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(71) Applicant(s)
Sandvik AB (publ)

(72) Inventor(s)
Goran Palmberg

(74) Agent/Attorney
GRIFFITH HACK,GPO Box 1285K,MELBOURNE VIC 3001

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(71) Applicant: SANDVIK AB (publ) [SE/SE]; S–811 81 Sandviken (SE).

(72) Inventor: PALMBERG, Göran; Rua Belgrado, 104, Vila Sao Fernando, CEP–06700–000 Cotia, SP (BR).

(74) Agent: CARLSSON, Lars–Åke; Sandvik AB, Patent Dept., S–811 81 Sandviken (SE).

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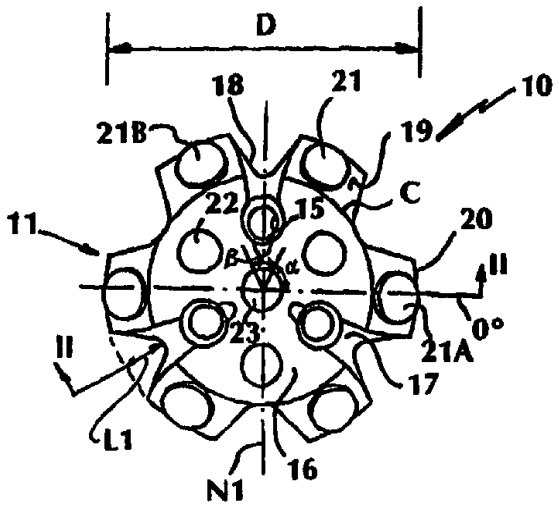
(57) Abstract

The present invention relates to a rock drill bit for percussive drilling, comprising a head (11) and a shank (12). The shank (12) has a central boring in which a thread (14) is provided. The thread (14) is provided to cooperate with a corresponding thread in a drill string driven by a top hammer. The boring is connected to at least one fluid passage (15), which emerges in or in the vicinity of a front face (16) of the head (11). The fluid passage connects to a first groove (17), which connects to a second groove (18) wherein at least three second grooves are provided and form between them axially forward lands. Each land carries a gauge insert (21). The gauge inserts (21) are asymmetrically positioned on the drill bit and the second groove (18) extends radially inwards to or beyond an imaginery circle (C) touching the radially innermost points of the inserts (21) generally in the plane of the front surface (16).



ROCK DRILL BIT

Background of the invention

The present invention relates to a rock drill bit for percussive drilling, comprising a head and a shank. The shank has a central boring in which a thread is provided, said thread being provided to cooperate with a corresponding thread in a drill string driven by a top hammer. The boring is connected to at least one fluid passage, which emerges in or in the vicinity of a front face of the head. The fluid passage connects to a first groove, which connects to a second groove. At least three second grooves are provided and form between them axially forward lands, each of which carries a gauge insert.

Previously known drill bits of the above-mentioned type have a number of disadvantages. The chipways constitute only a small part of the total front face area of the head such that the average diameter of the cuttings have to be small. This means that the hitherto known bits are not particularly suited for excavation purposes. Furthermore their gauge inserts are many in number relative to the diameter of the bit, which means that the chipways must be relatively small. Many gauge inserts also means costly and time-consuming regrinding. In addition the relatively poor flushing resulting from the narrow or small chipways makes it possible for cuttings to build up on the center of the front face. This built-up process impairs transfer of energy to the solid rock material in the bore which also impairs the threads in the drill string.

Objects of the invention

An object of the present invention is to provide a rock drill bit with asymmetrically positioned gauge inserts for enhancing the average diameter of the cuttings.

According to the present invention there is provided a rock drill bit for percussive drilling, comprising a head and a shank, said shank having a central boring in which a thread is provided, said thread being adapted to cooperate with a corresponding thread in a drill string driven by a top hammer, the boring being connected to at least one fluid passage, which emerges in or in the vicinity of a front face of the head, the fluid passage connecting to a first groove, which connects to a second groove wherein at least three second grooves are provided and form between them lands, each land carrying a gauge insert;
wherein the gauge inserts are asymmetrically positioned relative to a center axis of the drill bit and wherein each second groove extends radially inwards to or beyond an imaginary circle touching radially innermost points of the gauge inserts as viewed in a direction parallel to the axis, wherein a radius line of each gauge insert forms a first angle with a radius line of a first adjacent gauge insert and a second angle with a radius line of a second adjacent gauge insert, the first angle being different from the second angle; and each gauge insert having a diameter which is 10-30%, of an outer diameter of the rock drill bit.

