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Declarations under Rule 4.17:

— of inventorship (Rule 4.17(iv))

Published:

— with international search report (Art. 21(3))

(54) Title: ECCENTRIC FITTING ASSEMBLY

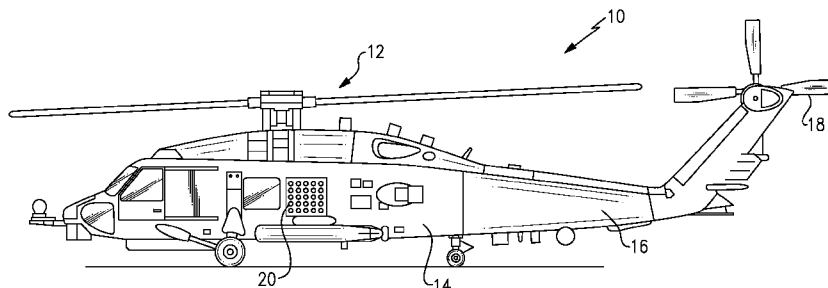


FIG.1

(57) Abstract: An eccentric fitting assembly includes an outer eccentric fitting which defines an outer axis, the outer eccentric fitting defines an opening offset from the outer axis and an inner eccentric fitting which defines an inner axis, the inner eccentric fitting defines a stud opening offset from the inner axis, the inner eccentric fitting receivable within the opening.

ECCENTRIC FITTING ASSEMBLY

BACKGROUND

5 [0001] This invention was made with government support under U.S. Army Contract No. W58RGZ-08-C-0003. The government therefore has certain rights in this invention.

 [0002] The present disclosure relates to a fitting assembly, and more particularly to a fitting assembly which facilitates installation of equipment through accommodation of airframe build and supplier component structure tolerances.

10 [0003] A variety of equipment may be mounted within an aircraft cabin. Aircrew seats, litters and weapon racks, for example, may be mounted to the cabin floor with a fitting which permits the installation and removal of the equipment to reconfigure the aircraft as required.

 [0004] Some equipment which is interchangeably mounted within the aircraft cabin
15 may require a structurally tight installation which does not generate a mount preload. Such equipment may not readily accommodate airframe build and equipment tolerances. Assembly may thereby necessitate the mix-and-match of specific equipment to specific aircraft to complete each installation.

SUMMARY

20 [0005] An eccentric fitting assembly according to an exemplary aspect of the present disclosure includes an outer eccentric fitting which defines an outer axis, the outer eccentric
25 fitting defines an opening offset from the outer axis. An inner eccentric fitting defines an inner axis, the inner eccentric fitting defines a stud receiver opening offset from the inner axis, the inner eccentric fitting receivable within the opening.

 [0006] A method of mounting equipment to a stud according to an exemplary aspect
of the present disclosure includes attaching an outer eccentric fitting to the equipment, the outer
30 eccentric fitting defines an outer axis, the outer eccentric fitting defines an opening offset from the outer axis. Attaching an inner eccentric fitting such that a stud opening surrounds the stud,

the inner eccentric fitting defines an inner axis, the stud opening offset from the inner axis. Receiving the inner eccentric fitting within the opening such that the inner eccentric fitting engages the stud and the inner eccentric fitting rotates within the opening to compensate for an offset between the equipment and the stud.

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BRIEF DESCRIPTION OF THE DRAWINGS

[0007] Various features will become apparent to those skilled in the art from the following detailed description of the disclosed non-limiting embodiment. The drawings that
10 accompany the detailed description can be briefly described as follows:

[0008] Figure 1 is a schematic view of a rotary-wing aircraft embodiment for use with the present disclosure;

[0009] Figure 2A is a perspective view within a cabin of a rotary-wing aircraft with a munition launcher supported upon a stand removably mounted to a cabin floor;

15 [0010] Figure 2B is a perspective view of a stud within the cabin floor;

[0011] Figure 3 is an exploded view of the eccentric fitting assembly;

[0012] Figure 4A is a schematic section view of the eccentric fitting assembly in a first position;

[0013] Figure 4B is a schematic line view of the eccentric fitting assembly in a
20 second position; and

[0014] Figure 5 is a schematic sectional line view of a spring pin system of the eccentric fitting assembly.

