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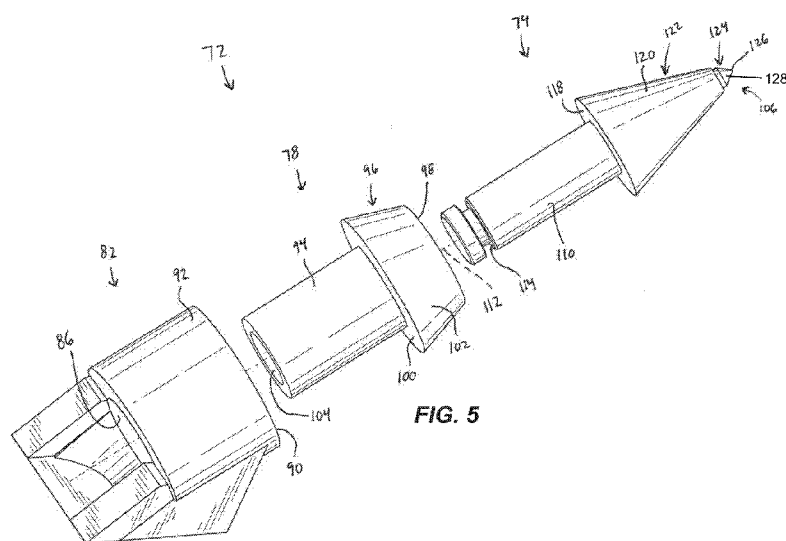


FIG. 5

(57) Abstract: A bit assembly for a cutting drum includes a sleeve and a bit. The sleeve includes a shank portion, a flange positioned, and a bore extending through the flange and the shank portion. The flange includes a first end surface, a second end surface, and a sleeve outer surface extending between the first end surface and the second end surface. A portion of the sleeve outer surface positioned adjacent the first end surface defines a sleeve profile. The bit includes a cutting end, a shank, and a shoulder positioned between the cutting end and the shank. The shank is positioned within the bore, and the shoulder is positioned adjacent the first end surface of the sleeve. A bit outer surface extending between the cutting end and the shoulder. A portion of the bit outer surface positioned adjacent the shoulder defines a bit profile that corresponds to the sleeve profile.

BIT ASSEMBLY FOR CUTTER HEAD

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of and priority to prior-filed, co-pending U.S. Provisional Application No. 62/145,603, filed April 10, 2015, and U.S. Provisional Application No. 62/202,573, filed August 7, 2015. The entire contents of these documents are hereby incorporated by reference herein.

BACKGROUND

[0002] The present application relates to cutting bits, and particularly to a cutting bit assembly for an industrial machine.

[0003] Conventional continuous mining machines, longwall mining machines, and entry development machines include a cutter head including multiple cutting bit assemblies. In some embodiments, each cutting bit assembly includes a bit holder block coupled to a rotating drum. The bit holder block also includes a slot. In some embodiments, the slot receives a sleeve. The sleeve includes a bore and an outer surface engaging the slot of the bit holder block. A bit is secured within the bore of the sleeve.

SUMMARY

[0004] In one aspect, a bit assembly for a cutting drum includes a sleeve and a bit. The sleeve includes shank portion, a flange positioned adjacent an end of the shank portion, and a bore extending through the flange and the shank portion. The flange includes a first end surface, a second end surface, and a sleeve outer surface extending between the first end surface and the second end surface. A portion of the sleeve outer surface positioned adjacent the first end surface defines a sleeve profile. The bit includes a cutting end, a shank, and a shoulder positioned between the cutting end and the shank. At least a portion of the shank is positioned within the bore of the sleeve, and the shoulder is positioned adjacent the first end surface of the sleeve. The bit further includes a bit outer surface extending between the cutting end and the shoulder. A portion of the bit outer surface positioned adjacent the shoulder defines a bit profile that corresponds to the sleeve profile.

[0005] In another aspect, a cutter head for an industrial machine includes a drum supported for rotation about a drum axis and a plurality of bit assemblies. Each bit assembly is supported on the drum and includes a sleeve and a bit. The sleeve includes a shank portion, a flange positioned adjacent an end of the shank portion, and a bore extending through the flange and the shank portion. The flange includes a first end surface, a second end surface, and a sleeve outer surface extending between the first end surface and the second end surface. A portion of the sleeve outer surface positioned adjacent the first end surface defines a sleeve profile. The bit includes a cutting end, a shank, and a shoulder positioned between the cutting end and the shank. At least a portion of the shank is positioned within the bore of the sleeve. The shoulder is positioned adjacent the first end surface of the sleeve. The bit further includes a bit outer surface extending between the cutting end and the shoulder. A portion of the bit outer surface positioned adjacent the shoulder defines a bit profile that corresponds to the sleeve profile.

[0006] In yet another aspect, a bit assembly is configured to be secured to a cutting drum and includes a bit and a holder. The bit includes a cutting end, a shank, and a shoulder positioned between the cutting end and the shank. The bit further includes a bit outer surface extending between the cutting end and the shoulder. A portion of the bit outer surface positioned adjacent the shoulder defines a bit profile. The holder includes a holder end surface, an opening positioned on the holder end surface, and a holder outer surface. The opening receives at least a portion of the shank. The holder end surface faces toward the shoulder. At least a portion of the holder outer surface positioned adjacent the holder end surface defines a holder profile that corresponds to the bit profile.

[0007] Other aspects will become apparent by consideration of the detailed description and accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] FIG. 1 is a perspective view of a mining machine.

[0009] FIG. 2 is a perspective view of a portion of a cutter head.

[0010] FIG. 3 is a perspective view of a cutting bit assembly.

[0011] FIG. 4 is a side view of the cutting bit assembly of FIG. 3.

- [0012] FIG. 5 is an exploded view of the cutting bit assembly of FIG. 3.
- [0013] FIG. 6 is a side view of a cutting bit and sleeve.
- [0014] FIG. 7 is an enlarged side view of area 7--7 of the cutting bit and sleeve of FIG. 6.
- [0015] FIG. 8 is a side view of a cutting bit assembly according to another embodiment.
- [0016] FIG. 9 is a top plan view of the cutting bit assembly of FIG. 8.

DETAILED DESCRIPTION

[0017] Before any embodiments are explained in detail, it is to be understood that the invention is not limited in its application to the details of construction and the arrangement of components set forth in the following description or illustrated in the following drawings. The invention is capable of other embodiments and of being practiced or of being carried out in various ways. Also, it is to be understood that the phraseology and terminology used herein is for the purpose of description and should not be regarded as limiting. The use of “including,” “comprising” or “having” and variations thereof herein is meant to encompass the items listed thereafter and equivalents thereof as well as additional items. The terms “mounted,” “connected” and “coupled” are used broadly and encompass both direct and indirect mounting, connecting and coupling. Further, “connected” and “coupled” are not restricted to physical or mechanical connections or couplings, and can include electrical or hydraulic connections or couplings, whether direct or indirect. Also, electronic communications and notifications may be performed using any known means including direct connections, wireless connections, etc.

