

Description

This invention relates to rock bits and in particular to rock bits having hard metal cutter inserts.

Such cutter inserts can take the form of inclined chisel inserts for use in a gage row of a rotary cone for a rock bit.

There are a number of prior art patents that disclose inserts that have certain non-symmetric features. For example, US Patent No. 3,442,342 which discloses the preamble of claim 1, discloses a rotary cone rock bit having tungsten carbide chisel inserts in a gage row of each of the three cones. After the bit is assembled, the sides of the gage row inserts are ground flat to the precise gage diameter of the hole to be drilled. The gage row inserts are intentionally installed so that the rock bit, when all three cones are in position, is overgage. The gage row inserts then have to be ground to provide a flat surface so that the diameter of the bit is correct. The patent goes on to teach that if there were no flats on the gage row inserts and the convex surface were simply tangent to a side wall of a borehole, there would be nothing but point contact and the borehole would quickly become undergage as the contact points of the inserts wore away.

It has been determined, however, that gage chisel type inserts having flat spots ground therein provide a relatively large contact area against the borehole sides. Each of the inserts then can be made susceptible to heat checking, resulting in premature wear and/or insert breakage. Insert heat checking can be defined as high cycle thermal fatigue due to intermittent frictional heat generated by borehole wall to gage insert contact and subsequent cooling by drilling fluid per each revolution. Certain formations such as shales can generate ordinate amounts of frictional heat at the borehole wall/gage insert interface. If the cobalt contents of the tungsten carbide alloy inserts is reduced or the tungsten carbide grain size is adjusted to reduce the tendency to heat check (independent of geometry change), then typically, the fracture toughness of the insert is reduced and the design is more susceptible to pure mechanical fatigue failure.

US Patent No 4,058,177 describes a non-symmetric gage row insert which provides a large wall contacting surface supposedly decreasing the wear on the gage insert because of the larger contact area and increasing the ability of the earth boring apparatus to maintain a full gage hole.

This patent, like the foregoing patent, provides a gage row insert with a large flat surface that parallels the borehole wall and thus is subject to the same insert degradation as the foregoing patent.

Another US Patent No. 4,108,260, describes specially shaped non-symmetrical inserts to be used in rotary cone rock bits. The inserts is generally chisel-shaped with flanks converging to a crest. The flanks are non-symmetrical with respect to each other, the leading flank is scoop-shaped and the trailing flank is rounded outwardly. This insert is designed for increased penetration in a rock formation. The insert is not, however, designed specifically for a gage row of a rock bit to maintain the gage of the bit as it is used in a borehole.

Still another prior art US Patent No. 4,334,586, describes inserts for drilling bits. The insert cutting elements comprise non-symmetrical inserts placed in at least one circumferential row in a roller cone in alternating alignment. This non-symmetrical type insert is cone-shaped with the apex of the insert rounded and off-centre. Each insert in the circumferential row is alternated so that its apex is not aligned with its neighbouring insert, every other insert being so arranged in rows on a rotary cone of a rock bit.

This non-symmetrical insert, like the foregoing insert, is not designed to be placed in a gage row of a cone to provide maximum gage protection during bit operation in a borehole.

The foregoing prior art patents are disadvantaged, especially those patents that teach a flattened area to be positioned adjacent a gage row of a rotary cone. The large area flat surface paralleling the wall of a borehole makes the gage row inserts susceptible to heat checking thereby prematurely wearing the insert and, in many cases, causing the insert to fracture through thermal fatigue failure. When this occurs the rock bit quickly goes undergage, creating all kinds of problems for subsequent new bits that are placed back into the borehole for further penetration of a formation. If a dull bit is undergage when removed or "tripped" from the borehole, a following new full gage bit will immediately pinch, forcing the cones inwardly towards each other and rendering the bit useless thereafter. The remedy is a costly reaming operation to bring the borehole back to gage.

