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PREVENTION OF MUD CUTTING IN EARTH BORING DRILLS

Original Filed July 15, 1950

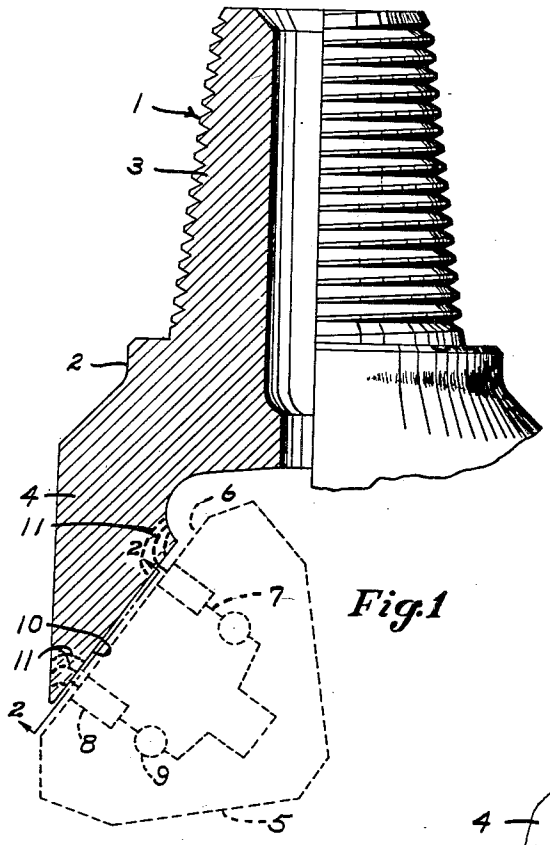


Fig. 1

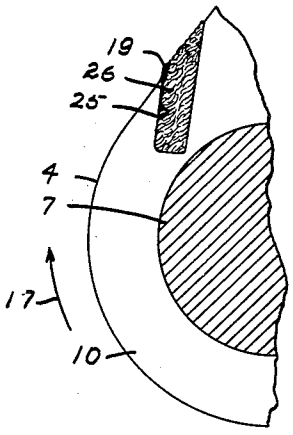


Fig. 6

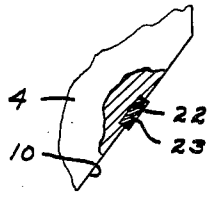


Fig. 5

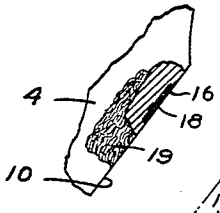


Fig. 3

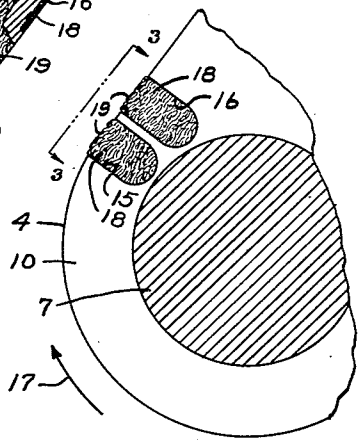


Fig. 2

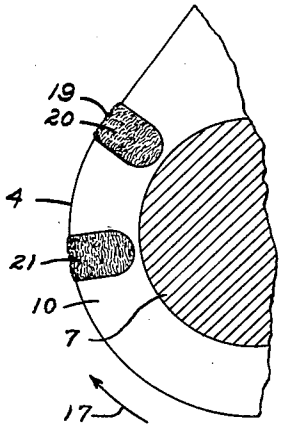


Fig. 4

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PREVENTION OF MUD CUTTING IN EARTH BORING DRILLS

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6 Claims. (Cl. 255—308)

This invention relates to well drills of the rolling cutter type wherein toothed rolling cutters roll upon and disintegrate the bottom of a well bore in accordance with the rotary method of drilling.

This application is a continuation of our prior application Serial No. 174,024, filed July 15, 1950, now abandoned.

In the drilling of wells, such as oil and gas wells, by the rotary method of drilling, a bit head is provided with a plurality of rolling cutters mounted upon shafts, or spindles, at the lower end of the head. Usually antifriction bearings are interposed between each cutter and its shaft proximate the shoulder on the head at the end of the spindle, the end of the cutter being in opposed spaced relation with the shoulder. In the use of drills of this type difficulty has been experienced in a phenomenon which has become known as "mud cutting." When this condition develops it seems that particles from the flushing fluid and/or particles disintegrated from the bottom of the well bore collect upon the end of the rolling cutter, in the space between the cutter and the shoulder revolve with the cutter and act as an abrasive to cut away the metal of the shoulder at the base of the spindle. Even though the particles do not form a solid mass, but are constantly disintegrating and building up, they function to cut away the shoulder and the spindle at the juncture with the bit leg whereby cutting action of the bit is impaired and eventually the bearings are released, cuttting action is terminated and the cutter may, especially on the cone type of well drill, be lost in the hole.

The primary object of our invention is to prevent mud cutting in the rolling cutter type of well drills.

