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(54) **Rock bit tip and rock bit**

(57) A rock bit tip (120) comprising a mounting portion (122), an end portion (11) converging from a top end of the mounting portion to form a work surface and at least one recess (125) in a bottom (124) of the mounting

portion, the recess extending towards said end portion, wherein there are more than one recess. The invention further relates to a rock bit.

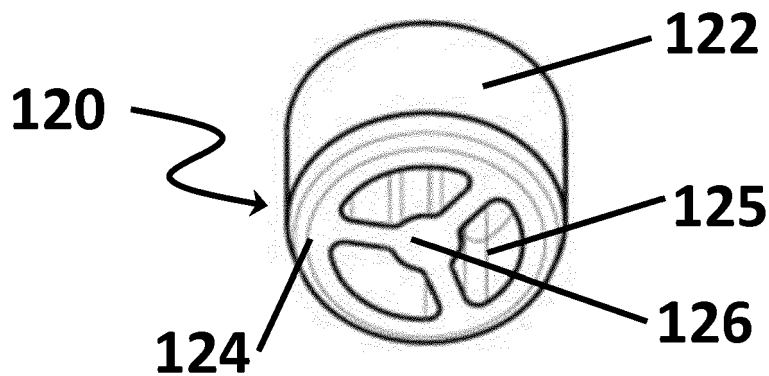


FIG 6

Description

Technical Field

[0001] The present disclosure relates to tips in rock or mining bits for use in a rock excavation apparatus.

[0002] The disclosure particularly relates to tips with hollow bases.

Background

[0003] There are several different methods used for drilling in earth formations. Some use rotary movement and some use a combination of rotary and percussive movement. One common aspect of these methods is that a drill bit rotates at an end of a drill string.

[0004] Rotary drilling is conducted by rotating a rigid string of tubular rods to which a rock-cutting bit is attached. The rotary drill imparts two basic actions through the drill rod and bit into the rock, i.e. axial thrust and rotational torque. Percussive drills break rock predominantly by crushing and chipping rock with the repeated application of high-frequency, high-energy blows through a drill bit. The impact energy is developed by a piston that strikes the bit (down-the-hole drill) or drill steel (surface-mounted drill).

[0005] To improve the wear resistance and increase the lifetime of such drill bits, cutting elements in the form of tips or inserts are attached to the drill bit body. These tips are often made of cemented carbide, most commonly tungsten carbide, due to its excellent combination of high hardness and high toughness. The tips can also be made of polycrystalline diamond (PCD). The purpose of the tips is mainly to apply pressure to and fracture rock. Sometimes tips are also positioned on the drill bit body as protection for the surrounding steel. The tips must therefore withstand high compressive and transverse loads.

[0006] The tungsten carbide tips are commonly mounted in cylindrical recesses in the outer surface of the drill bit body. The tips can be made a few hundredths of a mm larger than the recess and are pressed in to have a tight interference fit to prevent loosening during usage.

[0007] Tungsten carbide tips are also used for soft cutting conditions such as excavation of coal. The tips are, in this application, often named caps and are often adhesively bonded to a pick body by, for example, brazing or welding.

[0008] Several standard shapes are used for tungsten carbide tips, such as a part-spherical, conical, a double cone, a ballistic and a chisel crest. Common for these different shapes is that the base, also called mounting portion, of the tip is generally cylindrical.

[0009] In many applications it is advantageous to use tips having a diameter of about 2 cm or larger. The advantages being that fewer tips need to be used and also that the protrusion of the tip from the surface of the bit body can be greater while maintaining adequate strength to avoid transverse failure during the excavation opera-

tion. Having large tips concentrates the load to fewer tips and greater rock penetration can be obtained without engagement of the steel surface, resulting in improved excavation rate. Having large tips that extend a greater distance from the bit also increases the lifetime of the bit as the large tips can accommodate appreciable wear before they are worn out.

[0010] One problem with large diameter tips is that they are expensive. This is due to the high cost of the material required to manufacture a tip. The material quantity required increases with the square of the diameter of the tip. When using tungsten carbide tips it is more costly to use few tips with a diameter of about 2 cm than using a larger amount of small tips.

