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(54) Titre : RONDELLE NON ROTATIVE POUR PIOCHE, ENSEMBLE OUTIL ET BLOC, PROCEDE POUR REDUIRE L'USURE EROSIVE ET MACHINE D'ENLEVEMENT DE MATIERE

(54) Title: NON-ROTATING WASHER FOR TOOL PICK, TOOL AND BLOCK ASSEMBLY, METHOD TO REDUCE EROSIVE WEAR AND MATERIAL REMOVAL MACHINE

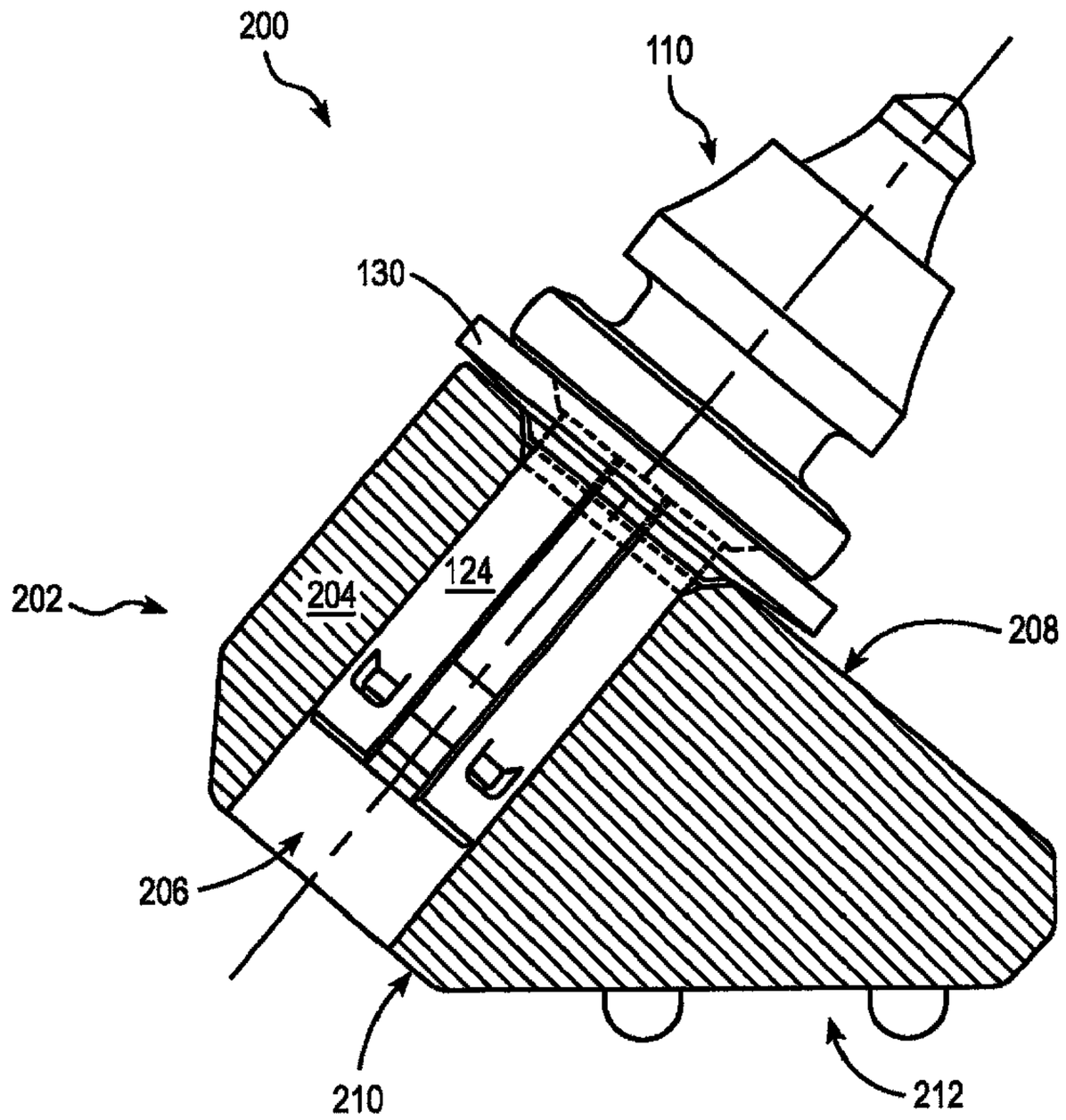

FIG. 8

(57) Abrégé/Abstract:
A rotatable tool pick has a retaining element axially separated from the shoulder section by a first axial distance that is less than an axial thickness of the washer at the inner peripheral surface. When the washer is mounted on the shank via a central opening, the

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(57) Abrégé(suite)/Abstract(continued):
inner peripheral surfaces of the washer are contacted by the retaining element and the washer is non-rotating relative to the retaining element. The non-rotation of the washer does not occur by a mechanical device, but rather by the outward forces generated by the retaining element. By placing the non-rotating washer between a shoulder of a tool pick and the contact face of a block or sleeve, erosive wear of the contact face is reduced.

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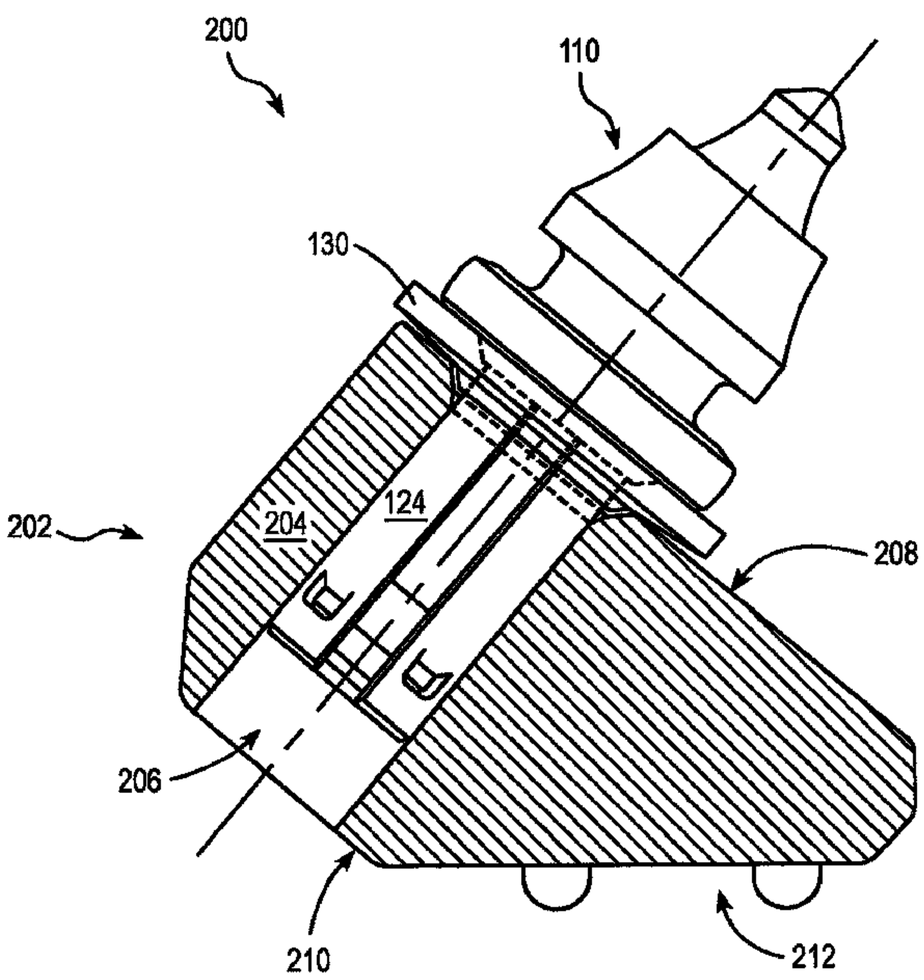

FIG. 8

(57) **Abstract**: A rotatable tool pick has a retaining element axially separated from the shoulder section by a first axial distance that is less than an axial thickness of the washer at the inner peripheral surface. When the washer is mounted on the shank via a central opening, the inner peripheral surfaces of the washer are contacted by the retaining element and the washer is non-rotating relative to the retaining element. The non-rotation of the washer does not occur by a mechanical device, but rather by the outward forces generated by the retaining element. By placing the non-rotating washer between a shoulder of a tool pick and the contact face of a block or sleeve, erosive wear of the contact face is reduced.

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NON-ROTATING WASHER FOR TOOL PICK, TOOL AND BLOCK ASSEMBLY, METHOD TO REDUCE EROSIVE WEAR AND MATERIAL REMOVAL MACHINE

FIELD

[0001] The present disclosure relates to a rotatable tool pick, particularly for the mining, excavating, tunnelling, road planing and/or construction industries. More particularly, the present disclosure relates to a rotatable tool pick incorporating a non-rotating washer at the interface of a pick shoulder and a corresponding contact face of the block or sleeve. A friction fit between a washer bore and a retaining element on the pick shank impedes or prevents rotation and the non-rotating washer reduces the wear on the contact face of the block or sleeve, which extends the life of the system. The disclosure relates to the tool pick with non-rotating washer per se and also relates to a block and sleeve assembly incorporating the rotatable tool pick with non-rotating washer, a machine incorporating such a block and sleeve assembly, particularly machines for mining, excavating, tunnelling, road planing and/or construction, and a method of mining, excavating, tunnelling, road planing and/or construction using the rotatable tool pick with non-rotating washer.

BACKGROUND

[0002] In the discussion of the background that follows, reference is made to certain structures and/or methods. However, the following references should not be construed as an admission that these structures and/or methods constitute prior art. Applicant expressly reserves the right to demonstrate that such structures and/or methods do not qualify as prior art.

[0003] All tool picks with washers incorporate some form of a steel shank with a ledge to accommodate the washer at installation. As seen in FIG. 1, a conventional tool body 10 of a tool pick includes a head end 12 and a shank end 14. The head end 12 includes the seat 16 for receiving a cutting tip 18 therein (a tool pick 20 including the tool body 10 and a cutting tip 18 is shown in FIGS. 2A and 2B) and a cutting portion 22

(here shown with a tapered forward section 22a and a non-tapered section 22b). After a puller groove 24, there is a shoulder 26 with a rearward facing surface 28. Between the rearward facing surface 28 of the shoulder 26 and an area 30 of the shank end 14 to receive a retaining element, there is a ledge 32 defined by a diameter (D) that is greater than the diameter of the area 30 that receives the retaining element but is less than a diameter of the shoulder 26.