DETAILED DESCRIPTION

25

[0015] Figure 1 schematically illustrates a rotary-wing aircraft 10 having a main rotor system 12. The aircraft 10 includes an airframe 14 having an extending tail 16 which mounts an anti-torque system 18. Although a particular helicopter configuration is described in the disclosed embodiment, other configurations and/or machines, such as high speed compound
30 rotary-wing aircraft with supplemental translational thrust systems, dual contra-rotating, coaxial

rotor system aircraft, turbo-props, tilt-rotors, tilt-wing and straight wing aircraft, will also benefit herefrom. The aircraft 10 may carry munitions 20 such as sonobuoys.

[0016] Referring to Figure 2A, the munitions 20 may be contained within a launcher 22 supported upon a stand 24. The stand 24 may be removably mounted within the aircraft cabin. The stand 24 includes two pivot arms 26A, 26B which interface with two lower window mount fittings 28A, 28B and two stand support legs 30A, 30B. Each of the stand interfaces are close tolerance fits for structural considerations and may not allow for normal tolerance variations in the airframe and stand even with the telescopic adjustment in the height of the stand support legs 30A, 30B (Figure 3).

[0017] An eccentric fitting assembly 36 mountable to each of the legs 30A, 30B facilitate interface with a respective stud 32 in the cabin floor 34 (Figure 2B). The eccentric fitting assembly 36 may be threaded into the legs 30A, 30B without interference with the telescopic adjustment. The eccentric fitting assembly 36 readily retrofits with other standard threaded/stud mount arrangements. It should be understood that although a sonobuoy stand is illustrated in the disclosed non-limiting embodiment, other equipment such as racks, crew seats and litters employed in military or commercial aircraft will also benefit from usage of the eccentric fitting assembly 36 disclosed herein.

[0018] Referring to Figure 3, the eccentric fitting assembly 36 generally includes an outer eccentric fitting 40, an inner eccentric fitting 42, an outer spring pin system 44, an inner spring pin system 46 and a lock ring 48. Relative rotation of the outer eccentric fitting 40 and the inner eccentric fitting 42 results in adjustment of the centerline of the eccentric fitting assembly 36. The outer eccentric fitting 40 and the inner eccentric fitting 42 are generally cylindrical in the illustrated non-limiting embodiment, but may alternatively be of a polygonal configuration to facilitate installation and adjustment with a tool.

[0019] A threaded section 40T of the outer eccentric fitting 40 facilitates installation of the eccentric fitting assembly 36 to the respective stand support legs 30A, 30B or other equipment. It should be understood that attachments other than the threaded section 40T may alternatively or additionally be provided.

[0020] The outer eccentric fitting 40 includes an opening 52 which is sized to receive the inner eccentric fitting 42. The opening 52 is offset from a longitudinal axis A defined by the

outer eccentric fitting 40. The inner eccentric fitting 42 includes a stud opening 54 which is also offset from a longitudinal axis B defined by the inner eccentric fitting 42.

[0021] The offset of opening 52 and stud opening 54 is equivalent such that relative rotation of the outer eccentric fitting 40 and the inner eccentric fitting 42 positions the stud opening 54 from along axis A which can be adjusted to achieve the true center of the eccentric fitting assembly 36 (Figure 4A) to a maximum radial offset when the outer eccentric fitting 40 and the inner eccentric fitting 42 define a relative rotational position of 180 degrees (Figure 4B). Through the relative rotation of the outer eccentric fitting 40 and the inner eccentric fitting 42, an axis b of the stud opening 54 may be located anywhere within a diameter.

[0022] Referring to Figure 4A, the outer spring pin system 44 is located within the outer eccentric fitting 40 transverse to axis A such that a multiple of lock pins 56 are receivable within a slot 58 defined about the outer perimeter of the inner eccentric fitting 42. Each of the lock pins 56 are biased outward relative axis A by a spring 60 and retained within the outer eccentric fitting 40 by a retainer 66 (Figure 5). The spring 60 reacts against a flange 68 formed by the lock pin 56. Alternatively, the flange 68 may be formed by a clip ring or the like attached to the lock pin 56.

[0023] The inner spring pin system 46 is located within the stud opening 54 transverse to axis B such that a multiple of stud lock pins 62 are engageable with the stud 32. Each of the stud lock pins 62 are biased outward relative axis B by a spring 64 and are mounted within the inner eccentric fitting 42 as discussed with regard to the outer spring pin system 44.

