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DRILL ROD AND BIT INCLUDING ONE-WAY VALVE STRUCTURE THEREIN

Original Filed Oct. 22, 1964

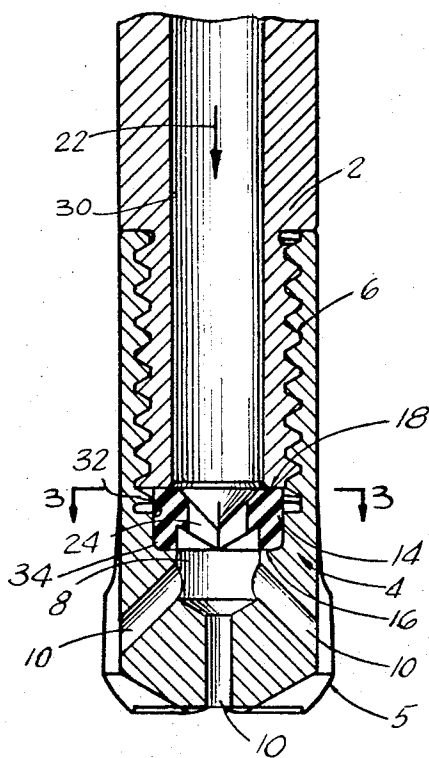


FIG. 1

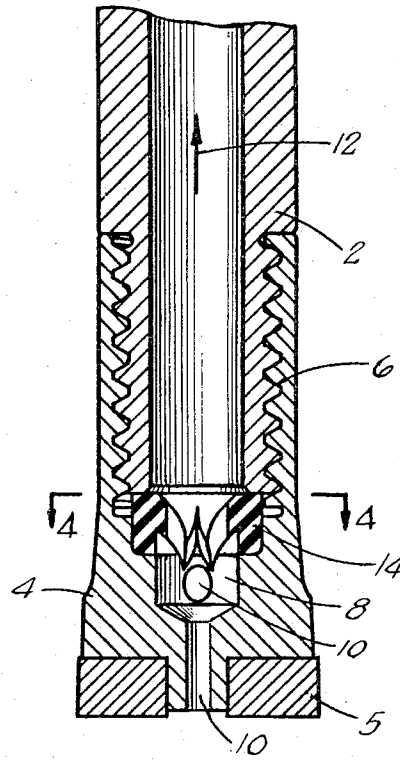


FIG. 2

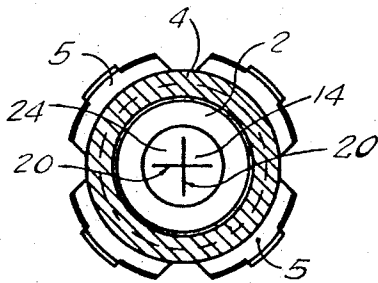


FIG. 3

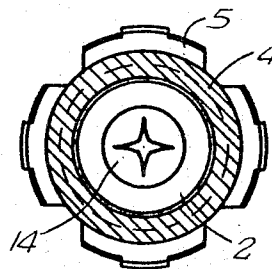


FIG. 4

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DRILL ROD AND BIT INCLUDING ONE-WAY VALVE STRUCTURE THEREIN

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Continuation of application Ser. No. 405,672, Oct. 22,

1964. This application June 21, 1967, Ser. No. 647,879

Claims priority, application Canada, Sept. 25, 1964,

912,578

3 Claims. (Cl. 175—318)

ABSTRACT OF THE DISCLOSURE

A resilient one way valve to be mounted between a drill bit and a drill rod. The valve has a generally circular outer ring portion for mounting the valve between the drill bit and drill rod to prevent relative movement of the valve, and a substantially conical central portion. The apex of the conical portion is directed towards the drill bit and contains radial slits extending from the apex to approximately half the diameter of said valve to thereby enable fluid under pressure to pass from the drill rod into the drill bit while preventing reverse flow.

This is a continuation of my earlier application 405,672 filed October 22, 1964 and now abandoned.

The present invention relates to an improvement in well drilling techniques, and particularly to a valving arrangement disposed within a bore hole drilling apparatus.

It is well known that bore holes are formed in the substrata by positioning a drill bit on the end of a drill rod and then rotating the drill rod and bit while applying pressure against the other end of the drill rod. The drill bit is usually attached to the drill rod by a screw thread arrangement. The drill rod is hollow and the drill bit is provided with apertures or holes in communication with the hollow drill rod to allow drilling fluid or air to be forced down the drill rod through the drill bit and into the bore hole for purposes of cleaning the bore hole by forcing drilling residue material up between the outer sides of the drill rod and the walls of the borehole to the surface. This is standard practice in the art and it is known that it is necessary to force drilling fluid or air down the bore hole under high pressure to accomplish cleaning of the bore hole. This is especially true of very deep holes.

It is also known that the life of the sharpness of a drill bit is relatively short and that it is necessary to remove all the drill pipe from the hole to change the drill bit at frequent intervals. Before the drill rod is withdrawn from the hole the supply of drilling fluid or air pumped down the drill rod is discontinued. With this release of pressure there is a tendency for the drilling fluid remaining in the bore hole to reverse back into the drill rod carrying with it the gritty rock slush resulting from the drilling operation. The drilling fluid and grit is forced back into the drill rod through the drill bit and up into the threads joining the drill bit to the rod.

When the terminal end of the drill rod carrying the drill bit is brought to the surface it has been found that the impregnation of the gritty drilling mud into the screw threads joining the drill bit to the drill rod makes it very difficult to remove the bit and once removed it is found that the threads on the bit are so worn and cut as to render the bit useless for further service.