[0004] To protect the contacting surfaces of the tool pick and the body in which the tool pick is mounted for rotational motion during operation, for example, a block and/or a sleeve, a washer can be included. Conventionally and for shipping and storage prior to use, the washer 34 comes assembled onto the shank end 14 of the tool pick 20, as shown in FIG. 2A. The washer 34 is placed over the shank end 14 with the retaining element 36 in a compressed condition, i.e., with a reduced diameter from the free state, which is accommodated by the reduced diameter of the area 30. In the position in FIG. 2A, the washer 34 is in friction fit contact with the outer surface of the retaining element 36. FIG. 2B shows the conventional arrangement for the washer 34 on the tool pick 10 when the tool pick 10 has been installed for use or the washer 34 has otherwise been moved axially forward. In FIG. 2B, the washer 34 has been forced axially forward on the shank end 14 and contacts the rearward facing surface 28 of the shoulder 26. The washer 34 is positioned such that the surface of the retaining element 36 is no longer in contact with surfaces of the opening in the washer 34 and the washer 34 can rotate relative to both the retaining element 36 and the tool pick 10. In practice, conventional washers 34 can have some axial movement while positioned on the ledge 32, and some portion 38 of the shank, whether the ledge 32 or some other portion, axially above the area 30 with the reduced diameter may protrude rearwardly below the washer 34.

[0005] Existing block and sleeve holder systems are prone to failure due to the excessive frictional wear between the washer and the contacting surface of the block or sleeve. As a tool pick cuts, abrasive fines become trapped between the washer and the contacting surface of the block or sleeve. These abrasive fines contribute to wear and erosion of the contacting face of the block or sleeve. Such wear can, among other

things, shorten the life of the block and sleeve holder system. Furthermore, such wear can require premature replacement of the block of the holder system at expense in efficiency, time and money.

[0006] Two existing designs of non-rotating washers, U.S. Patent No. 7,195,321 and U.S. Patent No. 6,692,083, both use a tab, or other mechanical device, to prevent the washer from rotating relative to the contact surface of the block or sleeve. Furthermore, neither of these designs completely prevents movement of the washer relative to the contact surface as there is always “slack” between the mechanical device and its corresponding mating surface. This slack allows some rotational movement of the washer relative to the contact surface and even small rotational movement can erode the contact surface of the block or sleeve over time to deleterious effect.

SUMMARY

[0007] To reduce erosive wear of a contact face of a block or a contact face of a sleeve, a washer is positioned between a shoulder of a tool pick and the contact face such that the washer is non-rotatable relative to a retaining element. Reducing rotation of the washer reduces the wear on the tool pick and associated parts of the block (or block and sleeve) holder system.

[0008] An exemplary embodiment of a rotatable tool pick comprises a head including a seat for receiving a cutting tip therein at an axially forward end and a shoulder section at an axially rearward end, a shank projecting rearwardly from the shoulder section of the head, the shank including a reduced diameter portion having an axial length, a retaining element positioned about at least a portion of the reduced diameter portion of the shank, and a washer with an inner peripheral surface defining a central opening, wherein the washer is mounted on the shank via the central opening and is non-rotatable relative to the retaining element through a friction fit.

[0009] An exemplary embodiment of a tool and block assembly comprises a block including a body having a bore extending axially from a first side to a second side, and a tool pick rotatably mounted in the bore of the block, the tool pick including a head

including a cutting tip mounted therein at an axially forward end and a shoulder section at an axially rearward end, a shank projecting rearwardly from the shoulder section of the head, the shank including a reduced diameter portion having an axial length, a retaining element positioned about at least a portion of the reduced diameter portion of the shank, and a washer with an inner peripheral surface defining a central opening, wherein the washer is mounted on the shank via the central opening and is non-rotatable relative to the retaining element through a friction fit.

[0010] Another exemplary embodiment of a tool and block assembly comprises a block including a body having a bore extending axially from a first side to a second side, a sleeve mounted in the bore of the block, the sleeve having a bore extending axially from a first end to a second end, and a tool pick rotatably mounted in the bore of the sleeve, the tool pick including a head including a cutting tip mounted therein at an axially forward end and a shoulder section at an axially rearward end, a shank projecting rearwardly from the shoulder section of the head, the shank including a reduced diameter portion having an axial length, a retaining element positioned about at least a portion of the reduced diameter portion of the shank, and a washer with an inner peripheral surface defining a central opening, wherein the washer is mounted on the shank via the central opening and is non-rotatable relative to the retaining element through a friction fit.

[0011] An exemplary material removal machine comprises a rotatable member, and one or more rotatable tool picks mounted on the rotatable member, wherein the rotatable tool pick includes a head including a cutting tip mounted therein at an axially forward end and a shoulder section at an axially rearward end, a shank projecting rearwardly from the shoulder section of the head, the shank including a reduced diameter portion having an axial length, a retaining element positioned about at least a portion of the reduced diameter portion of the shank; and a washer with an inner peripheral surface defining a central opening, and wherein the washer is mounted on the shank via the central opening and is non-rotatable relative to the retaining element through a friction fit.

[0012] An exemplary method to reduce erosive wear of a contact face of a block or a contact face of a sleeve comprises placing a washer between a shoulder of a tool pick and the contact face, wherein the washer is mounted on a shank of the tool pick via a central opening defined by an inner peripheral surface and is non-rotatable relative to a retaining element positioned about at least a portion of a reduced diameter portion of the shank through a friction fit.

[0013] It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] The following detailed description can be read in connection with the accompanying drawings in which like numerals designate like elements and in which:

[0015] FIG. 1 shows a body of a conventional tool pick.

[0016] FIGS. 2A and 2B show a conventional tool pick with two different positions of a washer.

[0017] FIG. 3 shows an exemplary tool body for a rotatable tool pick.

[0018] FIGS. 4A and 4B show exemplary embodiments of a rotatable tool pick with a washer in different positions.

[0019] FIGS. 5A and 5B show a cross-sectional view (FIG. 5A) and a plan view (FIG. 5B) of an exemplary embodiment of a washer.

[0020] FIG. 6 is a magnified, partial view of the area of the washer at the shank-head interface.

[0021] FIGS. 7A and 7B show, in cross-section, additional exemplary embodiments of a retaining element with different sections having different gauges.

[0022] FIG. 8 shows an exemplary embodiment of a tool and block assembly incorporating an exemplary embodiment of a rotatable tool pick.

DETAILED DESCRIPTION

[0023] An exemplary tool body for a rotatable tool pick is shown in FIG. 3. The exemplary tool body 100 comprises a head 102 and a shank 104. Axis 106 is shown about which the tool body 100 and any tool pick 110 formed with the tool body 100 are rotatable.

[0024] The head 102 includes a seat 108 for receiving a cutting tip therein at an axially forward end. The head 102 has a shoulder section 112 at an axially rearward end with a rearward facing surface 114. Between the front surface 116 and the shoulder section 112, the head 102 includes a side surface 118, extending axially rearward from the front surface 116 toward the shoulder section 112. The side surface 118 can be of various forms from being oriented substantially perpendicular to a central axis 106 of the tool body 100 to being oriented at an angle α to the central axis 106 (the angle α opening rearward), and combinations thereof and the form of the side surface 118 can be planar, concave, convex or combinations thereof and can optionally include other features, such as a puller groove 120.

[0025] The shank 104 projects rearwardly from the shoulder section 112 of the head 102. The shank 104 includes a reduced diameter portion 122 having an axial length (L_1) and a retaining element 124 positioned about at least a portion of the reduced diameter portion 122 of the shank 104. The reduced diameter portion 122 accommodates a reduced diameter state of the retaining element 124 (shown in FIGS. 4A and 4B), for example, while inserting the shank 104 into a bore of a holder or when a washer is placed over the retaining element. The shank 104 can include additional features, such as an annular recess 126.

[0026] The reduced diameter portion 122 is separated axially from the shoulder section 112 by a first axial distance (d_1). This first axial distance is associated with a portion 128 of the shank 104 between the rearward facing surface 114 of the shoulder section 112 and the reduced diameter portion 122 of the shank 104. This portion 128, also called herein a ledge section, has a diameter (D_L) that is greater than the diameter

(D_r) of the reduced diameter portion 122 but is less than a diameter (D_S) of the shoulder section 112.

[0027] Exemplary embodiments of rotatable tool picks include a washer 130. Although described and shown herein with a washer that is tapered, the disclosed arrangement and non-rotating principles can work equally as well with a flat washer and washers of any suitable form and shape can be used, including those disclosed and described in U.S. Patent Nos. 6,113,195 and 6,702,393; and U.S. Patent Application Publication No. 2007/0257545, the entire contents of each of these disclosures are incorporated herein by reference.

[0028] FIGS. 5A and 5B show a cross-sectional view (FIG. 5A) and a plan view (FIG. 5B) of an exemplary embodiment of a washer 130. The washer has a front main surface 132 and a rear main surface 134 that each extend from an outer peripheral surface 136 to an inner peripheral surface 138, which defines the central opening 140 of the washer 130. The front main surface 132 faces in a first axial direction consistent, which, when the washer 130 is mounted on the shank 104, is consistent with an axially forward direction, and the rear main surface 134 faces in a second, opposite axial direction, which, when the washer 130 is mounted on the shank 104, is consistent with an axially rearward direction. In the exemplary embodiment shown, the front main surface 132 is at a taper angle, β, to the plane 142 containing the intersection of the outer peripheral surface 138 and the front main surface 132, for example at a taper angle of from greater than zero to about 5º. The washer 130 has an overall thickness (T) in the axial direction and a thickness (t) at the inner peripheral surface. Where one or more of the ends of the inner peripheral surface 138 are radiused or chamfered, the thickness (t) is measured from where the radius or chamfer begins on the front main surface 132 and/or the rear main surface 134.

[0029] As seen, for example, in FIGS. 4A and 4B, the washer 130 is mounted on the shank 104 via the central opening 140 and is positioned over the retaining element 124. In FIG.4A, the washer 130 is located axially set-back from both of the axial ends of the retaining element 124. Here, the retaining element 124 is in a reduced diameter

condition limited outwardly by the diameter of the opening 140 in the washer. The force of the compressed retaining element 124 produces an outward force that establishes a friction fit with the washer 130, which is non-rotatable relative to the retaining element 124. As previously stated, this is typically the condition of the tool pick 110 when it is stored or transported. In FIG. 4B, the washer 130 is shown in the position it will be in when installed in a block or sleeve. Here, the washer 130 has been pushed axially forward into contact with the shoulder section 112, preferably with the rearward facing surface 114 of the shoulder section 112. Because the first axial distance (d_1), which is associated with a reduced size or even absence of a ledge section 128 to accept the washer 130, is less than an axial thickness (t) of the washer 130 at the inner peripheral surface 138, the washer 130 remains in contact with the retaining element 124. However, the compressed retaining element 124, i.e., compressed radially relative to its free state, acts with a radially outward force on the washer 130, establishing a friction fit and preventing the washer 130 from rotating relative to the retaining element 124. However, the washer 130 is free to rotate relative to the shank 104. This feature reduces, if not eliminates, frictional wear on contact faces of the block or sleeve and thus extends the life of the block or sleeve.

