



(51) International Patent Classification:

E21B 10/46 (2006.01) E21B 10/54 (2006.01)

E21B 10/50 (2006.01) E21B 10/56 (2006.01)

(21) International Application Number:

PCT/EP2020/053522

(22) International Filing Date:

12 February 2020 (12.02.2020)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

19157436.7 15 February 2019 (15.02.2019) EP

(71) Applicant: SANDVIK MINING AND CONSTRUCTION TOOLS AB [SE/SE]; 81181 Sandviken (SE).

(72) Inventor: ROLDAN SALDES, Raul; Stjärngatan 17, 81152 Sandviken (SE).

(74) Agent: FLODMAN, Anna; SANDVIK ASSOCIATION, Sandvik Mining and Construction Oy PL 100, 33311 Tampere (FI).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH,

GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

(54) Title: INSERT FOR A JOURNAL LEG AND / OR A CONE CUTTER OF A ROTARY DRILL TOOL

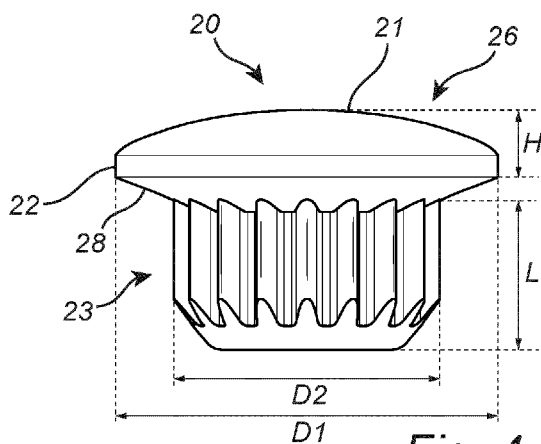


Fig. 4

(57) Abstract: An insert (10, 20) adapted to be mounted in a neck (2) of a journal leg (5) or a cone cutter (103) of a rotary drill tool for cutting rock, the insert being adapted to reinforce the neck (2) of the journal leg (5). The insert (10, 20) has a mushroom shape comprising a hat (16, 26) and a foot (13, 23), the hat (16, 26) having a diameter D1 and the foot (13, 23) having a diameter D2 being smaller than the diameter D1 of the hat (16, 26). Also a journal leg (5) of a rotary drill tool for cutting rock and a cone cutter (103) of a rotary drill tool.

Insert for a journal leg and / or a cone cutter of a rotary drill toolTechnology field

- 5 The present invention relates to an insert for a rotary drill tool and a rotary drill tool comprising an insert.

Background

- 10 Rotary drills have emerged as an effective tool for specific drilling operations such as the creation of blast holes and geothermal wells. The drill typically comprises a rotary drill bit having three journal legs that mount respective cone-shaped rolling cutters via bearing assemblies that include rollers and balls.

- 15 Typically, the drill bit is attached to one end of a drill string that is driven into the borehole via a rig. The cutting action is achieved by generating axial feed and rotational drive forces that are transmitted to the drill bit via the drill rods coupled end-to-end. Each of the cone-shaped cutters comprise externally mounted hardened cutting buttons positioned at different axial regions for optimised cutting as the drill bit rotates.

20

During the drilling operations the journal legs come into contact with the wall. Therefore, this area is subject to excessive wear.

- In order to protect the legs their area closest to the wall is normally covered with some
25 kind of hard facing. Covering the leg with a welded seam is a known solution to protect the shirt tail. An example rotary cone drill bit is described in US 8,522,899.

- However, the known designs are not sufficiently durable. They also involve manual work to a large extent. When welding is used the layout of the welded pattern varies, which
30 results in an irregular wear protection both in thickness and hardness. Another drawback with a welded hard facing is that the surface adherence not always is satisfactory.

-2-

A further problem is that during drilling the cone cutters are subjected to high levels of wear from exposure to cuttings. A groove in the cone cutter, which is typically positioned between the second and third rows of cutting buttons, is provided to aid with the removal of cuttings, is particularly prone to high exposure of the cuttings and excessive wear. The groove may be hard metal welded in order to add protection. However, the problem with a welded protection is that it is difficult to determine if it is thick enough and / or whether it is effectively adhered. Alternatively, additional cutting buttons could be incorporated in the groove, however the ring of steel around the cutting button will wear away quickly due to the high exposure to cuttings and consequently the cutting buttons will become dislodged. Further, it is not desirable to use cutting buttons in the groove as they protrude beyond the surface of the groove in the cone cutter as this would reduce the space available for the cuttings to pass through to be removed.

Accordingly, what is required is a drill tool that addresses the above problems and drawbacks.

