



- (51) International Patent Classification:
F02B 39/16 (2006.01) *F02B 37/00* (2006.01)
- (21) International Application Number:
PCT/US2014/032771
- (22) International Filing Date:
3 April 2014 (03.04.2014)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
102013006349.3 12 April 2013 (12.04.2013) DE
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- (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, IR, IS, JP, KE, KG, 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, SA, 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.

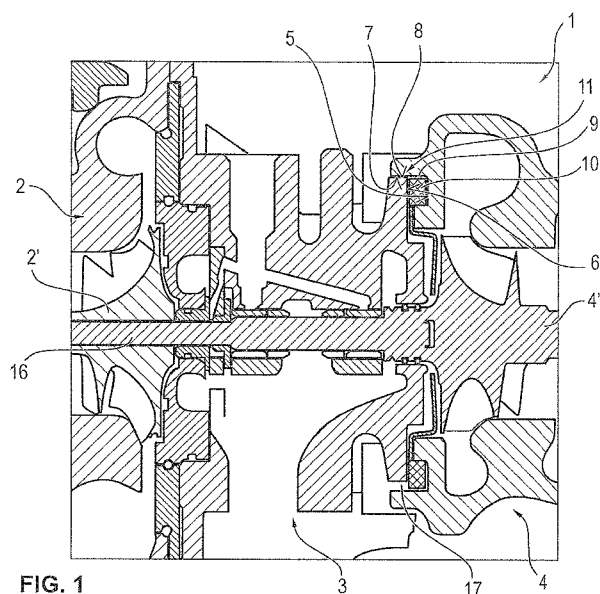
- (84) Designated States (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, 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, KM, 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))*

[Continued on next page]

(54) Title: EXHAUST-GAS TURBOCHARGER



(57) Abstract: The invention relates to an exhaust-gas turbocharger (1) having a compressor housing (2) in which a compressor wheel (2') is arranged; having a bearing housing (3); and having a turbine housing (4) in which a turbine wheel (4') is arranged, wherein axial abutment surfaces (5, 6) are provided between the bearing housing (3) and the turbine housing (4), wherein the axial abutment surfaces (5, 6) have at least one notch (9).



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))

EXHAUST-GAS TURBOCHARGER**DESCRIPTION**

5 The invention relates to an exhaust-gas turbocharger according to the preamble of claim 1.

 The bearing housing and the turbine housing of an exhaust-gas turbocharger of said type have a relatively large contact surface owing to the provision of a force-transmitting axial surface and a radial centering surface.

10 Owing to the high exhaust-gas temperatures that are encountered in modern Otto-cycle and diesel engines, the bearing arrangement of the exhaust-gas turbocharger in the bearing housing is subject to high thermal loading.

 This can result in oil coking in the bearing housing, an exceedance of the admissible component limit temperatures, and also an impairment of bearing stability.

15 It is therefore an object of the present invention to provide an exhaust-gas turbocharger of the type indicated in the preamble of claim 1 which makes it possible to at least alleviate the technical problems explained above.

 This object is achieved by the features of claim 1.

20 Through the provision of at least one notch in at least one of the axial abutment surfaces, it is possible for the contact surface to be decreased in size, and thus the introduction of heat into the bearing housing to be reduced.

 It is preferably possible for a multiplicity of such notches to be provided.

25 Here, the notches may be provided in a turbine-housing-side abutment surface and/or in a bearing-side abutment surface. To reduce a transmission of heat from the turbine housing to the bearing housing, a contact surface of a radial centering surface pairing can be reduced, for example through the formation of notches or the division of the centering surface pairing into a multiplicity of centering points of small area.

30 It is also possible for at least one thermal insulator to be arranged between the axial abutment surfaces, which thermal insulator performs the transmission of force and the thermal insulation and thus prevents any direct contact between the axial abutment surfaces.

 It is possible here for the thermal insulator to be in the form of a closed ring or else in the form of a multiplicity of segments with clearly defined breaking edges.

 It is preferable here for the thermal insulator to be arranged in a groove in the

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bearing housing and/or in the turbine housing such that an ingress of fragments into the exhaust-gas turbocharger in the event of the thermal insulator becoming damaged can be prevented.

