

(19) **DANMARK**

(10) **DK/EP 2874787 T3**



(12) **Oversættelse af
europæisk patentskrift**

Patent- og
Varemærkestyrelsen

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- (51) Int.Cl.: **B 25 B 23/10 (2006.01)** **B 25 B 13/06 (2006.01)**
- (45) Oversættelsen bekendtgjort den: **2019-08-05**
- (80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2019-05-08**
- (86) Europæisk ansøgning nr.: **13820527.3**
- (86) Europæisk indleveringsdag: **2013-07-19**
- (87) Den europæiske ansøgnings publiceringsdag: **2015-05-27**
- (86) International ansøgning nr.: **US2013051266**
- (87) Internationalt publikationsnr.: **WO2014015250**
- (30) Prioritet: **2012-07-20 US 201261674153 P**
- (84) Designerede stater: **AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**
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- (54) Benævnelse: **GRIBEFATNING, NØGLE OG FREMGANGSMÅDE TIL ANVENDELSE**
- (56) Fremdragne publikationer:
EP-A2- 1 312 447
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DESCRIPTION

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This claims the benefit of U.S. Provisional. Patent Application No. 61/674,153 filed July 20, 2012.

STATEMENT CONCERNING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

[0002] Not applicable.

FIELD OF THE INVENTION

[0003] This invention relates to sockets for tightening fasteners, and in particular to a socket that has a mechanism for gripping a fastener so as to resist removal of the socket from the fastener.

BACKGROUND OF THE INVENTION

[0004] When applying torque to a fastener with a wrench, it can be difficult to keep the socket of the wrench engaged with the fastener. When the tool is heavy, it becomes even more difficult. If the tool is used in a high location, is remotely operated, and/or has external forces applied to it, for example by hydraulic hoses in the case of a hydraulic torque wrench, the problem is further exacerbated or secure engagement can become of critical importance. US 2009/309316 A1 discloses a chuck for receiving a tool bit. Accordingly, the present invention provides a mechanism for helping to hold a wrench socket on a fastener during a tightening or loosening operation.

SUMMARY OF THE INVENTION

[0005] The invention provides a socket for engaging a fastener so as to drive the fastener rotationally, the socket having a gripping mechanism to help maintain the socket engaged with the fastener as claimed in claim 1. The socket includes a socket body having a fastener receiving opening sized and shaped to engage a fastener so as to drive the fastener rotationally. At least one ball opening is provided in the fastener receiving opening adjacent the fastener when the fastener is received in the opening. A ball is provided capable of partially protruding from the ball opening with the socket in an engaged state. A ball taper insert cams

against the ball to push the ball into the ball opening. A spring biases the ball taper insert so as to urge the ball into the ball opening to engage the fastener. To disengage, a release mechanism pushes the ball taper insert against the spring so as to move the ball taper insert out of the way of the ball.

[0006] In preferred aspects, the ball taper insert moves in a direction parallel to an axis of the socket when it cams against the ball. Multiple ball openings and associated balls are provided around the periphery of the fastener receiving opening. The fastener receiving opening may advantageously be for a hex head fastener having six flat surfaces in a hex pattern and one ball opening is provided in each flat surface.

[0007] In preferred aspects, the release mechanism includes a plunger and an activation collar. The activation collar is rotatable relative to the socket body so as to move the ball taper insert against the spring when the collar is turned in one direction or allow the spring to move the ball taper insert toward the activation collar when the collar is turned in the opposite direction. The activation collar may include a ramp surface that slides against the plunger. The plunger may be separate from the insert and extend between the activation collar and the ball taper insert, and the ball taper insert and plunger may be movable in a channel formed in the socket body.

[0008] The activation collar may be movable axially between a normal position in which it is not rotatable relative to the socket body and a rotatable position in which it can be turned so as to release gripping of the fastener. A bayonet connection between the activation collar and the socket body may be provided that enables the activation collar to be turned after it is slid axially relative to the socket body. Preferably, springs on the plungers bias the plungers away from the ball taper inserts and bias the activation collar toward the normal position.

[0009] The invention also provides a wrench incorporating the inventive socket and a method of turning a fastener using it.

[0010] The foregoing and other objects and advantages of the invention will appear in the detailed description which follows. In the description, reference is made to the accompanying drawings which illustrate a preferred embodiment of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011]

Fig. 1 is a perspective view of a hydraulic wrench and socket in engagement with a nut at the end of a bolted flange;

Fig. 2 is a top perspective view of the socket;

Fig. 3 is a bottom perspective view of the socket;

Fig. 4 is an exploded perspective view of the socket;

Fig. 5 is an exploded perspective view of a ball mechanism of the socket;

Fig. 6 is a fragmentary perspective view of the bottom of the collar of the socket and showing the socket body in phantom;

Fig. 7 is a perspective view of the ball taper insert of the ball mechanism;

Fig. 8 is a bottom perspective view of the collar;

Fig. 9 is a cross-sectional view of the socket assembly in an engaged position;

Fig. 10 is a view like Fig. 9 but in which the collar has been pushed down to enable turning the collar to a disengaged position;

Fig. 11 is a cross-sectional view from the plane of the line 11-11 of Fig. 10;

Fig. 12 is a view like Figs. 9 and 10 but in which the collar has been turned to the disengaged position;

Fig. 13 is a cross-sectional view from the plane of the line 13-13 of Fig. 12;

Fig. 14 is a cross-sectional view from the plane of the line 14-14 of Fig. 10;

Fig. 15 is a cross-sectional view from the plane of the line 15-15 of Fig. 12;

Fig. 16 is a detail view of the area of Fig. 14 indicated by line 16-16;

Fig. 17 is a detail view of the area of Fig. 15 indicated by line 17-17; and

Fig. 18 is a top perspective view of an alternate embodiment of the socket assembly.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0012] Referring to Figs. 1-9, a hydraulic wrench 10 and socket assembly 14 is illustrated including a socket body 18 having a nut receiving opening 22, and gripping means in the socket body 18 for releasably grasping a fastener 30. Socket body 18 may be, for example, a modified impact socket. Socket body 18 has a universal square drive coupling hole 9 at its tool interface end that receives the square drive of a tool as is well known so as to be driven rotationally by the tool.

