Nov. 15, 1955 W. P. FRASER 2,723,836

CORE BIT PROTECTOR

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Fig. 1

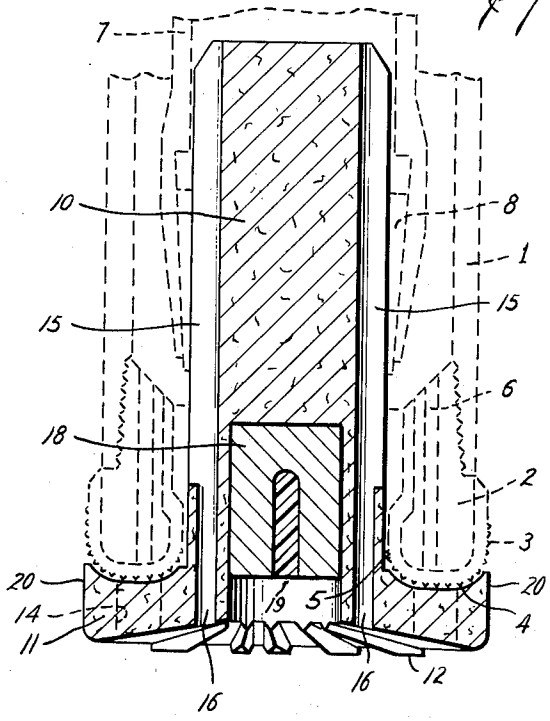


Fig. 3

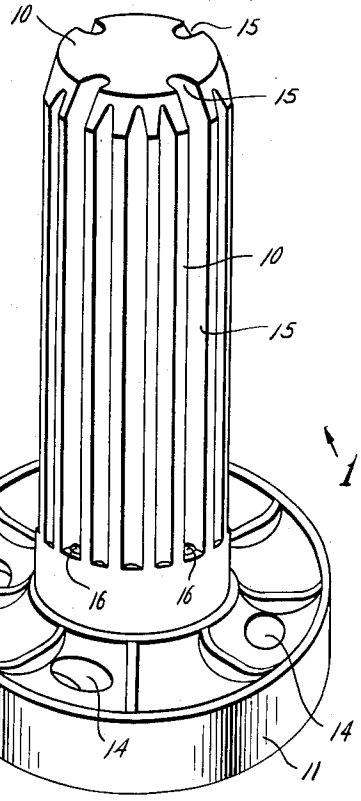
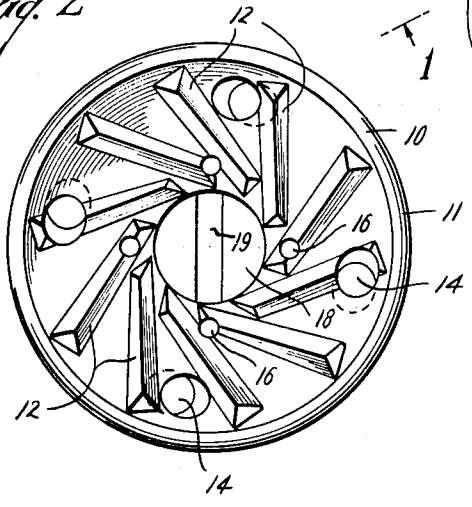


Fig. 2



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CORE BIT PROTECTOR

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1 Claim. (Cl. 255—72)

This invention relates to means for protecting the cutting means of core bits and the like.

In the drilling of oil wells, water wells, or any hole in the ground, it is often desired to cut a core (a large sized piece of the rock being drilled) and bring it to the surface of the well for analysis. This is commonly done with various types of core bits, including the type of diamond core bit illustrated, along with the invention, in Figure 1. The diamonds, or other cutting means, of such a bit are easily damaged while the bit is being lowered into the hole, by being knocked against or scraped along the walls of the well and by being rotated upon non-drillable metallic debris such as metal bit teeth, ball bearings and the like, which are at the bottom of the well where the core is to be cut.

An object of this invention is to provide improved means for protecting a core bit during its descent into the hole.

Another object of this invention is to provide improved means for protecting a core bit from damage resulting from rough treatment such as the shock upon being roughly set down upon the bottom of a hole.

Yet another object of this invention is to provide means for and method of protecting core catchers from damage by a core and for guiding a core into core catchers of a coring assembly.

Still another object of this invention is to provide improved means for protecting a core bit from metallic debris in the bottom of the hole to be cored.

A further object is to provide an improved core bit protector which permits circulation of drilling fluids thereby and therethrough.

Other objects will be apparent from the following description and accompanying drawings.

