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DULL BIT INDICATOR

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FIG. 1.

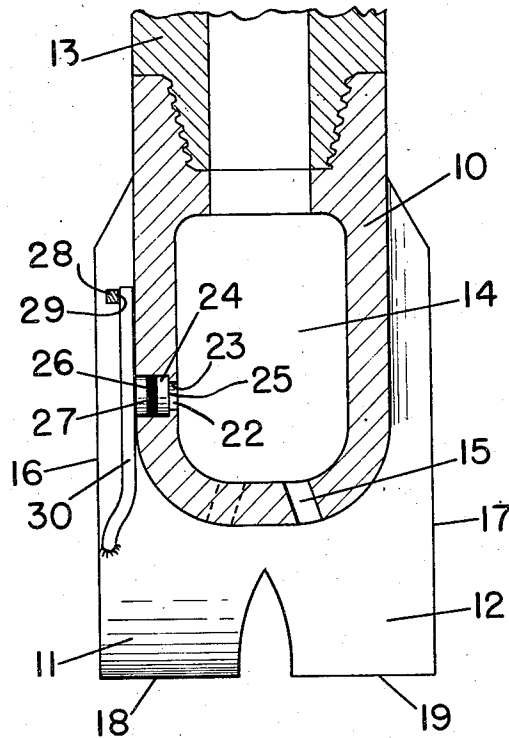
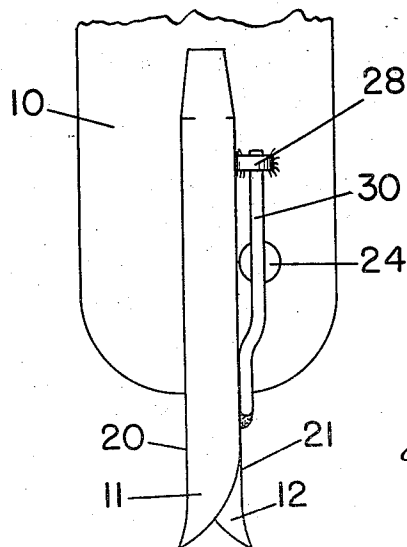


FIG. 2.



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DULL BIT INDICATOR

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3 Claims. (Cl. 255—61)

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This invention relates to a drill bit used for drilling boreholes into subsurface formations. More particularly, this invention relates to a drill bit which, when it is worn by a pre-determined amount during drilling operations, will give a signal of such wear at the surface of the earth.

In the drilling of boreholes into subsurface formations by the rotary drilling method, particularly in drilling boreholes for the production of minerals, such as oil and gas, the drill bit attached to the end of the drill stem is subjected to conditions which cause rapid wear of the cutting edges of the bit blades. The blades of several bits are ordinarily worn off in drilling such a well. Of course, when the blades are worn off a particular bit, the drilling crew must pull the drill stem out of the hole and replace the worn bit with a new bit before resuming drilling operations. When conventional bits are employed in such operations, no positive method is available for determining the point when the cutting blades of the drill bit are worn to such an extent as to require replacement of the bit; consequently, the selection of the time when the drill bit should be removed from the hole is wholly within the judgment of the drilling crew. As would be expected, conventional drill bits are sometimes removed from the hole before the blades have been worn to the point where the drill bit should really be replaced. On the other hand, and perhaps more commonly, the drill stem is sometimes not withdrawn from the hole and the bit replaced until long after the blades have been worn to such an extent that little or no hole is being made. As a matter of fact, drilling is sometimes continued until the bit blades have been completely worn off the bit body and the bit body itself damaged by wear.

Although excessive wear of the cutting edge of the bit blades is the most frequent reason for replacement of conventional drill bits, it sometimes happens that the bit should be replaced because it has become worn "out of gauge." Here again the drilling crew has no positive means of knowing when the bit has become so worn. A drill bit is said to be worn "out of gauge" when the reaming edges of the bit blades have been worn to such an extent that the diameter of the hole being made is smaller than may conveniently be tolerated. For example, the diameter of a hole drilled with a bit having worn reaming edges may not be sufficiently great to permit the free passage of a new unworn drill bit subsequently introduced into the hole. When this condition exists, the borehole walls must be enlarged by reaming in a suitable manner as with a new bit. Not only does reaming consume time but it also entails the risk of a stuck drill bit.

It is an object of this invention to provide a drill bit which, when worn by a pre-determined amount, will cause an increase in fluid pressure

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in the mud stream used with the drill string and thus give a signal to the drilling crew indicating that the drill bit should be removed because of excessive wear.

It is a further object to provide a drill bit, the body of which will not be damaged during drilling operations and in which the construction is such that repair of the used bit is convenient and simple.

The foregoing objects, as well as other advantages, are attained by the present invention as will be apparent from the following detailed description taken in connection with the accompanying drawing in which

Fig. 1 is a side view, partly in cross section, of a drill bit constructed in accordance with the present invention; and

Fig. 2 is a front view of the embodiment shown in Fig. 1.

Referring to the drawing, in which like numerals refer to like elements throughout, the drill bit of my invention consists of a body 10 and cutter blades 11 and 12. The body 10 may be affixed to the lower end of a drill stem 13 by any suitable means, such as by threads, the said drill stem being of the conventional design fluidly connectible with a source of drilling fluid under pressure. Body 10 is provided with a hollow internal portion 14 in fluid communication with drill stem 13 when drill stem 13 is connected with body 10. Ducts 15, conventionally termed "eyes" or "water courses", fluidly connect the hollow internal portion 14 of body 10 with the outer surface of said body, the outer terminus of ducts 15 being above the upper edge of bit blades 11 and 12 and normally directed in front of the cutting edge of said blades. Bit blades 11 and 12 may be of any desired design and are preferably made of hard, tough, metallic materials. The reaming edges 16 and 17 of bit blades 11 and 12, respectively, are approximately parallel to each other and to the longitudinal axis of body 10. Cutting edges 18 and 19 of bit blades 11 and 12, respectively, are normally slightly beveled outwardly and downwardly as shown. The cutting face 20 of bit blade 11 is disposed approximately 180° from the cutting face 21 of bit blade 12. Bit blades 11 and 12 may be incorporated into the lower end of body 10 in any desired manner and are normally welded thereto.

