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ROCK DRILL BIT

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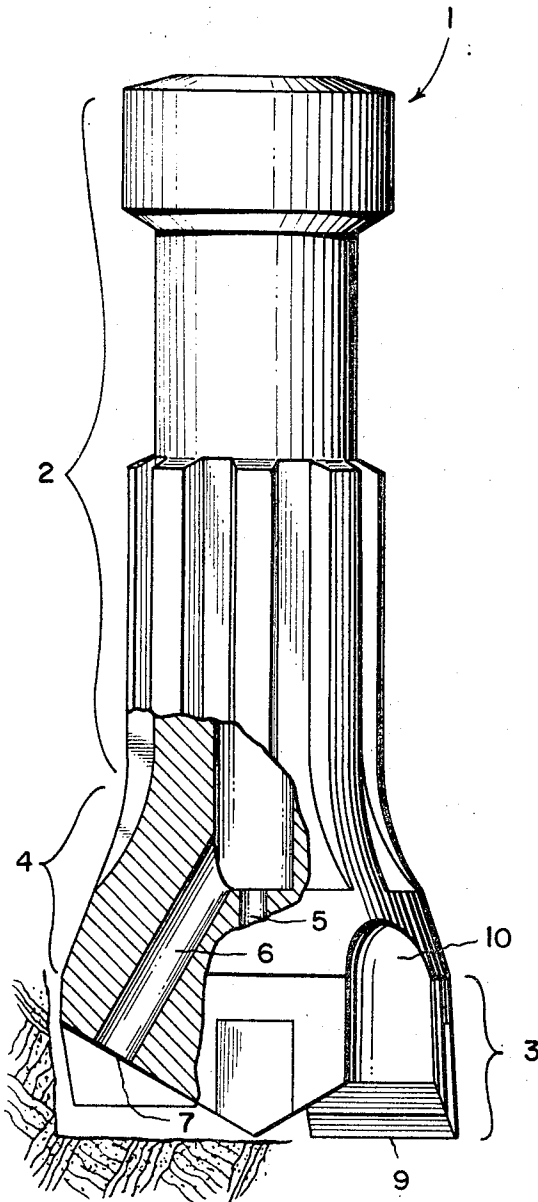


FIG. 1

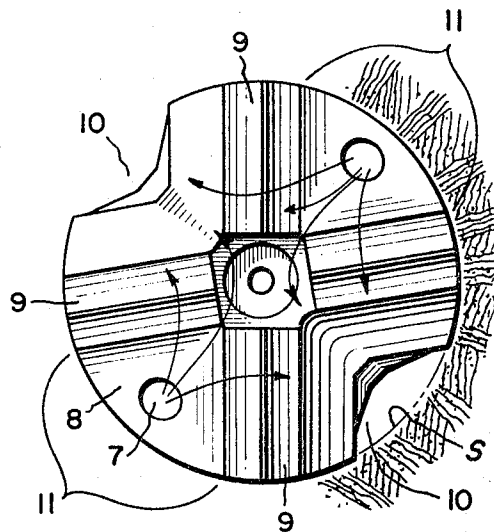


FIG. 2

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ROCK DRILL BIT

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10 Claims

ABSTRACT OF THE DISCLOSURE

A rock drill bit having a central fluid passageway and additional divergent fluid passageways opening on the face. The additional passageways are formed in face segments which dam the drilled hole thereat, forcing discharge of cuttings and fluid across adjacent cutting surfaces and into axial channels in the bit periphery.

Disclosure

This invention relates to rock drill bits, and in particular to a rock drill bit having a plurality of inlet passageways for fluid, and means for accommodating the discharge of cuttings and the fluid therefrom.

Removal of cuttings from the face of a rock drill bit is important if the bit is to continue to drill. Removal of cuttings is usually accomplished by introduction of fluid into or near the bottom of the drilled hole. Originally, air was introduced through a small axial hole in the bit. This arrangement caused a radial flow of air over the drilled face directing the cuttings satisfactorily. Objections to this single hole are concerned with size. It was not possible to provide a hole sufficiently large to permit adequate cleaning fluid to pass without exceeding other cutting face design requirements. Also, large center holes are easily plugged by clay and soft cuttings forced into the openings thereof by feed pressure. As a consequence, additional face or side holes in the bit have been used to raise the quantity of the fluid to a value that will flush the cuttings from the hole by entrainment, and to provide alternate paths for cleaning fluid when the center hole opening is plugged. The positioning of such additional holes is important if they are to function effectively. This is evidenced in the various combinations used over the years.

A drill bit design of four auxiliary holes, in addition to the axial hole in the face, is the present accepted standard. This design is a compromise in that the one axial hole supplies air to four auxiliary holes which open in the spaces between each of the four wings or cutting surfaces of the bit and, by turbulent action, stir up cuttings and eject them. However, the positioning of the additional holes generally results in a tendency to hold the more dense cuttings on the face of the drill bit and does not produce a cross-flow over the bit cutting edges.

Attempts have been made, in prior art, to overcome this deficiency. One such attempt is a drill bit design which creates a pressure differential across adjacent segments of the bit face by changing direction of the emerging air from some of the holes in such a manner as to create a reduced pressure segment or zone. The means used to change direction of the air within the bit frequently establishes internal pressure conditions that result in recirculation of cuttings about the face of the bit, and through the bit, which results in bit destruction under some rock conditions.