Finally, it is possible for the one or more thermal insulators to be of such a size as to extend behind the turbine wheel. It is alternatively possible for an additional thermal insulator to be arranged in the region behind the turbine wheel.

Further details, features and advantages of the invention become apparent from the following description of exemplary embodiments with reference to the drawing, in which:

Figure 1 shows a schematically slightly simplified sectional illustration through an exhaust-gas turbocharger according to the invention,

Figure 2 shows an illustration, corresponding to Figure 1, of a sub-region of the bearing housing and of the turbine housing according to a second embodiment of the exhaust-gas turbocharger according to the invention, and

Figure 3 shows a slightly simplified perspective detail illustration of a centering lobe arrangement.

The exhaust-gas turbocharger 1 illustrated in Figure 1 has a compressor housing 2 with a compressor wheel 2' arranged therein, a bearing housing 3, and a turbine housing 4, said housings being mounted on one another. The bearing housing 3 serves for mounting a shaft 12 which, on one end, bears the compressor wheel 2' and, on its other end, bears a turbine wheel 4' which is arranged in the turbine housing 4.

The turbine housing 4 has a turbine-housing-side axial abutment surface 5. The bearing housing 3 has a bearing-housing-side axial abutment surface 6.

Furthermore, there is a centering surface pairing formed by a turbine-housing-side centering surface 7 and a bearing-housing-side centering surface 8.

It can be seen from Figure 1 that the axial abutment surfaces 5, 6 have a notch 9 in which, in the particularly preferred embodiment illustrated in Figure 1, there is arranged a thermal insulator 10 which may be constructed for example from ceramic material. As explained in the introduction, it would basically also be conceivable to provide only the notch 9 without the thermal insulator 10, which in itself would result in a reduction of the introduction of heat into the bearing housing 3 because a heat-transmitting contact surface between the axial abutment surfaces 5, 6 can be reduced in size simply by means of a notch 9 of said type.

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The embodiment illustrated in Figure 1 is however preferable owing to the provision of a thermal insulator 10, because, by means of said thermal insulator 10, contact between the abutment surfaces 5 and 6 can be prevented, as emerges from the illustration of Figure 1. In this case, the transmission of force between the bearing
5 housing 3 and the turbine housing 4 takes place via the thermal insulator 10, as illustrated in Figure 2.

Here, Figure 2 shows that it is possible for the thermal insulator 10 to be of such a size that, as viewed in the radial direction R of the exhaust-gas turbocharger 1, it extends behind the turbine wheel 4', which permits a further reduction of the transfer of
10 heat into the bearing housing 3.

The radial centering surface pairing 7, 8 may be in the form of a centering lobe arrangement, wherein in Figure 1, owing to the selected illustration, one centering lobe 11 is visible.

It would however be preferable, as shown in Figure 3, for four such centering
15 lobes 12, 13, 14 and 15, for example, to be provided, which centering lobes may be arranged in each case separately from one another on the turbine housing 4 or on the bearing housing 3. The clearance generated by said arrangement is denoted in Figure 1 by the reference sign 17.

In addition to the above written disclosure of the invention, reference is hereby
20 explicitly made to the illustrative representation in Figures 1 to 3 to supplement the disclosure.

LIST OF REFERENCE SIGNS

	1	Exhaust-gas turbocharger
	2	Compressor
5	2'	Compressor wheel
	3	Bearing housing
	4	Turbine housing
	4'	Turbine wheel
	5	Turbine-housing-side abutment surface
10	6	Bearing-housing-side abutment surface
	7	Turbine-housing-side radial centering surface
	8	Bearing-housing-side centering surface
	9	Notch (groove)
	10	Thermal insulator
15	11-15	Centering lobes
	16	Shaft
	17	Clearance
	R	Radial direction