In accordance with the present invention, the conventional bit thus far described is modified by providing at least one additional passage through the side wall of body 10. Accordingly, body 10 defines duct 22 which provides fluid communication between the inner hollow portion 14 of body 10 and the outer surface of body 10 and may be located at any convenient point in body 10. Duct 22 is smaller in diameter at the portion thereof adjacent the hollow internal portion 14 than the remainder thereof, thus defining outwardly

extending shoulder 23. Plug 24 is slidably arranged within duct 22 with the inner edge 25 of said plug abutting against shoulder 23 defined by duct 22. Plug 24 defines at least one recess 26 in its outer periphery adapted to receive sealing means such as O-ring 27 so as to provide a fluid-tight seal between plug 24 and the walls of duct 22.

Rod anchor 28 is affixed to the outer surface of bit body 10 above duct 22 in any suitable manner, as for example by welding, rod anchor 28 being traversed by vertically extending duct 29. Plug 24 is held firmly in place in duct 22 against seat 23 by means of rod 30 which is adapted to have its upper end inserted in duct 29 carried by rod anchor 28 and its lower end tack-welded to blade 11 preferably on the back side of said blade, as shown. Rod 30 extends downwardly along blade 11 to a point at least below the lower edge of body 10 and it may extend to any point below such lower edge as desired.

In operation, rod 30 will prevent plug 24 from being pushed outwardly out of duct 22 by the pressure exerted by the drilling fluid circulated through water courses 15. Rod 30 will retain plug 24 in the aforementioned position until such time as bit blades 11 and 12 have been worn to the point at which rod 30 has been tack-welded to blade 11, at which point the lower end of rod 30 is also worn away. When the weld at the lower end of rod 30 is worn away, rod 30 will drop out of duct 29 of rod anchor 28, thus permitting plug 24 to be forced out of duct 22 by reason of the pressure exerted by the drilling fluid. After plug 24 has been forced from duct 22, drilling fluid will, of course, flow through duct 22, thus causing a sharp drop in the pressure exerted by the drilling fluid and providing a signal to the drilling crew that the drill bit has been worn to a point where replacement is required.

By tacking rod 30 in close proximity to a reaming edge of the bit, as for example by placing it in close proximity to reaming edge 16 of blade 11, the wearing of bit blade 11 "out of gauge" may also be indicated provided such wear occurs before the cutting edge 13 of bit blade 11 has been worn to the point to which rod 30 extends vertically.

It will be understood that various modifications may be made without departing from the spirit of the present invention or the scope of the annexed claims.

What I wish to claim as new and useful and desire to secure by Letters Patent is:

1. A drill bit comprising, in combination, a body having an internal chamber and means for mechanically affixing said body to a drill stem having a hollow passageway therethrough, said body defining a fluid passageway interconnecting said internal chamber with the hollow passageway of said drill stem, a bit blade having a leading and a trailing face and having a cutting edge on its lower end and a side edge, said blade being affixed to the lower edge of said body, said body having at least one first duct fluidly connecting said internal chamber with the external surface of said body above the cutting edge of said bit blade and directed ahead of the leading face thereof, said body having at least one second duct located in the side wall of said body fluidly connecting said internal chamber with the exterior surface of said body, a plug releasably disposed within and normally closing said second duct to the passage of fluid therethrough, a rod member affixed to said body with its lower

end affixed to said cutter blade below the lower end of said body and maintaining said plug within said second duct normally closing said second duct, said rod member being adapted to be removed from said body and said cutter blade by cutter blade wear.

2. A drill bit comprising, in combination, a body having an internal chamber and means for mechanically affixing said body to a drill stem having a hollow passageway therethrough, said body defining a fluid passageway interconnecting said internal chamber with the hollow passageway of said drill stem, a bit blade having a leading and a trailing face and having a cutting edge on its lower end and a side edge, said blade being affixed to the lower edge of said body, said body having at least one first duct fluidly connecting said internal chamber with the external surface of said body above the cutting edge of said bit blade and directed ahead of the leading face thereof, said body having a second duct located in the side wall of said body fluidly connecting said internal chamber with the exterior surface of said body, a closure means disposed within and normally closing said second duct to the passage of fluid therethrough, a rod member affixed to said body with its lower end affixed to said cutter blade below the lower end of said body and maintaining said closure means within said second duct normally closing said second duct, said rod member being adapted to be removed from said body and said cutter blade by cutter blade wear.

3. A drill bit comprising a hollow body having a releasable connection at its upper end for connection to a hollow drill stem and provided with cutter blades at its lower end, each blade having a cutting face, a first duct for each blade fluidly connecting the lower end of the interior hollow portion of said body with the exterior of said body ahead of the cutting face of each of said blades, said body having at least one second duct located above said first ducts and fluidly connecting the interior of said body with the exterior of said body above said first ducts and one of said cutter blades, a closure member releasably disposed within and normally closing said second duct to the passage of fluid therethrough, a bar member affixed at its upper end to the outer surface of said body and extending across said closure member, and affixed at its lower end to a cutter blade below said first and second ducts to maintain said closure member within said second duct, said bar member being released upon predetermined wear of said bar member, to permit displacement of said closure member.

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