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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
21 November 2013 (21.11.2013)

WIPO | PCT

(10) International Publication Number
WO 2013/173056 A1

(51) International Patent Classification:
F02B 39/00 (2006.01) *F02B 37/12* (2006.01) *F02B 37/00* (2006.01) *F02D 23/00* (2006.01) *F02B 39/16* (2006.01)

(21) International Application Number: PCT/US2013/038972

(22) International Filing Date: 1 May 2013 (01.05.2013)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/648,144 17 May 2012 (17.05.2012) US

(71) Applicant: **BORGWARNER INC.** [US/US]; Patent Department, 3850 Hamlin Road, Auburn Hills, Michigan 48326 (US).

(72) Inventors: **HEDDY III, George Edward**; 1381 Ransier Drive, Hendersonville, North Carolina 28739 (US). **HANDLON, Brian Edward**; 22 Amber Drive, Horse Shoe, North Carolina 28742 (US).

(74) Agents: **CARPENTER, John W.** et al.; Perkins Coie, LLP, 1900 Sixteenth Street, Suite 1400, Denver, Colorado 80202-5255 (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, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, 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, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:
— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*
— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*
— *of inventorship (Rule 4.17(iv))*

Published:
— *with international search report (Art. 21(3))*
— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

(54) Title: HEAT ISOLATING VTG LEVER AND LINKAGE

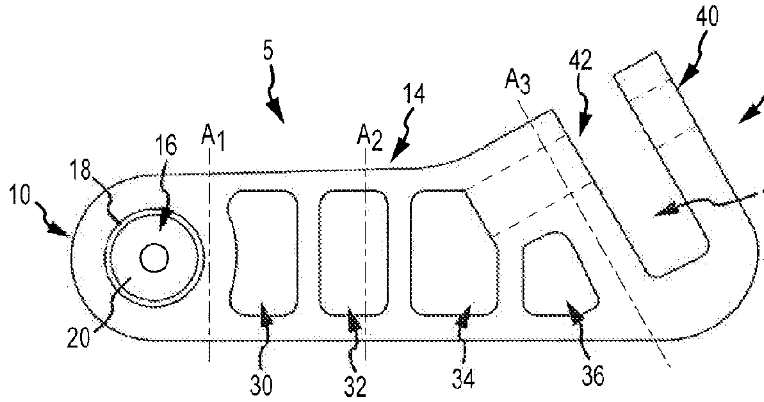

FIG.1

(57) Abstract: A heat isolating linkage (5) that includes an elongate link having first and second end portions (10, 12) and a middle portion (14) extending therebetween. A bearing opening (16) is formed in the first end portion (10) and a bearing race (18) is disposed in the bearing opening (16). A rod end ball (20) is disposed in the bearing race (18). At least one aperture (30-36) is formed through the middle portion (14). The middle portion (14) may include a plurality of apertures (30-36) each in the form of a rectangle that forms a ladder pattern. Accordingly, the middle portion (14) has a cross sectional area (A2) that is smaller than the cross sectional area of at least one of the first and second end portions (A1, A3).

WO 2013/173056 A1

HEAT ISOLATING VTG LEVER AND LINKAGE

BACKGROUND

[0001] Today's internal combustion engines must meet ever-stricter emissions and efficiency standards demanded by consumers and government regulatory agencies. Accordingly, automotive manufacturers and suppliers expend great effort and capital in researching and developing technology to improve the operation of the internal combustion engine. Turbochargers are one area of engine development that is of particular interest.

[0002] A turbocharger uses exhaust gas energy, which would normally be wasted, to drive a turbine. The turbine is mounted to a shaft that in turn drives a compressor. The turbine converts the heat and kinetic energy of the exhaust into rotational power that drives the compressor. The objective of a turbocharger is to improve the engine's volumetric efficiency by increasing the density of the air entering the engine. The compressor draws in ambient air and compresses it into the intake manifold and ultimately the cylinders. Thus, a greater mass of air enters the cylinders on each intake stroke.