[0024] The eccentric fitting assembly 36 facilitates installation of the stand 24 or other equipment onto the cabin floor 34 or other surface with studs 32. The threaded section 40T of the outer eccentric fitting 40 is threaded into the respective stand support legs 30A, 30B or other equipment. The inner eccentric fitting 42 is located over the stud 32. The outer eccentric fitting 40 is then located over the inner eccentric fitting 42 such that the inner eccentric fitting 42 is received within the opening 52. Insertion of the inner eccentric fitting 42 within the opening 52 drives the stud lock pins 62 into the stud opening 54 to lock the multiple of stud lock pins 62 onto the stud 32. The lock ring 48 is then mounted onto the outer eccentric fitting 40 to drive the multiple of lock pins 56 into the slot 58 to lock the inner eccentric fitting 42 within the outer eccentric fitting 40 to thereby lock the eccentric fitting assembly 36 together and attach the stand

24 to the cabin floor 34. The lock ring 48 may be engaged with the outer eccentric fitting 40 through a threaded or sliding engagement.

[0025] The eccentric fitting assembly 36 facilitates installation of equipment through accommodation of airframe build and supplier component structure tolerances yet reacts any upward or downward loads. Preservation of standard threaded stand and floor stud interfaces allow the eccentric fitting assembly 36 to be is directly retrofittable to legacy aircraft.

[0026] It should be understood that relative positional terms such as "forward," "aft," "upper," "lower," "above," "below," and the like are with reference to the normal operational attitude of the vehicle and should not be considered otherwise limiting.

[0027] It should be understood that like reference numerals identify corresponding or similar elements throughout the several drawings. It should also be understood that although a particular component arrangement is disclosed in the illustrated embodiment, other arrangements will benefit herefrom.

[0028] Although particular step sequences are shown, described, and claimed, it should be understood that steps may be performed in any order, separated or combined unless otherwise indicated and will still benefit from the present invention.

[0029] The foregoing description is exemplary rather than defined by the limitations within. Various non-limiting embodiments are disclosed herein, however, one of ordinary skill in the art would recognize that various modifications and variations in light of the above teachings will fall within the scope of the appended claims. It is therefore to be understood that within the scope of the appended claims, the invention may be practiced other than as specifically described. For that reason the appended claims should be studied to determine true scope and content.

CLAIMS

What is claimed is:

1. An eccentric fitting assembly comprising:
5 an outer eccentric fitting which defines an outer axis, said outer eccentric fitting defines an opening offset from said outer axis;
an inner eccentric fitting which defines an inner axis, said inner eccentric fitting defines a stud opening offset from said inner axis, said inner eccentric fitting receivable within said opening.
10
2. The assembly as recited in claim 1, wherein said outer eccentric fitting defines a threaded section.
3. The assembly as recited in claim 1, wherein said inner eccentric fitting defines a
15 slot about an outer periphery.
4. The assembly as recited in claim 3, further comprising an outer spring pin system within said outer eccentric fitting, said outer spring pin system includes a multiple of lock pins transverse to said outer axis such that said multiple of lock pins are receivable within said slot to
20 retain said inner eccentric fitting within said opening.
5. The assembly as recited in claim 4, wherein said multiple of lock pins are biased outward relative said opening.
- 25 6. The assembly as recited in claim 4, wherein said inner eccentric fitting is rotatable within said opening.
7. The assembly as recited in claim 6, further comprising a lock ring engageable with said outer eccentric fitting which retains said multiple of lock pins within said slot.

30

8. The assembly as recited in claim 1, further comprising an inner spring pin system within said inner eccentric fitting, said inner spring pin system includes a multiple of stud pins transverse to said inner axis.

5 9. The assembly as recited in claim 8, wherein said multiple of stud pins are biased outward relative said stud opening.

10 10. The assembly as recited in claim 9, wherein said multiple of stud pins are driven inward to extend at least partially into said stud opening in response to said inner eccentric fitting being received within said opening.

