint of drill pipe may fill rapidly as it is lowered into the well bore. After the drill string has been lowered into the well bore, the pump which communicates drilling fluid to the interior of the drill string is actuated to increase the pressure interiorly of the drill string which causes the drill pipe float valve of the present invention to automatically unlock so that it may move to its normally closed position should an upsurge of fluid in the pipe occur due to a blowout, or for any other cause.

Description of the prior art.—In all prior art drill pipe float valves, there is provided no means for rendering the drill pipe float valve inoperative as the drill string is lowered into the well bore, and thus it is always in a closed position so that as each joint of drill pipe is lowered into the well bore, it must be then filled with liquid before the next joint of drill pipe is added thereto.

This operation is time consuming, and particularly in offshore operations where drilling costs may be extremely high, such procedure is accepted by many as being highly undesirable.

The present invention solves this problem in that the drill pipe float valve may be locked in an open position so that the drill pipe may be more rapidly lowered into position in the well bore and it can be unlocked to function for its intended purpose.

SUMMARY OF THE INVENTION

The present invention is directed to incorporating in a valve ordinarily called a drill pipe float valve a means for holding or retaining the valve means in open position as the drill string in which the valve is positioned is lowered in the well bore so that the drill pipe may automatically fill with drilling fluid or with well bore fluid as the drill pipe is stepwise lowered into the well bore.

An object of the present invention is to provide a means in a drill pipe float valve which may be manually

set at the surface before inserting it in the drill string so that the valve will remain in open position as the drill pipe in which it is connected is lowered into the well bore, which valve may be actuated by an increase in hydraulic pressure at the earth's surface within the drill pipe to automatically unlock or release the valve from its open position so that it may assume its normal position after the drill string has been lowered to the bottom of the well bore.

Yet a further object of the present invention is to provide in a drill pipe valve having a valve body with a valve seat therein and valve means for engaging on said seat, said valve means having a valve stem extending from the valve and guide means carried by the body for slidably receiving the stem as well as spring means for normally urging the valve means towards closed position, cooperating means on the valve stem and guide means for holding the valve means off the seat as the drill string in which the valve is positioned is lowered into the well bore.

Yet a further object of the present invention is to provide in a drill pipe valve having a valve body with a valve seat therein and valve means for engaging on said seat, said valve means having a valve stem extending from the valve and guide means carried by the body for slidably receiving the stem as well as spring means for normally urging the valve means towards closed position, cooperating means on the valve stem and guide means for holding the valve means off the seat as the drill string in which the valve is positioned is lowered into the well bore, there being means on the lower end of the stem for manually pulling the stem downwardly against the force of the spring and for rotating the stem to engage a projection on the stem within a slot in the guide means to hold or lock said valve means spaced from said valve seat and in open position.

Other objects and advantages of the present invention will become apparent from the following description and drawings wherein:

FIG. 1 is a sectional view partly in elevation showing a form of the present invention in a drill string with the valve in seated position in the valve body;

FIG. 2 is a sectional view partly in elevation of the valve showing the projection on the valve stem seated in the slot in the guide means for holding the valve in open position; and

FIG. 3 is a sectional view on the line 3—3 of FIG. 2 and illustrates one form of suitable means for retaining the sleeve fitting within the hub against rotation relative to the hub.

DESCRIPTION OF THT PREFERRED EMBODIMENT

The present invention includes a valve means represented at **6** that is provided with means referred to generally at **7** so that the valve may be cocked or locked in position to hold the valve means **6** in spaced relation to the valve seat referred to generally by the numeral **9** in FIG. 2.

Attention is directed to FIG. 1 of the drawings wherein a portion of a drill string or drill pipe is represented by the numeral **11**. The portion of the drill string represented at **11** in which the valve referred to generally by the numeral **12** to which the present invention is directed is positioned normally immediately above the drilling bit in a drill string. The drill collar or portion of drill string **11** is provided with an annular shoulder **13** and also, of course, is provided with threaded end portions (not shown) whereby the portion of the drill collar or drill string **11** may be connected into the drill string.

Also not shown is the upper end of the drill string to

which the member **11** is connected, such end (not shown) forming an upper stop for the valve **12** and the shoulder **13** forming a lower stop for the valve **12**.

The valve **12** includes a valve body or cage **15** which includes an upper cylindrical portion **16** and a lower cylindrical portion **17** interconnected by circumferentially spaced ribs **18**.