[0003] Given that a turbocharger must handle exhaust straight from the engine, it can be appreciated that the components of a turbocharger are subjected to extreme temperatures. Many turbocharger components have been designed to handle extreme heat, particularly on the turbine side of the turbocharger. However, some components are difficult to make temperature resistant while maintaining functionality, such as the moving joints and actuators associated with variable turbine geometry (VTG) mechanisms and waste gate control mechanisms. Accordingly, these components must be at least partially protected from the heat generated by the exhaust gas.

SUMMARY

[0004] Provided herein is a heat isolating linkage that includes an elongate link having first and second end portions and a middle portion extending therebetween. A bearing opening is formed in the first end portion and a bearing race is disposed in the bearing opening. A rod end ball is disposed in the bearing race. At least one aperture is formed through the middle portion. In one embodiment, the middle portion includes a plurality of apertures each in the form of a rectangle that forms a ladder pattern. In another embodiment, the middle portion includes a plurality of apertures each in the form of a triangle that forms a truss pattern.

[0005] In certain aspects of the technology described herein, the middle portion has a cross sectional area that is smaller than the cross sectional area of at least one of the first and second end portions. The middle portion may have a cross sectional area that is smaller than the cross sectional area of both the first and second end portions.

[0006] In another embodiment, an insulation segment is disposed between the first and second end members. The insulation segment may comprise a plastic material or a composite material, for example. In another aspect of the technology, the insulation segment is clamped between the first and second end members.

[0007] In yet another embodiment, the middle portion includes at least one, if not a plurality of cooling fins extending from the middle portion. In one case, the cooling fins extend longitudinally along the middle portion. In another case, the cooling fins extend orthogonal to the longitudinal axis.

[0008] These and other aspects of the heat isolating linkages will be apparent after consideration of the Detailed Description and Figures herein. It is to be understood, however, that the scope of the invention shall be determined by the claims as issued and not by whether given subject matter addresses any or all issues noted in the background or includes any features or aspects recited in this summary.

DRAWINGS

[0009] Non-limiting and non-exhaustive embodiments of the heat isolating linkage, including the preferred embodiment, are described with reference to the following figures, wherein like reference numerals refer to like parts throughout the various views unless otherwise specified.

[0010] FIG. 1 is a top plan view of a heat isolating linkage according to a first exemplary embodiment;

[0011] FIG. 2 is a top plan view of a heat isolating linkage according to a second exemplary embodiment;

[0012] FIG. 3 is a top plan view of a heat isolating linkage according to a third exemplary embodiment;

[0013] FIG. 4 is a top plan view of a heat isolating linkage according to a fourth exemplary embodiment;

[0014] FIG. 5 is a top plan view of a heat isolating linkage according to a fifth exemplary embodiment;

[0015] FIG. 6 is a top plan view of a heat isolating linkage according to a sixth exemplary embodiment;

[0016] FIG. 7 is a top plan view of a heat isolating linkage according to a seventh exemplary embodiment;

[0017] FIG. 8 is a front view in elevation of a conventional rod end;

[0018] FIG. 9 is a side view in elevation of the conventional rod end shown in FIG. 8;

[0019] FIG. 10 is a top plan view of a rod end heat isolating actuator linkage according to a first exemplary embodiment;

[0020] FIG. 11 is a side view in elevation of the rod end heat isolating actuator linkage shown in FIG. 10;

[0021] FIG. 12 is a top plan view of a rod end heat isolating actuator linkage according to a second exemplary embodiment;

[0022] FIG. 13 is a front view in elevation of the rod end heat isolating actuator linkage shown in FIG. 12; and

[0023] FIG. 14 is a partial cross-sectional view of the rod end housing shown in FIG. 13.

DETAILED DESCRIPTION

[0024] Embodiments are described more fully below with reference to the accompanying figures, which form a part hereof and show, by way of illustration, specific exemplary embodiments. These embodiments are disclosed in sufficient detail to enable those skilled in the art to practice the invention. However, embodiments may be implemented in many different forms and should not be construed as being limited to the embodiments set forth herein. The following detailed description is, therefore, not to be taken in a limiting sense.

