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(54) Title: EXHAUST GAS TURBOCHARGER WITH HEAT SHIELD

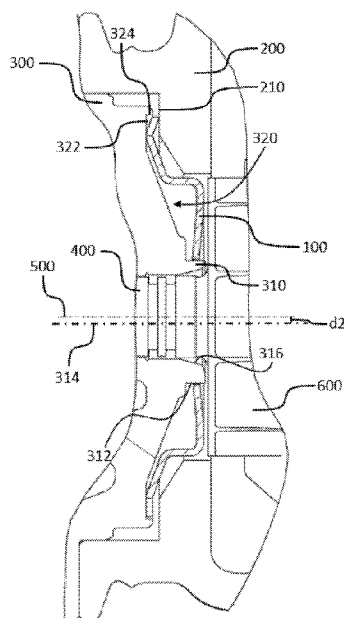


Fig. 1

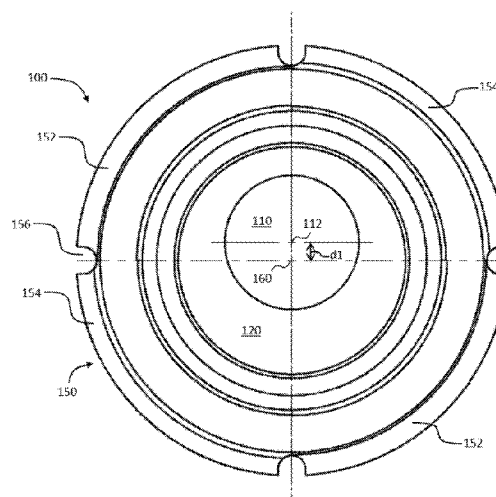


Fig. 3

(57) Abstract: The invention relates to an exhaust gas turbocharger comprising a turbine housing (200), a bearing housing (300), a rotor (400) which is rotatably mounted in the bearing housing and defines an axis of rotation (500) of the exhaust gas turbocharger, and a heat shield (100) which is arranged between the turbine housing and the bearing housing. The heat shield has a central hole (110) for positioning in the exhaust gas turbocharger; the center of the hole is positioned eccentric to the axis of rotation to prevent a rotation of the heat shield.

TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW,
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- *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))*

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EXHAUST GAS TURBOCHARGER WITH HEAT SHIELD

Field of the Invention

5 [0001] The present invention relates to an exhaust gas turbocharger with a heat shield.

Background Information

10 [0002] Increasingly more vehicles of the more recent generation are equipped with charging devices. In order to achieve the target demands and the legal requirements, it is imperative to promote development in the complete drive train and also to optimize the individual components as well as the system as a whole with respect to their reliability and efficiency.

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[0003] Exhaust gas turbochargers are known, for example, in which a turbine with a turbine wheel is driven by the exhaust gas flow of the internal combustion engine. A compressor wheel, which is arranged with a turbine wheel on a mutual rotor, compresses the fresh air taken in for the engine. By this means, the air or
20 oxygen amount, available to the engine for combustion, is increased, which in turn leads to an increased output of the internal combustion engine.

[0004] Known turbochargers comprise a turbine housing with a turbine wheel arranged therein, a compressor housing with a compressor wheel arranged therein,
25 and a bearing housing in which the rotor is mounted. To protect the bearing housing from the high temperatures that arise in the turbine housing, a heat shield is provided between the turbine housing and the bearing housing. The heat shield may, for example, be rigidly clamped between the turbine housing and the bearing housing via a direct force fit. The material costs for this type of incorporated heat
30 shields are relatively high since high-precision materials must be used. Alternatively, the heat shield may also be mounted between the bearing housing and the turbine housing via a force shunt. However, the risk exists in this case that the heat shield will rotate during operation of the exhaust gas turbocharger and

wear arises in the area of the heat shield over time. In the worst case, the entire exhaust gas turbocharger may fail.

[0005] The object of the present invention is consequently to provide an exhaust
5 gas turbocharger with a heat shield which eliminates the risk of wear in the area of the heat shield and despite this is relatively inexpensive to produce.

Brief Summary of the Invention

10 [0006] The present invention relates to an exhaust gas turbocharger according to Claim 1.

[0007] The exhaust gas turbocharger according to the invention comprises a turbine housing, a bearing housing, a rotor which is rotatably mounted in the
15 bearing housing and defines an axis of rotation of the exhaust gas turbocharger, and a heat shield which is arranged between the turbine housing and the bearing housing. The heat shield has a central hole for positioning in the exhaust gas turbocharger; the center of the hole is positioned eccentric to the axis of rotation to prevent a rotation of the heat shield. Due to this type of configuration and
20 arrangement of the heat shield, the heat shield does not have to be rigidly clamped between the bearing housing and the turbine housing. A fixing of the heat shield via a direct force fit is not necessary, for which reason a less expensive material may be selected for the heat shield. In spite of this, a rotation of the heat shield is prevented via the eccentric positioning of the hole, by which means the risk of
25 wear in this area is eliminated.