[0030] In exemplary embodiments, with the washer 130 in the installed position, for example, as shown in FIG. 4B, the friction fit can be sufficient, by itself, to prevent the washer 130 from rotating relative to the retaining element 124. In alternative exemplary embodiments, additional rotation preventing features may be used in combination with the friction fit to prevent the washer 130 from rotating relative to the retaining element 124.

[0031] FIG. 6 is a magnified, partial view of the area of the washer 130 at the shank-head interface. FIG. 6 helps to illustrate the arrangement of the washer 130, the retaining element 124, the rearward facing surface 114 of the shoulder section 112 and the ledge section 128, if any. As seen in FIG. 6, when a front main surface 132 of the washer 130 contacts the shoulder section 112, the inner peripheral surface 138 of the washer 130 is in contact with a surface of the retaining element 124. As seen in FIG. 6,

the reduced diameter portion 122 is axially separated from the shoulder section 114 by a first axial distance (d_1). The first axial distance (d_1) is less than an axial thickness (t) of the washer 130 at the inner peripheral surface 138. The difference in thicknesses is illustrated in FIG 6 as distance Δ, where $(t - d_1) = \Delta$. The distance Δ is occupied by the retaining element 124, which extends axially forward between the inner peripheral surface 138 of the washer 130 and the surface of the reduced diameter portion 122. The retaining element 124 can extend axially forward completely to the ledge section 126, or extend axially forward some portion of the distance Δ, as long as the inner peripheral surface 138 of the washer 130 is in contact with some portion of the radially outer surface of the retaining element 124. .Accordingly, the washer 130 is non-rotatable relative to the retaining element 124.

[0032] The non-rotation of the washer 130 relative to the retaining element 140 is in contrast to the conventional tool pick. Referring again to FIG. 2B, the ledge 32 or some other portion 38 of the shank axially above the area 30 with the reduced diameter protrudes rearwardly below the washer 34. Thus, there is no rotation-inhibiting contact between the washer 34 and the retaining element 36 and the washer 34 freely rotates relative to the retaining element 36.

[0033] To maximize the forces between the washer 130 and the retaining element 124 contributing to non-rotation, the engagement between the washer 130 and the retaining element 124 can be maximized. For example, the distance Δ can be maximized and the retaining element 124 can occupy the reduced diameter section 122 all the way forward to the ledge section 128, thus maximizing the axial length of retaining element 124 in contact with the inner peripheral surface 138 of the washer 130. However, too much engagement can detract from the retention force exerted by the retaining element on the surface of the bore when mounted in the block or sleeve. Further, too little retention force and the tool pick will be thrown from the holder. It has been found that a holding force in the range of about 0.7 kNewtons to about 1.0 kNewtons is suitable. One can adjust the holding force by any suitable means.

[0034] For example, one can increase the free state of the retaining element 124. Increasing the free state of the retaining element 124 will not only increase the radially outward force applied by the retaining element 124 to the inner peripheral surface 138 of the washer 130 (and thus contribute to relative non-rotation between the washer 130 and the retaining element 124), but also will increase the radially outward force applied by the retaining element 124 to the bore when mounted in the block or sleeve (and thus contribute to increased retention forces for the tool pick within the block or sleeve).

[0035] In another example, when the retaining element 124 is formed from metal, a first section 150 of the retaining element 124 contacting the inner peripheral surface 138 of the washer 130 has a first gauge and a second section 152 of the retaining element 124 not in contact with the inner peripheral surface 138 of the washer 130 has a second gauge. The first gauge is less than the second gauge so that the first gauge can establish sufficient outward force to the inner peripheral surface 138 of the washer 130 to make the washer 130 non-rotatable relative to the retaining element 124 and the second gauge can establish sufficient outward force to the surface of the bore when mounted in the block or sleeve to make the retaining element 124 non-rotatable relative to the bore.

[0036] In one exemplary embodiment and as shown in FIG. 7A, the retaining element can have two sections of different gauge with a distinct area of the change in gauge. An axial length (L_2) of the first section 150 can vary depending on how much of the length (L_2) will be in contact with the inner peripheral surface 138 of the washer 130 and can vary to balance the outward forces of the two sections. For example, since the amount of holding power is a function of both radial outward force and the length of contact between surfaces, varying the length of the sections can be used to achieve desired holding power between the washer 130 and retaining element 124 on the one hand and between the bore and the retaining element on the other hand. An example of a suitable length (L_2) is at least as long as the distance Δ.

[0037] In another exemplary embodiment and as shown in FIG. 7B, the retaining element 124 can have a continuous or near continuous gauge change from a first

section 170 at a first end 172 to a second section 174 at a second end 176. The axial length (L_3) of the continuous or near continuous gauge change can be coterminous with the first end 172 and/or second end 176, or the location on the retaining element 124 where the continuous or near continuous gauge change begins or ends can be at a distance separated from the first end 172 and/or second end 176, with the remaining axial length (L_R) of the retaining element 124 having a near constant gauge. As an example and for illustrative purposes, FIG. 7B shows a continuous or near continuous gauge change coterminous with the first end 172, while the second end 176 includes a remaining length having a near constant gauge. The relative lengths of L_3 and L_R can vary, as similarly described herein for axial length L_2.

[0038] When a cutting tip 150 is mounted in the seat 106 of the tool body 100, a tool pick 110 is formed, as shown in exemplary form in FIGS. 3A and 3B. An exemplary cutting tip 160 is made from a hard material. A suitable hard material for the cutting tip 112 is cemented carbide. An exemplary composition of the cemented carbide includes 6-12 wt. % Co with balance WC. The tool body 100 can be formed, for example, of hardened steel.

[0039] The retaining element 124 can be made of, for example, hardened steel. Other features that may be included on the retaining element 124 include, for example, one or more annular projections 162 that fit into the annular recess 124 to secure the retaining element 124 onto the shank 104.

[0040] FIG. 8 shows an exemplary embodiment of a tool and block assembly incorporating an exemplary embodiment of a rotatable tool pick. An exemplary embodiment of a tool and block assembly 200 comprises a block 202 including a body 204 having a bore 206 extending axially from a first side 208 to a second side 210. An exemplary embodiment of a tool pick 110 as disclosed and described herein, for example in connection with FIGS. 3 to 7B, is rotatably mounted in the bore 206 of the block 202.

[0041] The washer 130 is non-rotatable relative to the retaining element 124 and the retaining element 124 is rotatable relative to the shank 104. In addition, in one

embodiment, when the tool pick 110 is mounted in the bore 206 of the tool and block assembly 200, the washer 130 is non-rotatable relative to the contact face, which is the first side 208 of the body 204 of the holder 202. During use, the tool pick 110 rotates. However, the washer 130 may rotate relative to the contact face at a first rate and the head 102 of the tool pick 110 may rotate relative to the contact face at a second rate, where the first rate is lower than the second rate.

[0042] In another exemplary embodiment, a sleeve is first positioned in the bore 206 of a tool and block assembly 200 and the tool pick 110 is mounted in the bore of the sleeve, as is known in the art. In this instance, the contact face is the axially forward surface of the sleeve and the washer 130 is non-rotatable relative to this contact face. Here again, during use the tool pick 110 rotates. However, the washer 130 may rotate relative to this contact face at a first rate and the head 102 of the tool pick 110 may rotate relative to this contact face at a second rate, where the first rate is lower than the second rate.

[0043] Note that when mounted in the block or sleeve, the retaining element may flair radially outward in an area of the washer 130, as compared to the in the area of the bore, as the retaining element 124 expands to the limits of the central opening 140 in the washer 130.

[0044] The tool and block assembly can subsequently be mounted on a machine for use. A base portion 212 of the block 202 is adapted for mounting to a rotating element of a mining machine, construction machine, tunneling machining or trenching machine, such as Sandvik model MT720 tunneling machine or Voest-Alpine's Alpine Bolter Miner ABM 25. An exemplary mining machine comprises a rotating element in the form of a rotatable drum, and one or more blocks mounted on the rotatable drum, for example, by bolts and or welds. Exemplary embodiments of the tool pick 110 can be mounted in the bore of the blocks, with our without the use of a sleeve.

[0045] EXAMPLE: The distance from the shoulder of the tool pick to the area of the tool pick that accepts the retaining element is less than the thickness of the washer. In this example, the washer thickness is 0.198 to 0.190 inches, and the corresponding

area on the shank, i.e., d_1, is 0.090 to 0.075 inches. This allows for an engagement of 0.123 inches maximum and 0.100 inches minimum. The distance, i.e., d_1, is preferably about 0.083 inches, but it can be as much as 0.189, e.g., minimal engagement, and as little 0.000, e.g., maximal engagement. That is, the ledge section 128 can be omitted for maximum engagement of the washer 130 on the retaining element 124. However, too much engagement can detract from the retention force exerted by the retaining element 124 on the surface of the bore 206 of the block or sleeve; too little retention force and the tool pick 110 risks being thrown from the holder.

[0046] The disclosed design utilizes a standard washer with a diameter of the central opening 140 in the washer 130 about equal to or as much as, for example, about 0.012 inches larger than the bore diameter of the block or sleeve into which the tool pick will be inserted. When the central opening is about equal to the bore diameter, there should be sufficient retaining force between the retaining element 124 and the bore of the block or sleeve to hold the tool pick during installation. When the central opening 140 in the washer 130 is as much as, for example, about 0.012 inches larger than the bore diameter, the retaining element 124 is not overly limited in its radial expansion by the bore diameter so that a minimal friction force exists between the washer 130 and the retaining element 140 to have the washer 130 be non-rotating relative to each other.

[0047] Although described in connection with preferred embodiments thereof, it will be appreciated by those skilled in the art that additions, deletions, modifications, and substitutions not specifically described may be made without department from the spirit and scope of the invention as defined in the appended claims.

[0048] The disclosures in U.S. provisional patent application No. 61/231,095, from which this application claims priority, are incorporated herein by reference.

CLAIMS

What is claimed is:

1. A rotatable tool pick, comprising:

a head including a seat for receiving a cutting tip therein at an axially forward end and a shoulder section at an axially rearward end;

a shank projecting rearwardly from the shoulder section of the head, the shank including a reduced diameter portion having an axial length,

a retaining element positioned about at least a portion of the reduced diameter portion of the shank; and

a washer with an inner peripheral surface defining a central opening, wherein the washer is mounted on the shank via the central opening and is non-rotatable relative to the retaining element through a friction fit.

2. The rotatable tool pick of claim 1, wherein the reduced diameter portion is axially separated from the shoulder section by a first axial distance, and

wherein the first axial distance is less than an axial thickness of the washer at the inner peripheral surface.

3. The rotatable tool pick of claim 1, comprising a hard tip mounted in the seat.

4. The rotatable tool pick as in any one of claims 1, 2, and 3, wherein the retaining element is rotatable relative to the shank.

5. The rotatable tool pick as in any one of claims 1, 2, and 3, wherein, when a front main surface of the washer contacts the shoulder section, the inner peripheral surface of the washer is in contact with a radially outer surface of the retaining element.

