

(12) STANDARD PATENT
(19) AUSTRALIAN PATENT OFFICE

(11) Application No. **AU 2008270777 B2**

(54) Title
Ejector drill system

(51) International Patent Classification(s)
B23B 51/00 (2006.01) **B23P 15/32** (2006.01)

(21) Application No: **2008270777** (22) Date of Filing: **2008.06.20**

(87) WIPO No: **WO09/006042**

(30) Priority Data

(31) Number	(32) Date	(33) Country
60/947,249	2007.06.29	US

(43) Publication Date: **2009.01.08**

(44) Accepted Journal Date: **2013.09.26**

(71) Applicant(s)
Allied Machine & Engineering Corp.

(72) Inventor(s)
Porter, James R.;Lynch, Chad M.;Lutz, David A.

(74) Agent / Attorney
Spruson & Ferguson, L 35 St Martins Tower 31 Market St, Sydney, NSW, 2000

(56) Related Art
US 7018145 B2
US 2005/0025928 A1
US 5964553 A
US 6682275 B1
US 2005/0084343 A1
JP 58-191913 U

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
8 January 2009 (08.01.2009)

PCT

(10) International Publication Number
WO 2009/006042 A1

(51) International Patent Classification:
B23B 51/00 (2006.01) **B23P 15/32** (2006.01)

(21) International Application Number:
PCT/US2008/067611

(22) International Filing Date: 20 June 2008 (20.06.2008)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/947,249 29 June 2007 (29.06.2007) US

(71) Applicant (for all designated States except US): **ALLIED MACHINE & ENGINEERING CORP.** [US/US]; 120 Deed Drive, Dover, Ohio 44662 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **LUTZ, David A.** [US/US]; 5614 Darletta St. S.W., Navarre, Ohio 44662 (US). **PORTER, James R.** [US/US]; 66325 Plainfield Road, Belmont, Ohio 43718 (US). **LYNCH, Chad M.** [US/US]; 404 Orchard Street, Uhrichsville, Ohio 44683 (US).

(74) Agents: **OLDHAM, Scott M.** et al.; Suite 300, One GOJO Plaza, Akron, Ohio 44311-1076 (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, 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, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, 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, 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:

- with international search report
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

(54) Title: EJECTOR DRILL SYSTEM

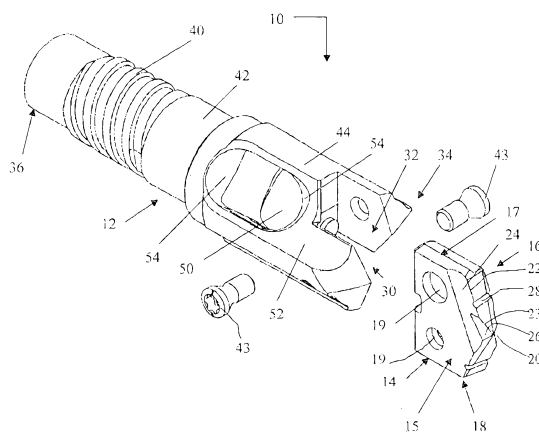


Fig. 1

(57) Abstract: A drilling head for a tubular shank having an inside diameter and threads may comprise an axial body comprising a duct exiting through a first end; threads adjacent the first end corresponding to the threads on the shank and aligning the duct with the shank inside diameter; a bore from an outer surface of the body to the duct; and two axially extending approximately parallel and offset surfaces adjacent a second end; and an insert affixed between the offset surfaces, the insert comprising: a first face at least partially contacting one offset surface and a second face at least partially contacting the other offset surface; one or more cutting edges adjacent the first face, the second face, or both; and a cutting lip adjacent one or more cutting edges.

WO 2009/006042 A1

EJECTOR DRILL SYSTEM

BACKGROUND AND SUMMARY OF THE DISCLOSURE

[0001] Certain deep hole drilling systems such as gun drills, single tube drilling systems, and double tube drilling systems are known in the art. These deep hole drilling systems may be used for drilling holes with a large depth to diameter ratio.

[0002] A single tube system, or STS drilling system may be used to drill holes having large depth to diameter ratios with improved penetration rates, hole size accuracy, and straightness over gun drills. At the same time, such systems have various disadvantages, such as tending to cut on themselves, due to a single effective cutting edge. This causes significant stresses. Additionally, such systems may utilize a wear pad, which due to the configuration, tends to bear on the sides of the formed hole during cutting with significant force, such that the wear pad tends to cause hardening of the hole and embrittlement of the material. This may be termed work hardening of the hole, which is undesirable. The STS drilling system may include a drilling head, a boring shank, or tube, and a pressure head. The drilling head may be threaded onto the tube, the inside of the tube being in communication with one or more apertures through the drilling head. In operation, the pressure head may force cutting fluid between the outside of the tube and the hole wall. The cutting fluid may be evacuated along with chips created by the drilling process through the drilling head and up through the center of the tube.

[0003] The STS requires a cutting fluid delivery system for providing a volume of cutting fluid at pressures of up to 1000 pounds per square inch (about 689.4 kilopascals) or more. The pressure head introduces cutting fluid between the tube and the hole wall. To maintain pressure in the cavity, the pressure head may seal against the part being drilled to produce a water tight seal. In one sealing embodiment, the part being drilled may have a flat area around the drilled hole for the pressure head to seal.

[0004] A Double Tube System, or DTS drilling system, also known as an Ejector System, is based on similar principles as the Single Tube System. Both systems may utilize a cylindrical body design and evacuate cutting fluid and chips internally. The DTS system may use less cutting fluid pressure and volume.

61292615486

2008270777 09 Sep 2013

2

[0005] The DTS drilling system may include a drilling head, an outer tube, an inner tube, and a rotating or non-rotating machine connection. The drilling head may be threaded onto the outer tube, with the inner tube in communication with one or more apertures through the drilling head. Both the inner and outer tubes are retained by the machine tool connector. Cutting fluid is channeled through the machine tool connector and between the outer tube and the inner tube. A portion of the cutting fluid is directed internally into the inner tube through venturi slots manufactured into the inner tube wall. The remaining cutting fluid proceeds to the cutting edge in order to cool and lubricate the tool. The cutting fluid diverted through the venturi slots creates a low pressure area in the inner tube drawing cutting fluid and chips from the cutting edge through the drilling head and into the inner tube. This vacuum-like phenomena may reduce the amount of cutting fluid pressure and volume by up to 50% or more. Certain DTS system embodiments may be used for holes that are about 0.75 inches (about 19 millimeters) in diameter or larger.

