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

(72) Inventors: **RADKE, Urban**; Kreuzstrasse 14, 66892 Bruchmuehlbach-Miesau (DE). **OSMANOVIC, Nermin**; An den Hofaekern 7b, 67297 Mannheim (DE).

(74) Agents: **PENDORF, Stephan A.** et al.; Patent Central LLC, 1401 Hollywood Blvd., Hollywood, FL 33020 (US).

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Declarations under Rule 4.17:

— as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))

[Continued on next page]

(54) Title: EXHAUST-GAS TURBOCHARGER

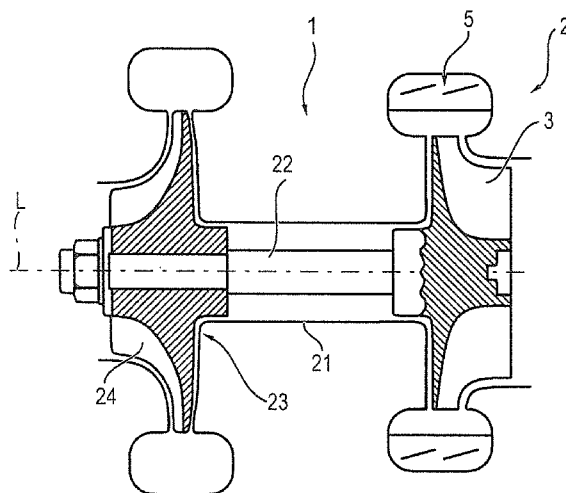


FIG. 1

(57) Abstract: The invention relates to an exhaust-gas turbocharger (1) having a turbine (2), which has a turbine wheel (3) surrounded by an intake duct (4), and having a VTG cartridge (5), which has a washer (6) and a vane bearing ring (7), which delimit the intake duct (4), and which has a plurality of vanes (8), which are arranged in the intake duct (4) and are mounted in the vane bearing ring (7) by way of rotatable vane shafts (9), which are connected to vane levers (10), the lever heads (11) of which engage into associated grooves (12) in a unison ring (13), which surrounds the vane bearing ring (7) on the outside, and which has a radial bearing between the vane bearing ring (7) and the unison ring (13), wherein the radial bearing has at least one pin (14), which is fixed on the vane bearing ring (7) and onto which a rolling roller (15) is placed, against which an inner wall region (16) of the unison ring (13) bears.



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- *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))*

## EXHAUST-GAS TURBOCHARGER

## DESCRIPTION

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

In the case of such an exhaust-gas turbocharger, provision is made of a variable turbine geometry (VTG), in which guide vanes are adjusted by means of a unison ring. The unison ring is in this respect mounted circumferentially by way of a radial bearing on the vane bearing ring.

10 It is an object of the present invention to provide an exhaust-gas turbocharger of the type indicated in the preamble of claim 1 which has a radial bearing with a simple design which can quickly and easily be mounted.

This object is achieved by the features of claim 1.

15 According to the invention, a pin/rolling roller arrangement is provided as the radial bearing. The pin is in this case fixed on the vane bearing ring. The rolling roller is placed onto the pin and, in the mounted state, an inner wall region of the unison ring is supported on the rolling roller mounted rotatably on the pin.

The dependent claims contain advantageous developments of the invention.

20 Claims 9 and 10 define a VTG cartridge according to the invention as an object which can be marketed independently.

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

25 Figure 1 shows a schematically greatly simplified illustration of an exhaust-gas turbocharger according to the invention,

Figure 2 shows a plan view of a first embodiment of a VTG cartridge according to the invention,

Figure 3 shows a perspective view of the VTG cartridge shown in Figure 2, and

30 Figure 4 shows a sectional partial illustration of the VTG cartridge according to the invention shown in Figures 2 and 3.

Figure 1 shows a schematically greatly simplified basic illustration of an exhaust-gas turbocharger 1 according to the invention, which has a charger axis of rotation L.

5 The exhaust-gas turbocharger 1 also has a turbine 2, which comprises a turbine wheel 3 surrounded by an intake duct 4, which is provided with a so-called VTG cartridge 5. This VTG cartridge 5 will be described in detail hereinbelow with reference to Figures 2 to 4.

10 The exhaust-gas turbocharger 1 also of course has all the other common parts of an exhaust-gas turbocharger, such as a rotor 22, which is mounted rotatably in a bearing housing 21 and which bears the turbine wheel 3 at one end and a compressor wheel 24 of a compressor 23 at the other end. These parts are likewise shown only in schematically greatly simplified form in Figure 1, since they are not of importance for explaining the principles of the present invention.