[0013] As shown in Figs. 4-9, the gripping means is in the form of a ball mechanism 26 for releasably engaging the fastener 30, the mechanism 26 including a steel ball 34 received within a plunger channel 38 extending parallel to a longitudinal axis of the fastener 30, a ball

receiving opening 42 extending between the plunger channel 38 and the fastener receiving opening 22, and urging means for releasably urging the ball 34 towards the fastener 30 received in the fastener receiving opening 22. The ball receiving opening 42 is sized slightly smaller than the ball 34, so that the ball 34 can pass only partially through the ball receiving opening 42.

[0014] The urging means includes a plunger 50 having a ball engaging ramp 54, the plunger 50 being received in the plunger channel 38, compression spring 58 for urging the plunger 50 and the ball 34 to a ball engaged position and a release mechanism 62 for engaging the plunger 50 and moving the plunger 50 to a ball disengaged position. The ramp 54 on the plunger 50 allows movement of the ball 34 between the engaged position, under urging of the spring 56, and the disengaged position, when the plunger 50 is moved toward the fastener receiving opening by camming on a ramp 82 on the face of the collar 74 that is toward the fastener receiving opening 22.

[0015] In the preferred embodiment, the plunger 50 includes a top piece or ball plunger 51 and separate bottom piece or ball taper insert 53. The top piece 51 is inserted into the plunger channel 38 from the top, and the bottom piece 53 is inserted into the plunger channel from the bottom. The spring 58 biases the ball taper insert 53 upwardly, toward collar 74, so as to cause the ball 34 to cam on the ramp 54 and be pushed into the opening 42, to protrude partially therefrom and bear against the adjacent surface of the fastener 30 when the fastener is in the opening 22. Since there is one ball and associated remainder of the mechanism 26 for each of the six faces of a hex fastener (hex nut or bolt), they all act together to pinch or grasp the fastener between them. The ramp surface 54 of each insert 53 is of a shallow incline, so considerable pressure can be brought to bear against the surfaces of the fastener with relatively light force from springs 58, and the balls 58 cannot back out until the inserts 53 are moved into the release position (downwardly in Fig. 2) by the release mechanism 62.

[0016] The spring 58 extends between a set screw 86 in the plunger channel and the ball taper insert 53. The set screw 86 allows access to the plunger channel 38 so that the compression spring 58 can be placed in the channel 38 between the bottom piece 53 and the set screw 86. Another compression spring 56 is provided for each of the six ball plungers 51 that biases the ball plungers upwardly away from the inserts 53, and also biases the activation collar 74 in the same direction.

[0017] The socket body 18 has retaining pin openings 70 on opposite sides of the square drive hole at the top of the socket to aid in securing the socket assembly 14 to the square drive of a wrench 10, as is conventional. A retaining pin 94 extends through the openings 70 and is retained therein by a rubber o-ring 73.

[0018] In one embodiment, the release mechanism 62 includes activation collar 74 toward the end of the socket body opposite from opening 22. The collar 74 is received over a reduced diameter or indentation 78 on the exterior of the socket body 18. The collar 74 is held on the socket body 18 end by a snap ring 75 received in an annular groove 77. The rotatable collar 74

has a plurality (six in the embodiment illustrated) of ramps 82, one for each plunger 50, so that in one direction of rotation of the collar 74 (clockwise as viewed from the top of the socket, the collar ramps 82 engage the upper end of the ball plungers 51, moving the plungers 51 to a ball disengaged position. In the opposite direction, counter-clockwise, the tops of the plungers 51 cam on ramps 82 and are pushed axially toward the respective inserts 53 and when they engage the inserts 53, they push the inserts 53 downwardly, toward the fastener opening end of the socket body 18, and out of the way of the balls 34 to release the grip of the socket 14 on the fastener. The collar 74 can be provided with blind holes 91 in which one or more rods can be inserted to help push down and turn the collar 74.

[0019] The socket 18 further has an external ball entrance opening 90 perpendicular to and into the plunger channel 38, opposite the ball receiving opening 42. The external ball entrance opening 90 provides ball access to the plunger channel 38. When assembling the ball mechanism 26, the ball 34 is placed inside the socket 18 by passing the ball 34 through the external ball entrance opening 90, through the plunger channel 38, to the ball receiving opening 42. The plunger bottom piece 53 is then placed into the plunger channel 38, followed by the spring 58 and set screw 86 to hold the ball in the opening 42.

[0020] As described in the embodiment above, the socket assembly 14 includes a plurality of peripherally spaced apart ball mechanisms 26 in the socket 18, as shown in the drawings and described above, and the rotatable collar 74 includes a plurality of peripherally spaced apart ramps 82 in its lower surface, as shown in Fig. 5 and described above. The presence, in this embodiment, of a plurality of fastener engaging ball mechanisms, aids in the securing of the socket assembly 14 onto the fastener 30.

[0021] As described above, turning the collar in one direction cams the plungers 50 into a disengaged position in which the balls can move outwardly from the ball openings and turning the collar in the opposite direction cams the plungers to an engaged position in which the balls are forced into the openings. Normally, the collar is held in the angular position in which the balls are urged into the openings 42. This is accomplished by a bayonet connection between the collar 74 and the socket body 18. The bayonet connection is provided by tabs 93 (a total of four, but there could be more or less) that slide in a corresponding number of bayonet grooves 97. Each bayonet groove 97 is a right angle groove with one straight section parallel to the axis of the socket body 18 and another straight section, formed as part of an annular groove in the form illustrated, that continues perpendicularly from the bottom of the first section in the counter-clockwise direction as viewed from the drive or top end of the socket.

[0022] Therefore, to move the collar 74 from its normal, ball-engaged position (Figs. 10, 11, 14 and 16) to its ball disengaged position (Figs. 12, 13, 15 and 17), the operator first pushes the collar down until the tabs reach the bottom of the first section of the groove 97 and then turns the collar counter-clockwise, with the tabs 93 sliding in the second sections of the grooves 97. Turning the collar causes the plungers 51 to cam on the ramps 82 so as to be pushed toward the inserts 53, which causes the inserts 53 to slide toward the entry end of the opening 22 so

as to move the ramps 54 away from the balls 34, to permit them to move out of the ball openings 42 thereby releasing the fastener. Turning the collar 74 in the opposite direction (clockwise) cams the plungers 51 against the ramps 82 under the bias of the springs 56 causing the plungers 51 to move away from the inserts 53, permitting the inserts 53 to be cammed against the balls 34 under the urging of the springs 58, thereby moving the balls 34 into the ball openings 42 under force of the springs 58 and ramps 54. When the tabs become aligned with the first sections of the grooves 97, the collar 74 is pushed upwardly by the springs 56 so as to be held in the ball engaged angular position.