[0025] The heat isolating linkage 5 shown in FIG. 1 is for use with a VTG turbocharger. In this embodiment, the heat isolating linkage 5 includes a first end portion 10 and a second end portion 12 with a middle portion 14 extending therebetween. The first end portion 10 includes a bearing opening 16 sized and configured to receive a bearing race 18 and a rod end ball 20. The second end portion 12 is, in this case, in the form of an actuator shaft clamp 44 which includes a clearance hole 40 and a threaded aperture 42, both of which are configured to receive a fastener therein. The middle portion 14 of heat isolating linkage 5 includes a plurality of apertures 30 - 36. In this case, apertures 30 - 36 are rectangular in form and, also in this case, create a ladder pattern. It should be appreciated that while each of the apertures may be truncated with respect to neighboring features of the linkage, in general, the apertures are rectangular in form, such as aperture 32. For example, aperture 30 is contoured to match the bearing opening 16. As another example, aperture 36 is truncated such that it does not intersect the threaded aperture 42 or clamp region 44.

[0026] Apertures 30-36 have the effect of reducing the cross-sectional area of the mid-portion 14. For example, aperture 32 reduces the area A2 of the mid-portion such that it is less than the area of the first end portion cross-section or the second end portion cross-section A1 and A3, respectively. Therefore, heat transfer from the VTG mechanism is inhibited such that it protects the bearing race 18 from excessive heat.

[0027] A heat isolating linkage 105 according to a second exemplary embodiment is represented in FIG. 2. In this case, the linkage includes an elongate link having a first end portion 110 and a second end portion 112 with middle portion 114 extending therebetween. First end portion 110 includes bearing opening 116 and a plurality of apertures 130 - 138. As can be appreciated, the linkage 105 is similar to that described above with respect to FIG. 1; however, in this case, the apertures 130 - 138 are each in the form of a triangle which, in turn, creates a truss pattern. While the above described embodiments illustrate apertures with particular shapes, it should be understood that the shape of the cutouts should not be limited to rectangular or triangular, but can be any shape that reduces longitudinal cross-sectional area.

[0028] A heat isolating linkage 205 according to a third exemplary embodiment is shown in FIG. 3. Again, this linkage 205 has similar features to those described above with respect to FIGS. 1 and 2 in that linkage 205 includes an elongate link having a first end portion 210, a second end portion 212, and a middle portion 214 extending therebetween. In this case, however, the middle portion includes an insulation segment 230. Insulation segment 230 may be comprised of plastic or a composite plastic material having good heat isolation characteristics.

[0029] FIGS. 4 - 7 illustrate heat isolating linkages intended for use with waste gate actuators. For example, FIG. 4 is an elongate heat isolating linkage according to a fourth exemplary embodiment including a first end portion 310 and a second end portion 312 with a middle portion 314 extending therebetween. First end portion 310 includes a bearing opening 316 and second end portion 312 may include an aperture 317 to facilitate welding the lever to a waste gate shaft. Middle portion 314 includes apertures 330 and 332, which reduce the cross-sectional area of linkage 305, thereby reducing its heat conductivity. In this case, the apertures are in the form of circles; however, other aperture shapes may be used. For example, with reference to FIG. 5, heat isolating linkage 405 according to a fifth exemplary embodiment includes an elongate or obround aperture 430 formed through the mid-portion 414. Again, the linkage 405 includes first and second end portions 410 and 412, respectively, with middle portion 414 extending therebetween. First end portion 410 includes a bearing opening 416 and second end portion 412 may include an aperture 417.

[0030] Waste gate heat isolation linkage 505 according to a sixth exemplary embodiment is shown in FIG. 6. Linkage 505 includes first and second end portions 510 and 512, respectively, with a middle portion 514 extending therebetween. First end portion 510 includes a bearing opening 516 and second end portion 512 may include an aperture 517. In this case, middle portion 514 includes a plurality of cooling elements, such as cooling fins 530. Linkage 505 extends along a longitudinal axis L. As can be seen in the figure, the cooling fins 530 extend transversely, or orthogonally, to the longitudinal axis L. FIG. 7 illustrates linkage 605 according to a seventh exemplary embodiment, which also includes cooling fins. Linkage 605 includes first and second end portions 610 and 612, respectively, with middle portion 614 extending therebetween. First end portion 610 includes a bearing opening 616 and second end portion 612 may include an aperture 617. Middle portion 614 includes a plurality of longitudinally extending cooling fins 630. As can be appreciated with reference to the figure, cooling fins 630 extend longitudinally along the longitudinal axis L of linkage 605. Although the cooling elements above are illustrated as fins having particular orientations, it should be appreciated that the cooling elements may have different forms and orientations, such as for example, rods that could be spiral as well as longitudinal, or orthogonal, or other suitable geometry.