[0011] This problem is addressed in U.S. Pat. No. 4,150,728. Here tungsten carbide tips with hollow bases are shown. Such a tip has a cavity opening to the inner end of the tip with a volume in the range of from about 15 to 30 % of the volume of the base portion of the tip.

[0012] The present inventor has surprisingly found that several prominent problems occur at tips with hollow bases. One is that the base of the tip tends to get oval in shape. Another problem is that the form of the tip tends to get conical, i.e. the diameter of the mounting portion decreases when approaching the very bottom of the tip. Ovality and conicity in the mounting portion decreases the force for pulling the tip from the drill bit body and therefore loosening of the tip is an unfavorable consequence.

[0013] Another problem is that the mounting portion may crack when a tip is press fitted into a recess in the drill bit body.

[0014] These and other aspects of, and advantages with the present invention will be apparent from the detailed description and the accompanying drawings.

Summary

[0015] One object of the present invention is to provide a hollow tip concept, which has better strength than known hollow tips. Another object is to provide a hollow tip concept which can be produced at a lower cost compared to solid tips, thus solving the above mentioned problems.

[0016] According to a first aspect, there is provided a rock bit tip comprising: a mounting portion, an end portion converging from a top end of the mounting portion to form a work surface and at least one recess in a bottom of the mounting portion, the recess extending towards said end portion, wherein there are more than one recess.

[0017] In a second aspect, there is provided a rock bit comprising a tip with more than one recess.

Brief Description of the Drawings

[0018] In the detailed description of the present invention reference will be made to the accompanying drawings, wherein,

Fig. 1 schematically illustrates a conventional tip or button, in a side view, suitable for excavation of rock, Fig. 2 schematically illustrates a tool for rotary drilling, in a side view,

Fig. 3 schematically illustrates a tool for percussive drilling, in a perspective view from above,

Fig. 4 schematically illustrates a mining pick in a side view,

Fig. 5a schematically illustrates a first embodiment of a tip according to the invention in a perspective view from below,

Fig. 5b schematically illustrates a first embodiment of the tip according to the invention in an axial cross-sectional view through the tip centre axis A,

Fig. 6 schematically illustrates a second embodiment of a tip according to the invention in a perspective view from below,

Fig. 7 schematically illustrates a third embodiment of a tip according to the invention in a perspective view from below,

Fig. 8 schematically illustrates a fourth embodiment of a tip according to the invention in a perspective view from below,

Fig. 9a schematically illustrates a fifth embodiment of a tip according to the invention in a perspective view from below,

Fig. 9b schematically illustrates the tip according to Fig. 9a in a side view,

Fig. 9c schematically illustrates the tip according to the line IX C - IX C in Fig. 9b, and

Fig. 9d schematically illustrates the tip according to the line IX D - IX D in Fig. 9b.

Description of Embodiments

[0019] The features and advantages of the present invention are well understood by reading the following detailed description in conjunction with the drawings in which like numerals indicate similar elements and in which:

[0020] FIG. 1 illustrates a tip 10 suitable for rock excavation. The tip comprises an end portion 11 having a top 13. The end portion is intended to project from a front surface of a bit to form a work surface that is in contact with the rock. The tip also comprises a mounting portion 12 extending from the end portion 11 towards a bottom end 14. The mounting portion of the tip is intended to be positioned in a recess in a drill bit body and assures that the tip is securely fixed to the bit body. If the tip 10 is comprised in a mining pick, the bottom end 14 may be secured to the bit, for example, by means of brazing or welding.

[0021] FIG. 2 illustrates a rock bit for rotary drilling 20. The bit comprises a thread 24 whereby the rotary bit 20 is to be connected to a drill string. The bit further comprises legs 25 with roller cones 21 attached at one end. Tips, of the type herein described, can be used as protective tips 23 on the legs 25 and/or as active tips 22 on

the roller cones 21. The term "protective" means that the main purpose of the tip 23 is to protect the steel in the drill bit from being too heavily worn. The term "active" means that the main purpose of the tip 22 is to apply pressure to and fracture rock. The technology is more closely described in US Patent Number 6,446,739.