[0023] The embodiment 14' of Fig. 18 is the same as the first embodiment, except it has a spline extension 13' rather than a universal square drive coupling like the first embodiment 14. Whereas the universal square drive is made to be easily releasable, for example with the retaining pin 94 or sometimes simply a ball detent on the square drive of the wrench, the spline extension is made to be incorporated into and driven by the drive train of the wrench, and made a permanent part of the wrench, for example in a dedicated hydraulic wrench that can only turn one size fastener.

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- [US61674153B \[0001\]](#)
- [US2009309316A1 \[0004\]](#)

GRIBEFATNING, NØGLE OG FREMGANGSMÅDE TIL ANVENDELSE

PATENTKRAV

1. Fatning til indgreb af et fastgørelseelement (30) for således at drive fastgørelseelementet rotationsmæssigt, hvilken fatning har en gribemekanisme til at hjælpe med til at holde fatningen i indgreb
5 på fastgørelseelementet, hvilken fatning omfatter:
- et fatningslegeme (18) med et fastgørelseelements modtagelsesåbning (22), der er dimensioneret og udformet til indgreb med et fastgørelseelement for således at drive fastgørelseelementet rotationsmæssigt;
- mindst én kugleåbning (90) i fastgørelseelementets modtagelsesåbning stødende op til
10 fastgørelseelementet, når fastgørelseelementet er modtaget i åbningen;
- en kugle (34), der er i stand til delvist at ruge frem fra kugleåbningen med fatningen i en indgrebstilstand; og
- en frigørelsesmekanisme (62);
- kendetegnet ved, at fatningen endvidere omfatter:
- 15 en konisk kugleindsats (53), der støder mod kuglen (34) for at skubbe kuglen ind i kugleåbningen (90);
- en fjeder (58), der forspænder den koniske kugleindsats (53) for således at tvinge kuglen (34) ind i kugleåbningen (90);
- hvor frigørelsesmekanismen (62) er tilpasset til at bevæge den koniske kugleindsats mod fjederen
20 (58) for således at bevæge den koniske kugleindsats (53) mod fastgørelseelementets modtagelsesåbning (22) og ud af vejen for kuglen (34), og hvor fjederen (58) er tilpasset til at forspænde den koniske kugleindsats (53) mod frigørelsesmekanismen (62).
2. Fatning ifølge krav 1, hvor:
- den koniske kugleindsats (53) bevæger sig i en retning parallel med en akse af fatningen, når den
25 støder mod kuglen (34); eller
- talrige kugleåbninger (90) og tilhørende kugler (34) er tilvejebragt omkring periferien af fastgørelseelementets modtagelsesåbning (22); eller
- fastgørelseelementets modtagelsesåbning er til et fastgørelseelement med sekskantet hoved med flade overflader i et sekskantsmønster og én kugleåbning er tilvejebragt i hver flade overflade.
- 30 3. Fatning ifølge krav 1, hvor frigørelsesmekanismen (62) indbefatter et stempel (50) og en aktiveringskrave (74), hvilken aktiveringskrave kan rotere i forhold til fatningslegemet (18) for således at bevæge den koniske kugleindsats (53) mod fjederen (58), når kraven drejes i én retning, for at gøre det muligt for fjederen at bevæge den koniske kugleindsats mod aktiveringskraven, når kraven drejes i den modsatte retning.
4. Fatning ifølge krav 3, hvor aktiveringskraven (74) indbefatter en rampeoverflade (54), der glider mod stemplet (50).
5. Fatning ifølge krav 3, der indbefatter et stempel (50), der strækker sig mellem aktiveringskraven (74) og den koniske kugleindsats (53).

6. Fatning ifølge krav 3, hvor den koniske kugleindsats (53) og stemplet (50) kan bevæges i en kanal (38), der er dannet i fatningslegemet.
7. Fatning ifølge krav 3, hvor aktiveringskraven (74) kan bevæges aksialt mellem en normal position, hvori den ikke kan rotere i forhold til fatningslegemet (18), og en roterbar position, hvori den kan drejes for således at frigøre fastgørelseelementets (30) greb.
8. Fatning ifølge krav 7, hvor en bajonetforbindelse mellem aktiveringskraven (74) og fatningslegemet (18) gør det muligt for aktiveringskraven at blive drejet, efter at de er gledet aksialt i forhold til fatningslegemet.
9. Fatning ifølge krav 7, hvor:
- 10 en fjeder på stemplet (50) forspænder aktiveringskraven (74) mod den normale position; eller en fjeder forspænder stemplet (50) væk fra den koniske kugleindsats (53).
10. Fatning ifølge krav 1, hvor:
- fatningslegemet (18) indbefatter en firkantet drivåbning modsat fra fastgørelseelementets modtagelsesåbning (22), hvilken firkantet drivåbning er til en nøgles indgreb; eller
- 15 fatningslegemet indbefatter en kileforlængelse (13) ved en ende modsat fra fastgørelseelementets modtagelsesåbning (22), hvilken kileforlængelse er til indgreb med en nøgles drev.
11. Nøgle med fatning ifølge et hvilket som helst foregående krav.
12. Nøgle ifølge krav 11, hvor:
- fatningslegemet indbefatter en firkantet drivåbning til indgreb med en firkantet drivstang af nøglen
- 20 med en udløselig kobling.
13. Nøgle ifølge krav 11, hvor fatningslegemet har en kileforlængelse, der drives ved hjælp af nøglen.
14. Fremgangsmåde til drejning af et fastgørelseelement modtaget inde i en åben ende af en fatning, der drejes ved hjælp af en nøgle, når nøglen anvendes, hvilken fremgangsmåde omfatter følgende trin:
- bevægelse af en frigørelsesmekanisme (62) af fatningen til en ikke-indgrebsposition af
- 25 frigørelsesmekanismen, hvori frigørelsesmekanismen skubber en fjederforspændt knast (54), der er forspændt mod frigørelsesmekanismen (62), mod den åbne ende (22) af fatningen og ud af vejen for en kugle (34) af fatningen, således at kuglen bevæges ud af vejen for at gøre det muligt for den åbne ende af fatningen at blive placeret over fastgørelseelementet i rotationsdrivindgreb med fastgørelseelementet;
- efter placering af fatningen over fastgørelseelementet, bevægelse af frigørelsesmekanismen til en
- 30 indgrebsposition for frigørelsesmekanismen (62), hvori frigørelsesmekanismen bevæges ud af vejen for at gøre det muligt for den fjederforspændte knast at skubbe en kugle af fatningen mod en side af fastgørelseelementet for således at interferere med fastgørelseelementet;
- anvendelse af nøglen til at dreje fastgørelseelementet;
- bevægelse af frigørelsesmekanismen til ikke-indgrebspositionen og
- 35 fjernelse af fatningen fra fastgørelseelementet.
15. Fremgangsmåde til drejning af et fastgørelseelement ifølge krav 14, hvor en krave af frigørelsesmekanismen bevæges med en kombination af aksial og roterende bevægelse mellem indgrebs- og ikke-indgrebspositionerne.