15

11. A method of mounting equipment to a stud comprising:

attaching an outer eccentric fitting to the equipment, the outer eccentric fitting defines an
outer axis, the outer eccentric fitting defines an opening offset from the outer axis;
attaching an inner eccentric fitting such that a stud opening surrounds the stud, the inner
eccentric fitting defines an inner axis, the stud opening offset from the inner axis;
and

receiving the inner eccentric fitting within the opening such that the inner eccentric fitting
engages the stud and the inner eccentric fitting rotates within the opening to
compensate for an offset between the equipment and the stud.

12. A method as recited in claim 11, further comprising:

driving a multiple of stud pins inward to extend at least partially into the stud opening to
engage the stud in response to the inner eccentric fitting being received within the opening.

13. A method as recited in claim 11, further comprising:

locating a lock ring about the outer eccentric fitting; and

driving a multiple of lock pins inward with the lock ring to drive multiple of lock pins at
least partially into a slot about an outer periphery of the inner eccentric fitting to retain the inner
eccentric fitting within the opening.

14. A method as recited in claim 11, further comprising:

locating the stud within an aircraft cabin floor.

15. A method as recited in claim 14, further comprising:

removably mounting the equipment to the aircraft cabin floor through the outer eccentric
fitting and the inner eccentric fitting.

16. A method as recited in claim 14, further comprising:

threading the outer eccentric fitting to the equipment.

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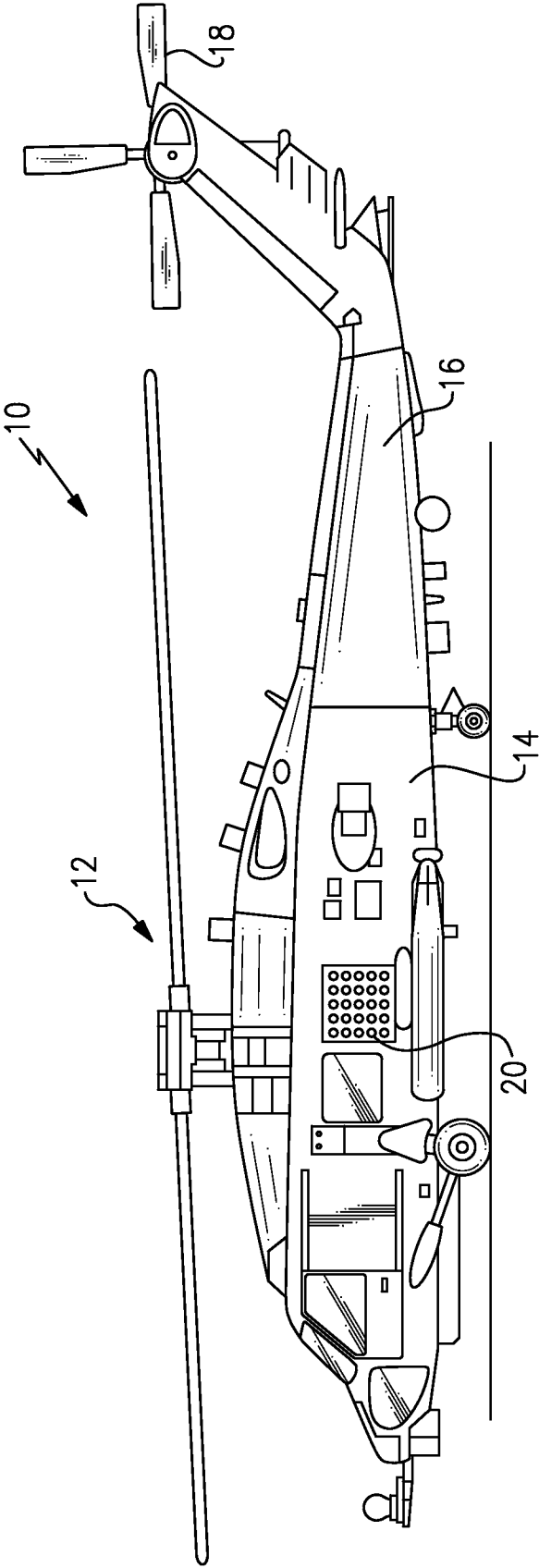


