

(51) Int Cl.: **E21C 35/18** ^(2006.01) **B28D 1/18** ^(2006.01)

(22) Date of filing: **03.07.2014**

(72) Inventors:

- **Fader, Joseph**
Marietta, GA 30066 (US)
- **Lammer, Alfred**
8740 Zeltweg (AT)

nular shoulder is provided at the cutting bit mounting end of the adaptor having a wedge configuration so as to mount the cutting bit at a tilted angle relative to the shank of the adaptor to provide a desired cutting bit attack angle.



Description

Field of invention

[0001] The present invention relates to a cutting bit retaining assembly for mounting a cutting bit at a cutting machine and in particular although not exclusively, to the assembly configurable to change the attack angle of the bit.

Background art

[0002] Rock cutting and excavation machines have been developed for various specific applications including mining, trenching, tunnelling, foundation drilling, road milling, etc. Typically, a drive body in the form of a rotatable drum or drill head comprises a plurality of replaceable cutting bits that provide the points of contact for the material or mineral face.

[0003] For example, a mobile mining machine comprises a rotatable cutting head with the cutting bits provided on rotating drums. As the bits contact the surface of the rock they occasionally break and inevitably wear resulting in decreased cutting inefficiency and a need for replacement. It is therefore desirable to mount the cutting bits at the cutting head (or drive body) via releasable mounting assemblies that enable the bits to be replaced conveniently and quickly during servicing and repair.

[0004] Cutting bit (alternatively termed '*cutting pick*' or '*tool pick*') mountings are described in US 3,342,531; US 3,627,381; US 3,932,952; US 4,343,516; US 5,261,499; WO 96/31682; US 5,799,741; WO 98/39553; US 2008/0258536; US 2008/0309148; WO 2010/027315; US 2011/0278908 and EP 2514918.

[0005] Cutting bits have been developed that may be considered to fall in at least two general categories. A first general type comprises a nose portion attached at one end of an elongate shaft whilst a second type comprises a bit having an inner cavity that fits onto an end of an '*adaptor*' that comprises a projection head and an elongate shaft, with the head received within the inner cavity of the bit and the shank secured at a through bore extending within a mount body.

[0006] The angle by which the bit strikes the rock is referred to as the '*attack angle*' and is an important cutting parameter. Super hard pick materials, such as diamond composites, exhibit enhanced wear resistance and are ideal for certain rock types. However due to their brittleness, a larger attack angle of 55 to 60° is preferred in contrast to a more conventional range being 40 to 50°. Conventional pick holders or mounts fix the pick at a predetermined attack angle and it is currently not possible for an operator to conveniently change the attack angle to take advantage of the different pick materials that are available to best suit particular cutting applications and rock or mineral types.

Summary of the Invention

[0007] It is an objective of the present invention to provide a cutting bit retaining assembly to allow the setting of different pick mounting angles. It is a further specific objective to allow the convenient and rapid interchange of picks formed from different materials that accordingly are optimised via the employment of different attack angle settings relative to a pick holder. It is a yet further specific objective to provide an assembly that allows the convenient interchange (within the working environment) and reliable mounting of different picks at a cutting head without having to exchange the head mounted pick holder.

[0008] The objectives are achieved via a pick retaining assembly in which a pick is releasably mounted at an adaptor, having a shaft-like configuration that, in turn, releasably mounted at a pick holder. In particular, the adaptor is configured with a pick mounting projection at one end of a shaft that is orientated at a predetermined transverse angle relative to a longitudinal axis of the shaft. Such an arrangement is effective to mount the pick at a tilted orientation representing a predetermined attack angle. By interchange of different adaptors having respective mounting projections set at different transverse angles relative to the central axis of the shaft, the pick attack angle may be adjusted conveniently. In particular, the adaptor may be releasably retained at the holder via a conventional retainer optionally in the form of a releasably clip, ring or bolt engageable with the shaft and pick holder. Additionally, the pick may be releasably engaged at the male projection by a corresponding retainer to provide a releasable couple between the projection and the bit.

[0009] According to a first aspect of the present invention there is provided a cutting bit retaining assembly for mounting a cutting bit at a cutting machine, the assembly comprising: a holder body having a bore extending in a direction between a forward and a rearward end of the body, an end surface positioned at an entrance of the bore; an elongate bit shaft having a central longitudinal axis and configured to extend axially into the bore to mount the shaft at the holder body; the shaft terminated at one end by a male projection configured to be received within a female cavity formed within a cutting bit attachable to the shaft; a shoulder projecting radially outward from the shaft at an axial junction of the male projection and a first end of the shaft, an underside surface of the shoulder configured to mate in touching or near touching contact with the end surface to support mounting of the shaft at the holder body; characterised in that: a central longitudinal axis of the male projection is aligned transverse to the longitudinal axis of the shaft such that the male projection is fixed at a generally tilted angle θ relative to the shaft so as to mount the bit at a predetermined attack angle relative to the holder body.

