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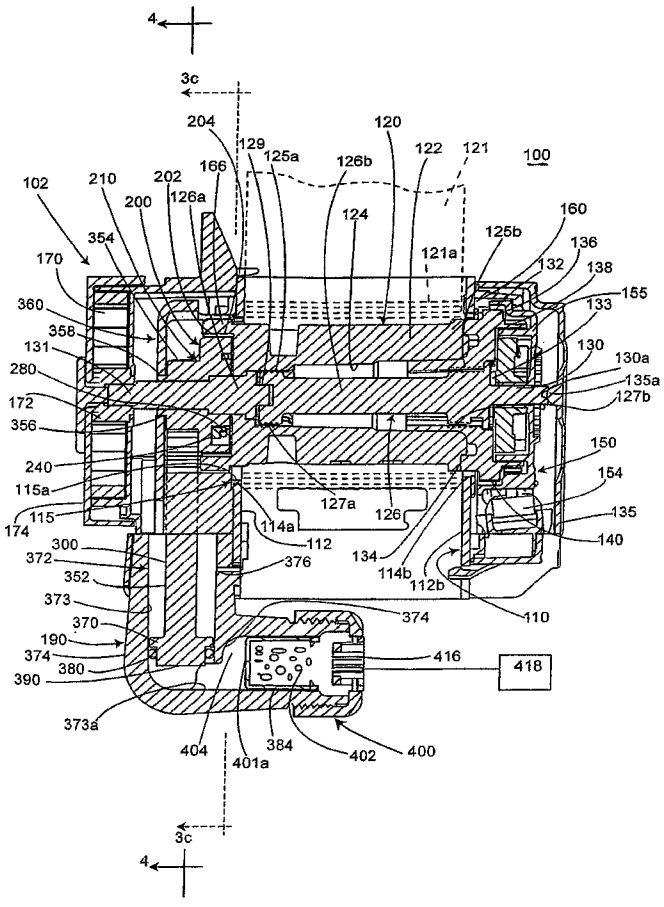
(54) Title: SEAT BELT RETRACTOR WITH RACK PRETENSIONER



(57) Abstract: A seat belt retractor (100) has a rotatable spool (122) upon which a seat belt (121) can be wound and a pretensioner (190) for winding the spool (122) in a belt winding direction to rewind the seat belt upon the spool (122); the pretensioner (190) comprising a rack and pinion mechanism (350) activated by a pyrotechnic device (400) for causing a clutch assembly (200) to change state from a disengaged mode to an engaged mode in which the clutch assembly drivingly engages the spool (122).

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SEAT BELT RETRACTOR WITH RACK PRETENSIONER

The present invention relates to seat belt retractors and more particularly to a seat belt retractor assembly having a pretensioner.

There is a need for a seat belt retractor with a pretensioner that is compact in design, fast to engage with the spool of the seat belt retractor and provides controlled loading of the spool during web rewinding.

Accordingly the invention comprises: a seat belt retractor having a rotatable spool upon which a seat belt can be wound and a pretensioner for winding the spool in a belt winding direction to rewind the seat belt upon the spool. The pretensioner comprises a rack and pinion mechanism activated by a pyrotechnic device, which causes a clutch assembly to change state from a disengaged mode to an engaged mode of operation in which the clutch assembly drivingly engages the spool. The clutch assembly comprises a clutch housing having provision to support a plurality of rotatable clutch pawls. The clutch housing is received within a recess of the spool, such recess including a plurality of engagement teeth thereon, each of the clutch pawls configured to become column loaded between the spool and the clutch housing when in the engaged mode.

Figure 1 is a cross-section view of a seat belt retractor of the present invention.

Figure 2 is an isometric view of the clutch housing.

Figure 2a is a plan view of the clutch housing of Figure 2a.

Figure 3 is an isometric view of a clutch assembly.

Figure 3a is an isometric view with the clutch housing and O-ring are removed to show three clutch pawls.

Figure 3b is an isometric view showing the bottom surface of a single clutch pawl.

Figure 3c is a front plan view of the clutch assembly of Figure 3 taken at line 3c – 3c of Figure 1.

Figure 3d is a cross-section of a plurality of clutch pawls in a deactivated position disengaged from the retractor spool.

Figure 3e is a cross-section of the clutch pawls in a position of initial engagement with the teeth of the retractor spool.

Figure 3f is a partial view of the clutch pawls fully engaged and column loaded between the spool and clutch housing.

Figure 4 is a cross-section showing details of the rack and pinion mechanism through section 4-4 of Figure 1.

Figure 5 shows a rack in an activated position.

Figure 1 shows the major parts of a seat belt retractor assembly 100 incorporating the present invention. The seat belt retractor assembly 100 includes a seat belt retractor 102 generally of known construction and a rotary pretensioner 190, which when activated during a crash, rotates the retractor spool in a belt winding direction, thereby tightening a shoulder belt about the torso of a vehicle occupant.

The seat belt retractor 102 includes many components known in the art such as a U-shaped frame 110 having sides 112, 112b with openings 114a, 114b therein. On of the openings 114a receives a bearing plate 115 having an opening 115a to receive and support one side of a spool or spool assembly 120 about which a seat belt 121 is wound. A portion 121a of the seat belt 121 is shown wound on the spool. The spool assembly 120 includes a spool 122 having a hollow bore 124 with a set of splines 125a, 125b therein, into which is received a shaft or driver 126. The shaft or driver 126 in the illustrated embodiment comprises two interacting portions 126a, 126b. A single-piece shaft can be used. One shaft portion 126b in the illustrated embodiment is a torsion bar having a plurality of splines 127a, 127b that engage the splines 125a, 125b in the spool 122.

The shaft portions 126a, 126b are drivingly connected at an interface 129. Upon assembly a first end 131 of the shaft 126 extends beyond the left face of the spool 122 and is received within a spring arbor 172. A second end 130 of the shaft 126 is received within a lock wheel or pilot wheel 132. The second end 130 of the shaft 126 is formed with a concave surface 130a supported by a convex surface 135a of a mechanism cover 135 that protectively encloses the inertia sensors and

lock ring. A thrust washer 133 locates the shaft 126 within the spool and provides for reduced friction with adjacent parts. The pilot or lock wheel 132 is physically secured to a mating face 134 of spool 122. In the illustrated embodiment the lock wheel 132 includes a plurality of ratchet wheels 136, 138.

