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2,818,233

DRILL BIT

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Fig. 1.

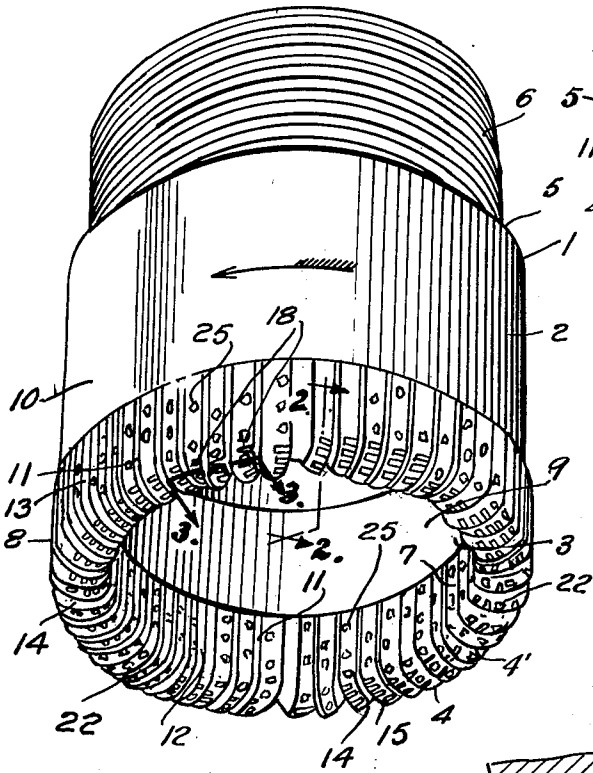


Fig. 4.

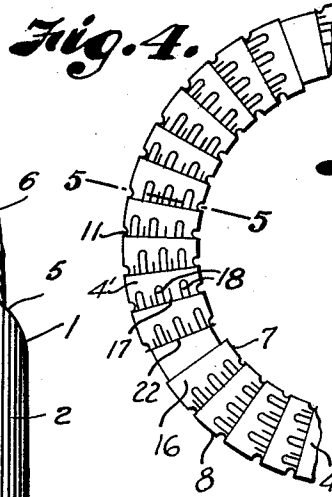


Fig. 5.

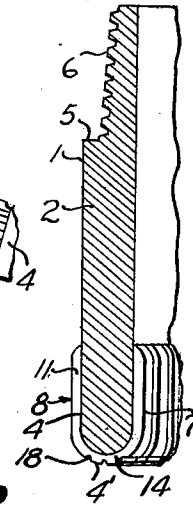


Fig. 2.

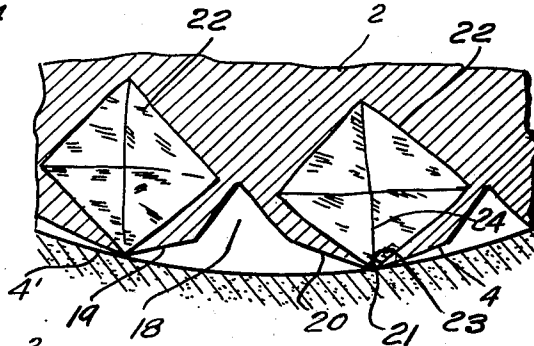
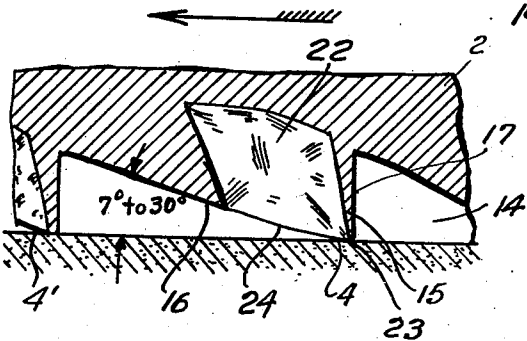


Fig. 3.



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DRILL BIT

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4 Claims. (Cl. 255—72)

This invention relates to a drill bit for drilling earth formations and particularly a drill bit wherein the cutting elements are diamonds or the equivalent embedded into teeth of the bit. Such bits are particularly desirable for drilling hard rock formations, however, when drilling certain types of hard rock, considerable vibration is set-up in the drilling string. This vibration is destructive of the bit and particularly the cutting elements thereof.