[0006] The drilling heads for STS and DTS drilling systems may comprise a threaded tool body with chip evacuation inlet apertures, one or more cutting edges, and one or more wear pads. The cutting edges in the prior art have included hardened steel cutting edges or a plurality of inserts. Drilling heads in the prior art contain cutting edges that are difficult to replace or re-sharpen, and are discarded after the cutting edges are worn.

OBJECT

[0007] It is the object of the present invention to substantially overcome or ameliorate one or more of the disadvantages of the prior art.

SUMMARY

[0008] The present invention provides a drilling head for a tubular shank having an inside diameter and threads, the drilling head comprising: an axial body comprising: a duct exiting through a first end; threads adjacent the first end corresponding to the threads on the shank and aligning the duct with the shank inside diameter; a bore from an outer surface of the body to the duct; and an insert affixed to the axial body by a temporary fastening system, the insert comprising: two effective cutting edges extending from a rotational axis of the insert in opposing manners for double effective cutting and having an outer edge which extends beyond

AH26(7819252_1):INK

RECEIVED TIME 9. SEP. 12:29

61292615486

2008270777 09 Sep 2013

2a

the axial body when mounted therewith; and a cutting lip adjacent the two effective cutting edges extending from a rotational axis of the insert, wherein in use, a drilling fluid is supplied to the area of the two effective cutting edges and exits through the duct which is positioned to receive drilling fluid from each of the two effective cutting edges. The present invention also provides a drilling head for a single or double tube shank having an inside diameter and threads, the drilling head comprising: an axial body comprising: a duct exiting through a first end; threads adjacent the first end corresponding to the threads on the shank and aligning the duct with the shank inside diameter; a bore from an outer surface of the body to the duct; and an insert affixed to the drilling head having two effective cutting edges extending from a rotational axis of the insert to provide double effective cutting in conjunction with one another, wherein a drilling fluid is supplied to the area of the two cutting edges and exits through the duct which is positioned to receive drilling fluid from each of the two cutting edges, and wherein the body has wear surfaces positioned on opposing sides of the body.

AH26(7819252_1):INK

RECEIVED TIME 9. SEP. 12:29

BRIEF DESCRIPTION OF THE DRAWINGS

- [0009] FIG. 1 is an exploded perspective view of a drilling head of the present disclosure;
- [0010] FIG. 2 is a side elevational view of the drilling head of FIG. 1;
- [0011] FIG. 3 is a perspective view of the drilling head of FIG. 1;
- [0012] FIG. 4 is a perspective view of the drilling head of FIG. 1 including carbide cladding;
- [0013] FIG. 5 is a perspective view of the drilling head of FIG. 1 including carbide wear pads ;
- [0014] FIG. 6 is a perspective view of another embodiment of a drilling head of the present disclosure; and
- [0015] FIG. 7 is a perspective view of yet another embodiment of a drilling head of the present disclosure.

DETAILED DESCRIPTION OF THE DRAWINGS

[0016] Referring now to FIG. 1-7, examples of a drilling system according to the invention are set forth. In FIGS. 1-5, an example of the drilling system is shown, having a drilling head 10 which may comprise an ejector holder body 12 and at least one cutting insert 14. The cutting insert 14 may be, for example but not limited to, a spade insert. Any suitable cutting insert 14 may be used in the ejector holder body 12. In operation, the ejector holder body 12 and cutting insert 14 rotate about an axis of rotation through the centerline of the hole being drilled.

[0017] As shown in FIG. 1, the cutting insert 14 may be a spade insert having an approximately flat polygonal shape having a first face 15, a second face 16, a first side 17, and a second side 18. The cutting insert may comprise one or more mounting apertures 19 through the first and second faces 15, 16. The cutting insert may further comprise a self-centering point 20, cutting edges 22, cutting lip 24, web cutting edges 23, cutting web 26, and optionally one or more chip breakers 28.

[0018] The cutting insert 14 may include cutting edges 22. The cutting edges 22 may be positioned at the leading edges as the insert rotates. The cutting insert 14 may be an approximately symmetrical shape with the axis of rotation passing through the self-centering point 20. In this embodiment, the insert may have cutting edges 22 on both sides of the insert.

The cutting edges 22 may extend about from the web cutting edges 23 around self centering point 20 toward the first side 17 adjacent the first face 15, from the self centering point 20 toward the second side 18 adjacent the second face 16, or both. Any number of cutting edges may be provided for making a desired hole diameter.

[0019] At least one cutting lip 24 may be positioned adjacent one or more cutting edges 22. The cutting lip 24 may include geometry capable of producing a curled metal chip for evacuating through the ejector holder body 12. The size and shape of the chip may be controlled by altering the cutting lip 24 position, size and configuration.

[0020] At least one cutting web 26 may be positioned adjacent the self-centering point 20, and the cutting web 26 may comprise one or more web cutting edges 23. The cutting web 26 may enable the material at the tip of the cutting insert 14 to shear and form a manageable chip. Some prior art drilling systems do not mechanically cut material (chip formation) at the center of the drilled hole, instead extruding material due to the low angular velocity at the center of the drill point. The cutting web 26 may enable chip formation at the drill point and reduce extrusion due to the shearing ability of the cutting web 26. Further, the cutting web 26 may enable the drill cutting insert 14 to start the hole on-center and retain its straightness.

[0021] One or more chip breakers 28 may be optionally provided on the cutting insert 14 to control the chip width. Controlling the chip width further enables the chip to be evacuated through the center of the ejector holder body 12. In some applications, chip breakers may not be required, for example with use in cutting cast iron or carbon fibers.

[0022] The ejector holder body 12 may comprise a generally tubular shape having a first end, or shank end 36, and a second end, or insert end 34. An evacuation channel, or duct 38 through at least a portion of the ejector holder body 12 may exit the shank end 36 for passing chips and cutting fluid through the ejector holder body 12 and into the shank, or tube. The shank end 36 may be configured to attach to a boring shank, or tube, (not shown). The tube may have an inside diameter and threads for attaching the drilling head. The ejector holder body 12 may comprise threads 40 adjacent the first end, or shank end 36, corresponding to the threads on the shank and aligning the duct 38 with the shank, or tube, inside diameter. The duct 38 does not have to be the same diameter as the inside diameter of the tube when the duct and tube are aligned.