[0008] In embodiments, the heat shield may, for example, be configured as pot-shaped. A center axis of the heat shield may coincide with the axis of rotation of the exhaust gas turbocharger. The center of the bore hold may have a distance d_1
30 to the central axis of at least 0.5 mm, preferably from 0.5 mm to 3.5 mm, in particular from 1 mm to 2 mm.

[0009] In embodiments, which may be combined with all previously described embodiments, the bearing housing may have an axially extending dome extension. The dome extension may be arranged at least partially in the hole. The dome extension may be arranged around the axis of rotation of the turbocharger, wherein an outer surface of the dome extension may describe a cylinder with a cylinder axis which is arranged eccentric to the axis of rotation. An inner surface of the dome extension may describe a cylinder or a cone which is arranged concentric to the axis of rotation. The cylinder axis of the outer surface may, for example, have a distance d_2 to the axis of rotation of at least 0.5 mm, preferably 0.5 to 3.5 mm, in particular from 1 mm to 2 mm. In particular, the distances d_1 , d_2 of the cylinder axis of the outer surface of the dome extension to axis of rotation 500 and of the center of the hole to the axis of rotation may be aligned to one another, for example, to be approximately the same.

[0010] In embodiments, which may be combined with all previously described embodiments, the heat shield may have a plurality of tabs in a radially outer area. The plurality of tabs may comprise at least one flat tab and a least one curved tab. The configuration with flat and curved tabs has the advantage that the heat shield may contact a flat lateral surface of the bearing housing and despite that a spring effect is still achieved at the same time due to the curved tab(s), so that there is a biasing of the heat shield (due to the turbine housing) in the installed state between the bearing housing and the turbine housing. A recess concentric to the axis of rotation may be provided in a side wall of the bearing housing, in which recess at least the flat tabs may be arranged and may contact the side wall. An interaction between at least the flat tabs with an inner wall of the recess prevents a rotation of the heat shield. Alternatively, the turbine housing may have a step concentric to the axis of rotation, in which area at least one part of the heat shield may be arranged, wherein an interaction of the tabs with the turbine housing in the area of the step prevents a rotation of the heat shield.

30

[0011] In configurations, which are combinable with all previously described configurations, notches may be provided between the tabs. The notches are

advantageous for manufacturing and reduce the risk of cracking during deep drawing of the heat shield.

5 [0012] In embodiments, which may be combined with all previously described embodiments, two, three, four, or more flat tabs may be provided. Likewise, two, three, four, or more curved tabs may be provided. The flat tabs and the curved tabs may be arranged distributed uniformly and alternatingly along the periphery of the heat shield.

10 [0013] In embodiments, which may be combined with all previously described embodiments, the curved tabs are curved in the direction toward the turbine housing and away from the bearing housing. Alternatively, the curved tabs may be curved in the direction toward the bearing housing and away from the turbine housing.

15 [0014] Additional details and features of the invention are subsequently described by way of the figures.

Brief Description of the Drawings

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Figure 1 shows a section of a cutaway view through one embodiment of the exhaust gas turbocharger according to the invention;

25 **Figure 2** shows a cutaway view of the heat shield from the embodiment of the exhaust gas turbocharger according to the invention from Figure 1;

30 **Figure 3** shows a top view of the heat shield from the embodiment of the exhaust gas turbocharger according to the invention from Figure 1.

Detailed Description of the Invention

[0015] Embodiments of the exhaust gas turbocharger according to the invention will subsequently be described based on the figures. In the scope of this application, radial surfaces/lateral surfaces refer to surfaces that are arranged in the planes that are perpendicular to axis of rotation 500 of the exhaust gas turbocharger.

[0016] **Figure 1** shows a section of cutaway view of one embodiment of the exhaust gas turbocharger according to the invention. The exhaust gas turbocharger comprises a turbine housing 200, a bearing housing 300, and a rotor 400 which is rotatably mounted in bearing housing 300 and defines an axis of rotation 500 of the exhaust gas turbocharger. Rotor 400 comprises on a first end a turbine wheel 600 which is arranged in turbine housing 200, and on a second end a compressor wheel which is arranged in a compressor housing (not shown in the figures). The exhaust gas turbocharger additionally has a heat shield 100 which is arranged between turbine housing 200 and bearing housing 300. Heat shield 100 has a central hole 110 for positioning in the exhaust gas turbocharger; the center 112 of the hole is positioned eccentric to axis of rotation 500 to prevent a rotation of heat shield 100 during operation of the exhaust gas turbocharger. Due to this type of configuration and arrangement of heat shield 100 in the exhaust gas turbocharger, heat shield 100 does not have to be rigidly clamped between bearing housing 300 and turbine housing 200. A fixing of heat shield 100 via a direct force fit is not necessary, for which reason a less expensive material may be selected for heat shield 100. In spite of this, a rotation of heat shield 100 is prevented via the eccentric positioning of hole 110. Thus, the risk of wear of heat shield 100, and thus the risk of exhaust gas turbocharger failing, is eliminated.