[0031] Also disclosed herein is a heat isolating actuator linkage in the form of a rod end. As shown in FIGS. 8 and 9, a conventional rod end 705 includes a rod end housing 710 with a bearing opening 714 formed therethrough. Inserted into the bearing opening 714 is a race insert 716. Race insert 716 may be comprised of a bearing material such as bronze or plastic, for example. A rod end ball 712 is disposed in the race insert. Accordingly, the race insert acts to prevent metal-to-metal contact between the rod end ball and the rod end housing 710.

The bearing housing also includes a threaded portion 718 extending from the rod end housing. In this case, the threaded portion includes female threads. However, as is known in the art, the rod end threaded portion may include male threads. It should be appreciated that with a conventional rod end bearing, the race insert and rod end ball are exposed to heat in the surrounding environment on both sides of the rod end.

[0032] FIG. 10 illustrates a heat isolating actuator linkage in the form of a rod end according to a first exemplary embodiment. In this embodiment, rod end 805 includes a housing 810 with a rod end ball 812 and race insert 816 disposed therein. In FIG. 10, it can be seen that housing 810 also includes a shield flange 830 in a pre-formed or pre-stamped state. With further reference to FIG. 11, which shows the shield 830 in its final form after stamping, it can be appreciated that the shield 830 extends to one side of the rod end housing 810. Accordingly, the shielded side of the rod end 805 is placed adjacent the heat source such as the turbine housing of a turbocharger. Accordingly, the heat shield 830 prevents the transfer of heat to the race insert which may be damaged by excessive heat emanating from the turbine housing.

[0033] FIG. 12 illustrates a rod end heat isolating actuator linkage according to a second exemplary embodiment. In this case, rod end 905 includes a rod end housing 910 with a race insert 916 and a rod end ball 912 assembled therein. In this case, shield 930 comprises a plurality of circumferentially spaced flange segments 932. As shown in FIG. 12, the flange segments are formed onto the rod end housing 910 and are thereafter stamped or otherwise deformed into position. With reference to FIGS. 13 and 14, it can be appreciated that every other flange segment 932 is bent to one side or the other of the rod end housing 910, thereby creating a cage-like structure on both sides of the race insert. As shown in FIG. 14, a cover 934 may be inserted between the flange segments 932 and the rod end housing 910. Cover 934 may be placed adjacent rod end housing 910 prior to bending flange segments 932 into position, thereby capturing cover 934 in place. Cover 934 may be in the form of a disc or cup shaped shield element, for example.

Accordingly, the heat isolating linkages have been described with some degree of particularity directed to the exemplary embodiments. It should be appreciated; however, that the present invention is defined by the following claims construed in light of the prior art so that modifications or changes may be made to the exemplary embodiments without departing from the inventive concepts contained herein.

CLAIMS

What is claimed is:

1. A heat isolating linkage **(5, 105, 305, 405)**, comprising:

an elongate link having first and second end portions **(10, 12, 110, 112, 310, 312, 410, 412)** and a middle portion **(14, 114, 314, 414)** extending therebetween;

a bearing opening **(16, 116, 316, 416)** formed in the first end portion **(10, 110, 310, 410)**;

a bearing race **(18)** disposed in the bearing opening **(16, 116, 316, 416)**; and

at least one aperture **(30, 32, 34, 36, 130, 132, 134, 136, 138, 330, 332, 430)** formed through the middle portion **(14, 114, 314, 414)**.

2. The heat isolating linkage **(5, 105, 305, 405)** according to claim 1, including a plurality of apertures **(30, 32, 34, 36, 130, 132, 134, 136, 138, 330, 332, 430)** formed through the middle portion **(14, 114, 314, 414)**.

3. The heat isolating linkage **(5, 105, 305, 405)** according to claim 2, wherein each aperture **(30, 32, 34, 36)** is in the form of a rectangle.

4. The heat isolating linkage **(5, 105, 305, 405)** according to claim 3, wherein the plurality of apertures **(30, 32, 34, 36)** forms a ladder pattern.