[0023] The threads 40 may be multiple lead locking threads. Alternately, the threads 40 may be a single lead thread.

[0024] A tube bearing surface 42 may be provided on the ejector holder body 12 adjacent the intersection of the tube and the ejector holder body 12. The tube bearing surface 42 may fit within an inside diameter of the tube and fit adjacent an inside surface of the tube. The tube bearing surface 42 may be used to align the ejector holder body 12 with the tube. The tube bearing surface may be precision ground to mate closely with the inside surface of the tube. A close tolerance fit may reduce total indicator run-out associated with the ejector drilling system and improve hole straightness.

[0025] The threads 40 or the tube bearing surface 42 or a combination thereof may be designed to substantially seal the union between the tube and the ejector holder body 12. Other sealing devices or methods may be utilized, such as for example but not limited to one or more o-rings, gaskets, sealing tapes, caulking materials, adhesives, or other sealing materials.

[0026] The boring shank, or tube, may be provided with threads on the inside surface corresponding to the threads 40 of the ejector holder body 12. The inside tube threads may be locking threads that draw the threads 40 tighter into the tube as the drilling system is rotated in operation.

[0027] Alternately, the ejector holder body 12 may attach to the boring shank, or tube, by other attachments, such as for example but not limited to one or more keyways, clamps, flanges, screws, or other fasteners.

[0028] The insert end 34 may be configured for attaching the cutting insert 14. The insert end 34 may be configured with two axially extending approximately parallel and offset surfaces 30, 32 adjacent a second end. The surfaces 30, 32 may be offset a distance equal to the thickness of the insert 14. The surfaces 30, 32 may also be offset in a longitudinal direction to provide clearance for fastening the insert 14 to the body 12. The cutting insert 14 may attach to the insert end 34 with the first face 15 at least partially contacting one offset surface 30 and the second face 16 at least partially contacting the other offset surface 32 by one or more screws 43 through the mounting apertures 19 of the cutting insert 14.

[0029] The ejector holder body 12 may comprise a bearing area 44. The bearing area 44 may include one or more outer surfaces of the ejector holder body 12. The bearing area 44 may have a layer of chrome to protect the bearing area 44 in operation. The outer diameter of the bearing area 44 may be slightly smaller than drill diameter. The chrome layer may protect the bearing area 44 at lower rotational speeds and temperatures.

[0030] As shown in FIGS. 4 and 5, the bearing area 44 may comprise a cladding 46 on at least a portion of the outer surface of the body. The cladding 46 may comprise a thin layer of a carbide material on the surface positioned at an outside diameter of the body. The outer diameter of the cladding 46 may be slightly smaller than drill diameter. The cladding 46 may protect the bearing area 44 at higher rotational speeds and temperatures. In the example of FIG. 5, there are provided a plurality of carbide wear pads 46' as an alternative embodiment. The wear pads 46' may be brazed into position or otherwise suitably secured. The thickness of the cladding 46 or wear pads 46' may be increased as suitable for the application. The cladding 46 and wear pads 46' may be formed of a carbide material, such as titanium carbide, a tungsten carbide, aluminum bronze, high speed steel, hard chroming or other suitable wear material.

[0031] As shown in the example of FIG. 3, a channel 48 may be placed along the outer surface of the ejector holder body 12 capable of directing fluid toward the insert. The channel 48 may enable cutting fluid to flow along the perimeter of the ejector holder body 12 toward the cutting insert 14, as shown in FIG. 3. The channel 48 may be approximately parallel to an axis through the ejector holder body 12. The channel 48 may be approximately parallel to an axis of rotation of the drilling head. Alternately, the channel 48 may be directed in an angled orientation, spiral orientation, arcuate orientation, or any other orientation capable of directing the cutting fluid toward the insert. The cutting fluid passing through the drilling system may act as a coolant for cooling the material being sheared in the cutting area to promote manageable chip formation. The cutting fluid also flushes the chips from the cutting area and evacuates the chips from the drilled hole. The coolant channels placed axially along the holder body 12 allow coolant to flow forward from the coolant tube, along the perimeter of the holder body 12 and be directed at the cutting zone of the insert 14. the coolant fluid quenches the material being sheared in the cutting zone and provides coolant flow in the direction for the formed chips to travel from the cutting zone to the evacuation cross hole and channel described below, and through the coolant tube and out of the machining center.

[0032] The ejector holder body 12 further comprises one or more cross holes, or bores 50 passing from one or more gullets 52 to the evacuation channel, or duct 38. The gullets 52 provide a passage for chips and cutting fluid from the cutting insert 14 to the bores 50. Relief areas 54 may be provided adjacent the bores 50 for directing chips and cutting fluid into the bores and reducing the chips collecting in the gullets 52.

[0033] In an example, the evacuation cross hole 50 passes through both gullets 52 approximately normal to the center axis of the holder body 12. Alternately, the bores 50 may pass through ejector holder body 12 at an angle to the axis of the ejector holder body 12. The bores 50 enable the chips and cutting fluid flushed from the cutting area to enter the duct 38.

[0034] The duct 38 may extend through the ejector holder body 12 between the shank end 36 and the bores 50. The chips that are evacuated from the cutting area may be flushed along the gullets 52, through the bores 50 and into the duct 38. The chips and cutting fluid from the drilled hole are flushed through the duct 38 and into the boring shank, or tube. From there the cutting fluid and chips flow through the tube and out of the machining center.

[0035] In operation, when the cutting edges 22 have reached their expected life, the cutting inserts 14 can be removed from the ejector holder body 12 by removing screws 43 and removing the inserts. A new cutting insert 14 may be installed and the drilling process continued.