Symmetrical chisel type inserts are sometimes used on gage and they do provide a conical rather than flat gage cutting surface adjacent to the borehole wall. However, the cutting surface of these inserts often does not closely parallel the borehole wall, therefore allowing the bit to go undergage much earlier. When the cone angle of a standard chisel insert is increased to improve the gage surface angle (or the angle between the side of the cone and the borehole wall), the extension of the insert becomes limited because the crest length decreases as the insert extension increases. Therefore, it is desirable to provide a special non-

symmetrical insert designed to provide increased crest length while providing the desired gage surface angle, thus providing maximum gage-keeping capability while minimizing wear on the special non-symmetrical inserts. It has been found that conical-shaped gage cutting surfaces provide a more desirable line or point contact rather than a full surface, large area contact like a gage chisel insert having a flat side as indicated in the foregoing prior art. The conically shaped gage cutting surface reduces the possibility of heat checking that can lead to catastrophic failure of the insert. In other words, it is desirable to have a design balance between the thermal fatigue associated with heat checking and the mechanical fatigue associated with insert shape and respective strength.

It is desirable to provide a gage row insert for rotating cones of a rotary cone rock bit which balances maximum gage-keeping capabilities with minimum wear on the gate row inserts.

More specifically it is desirable to provide non-symmetrical chisel type gage row inserts wherein the gage cutting surface, being rounded, more closely parallels the wall of the borehole which will keep the bit in gage after some wear of the gage row inserts has occurred.

A hard metal gage row insert for a roller cone rock bit is disclosed which consists of a generally cylindrical base crest portion at an opposite cutting end of the insert. The insert has different conical surfaces adjacent each end of a crown formed by the chisel crest. A first elongated conical surface is a gage cutting surface adapted to be in contact with a borehole wall formed in a formation by the rock bit. A second conical surface on an opposite end of the non-symmetric chisel crest serves to support the chisel crest. The angle of the elongated gage cutting side of the insert is oriented with respect to the borehole wall such that the elongated conical surface makes an initial point or line contact with the borehole wall before any wear of the insert during rock bit operation. The angle between the conical gage cutting surface and the borehole wall may be between 0° and 25° . The preferred angle between the conical gage cutting surface and the borehole wall is about at the midpoint between these two angles.

An advantage of the insert described over the prior art is the elongate conical gage cutting surface adjacent the borehole wall. Moreover, the inwardly facing, non-gage cutting conical surface, adjacent the crest of the insert has a smaller cone angle than the elongated gage side, thereby allowing the insert to have a longer crest length. The non-symmetrical created gage insert provides a more aggressive and less fragile insert as well as better bottom hole coverage.

Hard metal cutter inserts for rock bits and embodying the invention will now be described, by way of example, with reference to the accompanying diagrammatic drawings in which:

- 5 Figure 1 is a side view of a prior art insert;
- Figure 2 is a front view taken through 2-2 of Figure 1;
- Figure 3 is an oblique sectional view taken through 3-3 of Figure 1;
- 10 Figure 4 is top view of the prior art insert taken through 4-4 of Figure 2;
- Figures 5 to 8 are partially cut away front views of the prior art insert of Figure 1 that is gradually worn down against the borehole wall through stages "b", "c" and "d";
- 15 Figure 9 is a perspective view of a rotary cone rock bit, partially in phantom outline, illustrating a rotary cone with cutter inserts embedded therein;
- 20 Figure 10 is a partially cut away side view, partially in phantom outline, illustrating gage row inserts of the present invention;
- Figure 11 is a view of a borehole in an earth formation looking up at one of three rotary cones of a rock bit, partially in phantom, illustrating a gage row insert of the present invention in contact with the wall of the borehole;
- 25 Figure 12 is a side view of a preferred embodiment of an insert of the present invention;
- Figure 13 is a front view taken through 13-13 of Figure 12;
- 30 Figure 14 is an oblique sectional view taken through 14-14 of Figure 12; and
- Figure 15 is a top view of the insert of the present invention taken through 15-15 of Figure 12; and
- 35 Figures 16 to 19 are partially cut away front views of the insert of Figure 8 that is gradually worn down through stages "b", "c" and "d".
- 40 Figure 1 illustrates a prior art gage row chisel insert. The insert consists of a crest 5, a conical back surface 6, flat sides 4 and flat cutting surface 3. The prior art insert, before use, has a crest length 8. As the insert is worn during operation of the roller cone rock bit in a borehole, the flattened cutting surface 3, is progressively worn along dotted surfaces "b", "c" and "d". Surface "a" is the original flattened cutting surface prior to rock bit use. As is readily apparent, the crest length 8 becomes narrower as the bit is worn down towards surface "d", resulting in a crest length 9 which is relatively small and fragile. When the prior art insert reaches this worn condition the shortened crest length easily breaks off, resulting in catastrophic failure of the insert.
- 45
- 50
- 55