FIG. 1

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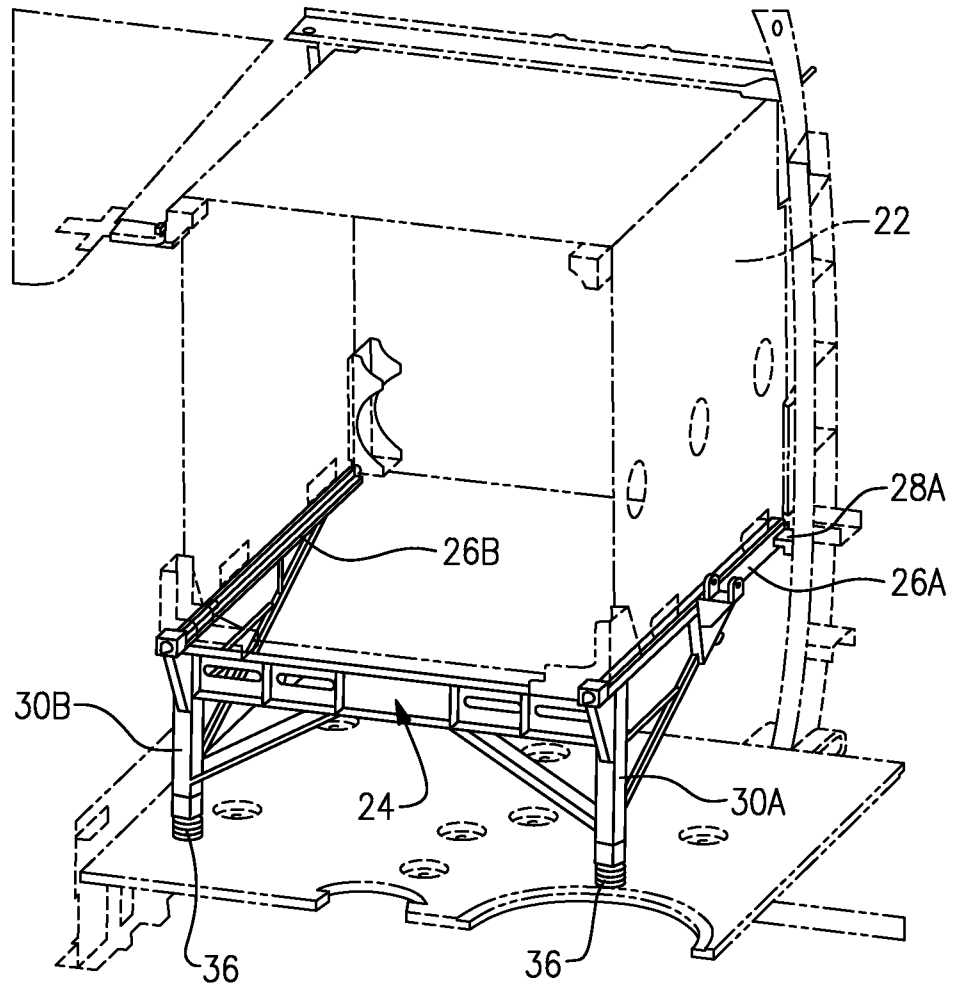