[0022] FIG. 3 illustrates a percussive rock drill bit 30 that comprises a drill bit head 31 and a shank 32. The drill bit head 31 may comprise tips, of the type described below, such as peripheral tips 33 and/or front tips 34. The technology is more closely described in US Patent Number 7,296,641.

[0023] FIG. 4 illustrates a mining pick 40 used in operations such as cutting soft minerals such as, for example, coal. The mining pick 40 includes a body 41 having a head 42 and a shank 43. The tip 44 is made according to the invention and is the part that actively cuts minerals. It is made of a hard material such as cemented carbide, diamond, SiC-D or combinations thereof. The technology is more closely described in US Patent Number 8,210,618.

[0024] FIGS. 5a and 5b illustrate a first embodiment of the invention. The tip 110 has a mounting portion 112. Four identical open recesses 115 extend axially from the bottom end 114 of the mounting portion 112. The open recesses 115 have cross sections at the bottom end 114 that can be substantially like circle sectors with rounded corners for avoiding stress concentrations. The recesses 115 are spaced apart by a support structure 116. At least one open recess 115 has its geometric centre axis B separate from the longitudinal tip centre axis A.

[0025] FIG. 6 illustrates a second embodiment of the invention. The tip 120 has a mounting portion 122. Three identical open recesses 125 extend axially from the bottom end 124 of the mounting portion 122. The open recesses 125 may have cross sections at the bottom end 124 that are substantially like truncated circle rings. The recesses 125 are spaced apart by a support structure 126. At least one open recess 125 has its geometric centre axis B separate from the longitudinal tip centre axis A.

[0026] FIG. 7 illustrates a third embodiment of the invention. The tip 130 has a mounting portion 132. Seven identical open recesses 135 extend axially from the bottom end 134 of the mounting portion 132. The open recesses 135 have cross sections at the bottom end 134 that are substantially hexagonal. The recesses 135 are spaced apart by a support structure 136. At least one open recess 135 has its geometric centre axis B separate from the longitudinal tip centre axis A. A central open recess 135 has its geometric centre axis B substantially coinciding with the longitudinal tip centre axis A.

[0027] FIG. 8 illustrates a fourth embodiment of the invention. The tip 140 has a mounting portion 142. Six open recesses 145 extend axially from the bottom end 144 of the mounting portion 142. The open recesses 145 have cross sections at the bottom end 134 that are substantially circular. The recesses 145 are spaced apart by a support structure 146. At least one open recess 145

has its geometric centre axis B separate from the longitudinal tip centre axis A.

[0028] FIGS. 9a - 9d illustrate a fifth embodiment of the invention. The tip 150 has a mounting portion 152. One open recess 155 extends axially from the bottom end 154 of the mounting portion 152. Between the bottom end 154 and the end portion, the open recess 155 is split into three identical separate recesses 157. The recesses 157 are spaced apart by a support structure 156. At least one of the recesses 157 has at least one cross section (IX D - IX D), parallel to the bottom of the mounting portion, between the bottom of the mounting portion and the end portion, which has its geometric centre axis B separate from the longitudinal tip centre axis A, Fig. 9d.

[0029] The number of recesses, and their sizes, may be altered compared to the examples described in the above-captioned embodiments. It is also possible to combine recesses with different sizes and shapes into a new embodiment. The depth of the recesses can also be varied, but the recesses are always of the blind hole type.

[0030] The present invention is not limited to the above described embodiments. Different alternatives, modifications and equivalents might be used. The above mentioned embodiments should therefore, not be considered limiting to the scope of the invention, which is defined by the patent claims.

Claims

1. A rock bit tip comprising:

a mounting portion (12;112;122;132;142;152),
an end portion (11) converging from a top end
of the mounting portion to form a work surface
and at least one recess (115;125;135;145;155)
in a bottom (14;114;124;134;144;154) of the
mounting portion, the recess extending towards
said end portion,

characterized in that there are more than one recess.

2. The tip as set forth in claim 1, wherein the recesses are spaced apart by a support structure (116;126;136;146;156), the support structure being integral with the mounting portion and the end portion.