Brief description of the drawings

Fig. 1 a rock drill bit according to a first embodiment of the present invention;
Fig. 2 shows the rock drill bit in a cross section along the line II-II in Fig. 1;
Fig. 3 shows the rock drill bit in a bottom view;
Fig. 4 shows a rock drill bit according to a second embodiment of the invention; and
Fig. 5 shows the rock drill bit in a cross section along the line V-V in Fig. 4.

Detailed description of the invention

A rock drill bit 10 for percussive drilling according to the present invention is shown in Figs. 1 and 2. The rock drill bit 10 comprises a drill head 11 and a shank 12 and has a center axis 13. The shank has a central bore provided with a thread 14. The thread 14 is provided to cooperate with a corresponding thread in a drill string driven by a top hammer, not shown. The bore connects to three flushing channels 15 emerging in or in the vicinity of a front face 16 of the head 11. Preferably the front face 16 is perpendicular to the center axis 13. Each channel 15 connects to a first groove 17 which has radially outwardly increasing width and depth and which connects to a second groove or chipway 18. Each chipway 18 is substantially V-shaped and has substantially constant width and depth axially rearwards. The chipway 18 intersects the front face 16 in a frustoconical bevel 19. The number of chipways 18 is larger than the number of the first grooves 17. Axially forward lands 20 protrude between the chipways 18. Each land 20 carries a gauge insert 21 which is inclined

about 35° relative to the center axis 13. The number of lands 20 is 4 to 10 pieces and preferably 4 to 6 pieces, depending on the size of the drill bit. The outer diameter of the drill bit is determined by the gauge inserts 21. The drill bit has three symmetry lines N1 perpendicular to the center axis 13. The gauge inserts are asymmetrically positioned on the drill bit but are symmetrically positioned on each land. With the line II-II as a reference line, see 0° in Fig. 1, the inserts 21 are placed anti-clockwise as follows: 65°; 117.5°; 182.5°; 237.5°; 302.5° and 357.5°. This means that every other chipway 18 has an available space proportional to 65° and that each of the rest of the chipways 18 has an available space proportional to 55°. An insert 21 is positioned such that it forms a first angle α with the center axis 13 and a first adjacent insert 21A. That insert 21 forms a second angle ß with the center axis 13 and a second adjacent insert 21B. The first angle α is always different from the second angle ß. The advantage with such a geometry is the possibility to manufacture some large chipways on the drill bit. The insert 21 projects a distance P1 perpendicularly from the bevel 19. Furthermore three front inserts 22 are provided in the front face 16 and each front insert projects a distance P2. The distance P1 is preferably somewhat larger than the distance P2, about 1 mm. Each gauge insert 21 has a diameter **d** measured at the grip portion of the insert. The diameter **d** is as large as 10 - 30 %, preferably 14 - 30 %, of the diameter of the rock drill bit diameter **D**. When comparing said available space or bow length for the chipway 18 and the gauge insert 21 diameter **d** the space is 1.2 to 1.6 times the gauge insert 21 diameter. The front inserts 22 and the flushing channels 15 form a crown of equal spacing about the center axis 13. Each chipway 18 has a radial extension L1 from the envelope surface of the lands 20 to the bottom of the V-shape that is 10 - 30 % of the drill bit diameter **D** and preferably 14 - 30 %. Stated another way the chipway 18 extend radially inwards to or beyond an imaginary circle **C** touching the radially innermost points of the inserts 21 in the plane of the front surface. The number of gauge insert 21 can be 4 to 10 pieces. The first groove 17

extends radially inwardly beyond the flushing channel 15 towards the center axis 13 of the drill bit and terminates in the vicinity of a central insert 23. The drill bit is provided with 6 axially rearwards lands 24 which have equal spacing of 60°, see Fig. 3. The rearward lands 24 are provided to guide the drill bit in case of deflection. The envelope surface of the rearward lands 24 is on a diameter which is less than the diameter of the envelope surface of the forward lands 20.

