(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
4 February 2010 (04.02.2010)

PCT

(10) International Publication Number
WO 2010/014327 A2

(51) International Patent Classification:
E21B 10/46 (2006.01) *E21B 10/36* (2006.01)
E21B 10/56 (2006.01)

(21) International Application Number:
PCT/US2009/049028

(22) International Filing Date:
29 June 2009 (29.06.2009)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
12/180,584 28 July 2008 (28.07.2008) US

(71) Applicant *(for all designated States except US)*: **KENNAMETAL INC.** [US/US]; P.O. Box 231, 1600 Technology Way, Latrobe, PA 15650-0231 (US).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: **KELLER, Donald, E.** [US/US]; 5200 Forest Avenue, Bedford, PA 15522 (US). **BILYEU, Michael, Lee** [US/US]; 190 Clarion Avenue, Bedford, PA 15522 (US).

(74) Agents: **SMITH, Matthew, W.** et al.; Kennametal Inc., P.O. Box 231, Latrobe, PA 15650 (US).

(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, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (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, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *without international search report and to be republished upon receipt of that report (Rule 48.2(g))*

(54) **Title**: CUTTING BIT FOR MINING AND EXCAVATING TOOLS

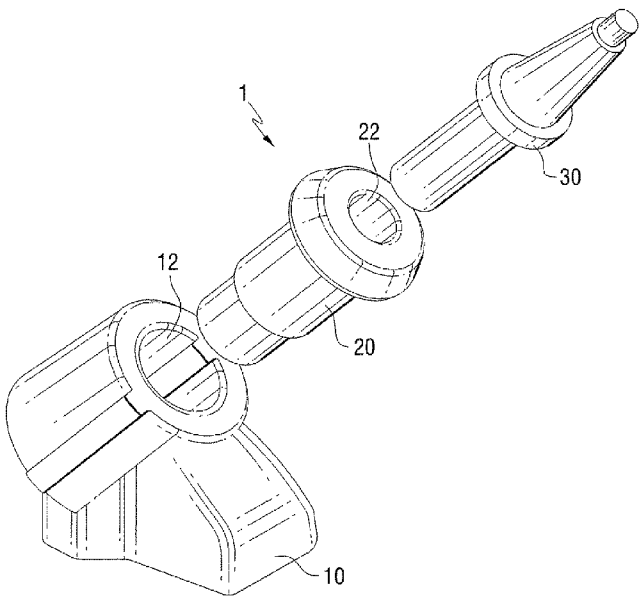

FIG. 1

(57) **Abstract**: A wear-resistant cutting bit for use on a mining or excavating cutting tool is disclosed. The cutting bit utilizes a hardened insert having a narrow base attached to the remainder of the cutting bit. An extended collar of the hardened insert projects from the cutting bit and ends with a generally conical section. The extended collar and narrow base of the hardened insert enable the cutting bits of the present invention to be more wear-resistant and cost-effective than other cutting bits used on mining and excavating equipment.

WO 2010/014327 A2

CUTTING BIT FOR MINING AND EXCAVATING TOOLS

FIELD OF THE INVENTION

[0001] The present invention relates to mining and excavating tools and, more particularly, is concerned with a cutting bit designed for erosion resistance.

BACKGROUND INFORMATION

[0002] Mining and excavating tools often employ drums and the like on which are mounted many cutting bits. Each cutting bit typically has a hard wear-resistant tip made of a material such as tungsten carbide attached to a generally conical steel head of the bit. A problem with such designs is that the softer steel head material erodes during cutting operations. This is commonly referred to as "steel wash".

[0003] Wear-resistant cutting bits have been developed in order to increase erosion resistance. U.S. Patent No. 4,725,098 to Beach discloses the deposition of a hard-facing material about the steel nose of a cutting bit. U.S. Patent No. 5,417,475 to Graham et al. discloses the installation of a ring of hard material on the front surface of a steel nose of a cutting bit. U.S. Patent No. 6,709,065 to Peay et al. discloses the use of a ledge of hard material mounted near the steel nose of a cutting bit. Published U.S. Application No. 2005/0035649 to Mercier et al. discloses the installation of hard wear rings on a stepped shoulder of a cutting bit.

