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J. A. HJÄLSTEN

3,062,306

DRILL BIT

Filed March 17, 1960

2 Sheets-Sheet 2

Fig. 7.

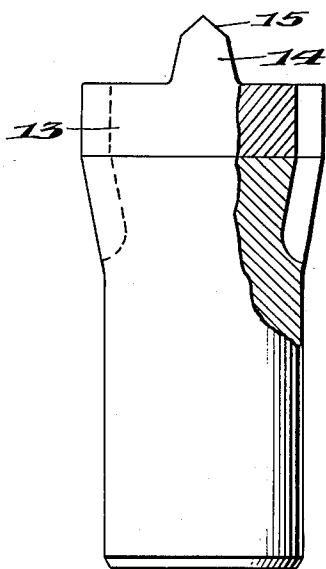


Fig. 8.

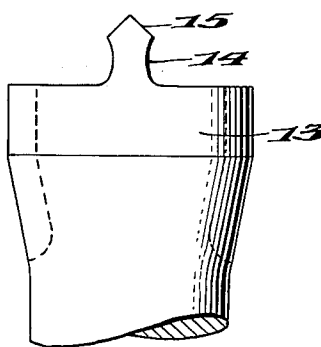


Fig. 9.

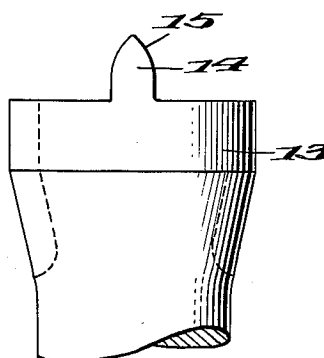


Fig. 12.

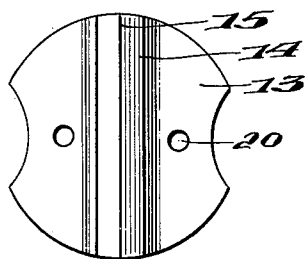


Fig. 11.

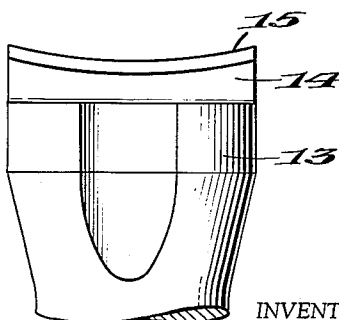
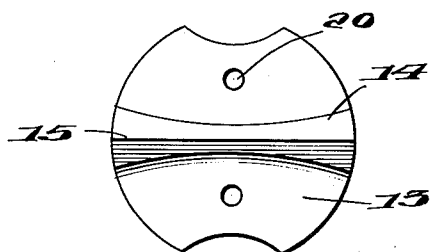


Fig. 10.



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1

3,062,306 DRILL BIT

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7 Claims. (Cl. 175-409)

This invention relates to an improvement in rock drill bits adapted for percussive drilling of the type in which the entire head or face portion of the bit is formed of sintered hard metal.

The present invention is characterized in that a drill bit of the type referred to and consisting of a conventional shank portion formed of steel which may be integral with or detachable from the drill rod and of an attached head portion formed of sintered hard metal and covering or forming the entire face of the bit is provided with one or more upstanding integral ridges constituting the cutting edge or edges of the bit, said ridge or ridges having substantially parallel side surfaces.

Drill bits of the type referred to but without the cutting ridges of the present invention have proved to be satisfactory particularly with respect to the avoidance of the difficulty common to other drill bits of the prior art known as counter-taper and the attendant wedging of the drill bit in the drill hole and damage to the drill bit. When using a drill bit which tends to wear at the periphery (diameter wearing) particularly when drilling certain species of rock it has been necessary to start the drill hole at a larger diameter than it is necessary to maintain. This expedient has certain drawbacks, particularly in drilling very deep holes. The great wear resistance of drill bits having the entire head portion formed of sintered hard metal has been found to avoid these difficulties i.e. diameter wearing, wedging etc. when drilling deep holes in species of rock which normally tend to give rise to such difficulties.

Drill bits of the type referred to are however not free of the drawback that they have to be reground from time to time in order to avoid the difficulties which attend the use of dull or worn bits i.e. great stresses which may result in breakage of or damage to not only the drill bit but also the drill rod. Drill bits are subject to both height wearing i.e. wearing away of the cutting edges and diameter wearing i.e. wearing at the corners and end surfaces adjacent to the periphery of the bits. Both types of wearing require regrinding if the drill bit is to be fully used.

Regrinding is of course a troublesome and expensive and time consuming operation as is well known.