3. The tip as set forth in claim 1 or 2, wherein at least one recess (157) has a cross section, parallel to the bottom of the mounting portion between a bottom of the mounting portion and the end portion, that has its geometrical centre (B) separate from the longitudinal tip centre axis (A).

4. The tip as set forth in claim 1, 2 or 3, wherein at least one recess (115) has a cross section, parallel to the

bottom of the mounting portion, at the bottom of the mounting portion, that is generally like a circle sector.

5. The tip as set forth in claim 1, 2 or 3, wherein at least one recess (125) has a cross section, parallel to the bottom of the mounting portion, at the bottom of the mounting portion, that is generally like a truncated circle ring.

6. The tip as set forth in claim 1, 2 or 3, wherein at least one recess (135) has a cross section, parallel to the bottom of the mounting portion, at the bottom of the mounting portion, that is generally hexagonal.

7. The tip as set forth in claim 1, 2 or 3, wherein at least one recess (145) has a cross section, parallel to the bottom of the mounting portion, at the bottom of the mounting portion, that is generally circular.

8. The tip as set forth in any of the preceding claims, wherein the tip comprises cemented carbide and/or polycrystalline diamond (PCD).

9. The tip as set forth in claim 8, wherein the tip comprises tungsten carbide.

10. A rock bit **characterized in that** it comprises a tip (10;110;120;130;140;150) as defined in any one of the preceding claims 1-9.

11. The rock bit as set forth in claim 10, wherein the rock bit is a bit for rotary drilling, a bit for percussive drilling or a mining pick.