[0010] Advantageously, the bit is rotatably mounted at the projection whilst the adaptor (comprising the elongate

shaft and male projection) is non-rotatably mounted at the holder body so as to maintain the predetermined attack angle of the bit when mounted at the adaptor. The subject invention according to a further aspect may also comprise a set or kit of parts comprising a plurality of adaptors having respective shoulders of different configurations so as to provide respective male projections that are inclined or tilted relative to the longitudinal axis of the shaft at different respective angles. Such an arrangement is advantageous to allow a user to conveniently interchange different adaptors at the holder body to obtain the desired bit attack angle in use.

[0011] Preferably, the shoulder is configured as a wedge having an axially thicker part relative to an axially thinner part, the underside surface provided at an underside of the wedge. The respective parts represent circumferential regions of the shoulder around the central axis. The relative axial thickness of the shoulder in a circumferential direction around the axis changes according to a smooth seamless transition so as to provide an uninterrupted annular surface for supporting contact with the rearward surface of the bit and the axially forward surface of the holder body. Such an arrangement is advantageous to effectively distribute the loading forces transmitted through the shoulder from the bit to the holder body. Accordingly and preferably, the shoulder comprises a forward facing surface to mate with a rearward facing surface of the bit.

[0012] Preferably, the angle by which the longitudinal axis of the male projection is transverse to the longitudinal axis of the shaft is in a range 1 to 60°; 1 to 40°; 1 to 30°; 2 to 20°; and more preferably 5 to 15°. Such an arrangement is effective to provide the desired range of different attack angle settings available by interchanging different adaptors at the holder body, with each adaptor having a different respective tilt angle.

[0013] Preferably, the shaft or the shoulder further comprises a first locking member and the holder body comprises a second locking member, the first and second members configured to engage and prevent the shaft rotating within the bore. Optionally, the first member comprises a male abutment projecting radially from the shaft or axially from the shoulder and the second member comprises a recess to at least partially receive the first member. Interlocking lug and groove arrangements are a convenient means of rotatably locking the adaptor at the holder body to prevent undesirable rotation. According to further embodiments, the adaptor and holder body may comprise a plurality of lug and recess mating components distributed and spaced apart circumferentially around the central axis of the shaft. Additionally, respective locking components may be provided at different axial positions of the adaptor and holder body including for example axially forward, axially mid and axially rearward positions relative to the forward mounted bit.

[0014] Preferably, the shoulder is formed integrally with the shaft. Such an arrangement is advantageous to provide a reliable and strong adaptor effective to reliably

transmit the loading forces from the bit to the holder body and to reduce the creation of stress concentrations.

[0015] Preferably, an axially rearward region of the male projection comprises a concave or tapered annular surface extending axially forward from the shoulder to mate in close touching contact with a convex or tapered surface within the cavity of the bit. Accordingly, the loading forces are transmitted evenly and effectively from the bit to the adaptor whilst allowing the bit to rotate on the adaptor.

[0016] Preferably, the shaft comprises a length sufficient to extend axially through the bore such that a rearward second end of the shaft projects from the rearward end of holder body; and the assembly further comprises a retainer mountable at or towards the second end of the shaft to releasably retain the shaft at the holder body. The adaptor may be axially locked at the holder body via a plurality of different mechanisms including for example threaded shaft and bolt arrangements; releasable clips; hole and pin or lug and groove arrangements and locking collar or ring arrangements as will be appreciated by those skilled in the art.

[0017] Optionally, an axial length of the male projection is substantially in a range 1/4 to 1/2 of an axial length of the shaft that extends rearwardly from the shoulder. Such an arrangement is effective to provide a secure mount of the bit at a forward end of the adaptor whilst providing a secure mount of the adaptor within the holder body.

[0018] According to a second aspect of the present invention there is provided a cutting bit assembly for mounting at a cutting machine comprising: a retaining assembly as claimed herein; and a cutting bit having a cutting tip at first end and a cavity projecting inwardly from a second end, the bit releasably mounted at the shaft via mating of the male projection within the cavity.

[0019] Preferably, the shoulder is annular to provide an annular underside surface. Preferably, the shoulder comprises an axial length sufficient to axially separate and provide a spatial gap between the second end of the bit and the forward end of the holder body. The spatial gap is sufficient to provide non-touching contact between the bit and the holder body to ensure loading forces are transmitted from the bit to the holder body exclusively via the adaptor. The minimum axial length of the shoulder is therefore configured to avoid touching contact between the bit and the holder body over the entire tilt-angle range of the male projection. The axial separation distance between the rearwardmost part of the bit and a respective forwardmost part of the holder body may vary for different adaptors having different projection tilt angles.

Brief description of drawings

[0020] 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:

Figure 1 is an external side view of a cutting bit as-

sembly in which a cutting head is releasably mounted at a mount body via an intermediate shank-like adaptor according to a specific implementation of the present invention;

Figure 2 is cross sectional side view through the cutting bit assembly of figure 1;

Figure 3 is an exploded external perspective view of the cutting bit assembly of figure 2 with the cutting bit removed for illustrative purposes;

Figure 4 is an exploded external perspective view of a cutting bit retaining assembly according to a further specific implementation of the present invention with the cutting bit removed for illustrative purposes.