6. The rotatable tool pick of claim 5, wherein the retaining element is formed from metal and wherein a first section of the retaining element contacting the inner peripheral surface of the washer has a first gauge and a second section of the retaining element not in contact with the inner peripheral surface of the washer has a second gauge, the first gauge less than the second gauge.

7. The rotatable tool pick of claim 5, wherein the washer has a taper angle.

8. The rotatable tool pick as in any one of claims 1, 2, and 3, wherein the first axial distance defines a ledge section of the shank.

9. A tool and block assembly, comprising:

a block including a body having a bore extending axially from a first side to a second side; and

a tool pick rotatably mounted in the bore of the block, the tool pick including a head including a cutting tip mounted therein at an axially forward end and a shoulder section at an axially rearward end, a shank projecting rearwardly from the shoulder section of the head, the shank including a reduced diameter portion having an axial length, a retaining element positioned about at least a portion of the reduced diameter portion of the shank, and a washer with an inner peripheral surface defining a central opening,

wherein the washer is mounted on the shank via the central opening and is non-rotatable relative to the retaining element through a friction fit.

10. The tool and block assembly of claim 9, wherein the reduced diameter portion is axially separated from the shoulder section by a first axial distance, and

wherein the first axial distance is less than an axial thickness of the washer at the inner peripheral surface.

11. The tool and block assembly of claim 9, wherein the first side of the body of the holder is a contact face and the washer is non-rotatable relative to the contact face.

12. The tool and block assembly of claim 9, wherein the first side of the body of the holder is a contact face and the washer rotates relative to the contact face at a first rate and wherein the head of the tool pick rotates relative to the contact face at a second rate, the first rate lower than the second rate.

13. The tool and block assembly of claim 9, wherein the retaining element is rotatable relative to the shank.

14. The tool and block assembly as in any one of claims 9, 10, and 13, wherein, when a front main surface of the washer contacts the shoulder section, the inner peripheral surface of the washer is in contact with a radially outer surface of the retaining element.

15. The tool and block assembly of claim 14, wherein the retaining element is formed from metal and wherein a first section of the retaining element contacting the inner peripheral surface of the washer has a first gauge and a second section of the retaining element not in contact with the inner peripheral surface of the washer has a second gauge, the first gauge less than the second gauge.

16. A tool and block assembly, comprising:

a block including a body having a bore extending axially from a first side to a second side;

a sleeve mounted in the bore of the block, the sleeve having a bore extending axially from a first end to a second end; and

a tool pick rotatably mounted in the bore of the sleeve, the tool pick including a head including a cutting tip mounted therein at an axially forward end and a

shoulder section at an axially rearward end, a shank projecting rearwardly from the shoulder section of the head, the shank including a reduced diameter portion having an axial length, a retaining element positioned about at least a portion of the reduced diameter portion of the shank, and a washer with an inner peripheral surface defining a central opening,

wherein the washer is mounted on the shank via the central opening and is non-rotatable relative to the retaining element through a friction fit.

17. The tool and block assembly of claim 16, wherein the reduced diameter portion is axially separated from the shoulder section by a first axial distance, and

wherein the first axial distance is less than an axial thickness of the washer at the inner peripheral surface.

18. The tool and block assembly of claim 16, wherein the first end of the sleeve includes a contact face and the washer is non-rotatable relative to the contact face.

19. The tool and block assembly of claim 16, wherein the first end of the sleeve includes a contact face and the washer rotates relative to the contact face at a first rate and wherein the head of the tool pick rotates relative to the contact face at a second rate, the first rate lower than the second rate.

20. The tool and block assembly of claim 16, wherein the retaining element is rotatable relative to the shank.

21. The tool and block assembly as in any one of claims 16, 17, and 20, wherein, when a front main surface of the washer contacts the shoulder section, the inner peripheral surface of the washer is in contact with a radially outer surface of the retaining element.

22. The tool and block assembly of claim 21, wherein the retaining element is formed from metal and wherein a first section of the retaining element contacting the inner peripheral surface of the washer has a first gauge and a second section of the retaining element not in contact with the inner peripheral surface of the washer has a second gauge, the first gauge less than the second gauge.

23. A material removal machine, comprising:

a rotatable member; and

one or more rotatable tool picks mounted on the rotatable member,

wherein the rotatable tool pick includes a head including a cutting tip mounted therein at an axially forward end and a shoulder section at an axially rearward end, a shank projecting rearwardly from the shoulder section of the head, the shank including a reduced diameter portion having an axial length, a retaining element positioned about at least a portion of the reduced diameter portion of the shank; and a washer with an inner peripheral surface defining a central opening, and

wherein the washer is mounted on the shank via the central opening and is non-rotatable relative to the retaining element through a friction fit.

24. The material removal machine according to claim 23, wherein the reduced diameter portion is axially separated from the shoulder section by a first axial distance, and

wherein the first axial distance is less than an axial thickness of the washer at the inner peripheral surface.

25. The material removal machine according to claims 23 or 24, wherein the material removal machine is an underground mining machine, a surface mining machine, a road planning machine, a trencher or a reclaiming machine.

26. A method to reduce erosive wear of a contact face of a block or a contact face of a sleeve, the method comprising:

placing a washer between a shoulder of a tool pick and the contact face, wherein the washer is mounted on a shank of the tool pick via a central opening defined by an inner peripheral surface and is non-rotatable relative to a retaining element positioned about at least a portion of a reduced diameter portion of the shank through a friction fit.

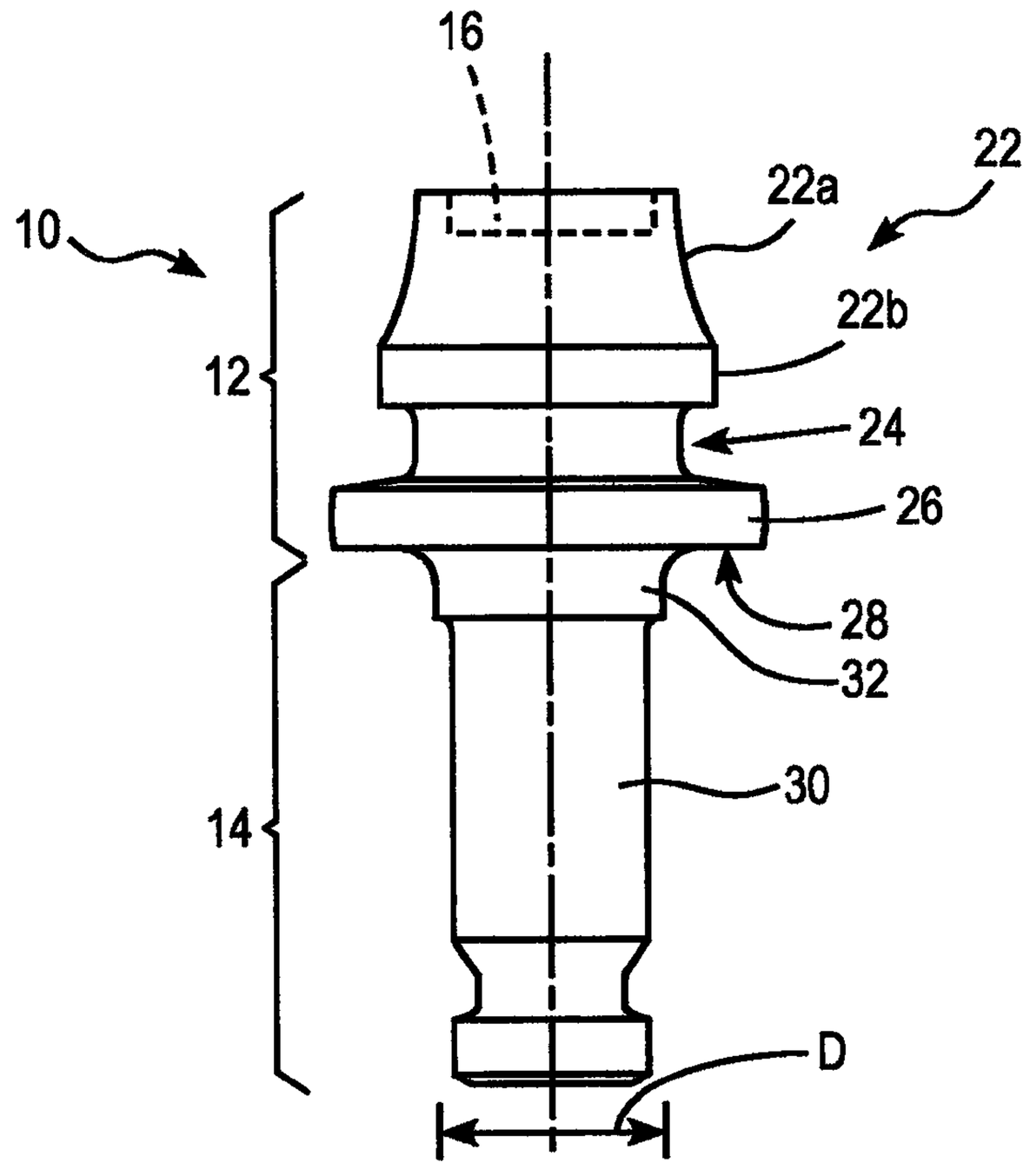
27. The method of claim 26, wherein the reduced diameter portion is axially separated from a shoulder section of a head of the tool pick by a first axial distance, and

wherein the first axial distance is less than an axial thickness of the washer at the inner peripheral surface.