A ratchet wheel 136 comprises a plurality of lock teeth 140, which engage a lock pawl (not shown) that is pivotably connected via a pivot pin to a side 112b of the frame 110. The lock pawl and lock wheel 136 comprise part of the locking mechanism. Seat belt retractor locking mechanisms include a vehicle sensor inertial lock mechanism 154 as well as a web sensor inertial locking mechanism 150, each of which is generally known in the art. One such inertial locking mechanism is disclosed in EP 0228729 A1. In EP 0228729 A1, like in Figure 1, the inertial mass of the vehicle sensor and the web sensor are housed within a lock ring 155 that is free to rotate about an end 130 of the shaft. Upon engagement of the lock ring with the shaft during high vehicle deceleration or the high extraction speed of the seat belt from the seat belt retractor, the lock ring will rotate with the shaft, if only momentarily, which moves the lock pawl into engagement with one or more teeth of the lock wheel.

The spool 122 is stabilized relative to the openings 114a, 114b in the frame by a bushing 160, which supports a cylindrical surface of the lock wheel 132, and by the bearing plate 115, which receives and supports a cylindrical surface 166 formed on the left side of spool 122. The shaft 126 is drivingly connected to a rewind spring 170 via the spring arbor 172. The rewind spring and arbor are protectively mounted within a spring housing 174 and a spring cover.

The seat belt retractor 102 includes a pretensioner 190, also called a belt tightener. The pretensioner includes a clutch subassembly 200 and a rack and pinion mechanism 300. The rack and pinion mechanism 300 includes a pyrotechnic device 400, which shares portions of the rack and pinion mechanism 300. The pyrotechnic device provides pressurized gas to move the rack and pinion mechanism 300, which activates the clutch

assembly, causing the spool to rotate in a belt-winding direction to reduce belt slack about a vehicle occupant.

In Figures 2, 2a and 3-3f, the clutch assembly 200 includes a clutch housing 210, a plurality of clutch pawls, collectively referred to as 240 and individually as 240a-c, and an O-ring 280. The clutch subassembly 200 is received within a recess 202 formed at an end 166 of spool 120. As more clearly illustrated in Figures 3c-3f, the recess 202 includes a roughened or friction enhancing surface 204 about its walls. This roughened or friction-enhancing surface can take the form of a plurality of small teeth 204 positioned about the periphery of the recess 202. Splines or other indentations can provide the roughened surface. The clutch housing 210, as shown in Figure 2, has a main body 212; the pinion gear 354 of the rack and pinion mechanism 300 extends from one side of the main body.

The main body 212 of the clutch housing is cylindrically shaped and includes an outer wall 211 and a front face 213. A plurality of relatively deep cavities 214a-c is formed in the front face 213. Each cavity 214 of the plurality of cavities includes a bottom 215 having a stepped configuration with a lower level 216 and an arcuate shoulder 217, which separates the lower level 216 from a higher or raised level 218. The cavities 214a-c are equally spaced about the main body 212 of the clutch housing. Each cavity 214 includes a flat wall 219. Each flat wall 219 follows a chord; that is, a flat wall 219 is perpendicular to a radius R1. Each flat wall 219 transitions to a radially extending wall 221 proximate the outer wall 211. Each cavity 214 includes, generally opposite the flat wall 219, an open mouth or open end 222 and a short angled flat wall 223 oriented at an angle A1 to a flat wall 219. The short flat wall 223 transitions to a second radially extending wall 224 proximate to the mouth 222. Each cavity 214 further includes a curved end wall 226, which is generally circular in cross-section, located between and tangent to both the flat wall 219 and the angled flat wall 226, and generally opposite the opening end 222.

The main body 212 of the clutch housing 210 further includes a circular groove 230, shown in Figure 2b, recessed into the front face 213 at

a depth less than that of each cavity 214. The inner diameter of the circular groove 230 is denoted as R2 and the outer diameter of the groove is denoted as R3. The depth of the groove is sufficient to receive an O-ring 280 as discussed below. In view of the deeply recessed cavities 214a-c, the circular groove 230 has three circular segments 230a-c. Each groove segment 230a-c, proximate each curved end wall 226, includes a partial-cylindrical slot that deepens each groove segment 230a-c toward a corresponding one of the curved end walls 226. The main body 212 of the clutch housing includes a center bore 234, which is received about a portion of the shaft 126. A clutch pawl 240 is pivotably received in each cavity 214.

Figures 3, 3a, 3b and 3c are views of one of the clutch pawls 240, as well as the clutch assembly 200. Each clutch pawl is configured to be relatively short, which reduces the overall size of the clutch assembly 200. In Figure 3b each clutch pawl has a narrow shaft portion 241 and a considerably wider head portion 250. This construction locates the center-of-gravity of the clutch pawl within the head portion. This construction also moves the center-of-gravity away from the pivot point of the clutch pawl to increase the effective radius (distance between the pivot point or surface and center-of-gravity), which tends to permit the clutch pawls to move outwardly faster at any given level of rotation of the clutch housing, which makes the clutch assembly quicker to operate than the prior art, which uses stamped pawls of uniform thickness.

Each clutch pawl 240 is configured so that when it is fully locked against the spool, the clutch pawl is column-loaded between the spool and the clutch housing, as shown in Figure 3f. This construction permits the full engagement of each clutch pawl with the spool. In Figure 3f the clutch pawl, which is preferably made of steel, in view of the column loading will dig into the softer spool, which is often made of zinc or aluminum. By column loading the clutch pawls, sheer stress is minimized, lessening the tendency of the clutch pawl to bend or twist. Column loading the clutch pawl permits the clutch pawl to be made of a powdered metal with an

effective hardness greater than that of the spool, which lessens the cost of the assembly.