FIG. 2A

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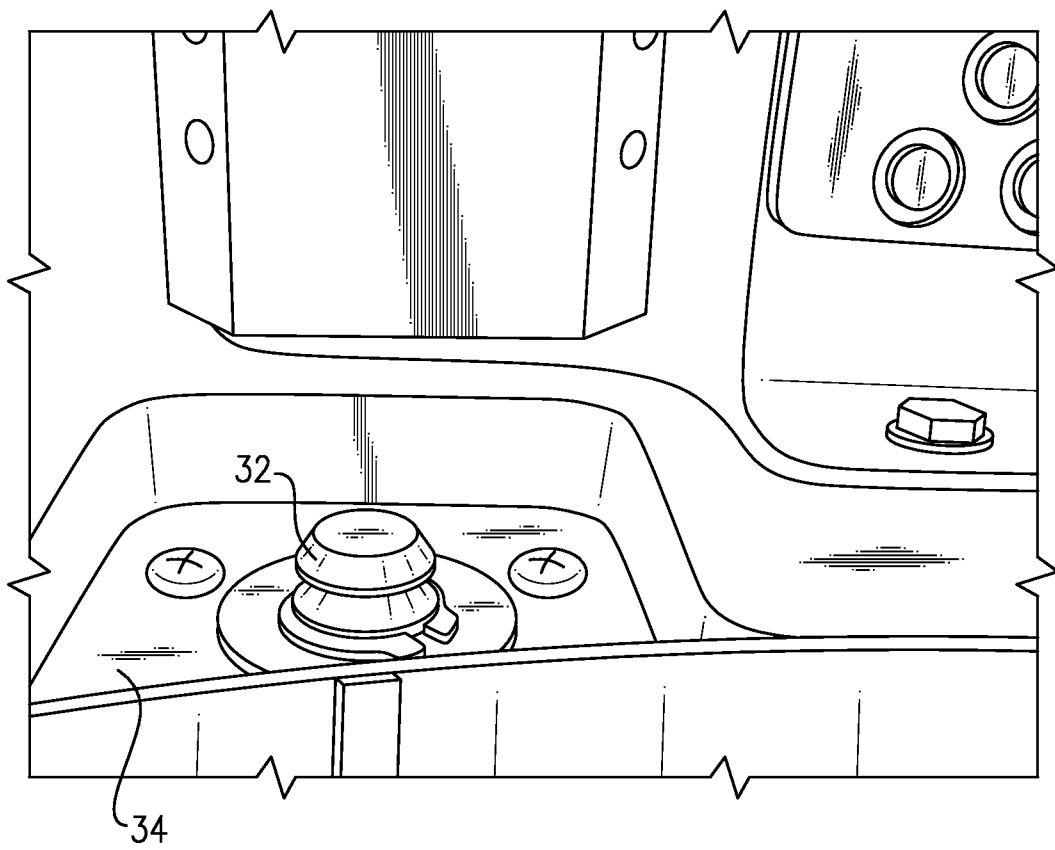
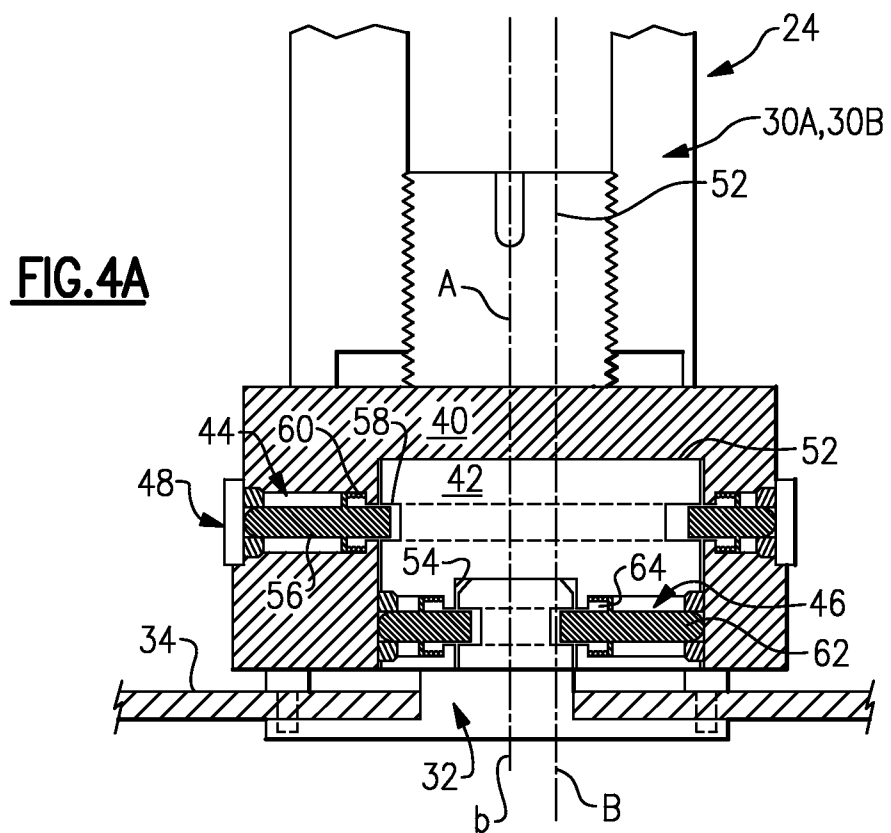
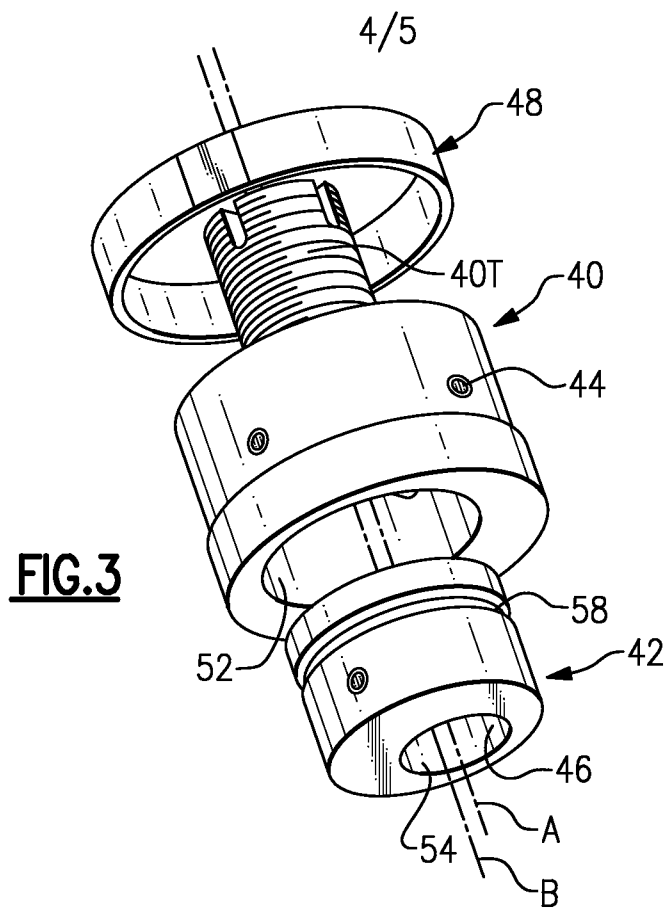