Summary

It is an objective of the present invention to provide a rotary drill tool with a journal leg configured for maximum wear protection of the neck of the journal leg. It is a further specific objective to provide a journal leg wear protection that requires a minimum amount of manual work in manufacturing and that the journal leg wear protection is not worn out faster than the cutting buttons that are used for drilling. It is yet a further specific objective to provide a journal leg with an efficient wear protection that also gives the same protection wherever applied and not gives variation in thickness or hardness or any other kind of variation in hardness, layout and design.

According to a first aspect of the present invention there is provided an insert adapted to be mounted in a neck of a journal leg or a cone cutter of a rotary drill tool for cutting rock to provide increased wear protection characterised in that the insert has a mushroom shape comprising a hat and a foot, the hat having a diameter and the foot having a diameter being smaller than the diameter of the hat. When mounted in the neck of a journal leg this shape

-3-

of the insert going beyond the diameter of the hole where the insert is located and above the surface of the neck of the journal leg gives good wear protection. When mounted in the cone cutter this shape of insert provides more effective wear protection and increases the rate of penetration of the rotary drill tool without reducing the efficiency of the removal of cuttings.

Preferably, the insert with the foot has a certain length from its outer end to the joint of the hat. The foot has a tapered outer end. This results in the insert smoothly fitting into the hole.

Preferably, the insert with the hat has a specific height from upper to lower side ranging from 1 mm to 4 mm. More specifically the height might be 2 mm or 3 mm, or it might even be larger than 4 mm, such as 5 mm or 6 mm. The height gives optimal protection of the journal leg.

Optionally, the insert has a hat with a flat top surface. This surface is mainly parallel with the surface of the journal leg. This gives good wear protection in certain types of drilling machines such as HDD when drilling is performed in horizontal directions.

Optionally, the insert has a hat with a rounded top surface. Any type of round can be used such as conical, spherical, ballistic or pointed. A rounded shape has the advantage of smooth wear protection, that is good in certain types of drilling such as rotary drilling.

Optionally, the insert with the hat has a chamfered lower side. This ensures a good fit in the hole.

Preferably, the insert with the diameter of the hat having a relation to the diameter of the foot that is 1,5. This gives good protection around the hole on the shirt of the journal leg.

Preferably, the insert having a height of the hat in relation to the length of the foot being 30% to 65%. This relation can also be 35%, 40%, 45%, 50%, 55% or 60%. A certain thickness of the hat is needed in order to not brake and last for wear protection. The

-4-

relation of the height of the hat versus the diameter of the foot is in the range of 20% to 40%, such that it can also be 25%, 30% or 35%. The relation of the height of the hat versus the diameter of the hat is in the range of 10% to 25%, it could also be 15% or 20%.

- 5 Preferably, the insert has a circumference or perimeter of the foot with lengthwise extending ridges and grooves. This gives a good grip. It also results in less manual work while manufacturing.

According to a second aspect of the present invention there is provided a journal leg of a
10 rotary drill tool for cutting rock comprising at least one insert.

Optionally, the journal leg of a rotary drill tool comprises a plurality of inserts being arranged at the neck of the journal leg. This is an area that is subject to a lot of wear, so the inserts give good protection.

15

Optionally, the journal leg comprises at least four inserts being arranged at the shirt of the journal leg. This area is specifically in need of wear protection, so it is advantageous to arrange inserts in this area.

- 20 Preferably, the journal leg comprises a plurality of inserts being arranged at the shirt of the journal leg such that the outer circumference of the hat is in line with the outer edge of the shirt. The inserts are placed as close to the edge as possible to in the best possible way protect the area specifically in need of wear protection.

- 25 Preferably, the journal leg comprises a plurality of inserts being arranged at the shirt of the journal leg such that the outer circumference of the hat of each insert is arranged adjacent to or on a short distance to the neighbouring insert. This ensures a reliable wear protection.

According to a third aspect of the present invention there is provided a cone cutter of a
30 rotary drill tool for cutting rock comprising at least one insert.

-5-

Preferably, the cone cutter of a rotary drill tool comprises at least one of inserts being arranged in a groove of the cone cutter. This provides wear protection in an area of the cone cutter that is exposed to high levels of wear without reducing the volume within the groove so as to maintain flushing efficiency.

5

Preferably, the cone cutter of a rotary drill tool comprises at least one of inserts being arranged in a collar of the cone cutter. This provides wear protection in an area of the cone cutter that is exposed to high levels of wear.

10 Brief description of drawings

A specific implementation of the present invention will now be described, by way of example only, and with reference to the accompanying drawings in which:

15 Figure 1 is an external perspective view of a rotary cutting tool for mounting at one end of a drill string;

Figure 2 is a perspective view of one of the three journal legs of the tool of figure 1 according to a specific implementation of the present invention;

20

Figure 3 is a side view of one embodiment of an insert of a journal leg;

Figure 4 is a side view of a further embodiment of an insert of a journal leg.

25 Figure 5 is a cross section of a cone cutter according to a further embodiment of the present invention.

Figure 6 is perspective view of a cone cutter according to a further embodiment of the present invention.

