May 14, 1963 C. H. GREENE 3,089,551

DRILL PIPE FLOAT

Filed Feb. 11, 1960

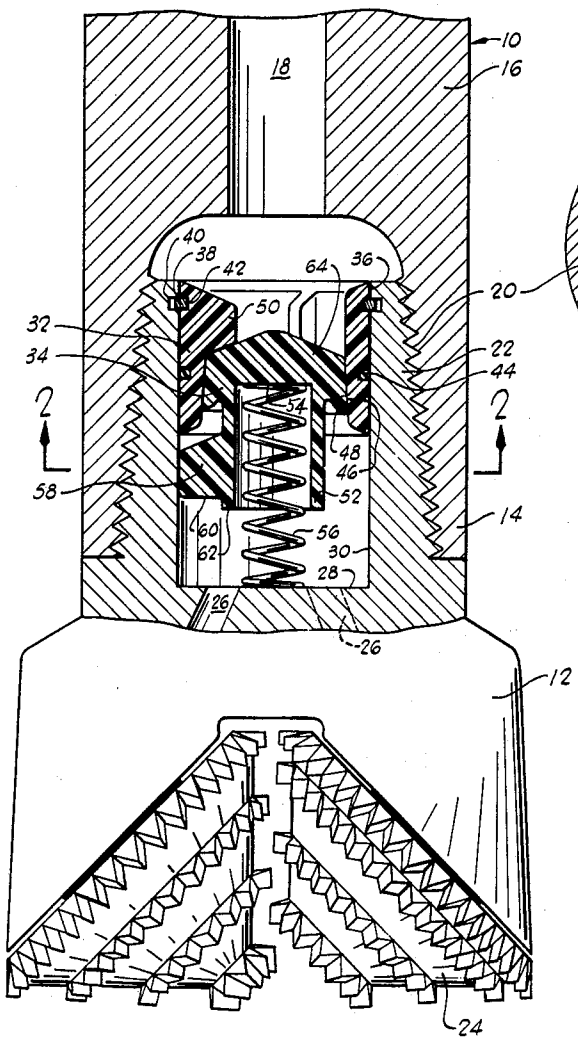


Fig. 1

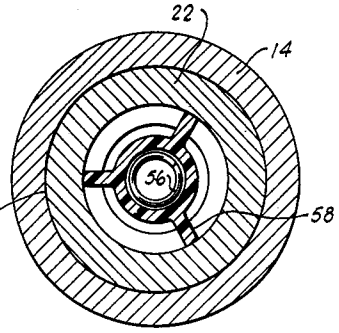


Fig. 2

INVENTOR.
CHARLES H. GREENE

BY Jerry J. Dunlap

ATTORNEY

United States Patent Office

3,089,551
Patented May 14, 1963

3,089,551

DRILL PIPE FLOAT

Charles H. Greene, Box 127, Healdton, Okla.

Filed Feb. 11, 1960, Ser. No. 8,141
6 Claims. (Cl. 175—318)

This invention relates generally to improvements in rotary drilling strings, and more particularly, but not by way of limitation, to an improved drill pipe float.

As it is well known in the oil drilling industry, a rotary drill string is usually provided with a downwardly opening valve in the lower portion thereof which allows the driller to "float" the drill string in and out of a partially completed well bore. Such a valve, commonly termed a "float valve," is usually installed either in a drill collar a short distance above the drill bit, or in a special sub in the vicinity of the drill collars. In either event, present day float valves are intended to last as long as possible, since such valves are expensive and replacement thereof (when a float valve is installed in a drill collar) requires additional machine work on the drill collar. As a practical matter, however, the abrasive drilling fluid passing through a float valve "washes out" either a portion of the seat of the valve or a portion of the drill collar in a relatively short period of time.

The present invention contemplates a novel float valve construction in the drill bit which, it is contemplated, will be disposable when the drill bit is discarded. The present float valve requires the minimum of parts or elements which may be simply designed for the maximum economy, such that disposal thereof will not materially affect the cost of a well drilling operation. In a preferred embodiment, the invention comprises a valve seat secured in the shank of a drill bit, a valve head reciprocally disposed in the drill bit shank below the valve seat, a spring urging the valve head upwardly toward the seat against the flow of drilling fluid through the bit, and circumferentially spaced guides on the valve head which slide along the walls of the bore of the drill bit shank to maintain the head in alignment with the seat.

An important object of this invention is to increase the economy of rotary drilling operations, both in the cost of equipment and in man hours, and particularly in the man hours presently devoted to repairing and replacing drill pipe float valves.

Another object of this invention is to simplify the work of a drilling crew employed on a rotary drilling installation.

A further object of this invention is to provide a combination drill bit and float valve for use on a rotary drilling string, wherein the float valve is merely disposed of with the drill bit when the drill bit is replaced.