Figs. 4 and 5 shows an alternative embodiment of a drill bit 10' according to the present invention constructed for drilling of smaller holes. Like reference numerals define like details as disclosed in connection with Figs. 1 - 3. In this embodiment the drill bit is provided with one central insert 23' in the front face 16' and four gauge inserts 21'. No front inserts are present. The chipway 18' is substantially V-shaped and its width increases but its depth decreases axially rearwardly. The drill bit has only one symmetry line N1 perpendicular to the center axis 13'. The drill bit has no rearward lands. Also in this drill bit the gauge insert 21' are asymmetrically positioned but centrally on each land 20'. With the line V - V taken as a reference, see 0° in Fig. 5, the inserts 21' are spaced as follows in the anti clock-wise direction: 96°; 185° and 272°. This means that an insert 21' is positioned such that it forms a first angle α' with the center axis 13' and a first adjacent insert 21A' and a second angle ß' with the center axis 13' and a second adjacent insert 21B'. The first angle α' is always different from the second angle ß'.

Thus a drill bit with asymmetrically positioned gauge insert 21, 21' has been disclosed, having chipways occupying a relatively large part of the total area of the drill head in order to increase the average diameter of the cuttings to increase penetration rate and to facilitate geological sampling during ordinary drilling. The drill bit 10, 10' has a relatively small number of large gauge insert 21, 21' compared to the diameter of the drill head to

resist diametrical wear and to facilitate regrinding. The drill bit improves power transfer to the hole bottom thereby increasing penetration rate while sparing the threads in the drill string from blow reflexions.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A rock drill bit for percussive drilling, comprising a head and a shank, said shank having a central boring in which a thread is provided, said thread being adapted to cooperate with a corresponding thread in a drill string driven by a top hammer, the boring being connected to at least one fluid passage, which emerges in or in the vicinity of a front face of the head, the fluid passage connecting to a first groove, which connects to a second groove wherein at least three second grooves are provided and form between them lands, each land carrying a gauge insert;

wherein the gauge inserts are asymmetrically positioned relative to a center axis of the drill bit and wherein each second groove extends radially inwards to or beyond an imaginary circle touching radially innermost points of the gauge inserts as viewed in a direction parallel to the axis, wherein a radius line of each gauge insert forms a first angle with a radius line of a first adjacent gauge insert and a second angle with a radius line of a second adjacent gauge insert, the first angle being different from the second angle; and each gauge insert having a diameter which is 10-30%, of an outer diameter of the rock drill bit.

2. The rock drill bit according to claim 1, wherein the diameter of each gauge insert is 14-30% of the outer diameter of the rock drill bit.

3. A rock drill bit according to claims 1 or 2, wherein each second groove is substantially V-shaped as viewed in the direction parallel to the axis.

4. A rock drill bit according to claim 3, wherein each second groove has a radial extension extending from an envelope surface of the lands to the bottom of the V-shape,

the extension being 10-30% of the outer diameter of the drill bit, and wherein a bow length of the second groove is 1.2 to 1.6 times a diameter of the gauge insert.

5. The rock drill bit according to claim 4, wherein the radial extension is 14-30% of the outer diameter of the drill bit.

6. A rock drill bit according to any one of the preceding claims, wherein the number of second grooves is larger than the number of first grooves, and wherein said second grooves form 4 to 10 lands and wherein the number of gauge inserts is 4 to 10.

7. A rock drill bit according to any of the preceding claims, further including a centre insert positioned on the axis, the first groove extends radially inwardly toward the center axis and terminating in the vicinity of the central insert, the gauge inserts being inclined at about 35° relative to the axis.

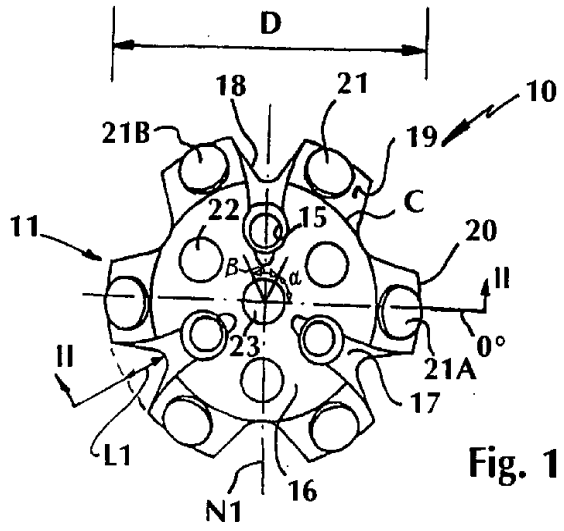
8. The rock drill bit according to any one of the preceding claims, wherein the second grooves define chipways, there being additional chipways not connected to a first groove.

9. The rock drill bit according to claim 8, wherein at least one of the chipways is wider than at least one other of the chipways.