[0018] FIG. 1 illustrates a mining machine, such as a continuous miner 10, including a frame 14 that is supported for movement (e.g., by tracks 18). The continuous miner 10 further includes a boom 22 and a cutter head 26 supported on the boom 22. In the illustrated embodiment, the frame 14 also includes a collecting mechanism or gathering head 30 and a conveyor 34 extending from a first or front end of the frame 14 toward a second or rear end of the frame 14. In the illustrated embodiment, the gathering head 30 includes a pair of rotating arms 38 that engage cut material below the cutter head 26 and direct the cut material onto the conveyor 34. The conveyor 34 transports the cut material along a longitudinal axis of the frame 14, from the

area below the cutter head 26 to a second conveyor (not shown) positioned proximate the second end of the frame 14.

[0019] The boom 22 includes one end pivotably coupled to the frame 14 and another end supporting the cutter head 26. The boom 22 is pivotable about a pivot axis 54 that is generally transverse to the longitudinal axis of the frame 14. The boom 22 is pivoted by a pair of actuators 58 that are coupled between the frame 14 and the boom 22. In the illustrated embodiment, the actuators 58 are hydraulic jacks or cylinders.

[0020] As shown in FIG. 2, the cutter head 26 is formed as an elongated drum 62 including cutting bit assemblies 66 secured to an outer surface of the drum 62. In the illustrated embodiment, the outer surface of the drum 62 includes multiple pedestals 68, and each cutting bit assembly 66 is secured to one of the pedestals 68. The drum 62 defines a drum axis 70 (FIG. 1) that is generally parallel to the pivot axis 54 of the boom 22, and the drum 62 is rotatable about the drum axis 70.

[0021] FIGS. 3-5 illustrate a cutting bit assembly 72 according to one embodiment. Although the cutting bit assemblies 66 illustrated in FIG. 2 are different from the cutting bit assembly 72, it is understood that multiple cutting bit assemblies 72 could be positioned on the cutting drum 62 in a similar manner.

[0022] Each cutting bit assembly 72 includes a bit 74, a sleeve 78, and a holder or holder block 82. The block 82 includes a bore or opening 86 (FIG. 5), and the sleeve 78 is received within the opening 86. The block 82 has an end surface or forward surface 90 and an outer surface 92. A portion of the outer surface 92 immediately adjacent the forward surface 90 defines a holder profile. In the embodiment of FIGS. 3-5, the holder profile has a generally cylindrical shape. In other embodiments, the holder profile may have a frustoconical shape. In still other embodiments, the holder profile may have another shape. Also, the block 82 may incorporate a nozzle aperture (not shown) for supporting a fluid spray nozzle. The nozzle can provide a spray envelope that encompasses a portion of the bit 74.

[0023] The sleeve 78 includes an elongated shank portion 94 (FIG. 5) and a flange 96. In the illustrated embodiment, the shank portion 94 has a generally cylindrical shape and is positioned within the opening 86 of the block 82. The flange 96 includes a first end surface or forward

surface 98 and a second end surface or rear surface 100. The rear surface 100 of the flange 96 is positioned adjacent the forward surface 90 of the holder block 82. In the illustrated embodiment, the rear surface 100 of the flange 96 abuts or contacts at least a portion of the forward surface 90 of the holder block 82. The flange 96 also includes an outer surface 102 extending between the forward surface 98 and the rear surface 100. The outer surface 102 of the flange 96 defines a sleeve profile. In the illustrated embodiment, the sleeve profile has a frustoconical shape. In other embodiments, the sleeve profile may have other shapes, such as a curved shape having a non-linear taper. The sleeve 78 also defines a bore 104 (FIG. 5) extending through the length of the sleeve 78.

[0024] Referring to FIG. 5, the bit 74 includes a cutting end 106 and a shank 110. The shank 110 is positioned within the bore 104 of the sleeve 78, and the shank 110 defines a shank axis or bit axis 112. In some embodiments, an end of the shank 110 protrudes from the end of the sleeve 78 and includes a slot 114. The slot 114 receives a retaining mechanism (e.g., by a cotter pin or hairpin clip – not shown) for securing the bit 74 against axial movement relative to the sleeve 78. Unless otherwise specified, the term “axial” refers to a direction extending parallel to the bit axis 112 and the term “radial” refers to a direction extending perpendicularly to the bit axis 112.

[0025] The bit 74 also includes a shoulder 118 positioned between the cutting end 106 and the shank 110. The shoulder 118 is positioned adjacent the forward surface 98 of the sleeve flange 96. In the illustrated embodiment, the shoulder 118 abuts or contacts at least a portion of the forward surface 98. A portion of the bit 74 extending between the shoulder 118 and the cutting end 106 has an outer surface 120 defining a bit profile. In the illustrated embodiment, the bit profile has a frustoconical shape. In other embodiments, the bit profile may have other shapes, such as a curved shape that tapers in a non-linear manner between the cutting end 106 and the shoulder 118.

[0026] In the illustrated embodiment, the bit 74 includes a bit body 122 and an insert 124 is positioned in an opening (not shown) on the cutting end 106 of the bit body 122. The insert 124 forms the cutting tip 126. The insert 124 includes an outer surface 128 extending from the tip 126 toward the cutting end 106, and the outer surface 128 defines an insert profile. In the illustrated embodiment, the insert profile has a frustoconical shape; in other embodiments, the insert profile may have another shape. In one embodiment, the insert 124 is made from tungsten

carbide. In other embodiments, the insert 124 is made from another material, and/or may be made from multiple materials. In other embodiments, the bit 74 may be formed without an insert, such that the cutting end 106 of the bit body 122 is formed as a cutting tip.

[0027] As shown in FIGS. 6 and 7, when the bit 74 is positioned within the sleeve 78, the bit profile of the bit 74 is generally continuous with the sleeve profile. Although a gap may exist at the mating interface between the bit 74 and the sleeve 78 (i.e., between the shoulder 118 and the forward surface 98), the overall profile of the combination of the bit 74 and the sleeve 78 is virtually continuous. Stated another way, the portion of the outer surface 120 adjacent the shoulder 118 has a profile that corresponds to the profile of a portion of the outer surface 102 of the sleeve flange 96 adjacent the forward surface 98. The contour of the outer surface 120 of the shoulder 118 is aligned with the contour of the outer surface 102 of the flange 96 at least in the area of the interface between the two components. Stated yet another way, the contour of the outer surface 120 of the shoulder 118 generally follows the same path as the contour of the outer surface 102 of the flange 96 near the interface between the two components. Stated still another way, an imaginary line 130 (FIG. 7) extends parallel to the outer surface 102 of the flange 96 and extends beyond the forward surface 98 of the flange 96. The imaginary line 130 is aligned with and parallel to the outer surface 120 of the bit 74 adjacent the shoulder 118.