28. The method according to claims 26 or 27, wherein the retaining element is rotatable relative to the shank.

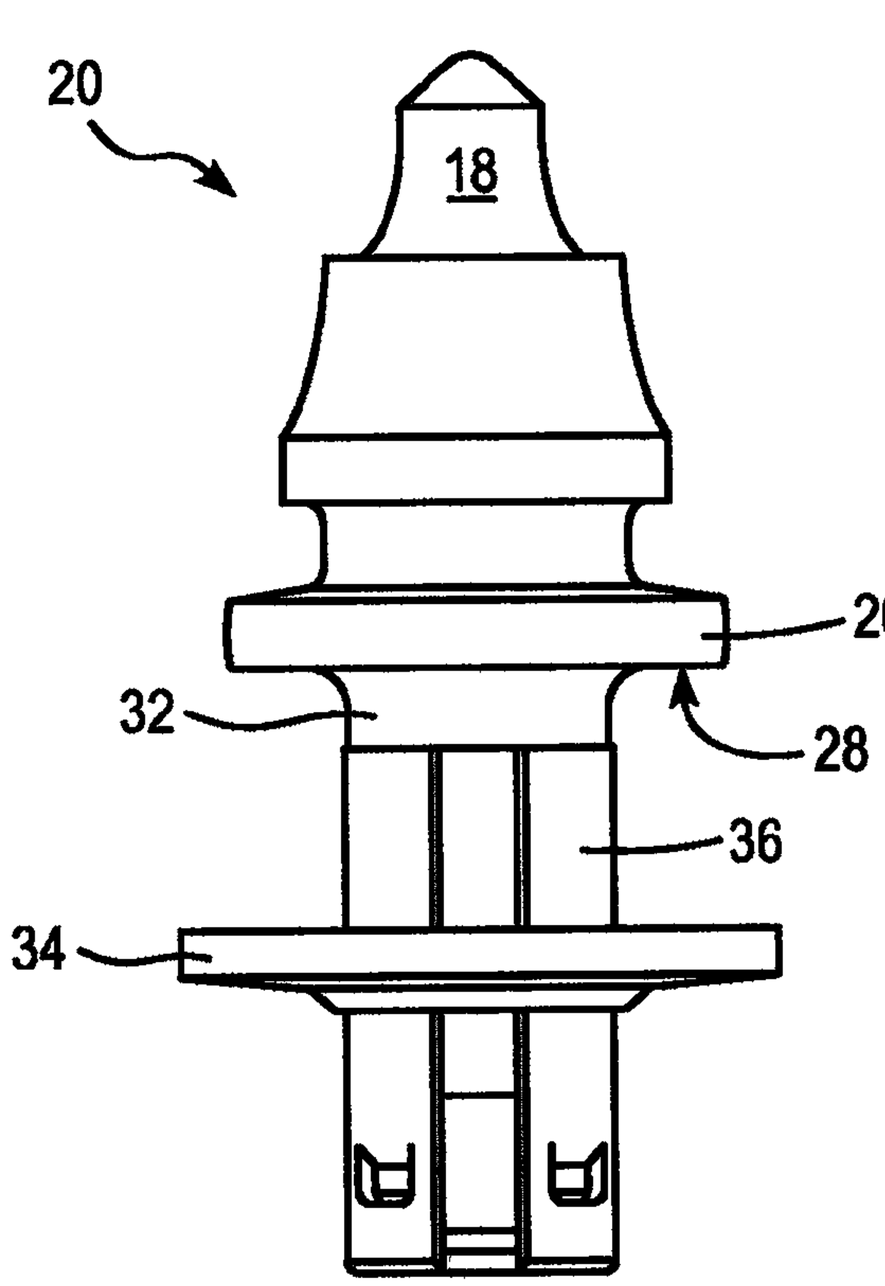
29. The method of claim 28, wherein, when a front main surface of the washer contacts the shoulder section, the inner peripheral surface of the washer is in contact with a radially outer surface of the retaining element.

30. The method of claim 29, wherein the retaining element is formed from metal and wherein a first section of the retaining element contacting the inner peripheral surface of the washer has a first gauge and a second section of the retaining element not in contact with the inner peripheral surface of the washer has a second gauge, the first gauge less than the second gauge.



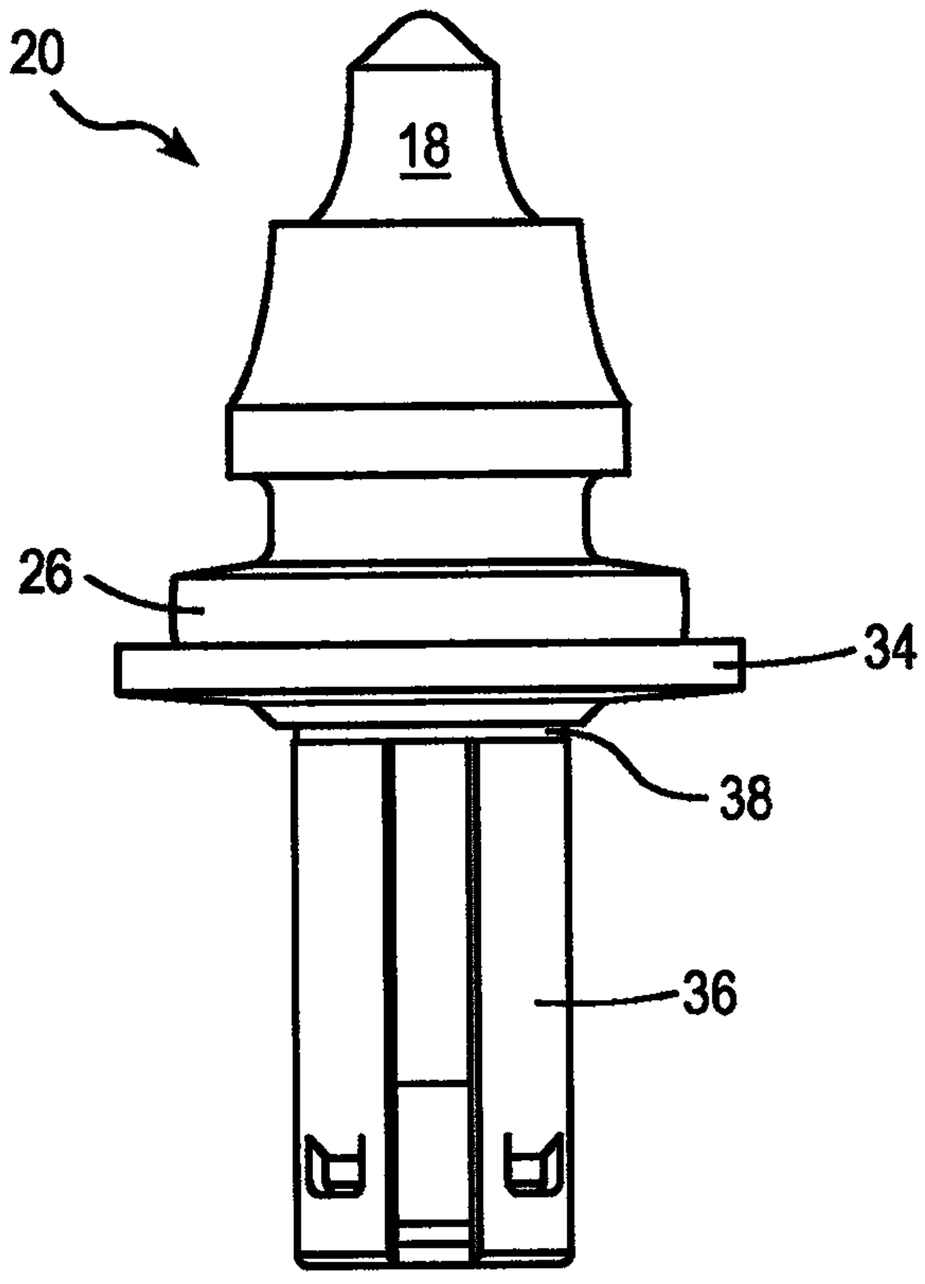
(PRIOR ART)

FIG. 1



(PRIOR ART)

FIG. 2A



(PRIOR ART)