5. The heat isolating linkage **(5, 105, 305, 405)** according to claim 2, wherein each aperture **(130, 132, 134, 136, 138)** is in the form of a triangle.

6. The heat isolating linkage **(5, 105, 305, 405)** according to claim 5, wherein the plurality of apertures **(130, 132, 134, 136, 138)** forms a truss pattern.

7. The heat isolating linkage **(5, 105, 305, 405)** according to claim 1, further comprising a rod end ball **(20)** disposed in the bearing race **(18)**.

8. A heat isolating linkage **(205)**, comprising:

a first end member **(210)** including a bearing opening **(216)** formed therethrough;

a second end member **(212)**;

a bearing race **(18)** disposed in the bearing opening **(216)**; and

an insulation segment **(230)** disposed between the first and second end members **(210, 212)**.

9. The heat isolating linkage **(205)** according to claim 8, wherein the insulation segment **(230)** comprises a plastic material.

10. The heat isolating linkage **(205)** according to claim 8, wherein the insulation segment **(230)** is clamped between the first and second end members **(210, 212)**.

11. The heat isolating linkage **(205)** according to claim 8, wherein at least one of the first and second end members **(210, 212)** includes an aperture formed therethrough.

12. A heat isolating linkage **(505, 605),** comprising:

an elongate link extending along a longitudinal axis **(L)** and having first and second end portions **(510, 512, 610, 612)** and a middle portion **(514, 614)** extending therebetween;

a bearing opening **(516, 616)** formed in the first end portion **(510, 610)**;

a bearing race **(18)** disposed in the bearing opening **(516, 616)**; and

at least one cooling fin **(530, 630)** extending from the middle portion **(514, 614)**.

13. The heat isolating linkage **(605)** according to claim 12, wherein the cooling fin **(630)** extends longitudinally along the middle portion **(614)**.

14. The heat isolating linkage **(505)** according to claim 12, wherein the cooling fin **(530)** extends orthogonal to the longitudinal axis **(L)**.

15. The heat isolating linkage **(505, 605)** according to claim 12, including a plurality of cooling fins **(530, 630)**.