Another object is to provide a slug or patch of wear resistant material within the area subject to mud cutting to disintegrate the accumulating abrasive material that would otherwise effect mud cutting, and in this manner, to prevent mud cutting throughout the entire surface where such action usually occurs.

Another and more specific object is to form a substantially radially etxending slot or groove in the shoulder at the base of the spindle of a rolling cutter type of well drill and to thereafter secure a wear resistant material within such groove, such material either filling or partially filling the groove.

The invention also comprehends that the material filling or partially filling the groove shall continue over and upon the outer surface of the bit leg at the end of the groove thereby preventing undercutting of the wear resistant material at the end of the groove.

The foregoing objects together with other objects and advantages of the invention will be more fully apparent from the following description considered in connection with the accompanying drawings in which:

Fig. 1 is a side view, in broken elevation and partly in section, of a cone type well drill embodying the invention;

Fig. 2 is a sectional view taken on line 2—2 in Fig. 1;

Fig. 3 is an enlarged detail, partly in section, taken on line 3—3 of Fig. 2 and showing one form of wear resistant pad used in accordance with the invention;

Fig. 4 is a view similar to Fig. 2 but showing a different orientation of the wear resistant pads;

Fig. 5 is a detail showing the manner of using a single compact or slug of wear resistant material to prevent mud cutting in accordance with the invention;

Fig. 6 is a view similar to Fig. 2 but showing another manner of practicing the invention.

While the invention is illustrated in the drawings as embodied in the cone type of well drill it is intended that such showing shall be considered as merely illustrative since the invention is also applicable in other types of well drill utilizing rolling cutters.

In the drawings there is shown a cone type of well drill 1 of conventional construction and comprising a head 2 with an upwardly tapered and threaded shank 3 for engagement with a drill collar or tool joint. At the lower or forward end of the drill are downwardly extending legs 4, one of which is shown in section in Fig. 1. The destructive effects of mud cutting to be eliminated in accordance with the invention are produced by an accumulation of abrasive material on the base 6 of the cutter 5 mounted on the spindle 7, antifriction bearings 8 and 9 being interposed betwen the spindle 7 and the inner bearing surface of the cutter 5 to assume axial and radial loads upon the cutter. This abrasive material, traveling with the cutter 5 during its rotation on the shaft 7, effects scoring or cutting away of the shoulder 10 at the base of the spindle even though these surfaces nominally are held in spaced relation by the bearing structure just described and as is clearly shown in Fig. 1. This is a progressive action which removes material from the shoulder as indicated by successive dotted lines 11. The effectiveness of the well drill is impaired at the outset but eventually the destruction is such that the bearings are released and cutting action of the drill is terminated.

We have found that mud cutting, as above explained can be eliminated by the proper application of a wear resistant material upon a portion only of the shoulder 10 as shown in Figs. 2 and 3. As shown in these figures a pair of recesses or grooves 15 and 16 are formed in the shoulder 10. These recesses or grooves extend substantially radially of the shoulder 10 and are located angularly a short distance from the lowermost point on the cutter in the direction indicated by the arrow 17, the direction of rotation of the cutter. A pad of wear resistant material 18 is deposited in each of the recesses or grooves 15 and 16, such material having its outer surface substantially flush with the adjacent surface of the shoulder 10. Where the recesses 15 and 16 intersect the outer surface of the leg 4 we preferably extend the material of the pad 18 to cover a small portion of such outer surface as shown at 19 in Fig. 3 to prevent undercutting of the wear resistant material in the groove 15 or 16 at that point. In this figure a portion of this extension area is cut away to show the relative position of the extension and the pad 18.

By utilizing a pad or pads of wear resistant material, in the manner just described, we find that the destructive effects of mud cutting are substantially eliminated, although only a small portion of the area subjected to mud cutting is covered by the pad.

An alternate arrangement for the wear resistant pads is shown in Fig. 4 wherein the pads are shown in angularly spaced relation at 20 and 21.

The pad 18 is preferably deposited in the groove 15 or 16 by a torch application such as is used for building up surfaces with a wear resistant material, such as tungsten

carbide particles with a matrix metal of mild steel, other metal or alloy.

Still another embodiment or form of the invention is shown in Fig. 5 wherein a recess **22** is provided in the shoulder **10** and a preformed pad **23** is secured in such recess in any suitable manner such as brazing or the like. A pad suitable for this purpose may comprise a body of sintered carbide although it is to be understood that mention of a particular material is illustrative only as any suitable material may be used without departing from the spirit of the invention.

In still another form of the invention, as illustrated in Fig. 6 a recess **25** is provided in the shoulder **10** at the base of the spindle **7**. This recess extends outwardly and forwardly relative to the direction of rotation of the cutter as indicated by the arrow **17**. A quantity of wear resistant metal **26** is deposited in the recess **25** in the manner already described in connection with grooves **15** and **16** in the embodiment shown in Figs. 1, 2 and 3. This deposit also extends over the edge of the bit leg as shown at **19** and in greater detail in Fig. 3. In this construction the abrasive material which tends to accumulate upon the base of the cone **5** engages the wear resistant metal **26** and thence sloughs off and moves outwardly whereby destructive effects upon the bit head are avoided.