[0028] Referring to FIG. 7, in the illustrated embodiment, the shoulder 118 includes an edge 134 defining a perimeter. A first inclined surface 138 extends along the perimeter adjacent the edge 134. The first bevel or first inclined surface 138 forms a first angle 142 relative to a plane 144 oriented perpendicular to the bit axis 112 (FIG. 5). In addition, the forward surface 98 of the flange 96 includes a second bevel or second inclined surface 146 extending along the perimeter of the forward surface 98. The second inclined surface 146 forms a second angle 150 relative to the plane 144. In the illustrated embodiment, the first angle 142 and the second angle 150 are approximately equal. Also, in some embodiments, similar bevel surfaces may be provided on the rear surface 100 of the flange 96 and the forward surface 90 of the block 82.

[0029] In some embodiments, the first angle 142 is between approximately 5 degrees and approximately 22.5 degrees. In some embodiments, the first angle 142 is between approximately 10 degrees and approximately 22.5 degrees. In some embodiments, the first angle 142 is approximately 15 degrees. In some embodiments, the second angle 150 is between

approximately 5 degrees and approximately 22.5 degrees. In some embodiments, the second angle 150 is between approximately 10 degrees and approximately 22.5 degrees. In some embodiments, the second angle 150 is approximately 15 degrees.

[0030] The inclined surfaces 138, 146 provide a space for an operator to insert an edge of a prying tool in order to apply force and extract the bit 74 from the sleeve 78. The first angle 142 and the second angle 150 form a combined wedge angle. In some embodiments, the combined wedge angle is between approximately 10 degrees and approximately 45 degrees. In some embodiments, the combined wedge angle is between approximately 20 degrees and approximately 45 degrees. In some embodiments, the combined wedge angle is approximately 30 degrees.

[0031] In the embodiment of FIGS. 3-5, the bit 74 and the sleeve 78 have a generally continuous profile. In addition, the outer edge of the forward surface 90 of the block 82 is radially adjacent the outer edge of the rear surface 100 of the flange 96. As a result, the profile of the outer surface 92 of the block 82 adjacent the forward surface 90 is generally continuous with the profile of the outer surface 102 of the flange 96 adjacent the rear surface 100, even though the block profile and the sleeve profile do not have the same shape. In a similar manner, the insert 124 may be formed with an outer surface 128 forms a profile that is continuous with the bit profile adjacent the cutting end 106 of the bit body 122.

[0032] The cutting bit assembly 72 has a continuous or smooth profile between the individual components, reducing and/or eliminating corners, hard edges, or other sizable discontinuities. The streamlined profile of the cutting bit assembly 72 reduces sharp contact, rubbing, scrubbing, scraping, crushing, and material carrying that occurs in conventional bit assemblies. As a result, the cutting bit assembly 72 can engage the material to be cut more efficiently, reducing the amount of airborne dust and fines caused by cutting the material and also improving power consumption required by cutter head drive motors.

[0033] FIGS. 8 and 9 illustrate a cutting bit assembly 472 according to another embodiment. The cutting bit assembly is similar to the cutting bit assembly 72 described above with respect to FIGS. 3-7, and similar features are identified with similar reference numbers, plus 400. For the sake of brevity, only differences between the cutting bit assembly 472 and the cutting bit assembly 72 are described.

[0034] The cutting bit assembly 472 includes a bit 474, a sleeve 478, a holder block 482, and an insert 524. The bit 474 includes an outer surface 520 extending between the cutting end 506 and the shoulder 518. The outer surface 520 includes a first portion 520a having a first profile and a second portion 520b having a second profile. The insert 524 includes an outer surface 528 having a profile that is generally continuous with the profile of the first portion 520a. The sleeve flange 496 includes an outer surface 502 having a profile that is generally continuous with the second portion 520b.

[0035] In addition, a forward portion of the block 482 includes an outer surface 492 having a profile that is generally continuous with the profile of the flange outer surface 502, and also corresponds to the profile of the flange outer surface 502. A portion of the outer surface 492 adjacent the forward surface 490 defines a profile that corresponds to the profile of the portion of the outer surface 502 of the flange 496 adjacent the rear surface 500. The contour of the outer surface 492 of the block 482 is aligned with the contour of the outer surface 502 of the flange 496 at least in the area of the interface between the two components. Stated yet another way, the contour of the outer surface 492 of the block 482 generally follows the same path as the contour of the outer surface 502 of the flange 496 near the interface between the two components. Although a gap may exist at the mating interface between the block 482 and the sleeve 478 (i.e., between the block forward surface 490 and the rear surface 500 of the flange 476), the overall profile of the combination of the block 482 and the sleeve 478 is virtually continuous. The block 482 further includes a lateral opening 550 (FIG. 8) extending transversely through the block 482 to provide access to a rear end of the bit 474.

[0036] In addition, the contour of the outer surface 492 of the block 482 also generally follows the same path as the contour of at least the second portion 520b of the outer surface 520 of the bit 474. In the illustrated embodiment, the portion of the outer surface 492 adjacent the forward surface 490 of the block 482 has a frustoconical shape; in other embodiments, the portion of the outer surface 492 may have another shape. In the illustrated embodiment, the frustoconical shape of the portion of the outer surface 492 is the same shape as the frustoconical shape of the second portion 520b of the bit 474. The block profile corresponds to and is aligned with the bit profile.

[0037] In some embodiments, the cutting bit assembly may be formed without a sleeve such that the bit is secured directly to the block. In such a configuration, a portion of the outer surface of the bit may define a bit profile and a portion of the outer surface of the block may define a block profile that corresponds to the bit profile.

[0038] Although aspects of the cutting bit assembly 72 have been described in the context of a mining machine, it is understood that the cutting bit assembly 72 could be incorporated into other types of machines having earth-engaging attachments, including other types of mining machines, construction machines, and road milling machines.

[0039] Although aspects have been described in detail with reference to certain preferred embodiments, variations and modifications exist within the scope and spirit of one or more independent aspects as described.

CLAIMS

We claim:

1. A bit assembly for a cutting drum, the bit assembly comprising:
a sleeve including shank portion, a flange positioned adjacent an end of the shank portion, and a bore extending through the flange and the shank portion, the flange including a first end surface, a second end surface, and a sleeve outer surface extending between the first end surface and the second end surface, a portion of the sleeve outer surface positioned adjacent the first end surface defining a sleeve profile; and
a bit including a cutting end, a shank, and a shoulder positioned between the cutting end and the shank, at least a portion of the shank positioned within the bore of the sleeve, the shoulder positioned adjacent the first end surface of the sleeve, the bit further including a bit outer surface extending between the cutting end and the shoulder, a portion of the bit outer surface positioned adjacent the shoulder defining a bit profile that corresponds to the sleeve profile.
2. The bit assembly of claim 1, wherein an imaginary surface aligned with a contour of the sleeve profile and extending beyond the first end of the sleeve is aligned with a contour of the bit profile.
3. The bit assembly of claim 1, wherein the bit profile defines a first frustoconical shape and the sleeve profile defines a second frustoconical shape, the first frustoconical shape and the second frustoconical shape having an identical, constant slope.
4. The bit assembly of claim 1, wherein the entire length of the sleeve outer surface defines the sleeve profile, and wherein the entire length of the bit outer surface defines the bit profile.
5. The bit assembly of claim 1, wherein an end surface of the bit shoulder is spaced apart from the first end surface of the sleeve by a gap.
6. The bit assembly of claim 1, wherein the bit is freely rotatable relative to the sleeve about a bit axis extending along the shank.

