DIAMOND BIT PROTECTOR
Ted C. Mathews, Fairbanks, Territory of Alaska
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My invention relates to diamond bit protectors. In diamond drilling operations, a bit is used which is tipped with a matrix in which is embedded diamonds or other extremely hard material such as silicon carbide.

Under ideal conditions of operation, in which the bit is in firm contact with a clean, solid bottom surface of a bore hole, and adequate circulation is maintained, drilling may proceed rapidly with a minimum of damage to the protruding cutting facets of the diamonds. However, during the course of lowering the bit into the bore hole and particularly during the initial operation of the bit at the bottom of the hole, the diamonds may be severely damaged. In lowering the bit, the side surfaces of the diamond-embedded matrix strike the walls of the bore hole and the exposed facets of the diamonds are broken. After the bit is on the bottom, and in spite of circulation, there may remain loose "junk" or debris. This does not readily grind up, but instead rolls and strikes the cutting facets breaking off these portions and thus impairing, if not completely ruining, the bit, before the drilling has actually started. Accordingly then, included in the objects of my invention are:

First, to provide a means, as well as a method, of protecting a diamond bit during the course of lowering the bit and particularly during the initial drilling operation after bottoming the bit, so that damage to the bit is materially reduced.

Second, to provide a diamond bit protector formed of thermo-plastic material or of a malleable material softer than the matrix comprising the tip of the bit, as well as softer than the formation encountered by the bit, so that upon the application of pressure exerted by the bit against the bottom of the bore hole, the protector is caused to deform or otherwise flow so as to embed or consolidate any loose material and form therewith a solid matrix, the protector being so attached to the bit that upon initial rotation under pressure, the protector strips from the bit so that it may be ground up and washed from the bore hole by circulation.

With the above and other objects in view as may appear hereinafter, reference is directed to the accompanying drawings in which:

Figure 1 is a side view of a typical diamond bit with my protector shown thereon.

Figure 2 is a similar view but with the protector shown spaced from the bit.

Figure 3 is a perspective view of the protector.

Figure 4 is a transverse sectional view through 4-4 of Figure 1.

Figure 5 is an enlarged fragmentary longitudinal sectional view taken through 5-5 of Figure 4.

Figure 6 is a sectional view similar to Figure 5 showing a modified form of my protector in which the side walls of the bit matrix are covered.

Figure 7 is a partial sectional view, partial elevational view of a large diameter diamond drill such as used in oil well drilling, showing another form of my protector.

Figure 8 is a fragmentary sectional view of another type of bit showing my protector thereon.

Figure 9 is a fragmentary end view of the bit and protector shown in Figure 8.

It is contemplated that my invention may be used on otherwise conventional diamond bits. These may vary in size and in construction. For purposes of illustration, a smaller size simple diamond bit 4 is shown.

The bit includes a tubular member body 2 screw-threaded at its upper end for attachment for a drilling string not shown. Molded or cast on the lower end of the body 2 or formed thereon by a sintering or welded technique is an annular matrix 3. The matrix comprises a bonding material and diamond or silicon carbide fragments, the exposed facets of which provide cutting attrition edges. The cutting tip of the bit is usually interrupted by grooves and slots to facilitate circulation of fluid from the inside drill string and bit around the under side of the bit and upwardly through the bore hole.

My protector is in the form of a ring 5 of substantial thickness having an internal diameter and an external diameter corresponding to that of the bit tip. Inasmuch as the bit tip is usually flat, the upper surface of the protector is likewise flat. In any case, the upper surface of the protector is shaped so as to conform to the cutting surface of the bit. It is preferred that the protector bridge the circulation grooves or channels 4.

A number of thermo-plastic materials are suitable for use. For example, methyl acrylate (Lucite) is satisfactory. Other materials are the amino acid related plastics, such as nylon, polyacrylonitrile, acetate and acetate butyrate may be used.

In selecting the material the temperature conditions existing at the bottom of the bore hole and the pressures employed must be taken into account.

The protector is pressed on to the end of the bit so as to embed the protruding portions of the diamonds, in addition, a cement indicated by 6 is employed. Actually the cement in most cases is a solvent for the plastic material comprising the protector. Alternately the protector may be cast or molded on the bit.

Still further, the protector may be provided with a thin marginal lip 7 covering the sides of
the bit matrix as shown in Figure 6. It should be noted however, that this lip must be relatively thin in order not to interfere with the lowering of the bit into the bore hole.

My protector is employed as follows:

1. The bit with the protector in place is lowered into the well bore, the driller may, before or after a preliminary circulation, set the full weight on bottom to cause plastic flow of the protector over and around any "junk" or loose debris which may be present in the bottom of the bore hole. The drill string is then picked up until a normal drilling weight is applied. The bit is then rotated slowly at first preferably in conjunction with a reduced circulation pressure. As soon as it is feasible to assume that the protector has been completely ground up, drilling may continue in a conventional manner.