FIG. 2B

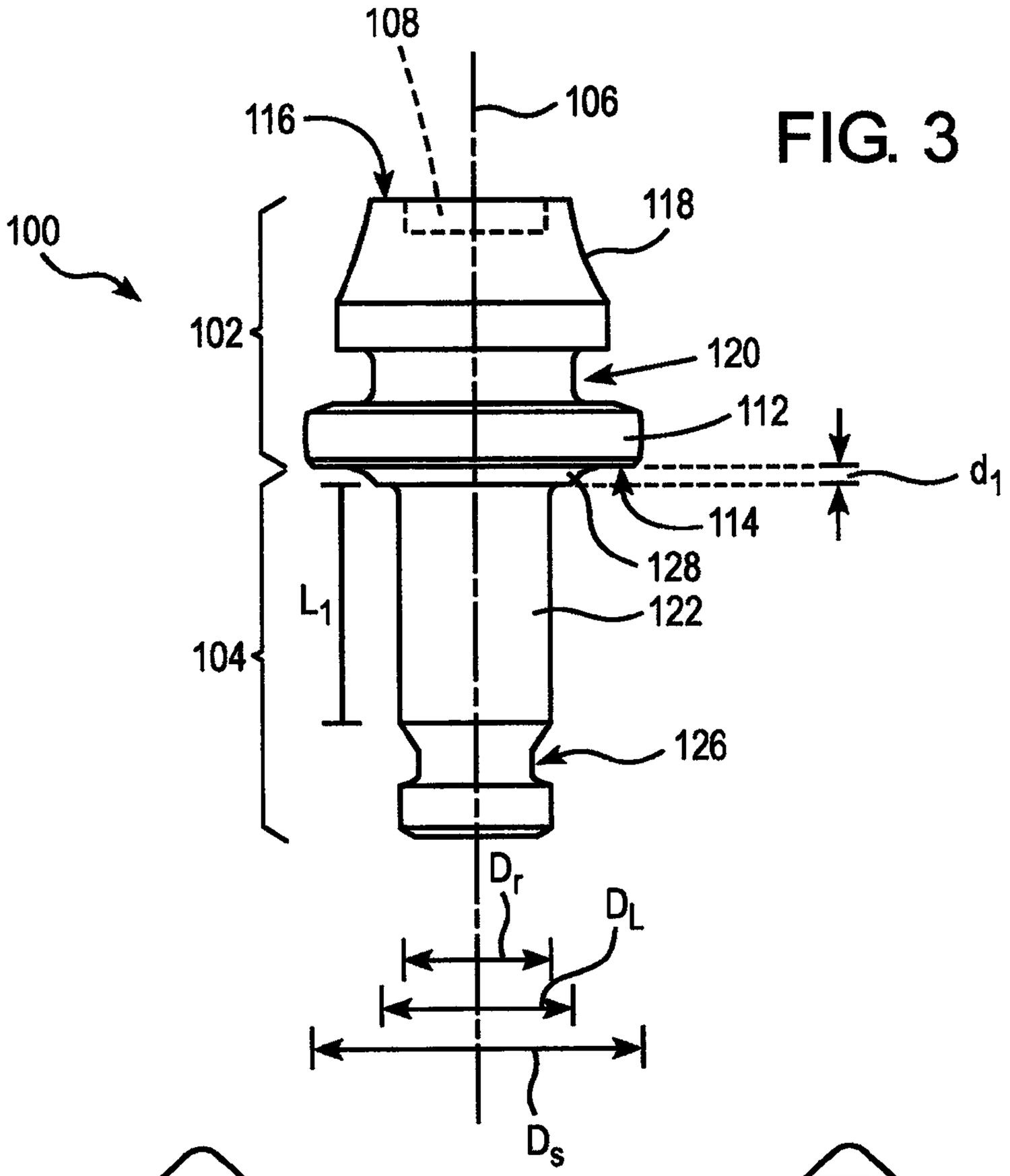


FIG. 3

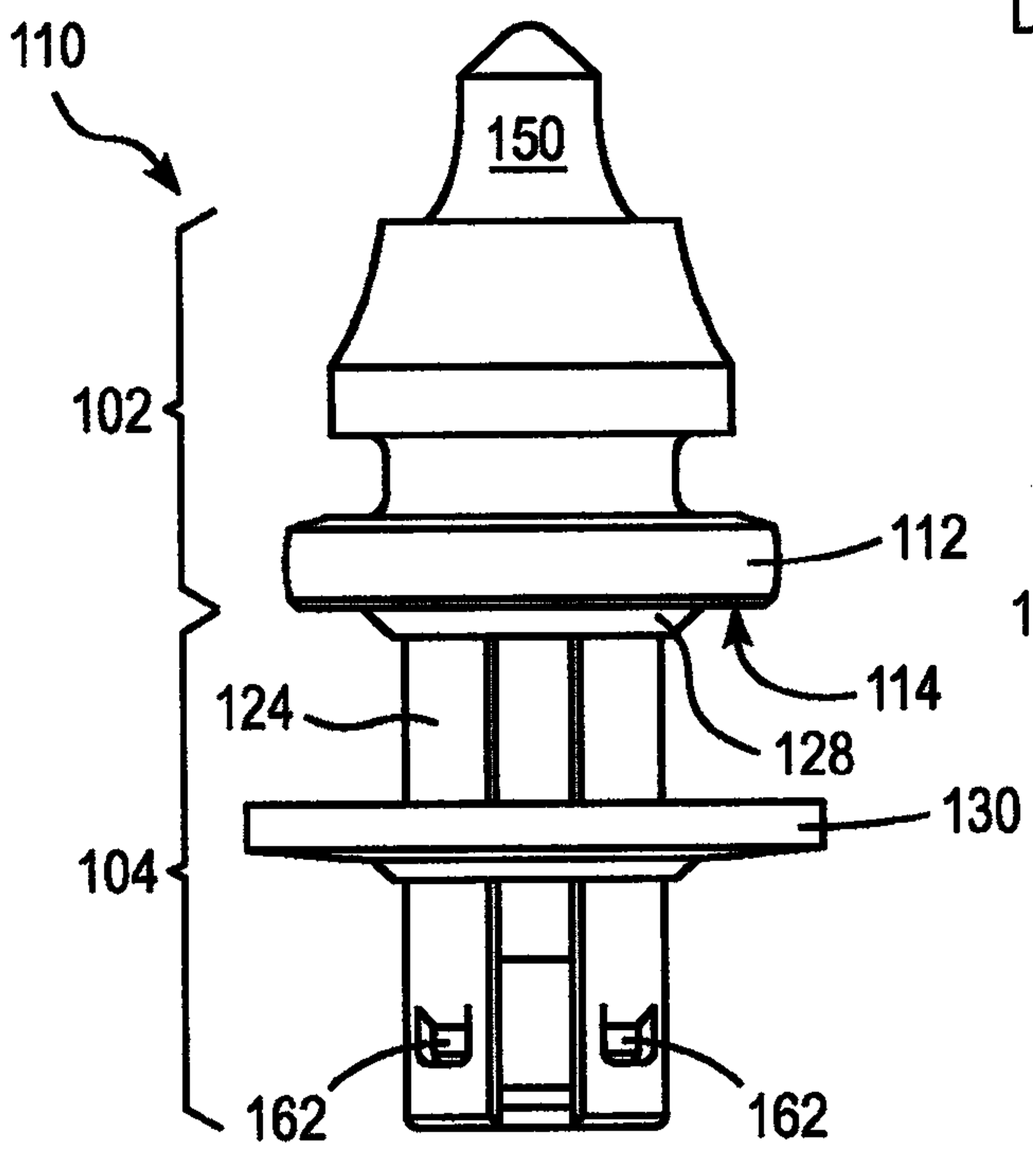


FIG. 4A

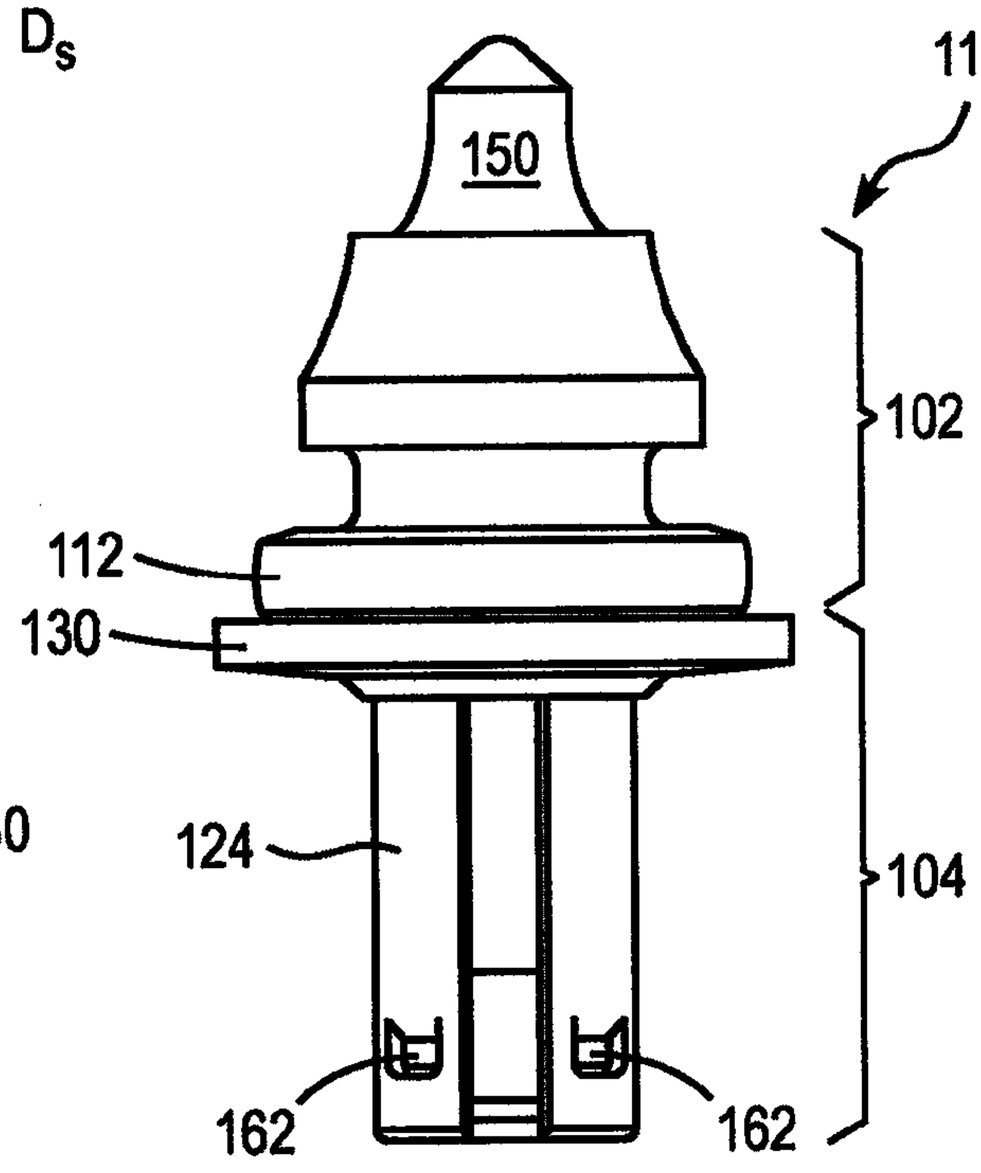


FIG. 4B