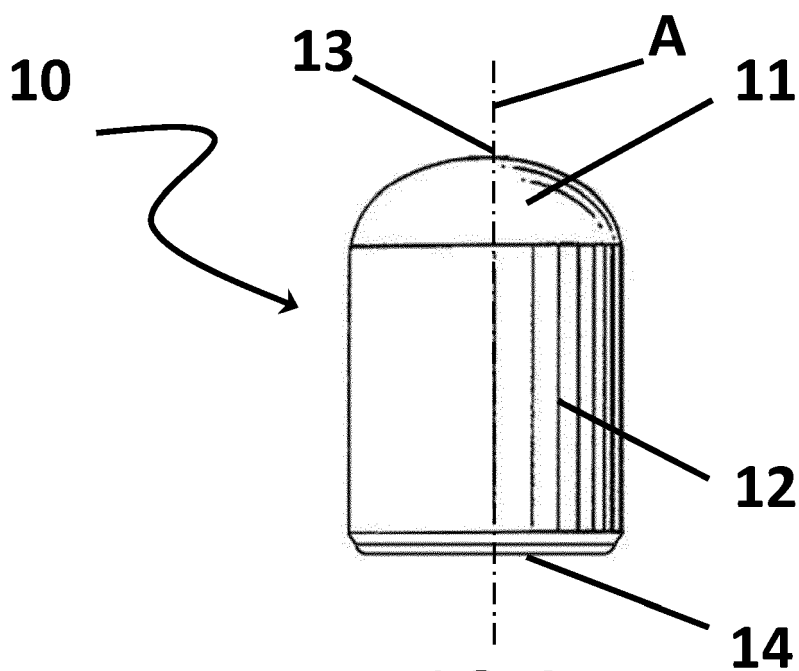


FIG 1

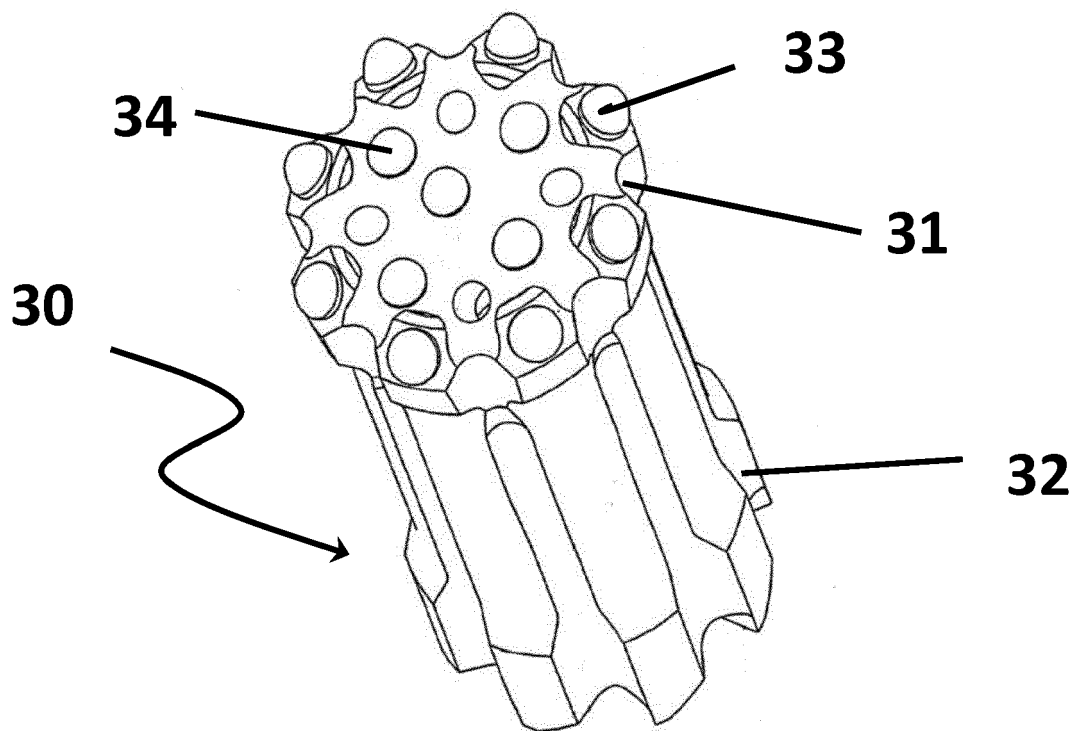