DRAWINGS

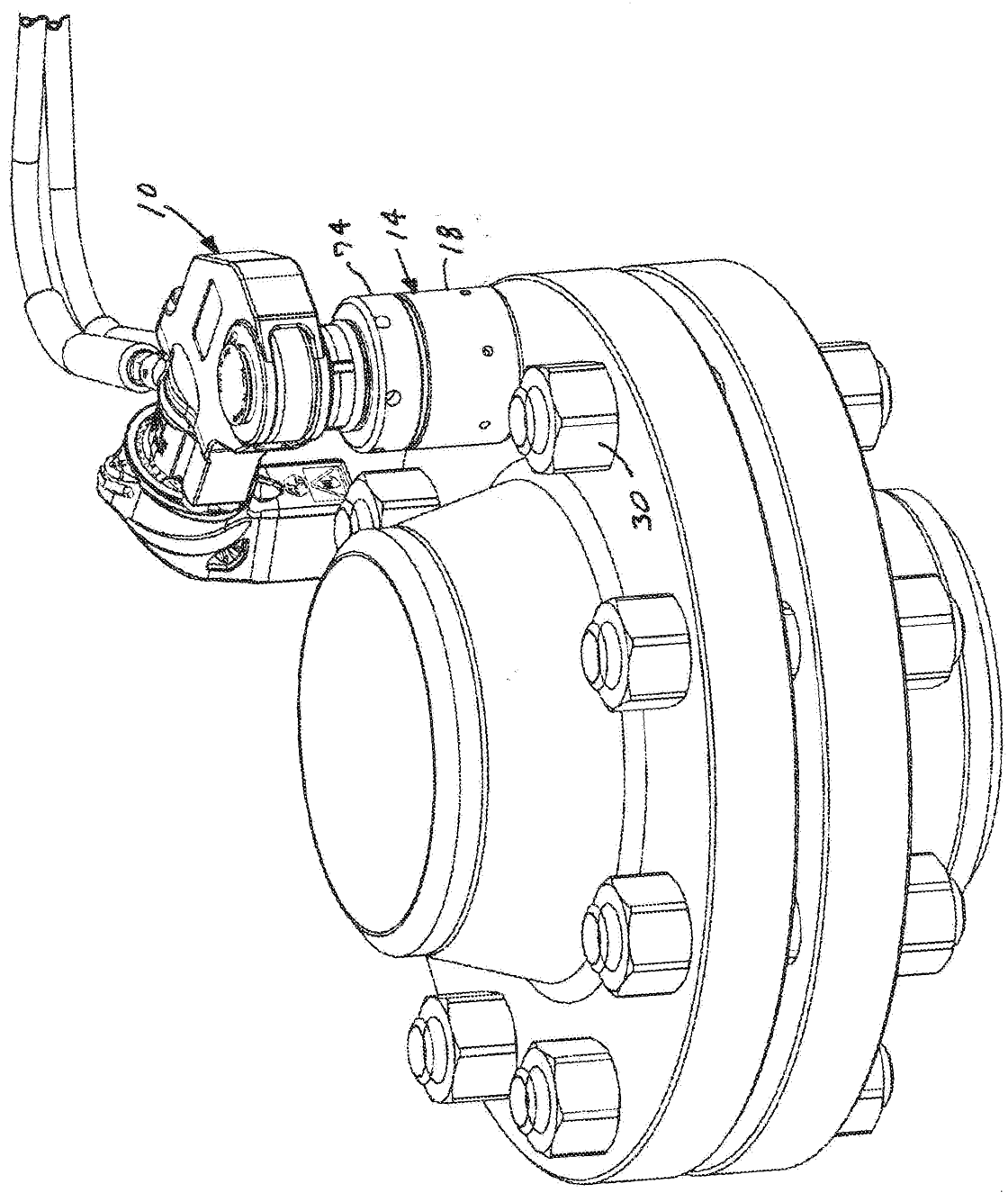


FIG. 1

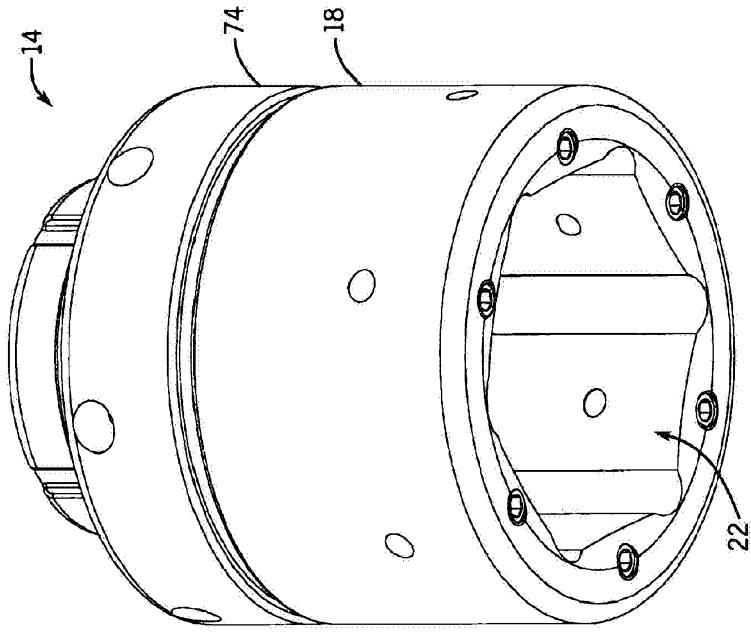


FIG. 3

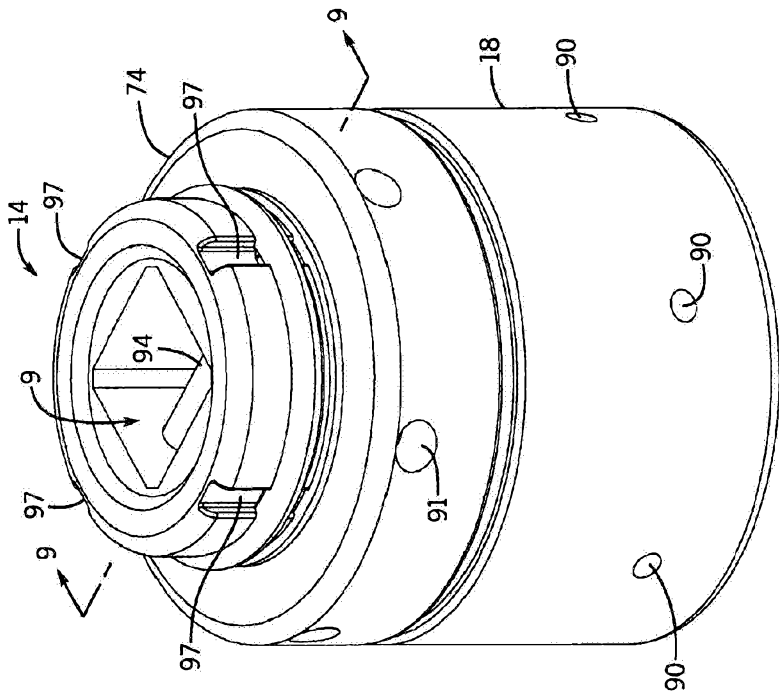


FIG. 2

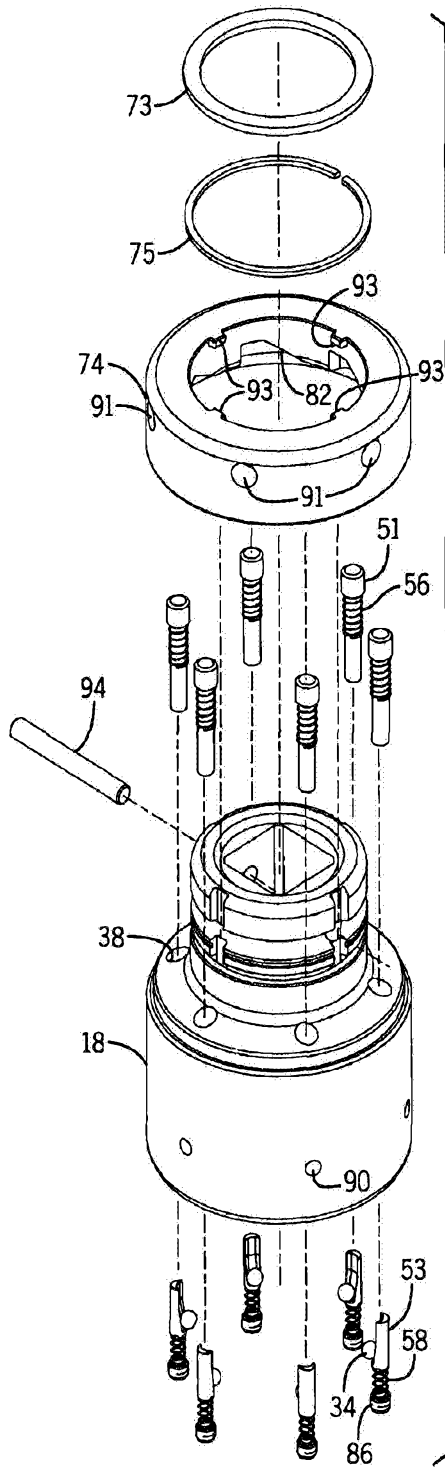