It is an object of the present invention to provide an improvement in the assembly of the drill bit and drill rod structure to prevent gritty drilling fluid from entering into the threading arrangement, and hence make it easier to remove the bit from the rod and lengthen the life of the threads on the drill bit and the drill rod.

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It is a particular object of this invention to provide a valving arrangement in the drilling assembly whereby drilling fluid under pressure may pass down the rod into the bit and into the bore hole, but which will also prevent gritty and dirty drilling fluid from passing from the drill bit back into the drill rod when the application of pressure downward in the drill rod is stopped.

The present invention will be more fully understood with reference to the accompanying drawings wherein:

FIGURE 1 is a cross-sectional view of a drill rod and attached drill bit and a valve according to the present invention in closed position in position therein;

FIGURE 2 is a cross-sectional view of a drill rod and attached drill bit and a valve according to the present invention in open position in position therein;

FIGURE 3 is a section taken along line 3—3 of FIGURE 1; and

FIGURE 4 is a section taken along line 4—4 of FIGURE 2.

In the drawings numeral 2 indicates the lowermost end of a drill rod, the drill rod being provided with a central bore 30, and numeral 4 indicates a drill bit with drilling flanges 5. The drill bit 4 is attached to the rod 2 by threading 6. The drill bit 4 is provided with a first central cavity 32 and a second central cavity 8 of smaller diameter than the first central cavity 32. Leading from the second central cavity 8 are holes or apertures 10, whereby drilling fluid or air under pressure is forced down through the drill rod and into the bore hole to force drilling residue to the surface.

As above explained it has been found that when the application of pressure against the drilling fluid in rod 2 ceases, the back pressure of the drilling mud and grit in the bore hole forces the drilling mud back up into the rod in the direction of arrow 12 in FIGURE 2 and into the threads 6 of the drill bit and rod.

It is an object of the present invention to provide a simple and inexpensive valve arrangement to prevent this backflow of drilling mud and grit.

An embodiment of the valve structure is shown generally by numeral 14 in cross-section in FIGURES 1 and 2 and in partial top view in FIGURES 3 and 4.

The valve is basically a circular ring, i.e. it is of annular shape and is provided with a cylindrical depending skirt 34. It may thus be said to be cylindrical and ring-shaped in configuration and has an inner cone shaped area the thickness of the walls of which decreases towards the apex as shown in FIGURE 1. The cone-shaped central portion of the valve is provided near the apex (i.e. at the center thereof) with radially extending slits 20 in the form of an "x" as shown in FIGURE 3. As shown both in FIGURE 3 and in FIGURE 4, the slits 20 extend less than one-half the diameter of the central portion of the ring-shaped valve. The valve is mounted in the drilling assembly with the apex of the conical portion pointing toward the drilling end of the drill bit as shown in FIGURE 1.

The valve is constructed of any suitable resilient material such as hard rubber, resilient plastic or like material and is mounted within the drilling head in the first central cavity 32 between shoulders 16 provided in the drill bit 4, and the end 18 of drill rod 2.

The valve is so constructed that the slits in the cone shaped portion are normally in closed position as in FIGURES 1 and 3.

When drilling fluid or air under pressure is forced down the drill rod in the direction of arrow 22, the valve flaps 24 bounding the slits 20 will however be forced open, due to the conical shape of the valve, to the position shown in FIGURES 3 and 4. The drilling fluid can then

continue through the apertures 10 in the drill bit and into the bore hole.

When the downward pressure on the drilling fluid or air in rod 2 is stopped, and the back pressure of the fluid in the bore hole reverses back through apertures 10 the flaps 22 close due both to their nature of construction and to the upward pressure against them. This closing prevents gritty drilling fluid or air from passing upwardly into the drill rod and into the thread arrangement 6.

The valve of this invention is simple and economical and can easily be constructed for adaptation to all types of drill rod and bit assemblies.

What is claimed is:

1. In combination:

- (a) a drill rod provided with a central bore;
- (b) a drill bit, said drill rod and said drill bit being adapted to be threadedly secured together, said drill bit including a first central cavity, a second central cavity of small diameter than said first central cavity, a plurality of apertures extending from said second cavity to the exterior of said drill bit, and a plurality of drilling flanges disposed around the outer circumference of said drill bit; and
- (c) a one-way valve structure disposed in said first cavity of said drill bit, and said one-way valve structure comprising a circular ring portion formed of resiliently deformable material adapted to be clamped between said drill rod and said drill bit to prevent relative movement of said valve structure and a central depressed portion with the vertex thereof being directed towards said drill bit, said central depressed portion being provided with a plurality of slits originating at the vertex thereof and extending radially less than one half the diameter of the central depressed portion of said ring to provide a plurality of

normally closed valve flaps thereon whereby fluid passing through said drill rod in the direction of said drill bit urges said valve flaps open so that fluid may pass through said valve structure and whereby fluid under pressure attempting to pass through said drill bit to said drill rod will urge said valve flaps to a closed position to prevent fluid from passing there-through.

2. The combination of claim 1 wherein said circular ring portion comprises an annular cylindrical peripheral skirt integral with and encircling said central depressed portion and depends therefrom, said skirt being adapted to be clamped between said drill rod and said drill bit to prevent relative movement of the valve structure, and said central depressed portion is conical.

3. The combination of claim 2 wherein the walls of the conical central portion are of decreasing thickness as they approach the apex thereof.

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