[0036] The drilling head 10 may be used with Single Tube or Double Tube Systems. The disclosed drilling head 10 has advantages over the existing drill systems. Firstly, the substrate, coating, and geometry options may allow for this tool 10 to function in applications where prior art drills fail. The substrate material of the cutting insert 14 may be changed to accommodate different types of applications. Also, different coatings may be usable in association with the insert 14. For example, a diamond film coating may be used on the cutting surfaces and clearance surfaces of insert 14 to minimize flank wear growth. Examples of these types of films include carbon vapor deposition (CVD) polycrystalline diamond film which is well known in the industry. Diamond film coatings are especially helpful when cutting non-metallic abrasive materials for example. Other coating materials, such as titanium aluminum nitride, may be used. The insert 14 may be coated by known suitable methods, with a desired coating based upon a particular application for the tool 10. The use of insert 14 also allows the cutting geometry to be formed for various applications, with various modifications in cutting geometry possible to enhance the cutting performance for different applications or materials. For example, different cutting geometries may include, but are not limited to, the cutting lip geometry having a positive rake angle, the cutting web having a positive rake angle, the insert 14 having a self-centering point, and/or providing a desired chip breaking configuration in association with the cutting edges. Positive cutting lip geometry produces a tightly curled chip that is easy to evacuate through the tool, with the compact size of the chip resulting from the predetermined lip position,

size and configuration. Many modifications can be made to the lip configuration to enhance the development of chip formation for example. The use of a positive cutting web geometry allows the material at the point of insert 14 to shear and form a more manageable chip, which can minimize the action of extruding material at the center of the drilled hole due to the low velocity differential at the center of the drill point. The web geometry can thus be configured to allow for much more mechanical chip formation at this location of the drill point, and result in less extrusion due to the shearing ability of the web cutting edge, and a freer cutting drill center. This also can provide the benefit of drilling a hole that starts on center and retains an improved overall straightness. A self-centering point geometry may be provided by a combination of clearance features on the point of the insert 14 that improve the centering capability. Improving the centering capability can improve the drilling stability and overall hole straightness. The addition of chip breakers can control the developing chip width, thereby assisting in creating a formable chip that can be evacuated through the center of the holder body as will be described.

[0037] A second advantage with the disclosed drilling head 10 is a reduction in cost per hole. This may be realized in several different ways. The brazed drill heads in the prior art are a one piece design. When the tool is worn out or damaged the entire drill head must be replaced. This can be costly, especially as the hole diameter increases. With the presently disclosed drilling head 10, an operator may replace the worn or damaged cutting insert 14. The drilling head 10 thus provides the ability to quickly and efficiently change the cutting edges when they become worn. The cost of the ejector holder body 12 may be amortized over multiple cutting insert 14 changes reducing the total tool cost.

[0038] The cost per hole can also be calculated based on an increased penetration rate. The presently disclosed drilling head 10 may include two effective cutting edges. This design can offer a significant performance advantage over the prior art having a single cutting edge. With two effective cutting edges presently disclosed drilling head 10 could double the feed rate of a comparable single cutting edge design. This increased penetration rate reduces the time in the cut freeing up machine time. The arrangement according to the examples of the present invention provides various advantages and overcomes problems associated with prior systems. For example, the arrangement does not result in work hardening or the materials adjacent the hole, as no significant forces are imposed on the sides of the formed hole. The system does not cut on itself as with prior STS systems, and the wear pad does bear against the hole with excessive

force, as there are two effective cutting edges in the system. The cutting geometry provides for an included angle such that radial loads imposed by the system are minimal, and heat generation is also minimized, such that no embrittlement of the machined material occurs.

[0039] An alternate example of the invention is shown in FIG. 6, wherein the ejector holder body 112 may also comprise a generally tubular shape having a first end, or shank end 136, and a second end, or insert end having an insert 214 as in the prior examples. The holder body 112 may again have an evacuation channel, or duct through at least a portion of the ejector holder body 112 which may exit the shank end for passing chips and cutting fluid through the ejector holder body 112 and into the shank, or tube. The shank end 136 may be configured to attach to a boring shank, or tube, (not shown). The tube may have an inside diameter and internal threads 140 for attaching the drilling head. The ejector holder body 112 may comprise threads 140 adjacent the first end, or shank end 136, corresponding to the threads on the shank and aligning the duct 138 with the shank, or tube, inside diameter. The duct 38 does not have to be the same diameter as the inside diameter of the tube when the duct and tube are aligned. The threads 140 may be multiple lead locking threads. Alternately, the threads 140 may be a single lead thread.

[0040] A further example is shown in FIG. 7, wherein the ejector holder body 212 may again comprise a generally tubular shape having a first end, or shank end, and a second end, or insert end. An evacuation channel, or duct is again provided through at least a portion of the ejector holder body 212 and exits the shank end for passing chips and cutting fluid through the ejector holder body 212 and into the shank, or tube. The shank end may be configured to attach to a boring shank, or coolant tube, (not shown). The tube may have an inside diameter and threads for attaching the drilling head. The ejector holder body 212 may comprise threads 240 adjacent the first end, or shank end, corresponding to the threads on the shank and aligning the duct with the shank, or tube, inside diameter, as in prior examples. The threads 240 may be multiple lead locking threads, or alternately, may be a single lead thread. A tube bearing surface 242 may be provided on the ejector holder body 212 adjacent the intersection of the tube or shank and the ejector holder body 212. The tube bearing surface 242 may fit within an inside diameter of the tube and fit adjacent an inside surface of the tube. The tube bearing surface 242 may be used to align the ejector holder body 212 with the coolant tube. The tube bearing surface may be precision ground to mate closely with the inside surface of the tube. A close tolerance fit may reduce total indicator run-out associated with the ejector drilling system and improve hole

straightness. The boring shank, or tube, may be provided with threads on the inside surface corresponding to the threads 240 of the ejector holder body 212. The inside tube threads may be multiple lead locking threads that draw the threads 240 tighter into the tube as the drilling system is rotated in operation, and installs the holder body 12 to the coolant tube securely.

[0041] The ejector holder body 212 may comprise a bearing area 244. The bearing area 244 may include one or more outer surfaces of the ejector holder body 212. The bearing area 244 may have a layer of chrome or other wear material to protect the bearing area 244 in operation. The chrome or other wear material serves to help protect the holder outside diameter as it guides the drill 10. The outer diameter of the bearing area 244 may be slightly smaller than drill diameter. The chrome layer may protect the bearing area 244 at lower rotational speeds and temperatures. For higher speed operation, a carbide clad material may be used in association with the bearing surface 244. Additionally, carbide wear strips 246 may be used to protect the ejector holder body 212. The carbide wear strips 246 may be provided in association with the bearing area 244. The wear strips 246 are provided on at least a portion of the outer surface of the body, and may comprise a thin strip of a carbide material on the surface positioned at an outside diameter of the body. The outer diameter of the strips 246 may be slightly smaller than drill diameter. The wear strips 246 may protect the bearing area 244 at higher rotational speeds and temperatures. The wear strips 246 may be brazed into position or otherwise suitably secured to the holder body 212. Alternatively, the wear strips 246 may be bolted in or otherwise suitably connected to the holder body 212. The wear strips 246 may be produced using carbide beading, but other suitable approaches are contemplated. The thickness of the wear strips 246 may be increased/decreased as suitable for the application. The wear strips 246 may be formed of a carbide material, such as titanium carbide, a tungsten carbide, aluminum bronze, high speed steel, hard chroming or other suitable wear material. A channel 248 may be placed along the outer surface of the ejector holder body 212 capable of directing fluid toward the insert 214. The channel 248 may enable cutting fluid to flow along the perimeter of the ejector holder body 212 toward the cutting insert 214.