The initial pressure applied to the protector so thoroughly embeds the protector in the debris at the bottom of the bore hole as to form a solid matrix firmly holding the plastic so that on rotation of the bit or application of fluid pressure through the bit or a combination of rotation and fluid pressure, the protector strips free of the bit intact.

Fluid pressure is utilized as an aid in stripping the protector from the bit by first applying excess weight to the bit, when on bottom, then, just before releasing the weight to that required for drilling, to apply excess fluid pressure. As the weight is reduced, the excess fluid pressure acts to lift the bit off bottom, creating a vertical vibration which loosens the protector. The fluid pressure is then returned to normal and drilling is resumed.

Reference is now directed to Figure 7. Here illustrated is a larger type of bit as used in oil well drilling. The bit 11 is adapted for screw-thread connection to a drilling string 12. The lower end of the bit is reduced internally to form a cutting head 13 and imbedded with diamond particles or similar cutting material 14. Water passages 15 extend axially through the cutting head and intersects its lower surface.

In conjunction with this bit construction, my protector is shown as a disk 16 covering the end of the bit and including a thin covering 17 on the external surface of the cutting head. If desired, the disk 16 may have one or more ports 18 of sufficiently small area to establish a pressure differential across the disk on circulation of fluid downwardly through the drilling string so as to be forced off, when desired.

Reference is directed to Figures 8 and 9. Here the bit is similar to the construction shown in Figure 7 with the addition of cross slots 19 intersecting the water passages 15. The protector disk 20 is shown which is similar to the disk 16 except that the central opening 21 coincides with the internal diameter of the drilling head. It is preferred that the protector be transparent so that the cutting material exposed at the surface of the bit may be inspected to determine its character and condition.

Having fully described my invention, it is to be understood that I do not wish to be limited to the details herein set forth, but my invention is of the full scope of the appended claims.

I claim:

1. The combination with a diamond bit of: a protector formed of malleable material having the tendency to flow under pressure and the tendency to retain its altered shape on relief of pressure, said material also being susceptible to fracture when subjected to shock loads; said protector initially covering the end of said bit during its descent into a well bore; said protector adapted to be compressed between the bit and the bottom of the well bore, thereby to flow around and embed debris at the bottom of the well bore; said protector adapted on rotation of said bit to strip therefrom and to be ground up with the debris to form cuttings dischargeable from the well bore.

2. A protector for use on diamond bits, involving: a disk of malleable plastic material capable of plastic flow under compression but friable under shock loads, said material initially secured to the end face of said bit and of such thickness as to embed debris at the bottom of the well bore when subjected to compression between the bit and the bottom of the well bore, thereby to form with the debris a grindable matrix; said disk adapted on rotation of said bit to strip therefrom.

3. A protector for use on diamond bits, involving: a disk of material softer than said bit and softer than the material encountered by said bit; said disk being capable of plastic flow under compression but friable under shock loads; said disk initially secured to and covering the end of the bit and of such thickness that on being compressed between the bit and the bottom of the well, loose debris present in the bottom of the well is embedded and held by the disk; said disk adapted on rotation of said bit to strip therefrom and form with the debris a heterogeneous grindable mass.

4. A protector as set forth in claim 1, wherein: said protector is transparent to expose to view the surface of said bit.

5. A protector as set forth in claim 3, wherein: said disk is initially transparent to expose to view the surface of said bit.

6. A protector for annular diamond core cutting bits, involving: a disk of material softer than a core cutting bit and softer than the material encountered by said bit; said disk being capable of plastic flow under pressure, said disk being initially secured to and covering the end of said bit and of such thickness as to embed loose debris present at the bottom of a bore hole to form with such debris a grindable matrix; and an annular covering of said material initially overlying the external cutting surface of said bit.

7. A protector for annular diamond core cutting bits, involving: a disk of material softer than a core cutting bit and softer than the material encountered by said bit; said disk being capable of plastic flow under pressure, said disk being initially secured to and covering the end of said bit and of such thickness as to embed loose debris present at the bottom of a bore hole to form with such debris a grindable matrix; and an annular covering of said material initially overlying the external cutting surface of said bit.

8. A protector as set forth in claim 6 wherein said disk is initially transparent to expose to view the surface of said bit.

TED C. MATHEWS.

References Cited in the file of this patent.

UNITED STATES PATENTS

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<tr>
<th>Number</th>
<th>Name</th>
<th>Date</th>
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<tbody>
<tr>
<td>2,107,788</td>
<td>Hall</td>
<td>Feb. 5, 1938</td>
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