7. The bit assembly of claim 1, wherein the sleeve profile is a first end sleeve profile, a portion of the sleeve outer surface positioned adjacent the second end surface defining a second end sleeve profile, the bit assembly further comprising:

a holder including a holder end surface, an opening positioned on the holder end surface, and a holder outer surface, the opening receiving the shank portion of the sleeve, the holder end surface positioned adjacent the second end surface of the flange, a portion of the holder outer surface positioned adjacent the holder end surface defining a holder profile, the holder profile corresponding to the second end sleeve profile.

8. The bit assembly of claim 1, wherein the bit includes a bit body and an insert, the bit body extending between a body end and the shoulder, the bit including an aperture positioned adjacent the body end, the insert positioned at least partially within the aperture and including a tip,

wherein the bit profile is a shoulder end bit profile, a portion of the bit outer surface positioned adjacent the body end defining a body end bit profile,

wherein the insert includes an insert outer surface, at least a portion of the insert outer surface defining an insert profile that corresponds to the body end bit profile.

9. The bit assembly of claim 1, wherein the shank extend along a bit axis, wherein the shoulder includes a shoulder edge and a first inclined surface extending along the shoulder edge around the perimeter of the shoulder, the first inclined surface forming a first acute angle relative to the bit axis,

wherein the first end surface of the flange includes a flange edge and a second inclined surface extending along the flange edge around the perimeter of the first end surface, the second inclined surface forming a second acute angle relative to the bit axis, wherein the first inclined surface and the second inclined surface are positioned adjacent one another such that the first acute angle and the second acute angle form a combined wedge angle.

10. The bit assembly of claim 1, wherein the shank extends along a bit axis, wherein the shoulder includes an edge defining a perimeter, a first surface, and a second surface, the first surface positioned adjacent the edge and radially between the edge and the bit axis, the second surface positioned adjacent the first surface and radially between the first surface and the bit axis, the first surface and the second surface extending along the length of the perimeter,
wherein the first surface is inclined at a first angle relative to the bit axis and the second surface is inclined at a second angle relative to the bit axis.
11. A cutter head for an industrial machine, the cutter head comprising
a drum supported for rotation about a drum axis; and
a plurality of bit assemblies, each bit assembly supported on the drum and including,
a sleeve including shank portion, a flange positioned adjacent an end of the shank portion, and a bore extending through the flange and the shank portion, the flange including a first end surface, a second end surface, and a sleeve outer surface extending between the first end surface and the second end surface, a portion of the sleeve outer surface positioned adjacent the first end surface defining a sleeve profile; and
a bit including a cutting end, a shank, and a shoulder positioned between the cutting end and the shank, at least a portion of the shank positioned within the bore of the sleeve, the shoulder positioned adjacent the first end surface of the sleeve, the bit further including a bit outer surface extending between the cutting end and the shoulder, a portion of the bit outer surface positioned adjacent the shoulder defining a bit profile that corresponds to the sleeve profile.
12. The cutter head of claim 11, wherein the bit profile defines a first frustoconical shape and the sleeve profile defines a second frustoconical shape, the first frustoconical shape and the second frustoconical shape having an identical, constant slope.
13. The cutter head of claim 11, wherein the entire length of the sleeve outer surface defines the sleeve profile, and wherein the entire length of the bit outer surface defines the bit profile.
14. The cutter head of claim 11, wherein an end surface of the bit shoulder is spaced apart from the first end surface of the sleeve by a gap.

15. The cutter head of claim 11, wherein the sleeve profile is a first end sleeve profile, a portion of the sleeve outer surface positioned adjacent the second end surface defining a second end sleeve profile, each bit assembly further including,

a holder including a holder end surface, an opening positioned on the holder end surface, and a holder outer surface, the opening receiving the shank portion of the sleeve, the holder end surface positioned adjacent the second end surface of the flange, a portion of the holder outer surface positioned adjacent the holder end surface defining a holder profile, the holder profile corresponding to the second end sleeve profile.

16. The cutter head of claim 11, wherein the bit includes a bit body and an insert, the bit body extending between a body end and the shoulder, the bit including an aperture positioned adjacent the body end, the insert positioned at least partially within the aperture and including a tip,

wherein the bit profile is a shoulder end bit profile, a portion of the bit outer surface positioned adjacent the body end defining a body end bit profile,

wherein the insert includes an insert outer surface, at least a portion of the insert outer surface defining an insert profile that corresponds to the body end bit profile.

17. A bit assembly configured to be secured to a cutting drum, the bit assembly comprising:

a bit including a cutting end, a shank, and a shoulder positioned between the cutting end and the shank, the bit further including a bit outer surface extending between the cutting end and the shoulder, a portion of the bit outer surface positioned adjacent the shoulder defining a bit profile; and

a holder including a holder end surface, an opening positioned on the holder end surface, and a holder outer surface, the opening receiving at least a portion of the shank, the holder end surface facing toward the shoulder, at least a portion of the holder outer surface positioned adjacent the holder end surface defining a holder profile that corresponds to the bit profile.

18. The bit assembly of claim 17, further comprising a sleeve including shank portion, a flange positioned adjacent an end of the shank portion, and a bore extending through the flange and the shank portion, the bore receiving the shank of the bit, the shank portion positioned within the opening of the holder, the flange positioned between the shoulder of the bit and the holder end surface of the holder, the flange including a flange outer surface, at least a portion of the flange outer surface defining a sleeve profile that corresponds to the holder profile.

19. The bit assembly of claim 18, wherein the shank portion of the sleeve extends along an axis, the flange including a first end surface adjacent the holder end surface and a second end surface adjacent the shoulder of the bit, the first end surface of the flange including an edge and a first inclined surface extending along the edge around the perimeter of the first end surface, the first inclined surface forming a first acute angle relative to the axis,

wherein the holder end surface includes a holder edge and a second inclined surface extending along the holder edge around the perimeter of the holder end surface, the second inclined surface forming a second acute angle relative to the axis, wherein the first inclined surface and the second inclined surface are positioned adjacent one another such that the first acute angle and the second acute angle form a combined wedge angle.

20. The bit assembly of claim 17, wherein the bit includes a bit body and an insert, the bit body including an aperture positioned adjacent the first end of the bit, the insert positioned at least partially within the aperture, the insert defining a tip, the insert including an insert outer surface defining an insert profile that is continuous with the bit profile.

21. The bit assembly of claim 17, wherein an imaginary surface aligned with a contour of the holder profile and extending beyond the holder end surface is aligned with a contour of the bit profile.