30

Detailed description

Referring to figure 1, a rotary cutting tool 100 is formed as a cutting bit and comprises a cutting end 101 at an axially forward position and an axially rearward attachment end 102 configured for mounting at one end of a drill string (not shown) forming part of a drill assembly operated via a drilling rig (not shown) configured to provide axial and rotational drive of tool 100. Tool 100 comprises three journal legs 105 projecting axially forward from attachment end 102 and being aligned slightly radially outward such that cutting end 101 comprises a generally larger cross section than attachment end 102. A generally conical shaped cutter 103 is mounted at an end of each journal leg 105 so as to be capable of rotation relative to leg 105 and independent rotation about a separate axis relative to a general rotation of tool 100 and the drill string (not shown).

Each cone cutter 103 comprises a generally cone or dome shaped configuration. A plurality of sets of cutting buttons that are used for drilling indicated generally by reference 104 (shown on figures 5 and 6) are provided at each respective axial direction of the cone cutter 103. Each cutting button 104 is formed from a wear resistant cemented carbide based material and may comprise any known configuration including semi-spherical, conical, ballistic, semi-ballistic or chisel shaped.

While drilling large number of cuttings pass in touching relation to the neck of the legs 105. This results in excessive wear of the surface of the leg. The leg 105 may be protected from erosion and abrasion of the cuttings by respective protectors 110 mounted there along. Each leg protector 110 may be an insert mounted in a respective socket formed in the respective leg portion by an interference fit. The leg protectors normally have the same diameter as the hole along the entire length. The diameter of the outer end is normally flush with the outer surface of the neck.

Referring to figure 2 disclosing a journal leg 5 of the present invention. A neck 2 is the area of the leg being farthest away from the attachment end to the drill string (seen as 102 in figure 1). At a shirt 3 of the neck is a cone cutter attached. On the neck surface, close to the shirt 3 wear protection is important since wear is heavy in this area. The neck surface is

provided with a number of holes 4 for receiving inserts 10, 20 to act as protectors. The hole 4 has the same diameter along its length with a tapering close to the neck surface, as can be seen in figure 2. In this figure five holes 4, whereof four of them are illustrated to have inserts 10, 20 received therein. The fifth hole is also intended to receive an insert 10, 20.

- 5 The number of holes 4 with protective inserts can be spread throughout a larger area of the neck surface, e.g. as shown in figure 1 having a large number of protectors 110.

Figure 3 discloses a first embodiment of an insert 10 having a general shape of a mushroom. The insert has a foot 13 with a specific length (similar as can be seen in figure 4), on top of which foot a hat 16 is connected. The outer diameter of the hat is larger than the outer diameter of the foot (similar as can be seen in figure 4). The lower part of the hat 18 connecting to the foot having a chamfered shape to smoothly fit into the tapered hole 4. The outer diameter of the foot 13 has a wave shaped layout with ridges 14 and grooves 15 regularly spread around the perimeter throughout the length of the foot, except for the lower part. The lower part of the foot 17 has a tapered section, where the tapering in radial direction is somewhat larger or going deeper into the core of the foot than the grooves 15. This results in the lower part of foot 17 having no ridges. The length L of the foot is defined as from the outer end defining the extremity of the lower part 17 to where the foot 13 intersects with the hat 16. So the length L of the foot includes the lower tapered section.

20

In an alternative version of the insert of the first embodiment the foot may be designed without grooves and ridges, such that the diameter is uniform along its length except for the tapered lower part.

- 25 The first embodiment shown in figure 3 has an upper outer part of the insert being a flat top surface 11 of the hat. As seen from the side the hat contour from the foot and upwards can be described as the chamfered lower part 18 followed by an outer edge of the hat 12, which represents the perimeter of the outer diameter of the hat 16. The outer edge of the hat 12 seen from the side is perpendicular to the top surface 11 or the outer edge of the hat 12 can be said to be parallel with the longitudinal axis of the foot. The contour of the hat also includes a tapered section between the outer edge of the hat 12 and the top surface 11. The height H of the hat 16 is defined as from a point of the horizontal plane that is
- 30

arranged in the intersection of the chamfered lower part 18 and the outer edge of the hat 12 to the horizontal plane representing the top surface 11. The chamfering 18 fits into the tapered hole 4 (seen in figure 2).

- 5 Figure 4 discloses a second embodiment of an insert 20 having a general shape of a mushroom. The insert has a foot 23 with a specific length L, on top of which foot a hat 26 is connected. The outer diameter of the hat D1 is larger than the outer diameter of the foot D2. The lower part of the hat 28 connecting to the foot having a chamfered shape to smoothly fit into the tapered hole 4. The outer diameter of the foot 23 has a wave shaped
- 10 layout with ridges and grooves (similar as the design of the foot in figure 3) regularly spread around the perimeter throughout the length of the foot, except for the lower part. The lower part of the foot has a tapered section, where the tapering in radial direction is somewhat larger or going deeper into the core of the foot than the grooves. This results in the lower part of foot having no ridges. As in the first embodiment the length L of the foot
- 15 is defined as from the outer end to where the foot 23 intersects with the hat 26.