[0042] While the invention has been illustrated and described in detail in the foregoing drawings and description, the same is to be considered as illustrative and not restrictive in character, it being understood that only illustrative embodiments thereof have been shown and described, and that all changes and modifications that come within the spirit of the invention

described by the following claims are desired to be protected. Additional features of the invention will become apparent to those skilled in the art upon consideration of the description. Modifications may be made without departing from the spirit and scope of the invention.

61292615486

2008270777 09 Sep 2013

12

CLAIMS

1. A drilling head for a tubular shank having an inside diameter and threads, the drilling head comprising:
an axial body comprising:
a duct exiting through a first end;
threads adjacent the first end corresponding to the threads on the shank
and aligning the duct with the shank inside diameter;
a bore from an outer surface of the body to the duct; and
an insert affixed to the axial body by a temporary fastening system, the insert comprising:
two effective cutting edges extending from a rotational axis of the insert
in opposing manners for double effective cutting and having an
outer edge which extends beyond the axial body when mounted
therewith; and
a cutting lip adjacent the two effective cutting edges extending from a
rotational axis of the insert, wherein in use, a drilling fluid is
supplied to the area of the two effective cutting edges and exits
through the duct which is positioned to receive drilling fluid from
each of the two effective cutting edges.
2. The drilling head according to claim 1, wherein the cutting lip adjacent each of the
two cutting edges forms a predetermined chip of material, and the size and
shape of the chip produced may be controlled by altering the position, size
and/or configuration of the cutting lip.
3. The drilling head according to claim 1, wherein the insert has a cutting geometry
providing for an included angle such that radial loads and heat generation are
minimized.

61292615486

2008270777 09 Sep 2013

13

4. The drilling head according to claim 1, wherein the cutting lip has a cutting geometry having a positive rake angle.
5. The drilling head according to claim 1, wherein the body has cladding brazed into position on the outside diameter of the body or a coating thereon, and on opposing sides of the body.
6. The drilling head according to claim 1, the body further comprising:
at least one channel along the outer surface of the body capable of directing fluid toward the insert.
7. The drilling head according to claim 6, the channel being approximately parallel to an axis of rotation.
8. The drilling head according to claim 1, the body further comprising:
relief around the bore.
9. The drilling head according to claim 1, the bore being a cross bore extending through the body.
10. The drilling head according to claim 1, the bore being approximately perpendicular to the duct.
11. The drilling head according to claim 1, the body further comprising:
a bearing surface corresponding to the inside diameter of the shank.
12. The drilling head according to claim 1, the insert further comprising:
one or more cutting webs positioned adjacent one or more cutting edges.

61292615486

2008270777 09 Sep 2013

14

13. The drilling head according to claim 1, the threads being external threads on an outer surface of the body.
14. The drilling head according to claim 1, the threads being internal threads adjacent the duct.
15. The drilling head according to claim 1, the threads being multiple lead locking threads.
16. The drilling head according to claim 1, further comprising at least two cutting edges adjacent the first face and the second face.
17. The drilling head according to claim 16, wherein the cutting geometry provides for an included angle between the at least two cutting edges such that radial loads are minimized.
18. A drilling head for a single or double tube shank having an inside diameter and threads, the drilling head comprising: an axial body comprising: a duct exiting through a first end; threads adjacent the first end corresponding to the threads on the shank and aligning the duct with the shank inside diameter; a bore from an outer surface of the body to the duct; and an insert affixed to the drilling head having two effective cutting edges extending from a rotational axis of the insert to provide double effective cutting in conjunction with one another, wherein a drilling fluid is supplied to the area of the two cutting edges and exits through the duct which is positioned to receive drilling fluid from each of the two cutting edges, and wherein the body has wear surfaces positioned on opposing sides of the body.
19. The drilling head according to claim 18, wherein the two effective

61292615486

2008270777 09 Sep 2013

15

cutting edges have a cutting geometry providing for an included angle between the at least two cutting edges such that radial loads are minimized.

20. A drilling head substantially as hereinbefore described with reference to Figures 1-5 or Figure 6 or Figure 7 of the accompanying drawings.

Allied Machine & Engineering Corp.