Each clutch pawl 240 is configured to rotate within its cavity 214 about the rear surface 226 between the engaged and disengaged positions. Each clutch pawl is also configured to receive a portion of O-ring 280. The O-ring 280 biases each of the clutch pawls 240 inwardly toward the center of the clutch housing 210; the bias force increases with outward angular displacement of the clutch pawls 240, where the maximum bias or return force is generated when the clutch pawls are displaced outwardly at the engaged position with the teeth 204 of the spool.

Each of the clutch pawls 240 further includes a body 242 with a front face 244 and a rear face 246. The clutch pawl is generally segmented into a shaft portion 241 and a head portion or head 250. A groove or recess 248 is formed upon the front face 244. The groove 248 forms one side of the head 250 and an inner side of an O-ring support 252, which extends upwardly as a projection from the bottom of the groove 248 as shown in Figure 3. In Figures 3 and 3c, portions of the O-ring 280 not within groove 230 are received within a respective groove or recess 248 of each clutch pawl 240. The O-ring 280 pushes inwardly upon and biases each of the O-ring supports 252 inwardly into the clutch housing to the disengaged position.

Reference is briefly made to Figures 3a and 3c. Each O-ring support 252 includes an inner surface 252a, which receives the O-ring 280. Each of the inner surfaces 252a is configured so that when each clutch pawl 240 is in its disengaged position, the inner surface 252a visually represents an extension of the inner diameter of groove 230 of the clutch housing 210. This smooth transition eliminates any kinks in the O-ring in the disengaged position.

In Figures 3a and 3b each rear face of a clutch pawl includes a shoulder or step 254 complementary in shape to the arcuate shoulder 217 as shown in Figure 2b. The shoulder 254 also enables the head 250 to be more massive in the area of the rear face 246 than an adjacent shaft 241 of

the clutch pawl, which has a smooth surface 258. When installed in the clutch housing 210, the rear face 246 and surface 258 of the clutch pawl slide upon the level or surfaces 216, 218.

The perimeter of each of the clutch pawls 240 includes a number of flat surfaces 260, 262, as well as a circular pivot surface 264. The first surface 260 transitions into an outwardly extending surface 260a. The pivot surface 264 transitions into a load-bearing surface 266 that is complementary to the shape of a surface 224 of the clutch housing 210. A generally flat surface 268 connects the load-bearing surface 266 to another surface 260a; the intersection of surfaces 268, 260a forms a shaped tooth 270. The tooth and the center of the curved surface 264 generally lie on a centerline 265 (see Figure 3d) of the clutch pawl.

During the operation of the pretensioner 300, the clutch housing 210 is rotated at a high speed in a seat belt winding direction. The centrifugal acceleration causes each clutch pawl 240 to rotate outwardly with each surface 264 rotating within surface or pocket 226 against the bias force of the O-ring 280. After each clutch pawl 240 is moved outwardly by the centrifugal forces, the tooth 270 of each clutch pawl 240a-c engages a portion of the roughed or friction enhancing surface, which in this embodiment is a respective tooth 204 of the spool 120. The roughened surface, teeth 204, is used primarily to initially engage with the tip of the pawl tooth 270, which urges the clutch pawl to rotate with the clutch housing 210 to its column loaded position, shown in Figure 3f. Any further rotation of the clutch housing 210 causes the pawl teeth 270 of the clutch to dig into the spool. When each pawl tooth 270 is fully engaged with a corresponding spool tooth 204, the surface 266 of the pawl column loads a surface 224 of the clutch housing, permitting the clutch housing, via pinion gear 354, to forcefully rotate the spool 120. Upon such contact, the rotational forces acting on the clutch housing 210 are fully transferred to the spool 120 which, in turn, rewinds the seat belt 121 about the spool.

The rack and pinion mechanism 300 as shown in Figures 1 and 4 comprises a rack 352 and a pinion gear 354. The pinion gear is formed as

an extending portion of the clutch housing 210. The pinion gear 354 further includes an extending shoulder 356 that is received within opening 358 of a clutch bracket 360. The pinion gear includes a plurality of teeth 362, as shown in Figures 1 and 4. The rack is generally cylindrical in shape and includes a plurality of teeth 364, which engage the teeth 362 of the pinion gear. Initially, the rack is maintained in a disengaged state from the pinion gear. The rack, which acts as a piston, includes an enlarged head 370 that can slide in the bore 372 of a rack housing 374. Bore 372 includes a vent 376. The rack 352 further supports an O-ring 380, which forms a seal with the rack and the bore 373.

The rack housing 374 also forms the housing or manifold for the pyrotechnic device 400. The rack housing 374 includes an extending portion 374a with an extension 373a of bore 373. The pyrotechnic device 400 includes a housing 401a and the housing contains a pyrotechnic material 402, capable of generating products of combustion when energized. The pyrotechnic device 400 includes a plurality of electrical contacts 416, one or both of which receive an electrical control signal from a controller such as an electronic control unit 418, which issues an activation signal upon determining the vehicle is involved in a crash, thereby energizing the pyrotechnic device 400. A bore 373a includes a space 404 with a terminus end 374 that is arcuate and spaced from an end 401a of the housing 401. The spacing 464 between end 401a of the pyrotechnic device and curved end 374 of bore 373a permits the housing 401a of the pyrotechnic device to open unabatedly and not create any flow restrictions that may impede the flow of gas to the base of the rack.

The housing 401a of the pyrotechnic device is breakable and can be made of aluminum. Upon initiation of the pyrotechnic device 400, an end of the housing 401a bursts outwardly as ands splits as shown in Figure 5, permitting a path for gas produced by the pyrotechnic material 386 to flow into the bore 372 and impact base end 390 of the rack 352, thereby propelling the rack 232 upwardly into engagement and rotation with the pinion gear 354, as shown in Figure 4. The broken and deformed end of

the housing that has been urged outwardly against the walls of the bore 374 is generally shown by numeral 394 in Figure 5.