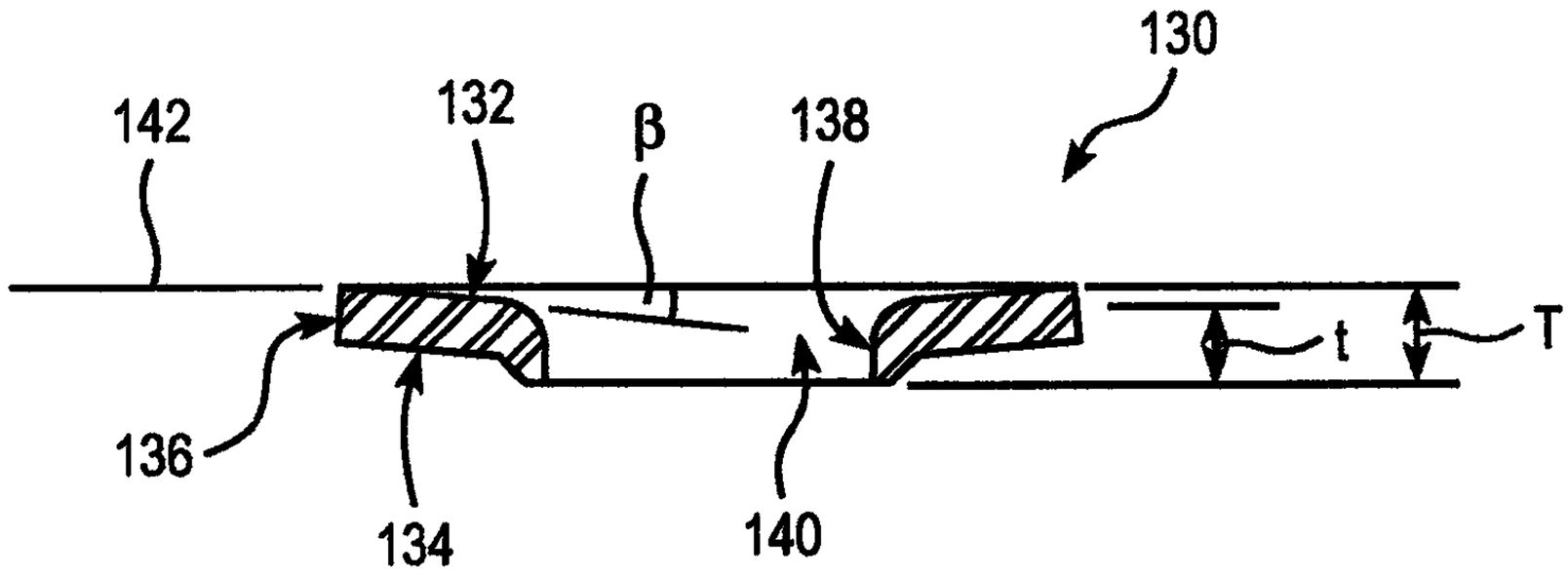


FIG. 5A

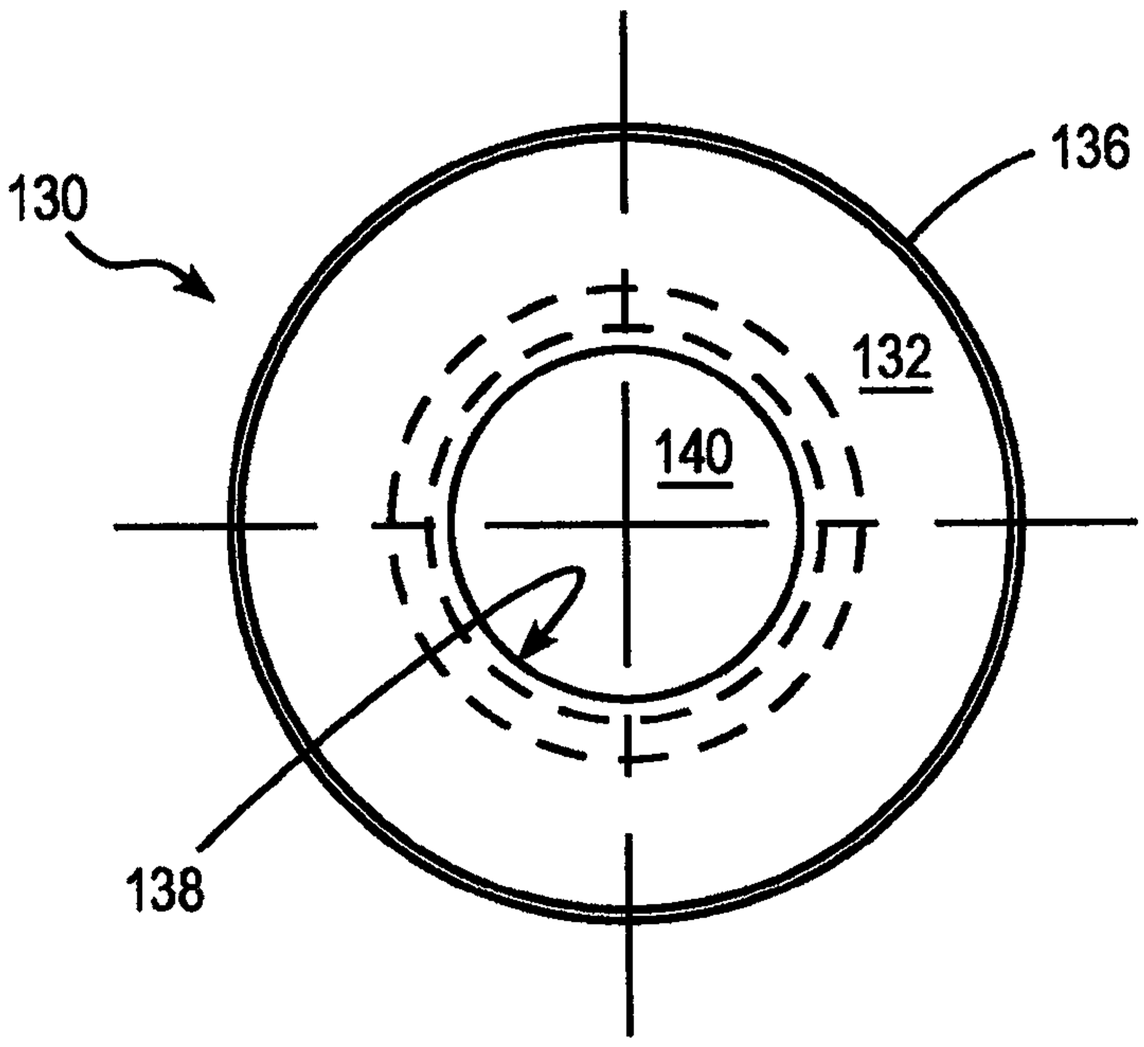


FIG. 5B

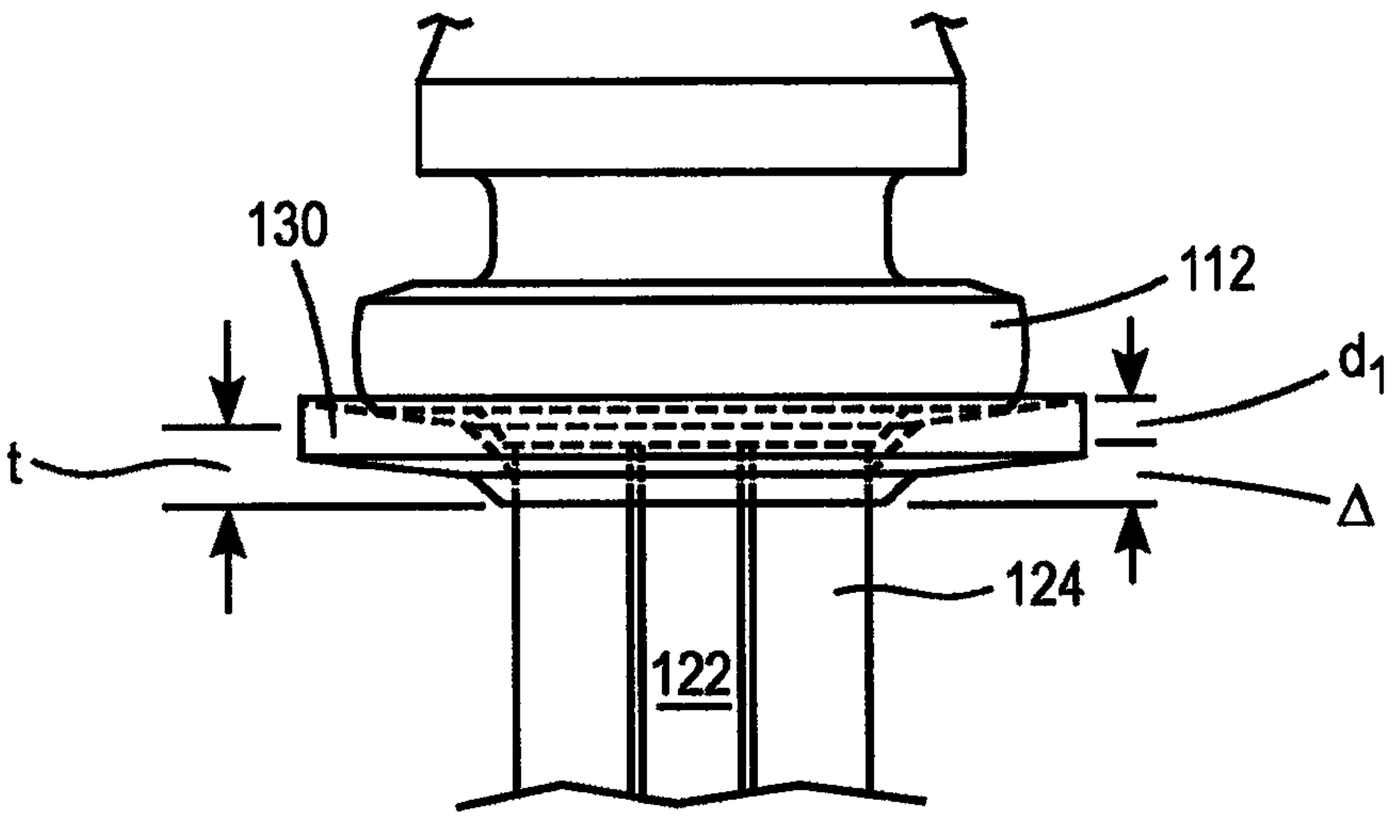


FIG. 6

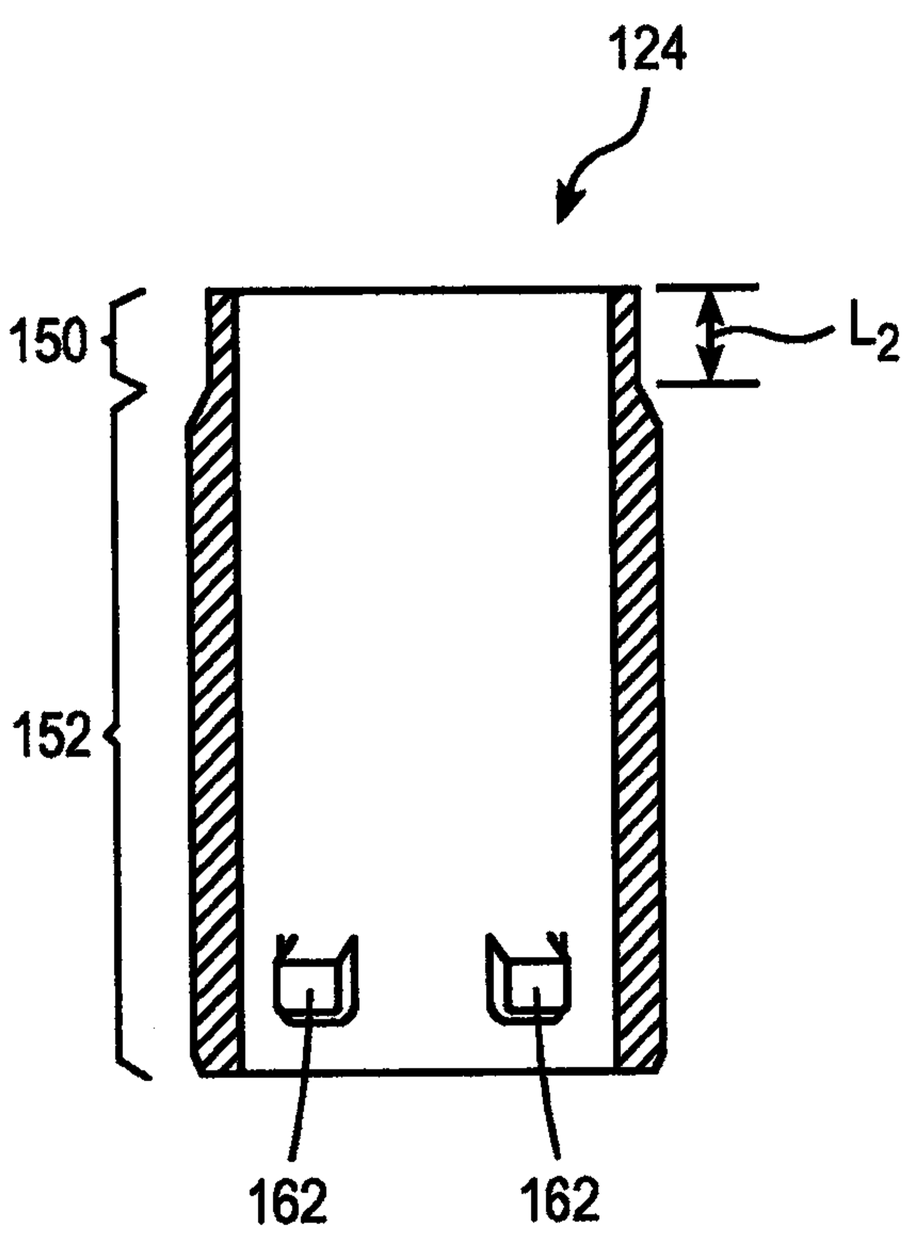