FIG 3

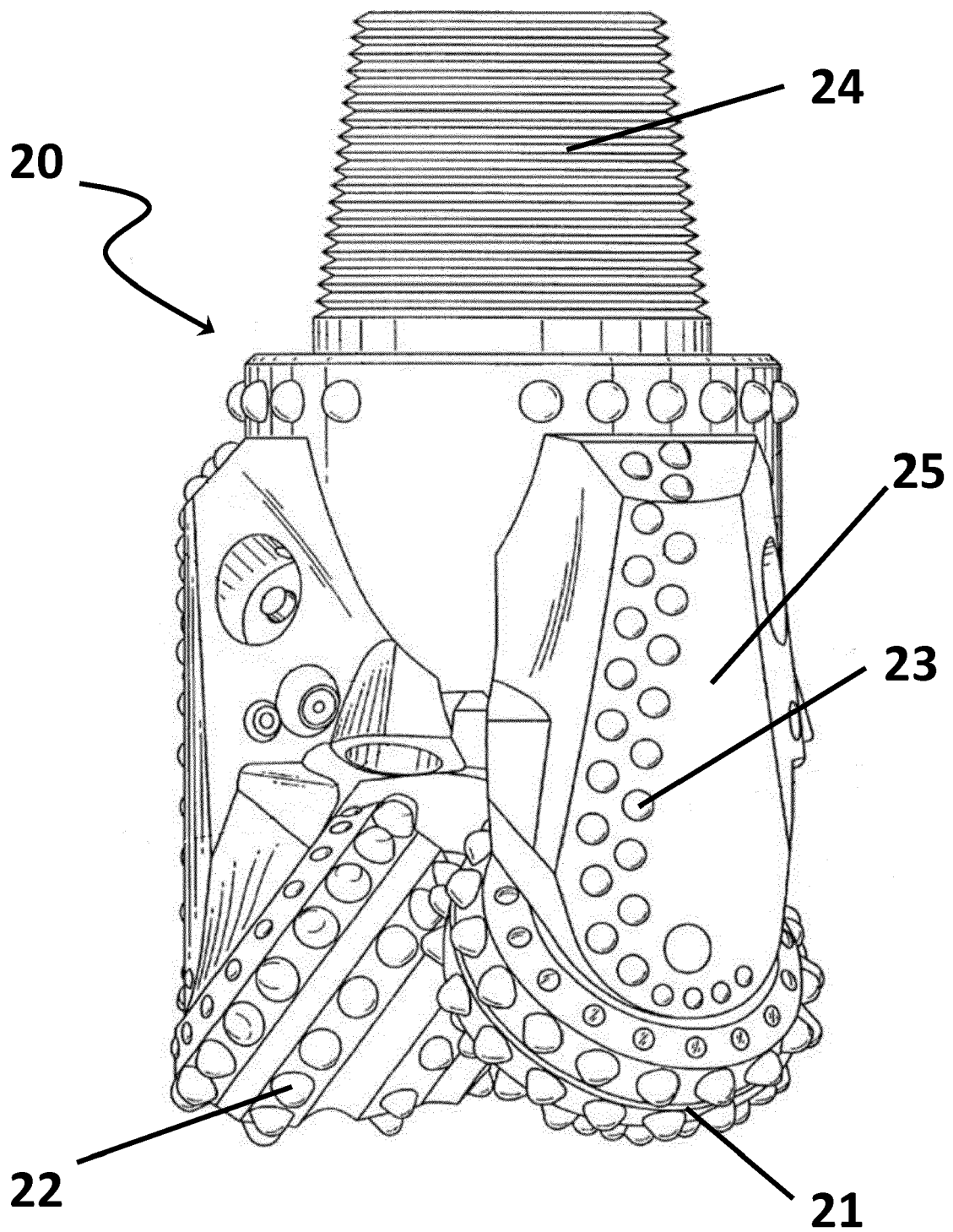
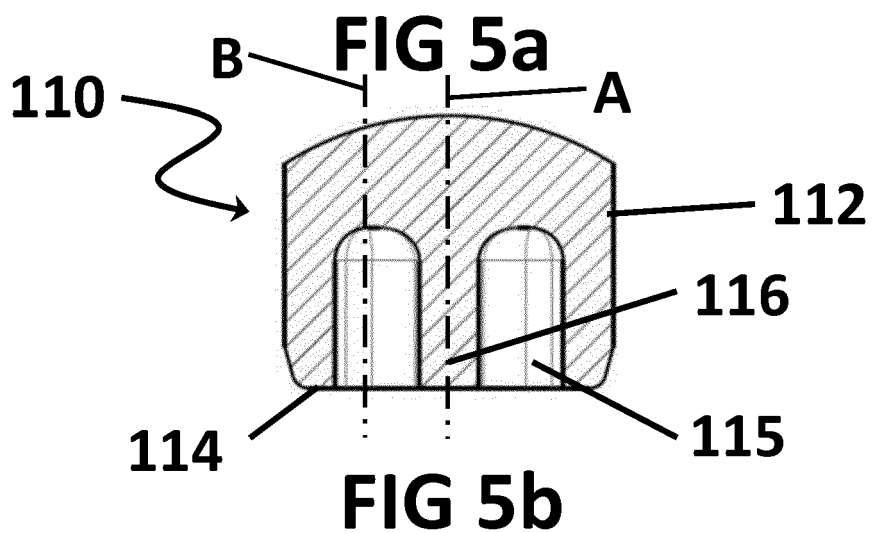