Detailed description of preferred embodiment of the invention

[0021] Referring to figure 1, a cutting bit assembly 100 is adapted for mounting at an external surface of a rotatable cutting head (or drum) of a cutting machine (not shown). The assembly 100 comprises a cutting bit 101 releasably and rotatably mounted at a cutting bit holder 103 via an elongate adaptor 102 that is, in turn, releasably mounted at bit holder body 103. Bit 101 comprises a generally conical shape profile having a forward end 104 that mounts a cutting tip 106 and rearward end 105 mounted at a forward end 107 of holder body 103. Holder body 103 is mounted at the cutting head (or drum) via a mounting flange 109 projecting laterally from one side of holder body 103. A shoulder 110 projects radially outward from adaptor 102 and comprises a generally wedge shaped configuration. Shoulder 110 comprises a forward facing annular surface 111 positioned in contact with bit rearward end 105 and a rearward facing annular surface 112 positioned in contact with an annular surface 113 at holder body forward end 107. Accordingly, shoulder 110 is configured to axially separate bit 101 from holder body 103 so that these two components are spaced apart in non-touching contact. Additionally, bit 101 via the wedge configuration of shoulder 110 is mounted at a tilted transverse angle relative to adaptor 102 so as to provide a desired attack angle when bit 101 is brought into contact with rock.

[0022] Referring to figure 2, adaptor 102 comprises an elongate shaft 220 that extends axially rearward from shoulder 110 and in particular rearward facing surface 112. Shaft 220 is terminated at a first end by a male projection indicated generally by reference 202. Projection 202 comprises a substantially circular end face 210 and has a main body that flares radially outward via an external concave surface 206 that terminates at its rearwardmost end via an axially short cylindrical surface 208 that extends axially forward from annular forward facing surface 111. A second end 212 of shaft 220 projects axially rearward from a rearward end 108 of holder body

103 with shaft 220 accommodated within a through bore 218 extending axially through holder body 103 between the forward and rearward ends 107, 108. An annular groove 217 is indented at shaft second end 212 to receive a retaining clip (not shown) or the like to axially lock adaptor 102 at holder body 103. Additionally, shaft 220 comprises an annular channel 216 positioned substantially axially mid-way between shoulder 110 and second end 212 to partially accommodate and engage with an attachment ring 215 sandwiched between shaft 220 and the internal surface that defines bore 218.

[0023] Bit 101 comprises an internal cavity indicated generally by reference 201 that extends axially inward from rearward end 105. Cavity 201 is shaped and dimensioned to receive projection 202 in generally close fitting contact such that bit 101 may be conveniently mounted and dismounted from adaptor 102 via the coupling between projection 202 and cavity 201. Additionally, bit 101 is rotatably mounted at projection 202 via an intermediate coupling ring 204 housed within cavity 201 and positioned radially between projection 202 and an internal facing surface 207 of cavity 201. In particular, an annular channel 203 is indented radially into bit 101 from cavity surface 207 to at least partially accommodate ring 204. Similarly, a corresponding channel 205 is indented within projection 202 to at least partially receive an opposite face of ring 204 such that ring 204 is accommodated within and between the respective channels 203, 205 to releasably retain bit 101 at adaptor 102. Cavity surface 207 at the region of the cavity opening (extending axially inward from rearward end 105) comprises a convex curvature so as to mate in close touching contact with the concave external surface of projection 202 at the position immediately axially forward of shoulder 110. Such a configuration is advantageous to optimise distribution of the loading forces imparted to bit 101 during crushing impacts to avoid stress concentrations at this region.

[0024] Shoulder 110 comprises an annular configuration with forward and rearward annular surfaces 111, 112 positioned in close touching engagement contact with the respective rearward annular surface 200 at bit rearward end 105 and adaptor body annular surface 113. The respective shoulder abutment surfaces 111, 112 are aligned transverse to one another and are separated by a cylindrical surface 219. As shoulder 110 is wedge shaped it comprises an axial thickness that is non-uniform in a circumferential direction around longitudinal axis 211 about which shoulder 110 is centred such that surface 219 extends in the axial direction but is aligned transverse to axis 211. In particular, a circumferential segment 214 of shoulder 110 is axially thicker than a corresponding circumferential segment 213. Accordingly, a length of cylindrical surface 219 (in the generally axial direction) is greater at the thicker segment 214 than the thinner segment 213. Additionally, and according to the specific implementation, a radial separation of cylindrical surface 219 from axis 211 at thicker segment 214 is greater than the corresponding radial separation of sur-

face 219 from axis 211 at thinner segment 213. This wedge configuration of shoulder 110 provides an effective angled seat for bit 101 such that the central axis 209 of bit 101 is aligned transverse to shaft axis 211 via a tilt angle θ . Axis 209 also corresponds to the central axis of projection 202 being received centrally within cavity 201. According to the specific implementation, the tilt angle by which projection 202 and bit 101 extend relative to axis 211 is in the range 8° to 12° .