Moreover, when tungsten carbide pieces mix in with the cuttings from the borehole bottom, the entire bit is in jeopardy oftentimes resulting in more

broken inserts, or worse yet, loss of a cone on the bottom of the borehole. "Fishing" operations (retrieval of bit parts from the borehole bottom) are expensive and result in non-productive downtime for the rig operators.

Figure 2 show the cutting face 3 of the prior art insert before use. The cutting surface 3, is relatively large and is oriented parallel or adjacent to a borehole wall during operation of the rock bit in a borehole. The insert is subject to frictional heat build up since there is a large surface area in contacts with the borehole wall. As the insert wears during use the surface "a" becomes larger as it approaches condition "b", "c" and "d". This enlargement of the already enlarged cutting surface results in even greater frictional heat build up which, of course, accelerates failure of the inserts through thermal fatigue.

Figure 3 is an oblique section taken through Figure 1 to show the sharp-angled corner 1 which transitions from the cutting face 3 to the insert sides 4 on either side of the crested ridge 5. The sharp corner 1 is present through all stages of wear of "b", "c" and "d" and results in chipping and cracking along this vulnerable edge during the working of the rock bit in a borehole. The included angle between cutting face 3 and insert sides 4 is about 110° , resulting in the sharp corner 1.

Figure 4 illustrates the broad contacting surface 3, and the sharp-angled corners 1, which intersects into the side flats 4 of the prior art insert 2.

The prior art Figures 5 to 8 illustrate the cutting surface 3 as it transitions through the various stages of wear. For example, in Figure 6 the area "b" is widened with respect to the new surface "a" of Figure 5. In addition, the surface begins to heat check at location 7 near the centre of worn surface "b". Figure 7 shows a progression of wear "c" with the wider surface area and pronounced heat checking 7. Finally, the prior art Figure 8 shows an extremely worn surface "d" that is thoroughly heat checked. The crest 5 is shortened and in danger of breaking off as is illustrated in the prior Figure 1.

The foregoing prior art gage row insert illustrated in Figures 1 to 8 clearly illustrates the degradation of these full contact inserts. The pronounced heat checking caused by the frictional heating of the enlarged areas against the borehole wall is a major contributor to the early failure of rock bits incorporating these types of gage row inserts. Attempts to correct the heat checking through adjustments in tungsten carbide particle grain size or cobalt content, can create inserts that also have low fracture toughness values, leading to increased mechanical fatigue failures.

The perspective view of Figure 9 illustrates a 3-cone rock bit. The rock bit generally designated

as 10 consists of a bit body 12 having a pin end 14 at one end and a cutting end generally designated as 16 at the other end. A rotary cone 18 is rotatively connected to a thrust bearing journal which is cantilevered inwardly from a rock bit leg 15. The cone 18 has, for example, a multiplicity of tungsten carbide cutter inserts 20 interference fitted into holes drilled in the surface of the cone 18. A series of gage row inserts 22 are pressed into holes drilled into an annular surface formed by the cone. The gage row inserts 22 contact the borehole wall and ultimately determine the diameter of the borehole. A series of flush type button inserts 21, for example, may be pressed into the base of the cone. These inserts reinforce the gage row of the cone and serve to prevent degradation of the cone while it works in the borehole.

Nozzle 17 provided in the bit body 12 directs hydraulic fluid toward the borehole bottom and serves to sweep detritous from the borehole and to clean and cool each of the cutter cones 18. In sealed bearing rock bits a lubrication chamber 19 is formed in each leg and serves to supply lubricant to the bearing surfaces formed between a journal and the cone 18.