FIG. 7A

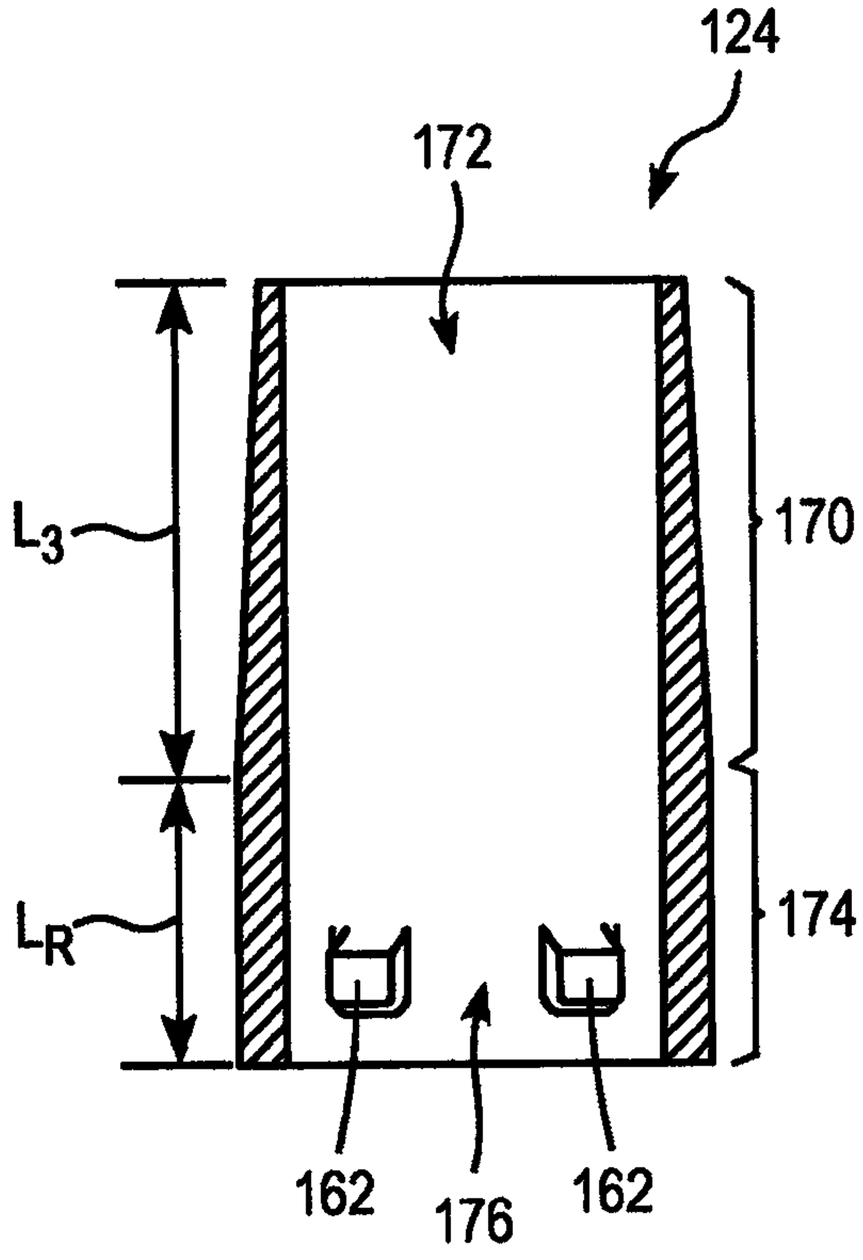


FIG. 7B

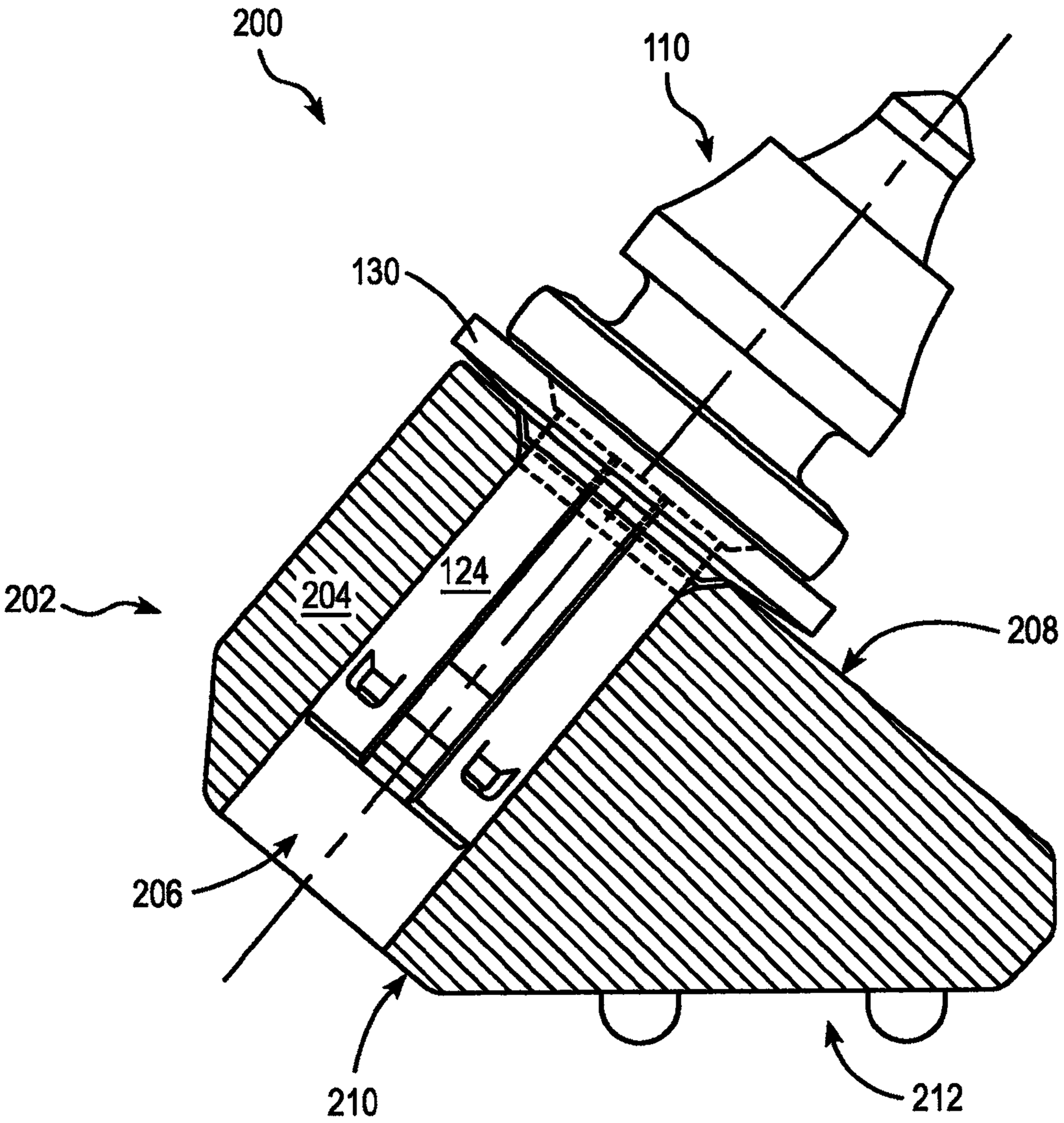


FIG. 8

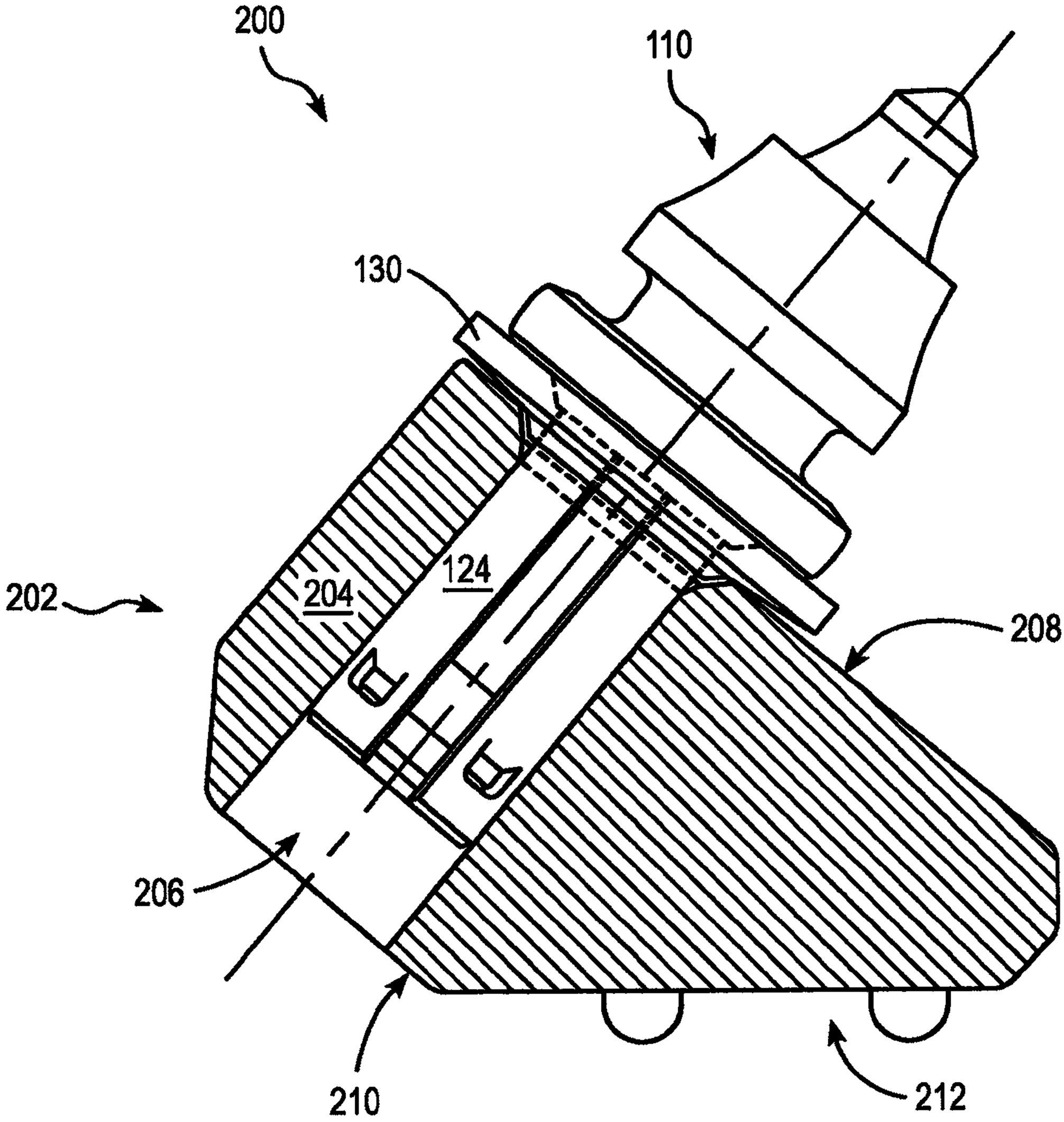


FIG. 8