There might also be an alternative design of the second embodiment having a foot without ridges and grooves. This results in a foot with a uniform diameter throughout the length. The diameter however diminishes at the lower part, which is tapered.

20

- The second embodiment shown in figure 4 has an upper outer part of the insert being a rounded top surface 21 of the hat. The top surface 21 can have any rounded shape such as conical, spherical or similar. As seen from the side the hat contour from the foot and upwards can be described as the chamfered lower part 28 followed by an outer edge of the
- 25 hat 22, which represents the perimeter of the outer diameter of the hat 26. The outer edge of the hat 22 seen from the side is parallel with the longitudinal axis of the foot. The contour of the hat then follows with the round top surface 21, so the round shape is intersecting with the outer edge 22. The height H of the hat 26 is defined as from a point of the horizontal plane that is arranged in the intersection of the chamfered lower part 28 and
- 30 the outer edge of the hat 22 to a horizontal plane along the tangent of the uppermost point of the rounded top surface 21.

The outer edge of the hat 12, 22 corresponding to the circumference of the hat 16, 26 being defined by the outer diameter (corresponding to D1, as seen in figure 4). This outer edge 12, 22 of the top of the insert could be arranged close to a neighbouring insert on the journal leg. The outer edge 12, 22 of one insert could even be arranged adjacent to the following insert, such that there is only a very small distance in between. So, nearly in touching relationship with a neighbouring insert. The distance between two inserts following upon each other could also be somewhat larger, i.e. where the edge 3 of the shirttail 2 of the journal leg is more rounded the inserts will be somewhat more distanced due to the curvature of the edge 3.

10

Figures 5 and 6 show an alternative use of inserts 10, 20 where they are used to provide wear protection on a cone cutter 103. The cone cutter 103 having a collar 106 at its bottom end is provided with a plurality of cutting buttons 104 arranged in circumferal rows. The cone cutter 103 surface is provided with a number of holes 4 for receiving inserts 10, 20 to act as protectors. The inserts 10, 20 can be provided anywhere on the surface of the cone cutter 103 where additional wear protection is required. Typically, there is a recessed groove 105, which is normally positioned between the second row 40 and third row 50 of cutting buttons 104, to allow space for the removal of cuttings and for the co-operation with cutting buttons 104 on adjacent cone cutters 103. Preferably, inserts 10, 20 are provided in the groove 105 to add additional wear protection in this region. Inserts 10, 20, could additionally or alternatively be provided in the collar 106 of the cone cutter 103 to add additional wear protection in this region or any other area on the surface of the cone cutter 103 that is exposed to high wear.

25

Claims

1. An insert (10, 20) adapted to be mounted in a neck (2) of a journal leg (5) or a cone cutter (103) of a rotary drill tool for cutting rock to provide increased wear protection
5 characterised in that:
the insert (10, 20) has a mushroom shape comprising a hat (16, 26) and a foot (13, 23), the hat (16, 26) having a diameter (D1) and the foot (13, 23) having a diameter (D2) being smaller than the diameter (D1) of the hat (16, 26).
- 10 2. The insert (10, 20) as claimed in claim 1 wherein the foot (13, 23) has a certain length (L) from its outer end to the joint of the hat (16, 26);
and wherein the foot (13, 23) has a tapered outer end (17).
3. The insert (10, 20) as claimed in any preceding claim wherein the hat (16, 26) has
15 a specific height (H) from upper to lower side ranging from 1 mm to 4 mm.
4. The insert (10) as claimed in any preceding claim wherein the hat (16) has a flat top surface (11).
- 20 5. The insert (20) as claimed in any of claims 1 to 3 wherein the hat (26) has a rounded top surface (21).
6. The insert (10, 20) as claimed in any preceding claim wherein the hat (16, 26) has a chamfered lower side (18, 28).
25
7. The insert (10, 20) as claimed in any preceding claim wherein the diameter (D1) of the hat (16, 26) has a relation to the diameter (D2) of the foot (13, 23) that is 1,5.
8. The insert (10, 20) as claimed in any preceding claim wherein the height (H) of
30 the hat (16, 26) in relation to the length (L) of the foot (13, 23) is 30% to 65%.

9. The insert (10, 20) as claimed in any preceding claim wherein the circumference/perimeter of the foot (13, 23) has lengthwise extending ridges (14) and grooves (15).

5 10. A journal leg (5) of a rotary drill tool for cutting rock comprising at least one insert (10, 20) according to any preceding claim.

11. The journal leg (5) of a rotary drill tool according to claim 10 comprising a plurality of inserts (10, 20) being arranged at the neck (2) of the journal leg (5).