Turning now to Figure 10, a partially cutaway rock bit leg 15 supports a cone 18 which is rotatively secured to a journal bearing (not shown) cantilevered from the leg 15. The gage row inserts of the present invention, generally designated as 22, are pressed into the gage row of the cone 18 with a cutting surface 42 facing towards the borehole or gage curve 26. The base 40 of insert 22 is typically interference fitted within a hole drilled into the gage row of cone 18. The extended portion of the insert 22 is inclined or non-symmetrical and comprises an elongated conical cutting surface 42, a crest 44 and a conical back surface 45. The sides 43 of the insert are substantially flat and terminate at crested surface 44 of the insert 22. The conical cutting surface 42 is longer than the back conical surface 45. The angle with respect to a centreline of the insert is greater along the conical cutting surface 42 (hence longer) than the angle of back conical surface 45. The cutting surface 42 intersects a "gage curve" 26, and determines the diameter of a hole the rotary cone cutter cuts.

A gage curve is a tool that rock bit engineers use to determine that the bit design in question will cut a specified hole diameter. A gage curve is defined as follows:

For a bit of given diameter, journal angle and journal offset, all the points that will cut the correct size hole projected into a plane through journal centreline and parallel to the bit centre.

The foregoing definition is complicated by the fact that most rock bits utilise rotating cones that

are offset from a true radial line emanating from the centreline of the rock bit. This parameter coupled with an oblique angle of the journal that is cantilevered off of the rock bit legs necessitates the use of the foregoing formulation to determine exactly where the gage row inserts will contact the borehole. Hence, the angle formed between the elongated cutting surface 42 of the insert 22 and the gage curve 26 should be an angle indicated as 28 that is between 0° and 25° . More specifically, this angle is optimised near the midpoint between these two angles.

To put it another way, Figure 11 illustrates a single cone shown in phantom as it is viewed when looking up a borehole at the bit. As stated before the gage row containing the gage row inserts 22 of the present invention establishes the diameter of the borehole 36. The cutting surface 42 of insert 22 contacts the borehole wall 37 at point "a" and the angle 30 between the borehole wall 37 and elongated cutting surface 42 is between 0° and 25° . The preferred angle being near the midpoint. This angulation (0° to 25°) between the gage row cutting surface 42 and the borehole wall has been determined to provide the best angle for the point contact of cutting surface 42 with the borehole wall 37.

By providing essentially a point contact "a" on an elongated rounded conical surface 42, the wear of the insert is minimised since surface 42 is not flat. Even if elongated conical surface 43 is in full contact with a borehole wall (0° angulation between surface 42 of insert 22 and borehole wall 37) a line contact only would occur between the two surfaces, thereby greatly reducing the area of contact and the inherent frictional heat generation problems that result therefrom. To further clarify this aspect of the preferred embodiment, reference is now made to Figures 12 to 19.

Referring now to Figure 12 an insert of the preferred embodiment is shown and designated generally at 22. Insert 22 consists of base portion 40, the cutting end of the insert comprising an elongated conical cutting surface 42, side surfaces 43, and conical back surface 45. The insert projection terminates at a rounded crest or crown portion 44. The elongated conical cutting surface 42 makes an initial contact with a borehole wall 37 (Figure 11) at surface "a" and as the insert works in the borehole it is worn through dotted surfaces "b", "c" and "d". As the insert wears from surface "a" through surface "d", the crest length 46 is reduced to crest length 47. (Crest length 47, however, is much longer than the crest length of a standard symmetrical chisel insert with the same conical gage cutting surface. This is due to the fact that the insert 22 is non-symmetrical, the shortened conical backface 45 permitting the crest length 44

to be essentially longer in length.) Consequently, when the insert reaches the worn position "d" there is sufficient crest length 47 to adequately support the insert even though it is at an advanced state of wear.

Referring now to Figure 13, the insert is rotated 90° so that we are now looking at the elongated cutting surface 42. In this view it is readily apparent that surfaces from "a" through "d" are much smaller in area than those surfaces depicted in the prior art Figures 5 to 8. Consequently, even though the insert wears, the worn surface area is smaller (more like a line contact) than the surface area of the prior art insert; hence, heat checking and fracturing of the insert is much more minimised. In addition, the corners 48 created between the worn surface and the conical surface 42 are much less severe.