[0025] To maintain the desired angular alignment of projection 202 (and hence bit 101) relative to bit holder surface 113 and shaft axis 211, adaptor 102 is rotatably locked at holder body 103 via a rotational locking mechanism. In particular, and referring to figure 3, the locking mechanism comprises a male abutment 301 that projects radially outward from shaft 220 immediately rearward of shoulder 110 and in particular rearward facing shoulder surface 112. Accordingly, abutment 301 is formed as a lug provided at the forward end of shaft 220. A corresponding recess 300 is formed within a mouth 302 of bore 218 being shaped and dimensioned to accommodate abutment lug 301 and in turn rotationally lock adaptor 102 at holder body 103. In particular, shaft 220 is prevented from rotation about axis 211 within bore 218 via mating abutment contact between lug 301 and recess 300.

[0026] Figure 4 illustrates an alternative embodiment in which a lug or axial projection 401 extends rearwardly from shoulder rearward facing surface 112. Lug 401 is formed as a truncated cylinder and is radially separated from shaft 220. According to the further embodiment, holder body 103 comprises a corresponding substantially cylindrical shaped recess 400 indented in forward facing annular surface 113 being radially separated from bore mouth 302. Accordingly, when adaptor 102 is mounted at holder body 103, lug 401 engages into recess 400 to rotationally lock shaft 220 within bore 218.

Claims

1. A cutting bit (101) retaining assembly (100) for mounting a cutting bit (101) at a cutting machine, the assembly comprising:

a holder body (103) having a bore (218) extending in a direction between a forward (107) and a rearward (108) end of the body (103), an end surface (113) positioned at an entrance (302) of the bore (218);

an elongate bit (101) shaft (220) having a central longitudinal axis (211) and configured to extend axially into the bore (218) to mount the shaft (220) at the holder body (103);

the shaft (220) terminated at one end by a male projection (202) configured to be received within a female cavity (201) formed within a cutting bit (101) attachable to the shaft (220);

a shoulder (110) projecting radially outward from the shaft (220) at an axial junction of the male projection (202) and a first end of the shaft (220), an underside surface (112) of the shoulder (110) configured to mate in touching or near touching contact with the end surface (113) to support mounting of the shaft (220) at the holder body (103);

characterised in that:

a central longitudinal axis (209) of the male projection (202) is aligned transverse to the longitudinal axis (211) of the shaft (220) such that the male projection (202) is fixed at a generally tilted angle (θ) relative to the shaft (220) so as to mount the bit (101) at a predetermined attack angle relative to the holder body (103).

2. The assembly as claimed in claim 1 wherein the shoulder (110) is configured as a wedge having an axially thicker part (214) relative to an axially thinner part (213), the underside surface (112) provided at an underside of the shoulder (110).
3. The assembly as claimed in claim 2 wherein the underside surface (112) and the end surface (113) are substantially planar to mate in close touching contact.
4. The assembly as claimed in any preceding claim wherein the shoulder (110) comprises a forward facing surface (111) to mate with a rearward facing surface (200) of the bit (101).
5. The assembly as claimed in any preceding claim wherein the angle (θ) by which the longitudinal axis (209) of the male projection (202) is transverse to the longitudinal axis (211) of the shaft (220) is in a range 1 to 60° .
6. The assembly as claimed in claim 5 wherein the range of the angle (θ) is 2 to 20° .
7. The assembly as claimed in any preceding claim wherein the shaft (220) or the shoulder (110) further comprises a first locking member (301, 401) and the holder body (103) comprises a second locking member (300, 400), the first and second members (301, 401, 300, 400) configured to engage and prevent the shaft (220) rotating within the bore (218).
8. The assembly as claimed in claim 7 wherein the first member (301, 401) comprises a male abutment projecting from the shaft (220) or the shoulder (110) and the second member (300, 400) comprises a recess to at least partially receive the first member (301, 401).