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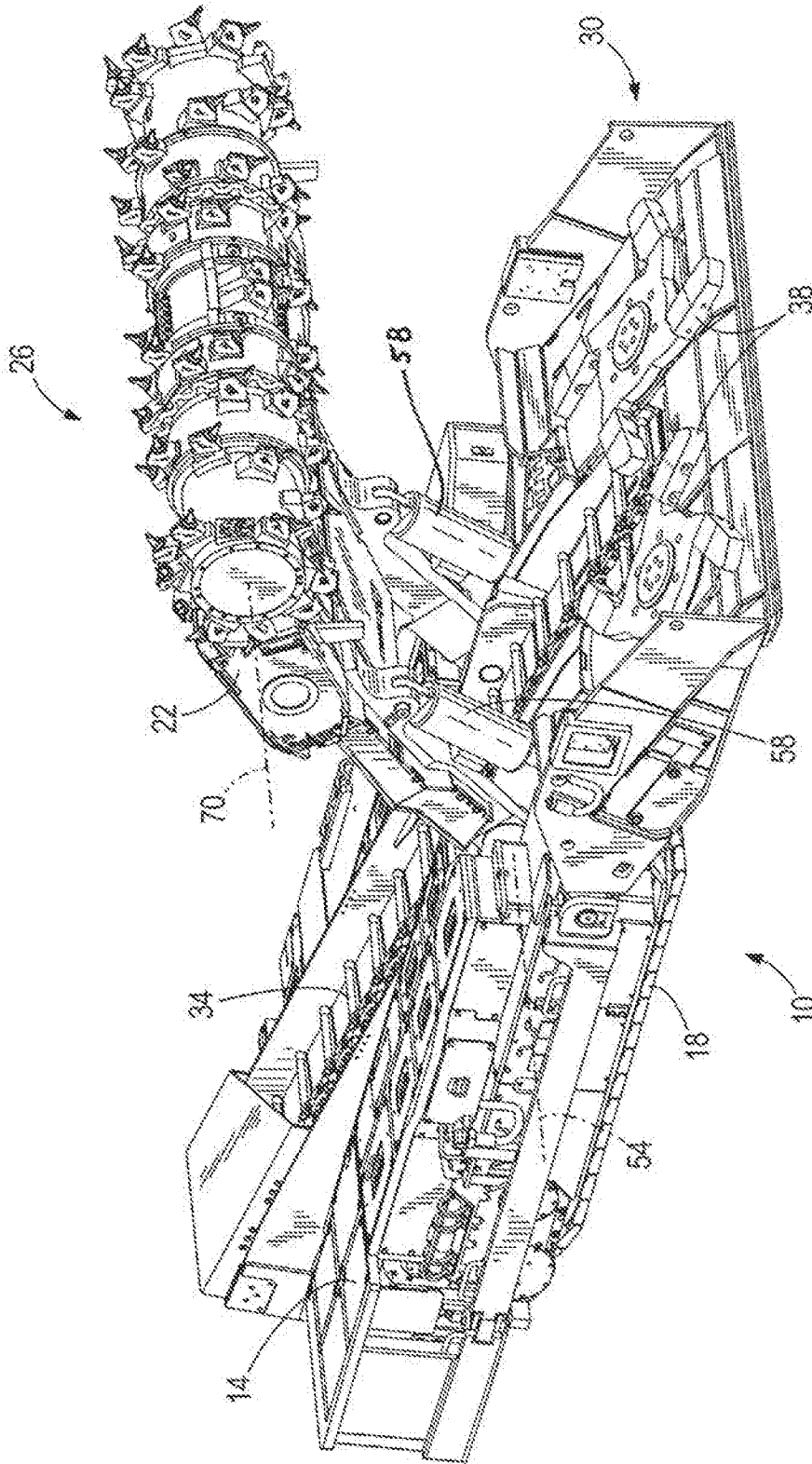