FIG. 4

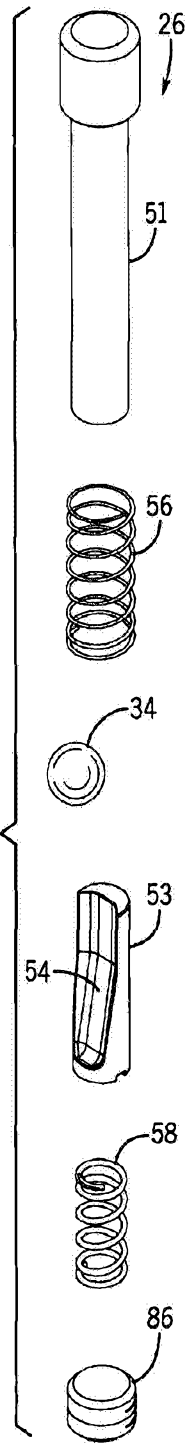
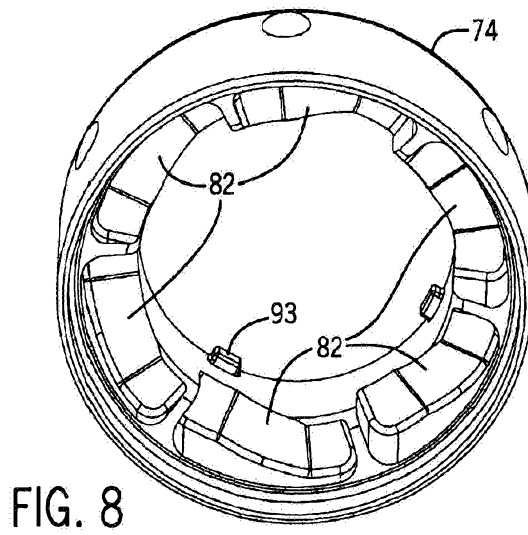
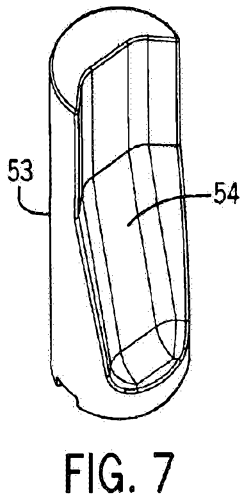
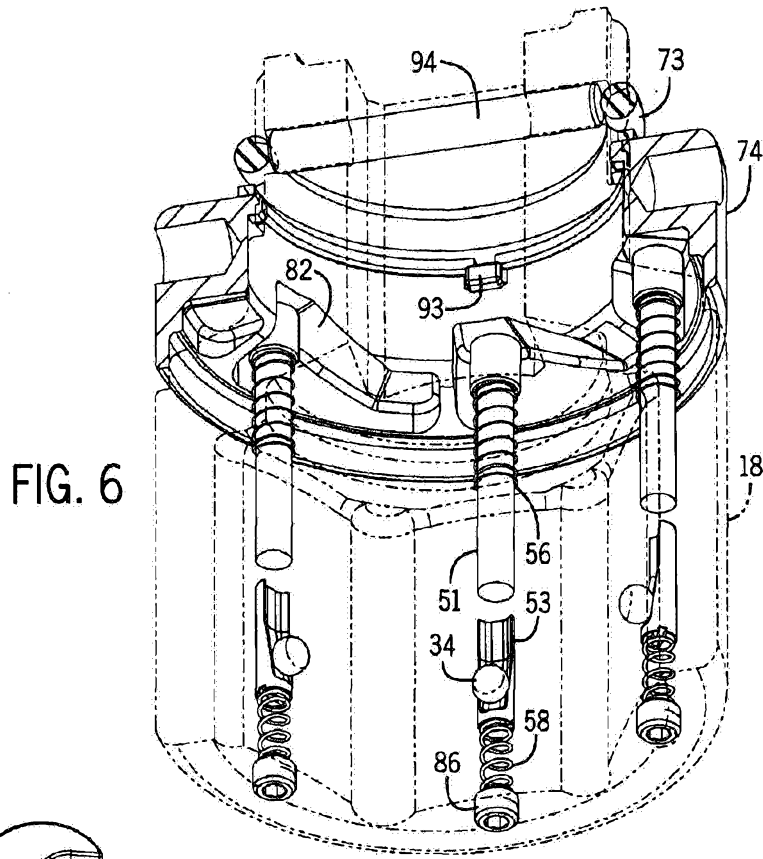