Referring now to Figure 14, it can be seen through this oblique section taken through Figure 12 that the corners 48 are very gentle and less severe than corners 1 of Figure 3. The included angle "f", for example, formed between progressively worn surfaces "b", "c" and "d" and elongated conical surface 42 is about 145° . The included angle may be between 114° and 170° . The included angle G of the prior art insert shown in Figure 3, for example, has an included angle of about 110° and is much more vulnerable to chipping and cracking as a result as heretofore described. Consequently, it is quite apparent that there is very little chance of the insert chipping or failing along this intersection 48 between worn surfaces "b" through "d" and the elongated conical, or rounded surface 42 of insert 22.

Figures 16 to 19 depict the insert through various stages of wear. Figure 16 illustrates the elongated conical surface 42 of insert 22 with the initial point "a" in contact with a borehole wall 37 (Figure 11). Figure 17 shows the insert with a little bit of wear "b" that is devoid of sharp, angular corners typical of the prior art of Figures 1 to 4. Figure 18 shows worn surface "c" which is still small in area. Since surface "c" is small in area it is not as subject to heat degradation as the prior art inserts. Finally, Figure 19 shows an insert that is considerably worn yet, surface "d" is much smaller in area than surface "d" of Figure 8; hence, while the surface is worn, the integrity of the insert of the instant invention is maintained because very little of the insert is worn away due to the line contact nature of the cutting surface 42. The gentle or less severe corners 48, also serve to maintain the integrity of the insert as it wears from surface "a" to surface "d", virtually eliminating catastrophic failures of the gage row inserts 22 as they are working in a borehole.

The gage row inserts 22 may be of the enhanced type wherein the non-symmetrical insert is crowned with a layer of diamond (not shown). Such enhanced inserts are the subject of US Patent No. 4,604,106 entitled Composite Polycrystalline Diamond Compact.

Moreover, the conically shaped non-symmetrical gage surface illustrated in Figure 12 of the preferred embodiment is uniquely suited to the foregoing invention (point or line contact with a borehole wall). It is well known by the diamond cutting insert manufacturers that full contact with a gage surface will create heat that is detrimental to a diamond cutting surface. The use of a diamond coated gage row insert of the present invention, wherein point contact conical gage surfaces are employed, virtually assures maintenance of the full gage diameter of the borehole since diamond surfaces do not wear or disintegrate when heat generation is controlled. These enhanced diamond layered inserts may be obtained from Megadiamond of Provo, Utah, a subsidiary of Smith International, Inc.

The preferred embodiment of gage row insert 22, while at first glance does not appear to be much different than the prior art inserts, is surprisingly different in performance. The effect of the elongated conical surface 42 as it works in a borehole and the angle at which surface 42 contacts the borehole wall is dramatically different than the inserts of the prior art. Thus, the insert of the instant invention is far superior to that illustrated in the prior art. Furthermore, the present invention teaches away from the principles set forth in the prior art.

Claims

A rock bit comprising a rock bit body (12), a plurality of rotary cones (18) mounted on the body (12) for rotation against the bottom of a hole being drilled by the rock bit, and a plurality of cutter inserts (20) inserted in each cutter cone (18), the cutter inserts comprising a plurality of gage row inserts (22) for contacting the sidewall of the hole being drilled, each gage row insert comprising: a generally cylindrical base portion (40) at one end of said insert, and a chisel crest portion (42, 43, 44, 45) at an opposite end of said insert, the rock bit being characterized in that the gage row inserts are non-symmetric with different conical surfaces (42, 45) adjacent each end of a crown (44) forming a non-symmetric chisel crest; a first elongated conical surface (42) being a gage cutting surface adapted to contact a borehole wall formed in a formation by said rock bit, a second conical surface (45) on an

opposite end of said chisel crest serving to support said chisel crest, the first elongated conical surface (42) of said insert (20) being oriented with respect to the gage curve (26) of the rock bit, which corresponds to the side surface of the borehole to be bored, such that, during initial operation of the rock bit before any wear of the insert (20) has occurred, it makes a line or point contact with said gage curve (26).