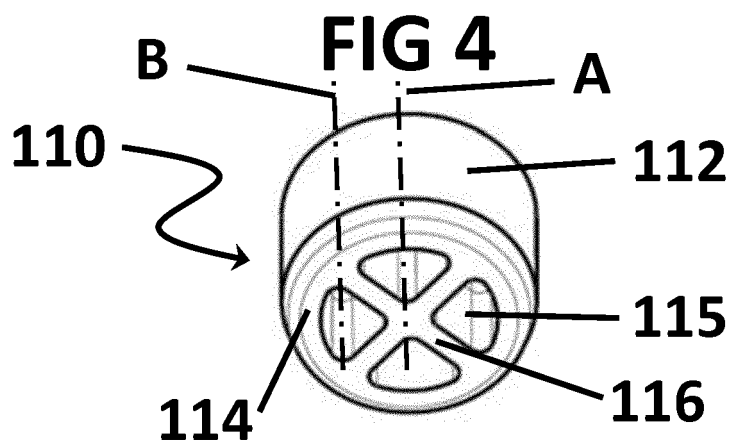
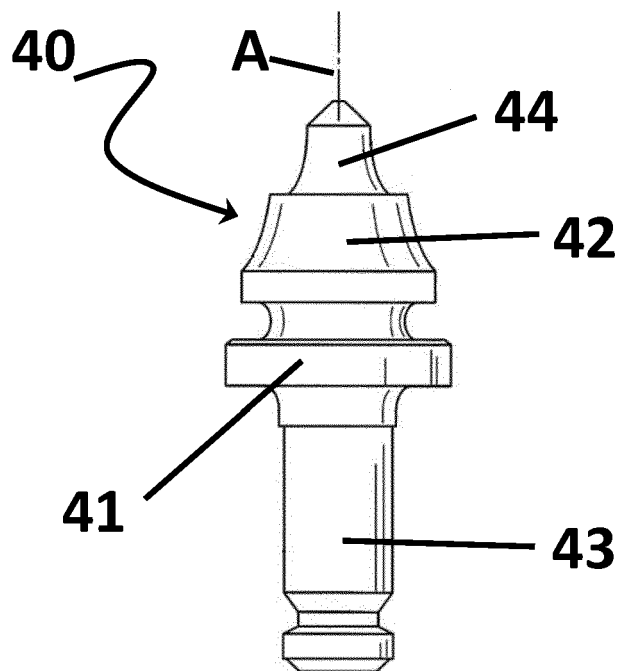