[0017] As is particularly clear in **Figure 1** and **Figure 2**, heat shield 100 is configured approximately pot shaped in the embodiment depicted. Pot-shaped heat shield 100 has a central bottom area 120 extending approximately radially, a first wall area 130 extending approximately axially, a second wall area 140 extending approximately conically, and a tab area 150 lying radially outward. Tab area 150 is also particularly clear in **Figure 3**, which shows a top view of heat

shield 100. A center axis 160 (see e.g. **Figure 2**) of heat shield 100 coincides in the mounted state of heat shield 100 with axis of rotation 500 (see e.g. **Figure 1**) of the exhaust gas turbocharger. This is indicated in **Figure 2**, in that the inscribed axis includes the reference numerals for axis of rotation 500 and also for center axis 160. Center axis 160 thereby describes that axis to which heat shield 100 is rotationally symmetrical (if central hole 110 and, depending on configuration, tab area 150 were to be left out of consideration).

[0018] Hole 110 is, in contrast, not arranged in the center of heat shield 100. Center 112 of hole 110 may, for example, have a distance d1 (see **Figure 2** and **Figure 3**) to center axis 160 of at least 0.5 mm, preferably from 0.5 mm to 3.5 mm, in particular from 1 mm to 2 mm.

[0019] As is clear in **Figure 1**, bearing housing 300 of the exhaust gas turbocharger additionally has an axially extending dome extension 310. Dome extension 310 is positioned at least partially in hole 110 so that heat shield 100 is arranged virtually on dome extension 310 and is supported by dome extension 310. Dome extension 310 is arranged about axis of rotation 500 of the turbocharger. An outer surface 312 of dome extension 310 describes a cylinder with a cylinder axis 314, wherein cylinder axis 314 is arranged eccentric to axis of rotation 500. In contrast, an inner surface 316 of dome extension 310 describes a cylinder or a cone (as in the example depicted in **Figure 1**), which is arranged concentric to axis of rotation 500 of the exhaust gas turbocharger. The eccentricity of outer surface 312 of dome extension 310 is defined over a distance d2 of cylinder axis 314 to axis of rotation 500 of the exhaust gas turbocharger. Cylinder axis 314 of outer surface 312 may, for example, have a distance d2 (see **Figure 1**) to axis of rotation 500 of at least 0.5 mm, preferably 0.5 to 3.5 mm, in particular from 1 mm to 2 mm. In particular, distances d1, d2 of cylinder axis 314 of outer surface 312 of dome extension 310 to axis of rotation 500 and of center 112 of hole 110 to axis of rotation 500 may be aligned to one another. Distances d1 and d2 may, for example, be approximately the same size. In other words: center 112 of hole 110 of heat shield 100 lies on cylinder axis 314 of the cylinder which is described by outer surface 312 of dome extension 310.

[0020] In radially outward tab area 150, heat shield 100 has a plurality of tabs 152, 154 (see **Figure 3**). The plurality of tabs 152, 154 thereby comprises, in the embodiment shown in **Figure 3**, two flat tabs 152 and two curved tabs 154. "Flat" means in conjunction with flat tabs 152, that they extend in a radial direction to axis of rotation 500 of the turbocharger so that straight tabs 152 may lie flat on a radial lateral surface of bearing housing 300. In contrast, curved tabs 154 have an extension radially outward, which does not extend parallel to flat tabs 152. Tab area 150 may also have only one, or three, four, or more flat tabs 152. Likewise, only one, or three, four, or more curved tabs 154 may also be provided. As is shown in **Figure 3**, an equal number of flat and curved tabs 152, 154 may be provided. Alternatively, the number of flat tabs 152 may also differ from the number of curved tabs 154. Flat tabs 152 and curved tabs 154 may be arranged (as shown in **Figure 3**) distributed uniformly and alternatingly along the periphery of heat shield 100. Alternatively, curved tabs 154 and flat tabs 152 may also differ in size (e.g. with respect to the angular area that each tab covers) and be arranged distributed non-uniformly and randomly (not necessarily alternating).

[0021] The configuration of heat shield 100 with flat and curved tabs 152, 154 has the advantage that heat shield 100 may contact a flat lateral surface of bearing housing 300 and despite that a spring effect is still achieved at the same time due to curved tab(s) 154, so that there is a biasing of heat shield 100 (due to the turbine housing) in the installed state between bearing housing 300 and turbine housing 200.