Another object of this invention is to provide a drill pipe float valve having the minimum of parts and which will not materially restrict the normal flow of drilling fluid through a drill string.

A still further object of this invention is to provide a simply constructed drill pipe float which may be economically constructed and which will perform the desired function of floating a drill string for the desired length of time.

Other objects and advantages of the invention will be evident from the following detailed description, when read in conjunction with the accompanying drawings which illustrate my invention.

In the drawings:

FIGURE 1 is an elevational view of the lower portion of a drill string incorporating my invention, with portions shown in section to illustrate details of construction.

FIGURE 2 is a sectional view as taken along lines 2—2 of FIG. 1.

Referring to the drawings in detail, reference character

10 generally designates a rotary drill string (only a portion of which is shown) which includes a drill bit 12 secured on the lower end 14 of a drill collar 16. As it is well known in the art, the drill collar 16 is a heavy tubular member utilized to place the desired amount of weight on the drill bit 12, and several of the drill collars 16 are utilized in a normal drilling operation. A passageway 18 extends longitudinally through the center of the drill collar 16 to convey a stream of drilling fluid to the drill bit 12, and an internally threaded, tapered counterbore 20 is formed at the lower end of the passageway 18 to connect with the externally threaded shank 22 of the drill bit 12.

The drill bit 12 may be of any desired type, such as a rock-type bit having a plurality of cutters 24 thereon, and which has one or more of the usual fluid passages 26 therethrough for conveying drilling fluid through the bit to the portion of a well bore (not shown) being cut by the bit. The passages 26 extend generally downward from the lower end 28 of a bore 30 formed in the shank 22 of the bit, such that drilling fluid flowing downwardly through the drill collar 16 will flow through the bore 30 and then through the various passages 26.

In accordance with the present invention, a float valve seat 32 is secured in the drill string 10, preferably in the bore 30 of the drill bit shank 22, to receive a valve member or head 34 reciprocally disposed in the drill bit 12. In a preferred embodiment, the valve seat 32 is tubular in form, with an outer diameter of a size to provide a sliding fit thereof in the bore 30, and is secured in the upper end portion 36 of the bore 30 by a snap ring 38 extending into mating grooves 40 and 42 formed in the walls of the bore 30 and around the seat 32, respectively. With this construction, the seat 32 and head 34 are not easily removable from the drill bit 12 and will be disposed of with the bit, as will be described. It is to be understood, however, that the seat 32 may be secured in the bore 30 in any desired manner. It should also be noted that a suitable sealing ring 44, such as an O-ring, is secured in a mating groove around the seat 32 to cooperate with the walls of the bore 30 and direct all of the drilling fluid through the valve seat 32, as well as prevent a retrograde flow of drilling fluid around the seat 32 when the drill string 10 is being floated in a well bore.

A downwardly facing, tapered valve seating area 46 is formed around the lower, inner periphery of the seat 32 to cooperate with a correspondingly tapered seating area 48 formed around the valve head 34. Also circumferentially spaced stops 50 extend radially inward from the inner periphery of the seat 32 and are shaped to contact the valve head 34 when the seating areas 46 and 48 are in contact to prevent inadvertent wedging of the head in the seat. The stops 50 are preferably formed integrally with the seat 32 and are so spaced and of a size as to not interfere with the downward flow of drilling fluid through the drill string.

A tubular shank portion 52 is formed on the lower end 54 of the valve head to receive and guide a helical compression spring 56. The spring 56 bears against the lower end 54 of the head 34 and against the bottom 28 of the bore 30 to continually urge the head 34 toward the seat 32. A plurality of radially extending guides 58 are formed in circumferentially spaced relation around the shank 52 and are of a size to slidingly contact the walls of the bore 30 to retain the head 34 in alignment with the seat 32. It should also be noted that the lower end 60 of each guide 58 is spaced upwardly from the lower end 62 of the shank 52, such that the guides 58 will not close off the passages 26 when the valve head 34 is in its fully open (lowermost) position. Furthermore, the valve head 34 and guides 58 are sized to provide no material restriction to the downward flow of fluid through

the drill string 10 when the head 34 is in an open position. In this latter connection it should also be noted that not only is the bore 30 normally larger in diameter than the passageway 18 in the drill collar 16, but the upper end 64 of the head 34 is conically-shaped to provide the minimum resistance to flow of fluid through the bore 30.

Although the operation of the embodiment disclosed will be apparent to those skilled in the art, it may be noted that drilling fluid flowing downwardly through the drill string 10 will hold the head 34 downwardly from the seat 32 against the action of the spring 56 for a normal drilling operation. As soon as the downward flow of drilling fluid through the drill string is stopped, as when it is desired to remove the drill string for replacement of the bit 12, the spring 56 moves the head 34 onto the seat 32; whereupon a retrograde or upward flow of fluid through the drill string is prevented. Therefore, the drill string may be floated in the usual fashion. However, the valve head 34 will again be moved down in the event a normal flow of drilling fluid is resumed.