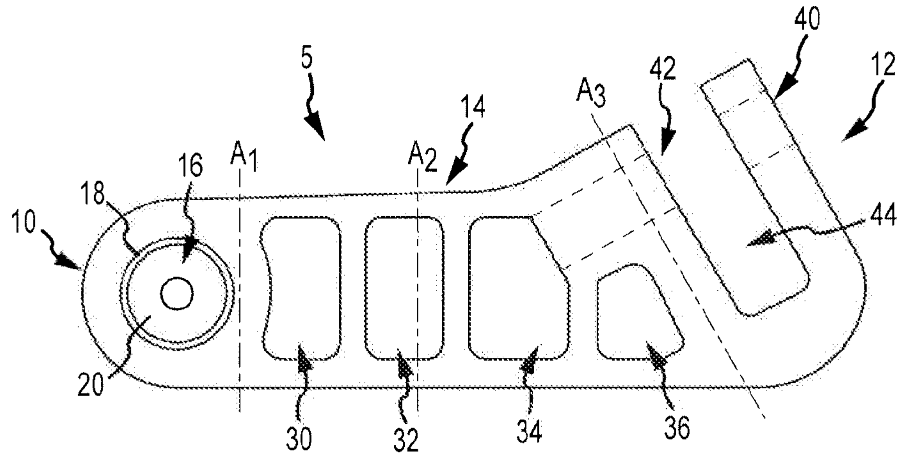

FIG.1

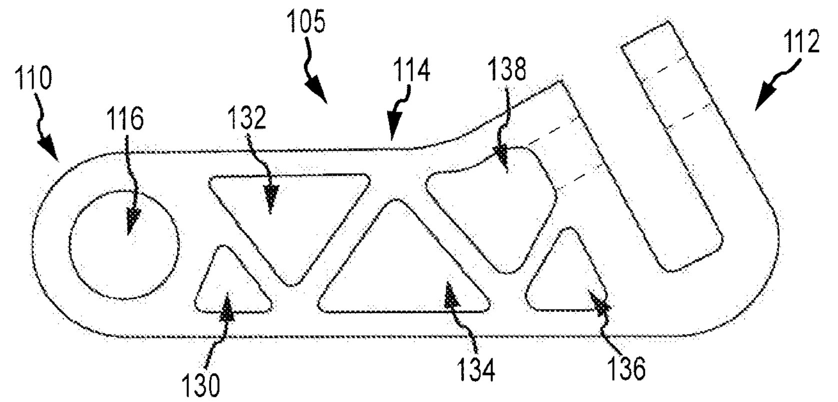

FIG.2

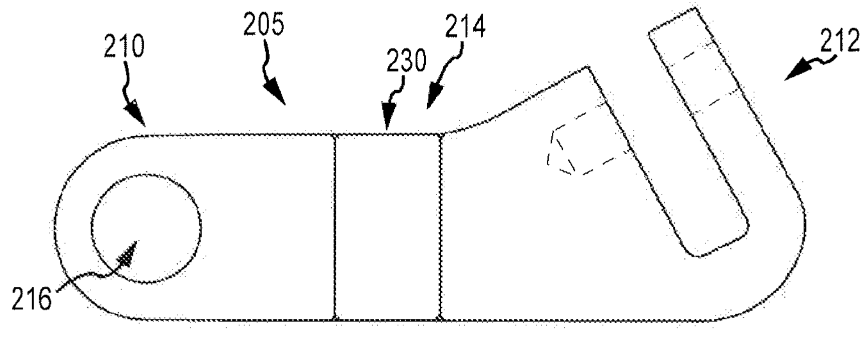

FIG.3

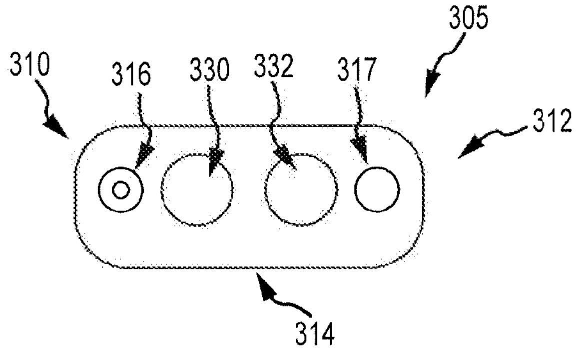

FIG.4

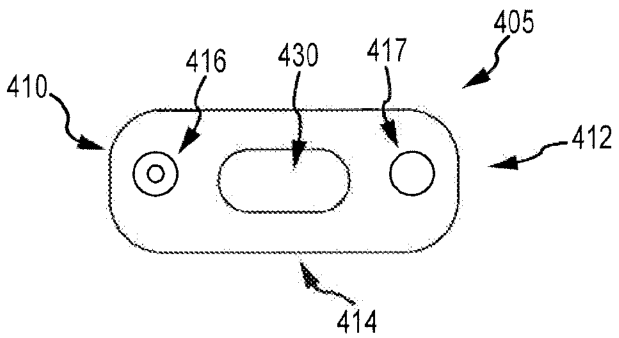

FIG.5

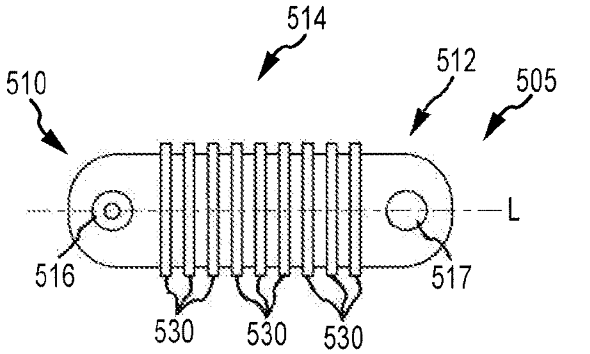