While the width and depth of the grooves **15**, **16** and **25** may vary, it has been found that a width of five-sixteenths of an inch and a depth of one-sixteenth inch are satisfactory. It has also been found that an extension **19** of the hard facing metal of one-half inch on the periphery of the leg beyond the outer end of the groove will adequately protect the pad of wear resistant material from undercutting at that point.

Construction and use of the invention are believed apparent from the foregoing description. By way of reiteration and supplementation it will be assumed that a quantity of wear resistant material is secured upon the shoulder **10** in a manner heretofore described. When the bit **1** is in normal operation, abrasive material collecting upon and moving with the base **6** of the cutter **5** moves in the direction of the arrow **17** and contacts the wear resistant material secured upon the shoulder **10**. Such contact effects progressive disintegration of the mass of abrasive material whereby mud cutting of the shoulder **10** and the adjacent spindle are avoided. While there is a tendency for the substantially radially extending pads of Figs. 1 to 5 to cause the abrasive mud particles to slough off at the periphery of the shoulder **10** as the cutter rotates in the direction of the arrow **17**, this action is accentuated in the embodiment of Fig. 6 which shows an important form of the invention.

Broadly the invention comprehends a drill bit structure which includes areas of wear resistant material so located and oriented as to effectively disintegrate abrasive material which tends to effect mud cutting.

The invention claimed is:

1. In a well drill, a head, a downwardly extending leg thereon, a shaft integral with and extending inwardly from said leg, there being a shoulder at the juncture of said leg and shaft, a cutter rotatively mounted on said shaft and having a portion in confronting spaced relation with said shoulder, a radially extending recess in said shoulder, and wear resistant material secured in and filling said recess, the surface of said wear resistant material being in spaced relation with the confronting portion of said cutter so that said wear resistant material effects progressive disintegration of abrasive material that builds up on the cutter, travels wih the cutter and tends to produce mud cutting upon said shoulder.

2. In a well drill, a head, a downwardly extending leg thereon, a shaft integral with and extending inwardly from said leg, there being a shoulder at the juncture of said leg and shaft, a cutter rotatively mounted on said shaft and having a portion in confronting spaced relation with said shoulder, a radially extending recess in said shoulder, and wear resistant material secured in and filling said recess, said wear resistant material including a continuation covering and bonded to an area on the periphery of the bit leg at the outer end of the recess.

3. In a well drill, a head, a downwardly extending leg thereon, a shaft integral with and extending inwardly from said leg, there being a shoulder at the juncture of said leg and shaft, a cutter rotatively mounted on said shaft and having a portion in confronting spaced relation with said shoulder, a pair of recesses in said shoulder and extending substantially radially thereof, and wear resistant material secured in and filling said recesses, the surface of said wear resistant material being in spaced relation with the confronting portion of said cutter so that said wear resistant material effects progressive disintegration of abrasive material that builds up on the cutter, travels with the cutter and tends to produce mud cutting upon said shoulder.

4. In a well drill, a head, a downwardly extending leg thereon, a shaft integral with and extending inwardly from said leg, there being a shoulder at the juncture of said leg and shaft, a cutter rotatively mounted on said shaft and having a portion in confronting spaced relation with said shoulder, a pair of recesses in said shoulder and extending substantially radially thereof, and wear resistant material secured in, filling said recesses, and extending outwardly and bonded to an area on the periphery of the bit leg at the outer ends of the recesses.

5. In a well drill, a head, a downwardly extending leg thereon, a shaft integral with and extending inwardly from said leg, there being a shoulder at the juncture of said leg and shaft, a cutter rotatively mounted on said shaft and having a portion in confronting spaced relation with said shoulder, a recess in said shoulder extending outwardly from the shaft, forwardly in the direction of rotation of the cutter on the shaft and terminating at its outer end in the peripheral surface of the leg, and a quantity of wear resistant material bonded to the side walls and bottom of the recess so that said wear resistant material effects progressive disintegration of abrasive material that builds up on the cutter and tends to effect mud cutting of the shoulder.

6. In a well drill, a head, a downwardly extending leg thereon, a shaft integral with and extending inwardly from said leg, there being a shoulder at the juncture of said leg and shaft, a cutter rotatively mounted on said shaft and having a portion in confronting spaced relation with said shoulder, a recess in said shoulder extending outwardly from the shaft, forwardly in the direction of rotation of the cutter on the shaft and terminating at is outer end in the peripheral surface of the leg, and a quantity of wear resistant material bonded to the side walls and bottom of the recess so that said wear resistant material effects progressive disintegration of abrasive material that builds up on the cutter and tends to effect mud cutting of the shoulder, said wear resistant material extending beyond the outer end of said recess and being bonded to the periphery of the bit leg proximate the outer end of the recess.

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