10

12. The journal leg (5) of a rotary drill tool according to any of claims 10 or 11 comprising at least four inserts (10, 20) being arranged at the skirt (3) of the journal leg (5).

13. The journal leg (5) of a rotary drill tool according to any of claims 10 to 12
15 comprising a plurality of inserts (10, 20) being arranged at the skirt (3) of the journal leg (5) such that the outer circumference of the hat (16, 26) is in line with the outer edge of the skirt (3).

14. The journal leg (5) of a rotary drill tool according to any of claims 10 to 13
20 comprising a plurality of inserts (10, 20) being arranged at the skirt (3) of the journal leg (5) such that the outer circumference of the hat (16, 26) of each insert (10, 20) is arranged adjacent to or on a short distance to the neighbouring insert (10, 20).

15. A cone cutter (103) of a rotary drill tool for cutting rock comprising
25 at least one insert (10, 20) according to any of claims 1 to 9.

16. The cone cutter (103) of a rotary drill tool according to claim 15 comprising at least one of inserts (10, 20) being arranged in a groove (105) of the cone cutter (103).

30 17. The cone cutter (103) of a rotary drill tool according to any of claims 15 to 16 comprising at least one of inserts (10, 20) being arranged in a collar (106) of the cone cutter (103).

1/3

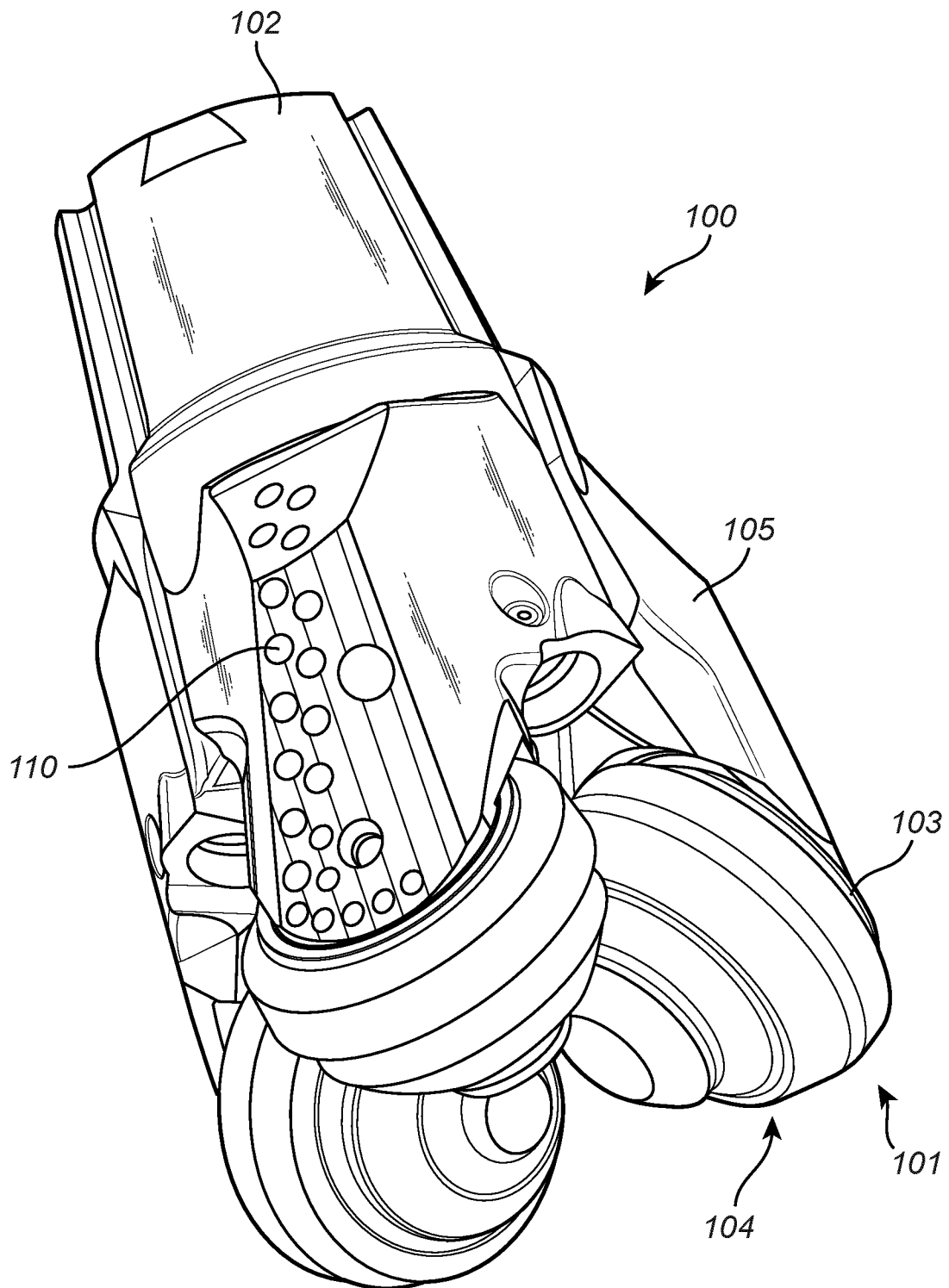
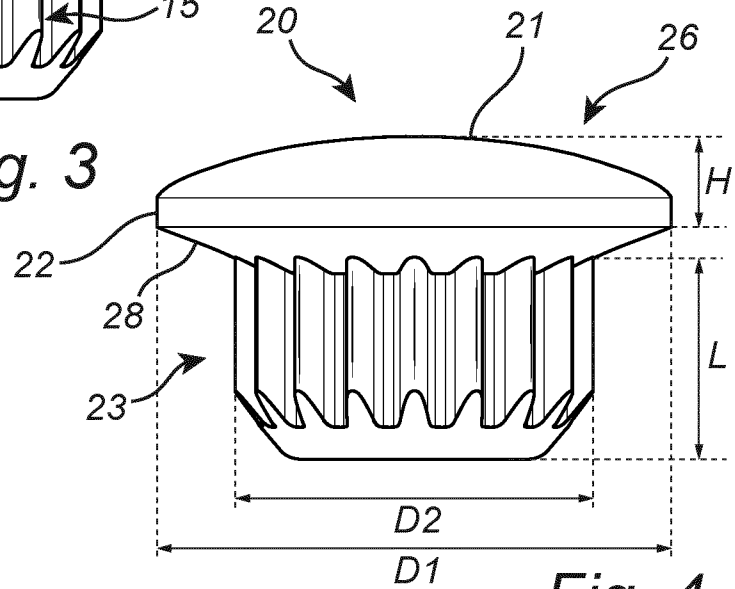
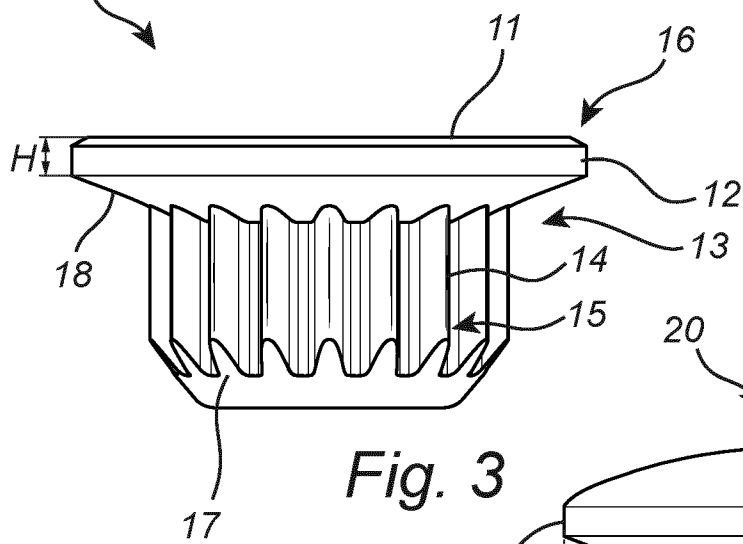
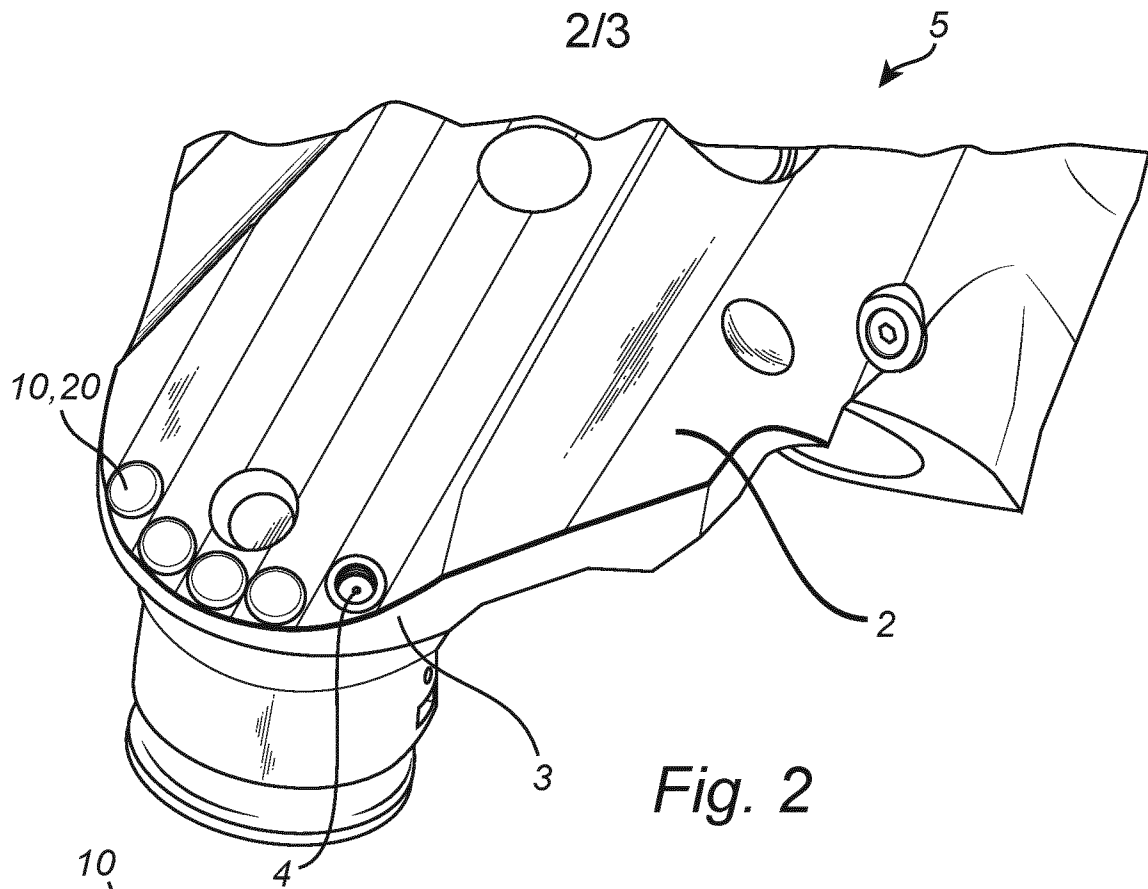


