

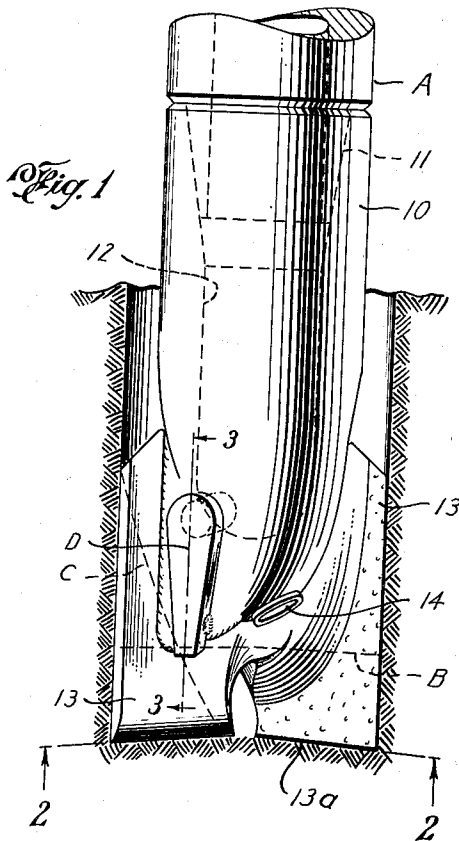
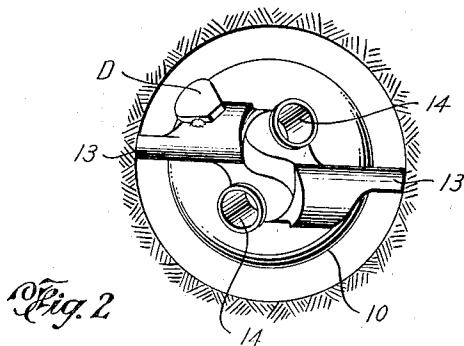
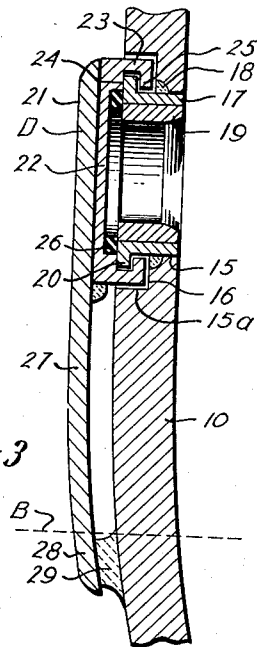
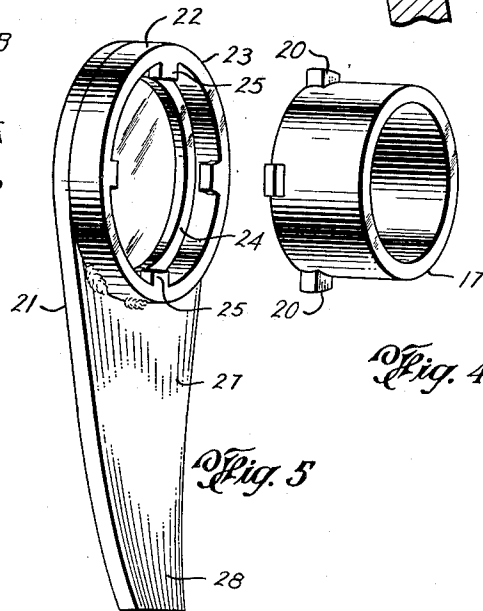
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D. L. DEL 'HOMME

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WEAR INDICATING DEVICE FOR DRILL BITS

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D. L. Del 'Homme

INVENTOR.

Vincent Martin
and

Joe E. Edwards

ATTORNEYS

UNITED STATES PATENT OFFICE

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WEAR INDICATING DEVICE FOR DRILL BITS

Daniel L. Del'Homme, Houston, Tex., assignor to
Reed Roller Bit Company, Houston, Tex., a cor-
poration of Texas

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This invention relates to new and useful improvements in wear indicating devices for drill bits.

In well drilling, maximum efficiency is obtained when the drill bit which is attached to the lower end of the drill pipe is used until it is substantially dull and is no longer capable of performing the drilling operation. It has heretofore been the practice to rely solely upon the driller and his particular knowledge based upon experience with respect to the time when the drill bit has dulled and should be removed, and obviously the human element of error has always been present with the result that in many instances the bit has been "pulled" or removed from the well prematurely or too long after the drilling bit has lost its efficiency.

It is one object of this invention to provide an improved simplified indicating device which will automatically signal to the surface when the drill bit is worn to a predetermined point, whereby accurate information as to the condition of the drill bit is made known to the driller or operator.

An important object is to provide an improved wear indicating device for drill bits wherein an opening is formed in the bit body in communication with the drilling fluid which is normally circulated through the bit, together with means closing said opening and arranged to automatically open the same when the bit wears to a predetermined point.