[0022] Notches 156 are provided between tabs 152, 154. Notches 156 are advantageous for manufacturing and reduce the risk of cracking during the deep drawing of heat shield 100. In the embodiment from **Figure 1**, curved tabs 154 are curved in the direction toward turbine housing 200 and away from bearing housing 300. Alternatively, tabs 154 may also be curved in the direction toward bearing housing 300 and away from turbine housing 200.

[0023] As is clear in **Figure 1**, a recess 322, concentric to axis of rotation 500, is provided in one lateral wall 320 of bearing housing 300. At least flat tabs 152 are arranged in recess 322 and contact lateral wall 320. In interaction of flat tabs 152 with one inner wall 324 of recess 322 ultimately prevents a rotation of heat shield 100. This is subsequently described in greater detail. Inner wall 324 is the annular inner wall within recess 322, which delimits recess 322 radially outward. As already mentioned, in particular flat tabs 152 and at least part of curved tabs 154 are arranged in recess 322 (see **Figure 1**). Flat tabs 152 thereby lie flat on side wall 320 of bearing housing 300 extending in this area essentially in the radial direction in recess 322, whereas curved tabs 154 are only in line contact with this side wall 320 and the radially outer ends of curved tabs 154 project out beyond recess 322. By this means, curved tabs 154 arrive in contact with a radial wall 210 of turbine housing 200 during assembly of the exhaust gas turbocharger so that a biasing of heat shield 100 occurs between turbine housing 200 and bearing housing 300. When forces, which would cause a rotation, act on heat shield 100, there is a contact of the outer areas of at least flat tabs 152 with inner wall 324 of recess 322 due to eccentric hole 110, via which heat shield 100 is arranged on dome extension 310 (likewise eccentrically configured). Due to this contact, a rotation of heat shield 100 is prevented.

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[0024] In an alternative embodiment of the exhaust gas turbocharger according to the invention, which is not shown in the figures, turbine housing 200 may have a step, concentric to axis of rotation 500, in which area at least a part of heat shield 100 is arranged, in particular tab area 150. An interaction of tabs 152, 154 with turbine housing 200 in the area of the step then prevents a rotation of heat shield 100. The step thereby fulfils both the task of recess 322 in bearing housing 300 from the first embodiment shown in the figures, and simultaneously functions as a stop surface for curved tabs 154 in order to facilitate a biasing of heat shield 100 between bearing housing 300 and turbine housing 200. Flat tabs 152 thereby lie, as in the first embodiment, again flat on a radial side wall 320 of bearing housing 300, only not in a recess 322 of bearing housing 300, which may be omitted in this embodiment.

30

Although the present invention has been described and is defined in the attached claims, it should be understood that the invention may also be alternatively defined according to the following embodiments:

- 5 1. An exhaust gas turbocharger comprising
a turbine housing (200);
a bearing housing (300);
a rotor (400) which is rotatably mounted in the bearing housing (300) and
defines an axis of rotation (500) of the exhaust gas turbocharger; and
10 a heat shield (100) which is arranged between the turbine housing (200)
and the bearing housing (300),
characterized in that the heat shield (100) has a central hole (110) for
positioning in the exhaust gas turbocharger; the center (112) of the hole is
positioned eccentric to the axis of rotation (500) to prevent a rotation of the
15 heat shield (100).
2. The exhaust gas turbocharger according to Embodiment 1, characterized in
that the heat shield (100) is configured as pot shaped.
- 20 3. The exhaust gas turbocharger according to Embodiment 1 or Embodiment
2, characterized in that a center axis (160) of the heat shield (100)
coincides with the axis of rotation (500) of the exhaust gas turbocharger.
4. The exhaust gas turbocharger according to Embodiment 3, characterized in
25 that the center (112) of the hold (110) has a distance (d1) to the center axis
(160) of at least 0.5 mm, preferably 0.5 to 3.5 mm, in particular from 1
mm to 2 mm.
5. The exhaust gas turbocharger according to any one of the preceding
30 embodiments, characterized in that the bearing housing (300) has an
axially extending dome extension (310).