15 The VTG cartridge, which, as mentioned, will be explained in detail hereinbelow with reference to Figures 2 to 4, is likewise shown in greatly schematically simplified form.

20 A VTG cartridge is understood to mean a structural unit which, between a vane bearing ring 7 and a washer 6, delimits an intake duct 4 for the passage of exhaust gases to the turbine wheel 3. Furthermore, a VTG cartridge 5 of this type has a plurality of vanes, which are arranged in the intake duct 4 and of which Figures 3 and 4 show one vane designated 8 as a representative example of all vanes bearing the corresponding reference numeral. The vanes 8 can be moved rotatably in the vane bearing ring 7 between a closed and an open position. For this purpose, the vanes 8 have vane shafts 9 each having an axis of rotation. The vane shafts 9 in turn are  
25 connected to vane levers 10, of which two vane levers are denoted in each case in Figures 2 and 3 with the reference numeral 10. As Figures 2 and 3 show, the embodiment shown there has 10 such, preferably cranked vane levers, in each case of identical design.

30 Each vane lever 10 has a lever head 11, which engages into an associated groove 12 in a unison ring 13. Figure 2 above all shows in this respect that the unison ring 13 surrounds the vane bearing ring 7 on the outside, i.e. along the outer circumference thereof.

For radially mounting the unison ring 13, provision is made of a radial bearing, which according to the invention is formed by at least one pin 14 fixed on the vane bearing ring 7. A rolling roller 15, against which an inner wall region 16 of the unison ring 13 bears, is placed onto the pin 14.

5           The pin 14 is preferably butt-welded onto the vane bearing ring 7, which is evident in particular from the illustration in Figure 4, the pin 14 having a small journal 17 which serves to ignite the arc upon welding and in the process completely melts down, such that the pin 14 is joined to the vane bearing ring 7 in an abutting manner.

10           A lock washer 18 is fixed to the free end 20 of the pin 14 and, in a particularly preferred embodiment, is fastened to the end 20 of the pin 14 at a distance A (see Figure 4) from the upper side OS of the rolling roller.

15           As Figures 2 and 3 illustrate, in this particularly preferred embodiment a total of three pin/rolling roller pairs denoted by the reference numerals 14, 14', 14'' and 16, 16', 16'' are provided as the radial bearing. Furthermore, a lock washer 18, 18', 18'' is of course assigned to each of these pairs.

Finally, Figures 3 and 4 show that the vane levers 10 have a cranked form, since the plane of the grooves 12 into which the lever heads 11 engage is offset in relation to the upper side of the vane bearing ring 7, as is evident in particular from Figure 4.

20           In addition to the above written disclosure, reference is hereby explicitly made to the illustrative representation of the invention in Figures 1 to 4 to supplement the disclosure of the invention.

## LIST OF REFERENCE SIGNS

	1	Exhaust-gas turbocharger
	2	Turbine
5	3	Turbine wheel
	4	Intake duct
	5	VTG cartridge
	6	Washer
	7	Vane bearing ring
10	8	Vanes
	9	Vane shafts
	10	Vane lever
	11	Lever heads
	12	Grooves
15	13	Unison ring
	14, 14', 14''	Pin
	15, 15', 15''	Rolling roller
	16	Inner wall region
	17	Journal
20	18, 18', 18''	Lock washer
	19	Weld
	20	End of the pin 14
	OS	Upper side
	L	Charger longitudinal axis
25	A	Distance

## CLAIMS

1. An exhaust-gas turbocharger (1)
  - having a turbine (2),
    - 5 • which has a turbine wheel (3) surrounded by an intake duct (4),  
and
  - having a VTG cartridge (5),
    - which has a washer (6) and a vane bearing ring (7), which  
delimit the intake duct (4), and
    - 10 • which has a plurality of vanes (8), which are arranged in the  
intake duct (4) and are mounted in the vane bearing ring (7) by  
way of rotatable vane shafts (9), which are connected to vane  
levers (10), the lever heads (11) of which engage into associated  
grooves (12) in a unison ring (13), which surrounds the vane  
15 bearing ring (7) on the outside, and
    - which has a radial bearing between the vane bearing ring (7) and  
the unison ring (13),  
wherein
  - the radial bearing has at least one pin (14), which is fixed on the vane  
20 bearing ring (7) and onto which a rolling roller (15) is placed, against  
which an inner wall region (16) of the unison ring (13) bears.
2. The exhaust-gas turbocharger as claimed in claim 1, wherein the pin  
(14) is butt-welded onto the vane bearing ring (7).
- 25 3. The exhaust-gas turbocharger as claimed in claim 1 or 2, wherein a lock  
washer (18) is fastened on the free end (20) of the pin (14).
4. The exhaust-gas turbocharger as claimed in one of claims 1 to 3,  
30 wherein the lock washer (18) is fastened on the free end (20) at a defined distance (A)  
from the upper side (OS) of the rolling roller.