FIG. 5



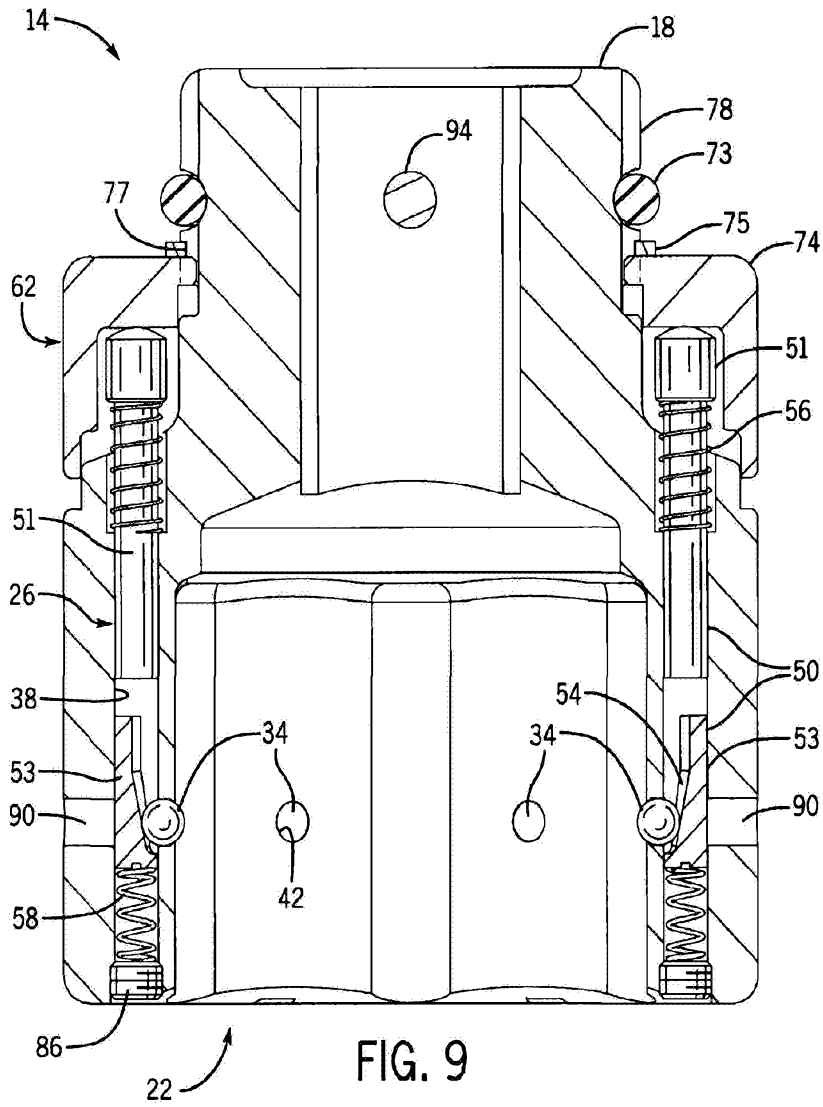


FIG. 9

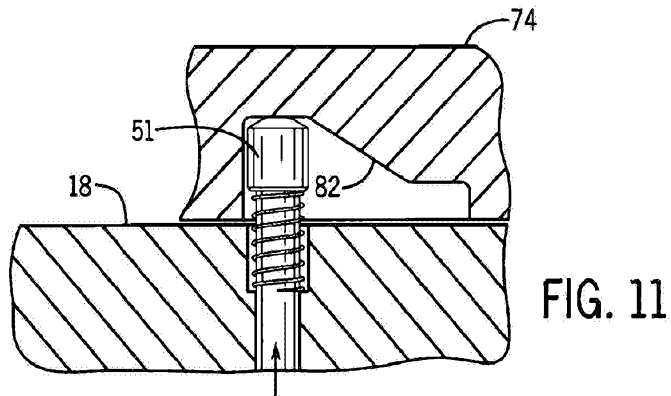