It is an object of this invention to provide a drill bit which accommodates an adequate supply of fluid to entrain and flush the cuttings. Another object of this invention is to provide a drill bit of such novel configuration

as to establish a positive fluid flow of adequate magnitude across the cutting edges thereof. Another object of this invention is to provide a drill bit having means to prevent the recirculation of cuttings about the cutting face and through the bit. A feature of this invention comprises the disposition of fluid passageway openings in cutting face segments which segments prohibit discharge thereat and force the cuttings and fluid to be directed across adjacent cutting surfaces, and across the center of the face for subsequent discharge.

Other objects and features of this invention will become more apparent by reference to the following description taken in conjunction with the accompanying figures, in which:

FIGURE 1 is a side elevational view, partially broken away, of a drill bit according to the invention;

FIGURE 2 is an end view of the novel drill bit showing the cutting face.

An embodiment of a drill bit according to the invention is shown in FIGURE 1 generally as 1. The bit comprises a shank portion 2, an enlarged cutting portion 3, and a conical intermediate portion 4 therebetween. A central axial fluid passageway 5 is shown formed through the three portions with branching, diverging auxiliary passageways 6 in communication with passageway 5 and, as seen in FIGURE 2, terminating in openings 7 in the cutting face 8. Radially disposed cutting surfaces 9 are arrayed on the cutting face 8, and openings 7 are formed between opposite pairs of cutting surfaces 9. Exit channels 10 for fluid and entrained cuttings, seen in FIGURES 1 and 2, are relieved axial areas of the drill bit. Cutting face segments 11, best viewed in FIGURE 2, comprise dam means to prohibit the exhausting of the fluid and entrained cuttings thereat. The dam means or segments 11 about the inner surface S of the drilled hole proscribing any exhaust access. Accordingly, the fluid must pass over the adjacent cutting surfaces 9, in the manner shown by the arrows in FIGURE 2, to exhaust along channels 10. In this manner positive flows of fluid, of adequate magnitude, are forced across the cutting surfaces 9 insuring the more efficient movement and exhausting of the cuttings and avoiding the recirculation or retention of the cuttings about the cutting face 8.

The embodiment shown is that of the X-type or cross-type drill bit, but it is to be clearly understood that my invention has equal application to drill bits of other configurations. To wit, the drill bit can have any greater and even-numbered plurality of radially disposed cutting surfaces, four, six, eight, etc., with auxiliary fluid openings in dam means occurring between alternate pairs of the cutting surfaces. Further embodiments of my invention will occur to those skilled in the art. Accordingly, the embodiment shown, and those suggested here above, are given only by way of example and not as a limitation to the scope of my invention as set forth in the objects there and in the accompanying claims.

I claim:

1. A drill bit, used with a percussive drilling machine for boring holes in rock and like material, comprising: means disposed on one end thereof for coupling to the machine; a plurality of cutting means disposed on the opposite end thereof for cutting material; first passage means for conveyance of fluid therethrough along the axis thereof; and other passage means formed therein for conveyance of fluid therethrough along paths divergent from said first passage means; means disposed on the periphery of said bit cooperative with walls of the bore hole to provide accommodation for the discharge of cuttings and said fluid from said opposite end; and means disposed adjacent only one side of each cutting means of said plurality cooperative with said walls to dam the

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bore hole and prohibit discharge of said cuttings and fluid thereat and to cause said cuttings and fluid to discharge via said discharge accommodation means.

2. A drill bit, according to claim 1, wherein: said other passage means are in communication with said first passage means.

3. A drill bit, according to claim 1, wherein: said discharge accommodation means comprise axially relieved areas formed in the periphery of the drill bit.

4. A drill bit, according to claim 1, wherein: said cutting means include cutting surfaces of a given number radially disposed on said opposite end; and said other passage means are less in number than said given number.

5. A drill bit, according to claim 4, wherein: said other passage means terminate in openings on said opposite end between pairs of said cutting surfaces.

6. A drill bit, according to claim 4, wherein: said dam means are disposed between pairs of said cutting surfaces; and said other passage means terminate in openings in said dam means.

7. A drill bit, according to claim 4, wherein: said other passage means number half said given number.

8. A drill bit, according to claim 7, wherein: said discharge accommodation means are the same in number as said other passage means.

9. A drill bit, comprising: a shank portion, a cutting portion, an intermediate portion therebetween, said shank portion defining a first section, and said cutting and intermediate portions defining a second section, wherein said cutting portion terminates in a face having cutting sur-

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faces radially disposed thereon, said drill bit having a first passageway formed through the center thereof, said second section having a plurality of equally spaced and axially disposed relieved areas formed in the periphery thereof, and said second section further having a plurality of other passageways formed therethrough each of which is in communication with said first passageway at one end thereof and diverges therefrom to terminate in an opening on said face, said openings being equally spaced therebetween, wherein said face has relieved segments and full segments, said full segments being disposed adjacent only one side of each of said cutting surfaces.

10. A drill bit, according to claim 9, wherein said plurality of other passageways are the same in number as said full segments, and one of each of said other passageways terminates in one of said openings in one of said full segments.

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