Fig. 1



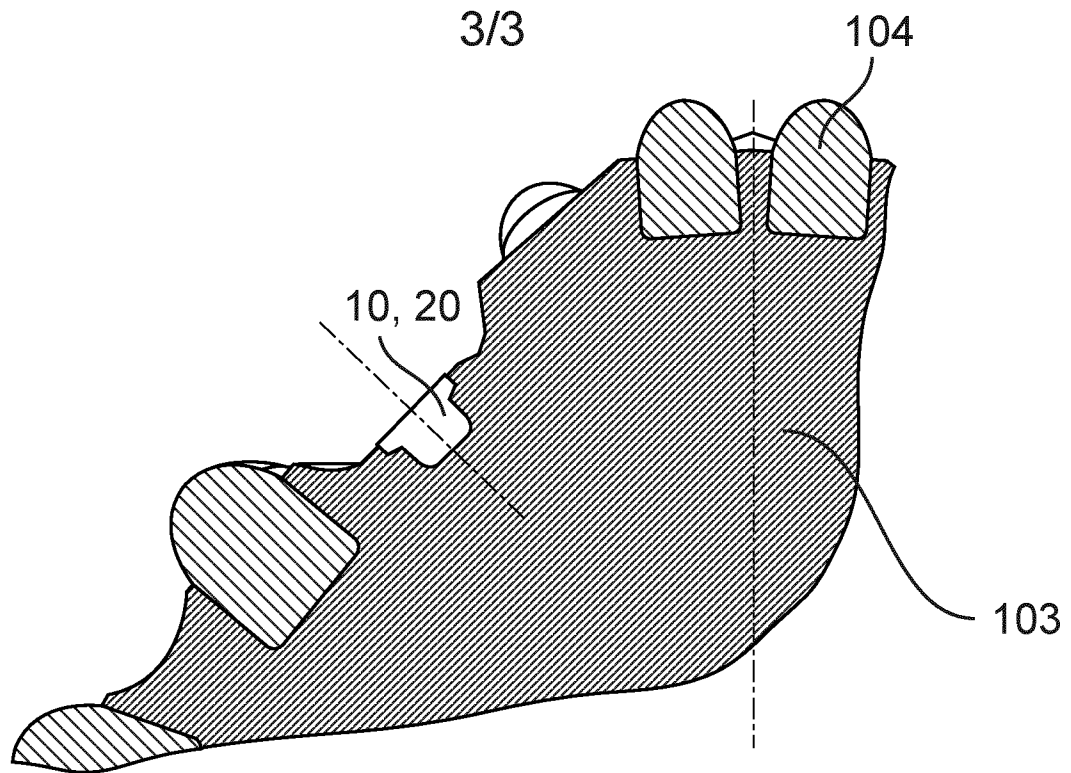


Fig. 5

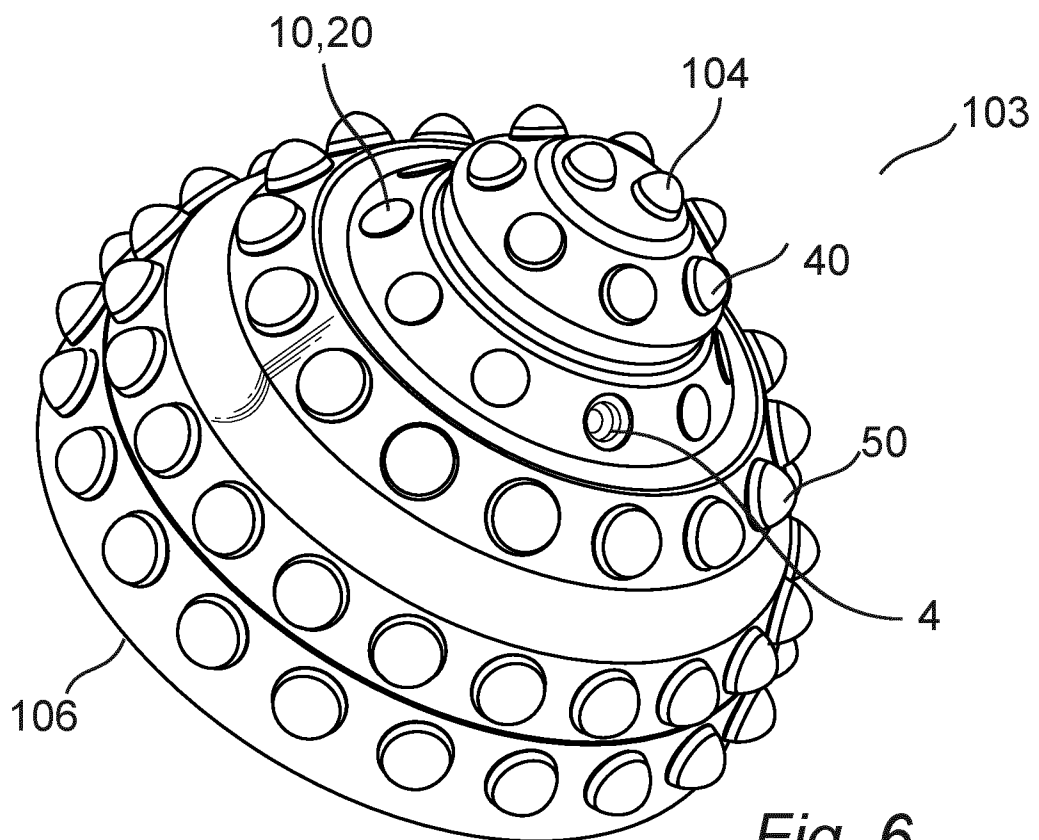


Fig. 6

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2020/053522

A. CLASSIFICATION OF SUBJECT MATTER INV. E21B10/46 E21B10/50 E21B10/54 E21B10/56 ADD.		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) E21B		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPO-Internal, WPI Data		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 1 343 040 A (STEBLEY F E) 10 January 1974 (1974-01-10) page 1, lines 10-16; figures 3, 4, 9 page 2, lines 55-66, 76-83 -----	1-17
A	US 5 890 550 A (SWADI MOHAMMAD [US] ET AL) 6 April 1999 (1999-04-06) figures 1-5 -----	1-17
A	EP 0 083 287 A1 (STENUICK FRERES [BE]) 6 July 1983 (1983-07-06) figures 1, 3,5 -----	1-17
A	US 3 389 761 A (OTT EUGENE G) 25 June 1968 (1968-06-25) figures 1, 5A -----	1-17
☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
* Special categories of cited documents : "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 3 April 2020		Date of mailing of the international search report 15/04/2020
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer Georgescu, Mihnea

INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP2020/053522

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☒ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-17

-

1.1. claims: 1-9

An insert (10, 20) adapted to be mounted in a neck (2) of a journal leg (5) or a cone cutter (103) of a rotary drill tool for cutting rock to provide increased wear protection characterised in that: the insert (10, 20) has a mushroom shape comprising a hat (16, 26) and a foot (13, 23), the hat (16, 26) having a diameter (D1) and the foot (13, 23) having a diameter (D2) being smaller than the diameter (D1) of the hat (16, 26).

1.2. claims: 10-14

A journal leg (5) of a rotary drill tool for cutting rock comprising at least one insert (10, 20) according to any preceding claim.

1.3. claims: 15-17

A cone cutter (103) of a rotary drill tool for cutting rock comprising at least one insert (10, 20) according to any of claims 1 to 9.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2020/053522

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB 1343040	A	10-01-1974	NONE

US 5890550	A	06-04-1999	US 5890550 A 06-04-1999
		US 6607047 B1	19-08-2003

EP 0083287	A1	06-07-1983	AT 15249 T 15-09-1985
		DE 3265914 D1	03-10-1985
		EP 0083287 A1	06-07-1983
		ES 276309 U	01-05-1984
		FR 2519064 A1	01-07-1983

US 3389761	A	25-06-1968	NONE