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CLAIMS

1. An exhaust-gas turbocharger (1)
 - having a compressor housing (2) in which a compressor wheel (2') is
 - 5 arranged;
 - having a bearing housing (3); and
 - having a turbine housing (4) in which a turbine wheel (4') is arranged,wherein axial abutment surfaces (5, 6) are provided between the bearing housing (3) and the turbine housing (4), wherein
- 10 - the axial abutment surfaces (5, 6) have at least one notch (9).
2. The exhaust-gas turbocharger as claimed in claim 1, wherein a multiplicity of notches (9) is provided.
- 15 3. The exhaust-gas turbocharger as claimed in claim 1 or 2, wherein the notch (9) is provided in a turbine-housing-side abutment surface (5) and/or in a bearing-housing-side abutment surface (6) of the axial abutment surfaces (5, 6).
4. The exhaust-gas turbocharger as claimed in one of claims 1 to 3,
- 20 wherein at least one thermal insulator (10) is arranged between the axial abutment surfaces (5, 6).
5. The exhaust-gas turbocharger as claimed in claim 4, wherein the thermal insulator (10) is in the form of a closed ring.
- 25 6. The exhaust-gas turbocharger as claimed in claim 4, wherein the thermal insulator (10) is constructed from a multiplicity of separate segments.
7. The exhaust-gas turbocharger as claimed in one of claims 4 to 6,
- 30 wherein the thermal insulator (10) is arranged in the notch (9).
8. The exhaust-gas turbocharger as claimed in one of claims 4 to 7, wherein the thermal insulator (10) extends radially inward behind the turbine wheel (4').

9. The exhaust-gas turbocharger as claimed in one of claims 1 to 7, wherein a further thermal insulator is provided which is arranged behind the turbine wheel (4').

5

10. The exhaust-gas turbocharger as claimed in one of claims 1 to 8, having a radial centering surface pairing (7, 8) formed by a multiplicity of centering lobes (11-15).

10

11. The exhaust-gas turbocharger as claimed in claim 10, wherein a clearance (17) is arranged between the centering lobes (11-15).