FIG 2



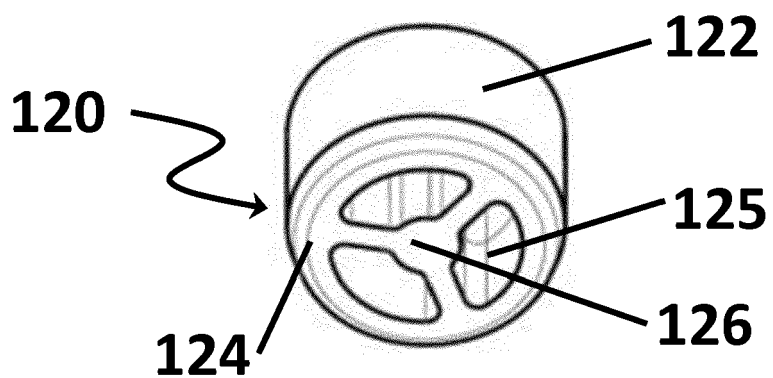


FIG 6

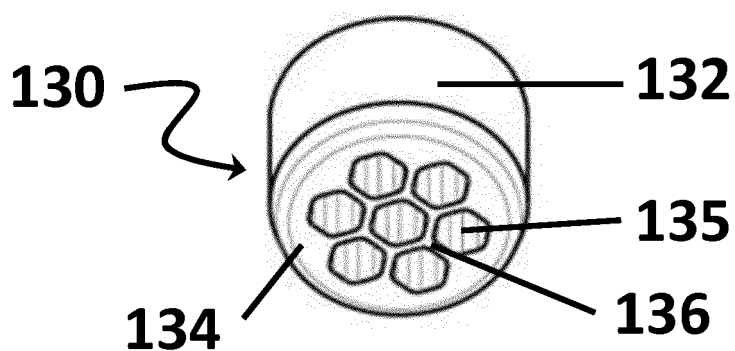


FIG 7

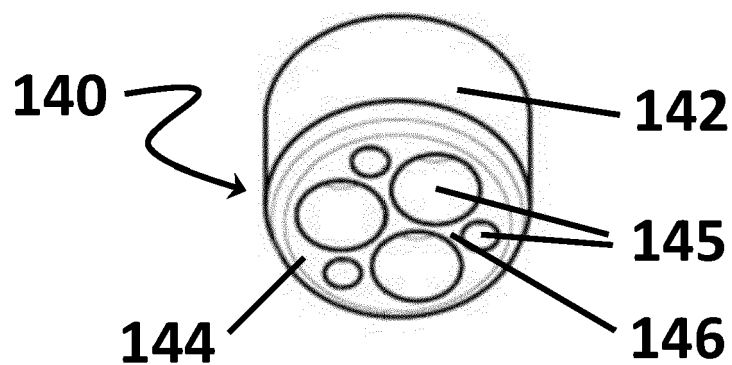
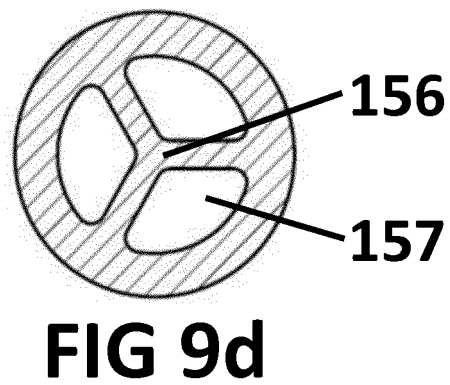
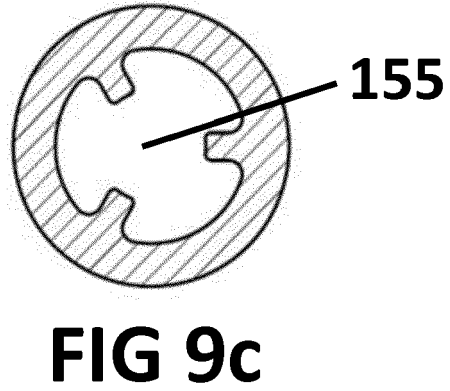
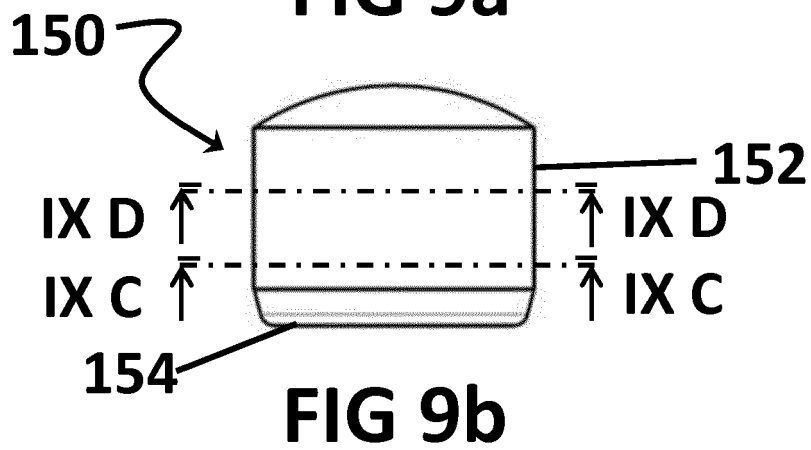
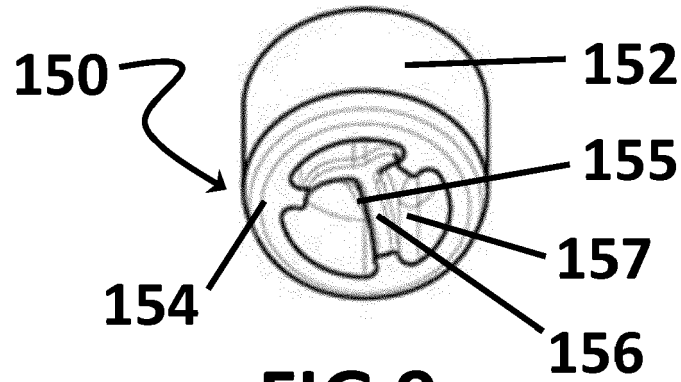


FIG 8





EUROPEAN SEARCH REPORT

Application Number
EP 12 19 5889

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 4 176 725 A (SHIELDS SANTOS [US]) 4 December 1979 (1979-12-04) * figures 3-5 *	1-11	INV. E21B10/16 E21B10/43 E21B10/573
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The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
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Place of search Munich		Date of completion of the search 13 May 2013	Examiner Morrish, Susan
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			

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EPO FORM 1503 03/82 (P04C01)

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

EP 12 19 5889

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The members are as contained in the European Patent Office EDP file on
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13-05-2013

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