6. The exhaust gas turbocharger according to Embodiment 5, characterized in that the dome extension (310) is arranged at least partially in the hole (110).
- 5 7. The exhaust gas turbocharger according to Embodiment 5 or Embodiment 6, characterized in that the dome extension (310) is arranged about the axis of rotation (500) of the turbocharger, wherein an outer surface (312) of the dome extension (310) describes a cylinder with a cylinder axis (314) which is arranged eccentric to the axis of rotation (500).
- 10 8. The exhaust gas turbocharger according to Embodiment 7, characterized in that an inner surface (316) of the dome extension (310) describes a cylinder or a cone which is arranged concentric to the axis of rotation (500).
- 15 9. The exhaust gas turbocharger according to Embodiment 7 or Embodiment 8, characterized in that the cylinder axis (314) of the outer surface (312) has a distance (d2) to the axis of rotation of at least 0.5 mm, preferably 0.5 to 3.5 mm, in particular from 1 mm to 2 mm.
- 20 10. The exhaust gas turbocharger according to any one of Embodiments 7 through 9, characterized in that the distances (d1, d2) of the cylinder axis (314) of the outer surface (312) of the dome extension (310) to the axis of rotation (500) and of the center (112) of the hole (110) to the axis of rotation (500) are aligned with one another, in particular, are
- 25 approximately the same size.
- 30 11. The exhaust gas turbocharger according to any one of the preceding embodiments, characterized in that the heat shield (100) has a plurality of tabs (152, 154) in a radially outer area (150).

12. The exhaust gas turbocharger according to Embodiment 11, characterized in that the plurality of tabs (152, 154) comprises at least one flat tab (152) and at least one curved tab (154).
- 5 13. The exhaust gas turbocharger according to Embodiment 11 or Embodiment 12, characterized in that a recess (322), concentric to the axis of rotation (500), is provided in one side wall (320) of the bearing housing (300), in particular wherein at least the flat tabs (152) are arranged in the recess (322) and contact the side wall (320), wherein an interaction of at
10 least the flat tabs (152) with an inner wall (324) of the recess prevents a rotation of the heat shield (100).
14. The exhaust gas turbocharger according to Embodiment 11 or Embodiment 12, characterized in that the turbine housing has a step,
15 concentric to the axis of rotation (500), in which area at least a part of the heat shield (100) is arranged, wherein an interaction of the tabs (152, 154) with the turbine housing in the area of the step prevents a rotation of the heat shield (100).
- 20 15. The exhaust gas turbocharger according to any one of Embodiments 11 through 14, characterized in that notches (156) are provided between the tabs (152, 154).
16. The exhaust gas turbocharger according to any one of Embodiments 12
25 through 15, characterized in that two, three, four, or more flat tabs (152) are provided.
17. The exhaust gas turbocharger according to any one of Embodiments 12 through 16, characterized in that two, three, four, or more curved tabs
30 (154) are provided.
18. The exhaust gas turbocharger according to any one of Embodiments 12 through 17, characterized in that the flat tabs (152) and the curved tabs

(154) are arranged distributed uniformly and alternately along the periphery of the heat shield (100).

19. The exhaust gas turbocharger according to any one of Embodiments 12
5 through 18, characterized in that the curved tabs (154) are curved in the direction toward turbine housing (200) and away from bearing housing (300).

20. The exhaust gas turbocharger according to any one of Embodiments 12
10 through 18, characterized in that the curved tabs (154) are curved in the direction toward bearing housing (300) and away from turbine housing (200).

Claims

1. An exhaust gas turbocharger comprising
a turbine housing (200);
5 a bearing housing (300);
a rotor (400) which is rotatably mounted in the bearing housing (300) and
defines an axis of rotation (500) of the exhaust gas turbocharger; and
a heat shield (100) which is arranged between the turbine housing (200)
and the bearing housing (300),
10 characterized in that the heat shield (100) has a central hole (110) for
positioning in the exhaust gas turbocharger; the center (112) of the hole is
positioned eccentric to the axis of rotation (500) to prevent a rotation of the
heat shield (100).
- 15 2. The exhaust gas turbocharger according to Claim 1, characterized in that a
center axis (160) of the heat shield (100) coincides with the axis of rotation
(500) of the exhaust gas turbocharger.
3. The exhaust gas turbocharger according to Claim 2, characterized in that
20 the center (112) of the hole (110) has a distance (d1) to the center axis
(160) of at least 0.5 mm, preferably 0.5 to 3.5 mm, in particular from 1
mm to 2 mm.
4. The exhaust gas turbocharger according to any one of the preceding
25 claims, characterized in that the bearing housing (300) has an axially
extending dome extension (310).
5. The exhaust gas turbocharger according to Claim 4, characterized in that
30 the dome extension (310) is arranged about the axis of rotation (500) of the
turbocharger, wherein an outer surface (312) of the dome extension (310)
describes a cylinder with a cylinder axis (314) which is arranged eccentric
to the axis of rotation (500).