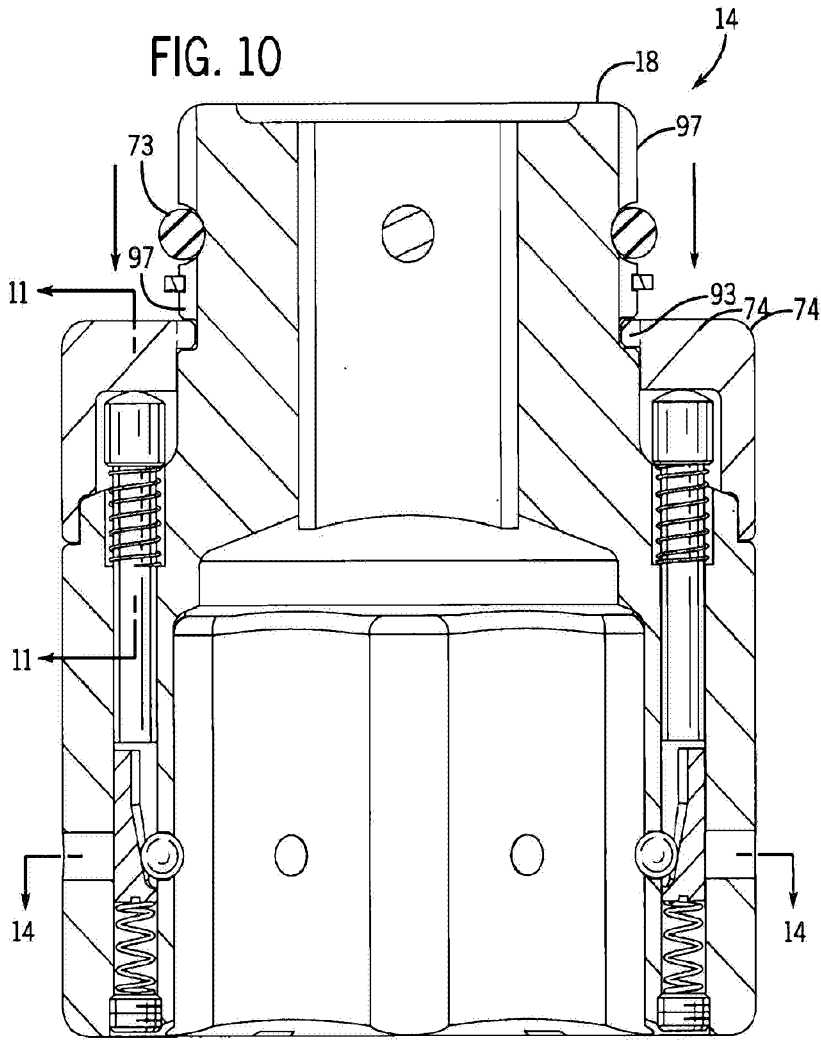


FIG. 12

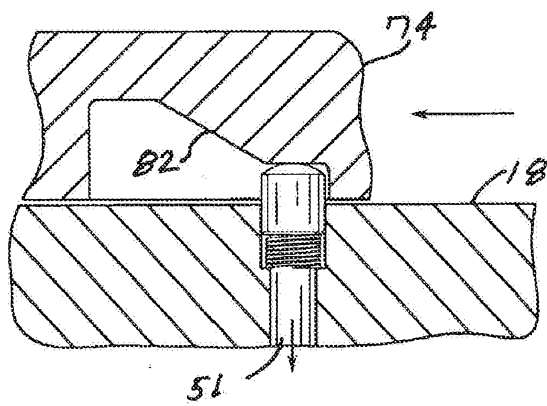
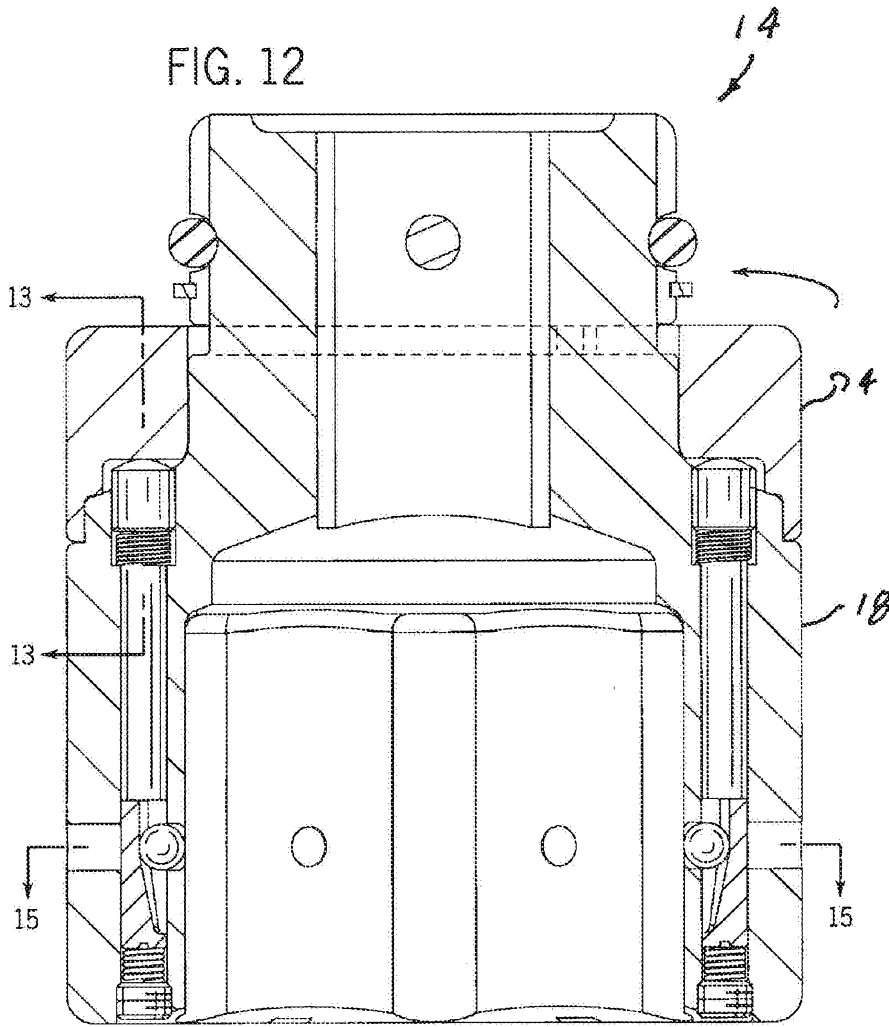