514
510
512
505
L
516
517
530
530
530

FIG.6

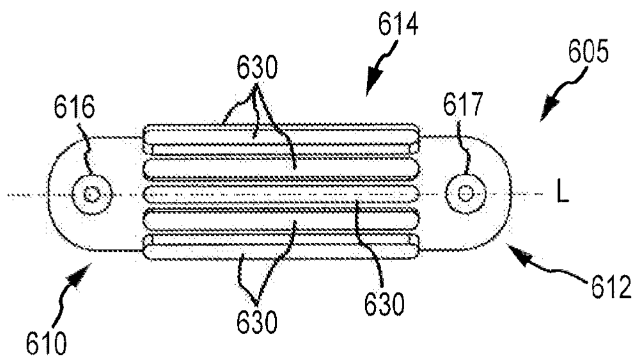
614
605
630
616
617
L
612
630
630
610

FIG.7

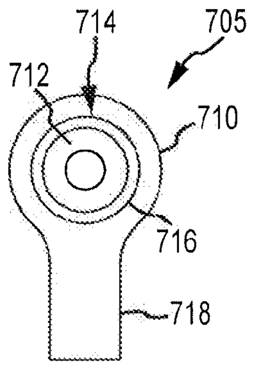

FIG.8
(PRIOR ART)

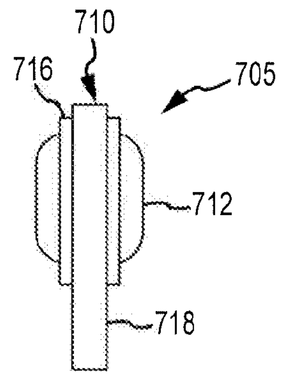

FIG.9
(PRIOR ART)