10. The rock drill bit according to any one of the preceding claims, wherein the second groove(s) extend(s) rearwardly at substantially constant width and depth.

11. A rock drill bit substantially as herein described with reference to and as illustrated by the accompanying drawings.

Dated this 25th day of May 2000
SANDVIK AB (PUBL)
By their Patent Attorneys
GRIFFITH HACK
Fellows Institute of Patent and
Trade Mark Attorneys of Australia


D
18
21
10
21B
19
C
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11
20
β
α
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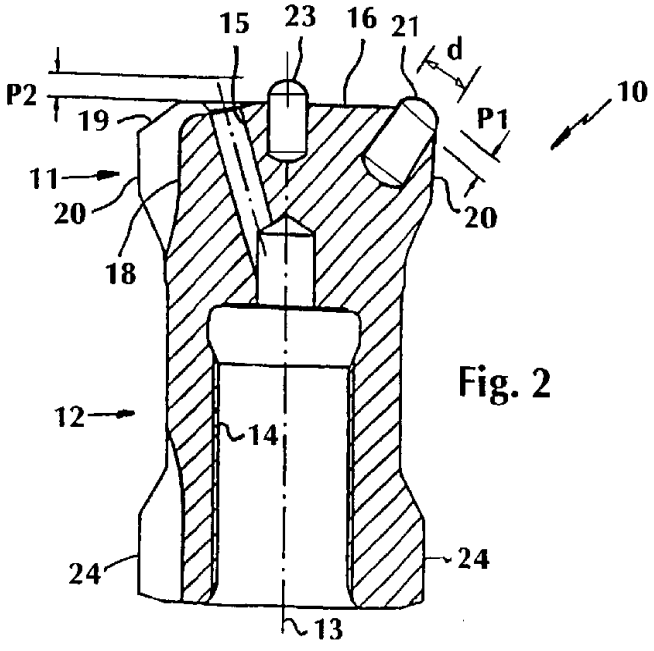
23
0°
II
21A
17
L1
16
N1

Fig. 1


15
23
16
21
d
P2
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P1
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11
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14
24
24
13

Fig. 2

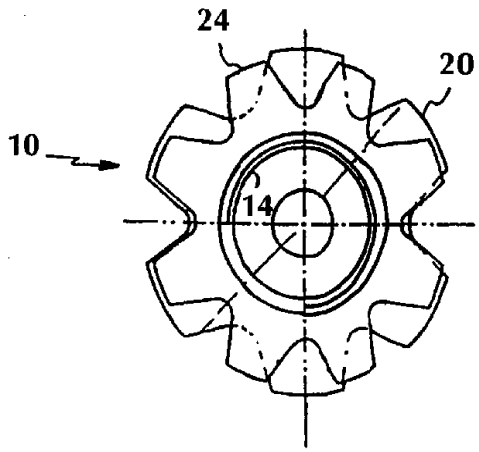

Fig. 3

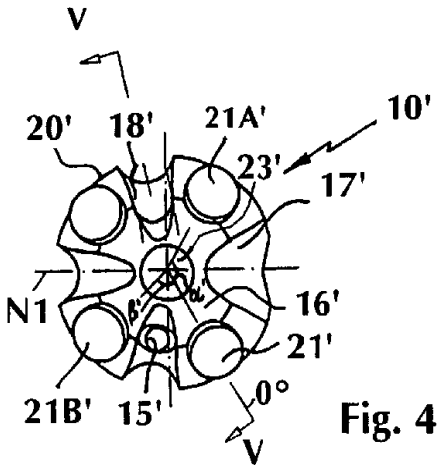

Fig. 4

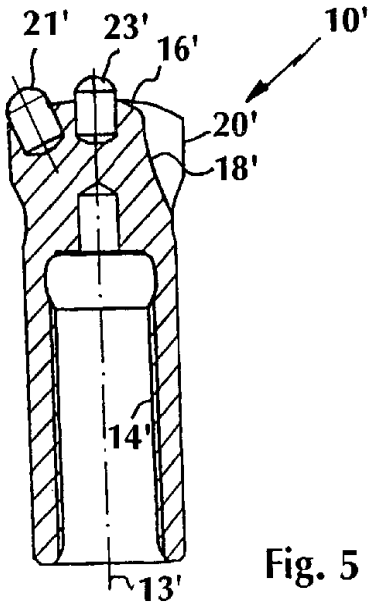

Fig. 5