5. The exhaust-gas turbocharger as claimed in claim 3 or 4, wherein the lock washer (18) is fastened on the end (20) by means of a weld (19).

6. The exhaust-gas turbocharger as claimed in one of claims 1 to 5,  
5 wherein the radial bearing has three pins (14, 14', 14'') and rolling rollers (15, 15', 15'') placed onto the latter.

7. The exhaust-gas turbocharger as claimed in claim 6, wherein the pin/rolling roller pairs are arranged at identical angular distances circumferentially on  
10 the vane bearing ring (7).

8. The exhaust-gas turbocharger as claimed in one of claims 1 to 7, wherein the vane levers (10) are cranked.

15 9. A VTG cartridge (5) of an exhaust-gas turbocharger (1),  
- having a washer (6) and a vane bearing ring (7), which delimit an intake duct (4),  
- having a plurality of vanes (8), which are arranged in the intake duct (4) and are mounted in the vane bearing ring (7) by way of rotatable vane  
20 shafts (9), which are connected to vane levers (10), the lever heads (11) of which engage into associated grooves (12) in a unison ring (13), which surrounds the vane bearing ring (7) on the outside, and  
- having a radial bearing between the vane bearing ring (7) and the unison ring (13),  
25 wherein  
- the radial bearing has at least one pin (14), which is fixed on the vane bearing ring (7) and onto which a rolling roller (15) is placed, against which an inner wall region (16) of the unison ring (13) bears.

30 10. The VTG cartridge as claimed in claim 9, characterized by one of claims 2 to 8.



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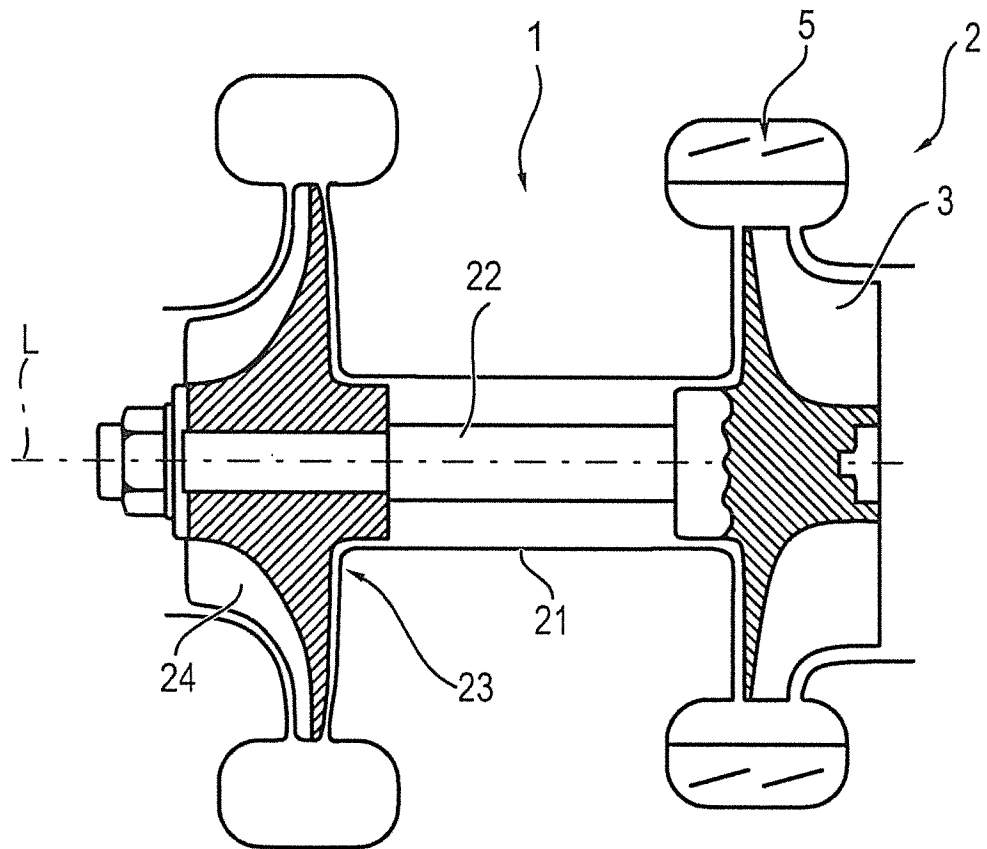