These objects are accomplished, in accordance with this invention, by the use of a plug adapted to be received and held in the core bit as is the core being cut, such plug carrying thereon a flange adapted to cover and protect the cutting means of the bit, and if desired, also carrying magnetic means for removing metal debris from the path of the bit cutters before cutting begins.

Figure 1 is an elevational section of the invention positioned within a conventional diamond core bit, taken along line 1—1 of Figure 3.

Figure 2 is a bottom view of a preferred form of the invention.

Figure 3 is an isometric view of a preferred form of the invention.

Consider the diamond core bit of Figure 1. The outside tubular member shown is the body 1 of the bit. At the lower end of the body 1, there is mounted the bit cutting means 2, which may be an annulus in which diamonds have been set, or which may be any other appropriate cutting means. Whether the cutting means is itself of annular form, or is composed of spaced apart edges, or the like, when rotated it and its cutting edges define a circle. Often there are diamonds on the outside surface 3, the bottom surface 4 and the inside surface 5 of the cutting means depicted by the annulus 2. Extending

vertically through the annulus 2, there may be fluid circulation holes 6, spaced around the annulus 2.

Within the body 1, there is a receptacle in the form of a core barrel 7 of tubular form. Inside the lower end of the core barrel 7, there may be pawls, catchers, or slips 8 in grooves or slots in the lower end of the core barrel 7. The slips are adapted to move either upward and outward, thus enlarging the circle they define, or downward and inward, thus diminishing the circle they define. Accordingly, objects of cylindrical form, such as a core being cut by the cutting means 2, may be easily moved upward into the barrel 7 without interference from the slips 8, but when it is attempted to move the same object downward out of the barrel 7, the slips 8 set downward and inward, gripping and holding the object.

The invention is best observed in the isometric view of Figure 3. The body of the invention is a mass of material which is easily drillable. Among the many possible materials there is included a sort of an alloy of paper pulp and plastic moulded under high pressure. Such material grinds very easily without dulling cutting teeth, diamond edges, or other cutting means, yet is very tough and is rigid enough for the demands here made upon it. Alternatively, certain of the new plastics may be cast or cut into the appropriate forms hereinafter described and used.

The mass is formed into two principal portions, the plug portion 10 and the flange portion 11. The plug 10 is generally cylindrical in shape, and of diameter substantially equal to the diameter of the core cut by the particular core bit being used, so that the plug portion may pass into the core barrel 7 and be held by the slips or catchers 8 therein. The upper end of the plug portion 10 is preferably tapered somewhat to make insertion of the plug 10 into the core catchers 8 easier.

It is important to note that in normal coring operations, without the use of the protector described herein, the core catchers 8 are downward and inward, defining their minimum diameter, when the core cutting begins. As the core begins to form and engages the core catchers 8 in their extended position, it often occurs that the core catchers 8 are damaged by the core, and are thereafter rendered incapable of receiving the core, or of holding it if received. The plug 10, however, with the top tapered somewhat, and having been inserted into the core catchers 8 by hand, holds the core catchers 8 upward and retracted so that the core is easily received by the catchers without damage.

At the lower end of the plug portion 10, there is a flange portion 11, adapted to be urged against and to fit the cutting annulus 2 and cutting edges thereon. Most core drilling is done from the bottom of a so-called rat hole whose internal diameter is almost identical to the external diameter of the core bit, the rat hole frequently having been cut by the same core bit being used to cut the new core. Accordingly, it is usually preferable that the flange 11 be of no larger diameter than the lower face 4 of the cutting annulus 2 so that the bit protector does not bind when moving into the rat hole. If the core is to be cut from a large diameter hole, then a bit protector may be used with a large diameter flange 11. With such an arrangement, when the bit is buffeted about during descent into the hole, the flange 11 rather than the outside cutting surfaces on the annulus 2 takes the blows.

The flange 11, in the normal position, has a top surface adapted to fit against the bottom bit cutting surface 4, and a lower surface, which is opposite the plug 10. This lower surface may conveniently be fitted with scrapers or protrusions 12, molded therein when the flange is made. Such scrapers or protrusions are preferably of the ridge type illustrated, the ridges angling inward. This type of protrusion agitates well fluids when

rotated, and tends to cause a fluid movement from the circumference inward along the lower surface of the flange. Metallic debris that is moved by such circulation is thus brought toward the center of the flange to be caught by a magnet hereinafter described.