[0004] Despite these known designs, a need still exists for cutting bits which exhibit improved wear resistance thereby extending the life of the bit and reducing operating costs.

[0005] The present invention has been developed in view of the foregoing.

SUMMARY OF THE INVENTION

[0006] The present invention provides a wear-resistant cutting bit for use on a mining or excavating cutting tool. The cutting bit utilizes a hardened insert having a narrow base attached to the remainder of the cutting bit. An extended collar of the hardened insert projects from the cutting bit and ends with a generally conical section. The extended collar and narrow base of the hardened insert enable the cutting bits of the

present invention to be more wear-resistant and cost-effective than other cutting bits used on mining and excavating equipment.

[0007] An aspect of the present invention provides an insert for a cutting bit comprising a forward most generally conical portion, an extended collar adjacent and rearward of the generally conical portion, the extended collar portion having a diameter and an axial length, a tapered transition segment and a reduced diameter base.

[0008] Another aspect of the present invention provides a cutting bit comprising a forward portion and a shank oriented about a longitudinal axis, the forward portion having a socket, a hardened insert affixed to the socket of the forward portion, the hardened insert comprising a generally conical portion adjacent an extended collar adjacent and transition segment adjacent a reduced diameter base, wherein the reduced diameter base and transition section fit into the socket of the forward portion.

[0009] These and other aspects will become more apparent from the following description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] Fig. 1 is an exploded, oblique view of a cutting bit and bit holder comprising a base block and sleeve according to one embodiment of the present invention.

[0011] Fig. 2 is a side view of a cutting bit with a section of the nose cut away around the hardened tip.

[0012] Fig. 3 is a side view of a hardened tip according to one embodiment of the present invention.

[0013] Fig. 4 is a side view of a cutting bit with a hardened ring about the forward portion according to one embodiment of the present invention.

[0014] Fig. 5 is a side view of a cutting bit with a hardened ring about the forward portion according to one embodiment of the present invention.

DETAILED DESCRIPTION

[0015] Referring now to Fig. 1, a cutting assembly 1 is shown. The cutting assembly 1 includes a base block 10 which mounts onto a rotating drum or other piece of

equipment. A sleeve 20 fits inside an opening 12 in the base block 10. Cutting bit 30 inserts into a bore 22 of the sleeve 20. Sleeve 20 and cutting bit 30 may be secured to the opening 12 and bore 22 through appropriate means known to those skilled in the art, for example, by press fitting, by using a retainer ring or other fastening means.

[0016] Referring now to Fig. 2, a more detailed side view of the cutting bit 30 according to one embodiment of the present invention is shown. Cutting bit 30 may have a shank 40 and forward portion 50 separated by a flared collar 60. The cutting bit 30 may be situated about a longitudinal axis 2. The cutting bit 30 has an axially forward end 70 and an axially rearward 80 in relation to the longitudinal axis 2. At the axially forward end 70 of the cutting bit 30 is a hardened insert 100 located into a socket 90 in the forward portion 50 of the cutting bit 30.

[0017] Hardened insert 100 may be any number of wear materials, including tungsten carbide, titanium carbide and tantalum carbide, aluminum oxide, titanium nitride, cobalt, cubic boron nitride, polycrystalline diamond, and may include other ceramics, and alloys and cermets of these materials. Hardened insert 100 is typically made of cemented tungsten carbide and is brazed into the socket 90 or attached by any other method known to those skilled in the art.

[0018] In the embodiment shown in Fig. 2, the shank 40 of the cutting bit 30 has a retainer 42 near the axially rearward end 80. This retainer 42 provides a seating surface for press fitting the cutting bit 30 into the sleeve 20.