The present invention retains the described advantages of drill bits of the type described but avoids the principal disadvantage thereof i.e. regrinding and resides as stated, principally in the provision of an integral cutting ridge or ridges having two substantially parallel side surfaces. The side surfaces need not be precisely plane nor precisely parallel so long as they define a cutting ridge which may be worn away while maintaining its cutting edge. It follows that the side surfaces must be relatively close together so that free edge constitutes a cutting edge regardless of its shape. It will be understood that the part referred to as the cutting edge is the top surface of the ridge and it may be flat or rounded or provided with a chisel edge as will appear more fully hereinafter. The side surfaces of the ridge may, as stated be plane and parallel or they may be plane and more or less divergent downwardly, that is away from the cutting edge or they may be concave or convex with respect to the axis of the drill bit and the ridge may be higher adjacent the periphery than adjacent the axis of

2

the bit or it may be thicker at one end than the other that is the side surfaces thereof may be divergent toward the periphery of the drill bit. The cutting edges may be arranged with respect to the drill bit face in the conventional ways of arranging hard metal cutting inserts in a drill bit face e.g. diametrically across the face of the bit or in the form of a cross or an even or odd number of ridges radiating from the center. Several possible arrangements will be described hereinafter.

The head or face portion of the drill bit including its integral ridge or ridges is made of sintered hard metal as is understood in this art e.g. a granular hard material such as tungsten carbide bonded together by sintering with a bonding material such as cobalt and/or other metal of the iron group. Sintered ceramic products such as alumina with or without a bonding material also may be used. The present invention is not concerned with the composition of the sintered hard metal cutting face of the drill bit or how it is made but may make use of the known expedients of the prior art such as the use of coarser or finer hard material and variation of the kind and quantity of bonding material to vary the hardness and toughness of the different parts of said cutting face.

The invention will now be further described in connection with the accompanying drawings which show several illustrative embodiments of the invention.

Referring to the drawings:

FIG. 1 is a side elevation of a drill bit,

FIG. 2 is a section on the line 2-2 of FIG. 3,

FIG. 3 is a plan view of the cutting face of the drill bit of FIG. 1,

FIG. 4 is a plan view of the cutting face of another form of drill bit,

FIG. 5 is a front elevation of the drill bit of FIG. 4,

FIG. 6 is a section on the line 6-6 of FIG. 4,

FIG. 7 is a side elevation of a drill bit with a portion broken away showing a cutting edge ridge having downwardly divergent plane side surfaces,

FIG. 8 is a side elevation of a drill bit showing a cutting edge ridge with concave side surfaces,

FIG. 9 is a side elevation of a drill bit showing a cutting edge ridge with convex side surfaces,

FIG. 10 is a top plan view of a drill bit similar to that shown in FIG. 7 but in which the cutting edge ridge has side surfaces which diverge radially of the bit,

FIG. 11 is a side elevation of a drill bit showing a cutting edge ridge which is higher adjacent to the periphery of the bit than adjacent to the axis thereof, and

FIG. 12 is a top plan view of the drill bit shown in FIG. 7.

In the embodiment of the invention shown in FIGS. 1-3, 11 is the steel shank of the bit which may be either integral with or detachable from the drill rod (not shown) as is well known in this art. The head or face portion 13 is connected to the shank portion 11 at the surface 12 which may, as illustrated, have portions at different levels or be provided with projections corresponding to recesses in the head portion or vice versa in order to increase the strength of the joint. The adjoining surfaces of the face and shank may be joined by brazing, welding, wedging or in any other manner known in the art. The joining of the head portion 13 with the shank portion may also be effected with an intermediate layer of metal which may have a coefficient of expansion between those of the head and shank portions.

As has been stated the head portion 13 including the ridges 14 is formed entirely of sintered hard metal. The ridges 14 as shown in FIGS. 1-3 have chisel shaped cutting edges 15 and substantially plane parallel side surfaces 16. As stated above the cutting edge may be chisel shaped as shown or it may be rounded or even

a flat plane surface. The ridges 14 are sufficiently thin in the tangential direction (dimension between the side surfaces 16) that the cutting edge is self grinding, that is, even as the ridge 14 wears away the edge 15 regardless of its cross sectional shape continues to serve as a cutting edge. It has been found that this is true in a drill bit for percussive drilling if the thickness of the ridges 14 is within the range from 2 to 5 mm., preferably about 3 mm., in a drill bit the diameter of the cutting face of which is within the range from 25 to 50 mm., preferably 40-42 mm. and which has four ridges arranged as a cross. The height of the ridges 14 when new should be about the same as their thickness and should be from about 5% to 13% of the diameter of the diameter of the cutting face of the drill bit.