FIG. 1

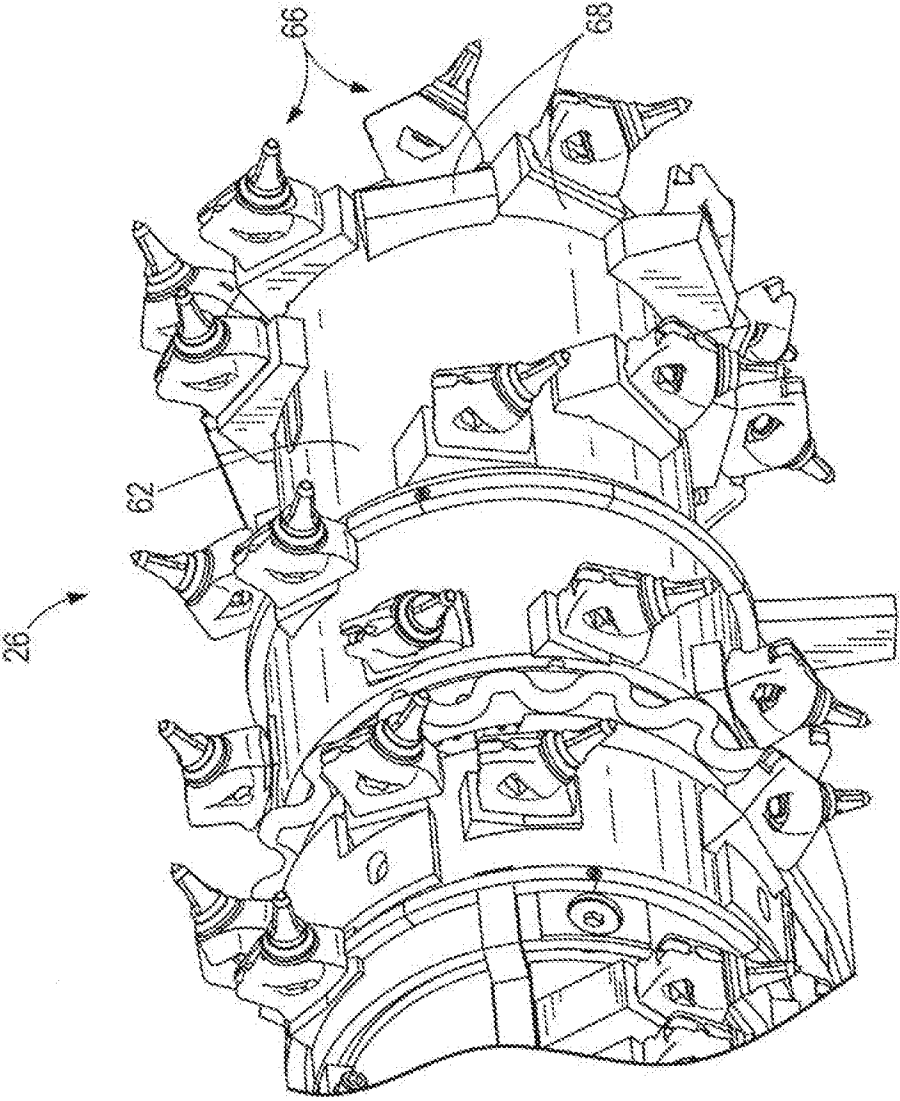
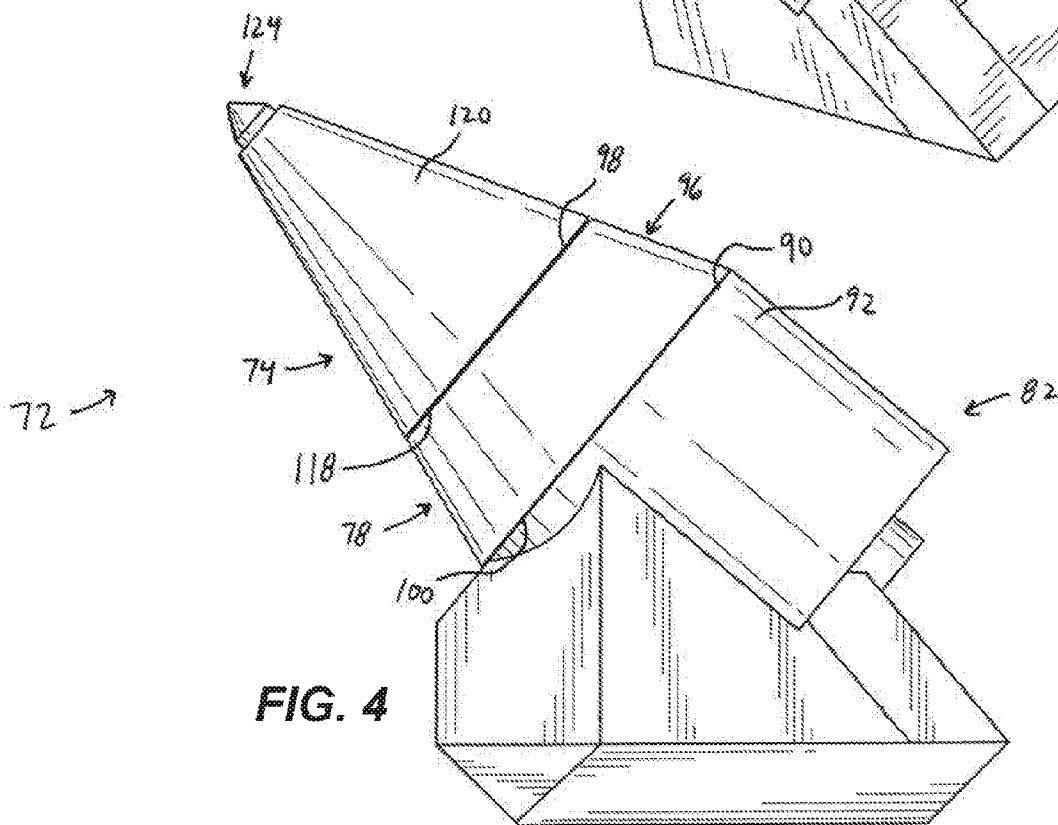
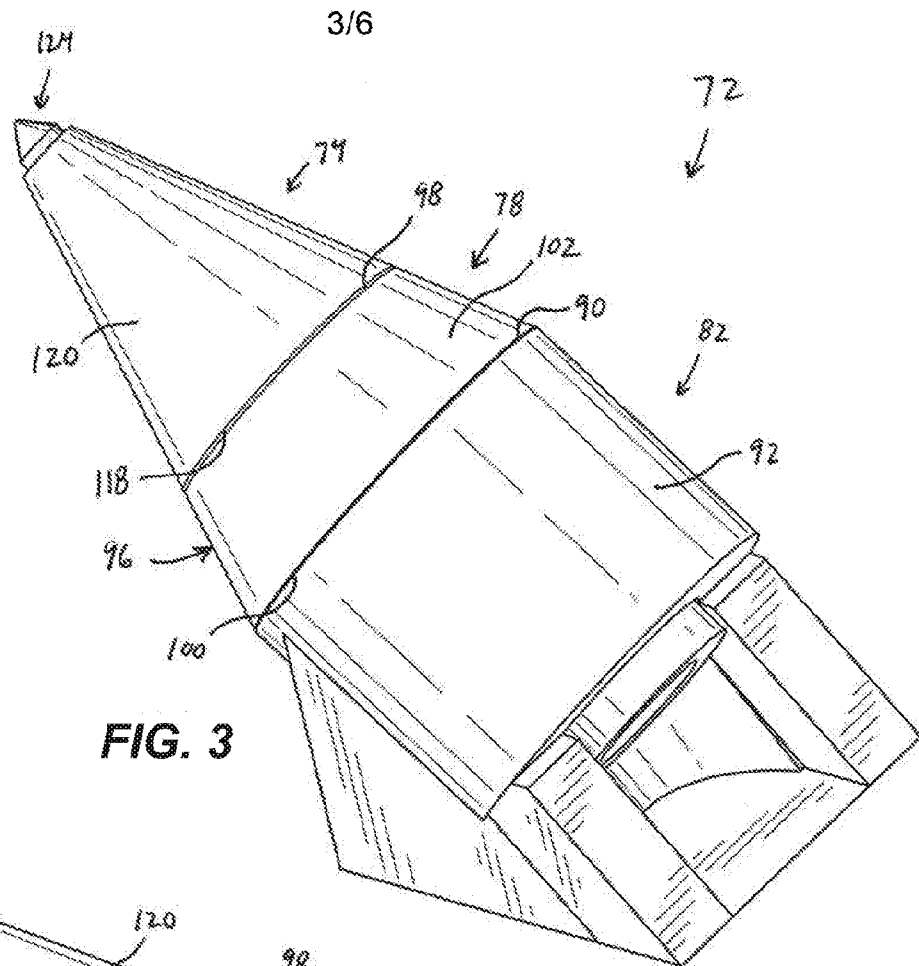