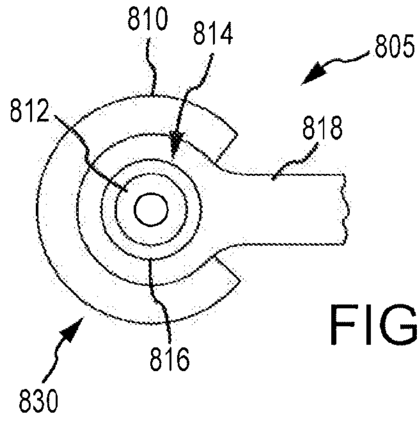

FIG.10

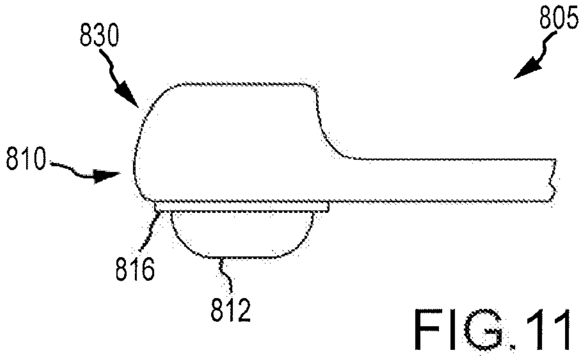

FIG.11

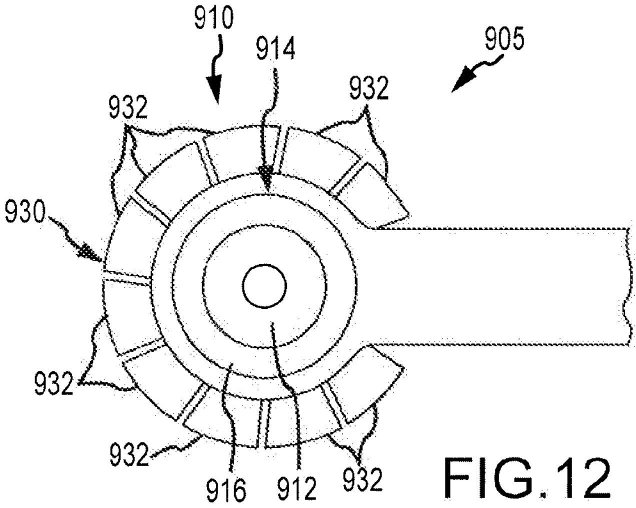

FIG.12

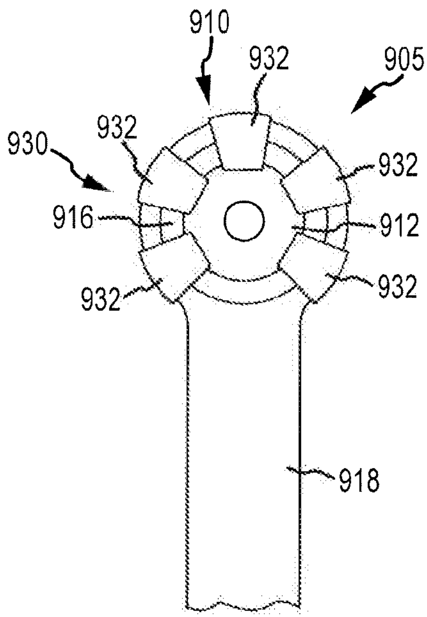

FIG.13

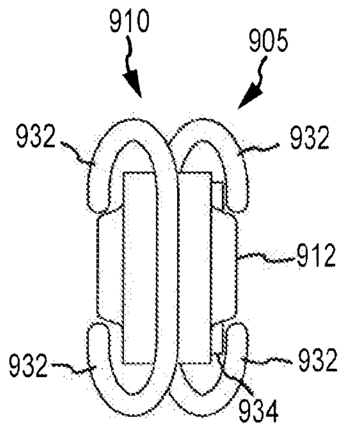

FIG.14

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2013/038972

A. CLASSIFICATION OF SUBJECT MATTER

F02B 39/00(2006.01)i, F02B 37/00(2006.01)i, F02B 39/16(2006.01)i, F02B 37/12(2006.01)i, F02D 23/00(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)
F02B 39/00; F02B 47/08; F16D 1/00; C21D 1/06; F02D 23/00; F02B 37/00; F02B 39/16; F02B 37/12

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
Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
eKOMPASS(KIPO internal) & Keywords: turbocharger, actuator, linkage, connector, heat, aperture, isolate and insulate

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4,465,392 A (LANG, CLIFFORD H.) 14 August 1984 See abstract; column 3, lines 26-60; figures 1-6.	8-11
Y		12-15
A		1-7
Y	WO 2011-087939 A2 (BORGWARNER INC.) 21 July 2011 See abstract; page 2 lines 21-29, page 11 lines 19-28, page 12 lines 9-10, page 13 lines 1-4, page 15 lines 19-23, page 20 line 4; figures 1-14.	12-15
A		1-11
A	US 6,079,210 A (PINTAURO et al.) 27 June 2000 See abstract; column 5 lines 11-17, column 6 lines 47-62, column 7 line 58-column 8 line 4; figures 1-4.	1-15
A	US 2002-0050138 A1 (DEACON, EDWIN RICHARD) 02 May 2002 See abstract; paragraphs [0033]-[0034]; figures 4-9.	1-15
A	US 5,759,309 A (WATTS et al.) 02 June 1998 See abstract; column 2 line 63-column 3 line 3,column 3 lines 9-15; figures 1,2,5.	1-15

☐ Further documents are listed in the continuation of Box C.   ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"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
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
26 September 2013 (26.09.2013)	**27 September 2013 (27.09.2013)**

Name and mailing address of the ISA/KR
Korean Intellectual Property Office
189 Cheongsa-ro, Seo-gu, Daejeon Metropolitan City, 302-701, Republic of Korea
Facsimile No. +82-42-472-7140

Authorized officer
HAN Joong Sub
Telephone No. +82-42-481-5606

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/US2013/038972

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4465392 A	14/08/1984	None	
WO 2011-087939 A2	21/07/2011	DE 112011100249 T5	08/11/2012
		US 2013-0011243 A1	10/01/2013
		WO 2011-087939 A3	24/11/2011
US 6079210 A	27/06/2000	AT 305086 T	15/10/2005
		DE 69927323 D1	02/02/2006
		DE 69927323 T2	29/06/2006
		EP 0972918 A2	19/01/2000
		EP 0972918 A3	14/05/2003
		EP 0972918 B1	21/09/2005
		JP 04442954 B2	31/03/2010
		JP 2000-136886 A	16/05/2000
		NO 993447 A	17/01/2000
		NO 993447 D0	13/07/1999
US 2002-0050138 A1	02/05/2002	EP 1203872 A1	08/05/2002
		JP 2002-195029 A	10/07/2002
		US 6543228 B2	08/04/2003
US 5759309 A	02/06/1998	IT 1293987 B1	15/03/1999
		IT TO970761 A1	28/02/1998
		JP 10-088228 A	07/04/1998