In the form or embodiment of the invention illustrated the shank portion 11 of the bit is in the form of a sleeve 19 having a conical opening 18 for attachment to the drill rod (not shown) but it will be appreciated that the invention is not concerned with the form of the shank portion and that it can be of any desired shape and either integral with or detachable from the drill rod. The only feature of the shank portion with which the present invention is concerned is that the head portion 13 covers all of substantially all of the front end thereof.

Drill bits in accordance with the invention may have a head portion with a single ridge 14 (see FIGS. 7-12) extending diametrically across the face of the bit as is quite common in the drill bit art or the ridges 14 may be in any other suitable number and arrangement, for instance as shown in FIGS. 1-6. In the embodiment shown in FIGS. 1-3 one ridge extends diametrically across the face of the head 13 while the other ridge extends across the face of the head 13 at a somewhat oblique angle to the first ridge and its middle portion is omitted. Instead of this specific arrangement the ridges may join each other at the center of the face of the head 13 as shown in FIG. 4. In FIG. 4 there are three of the ridges 14 which meet at the center of the face of the head 13 at equal angles to each other. This arrangement may be adapted to any number of ridges i.e. 4, 5, 6 etc.

As shown in several of the figures, 20 is or are openings for flushing liquid and are suitably positioned between the ridges 14 and or at the center of the face of the head 13 as shown in FIGS. 10 and 12.

As appears in FIGS. 1, 3 and 4 the face of the head portion 13 need not be in the form of a complete circle but may be provided with grooves 21 between the peripheral ends of the ridges 14 to facilitate the discharge of drilled material and flushing liquid.

The head portions 13 of sintered hard metal may be made by the conventional procedure i.e. the mixture of hard material e.g. tungsten carbide and the bonding material e.g. cobalt is pressed to the desired shape, pre-sintered, ground to the precise final shape and subjected to a final sintering. The head portion 13 is then attached to the shank portion 11 as by brazing; the thickness of the brazing joint being 0.1 mm. or more.

In each of FIGS. 7-12, 13 is the head portion, 14 is the cutting edge ridge and 15 is the cutting edge.

The invention is concerned primarily with the head portion 13 and more particularly with the shape and relative size of the ridges 14. As stated above the side surfaces 16 of the ridges 14 may be plane and parallel as illustrated but substantial variations from this shape and arrangement are possible. For instance the side surfaces may be concave or convex or they may be

plane and diverge downwardly making the ridges somewhat thicker at the bottom than at the top or the surfaces may diverge radially making the ridges thicker adjacent the periphery than adjacent the center. At the very end of the ridge the increase of the thickness may be substantial, for instance three times the thickness of the main part of the ridge. Also the height of the ridges 14 may be uniform as illustrated or may vary from end to end e.g. the ridges may be higher adjacent the periphery of the drill bit than adjacent to the center thereof. All such variations in the shape and arrangement of the side surfaces 16 of the ridges 14 which provide ridges which maintain their cutting edges as they wear away are intended to be embraced by the expression "substantially plane and parallel" side surfaces.

I claim:

1. A drill bit comprising a shank portion and a head portion, said shank portion being formed of steel and having a hollow rear portion adapted to be attached to a drill rod and a front surface and said head portion being a unitary body of sintered hard metal brazed to and completely covering said front surface of said shank portion, said head portion having in its periphery axially extending grooves for the removal of detritus and between said grooves radially protruding parts each of which at its front surface carries a cutting edge in the form of a radially placed ridge integral with the remainder of said head portion, each ridge having at least along its main part substantially parallel side surfaces, each ridge measured between said side surfaces having a thickness of from 2-5 mm. and being sufficiently thin to maintain a cutting edge without grinding as the ridge wears away, each radially protruding part being in the tangential direction at least several times as thick as the cutting edge ridge carried thereon.

2. A drill bit as defined in claim 1 in which the ridge is higher adjacent the ends thereof than adjacent to the axis of the bit.

3. A drill bit as defined in claim 1 in which said ridge is from about 2 to about 5 mm. high.

4. A drill bit as defined in claim 3 in which the side surfaces of the ridge diverge downwardly.

5. A drill bit as defined in claim 3 in which the side surfaces of the ridge diverge toward the periphery of the bit.

6. A drill bit as defined in claim 3 in which the side surfaces of the ridge are concave.

7. A drill bit as defined in claim 3 in which the side surfaces of the ridge are convex.

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