2. A rock bit as set forth in Claim 1, wherein said first elongated conical surface (42) makes substantially a point contact with said gage curve (26) during rock bit operation.
3. A rock bit as set forth in Claim 1 or in Claim 2, wherein the angle between first elongated conical surface (42) and said gage surface (26) is between 0° and 25°.
4. A rock bit as set forth in Claim 3, wherein the angle is midway between 0° and 25°.
5. A rock bit according to any preceding claim wherein the first elongated conical surface (42) of said insert is longer in length than said second opposite conical surface (45) adjacent said crown (44), and the cone angle of said first elongated cutting surface (42) is greater with respect to a centreline of said insert than that of said second conical surface (45).
6. A rock bit according to any preceding claim, wherein after each said gage row insert works in a borehole for a period of time to cut the borehole diameter in a formation, an included angle formed between a worn substantially flat surface and the first elongated conical surface (42) of the gage row insert is between 114° and 170°.
7. A rock bit according to Claim 6, wherein said included angle between said flat worn surface and said elongated conical surface (42) of each said gage row insert is about 145°.
8. A rock bit according to any preceding claim, wherein said gage row inserts are fabricated from tungsten carbide.
9. A rock bit as set forth in Claim 8, wherein the cutting surfaces of the gage row inserts are enhanced with a layer of diamond material.



The gage row inserts 22 may be of the enhanced type wherein the non-symmetrical insert is crowned with a layer of diamond (not shown). Such enhanced inserts are the subject of US Patent No. 4,604,106 entitled Composite Polycrystalline Diamond Compact.

Moreover, the conically shaped non-symmetrical gage surface illustrated in Figure 12 of the preferred embodiment is uniquely suited to the foregoing invention (point or line contact with a borehole wall). It is well known by the diamond cutting insert manufacturers that full contact with a gage surface will create heat that is detrimental to a diamond cutting surface. The use of a diamond coated gage row insert of the present invention, wherein point contact conical gage surfaces are employed, virtually assures maintenance of the full gage diameter of the borehole since diamond surfaces do not wear or disintegrate when heat generation is controlled. These enhanced diamond layered inserts may be obtained from Megadiamond of Provo, Utah, a subsidiary of Smith International, Inc.

The preferred embodiment of gage row insert 22, while at first glance does not appear to be much different than the prior art inserts, is surprisingly different in performance. The effect of the elongated conical surface 42 as it works in a borehole and the angle at which surface 42 contacts the borehole wall is dramatically different than the inserts of the prior art. Thus, the insert of the instant invention is far superior to that illustrated in the prior art. Furthermore, the present invention teaches away from the principles set forth in the prior art.

Claims

A rock bit comprising a rock bit body (12), a plurality of rotary cones (18) mounted on the body (12) for rotation against the bottom of a hole being drilled by the rock bit, and a plurality of cutter inserts (20) inserted in each cutter cone (18), the cutter inserts comprising a plurality of gage row inserts (22) for contacting the sidewall of the hole being drilled, each gage row insert comprising: a generally cylindrical base portion (40) at one end of said insert, and a chisel crest portion (42, 43, 44, 45) at an opposite end of said insert, the rock bit being characterized in that the gage row inserts are non-symmetric with different conical surfaces (42, 45) adjacent each end of a crown (44) forming a non-symmetric chisel crest; a first elongated conical surface (42) being a gage cutting surface adapted to contact a borehole wall formed in a formation by said rock bit, a second conical surface (45) on an

opposite end of said chisel crest serving to support said chisel crest, the first elongated conical surface (42) of said insert (20) being oriented with respect to the gage curve (26) of the rock bit, which corresponds to the side surface of the borehole to be bored, such that, during initial operation of the rock bit before any wear of the insert (20) has occurred, it makes a line or point contact with said gage curve (26).