FIG. 13

FIG. 14

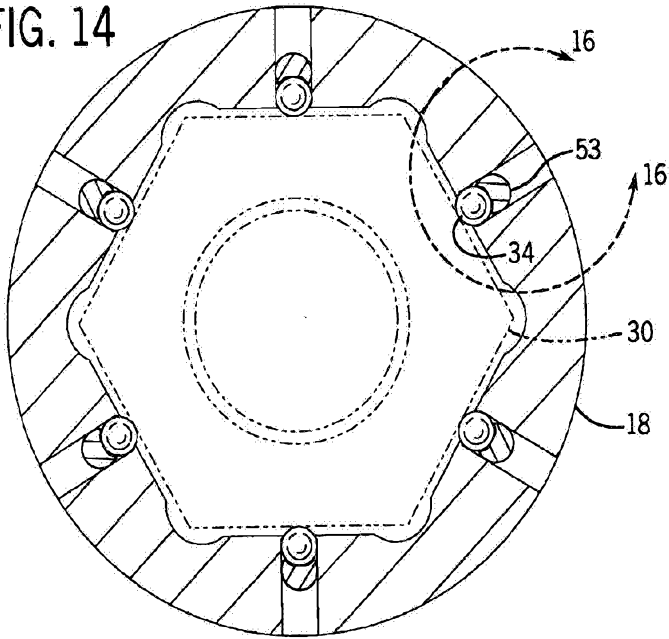
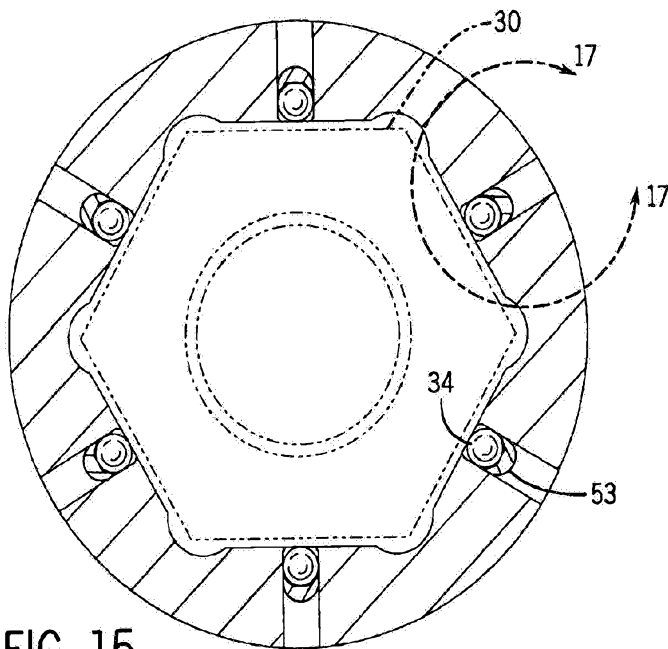


FIG. 15



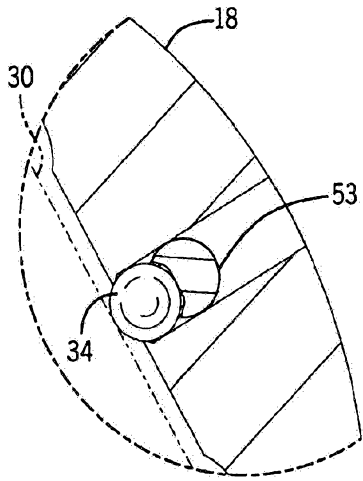


FIG. 16

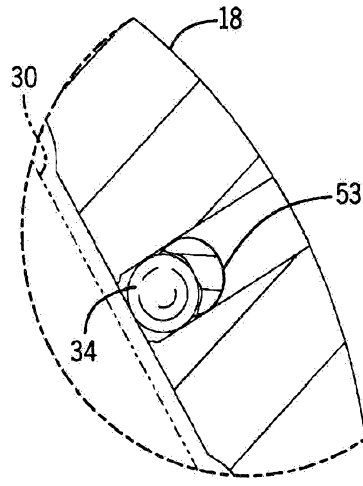


FIG. 17

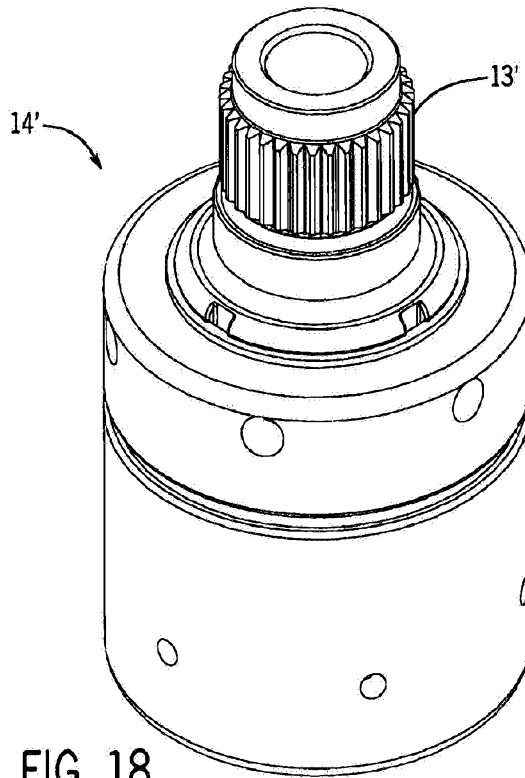


FIG. 18