FIG. 2



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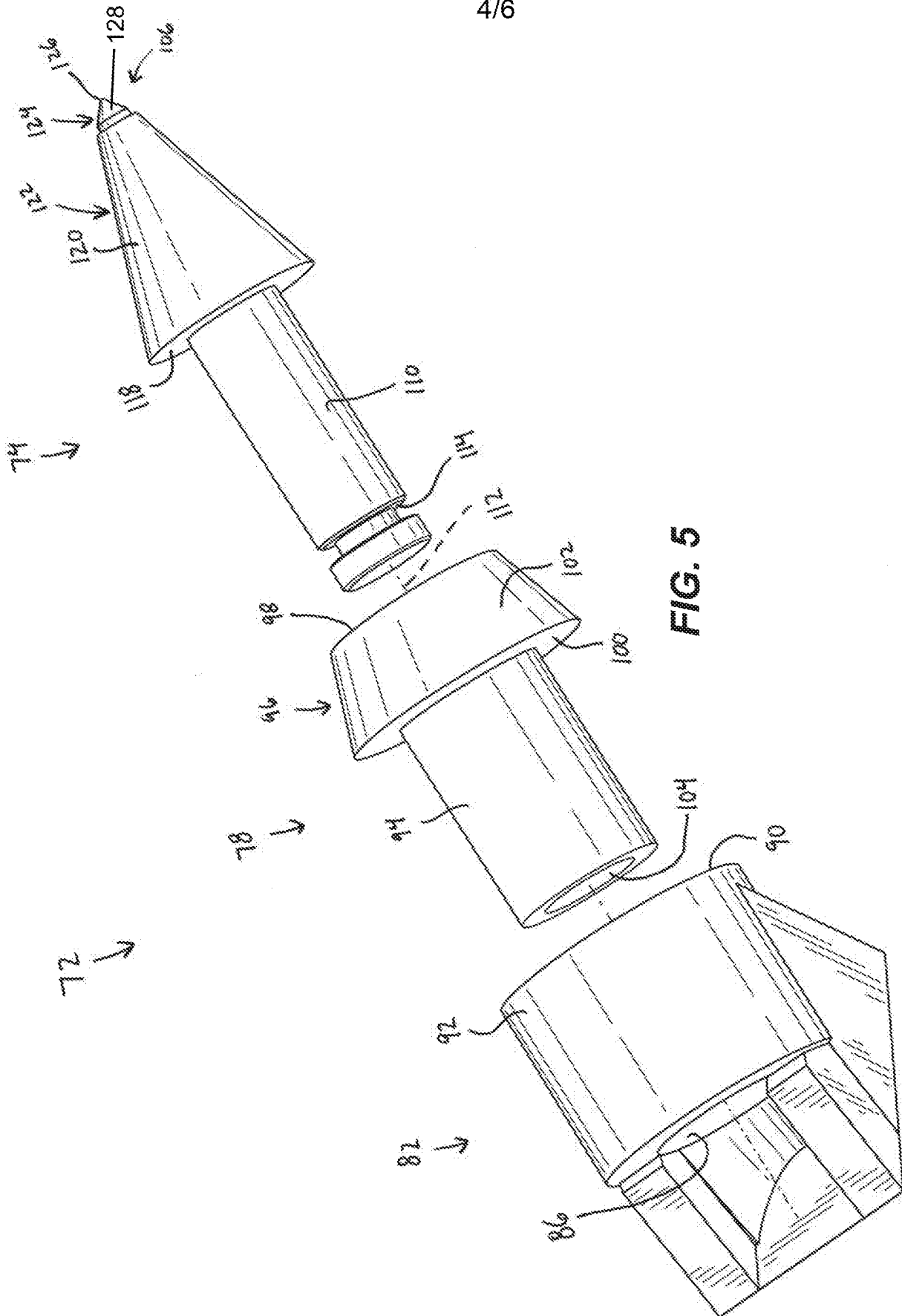


FIG. 5

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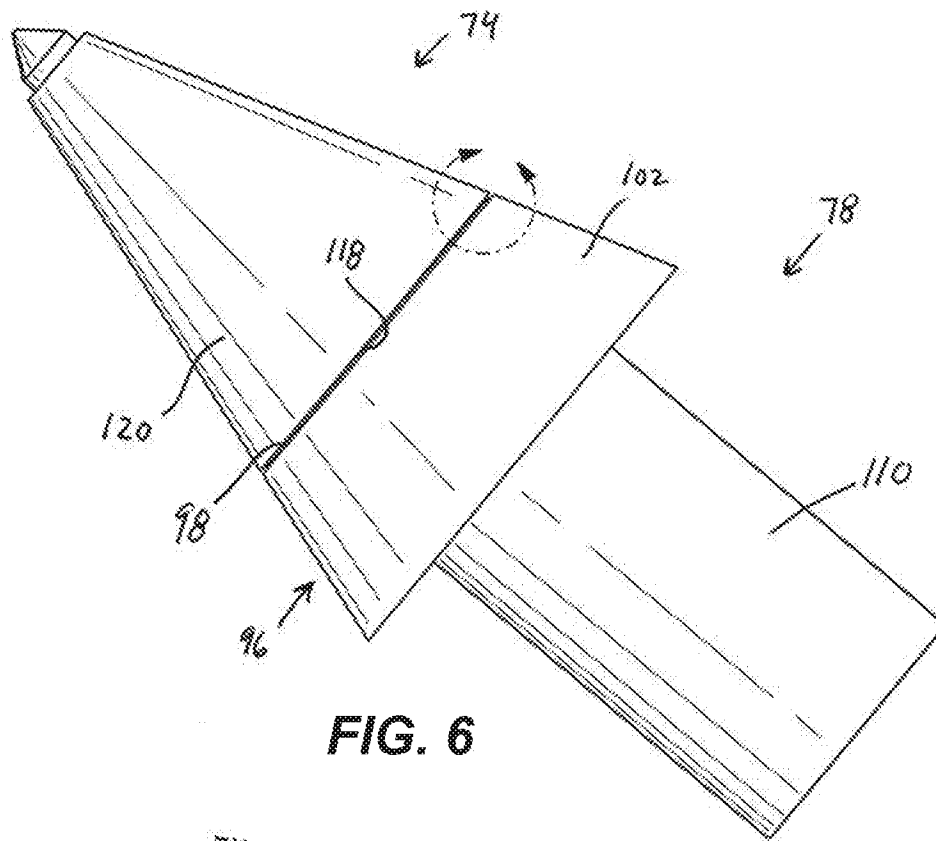