Patent Attorneys for the Applicant/Nominated Person

SPRUSON & FERGUSON

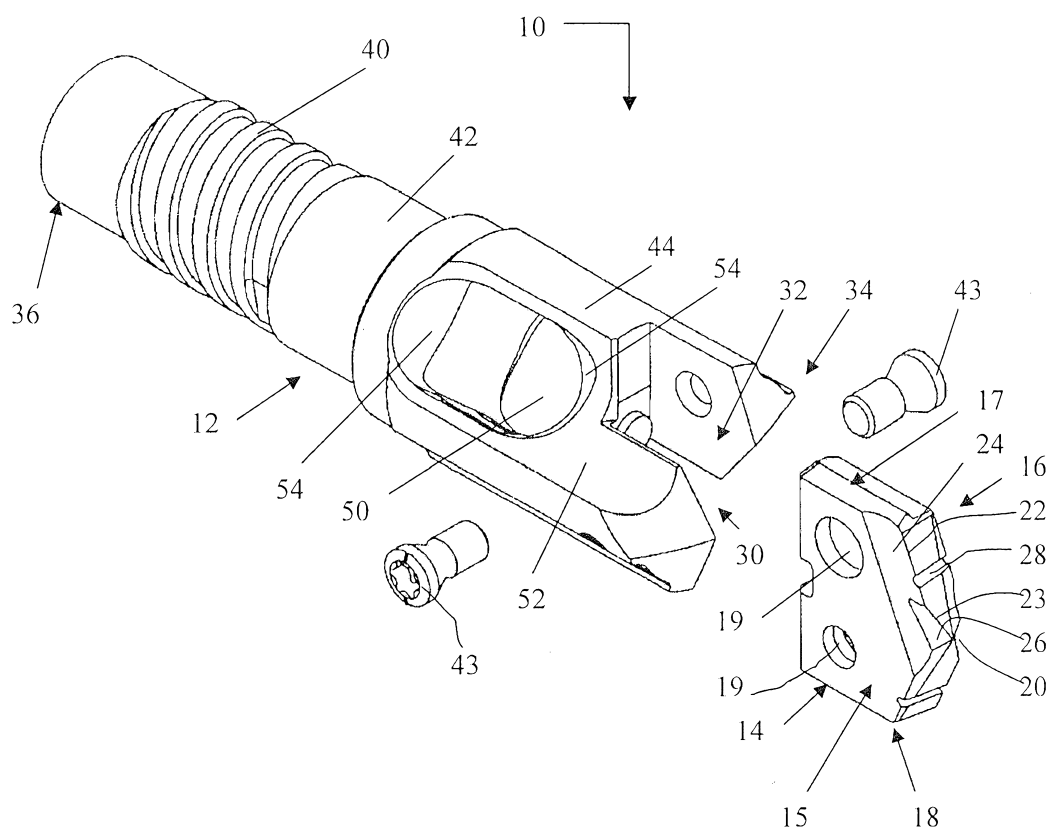


Fig. 1