The upper cylindrical portion **16** is provided with a pair of oppositely directed seals **19** and **20** which may be of any suitable packing such as cup-shaped packing. It will be noted that the packing **19** and **20** is provided with a portion **19'** and **20'**, respectively, which fits within annular grooves **21** and **22**, respectively, formed on the outer periphery of the upper cylindrical portion **16** of the valve body **15**, and each seal **19** and **20** also includes a lip portion **19***a* and **20***a* which extends circumferentially for engaging with the cylindrical wall of the bore **11***a* of the drill string portion **11** in which the valve **12** is positioned as better shown in FIG. 1 of the drawings. The upper seal ring **19***a* seals off so as to preclude downward flow of fluid between the valve body **15** and the drill pipe portion **11**, and the lower packing member **20** precludes upward flow of fluid between the valve body **15** and the tubular section **11**.

The enlarged bore **25** of the valve is provided with a tapered annular shoulder **26** at its lower end against which the tapered surface **27** of the valve stop or valve head **28** is adapted to engage as illustrated in FIG. 1 to serve as a partial seal. Depending downwardly from the valve stop **28** is a valve stem **29** which may be secured to the valve head or stop **28** by any suitable means.

It will be noted that the valve stem **29** extends through a cylindrical opening **30** formed in the resilient sealing element **31** formed of rubber or other similar material which element **31** is adapted to engage the tapering counterbore **32** when the valve is in closed position as illustrated in FIG. 1 to sealing off fluid flow through the drill pipe. The stem **29** extends downwardly from the head or stop **28** and is freely slidable through the guide means referred to generally by the numeral **33**.

The guide means **33** includes a central hub **34** better shown in FIG. 3 which is secured to the valve body **15** adjacent the lower cylindrical portion **17** by suitable means such as the radially extending ribs **35**. Fitting within the central hub **34** is a sleeve **36** having a flange **37** at its upper end. The sleeve **36** is held against rotation relative to the inner hub **34** by any suitable means such as that illustrated in FIG. 3 wherein a screw **48** is threadedly engaged through the hub to abut the inner periphery of the sleeve and lock it against rotation.

Secured in the lower end of the stem **29** are suitable means represented generally by the numeral **39** to enable the stem to be moved longitudinally of the valve body **15** and rotated relative to the sleeve **36** for a purpose as will be described in greater detail hereinafter.

Spring means **40** are provided which abut the guide means **33** at its lower end and specifically rest upon the flange **37** as shown in the drawings and engages the valve means **6** at its upper end so as to tend to urge the valve means **6** towards the seated position as illustrated in FIG. 1 of the drawings. More specifically, the upper end **42** of the spring **40** engages the nether side of the seating element **31** which is retained in position by means of the retainer collar **43** which also serves to retain the spring **40** in position about the stem **29** as shown to inhibit lateral movement thereof relative to the sealing element and the valve means.

A projection **45** is provided on the stem **29**, and the sleeve **36** is provided with an upwardly extending slot **36***b* in which projection **45** may move so that when the means **39** is grasped manually and the valve stem **6** moved downwardly against the force of the spring and rotated, the pin **45** engages within the upwardly inclined slot **36***b* in sleeve **36** as shown in FIG. 2 to cock or hold the valve

means **6** in spaced relation relative to the valve seat so that the valve is open for fluid flow therethrough.

The inner hub **34** is provided with a longitudinally extending slot **34***a* which is generally aligned with the longitudinally extending slot **36***a* formed in sleeve **36**.

The slot **34***a* formed in the inner hub is of a larger width than the stem **29** to enable the stem to be fitted therein and the valve **12** assembled. However, the slot **36***a* is smaller in width than the diameter of the stem **29** to retain the stem in substantially close slidable engagement within the guide means and specifically with the inner bore of the sleeve **36**.

The means **39** may be of any suitable form and as illustrated is shown as including a threaded member **39***a* that is threadedly engaged in the lower end of the stem and is provided with a nut **39***b* to lock such member in position. Radially extending portions **39***c* are provided at the lower end of the means **39** so that the means **39** may be readily grasped manually to pull the stem downwardly against the force of the spring **40** and rotate the projection **45** from longitudinal slot **36***a* into the slot **36***b* to hold the valve means **6** in open position. The radially extending portions **39***c* of the means **39** is of shorter extent than the internal diameter of the lower cylindrical portion **17** so as to not interfere with upward movement of the valve when it moves to closed position.