It is therefore a principal object of the present invention to eliminate destructive vibration and provide a more efficient and smoother operation of such bits when drilling hard rocks by setting the diamonds to produce drag cuts.

Other objects of the invention are to provide a bit with a drag tooth contour to give the desired orientation of the cutting elements for producing drag cuts in the formation, and to provide a diamond bit of this character specially adapted for core drilling.

In accomplishing these and other objects of the invention as hereinafter pointed out, I have provided improved structure the preferred form of which is illustrated in the accompanying drawing wherein:

Fig. 1 is a perspective view of a core bit embodying the features of the present invention.

Fig. 2 is an enlarged fragmentary radial section through one tooth of the bit, the section being taken on the line 2—2 of Fig. 1.

Fig. 3 is an enlarged fragmentary section in the circumferential direction of the cutting face of the bit, the section being taken on the line 3—3 of Fig. 1.

Fig. 4 is a bottom plan view of one side of the drill bit.

Fig. 5 is a vertical section through the wall of the bit on the line 5—5 of Fig. 4.

Referring more in detail to the drawings:

1 designates a drill bit of the core producing type and which embodies the features of the present invention, although the invention is adaptable to diamond bits of other types where a drag cut is desired.

The bit illustrated includes a substantially cylindrical sleeve-like body 2 formed of suitable material and having a wall thickness to withstand drilling strains. The body 2 is shaped to provide an axial bore 3 extending inwardly from the drilling end 4 of the bit to connect with a core barrel (not shown) and through which the core is passed as will be well understood by those skilled in the drilling art. The upper end of the body 2 has a reduced exterior to form a shoulder 5 and provide a threaded portion 6 to connect the bit with the core barrel, which in turn is connected with the lower end of a string of drill pipe (not shown). The drilling end 4 has inner and outer annular faces 7 and 8 and an end drilling face 4'. The annular faces 7 and 8 project from the corresponding inner and outer faces 9 and 10 of the body portion 2 to accommodate vertically extending grooves 11 that are spaced apart circumferentially of the bit to provide water courses 12 for the inner face 7 of the bit and 13 for the outer face 8 as best shown in Fig. 1, the inner and outer grooves 11 being connected across the cutting face 4' by radial grooves 14. The grooves 14 are arranged radially

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in a circular series and shaped to provide a circular series of radially extending teeth 15, each having an inclined forward face 16 sloping upwardly in the rotational direction of the bit as indicated in Figs. 3 and 4 to join with a substantially vertical rear face 17 on the side of the next adjacent tooth as best shown in Fig. 3. The teeth thus extend transversely of the end portion of the cutting face 4' and are of substantially triangular cross section in the circumferential direction of the bit.

The cutting face 4' is rounded transversely between the inner and outer faces 7 and 8 to provide a circular cut having a rounded bottom. The teeth 15 forming the cutting face 4' are provided with spaced apart grooves 18 that extend in a generally circular direction and connect one radial groove 14 with the adjacent groove 14. The grooves 18 cooperate in serving as circumferential water courses interconnecting the grooves 14 and are of substantial V-shaped cross section. The sides of the grooves 18 terminate in bevel faces 19 and 20 that converge at 21 as shown in Fig. 2. The grooves 18 are spaced apart a sufficient distance to accommodate cutting elements 22 that are bedded in a row into the material of each tooth, for example in the manner disclosed in Patent 2,371,488 for "Core Bit," issued March 13, 1945. There need not be a groove between each of the adjacent cutting elements in the respective teeth.

Another method of securing the diamonds is to build up the teeth about the diamonds by use of welding metal.

The cutting elements 22 are preferably diamonds, each having an elongated body provided with a cutting point or corner 23 at one end and having a cutting edge 24 extending from the cutting point along the side of the body in the direction of the opposite end of the diamond. The diamonds are oriented in the material of the teeth 15 with the cutting points exposed at the radial edges of the teeth and at the points 21 where the bevel faces 19 and 21 converge and the elongated bodies of the diamonds are bedded within said teeth with the cutting edges inclined upwardly and forwardly in corresponding relation with the upwardly and forwardly sloping faces 16 of the teeth. It is thus apparent that the cutting portions of each diamond are set to produce a circumferential drag cut on the face of the formation as distinguished from the gouge cut of the cutting elements disclosed in the above numbered patent. With this arrangement, the bit is effective in cutting hard rock formations without vibration or chatter of the bit. It is also obvious that the upward slope of the faces 16 in the rotational direction of the bit gives ample clearance for passage of the drilling fluid as it passes from the inner vertical water courses to the outer water courses of the bit to flush the cuttings from the path of the cutting elements.