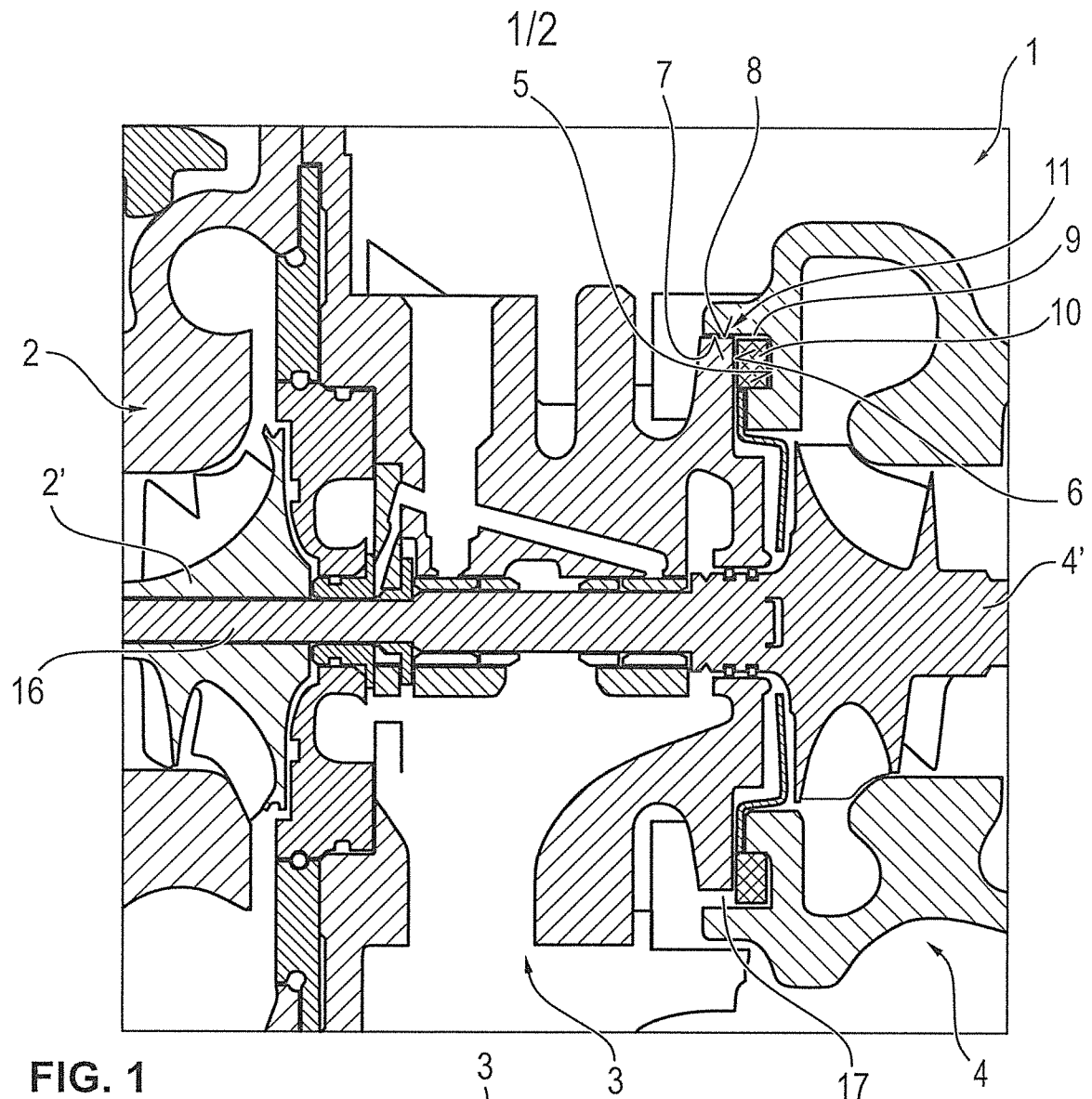


FIG. 1

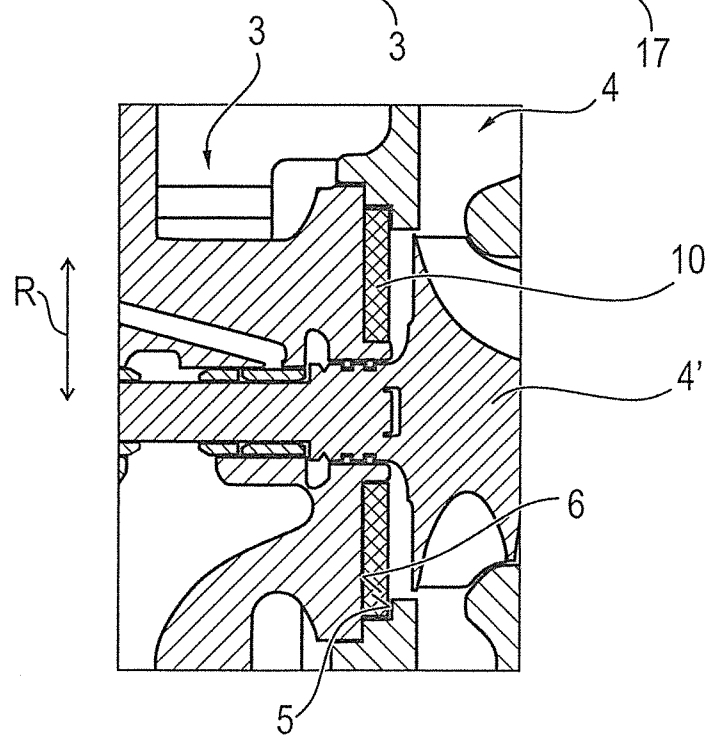


FIG. 2

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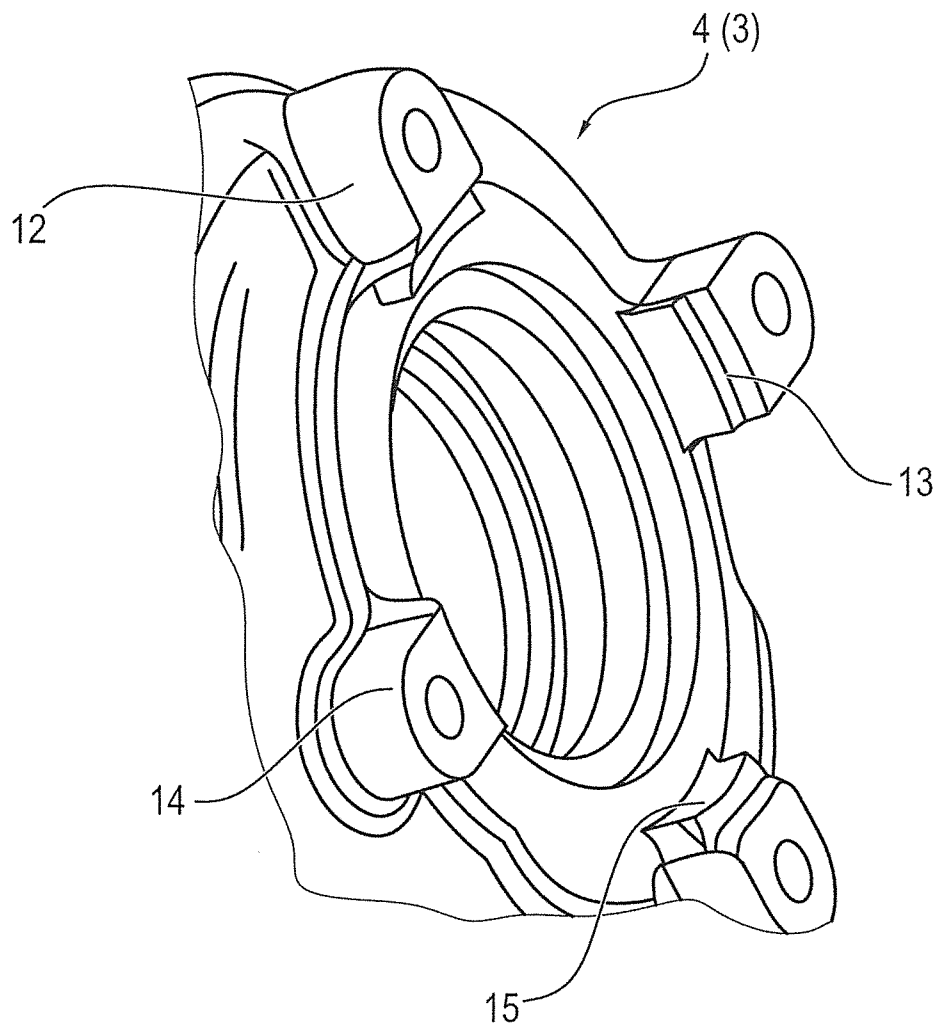


FIG. 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2014/032771**A. CLASSIFICATION OF SUBJECT MATTER****F02B 39/14(2006.01)i, F02B 39/16(2006.01)i, F02B 37/00(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 39/14; F02B 39/00; F01D 25/16; F02B 33/44; F04D 29/58; F02B 39/16; F02B 37/00

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

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, turbine housing, bearing housing, abutment surface, notch, and insulate

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2007-0089414 A1 (YOKOYAMA et al.) 26 April 2007 See paragraphs [0051]-[0058] and figures 1,3.	1-3
Y	EP 2055911 A1 (MITSUBISHI HEAVY INDUSTRIES, LTD.) 06 May 2009 See paragraphs [0081]-[0083] and figure 16.	1-3
A	JP 2004-353660 A (ABB TURBO SYSTEMS AG.) 16 December 2004 See paragraphs [0014]-[0017] and figure 1.	1-3
A	US 2010-0043431 A1 (THAYER et al.) 25 February 2010 See paragraphs [0027]-[0030] and figure 3-4.	1-3
A	JP 07-189723 A (ISHIKAWAJIMA HARIMA HEAVY IND CO., LTD.) 28 July 1995 See paragraphs [0020]-[0022] and figure 1.	1-3



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 another 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

13 August 2014 (13.08.2014)

Date of mailing of the international search report

13 August 2014 (13.08.2014)

Name and mailing address of the ISA/KR

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INTERNATIONAL SEARCH REPORTInternational application No.
PCT/US2014/032771**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.: 5-6,11
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:
Claims 5-6 and 11 are unclear because they refer to multiple dependent claims 4 and 10 respectively which do not comply with PCT Rule 6.4(a).
3. ☒ Claims Nos.: 4,7-10
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:

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 fees, this Authority did not invite payment of any additional fees.
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.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2014/032771

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Information on patent family members

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None