Another object is to provide a wear indicating device of the character described wherein a mechanical closure element is secured to the outer surface of a bit body and normally closes a discharge outlet, with said closure element being adapted to be worn by the abrading action of the formation thereagainst to release said element from its position closing said discharge whereby when the bit wears to a predetermined point the discharge outlet is automatically opened to effect an abrupt change in the pressure of the circulating fluid.

A further object is to provide a device of the character described wherein a discharge outlet is formed within a bit body and is adapted to be closed by a closure element which is welded or otherwise secured to the bit body in a position closing the outlet; the closure being detached by the abrading action of the formation thereagainst when the bit has worn to a predetermined point whereby the outlet is automatically opened to cause an abrupt pressure variation in the circulating drilling fluid to indicate that the bit has become worn.

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Other and further objects of the invention will appear from the description of the invention.

In the accompanying drawings, which form a part of the instant specification, which are to be read in conjunction therewith, and wherein like reference numerals are used to indicate like parts in the various views:

Figure 1 is an elevation of a drill bit having the improved indicating device constructed in accordance with the invention mounted thereon.

Figure 2 is a bottom view of the drill bit.

Figure 3 is a transverse vertical sectional view of the indicating device taken on the line 3—3 of Figure 1.

Figure 4 is an isometric view of the bushing which is mounted within the discharge outlet, and

Figure 5 is an isometric view of the closure element for closing the discharge outlet.

In the drawings, the numeral 10 designates a bit body which has the usual threaded box 11 at its upper end whereby the bit may be connected to the lower end of the drill pipe or stem A. The usual fluid cavity or chamber 12 is formed within the bit body and the usual drilling fluid circulated downwardly through the drill pipe is directed into the cavity or chamber. Cutting blades 13 are welded or otherwise secured to the lower portion of said body and drilling fluid circulating passages 14 extend from the cavity or chamber 12 and discharge from the lower portion of the body adjacent the cutting blades. As illustrated, the blades 13 are disposed transversely of the bit body and have their lower cutting edges 13a located in a plane below the lower end of the body. When the cutting blades have been worn through the drilling operation to the point indicated by the dotted line B or when their vertical edges have been worn to the position indicated by the dotted line C, the bit is dulled and it is desirable that said bit be replaced.

For indicating that the bit blades 13 are worn to either the points B or C, the improved indicating device D is adapted to be mounted on the bit body 10. The indicating device comprises a relatively large opening or outlet 15 which is formed in the wall of the bit body and which establishes communication between the internal chamber or cavity 12 and the area outside of the bit body. The outer portion of the outlet or discharge opening 15 is enlarged in diameter as indicated at 15a whereby an annular counter-sunk recess 16 is formed in the outer portion

of the body surrounding the opening. A bushing 17 is mounted within the opening and is welded as indicated at 18 within said opening. The bore of the bushing 17 may have a slush wear ring 19 mounted therein to prevent excessive wear of the bore of the bushing. The bushing 17 has its outer end projecting into the annular recess 16 and this outer portion is formed with a plurality of radially extending projections or lugs 20 which are spaced around the periphery of the bushing. The ends of the bushing are preferably substantially flush with the inner and outer walls of the body 10.

For closing the opening or outlet through the bushing a closure element 21 is provided and this closure element comprises a circular plate or disc 22 having an inwardly directed annular flange 23. An internal annular shoulder 24 is formed at the intersection of the flange 23 and the main body of the plate or disc 22, and this shoulder is arranged to abut the outer end of the bushing when the closure is applied to said bushing, as will be explained. For interlocking the closure disc or plate 22 on the bushing, the flange 23 is provided with a plurality of inwardly directed lugs 25 which are spaced around the flange, as is clearly shown in Figure 5. The lugs 25 are equal in number to the projections 20 on the bushings 17 and in connecting the closure plate 22 to the bushing the flange 23 is introduced into the annular recess 18 surrounding the outer end of the flange with the lugs 25 misaligned with the projections 20. Inward movement of the disc or plate 22 is limited by the engagement of the internal shoulder 24 with the end of the bushing and subsequently a rotation is imparted to the disc and its flange to cause the lugs 25 to engage the projections 20, as shown in Figure 3. In this position, outward displacement of the closure disc from the bushing is prevented. For sealing between the disc and the outer end of the bushing an annular sealing ring 26 is provided and is confined between the inner surface of the disc or plate 22 and the outer end of the bushing, being located adjacent the shoulder 24.

The closure disc or plate 22 has an elongate fastening element 27 welded or otherwise secured thereto and the fastening element has a depending reduced leg portion 28 which generally follows the curvature of the bit body and is adapted to be welded as indicated at 29 to the outer surface of said bit body. The point of welding of the fastening element 27 to the bit body is preferably in alignment with the dotted lines B and C which indicate the point to which the bit will wear at the time it requires replacement. Thus, until such time as the bit has worn to the point of the weld 29, the fastening element 27 will maintain the closure disc 22 in a position closing the discharge opening through the bushing 17.