When the rack moves sufficiently so that O-ring 380 is above the location of the vent 376, the gas within the bore, produced by the pyrotechnic device, can be vented to atmosphere, thereby reducing and eliminating the upward force acting upon the rack 352, tending to force it into engagement with the pinion gear 354. Thereafter, as the spool 120 rotates, even if the rack 352 remains in engagement with the pinion gear 354, this engagement will not impede the rotary motion of the spool.

Claims

1. A seat belt retractor assembly (100) having a rotatable spool (122) upon which a seat belt (121) can be wound and a pretensioner (190) for selectively winding the spool (122) in a belt winding direction to rewind the seat belt upon the spool (122); the pretensioner (190) comprising:

a power transfer mechanism (350) activated by a pyrotechnic device (400) for causing a clutch assembly (200) to change from a disengaged mode to an engaged mode in which the clutch assembly drivingly engages the spool (122);

the clutch assembly (200) comprising a clutch housing (210) having provision to support a plurality of rotatable clutch pawls (240a-c), the clutch housing (210) received within a recess (202) of the spool (122), such recess including a plurality of engagement teeth (204) thereon, each of the clutch pawls (240a-c) configured to be column loaded between the spool (122) and the clutch housing (210) when in the engaged mode.

2. A seat belt retractor assembly (100) according to claim 1 wherein the clutch housing (210) includes a plurality of pockets (226), one for each clutch pawl (240a-c); each clutch pawl having a shaft portion (241) and a head portion (250), the shaft portion (241) including at one end thereof a curved surface (264) complementary in shape to the corresponding pocket (226), the head portion (250) including a tooth (270) configured to engage one of the engagement teeth (204) of the spool (122), the tooth and the center of the curved surface (264) generally lying on a centerline (265) of the clutch pawl (240a-c).

3. A seat belt retractor assembly (100) according to claim 1 wherein the clutch pawls (240a-c) are symmetrically arranged within the clutch housing (210) for rotating from the disengaged position to the engaged position, the clutch housing (210) including an O-ring receiving feature (230) configured to support portions of an O-ring (270), the O-ring

extending across portions of each clutch pawl (240a-c), each clutch pawl including an O-ring receiving member (252) configured to receive an inner wall of the O-ring, the O-ring biasing each clutch pawl (240a-c) via the O-ring receiving member (252) to the disengaged position.

4. A seat belt retractor assembly (100) according to claim 1 wherein the pyrotechnic device includes a housing (384) having a frangible first end (402a), the frangible end configured to break into petals or sections; the housing is received within a remote portion (372b) of a bore (372), the remote portion of the bore (372b) being convexly shaped and spaced relative to the first end of the housing to receive at least one of the broken petals or sections of the housing.

5. A seat belt retractor assembly (100) according to claim 1 wherein the column loaded clutch pawls (240a-c) are made from a powdered-metal.

6. A seat belt retractor assembly (100) according to claim 1 wherein the power transfer mechanism (350) is a rack and pinion mechanism (300).

7. A seat belt retractor assembly (100) according to claim 1 wherein the spool (122) includes a recess (202) with a peripheral surface (203), the surface configured to enhance engagement with the clutch pawl (240a-c).

8. A seat belt retractor assembly (100) according to claim 1 wherein the clutch housing (210) is cylindrically shaped and received within the spool recess (202) with the clutch pawls (240a-c) positioned opposite the peripheral surface.

9. A seat belt retractor assembly (100) according to claim 7 wherein the peripheral surface has either teeth (204) or a friction enhancing feature for engagement with the clutch pawls (240a-c).

10. A seat belt retractor assembly (100) according to claim 1 wherein the clutch housing (210) includes a front face (213) having a plurality of cavities (214a-c) formed thereon, each cavity having a stepped configuration having a lower level with an arcuate shoulder (217) separating the lower level from a raised or higher level (218).

11. A seat belt retractor assembly (100) according to claim 10 wherein the cavities (214a-c) are equally spaced about a main body (212) of the clutch housing (210), each cavity (214a-c) includes a flat wall (219) that is perpendicular to a radius of R1, each flat wall (219) transitions to a radially extending wall (221) proximate an outer wall (211), each cavity (214a-c) includes, generally opposite the flat wall (219), an open mouth or open end (222) and a short angled flat wall (223) oriented at an angle A1 to wall (219), the short, flat wall (223) transitions to a second radially extending wall (224) proximate mouth (222), each cavity (214a-c) further includes a curved end wall (226), which is generally circular in cross-section, located between and tangent to both the flat wall (219) and the angled flat wall (226), and generally opposite the opening end (222).

12. A seat belt retractor assembly (100) according to claim 12 wherein the main body includes grooved segments (230a-c) lying on a same radius effectively forming a circular groove (230) for receiving a resilient member including an O-ring (232).

13. A seat belt retractor assembly (100) according to claim 13 wherein each groove segment (230a-c), proximate each curved end wall (226), includes a partial-cylindrical slot (231a), which deepens each groove segment (230a-c) toward a corresponding one of the curved end walls (226), the main body (212) includes a center bore (234), received about a portion of the shaft (126), further, a clutch pawl (240a-c) is pivotably received in each cavity (214a-c).