[0019] Referring now to Fig. 3, the hardened insert 100 will now be described in more detail. At the axially forward end 70 the hardened insert 100 has generally conical portion 110 ending at a cutting tip 120. As used herein the phrase "generally conical" desribes a portion of the cutting tip being shaped like a cone and includes frustoconical and pyramidal shapes. Rearward of the generally conical section 110 is an extended collar 130. Rearward of the extended collar 130 is an inwardly tapering transition segment 140. Rearward of the transition segment 140 is a reduced diameter base 150. The reduced diameter base 150 may be any suitable shape, for example cylindrical and/or conical. As used herein, phrase "reduced diameter" describes a diameter of the base of the hardened insert being of lesser diameter than the diameter of the extended collar of the hardened insert. The reduced diameter base 150 may be about 85% to about 35%, for example about 70% of the diameter of the extended collar 130. The extended

collar 130 may have an extended collar diameter 132 of about 15 mm to about 35 mm, for example about 25 mm. Although, the embodiment in Fig. 3, shows a reduced diameter base having a uniform diameter, non-uniform shapes of varying diameter are also contemplated.

[0020] The reduced diameter base 150 enables the forward portion 50 to withstand a significant amount of wear before resulting in cutting bit failure. Forward portion 50 and shank portion are typically made of carbon steel. Still referring to Fig. 3, a wear area 52 is illustrated by the phantom line 53. This is a high wear area 52 in cutting bits. The relatively soft carbon steel of the forward end abrades much faster than the hardened insert 100. Due to the reduced diameter of the base 150, the wider extended collar 130 and conical section 110 protect the base 150 and the steel of the forward portion 50 adjacent to the base 150 from much abrasion. This maintains the integrity of the steel and brazing securing the hardened insert for a much longer time than would be achievable with an insert of uniform diameter.

[0021] Hardened inserts 100 typically wear along the generally conical portion 110 at an angle of 90° to 120°, for example 110°. The wear angle, denoted θ, is illustrated in Fig. 3. As described above, the hardened insert 100 has an extended collar 130 designed to extend useful life of the cutting bit 30. The extended collar 130 may be generally cylindrical and has an axial length 134 illustrated in Fig. 3. The axial length 134 may be about 5 mm to about 35 mm, for example about 10 mm. As a consequence, the hardened insert 100 is able to wear from the cutting tip 120 position shown in Fig. 3 through to position A. In most instances, the reduced diameter base 150 allows wear of the cutting bit 30 even beyond position A before the cutting bit 150 ultimately fails.

[0022] In one embodiment of the present invention shown in Fig. 4, the cutting bit 200 has a hardened exterior surface placed about the nose 252 of the forward portion 250. In this embodiment, the hardened exterior surface is a sheath 220 made from cemented tungsten carbide. The nose 252 may be slightly recessed about the periphery of the forward portion 250 to accommodate the sheath 220 or the sheath 220 may be fit over an unrecessed periphery of the nose 252. The sheath 220 may be affixed to the forward portion 250 by brazing or other known method.

[0023] Another embodiment incorporating a hardened exterior surface about the nose 352 of the forward portion of the cutting bit 300 is shown in Fig. 5. In this

embodiment, the nose 352 of the forward portion 350 has a wear-resistant exterior comprising a hardfacing weld 354. In the embodiments shown in Figs. 4-5 the exterior of the nose 252, 352 has been hardened to at least a hardness 50 RWc. In other embodiments, the forward portion may be made from a hardened or alloy steel to provide wear-resistance.

[0024] In addition to exceptional life, the cutting bits of the present invention have shown an ability to reduce sparking during mining operations. At times, the atmosphere in underground mines can become combustible. It is therefore desirable to reduce ignition sources, such as sparks, in mining equipment.