FIG.2B



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FIG.4B

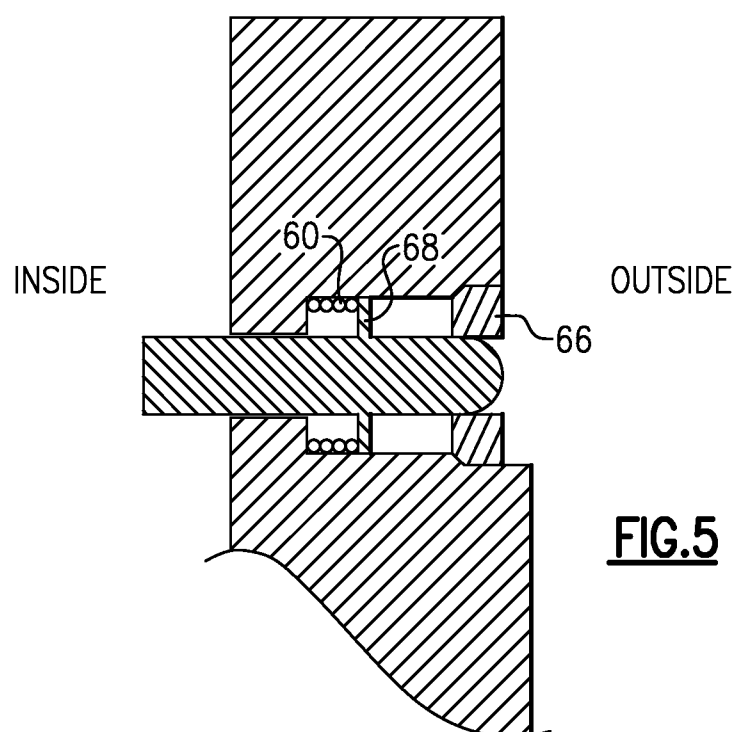
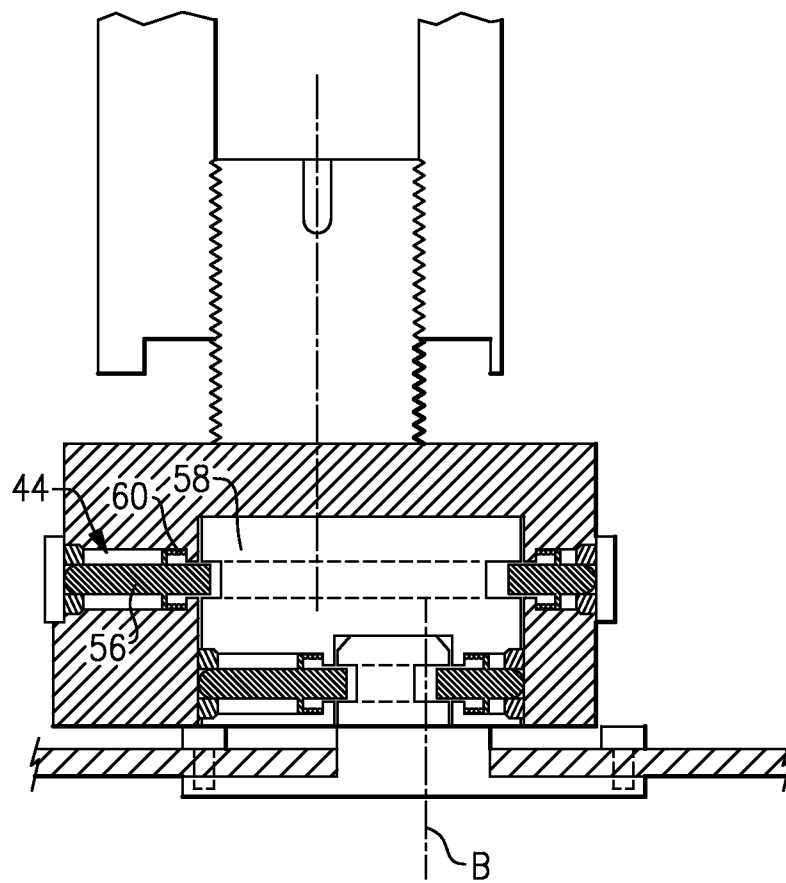