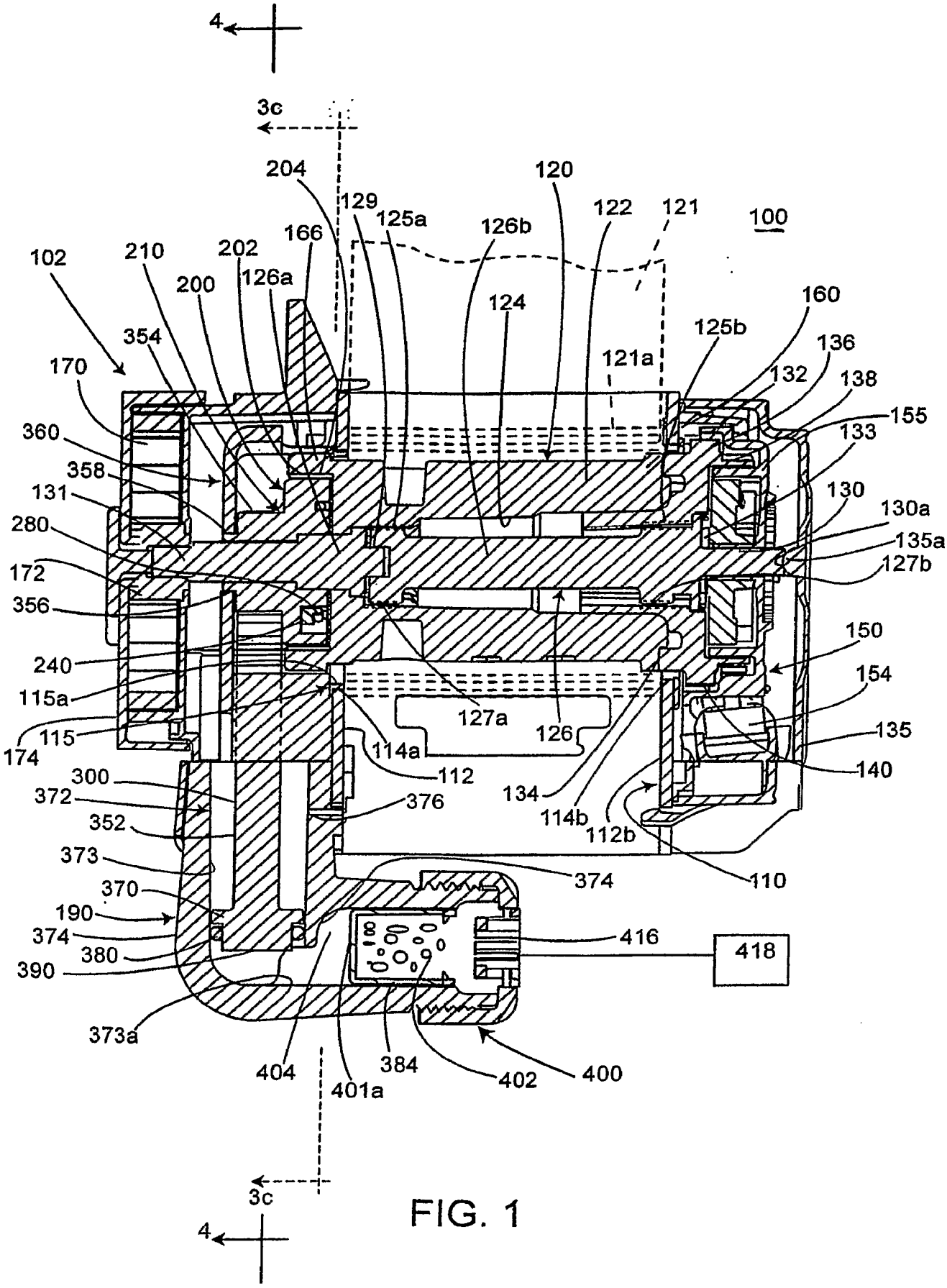
14. A seat belt retractor assembly (100) according to claim 14 wherein each clutch pawl (240a-c) has a narrow shaft portion (241) and considerably wider head portion (250) which is configured to locate the center-of-gravity of the clutch pawl (240a-c) within the head portion to increase an effective radius between the center of gravity and a pivot end of the clutch pawl (240a-c), thereby enhancing the speed of outward rotation of the clutch pawl (240a-c) at any speed of the clutch housing (210).

15. A seat belt retractor assembly (100) according to claim 15 wherein each clutch pawl (240a-c) has a hardness greater than that of the spool (122), and the clutch housing (210) and clutch pawls are configured to enable the clutch pawls (240a-c) to be column loaded to the clutch housing (210) when a toothed end of the clutch pawl has engaged the peripheral surface of the spool (122).

16. A seat belt retractor assembly (100) according to claim 15 wherein each rear face of a clutch pawl (240a-c) includes a shoulder or step (254) complementary in shape to shoulder (217).

17. A seat belt retractor assembly (100) according to claim 15 wherein portions of the O-ring (280) not within groove (230) are received within a respective groove or recess (248) of each clutch pawl (240a-c), wherein the O-ring (280) of each clutch pawl includes an O-ring support (252) configured to engage with the O-ring (232), wherein the O-ring pushes inwardly upon and biases each of the O-ring supports (252) inwardly into the clutch housing (210) to the disengaged position, each O-ring support (252) includes an inner surface (252a) to receive a portion of the O-ring (280), each of the inner surfaces (252a) is configured so that when each clutch pawl (240a-c) is in its disengaged position, the inner surface (252a) effectively represents an extension of the inner diameter of