9. The assembly as claimed in any preceding claim wherein the shoulder (110) is formed integrally with the shaft (220).
10. The assembly as claimed in any preceding claim wherein an axially rearward region of the male projection (202) comprises a concave or tapered annular surface (206) extending axially forward from the shoulder (110) to mate in close touching contact with a convex or tapered surface (207) within the cavity (201) of the bit (101). 5 10
11. The assembly as claimed in any preceding claim wherein the shaft (220) comprises a length sufficient to extend axially through the bore (218) such that a rearward second end (212) of the shaft (220) projects from the rearward end (108) of holder body (103); and the assembly further comprises a retainer mountable at or towards the second end (212) of the shaft (220) to releasably retain the shaft (220) at the holder body (103). 15 20
12. The assembly as claimed in any preceding claim wherein an axial length of the male projection (202) is substantially in a range $1/4$ to $1/2$ of an axial length of the shaft (220) that extends rearwardly from the shoulder (110). 25
13. A cutting bit assembly for mounting at a cutting machine comprising: 30
- a retaining assembly (100) as claimed in any preceding claim; and
- a cutting bit (101) having a cutting tip (106) at first end (104) and a cavity (201) projecting inwardly from a second end (105), the bit (101) releasably mounted at the shaft (220) via mating of the male projection (202) within the cavity (201). 35 40
14. The assembly as claimed in claim 13 wherein the shoulder (110) is annular to provide an annular underside surface (112). 45
15. The assembly as claimed in claims 13 or 14 wherein the shoulder (110) comprises an axial length sufficient to axially separate and provide a spatial gap between the second end (105) of the bit (101) and the forward end (107) of the holder body (103). 50