Although the seat 32 and head 34 may be formed of any desired materials which will not be quickly ruined by the abrasive drilling fluid flowing therethrough and therearound, this invention contemplates the use of economical materials which may be easily molded into the desired shapes. With such an economical construction, the seat 32 and head 34 may be disposed of with the bit 12 without materially affecting the cost of a drilling operation. A plastic material such as nylon is easily molded to the desired shape and will withstand the action of the abrasive drilling fluid for a period at least equal to the normal life of a drill bit. It may also be noted that when the seat 32 is secured in the bore 30 by use of the snap ring 38, a minimum of machine work will be required in the bore 30. Furthermore, only a small amount of smoothing of the walls of the bore 30 will be necessary to provide free sliding of the guides 58, particularly when the guides are formed of nylon or the like.

From the foregoing it will be apparent that the present invention will increase the economy of a rotary drilling operation. The time presently required to repair drill collars and repair or replace worn float valves will be drastically reduced, and the present float valve construction is substantially more economical than present day float valves used in drill collars and special subs. Also, the present invention requires the minimum of parts and these parts are readily adapted to a molding or other economical forming operation.

Changes may be made in the combination and arrangement of parts or elements as heretofore set forth in the specification and shown in the drawings, it being understood that changes may be made in the precise embodiment disclosed without departing from the spirit and scope of the invention as defined in the following claims.

I claim:

1. In a rotary drill string, the combination of:

(*a*) a drill bit having a shank portion, said shank portion having an upper end and a lower end and said drill bit further having a fluid flow passage therethrough through which drilling fluid normally flows in one direction, said fluid flow passage comprising a bore extending downwardly in said shank portion from the upper end thereof, and a plurality of passages smaller than said bore communicating with the lower end of said bore;

(*b*) a valve seat positioned in said bore;

(*c*) a valve member positioned in said bore for cooperation with said valve seat to close said passage upon retrograde flow of fluid through said passage, said valve member having a conically-shaped upper end and a lower end;

(*d*) a shank depending from the lower end of said valve member; and

(*e*) a plurality of circumferentially-spaced guides extending radially outward from the valve member shank, said guides being of a size to contact the walls of said bore and maintain the valve member in alignment with the valve seat.

2. A drill string as defined in claim 1 wherein said valve member shank is tubular with the lower end thereof open, and characterized further to include a compression spring positioned in said valve member shank in contact with the lower end of the valve member and in contact with the bottom of said bore urging the valve member toward the valve seat.

3. A drill string as defined in claim 1 wherein said guides terminate above the lower end of the valve member shank to prevent closing off of said plurality of smaller passages when the valve member is in a fully open position.

4. In a rotary drill string, the combination of:

(*a*) a drill bit having a shank portion, said shank portion having an upper end and a lower end, and said drill bit further having a fluid flow passage therethrough through which drilling fluid normally flows in one direction, said fluid flow passage comprising a bore extending downwardly in said shank portion from the upper end thereof and a plurality of passages smaller than said bore communicating with the lower end of said bore;

(*b*) a valve seat positioned in said bore;

(*c*) a conically-shaped valve member positioned in said bore and dimensioned to extend into the valve seat for cooperation with said valve seat to close said passage upon a retrograde flow of fluid through said passage, and said valve seat having a plurality of circumferentially-spaced stops therein extending radially inward and shaped to stop upward movement of the valve member when the valve member is seated on the valve seat.

5. In a rotary drill string, the combination of:

(*a*) a drill bit having a shank portion, said shank portion having an upper end and a lower end, and said drill bit further having a fluid flow passage therethrough through which drilling fluid normally flows in one direction, said passage comprising a bore extending downwardly in said shank portion from the upper end thereof and a plurality of passages smaller than said bore communicating with the lower end of said bore;

(*b*) a valve seat slidingly positioned in said bore and having a circumferential groove in the outer periphery thereof, said bore having a mating circumferential groove in the walls thereof, a snap ring in said mating circumferential grooves securing the valve seat in said bore, and a sealing ring seated in a mating groove around the valve seat of a size to engage the walls of said bore and seal the valve seat in said bore; and

(*c*) a valve member positioned in said bore to cooperate with the valve seat and close said passage upon retrograde flow of fluids through said passage.

6. The combination claimed in claim 5 wherein said valve seat and valve member are constructed of a thermoplastic material.

References Cited in the file of this patent

UNITED STATES PATENTS

1,903,232	Giesey	Mar. 28, 1933
1,918,096	Greve	July 11, 1933
2,307,658	Appleby	Jan. 5, 1943
2,534,183	Shaff	Dec. 12, 1950
2,858,838	Scaramucci	Nov. 4, 1958
2,890,861	Cook	June 16, 1959
2,919,709	Schwegman	Jan. 5, 1960
2,920,861	Hartmann	Jan. 12, 1960