groove (230) to achieve a smooth transition to eliminate any kinks in the O-ring in the disengaged position.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3c
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129
125a
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354
121a
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114b
112b
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401a
3c
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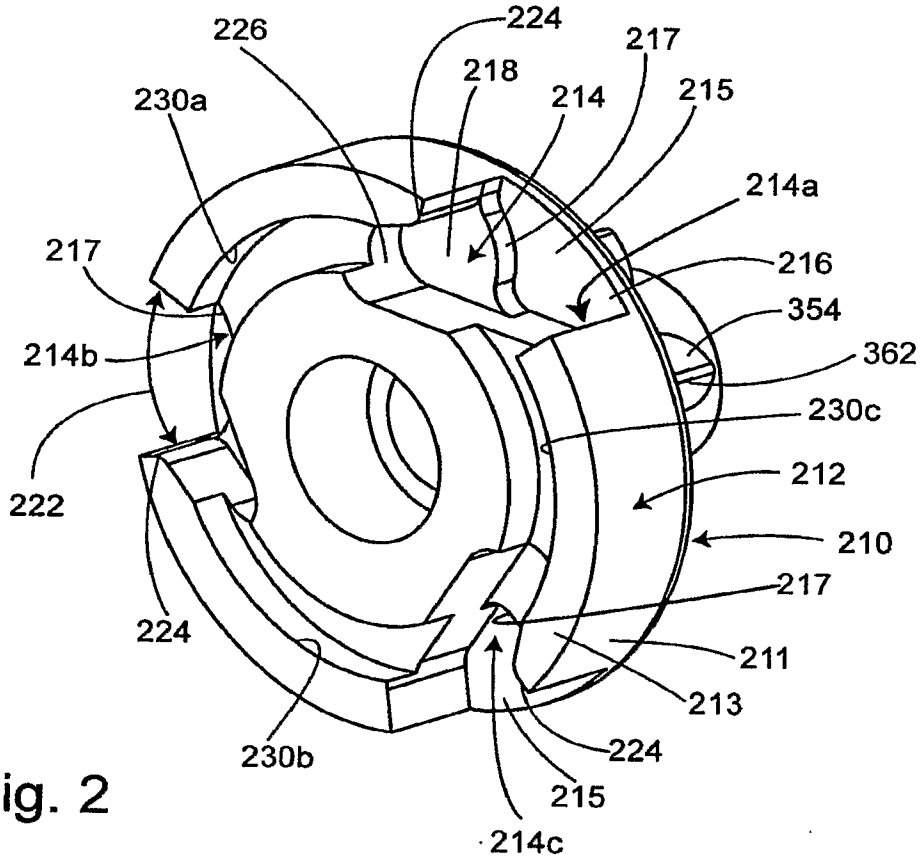
FIG. 1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230a
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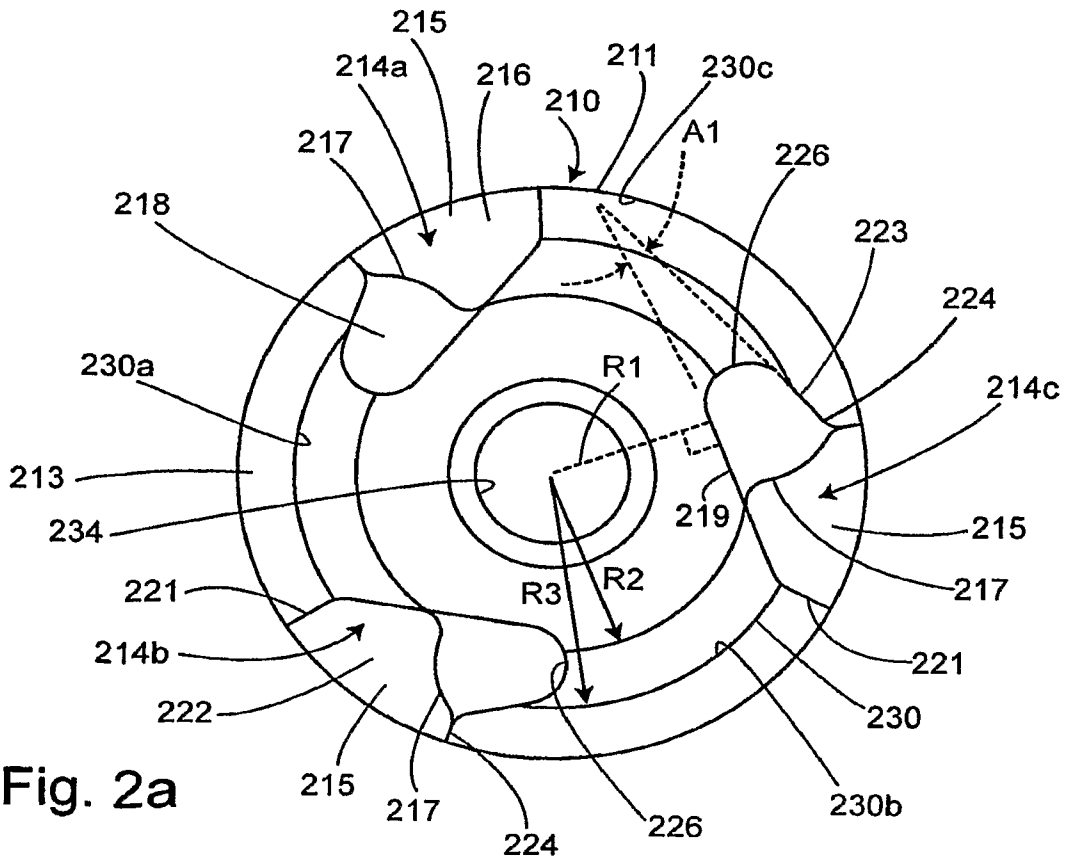
214c