2. A rock bit as set forth in Claim 1, wherein said first elongated conical surface (42) makes substantially a point contact with said gage curve (26) during rock bit operation.
3. A rock bit as set forth in Claim 1 or in Claim 2, wherein the angle between first elongated conical surface (42) and said gage surface (26) is between 0° and 25°.
4. A rock bit as set forth in Claim 3, wherein the angle is midway between 0° and 25°.
5. A rock bit according to any preceding claim wherein the first elongated conical surface (42) of said insert is longer in length than said second opposite conical surface (45) adjacent said crown (44), and the cone angle of said first elongated cutting surface (42) is greater with respect to a centreline of said insert than that of said second conical surface (45).
6. A rock bit according to any preceding claim, wherein after each said gage row insert works in a borehole for a period of time to cut the borehole diameter in a formation, an included angle formed between a worn substantially flat surface and the first elongated conical surface (42) of the gage row insert is between 114° and 170°.
7. A rock bit according to Claim 6, wherein said included angle between said flat worn surface and said elongated conical surface (42) of each said gage row insert is about 145°.
8. A rock bit according to any preceding claim, wherein said gage row inserts are fabricated from tungsten carbide.
9. A rock bit as set forth in Claim 8, wherein the cutting surfaces of the gage row inserts are enhanced with a layer of diamond material.



Patentansprüche

1. Gesteinsbohrmeißel mit einem Gesteinsbohrmeißelkörper (12), mehreren Drehkugeln (18), die am Körper (12) zur Rotation gegen den Boden eines vom Gesteinsbohrmeißel gebohrten Loches befestigt sind, und mehreren in jedem Schneidkegel (18) eingesetzten Schneideinsätzen (20), welche mehrere Meßreiheneinsätze (22) zur Berührung der Seitenwand des gebohrten Loches aufweisen, von denen jeder Meßreiheneinsatz umfaßt: einen im allgemeinen zylindrischen Basisabschnitt (40) an einem Ende des Einsatzes und einen Meißelspitzenabschnitt (42, 43, 44, 45) an einem gegenüberliegenden Ende des Einsatzes, wobei der Gesteinsbohrmeißel dadurch gekennzeichnet ist, daß die Meßreiheneinsätze nicht symmetrisch sind, wobei verschiedene konische Oberflächen (42, 45) benachbart an jedem Ende einer Krone (44) eine nicht-symmetrische Meißelspitze bilden; eine erste längliche konische Oberfläche (42), die eine Meßschneidfläche ist, die für eine Berührung mit einer in einer Formation vom Gesteinsbohrmeißel gebildeten Bohrlochwand ausgebildet ist, wobei eine zweite konische Oberfläche (45) an einem gegenüberliegenden Ende der Meißelspitze zur Stützung der Meißelspitze dient, die erste längliche konische Oberfläche (42) des Einsatzes (20) gegenüber der Meßkurve (26) des Gesteinsbohrmeißels, welcher der Seitenfläche des zu bohrenden Bohrloches entspricht, derart verläuft, daß während eines Anfangsbetriebes des Gesteinsbohrmeißels, bevor irgendein Verschleiß des Einsatzes (20) aufgetreten ist, er einen linien- oder punktförmigen Kontakt mit der Meßkurve (26) beschreibt.
2. Gesteinsbohrmeißel nach Anspruch 1, bei welchem die erste längliche konische Oberfläche (42) im wesentlichen einen punktförmigen Kontakt mit der Meßkurve (26) während des Betriebes des Gesteinsbohrmeißels bildet.
3. Gesteinsbohrmeißel nach Anspruch 1 oder Anspruch 2, bei welchem der Winkel zwischen den ersten länglichen konischen Oberflächen (42) und der Meßoberfläche (26) zwischen 0° und 25° liegt.
4. Gesteinsbohrmeißel nach Anspruch 3, bei welchem der Winkel mittig zwischen 0° und 25° liegt.
5. Gesteinsbohrmeißel nach einem vorangegangenen Anspruch, bei welchem die erste längliche

che konische Oberfläche (42) des Einsatzes länger in ihrer Länge ist als die zweite gegenüberliegende konische Oberfläche (45) benachbart zur Krone (44) und der Kegelwinkel der ersten länglichen Schneidfläche (42) gegenüber einer Mittellinie des Einsatzes größer als der der zweiten konischen Oberfläche (45) ist.