[0025] Test results demonstrating the performance of the cutting bits according to one embodiment of the present invention have shown a 3:1 improvement in wear. Tests of the cutting bits of the present invention were performed on a single continuous mining machine having two drums. One drum was equipped with standard cutting bits while the second drum was equipped with cutting bits of the present invention. The test setup ensured the standard cutting bits and the cutting bits of the present invention where used under identical conditions, e.g. the material cut, time in operation and rate of cutting. The cutting bits were run until failure. The standard cutting bits lasted for one 8-hour shift while the cutting bits of present invention cut for three 8-hour shifts.

[0026] Some improvement in the life of the bits was expected due to a slight increase in the amount of material used in the inserts of the present invention compared to standard cutting bits. However, a 3:1 increase in cutting bit life exceeded expectation considering a less than 2:1 increase in hardened material was added to the cutting bits.

[0027] Whereas particular embodiments of this invention have been described above for purposes of illustration, it will be evident to those skilled in the art that numerous variations of the details of the present invention may be made without departing from the invention as defined in the appended claims.

CLAIMS:

1. An insert for a cutting bit comprising:

a generally conical portion;

an extended collar adjacent and rearward of the generally conical portion, the extended collar portion having a diameter and an axial length;

a tapered transition segment adjacent the extended collar; and

a reduced diameter base adjacent the tapered transition segment.

2. The insert for a cutting bit of claim 1, wherein the reduced diameter base has a diameter which is about 35% to about 85% of the diameter of the extended collar.

3. The insert for a cutting bit of claim 1, wherein the reduced diameter base has a diameter which is about 70% of the diameter of the extended collar.

4. The insert for a cutting bit of claim 1, wherein the hardened bit is made from cemented tungsten carbide.

5. The insert for a cutting bit of claim 1, wherein the extended collar has a diameter of about 15 mm to about 35 mm.

6. The insert for a cutting bit of claim 1, wherein the extended collar has a diameter of about 25 mm.

7. The insert for a cutting bit of claim 1, wherein the extended collar has an axial length of about 5 mm to about 35 mm.

8. The insert for a cutting bit of claim 1, wherein the extended collar has an axial length of about 10 mm.

9. A cutting bit comprising:

a forward portion and a shank oriented about a longitudinal axis, the forward portion having a socket;

a hardened insert affixed to the socket of the forward portion, the hardened insert comprising a generally conical portion adjacent an extended collar adjacent and transition segment adjacent a reduced diameter base,

wherein the reduced diameter base and transition section fit into the socket of the forward portion.

10. The a cutting bit of claim 9, wherein the reduced diameter base has a diameter which is about 35% to about 85% of the diameter of the extended collar.

11. The cutting bit of claim 9, wherein the reduced diameter base has a diameter which is about 70% of the diameter of the extended collar.