FIG.5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2008/085626**A. CLASSIFICATION OF SUBJECT MATTER*****F16B 7/16(2006.01)i, F16B 7/18(2006.01)i, B64C 1/18(2006.01)i, B64D 47/00(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)

IPC: F16B 2/18, B64D 11/06, B64D 9/00

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)

eKOMPASS(KIPO internal) and keywords: eccentric, fitting, mount, fixture, connector

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2008-0149764 A1 (FREY, ANDREAS) 26 JUNE 2008 See Paragraph 8 - Paragraph 13; Claim 1 and Figures 1-4.	1-16
X	JP 17-324612 A (JAMCO CORP.) 24 NOVEMBER 2005 See Claim 1 and Figures 1-7.	1, 11, 14
A	JP 02-066308 A (MATSUI KAZUHIRO et al) 06 MARCH 1990 See Claim 1 and Figures 1-4.	1-16



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

31 AUGUST 2009 (31.08.2009)

Date of mailing of the international search report

03 SEPTEMBER 2009 (03.09.2009)

Name and mailing address of the ISA/KR

Korean Intellectual Property Office
Government Complex-Daejeon, 139 Seonsa-ro, Seo-gu,
Daejeon 302-701, Republic of Korea

Facsimile No. 82-42-472-7140

Authorized officer

SONG, Jay Wook

Telephone No. 82-42-481-5504



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2008/085626

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2008-0149764 A1	26.06.2008	DE 102004047455 A1 EP 1794052 A1 EP 1794052 B1 WO 2006-037397 A1	06.04.2006 13.06.2007 08.04.2009 13.04.2006
JP 2005-324612 A	24.11.2005	DE 602005002076 T2 DE 602005002076 D1 EP 1596075 A1 EP 1596075 B1 JP 3949123 B2 JP 03-949123 B2	12.06.2008 04.10.2007 16.11.2005 22.08.2007 25.07.2007 27.04.2007
JP 02-066308 A	06.03.1990	DE 68901116 D1 EP 0357129 A1 EP 0357129 B1 KR 10-1993-0001624 B1 US 04938625 A	07.05.1992 07.03.1990 01.04.1992 08.03.1993 03.07.1990

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2008/085626**Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)**

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

Claims 1-10, and claims 11-16 have a common technical feature of employing an eccentric fitting assembly with an outer and inner eccentric fitting.
However, this feature lacks novelty and/or inventive step with respect to JP 17-324612 cited in this ISR.
Thus, there is no technical relationship left over the prior art among these inventions, leaving the claims without a single general inventive concept.
Hence there is lack of unity "a posteriori"(PCT Rules 13.1 and 13.2)

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☒ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.