The operation of the device is believed obvious and in using the same the closure disc 22 is connected by means of its lugs 25 and the projections 20 of the bushing to said bushing in order to close the opening therethrough. The fastening element 27 has its lower end welded at 29 to the bit body with the closure disc 22 closing the opening through the bushing. Thus, the element 27 functions to lock the closure in a position closing the discharge opening.

Drilling may then proceed in a normal manner and since the fastening element 27 is contiguous to the rear surface of one of the bit blades,

said element will not interfere with the normal drilling function of the bit. When the bit wears to a predetermined point as determined by the location of the lower portion 28 of the fastening element and the weld 29, the abrasive action of the formation against the leg portion 28 and against the weld 29 will cause a wearing away of these parts with the result that the fastening element 27 is actually disconnected from the bit body. When this occurs further rotation of the bit will result in a movement of the fastening element sufficient to rotate the fastening lugs 25 of the closure out of alignment with the projections 20 of the bushing. Such misalignment of the lugs and projections will permit the closure disc 22 to be forced outwardly by the drilling fluid which is being circulated downwardly through the drill pipe or stem. It might be noted that the closure disc is constantly exposed to the pressure of this drilling fluid which, as is well known, is pumped downwardly through the drill stem and bit body during normal drilling. The outward displacement of the closure disc 22 from the bushing 17 results in an abrupt or sudden opening of the bushing and allows a sudden escape of the drilling fluid through said opening. Because the area of the opening through the bushing is relatively large, the sudden discharge of drilling fluid through said opening results in an abrupt drop in the pressure of the fluid, and this pressure drop may be readily observed at the surface. Thus, it is apparent that the abrupt pressure change occurring at the surface indicates when the fluid is discharged through the opening and this is indicative that the drill bit has worn sufficiently to require replacement.

It is obvious that the fastening element 27 which is secured to the closure disc 22 and which maintains the disc in a position closing the opening through the bushing may vary in length or shape and may be disposed in any desired plane with respect to the bit blades whereby the device may be arranged to indicate when the bit blades have worn to any predetermined point. The device is extremely simple in construction and comprises only the bushing 17 and the closure element. The disc provides a mechanical closure for the outlet through the bushing which is maintained in fixed position until such time as a predetermined wear of the bit has occurred.

From the foregoing it will be seen that this invention is one well adapted to attain all of the ends and objects hereinabove set forth, together with other advantages which are obvious and which are inherent to the structure.

It will be understood that certain features and subcombinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of the claims.

As many possible embodiments may be made of the invention without departing from the scope thereof, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

Having described the invention, I claim:

1. In combination, a drill bit having cutting elements and also having an opening in its wall, a closure member for said opening normally preventing flow of pressure drilling fluid from within the body through the opening, coacting means on the closure member and the bit body for con-

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necting the member in a position closing the opening, said coacting means being disengageable upon rotation of the member relative to the body and a fastening element secured to the closure member and to the bit body for holding the closure member against rotation, said fastening element being adapted to be disconnected from the bit body by the abrasive action of the formation when the cutting elements of the bit have been worn to a predetermined point whereby the closure may be rotated to disengage the coacting means and thereby uncover the opening to allow escape of the pressure drilling fluid through said opening.

2. In combination, a drill bit having cutting elements and having an opening in its wall, an annular bushing within said opening, a closure member detachably connected with the bushing for closing said opening to prevent flow of pressure drilling fluid from within the bit body through the bushing, and a fastening element having one portion secured to the closure member and having another portion adapted to be secured to the bit body for holding the closure member in its attached position on the bushing with the closure closing said bushing, said fastening element being adapted to be disconnected from the bit body by the abrasive action of the formation when the cutting elements of the bit have been worn to a predetermined point whereby the closure member may be disconnected from the bushing to uncover the opening and allow escape of the pressure drilling fluid through said opening.

3. The combination set forth in claim 2 wherein the bushing and the closure member are provided with coacting lugs and projections for detachably fastening the bushing and closure member to each other.

4. The combination set forth in claim 2 to-

gether with a wear ring mounted within the bore of the bushing and an annular packing ring for sealing the joint between the closure member and the bushing when the closure member is in position on said bushing.

5. The combination as set forth in claim 2 wherein the opening having the bushing therein is located at some distance above the lower portion of the bit and wherein that portion of the fastening element which is secured to the closure comprises a downwardly extending leg portion which is welded to the bit body, the weld being disposed in a plane with respect to the cutting elements of the bit which is at the point where said cutting elements are unduly worn.

6. The combination as set forth in claim 2, wherein the bushing and closure member are formed with radially spaced coacting lugs and projections which are adapted to be interlocked or disengaged by a rotation of the closure member with respect to the bushing, and also wherein the fastening element when secured to the bit body prevents rotation of the closure member to maintain the closure member attached to the bushing, disconnection of said fastening element from the bit body permitting rotation of the closure member to effect disengagement of the coacting lugs and projections.

DANIEL L. DEL'HOME.

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