12. The cutting bit of claim 9, wherein the hardened bit is made from cemented tungsten carbide.

13. The cutting bit of claim 9, wherein the extended collar has a diameter of about 15 mm to about 35 mm.

14. The cutting bit of claim 9, wherein the extended collar has a diameter of about 25 mm.

15. The cutting bit of claim 9, wherein the extended collar has an axial length of about 5 mm to about 35 mm.

16. The cutting bit of claim 9, wherein the extended collar has an axial length of about 10 mm.

17. The cutting bit of claim 9, wherein the hardened insert is affixed to the socket by brazing.

18. The cutting bit of claim 9, further comprising a wear-resistant sheath affixed to the forward portion.

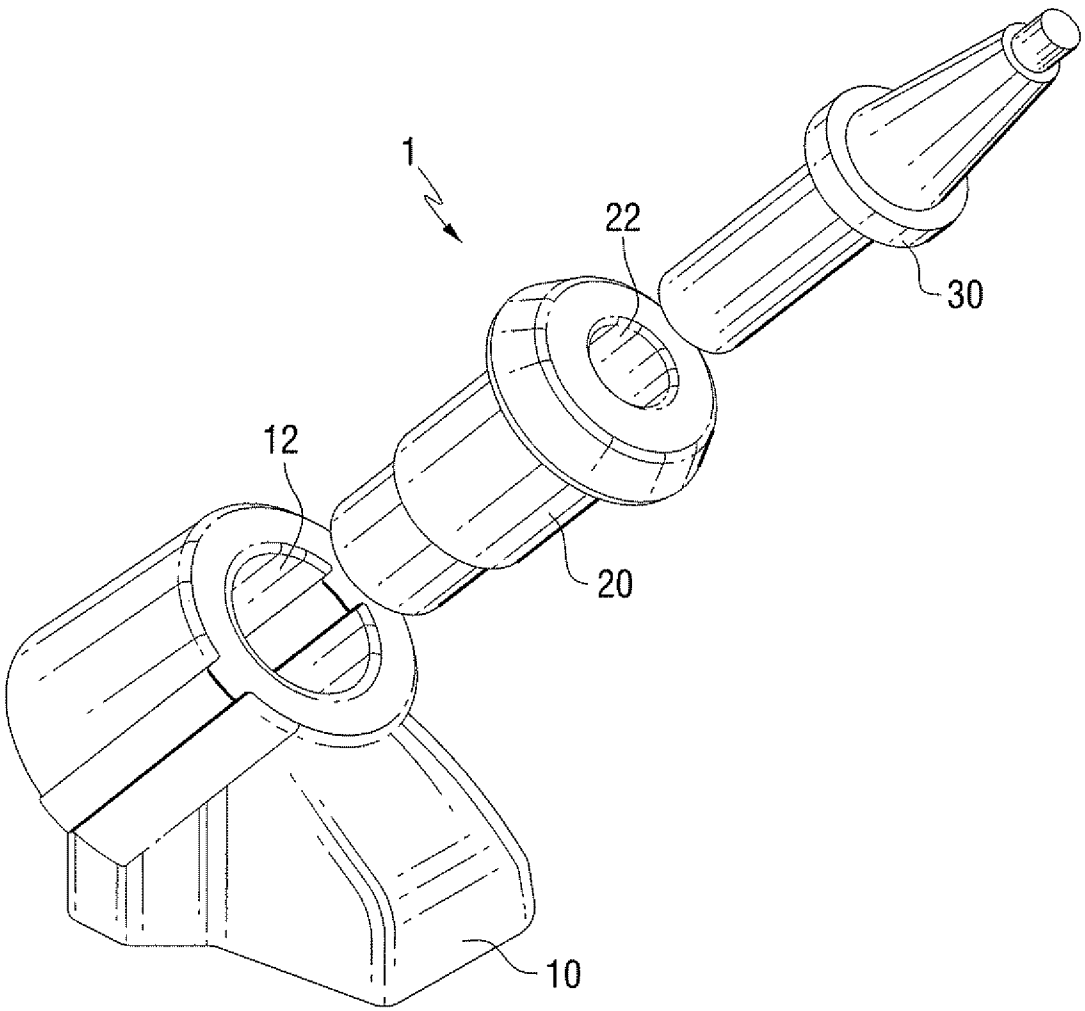

FIG. 1

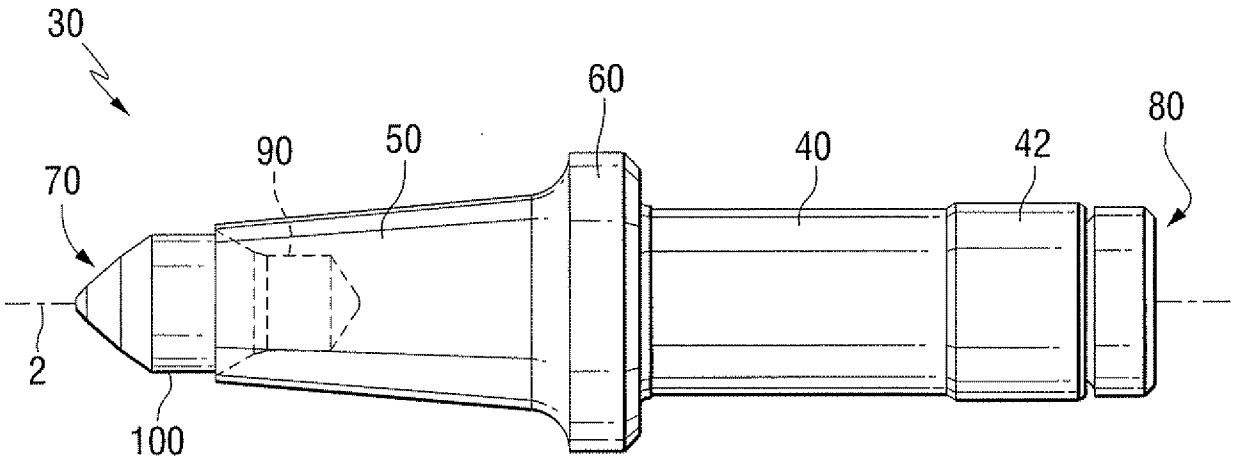
30
60
80
90
50
40
42
70
2
100

FIG. 2

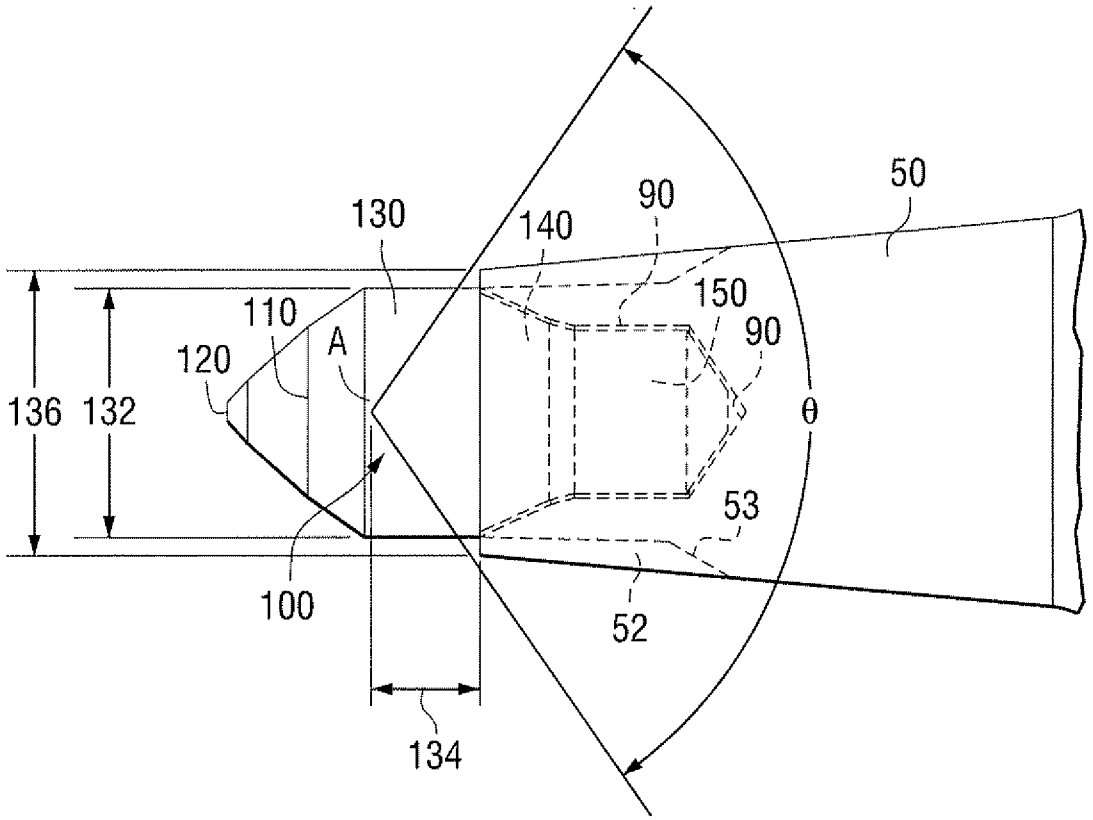
50
130
90
140
150
110
90
120
A
136
132
θ
53
100
52
134