55

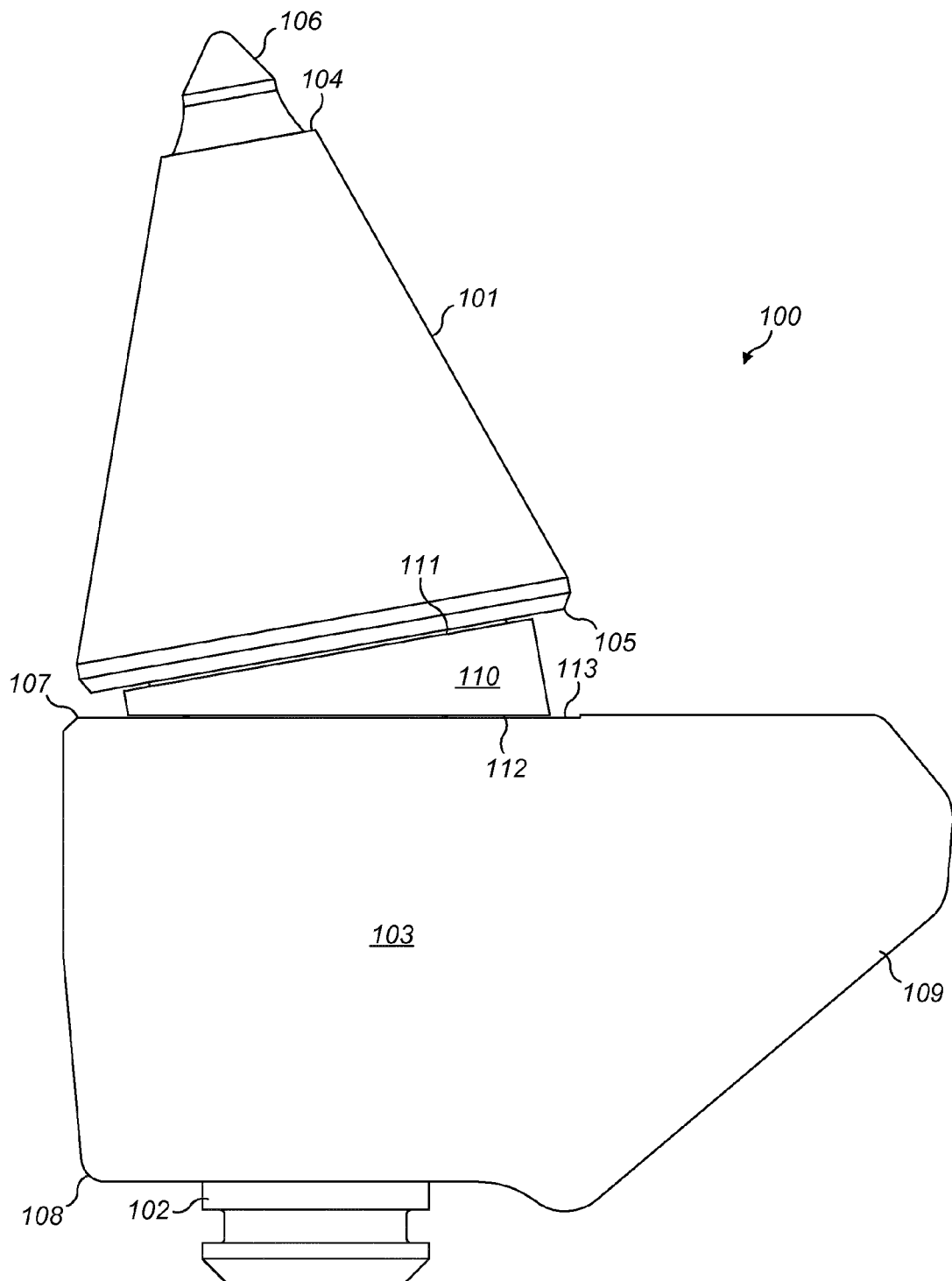


FIG. 1

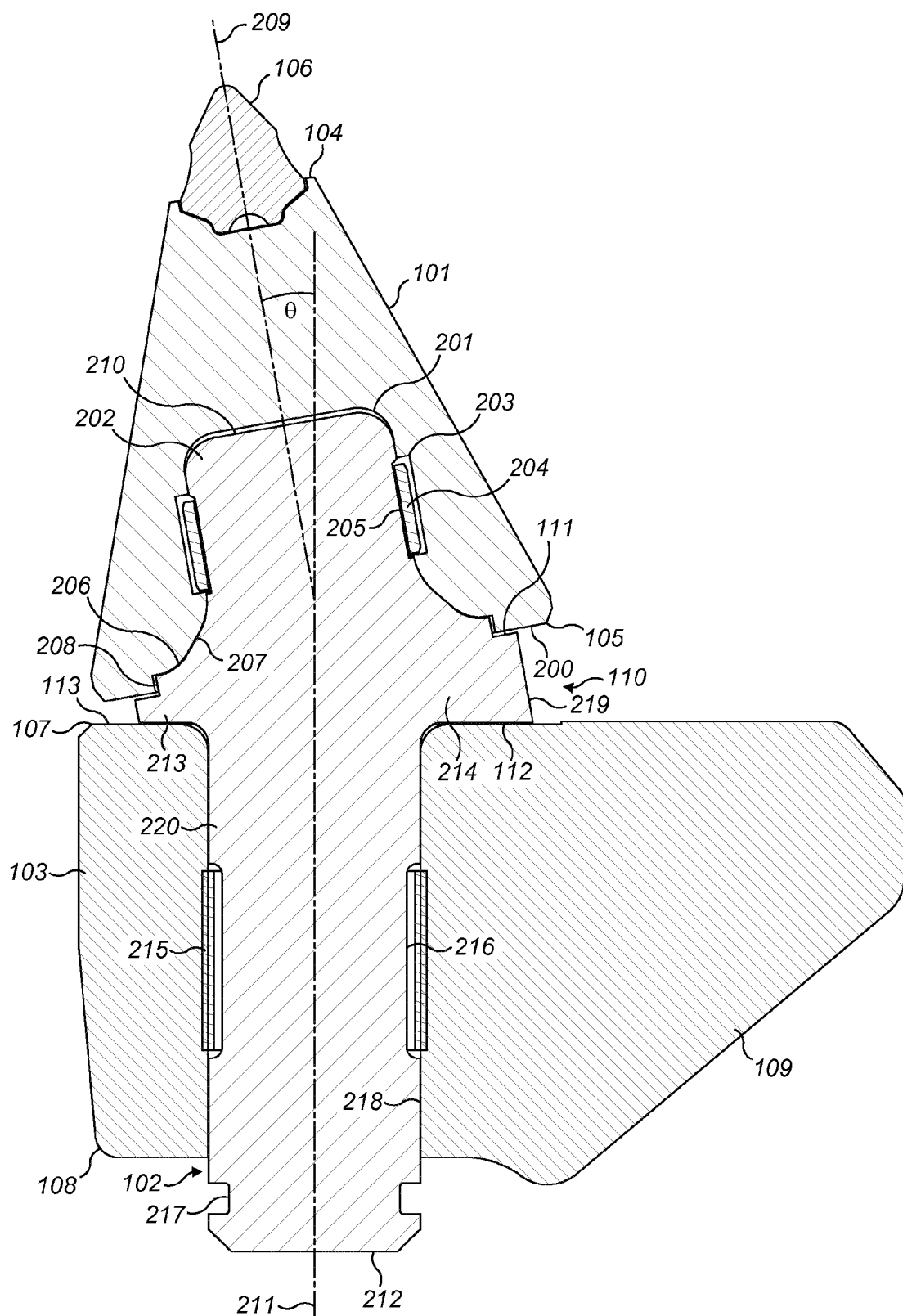


FIG. 2

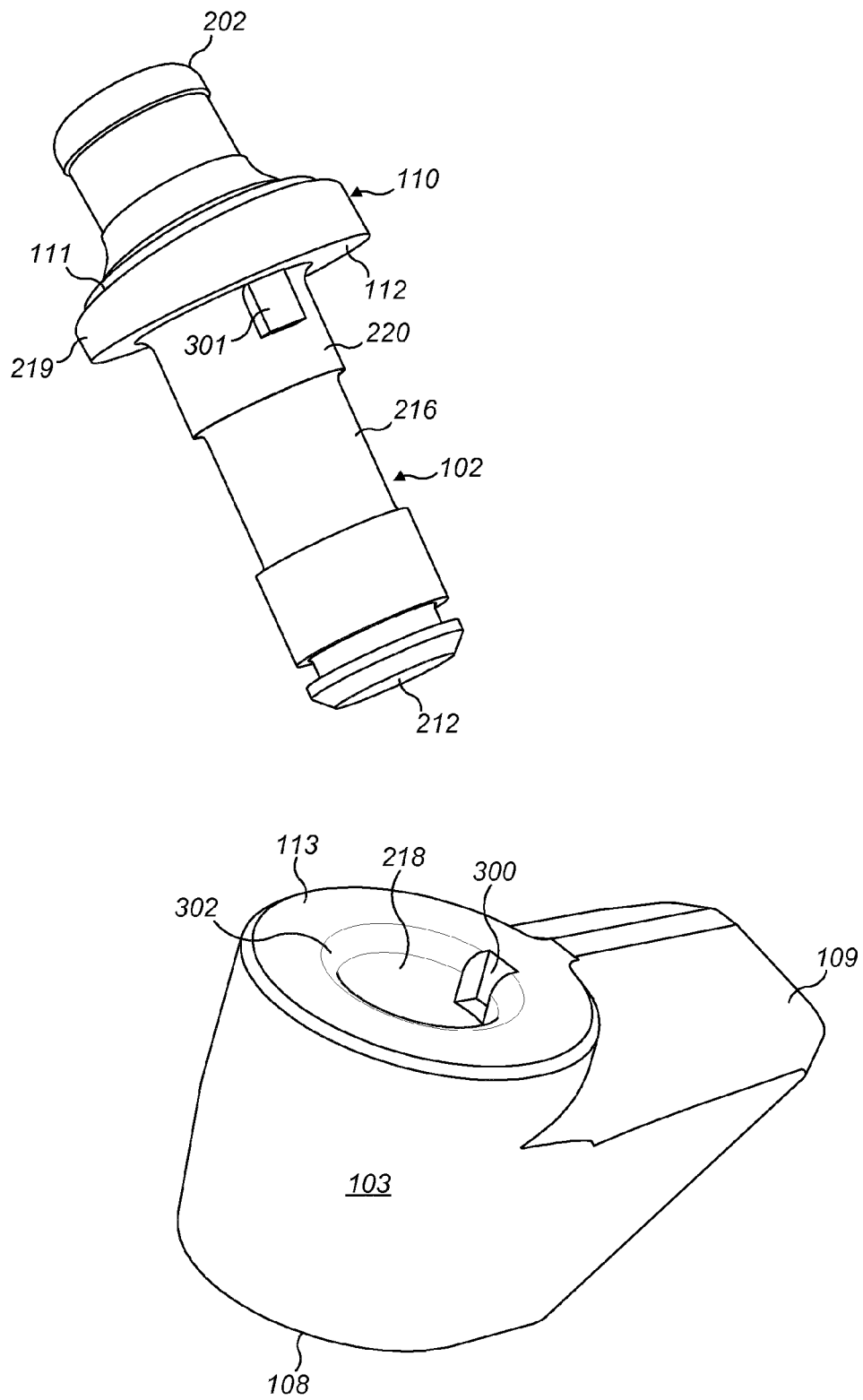


FIG. 3

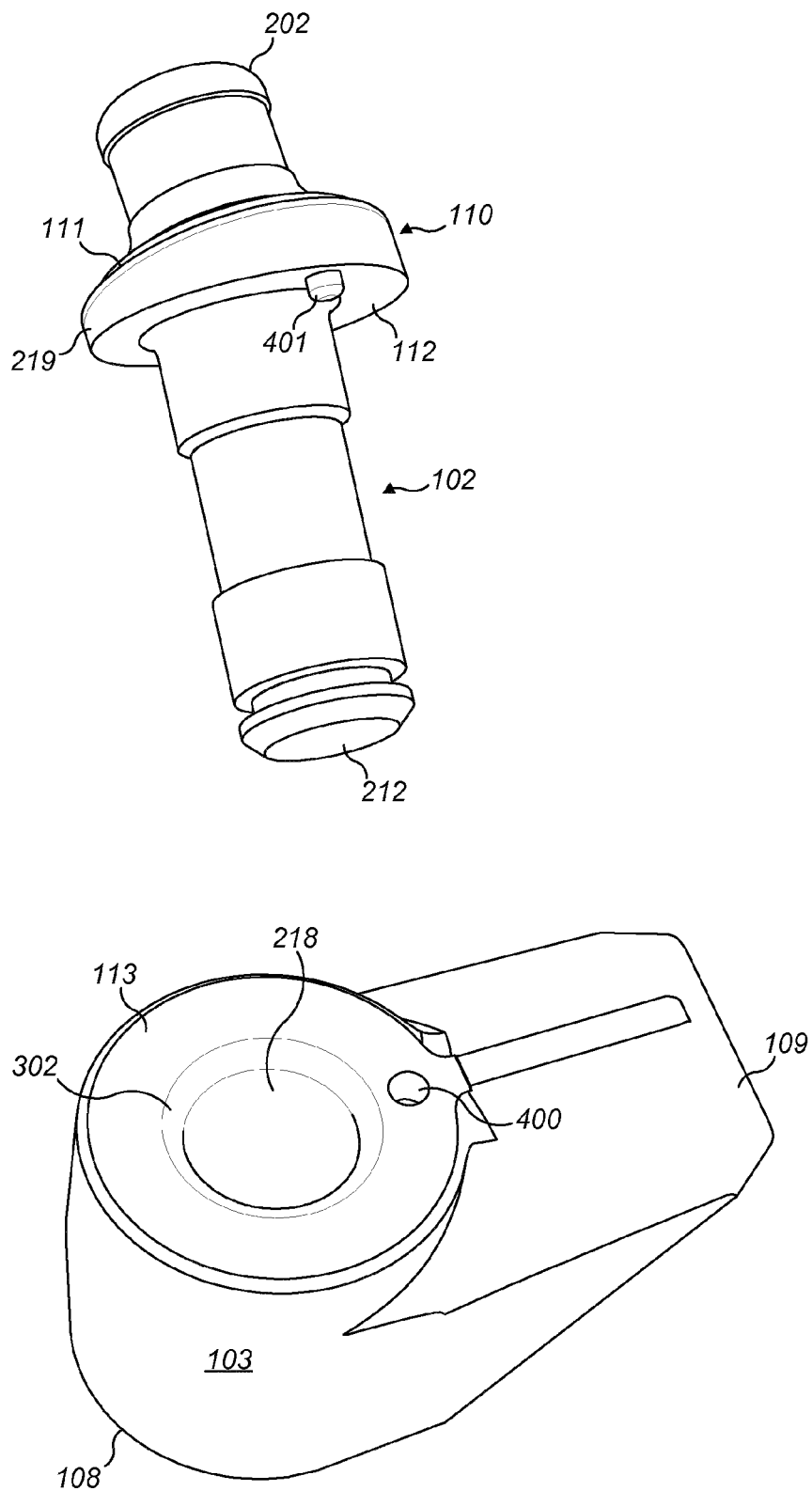


FIG. 4



EUROPEAN SEARCH REPORT

Application Number
EP 14 17 5520

5

10

15

20

25

30

35

40

45

50

55

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 1 069 278 A1 (BAUER SPEZIALTIEFBAU GMBH) 17 January 2001 (2001-01-17) * paragraphs [0006], [0009], [0010] *	1,3,5-7, 9,14	INV. E21C35/18 B28D1/18
A	EP 1 033 216 A1 (BITELLI S.P.A.) 6 September 2000 (2000-09-06) * paragraphs [0024], [0033], [0034] *	1	
A	DE 10 2009 052351 A1 (STEINBRECHER) 12 May 2011 (2011-05-12) * paragraphs [0003] - [0005], [0027] - [0029] *	1,8	
A,D	WO 98/39553 A1 (BINGHAM ENGINEERING LTD) 11 September 1998 (1998-09-11) * the whole document *	2	