Fig. 2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230b

Fig. 2a

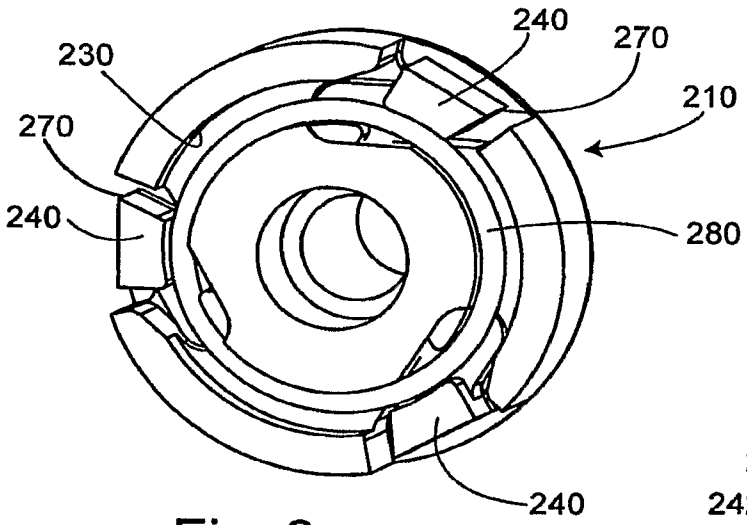


Fig. 3

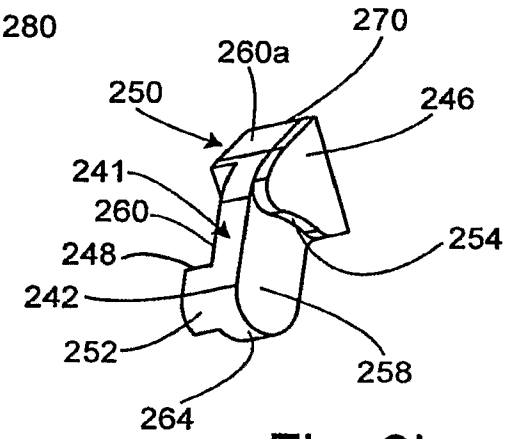


Fig. 3b

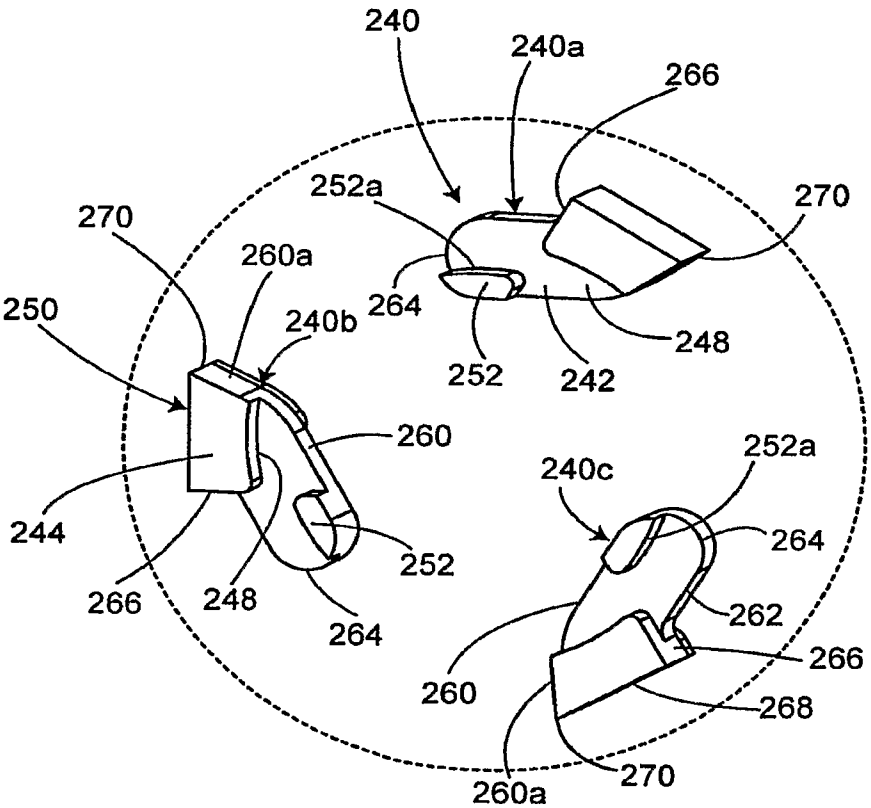


Fig. 3a

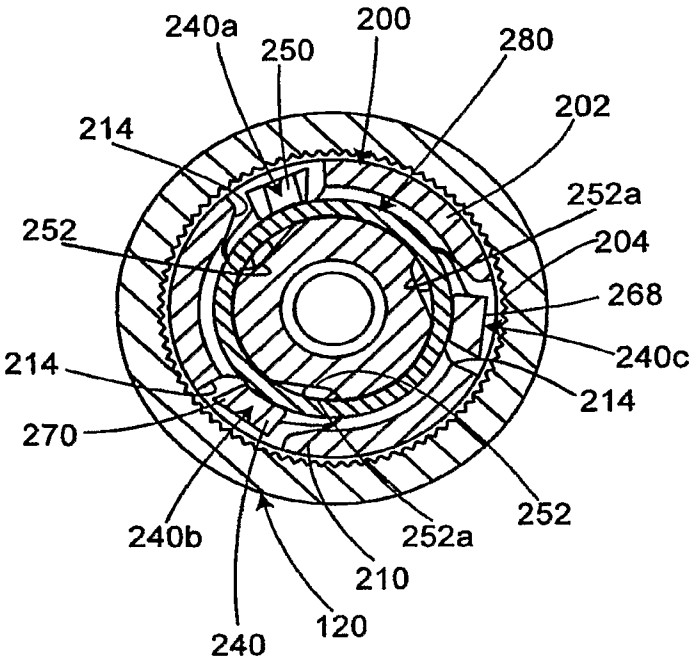


Fig. 3c

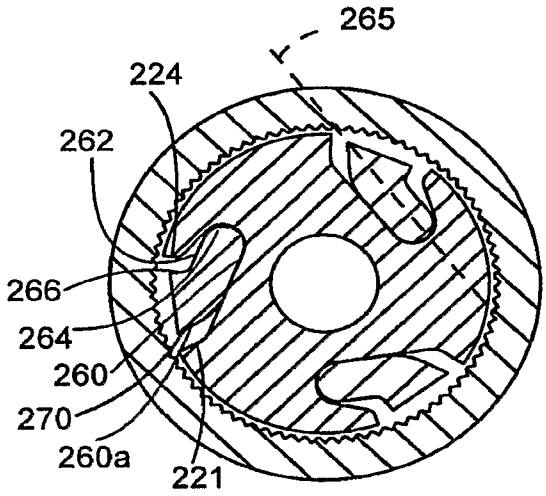


Fig. 3d

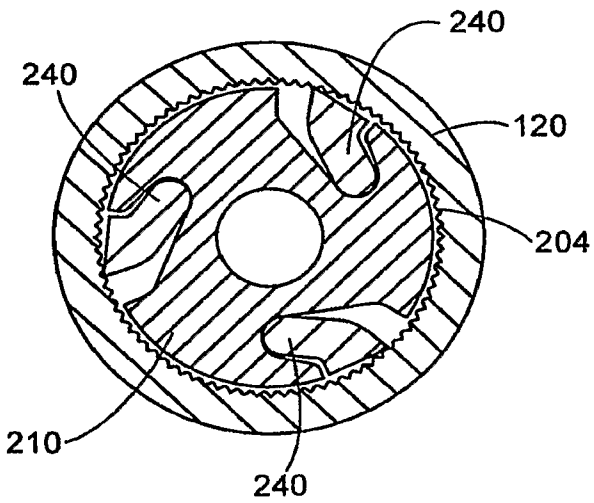


Fig. 3e

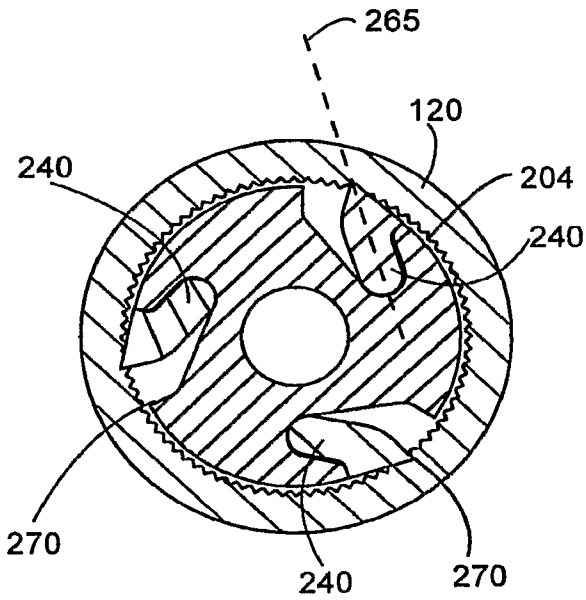
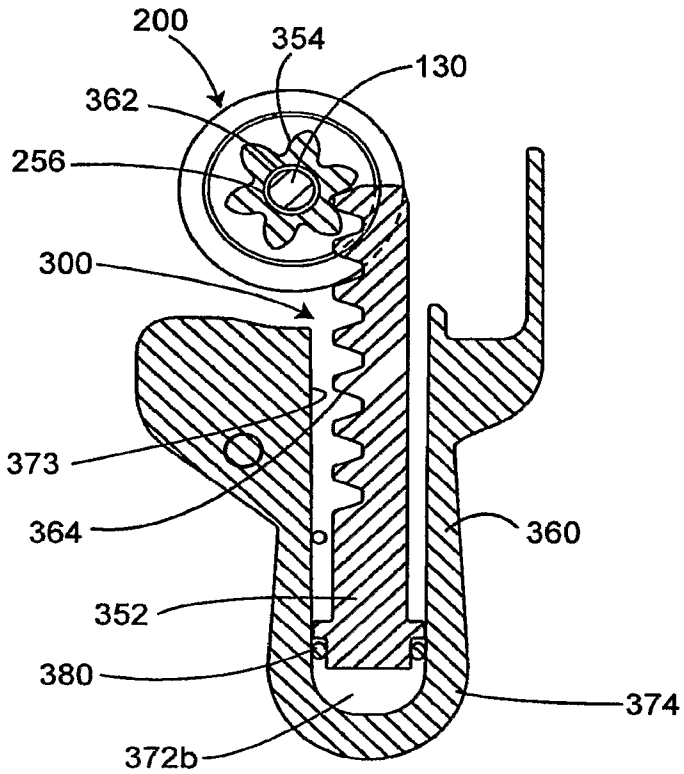


Fig. 3f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380
374
372b

Fig. 4

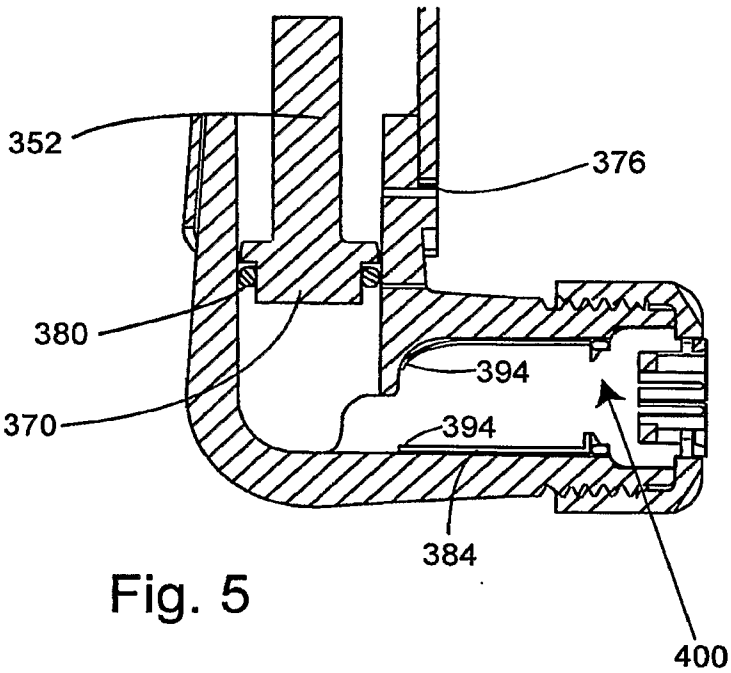
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Fig. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2007/007691

A. CLASSIFICATION OF SUBJECT MATTER

B60R 22/34(2006.01)i, B60R 22/46(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 8 : B60R 22/34

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

Korean Utility models and applications for Utility models since 1975

Japanese Utility models and applications for Utility models since 1975

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

e-KIPASS (KIPO internal) : "RETRACT* OR PRETENSION*" &"PYRO* OR GAS*"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6,513,747 B1 (JONG-HOON LEE et al.) 4 February 2003 see the abstract and Fig 3.	1-17
A	US 6,419,272 B1 (HIROYOSHI YAMAGUCHI et al.) 16 July 2002 see the abstract and Fig 2.	1-17
A	US 5,505,399 A (JOHANNES SCHMID et al.) 9 April 1996 see the abstract and Fig 2 & 3	1-17
A	US 6,264,281 B1 (MATTHEW E. DUKATZ et al.) 24 July 2001 see the abstract and Fig 1.	1-17

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
08 OCTOBER 2007 (08.10.2007)	**09 OCTOBER 2007 (09.10.2007)**
Name and mailing address of the ISA/KR Korean Intellectual Property Office 920 Dunsan-dong, Seo-gu, Daejeon 302-701, Republic of Korea Facsimile No. 82-42-472-7140	Authorized officer HAM, Joung Hyun Telephone No. 82-42-481-5458

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

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