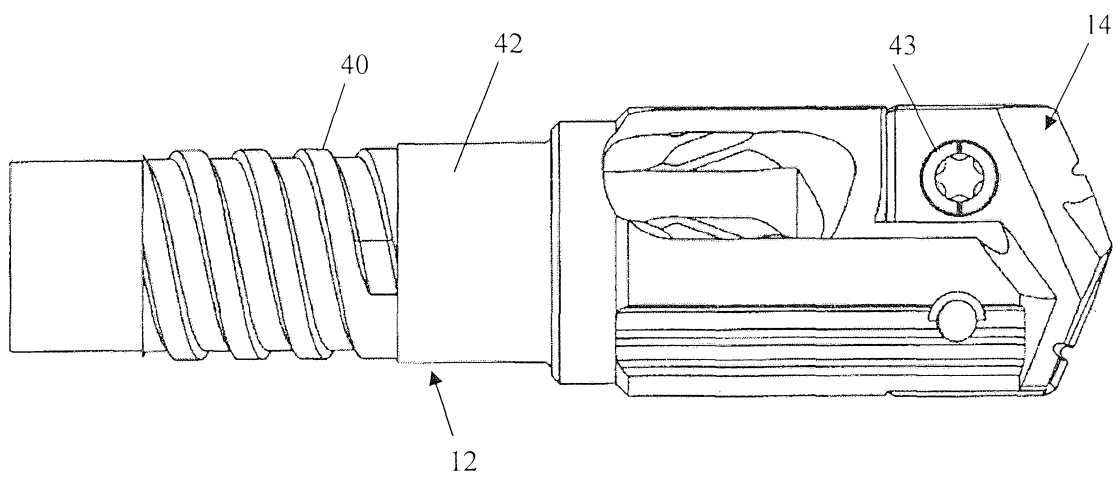


Fig. 2

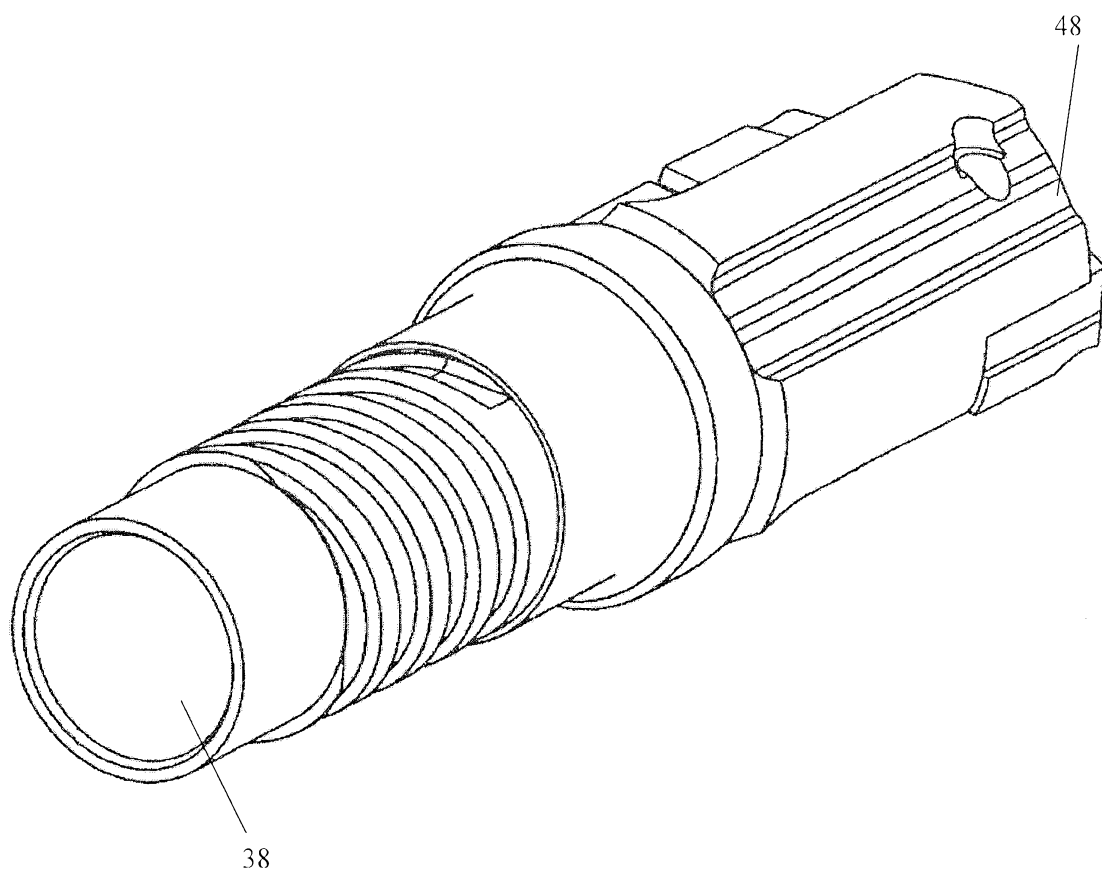


Fig. 3

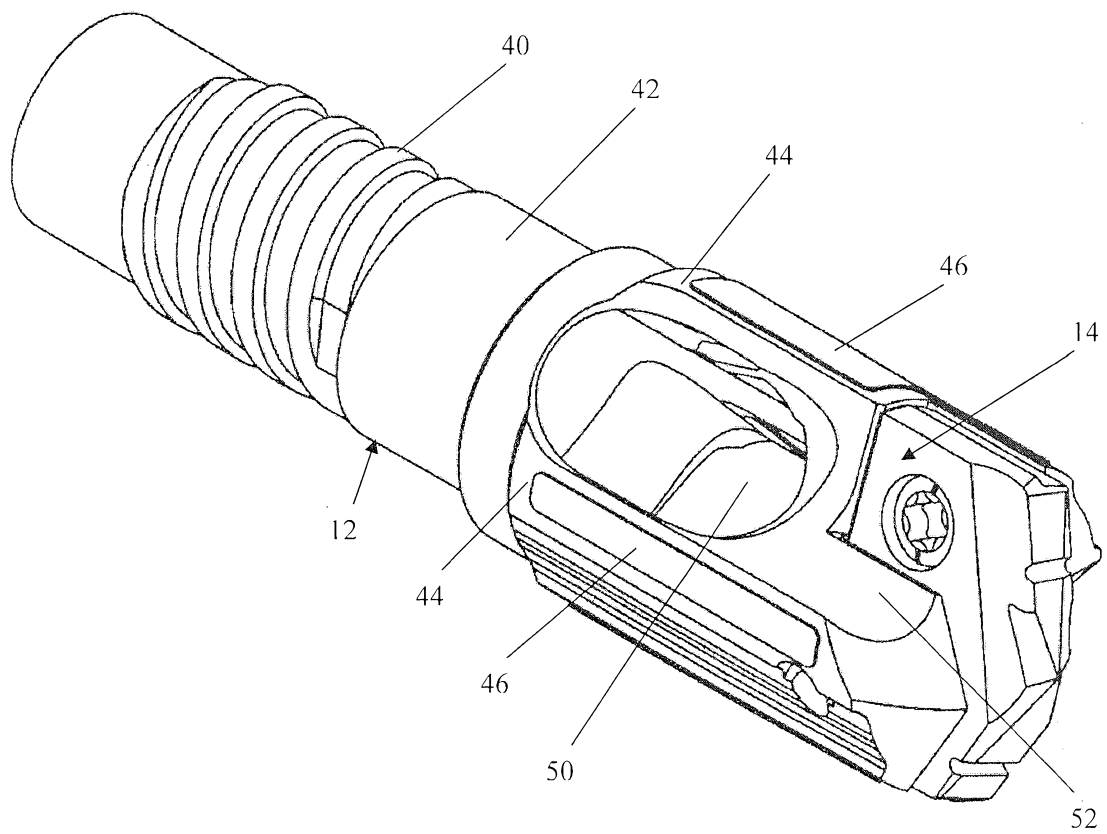


Fig. 4