The projecting faces 7 and 8 which extend circumferentially of the inner and outer sides of the bit may be provided with cutting elements 25 to maintain the gauge of the bore hole and the size of the core. The cutting elements 25 may also be diamonds bedded into the material of the bit in any suitable manner.

When in operation the bit is rotated by the drill pipe in the direction of the arrow (Fig. 1) so that the diamonds produce drag cuts in the formation. Simultaneously with rotation of the bit a drilling fluid is circulated downwardly through the drill pipe, and around the core through the inner water courses 12 to wash the cuttings from the grooves 14 and up the outer water courses to the top of the bore hole. The drilling fluid also keeps the cutting surfaces of the bit in cool condition and prevents heating of the diamonds.

I claim:

1. A drill bit including a cylindrical body member having a drilling end provided with a circular cutting face extending about the axis of said body member for sup-

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port on the bottom of the hole to be drilled by the bit when the bit is in use and rotated on said axis, said cutting face having a series of teeth extending radially of said axis and each having an upwardly inclined forward face and a substantially vertical rear face relatively to the direction that the bit is rotated, said faces converging to form radial edges, and cutting elements each having an elongated body provided with a cutting point at one end and a cutting edge extending from the cutting point along a side of said body in the direction of the opposite end, said elongated bodies being bedded within said teeth with the cutting points exposed at said radial edges and the cutting edges inclined forwardly and upwardly in corresponding relation with the inclined forward faces of the teeth to provide drag cuts by said cutting elements when the bit is in use and turning about said axis.

2. A drill bit including a cylindrical body member having a drilling end provided with a circular cutting face extending about the axis of said body member for support on the bottom of the hole to be drilled by the bit when the bit is in use and rotated on said axis, said cutting face having a series of teeth extending radially of said axis and each having an upwardly inclined forward face and a substantially vertical rear face relatively to the direction that the bit is rotated, said faces converging to form radial edges, cutting elements each having an elongated body provided with a cutting point at one end and a cutting edge extending from the cutting point along a side of said body in the direction of the opposite end, said elongated bodies being bedded within said teeth with the cutting points exposed at said radial edges and the cutting edges inclined forwardly and upwardly in corresponding relation with the inclined forward faces of the teeth to provide drag cuts by said cutting elements when the bit is in use and turning about said axis, and said teeth having grooves extending in a generally circular direction with respect to the axis of the body member and located between the cutting elements.

3. A drill bit including a cylindrical body member having a drilling end provided with a circular cutting face extending about the axis of said body member for support on the bottom of the hole to be drilled by the bit when the bit is in use and rotated on said axis, said cutting face having a series of teeth extending radially of said

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axis and each having forward faces inclined upwardly at an angle between 7 and 30 degrees and having a substantially vertical rear face relatively to the direction that the bit is rotated, said faces converging to form radial edges, and cutting elements each having an elongated body provided with a cutting point at one end and a cutting edge extending from the cutting point along a side of said body in the direction of the opposite end, said elongated bodies being bedded within said teeth with the cutting points exposed at said radial edges and the cutting edges inclined forwardly and upwardly in corresponding relation with the inclined forward faces of the teeth to provide drag cuts by said cutting elements when the bit is in use and turning about said axis.

4. A core bit including a body member having a cylindrical wall encircling a core opening in the axis of said body member and having an end providing a circular cutting face for support on the bottom of a hole to be drilled when the bit is in use and rotated on said axis, said circular cutting face curving into inner and outer annular faces of the cylindrical wall and having a series of cutting teeth each having an inclined forward face and a substantially vertical rear face relatively to the direction that the bit is rotated, said faces converging to form edges for said teeth, cutting elements, each having an elongated body provided with a cutting point at one end and a cutting edge extending from the cutting point along a side of said elongated body in the direction of the opposite end, said elongated bodies being bedded within said teeth with the cutting points exposed at said edges of the teeth and the cutting edges inclined forwardly in corresponding relation with the inclined forward faces of the teeth to provide drag cuts by said cutting elements when the bit is in use and turning about said axis, and cutting elements bedded in said inner and outer annular face portions.

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