Conveniently, the flange **11** may also have holes **14** therein, to cooperate with the holes **6** through the annulus **2**, thereby permitting fluid flow through the core bit and the bit protector at all times. Also, the outside surface of the plug body **10** may have therein, grooves **15**, generally longitudinal of the body. Additional holes **16** may be drilled through the lower end of the plug portion, or through the inside of the flange portion, as you may prefer to phrase it, to cooperate with certain of the grooves **15**, thus affording additional circulation paths for drilling fluids to move from within the bit to impinge upon the bottom of the well.

Conveniently, there may be, within the lower end of the plug **10**, a magnetic circuit with an air gap between two poles inside the circle defined by the flange **11**, or closely adjacent thereto. The magnetic circuit may be simply a conventional U or horseshoe magnet **18** with the air gap **19** between the two poles positioned toward the bottom of the plug portion **10**. Or it may be a cup assembly type of magnetic circuit such as that illustrated in United States Patent 2,668,077 wherein one pole is the annular edge of a cup and the other pole is the end of a rod or shaft centered within the cup, the air gap being the annular space between the annular edge of the cup and the end of the centered rod. The magnet in the circuit may be either the center rod or the outside cup wall or both.

If a cup assembly magnetic circuit is used, there may be provision for circulation downward through the center of the rod, or it may pass through the annular space between rod and outside wall of the cup, or the circulation may be entirely on the outside of the magnetic circuit as illustrated in connection with the horseshoe magnet depicted in Figures 1 and 2. Spaces between portions of the magnetic circuit may or may not be filled with non-magnetic material, the important considerations being only to avoid shorting the magnetic circuit, and to locate the poles of the circuit so that they may most efficiently attract metal objects in the bottom of the hole.

In accordance with this invention, when a core is to be cut, a typical core bit is secured to the drill string. The plug portion of a bit protector of the type described is inserted into the core barrel and is caught there by the core catcher. The flange portion of the protector is pressed against the lower surface **4** of the cutting means.

The bit, with protector inserted, is lowered into the well hole. As it descends, the outside edge **20** of the flange **11** scrapes along the wall of the well, guiding the bit into the hole and protecting it from damage and wear from the well wall. Near the bottom of the hole, the bit is rotated and raised up and down short distances to agitate the mud and other debris at the bottom of the hole. Drilling mud or other drilling fluid is circulated through the holes **14** and **16**. Metallic debris is moved about in the agitated fluid and is attracted to and held by the magnet at the lower end of the plug **10**.

Then the bit is set upon the bottom of the hole, and drilling commences. Since the flange **11** is made of easily drillable material, the bit soon cuts through the flange and commences to cut the rock formation being drilled, forming a core inside the annulus **2** as the cutting proceeds.

With the flange **11** gone, as the core is formed and moved upward, it pushes the plug **10** ahead of it upward toward the top of the core barrel **7**. A core of any desired length may be cut, the plug rising in the core barrel on top of the core, and taking with it, all metal debris picked up by the magnet.

When the desired core has been cut, the core barrel is removed from the hole. The core and the plug are taken out of the barrel. The magnet is retrieved from the plug to be used in making up another protector.

Many advantages of this invention appear at once to those familiar with this art. It is unnecessary, in most instances, to make two runs to the bottom of the hole, once with a fishing magnet and then again with the core bit. The cutting means on the bit are protected at all times; yet, drilling is not materially interfered with. Drilling fluid can still be circulated. The protector takes literally only a second to insert in the core bit before it is lowered into the hole. The protector takes no more time to remove than it takes to remove the core that is cut.

Modifications may be made in the structure particularly described herein without departure from the scope of the invention. Accordingly, this description is to be construed as illustrative only, and is not to be construed as a limitation upon the scope of the invention as defined in the following claim.

I claim:

For use in connection with core bits for cutting and taking cores from the bottom of holes in the earth, said core bits having cutting means disposed in annular form defining a circle, and having a receptacle of generally cylindrical form for receipt of a core cut by said bit, and said receptacle having an opening downward into said circle; a mass of drillable material including a plug portion of generally cylindrical form adapted to be received in and be held in said receptacle in the manner of a core and a flange portion of annular form positioned adjacent one end of said plug portion and adapted to be positioned below the cutting means of said bit when said plug portion is in said receptacle, said flange portion extending radially at least as far outward as the outermost extremity of said cutting means; a permanent magnet positioned within said plug portion with at least one pole of said magnet located at the end of said plug portion upon which said flange portion is mounted; said flange portion having openings therein to permit the passage of drilling fluids therethrough; said plug portion being of such diameter as to substantially fill said receptacle whereby it is held firmly therein; said plug portion having grooves cut longitudinally of the sides thereof, which grooves connect with holes through said flange portion, thereby permitting the flow of well fluids along the side of said plug portion and through said flange portion to impinge upon the bottom of the well.

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