FIG. 3

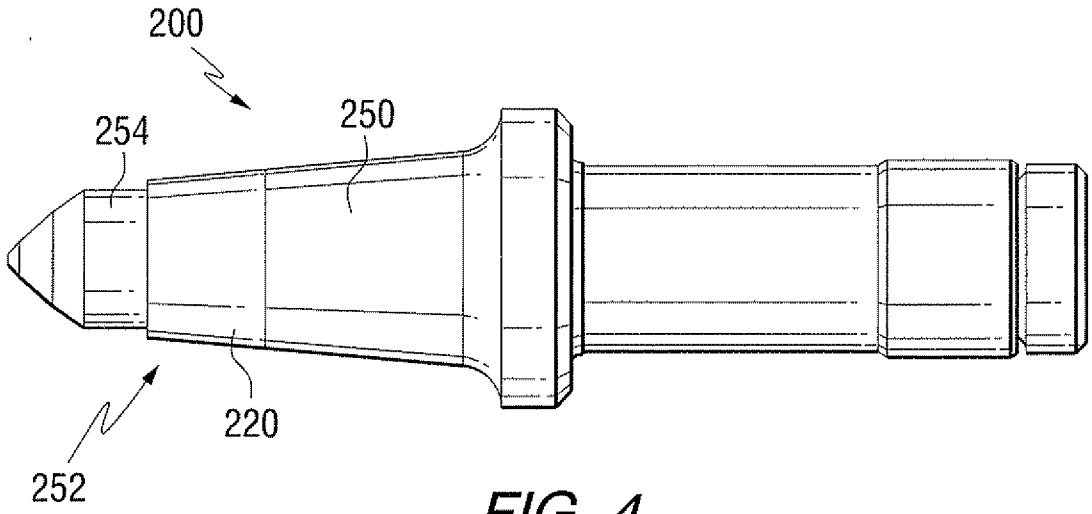

FIG. 4

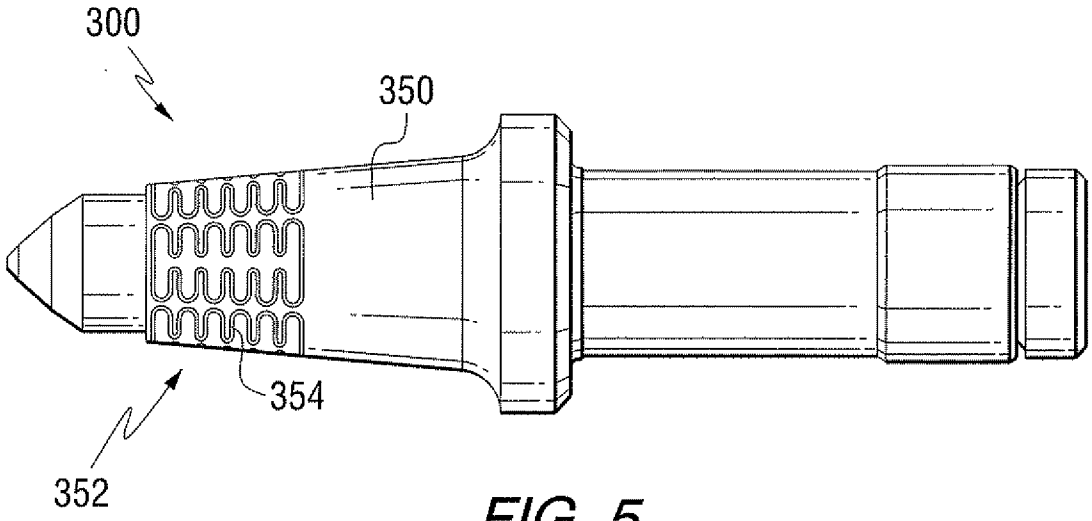

FIG. 5