6. The exhaust gas turbocharger according to Claim 5, characterized in that the cylinder axis (314) of the outer surface (312) has a distance (d2) to the axis of rotation of at least 0.5 mm, preferably 0.5 to 3.5 mm, in particular from 1 mm to 2 mm.
- 5
7. The exhaust gas turbocharger according to Claim 5 or Claim 6, characterized in that the distances (d1, d2) of the cylinder axis (314) of the outer surface (312) of the dome extension (310) to the axis of rotation (500) and of the center (112) of the hole (110) to the axis of rotation (500) are aligned with one another, in particular, are approximately the same size.
- 10
8. The exhaust gas turbocharger according to any one of the preceding claims, characterized in that the heat shield (100) has a plurality of tabs (152, 154) in a radially outer area (150).
- 15
9. The exhaust gas turbocharger according to Claim 8, characterized in that the plurality of tabs (152, 154) comprises at least one flat tab (152) and at least one curved tab (154).
- 20
10. The exhaust gas turbocharger according to Claim 8 or Claim 9, characterized in that a recess (322), concentric to the axis of rotation (500), is provided in one side wall (320) of the bearing housing (300), in particular wherein at least the flat tabs (152) are arranged in the recess (322) and contact the side wall (320), wherein an interaction of at least the flat tabs (152) with an inner wall (324) of the recess prevents a rotation of the heat shield (100).
- 25
11. The exhaust gas turbocharger according to Claim 8 or Claim 9, characterized in that the turbine housing has a step, concentric to the axis of rotation (500), in which area at least a part of the heat shield (100) is arranged, wherein an interaction of the tabs (152, 154) with the turbine housing in the area of the step prevents a rotation of the heat shield (100).
- 30

12. The exhaust gas turbocharger according to any one of Claims 8 through 11, characterized in that notches (156) are provided between the tabs (152, 154).
- 5 13. The exhaust gas turbocharger according to any one of Claims 9 through 12, characterized in that two, three, four, or more flat tabs (152) are provided.
- 10 14. The exhaust gas turbocharger according to any one of Claims 9 through 13, characterized in that two, three, four, or more curved tabs (154) are provided.
- 15 15. The exhaust gas turbocharger according to any one of Claims 9 through 14, characterized in that the flat tabs (152) and the curved tabs (154) are arranged distributed uniformly and alternatingly along the periphery of the heat shield (100).