To disassemble the invention illustrated, the means **39** is threadedly disengaged from the lower end of the stem **29** and the sleeve **36** moved upwardly against the force of the spring until the lower end thereof has cleared the upper end of the hub **34** whereupon the stem **29** may be moved radially through the slot **34***a* and thereafter the sleeve **36** may be removed as well as the spring **40** and the retainer **43** for replacement of the seal means **31** if such becomes necessary.

In the use of the present invention, it is desirable in lowering drill string into the well bore, particularly in offshore drilling operations, that such lowering be accomplished with a minimum loss of time to avoid possible sticking of the drill pipe and to reduce drilling costs. To accomplish this, the valve **12** after assembly is then manually cocked to lock it in open position as shown in FIG. 2 by grasping the means **39** and pulling the stem **29** downwardly against the force of the spring and rotating it so that the projection **45** engages within the tapering slot **36***b*. This serves to hold or lock the valve means **6** in spaced relation to the valve seats. The valve **12** is then positioned within the portion **11** of the drill string and seated on the shoulder **13** and the portion **11** of the drill string then connected preferably immediately above the drill bit.

Additional joints of drill collars and drill pipe are then added to the drill string a joint at a time, and it can be appreciated that since the valve is in open position fluid flow may occur upwardly through the lower cylindrical portion **17** around the ribs **35** and through the valve body **15** and open valve and outwardly through the upper cylindrical portion **16** into the next adjacent joint so that fluid communication within the bore of the drill string is not restricted, thus permitting the joints of pipe to be rapidly connected into the drill string as the drill pipe is progressively lowered into the well bore as each joint is added thereto.

When the drill string reaches the bottom of the well bore, pump pressure at the earth's surface may be increased whereupon such pump pressure will act upon the stop **28** to tend to move it downwardly, and when this occurs, the projection **45** is urged out of the tapering slot **36***b* and into the longitudinally extending slot **36***a* formed in sleeve **36**. Should pressure beneath the valve means increase above the weight of the column of drilling fluid in the drill string above the valve stop **28**, the valve means will be urged upwardly into seating position as shown in FIG. 1, thereby inhibiting blowouts or fluid flow upwardly through the internal bore of the drill string.

From the foregoing description, it can be appreciated that the present invention provides a means whereby a drill pipe valve commonly referred to as a drill pipe float valve may be initially cocked in open position so that the drill string automatically fills as it is lowered into the well bore and after the drill pipe has been set on bottom within the well bore and pump pressure increased, the projection **45** moves out of the slot **36***b* and the valve is in operative position and ready to close upon any increase in pressure within the drill string below the valve **12.**

Broadly, the present invention relates to a drill pipe valve commonly referred to as a drill pipe float valve whereby it may be initially locked in open position and thereafter automatically unlocked by an increase in pump pressure at the earth's surface.

What is claimed is:

1. In a drill pipe valve:

(a) a valve body;

(b) a valve seat in said valve body;

(c) valve means for engaging said seat;

(d) a valve stem extending from said valve means within said body;

(e) guide means carried by said valve body and including a central structure spaced below said valve means, said valve stem being slidably received through said central structure;

(f) spring means engaging said central structure and said valve means to urge the latter into engagement with said seat;

(g) co-operating means on said valve stem and central structure for holding said valve means off said seat, said co-operating means including a projection on said stem and a longitudinal slot and an adjoining upwardly inclined slot in said central structure for receiving said projection;

(h) means on the lower end of said stem for manually pulling said stem downwardly against the force of said spring and for rotating said stem to engage said projection within said slot to hold said valve means spaced from said valve seat; and

(i) said valve means being movable downwardly by an increase in upstream pressure to remove said projection from said inclined slot into said longitudinal slot to permit the valve means to close upon back flow.

2. The drill pipe valve of claim **1** wherein said central structure comprises a hub with a sleeve in such hub, said sleeve having a flange engaging the upper end of said hub, said valve stem being slidably received through said sleeve, and said spring means engaging said flange on said sleeve and said valve means, and wherein said longitudinal slot and said upwardly inclined slot are located in said sleeve.

3. The drill pipe valve of claim **2** which also includes means for holding said sleeve against rotation relative to said hub.

References Cited

UNITED STATES PATENTS

2,771,091	11/1956	Baker	137—454.2 XR
2,802,482	8/1957	Arnhold	137—315
2,804,281	8/1957	Osburn	137—454.2 XR
2,884,002	4/1959	Melton	137—454.2

HAROLD W. WEAKLEY, *Primary Examiner.*

U.S. Cl. X.R.

137—516.29, 523, 543