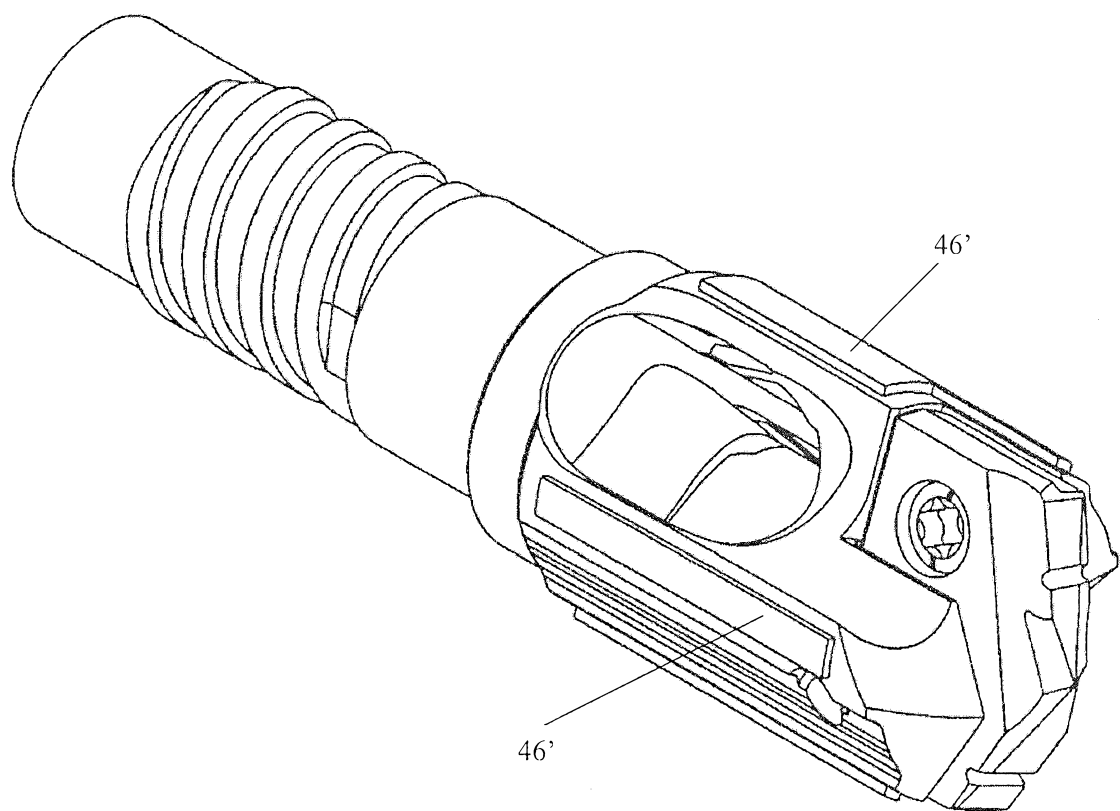


Fig. 5

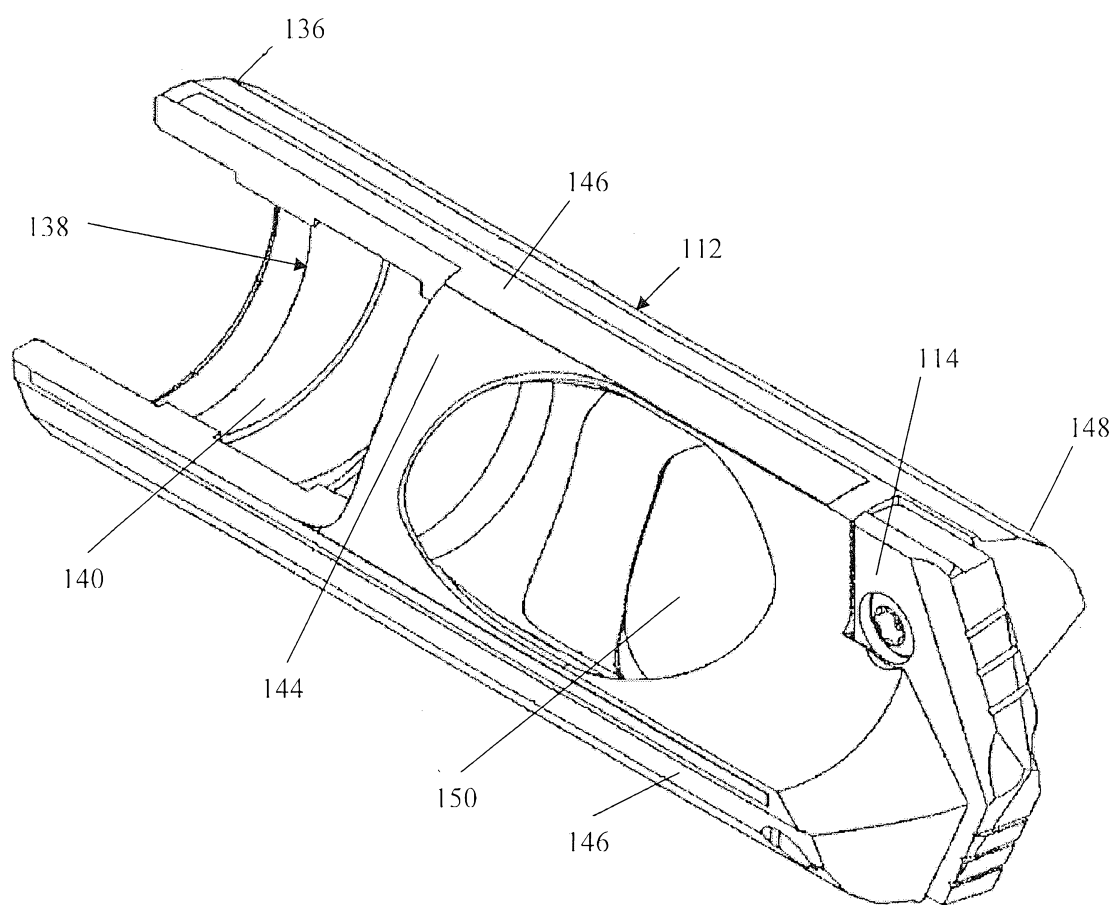
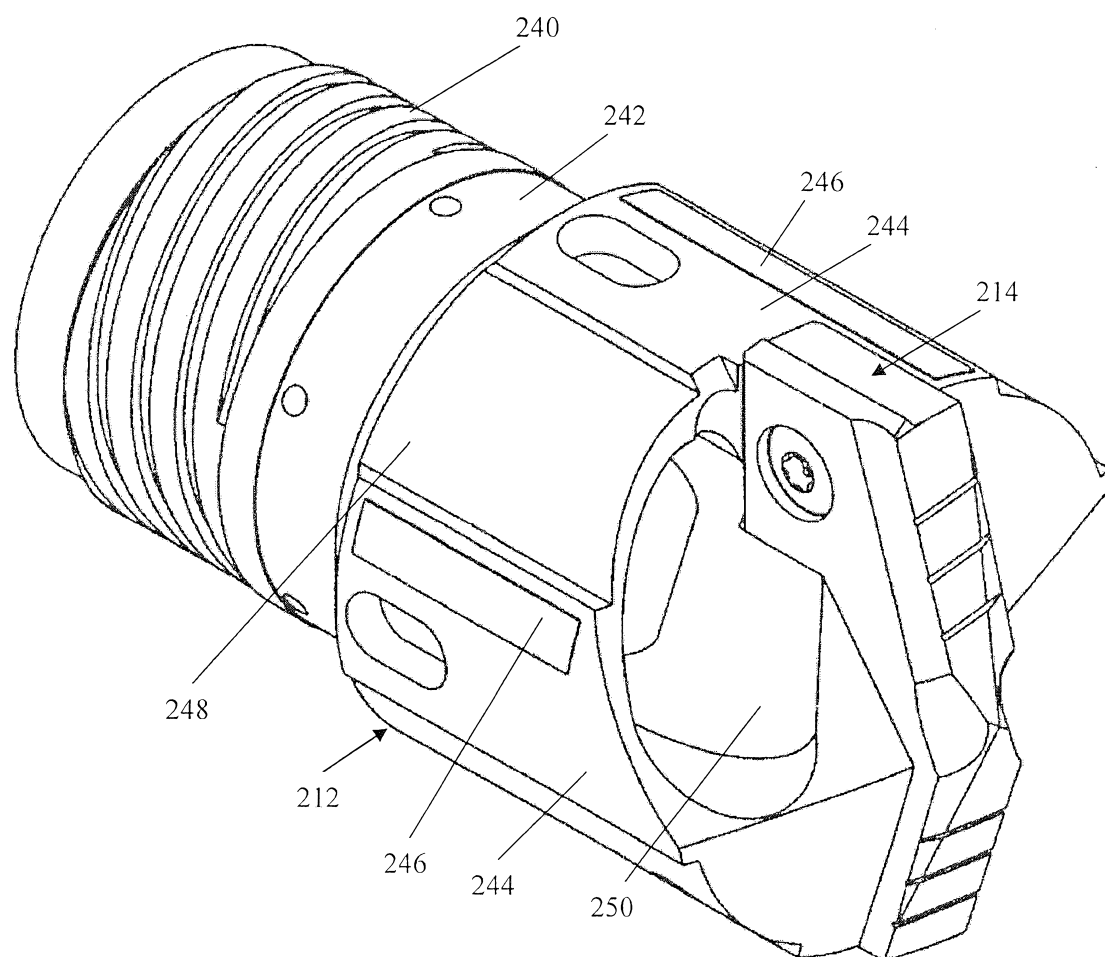


Fig. 6

**Fig. 7**