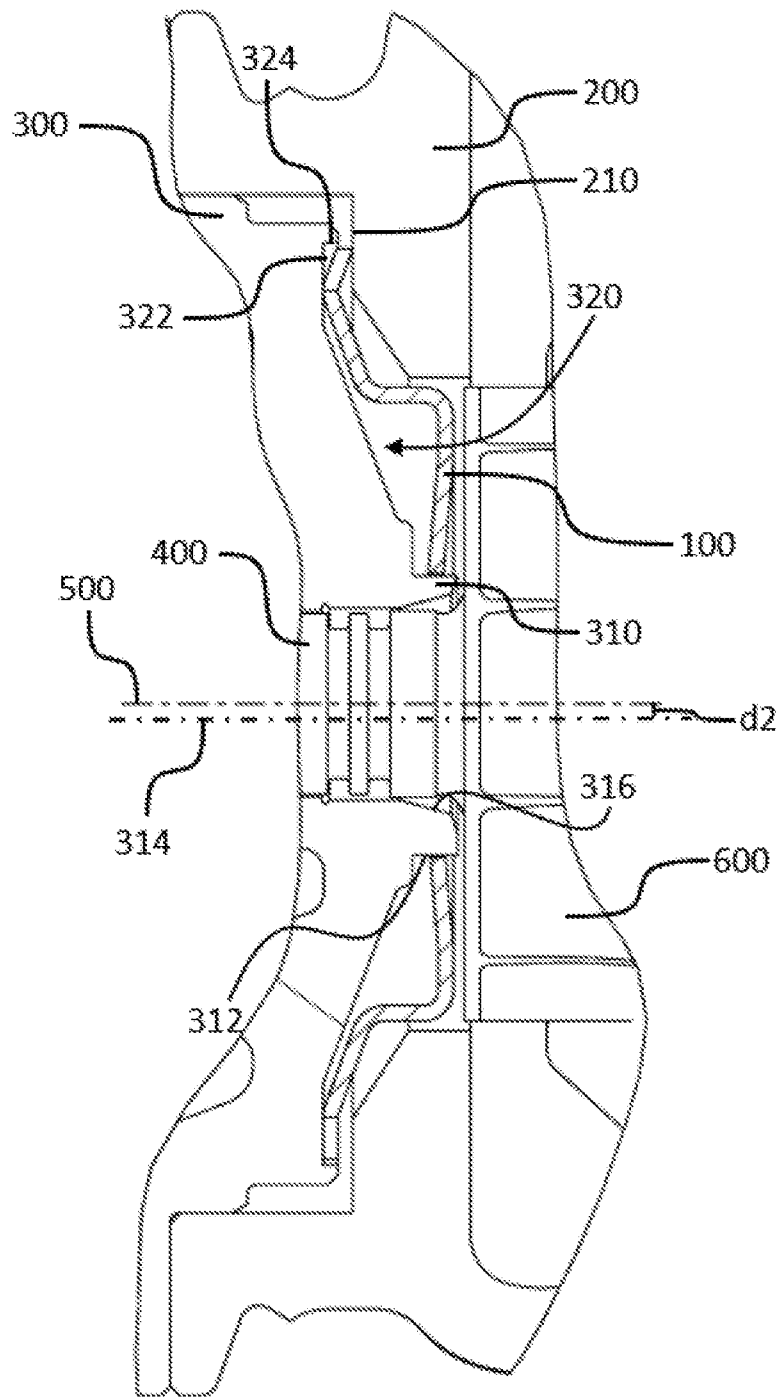


Fig. 1

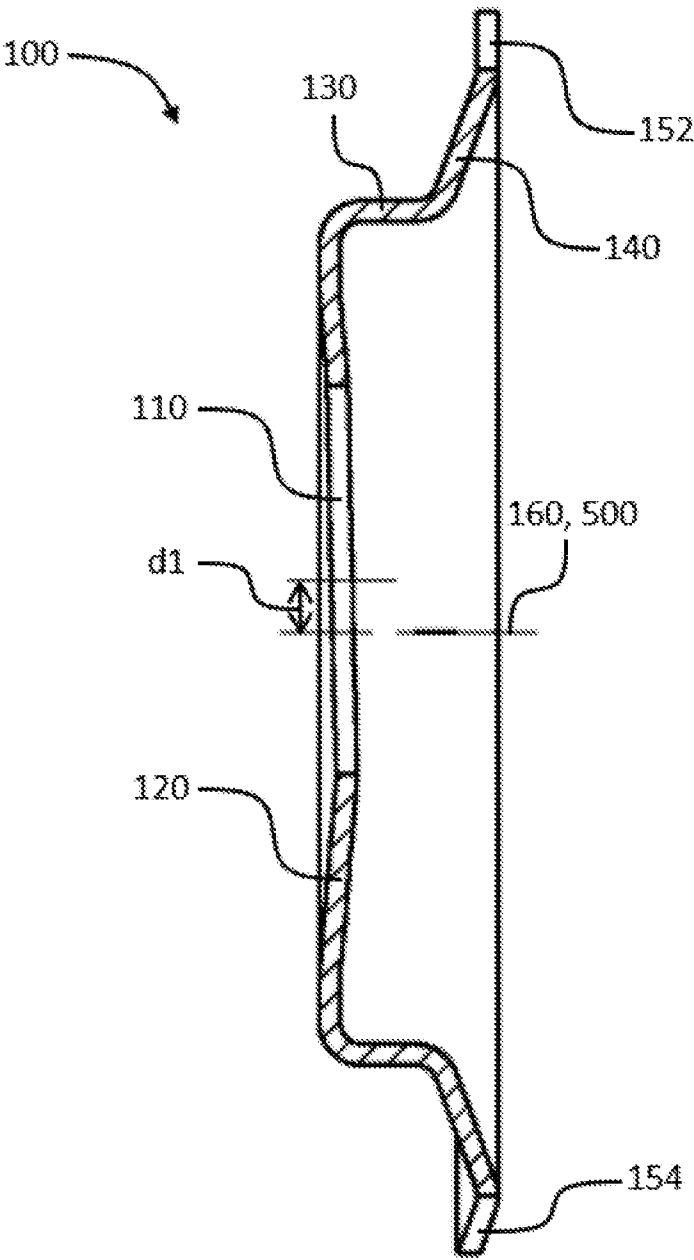


Fig. 2

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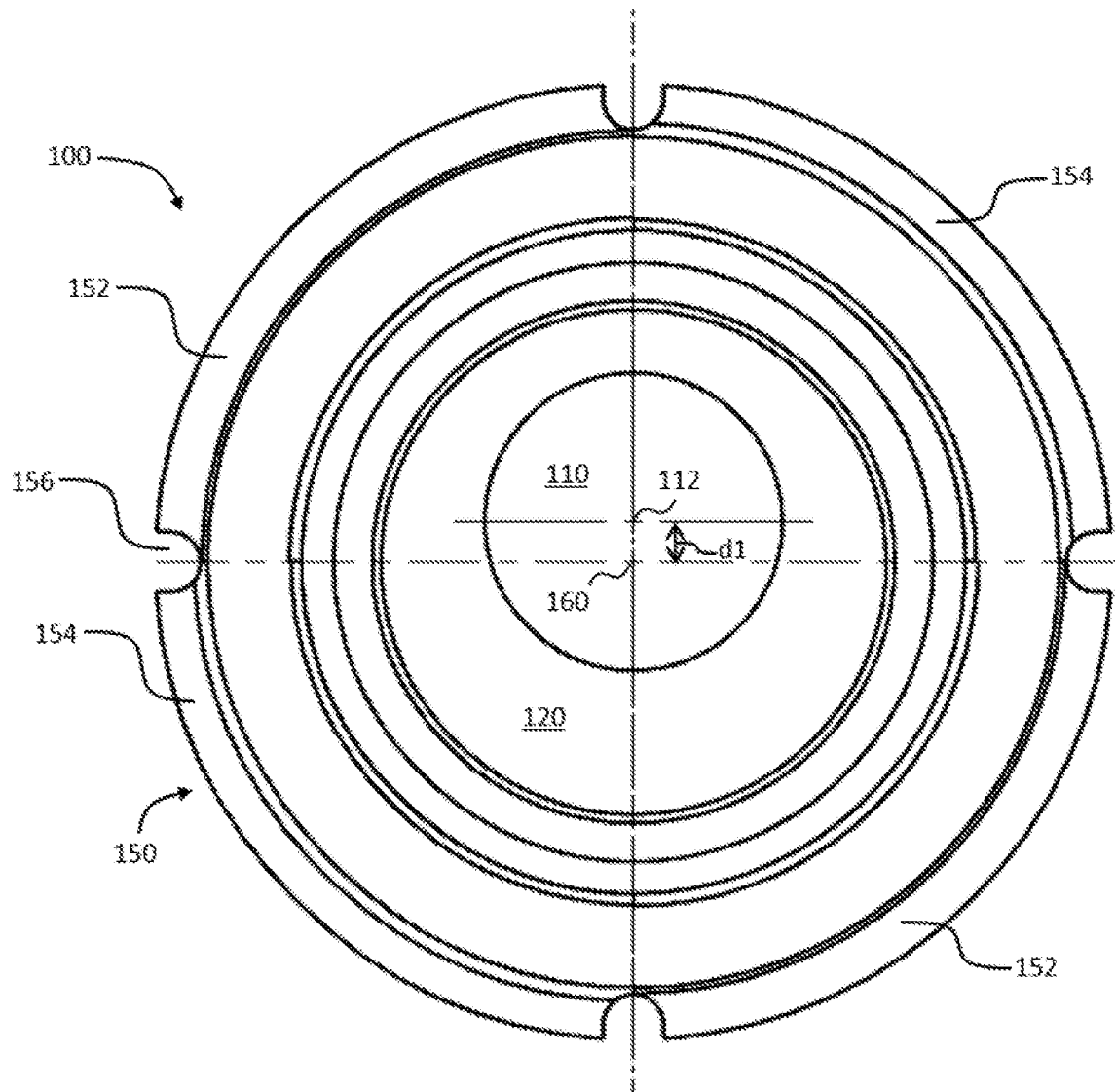


Fig. 3

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2018/028988

A. CLASSIFICATION OF SUBJECT MATTER
INV. F02C6/12
ADD.

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)
F02C

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

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

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2006/046892 A1 (VOLVO LASTVAGNAR AB [SE]; GISELMO KENT [SE]) 4 May 2006 (2006-05-04)	1,2,4
Y	figures 1-3 abstract page 2, line 26 - page 3, line 35	3,8-15
Y	DE 10 2015 113393 A1 (IHI CHARGING SYSTEMS INT GMBH [DE]) 16 February 2017 (2017-02-16) paragraph [0046] - paragraph [0069]; figures 3-5, 12, 15-18	3,8-15
A	EP 2 098 703 A1 (HONEYWELL INT INC) 9 September 2009 (2009-09-09) paragraph [0033] - paragraph [0035]; figures 5-8 ----- -/-	1-15



Further documents are listed in the continuation of Box C.



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"&" document member of the same patent family

Date of the actual completion of the international search

26 June 2018

Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 1 785 613 A2 (MITSUBISHI HEAVY IND LTD [JP]) 16 May 2007 (2007-05-16) paragraph [0048]; figure 2 -----	1-15

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2018/028988

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2006046892	A1	04-05-2006	NONE
DE 102015113393	A1	16-02-2017	NONE
EP 2098703	A1	09-09-2009	CN 101532401 A 16-09-2009
		EP 2098703 A1	09-09-2009
		EP 2284374 A1	16-02-2011
		US 2009226307 A1	10-09-2009
		US 2011274535 A1	10-11-2011
EP 1785613	A2	16-05-2007	BR PI0604300 A 21-08-2007
		CN 1952361 A	25-04-2007
		EP 1785613 A2	16-05-2007
		JP 4468286 B2	26-05-2010
		JP 2007113501 A	10-05-2007
		KR 20070043599 A	25-04-2007
		US 2007089414 A1	26-04-2007