A,D	US 5 261 499 A (GRUBB) 16 November 1993 (1993-11-16) * the whole document *	4,13	
A,D	US 2008/309148 A1 (HALL ET AL.) 18 December 2008 (2008-12-18) * the whole document *	10	TECHNICAL FIELDS SEARCHED (IPC)
A,D	EP 2 514 918 A1 (SANDVIK) 24 October 2012 (2012-10-24) * the whole document *	10	E21C B28D E02F E01C
A,D	US 2011/278908 A1 (GREGORY) 17 November 2011 (2011-11-17) * the whole document *	11	
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 19 September 2014	Examiner Rampelmann, Klaus
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 14 17 5520

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

19-09-2014

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1069278 A1	17-01-2001	DE 19932440 A1	25-01-2001
		EP 1069278 A1	17-01-2001
EP 1033216 A1	06-09-2000	EP 1033216 A1	06-09-2000
		IT VI990042 A1	04-09-2000
		JP 2000282407 A	10-10-2000
DE 102009052351 A1	12-05-2011	DE 102009052351 A1	12-05-2011
		WO 2011054334 A1	12-05-2011
WO 9839553 A1	11-09-1998	EP 0970290 A1	12-01-2000
		WO 9839553 A1	11-09-1998
US 5261499 A	16-11-1993	US 5261499 A	16-11-1993
		ZA 9305006 A	24-02-1994
US 2008309148 A1	18-12-2008	US 2008309147 A1	18-12-2008
		US 2008309148 A1	18-12-2008
EP 2514918 A1	24-10-2012	AU 2012244559 A1	31-10-2013
		CN 103492673 A	01-01-2014
		EP 2514918 A1	24-10-2012
		US 2014042795 A1	13-02-2014
		WO 2012143153 A2	26-10-2012
US 2011278908 A1	17-11-2011	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 3342531 A [0004]
- US 3627381 A [0004]
- US 3932952 A [0004]
- US 4343516 A [0004]
- US 5261499 A [0004]
- WO 9631682 A [0004]
- US 5799741 A [0004]
- WO 9839553 A [0004]
- US 20080258536 A [0004]
- US 20080309148 A [0004]
- WO 2010027315 A [0004]
- US 20110278908 A [0004]
- EP 2514918 A [0004]