FIG. 6

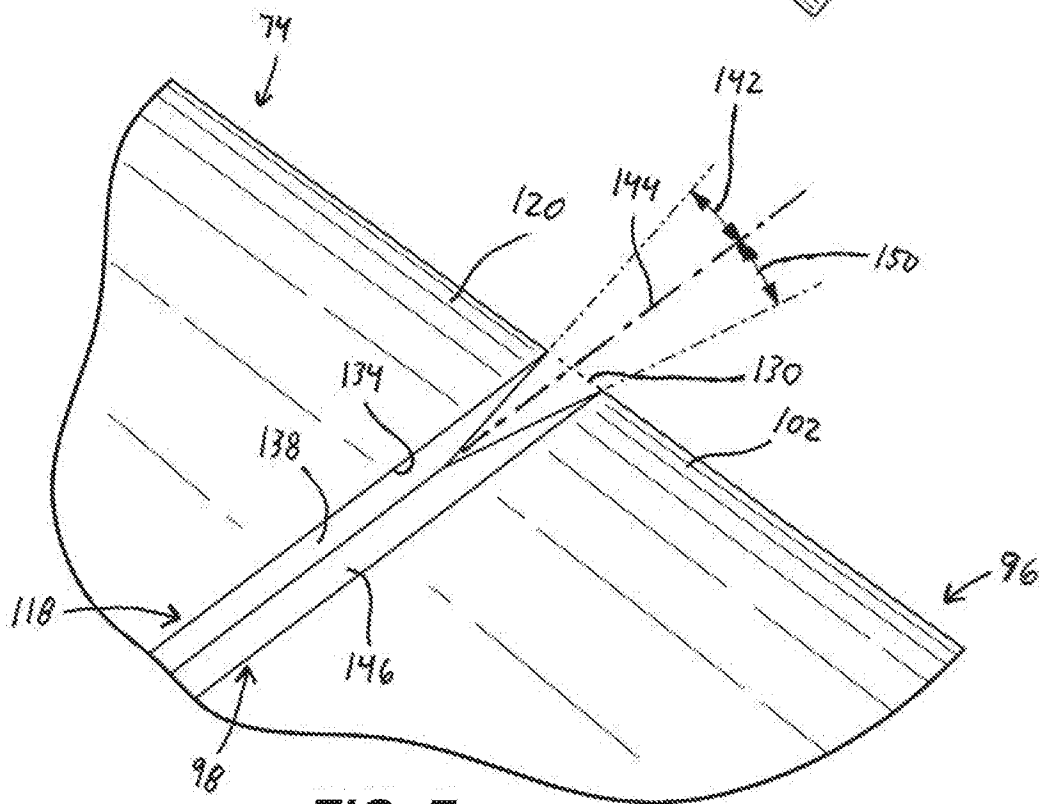


FIG. 7

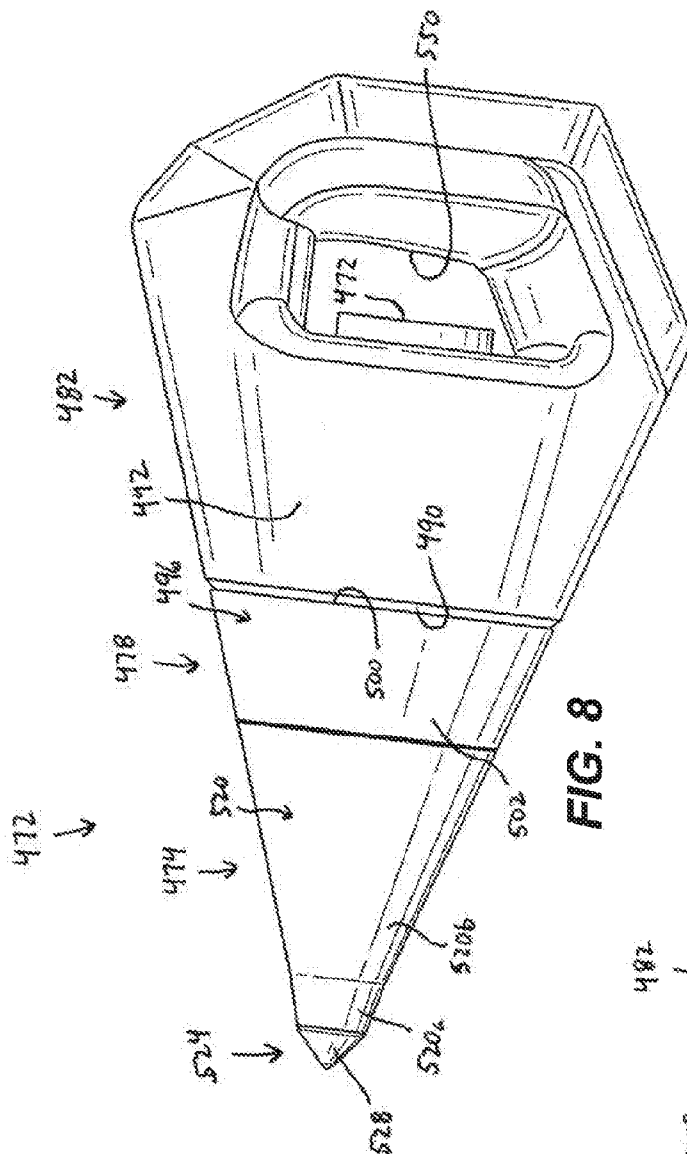


FIG. 8

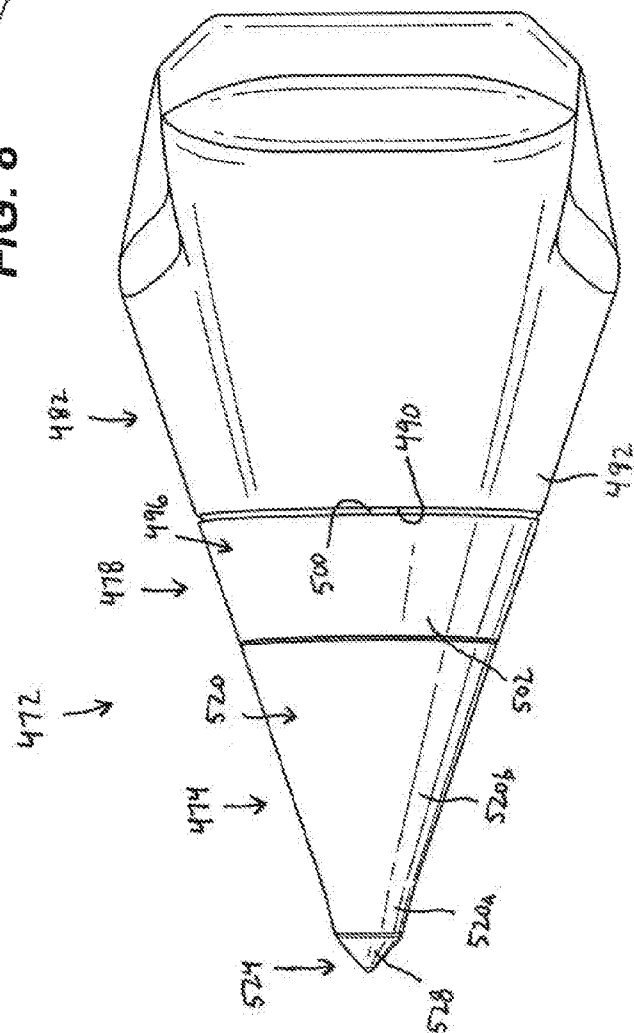


FIG. 9

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2016/026946**A. CLASSIFICATION OF SUBJECT MATTER****E21C 27/24(2006.01)i, E21C 25/10(2006.01)i, E21C 35/18(2006.01)i**

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)

E21C 27/24; E21C 35/183; E21B 10/36; E21C 35/197; E21B 10/00; E21C 35/19; E21C 25/10; E21C 25/00; E21C 35/18

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & Keywords: bit, sleeve, shank, flange, bore, surface, cutting end, shoulder and mining

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2010-0253130 A1 (SOLLAMI, PHILLIP A.) 07 October 2010 See paragraphs [0018]–[0028] and figures 1–6.	1–7, 9–15, 17–19, 21
Y		8, 16, 20
Y	US 2010-0018776 A1 (KELLER et al.) 28 January 2010 See paragraphs [0015]–[0017] and figures 1–2.	8, 16, 20
A	US 2012-0223568 A1 (SULOSKY, WILLIAM P.) 06 September 2012 See paragraphs [0018]–[0032] and figure 1.	1–21
A	US 2008-0053711 A1 (O' NEILL, MICHAEL L.) 06 March 2008 See paragraphs [0010]–[0018] and figures 1–3.	1–21
A	US 2011-0181098 A1 (ZIMMERMAN et al.) 28 July 2011 See paragraphs [0016]–[0021] and figures 4–5.	1–21



Further documents are listed in the continuation of Box C.



See patent family annex.

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"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

29 July 2016 (29.07.2016)

Date of mailing of the international search report

29 July 2016 (29.07.2016)

Name and mailing address of the ISA/KR

International Application Division

Korean Intellectual Property Office

189 Cheongsa-ro, Seo-gu, Daejeon, 35208, Republic of Korea

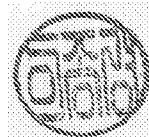


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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2016/026946

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