6. Gesteinsbohrmeißel nach einem vorangegangenen Anspruch, bei welchem, nachdem jeder Meßreiheneinsatz in einem Bohrloch während einer Zeitperiode arbeitet, um den Bohrdurchmesser in einer Formation zu schneiden, ein eingeschlossener Winkel zwischen einer verschlissenen im wesentlichen flachen Oberfläche und der ersten länglichen konischen Oberfläche (42) des Meßreiheneinsatzes zwischen 114° und 170° liegt.
7. Gesteinsbohrmeißel nach Anspruch 6, bei welchem der eingeschlossene Winkel zwischen der flachen verschlissenen Oberfläche und der länglichen konischen Oberfläche (42) jedes Meßeinsatzes etwa 145° beträgt.
8. Gesteinsbohrmeißel nach einem vorangegangenen Anspruch, bei welchem die Meßreiheneinsätze aus Wolframcarbid hergestellt sind.
9. Gesteinsbohrmeißel nach Anspruch 8, bei welchem die Schneidflächen der Meßreiheneinsätze mit einer Schicht aus Diamantmaterial verstärkt sind.

Revendications

1. Trépan de roche, comprenant un corps de trépan (12), une pluralité de cônes rotatifs (18) montés sur le corps (12) pour tourner contre le fond d'un trou foré par le trépan, et une pluralité d'inserts de coupe (20) insérés dans chaque cône de coupe (18), les inserts de coupe comprenant une pluralité d'inserts de ligne de calibrage (22) agencés pour entrer en contact avec la paroi latérale du trou en train d'être foré, chaque insert de ligne de calibrage comprenant: une partie de base globalement cylindrique (40) à une extrémité dudit insert, et une partie de crête biseautée (42, 43, 44, 45) à une extrémité opposée dudit insert, le trépan de roche étant caractérisé en ce que les inserts de ligne de calibrage sont asymétriques par rapport à des surfaces coniques différentes (42, 45) agencées au voisinage de chaque extrémité d'un sommet (44) qui forme une crête biseautée asymétrique, dont une première surface conique allongée (42) est une surfa-



- ce coupante de calibrage conçue pour entrer en contact avec une paroi de trou foré formée dans une formation rocheuse par ledit trépan de roche, et une seconde surface conique (45), à une extrémité opposée de ladite crête biseautée, qui sert à supporter ladite crête biseautée, la première surface conique allongée (42) dudit insert (22) étant orientée, par rapport à la courbe de calibrage (26) du trépan, courbe qui correspond à la surface latérale du trou à forer, de telle sorte qu'au début de l'utilisation du trépan, avant que l'insert (22) commence à s'user, elle réalise un contact linéaire ou ponctuel avec ladite courbe de calibrage (26).
2. Trépan de roche selon la revendication 1, dans lequel ladite première surface conique allongée (42) réalise un contact sensiblement ponctuel avec ladite courbe de calibrage (26) pendant l'utilisation du trépan.
 3. Trépan de roche selon la revendication 1 ou 2, dans lequel l'angle entre la première surface conique allongée (42) et ladite courbe de calibrage (26) est compris entre 0° et 35° .
 4. Trépan de roche selon la revendication 3, dans lequel l'angle est à mi-chemin entre 0° et 25° .
 5. Trépan de roche selon l'une quelconque des revendications précédentes, dans lequel la première surface conique allongée (42) dudit insert est plus longue que ladite seconde surface conique opposée (45) au voisinage dudit sommet (44), et l'angle de cône de ladite première surface conique allongée (42) est supérieur, par rapport à un axe médian dudit insert, à celui de ladite seconde surface conique (45).
 6. Trépan de roche selon l'une quelconque des revendications précédentes, dans lequel, après que chaque insert de ligne de calibrage a travaillé pendant un certain temps dans un trou foré afin d'évider le diamètre du trou dans une formation rocheuse, l'angle inscrit formé entre une surface usée sensiblement plate et la première surface conique allongée (42) de l'insert de ligne de calibrage est compris entre 114° et 170° .
 7. Trépan de roche selon la revendication 6, dans lequel l'angle inscrit entre ladite surface usée plate et ladite surface conique allongée (42) de chaque insert de ligne de calibrage est égal à environ 145° .
 8. Trépan de roche selon l'une quelconque des revendications précédentes, dans lequel lesdits inserts de ligne de calibrage sont réalisés en carbure de tungstène.
 9. Trépan de roche selon la revendication 8, dans lequel les surfaces de coupe des inserts de ligne de calibrage sont renforcées par une couche diamantée.