FIG. 1

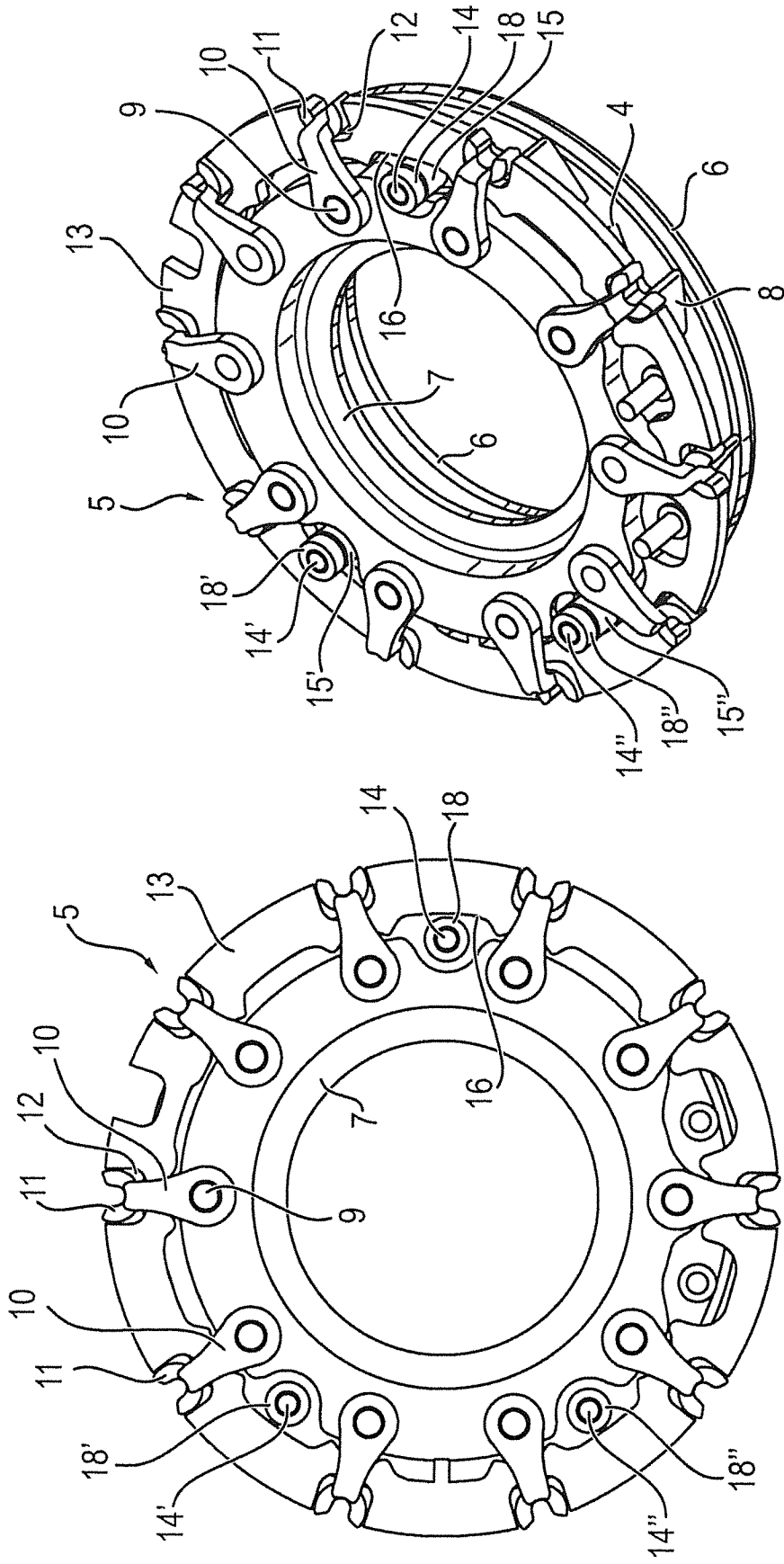


FIG. 2

FIG. 3

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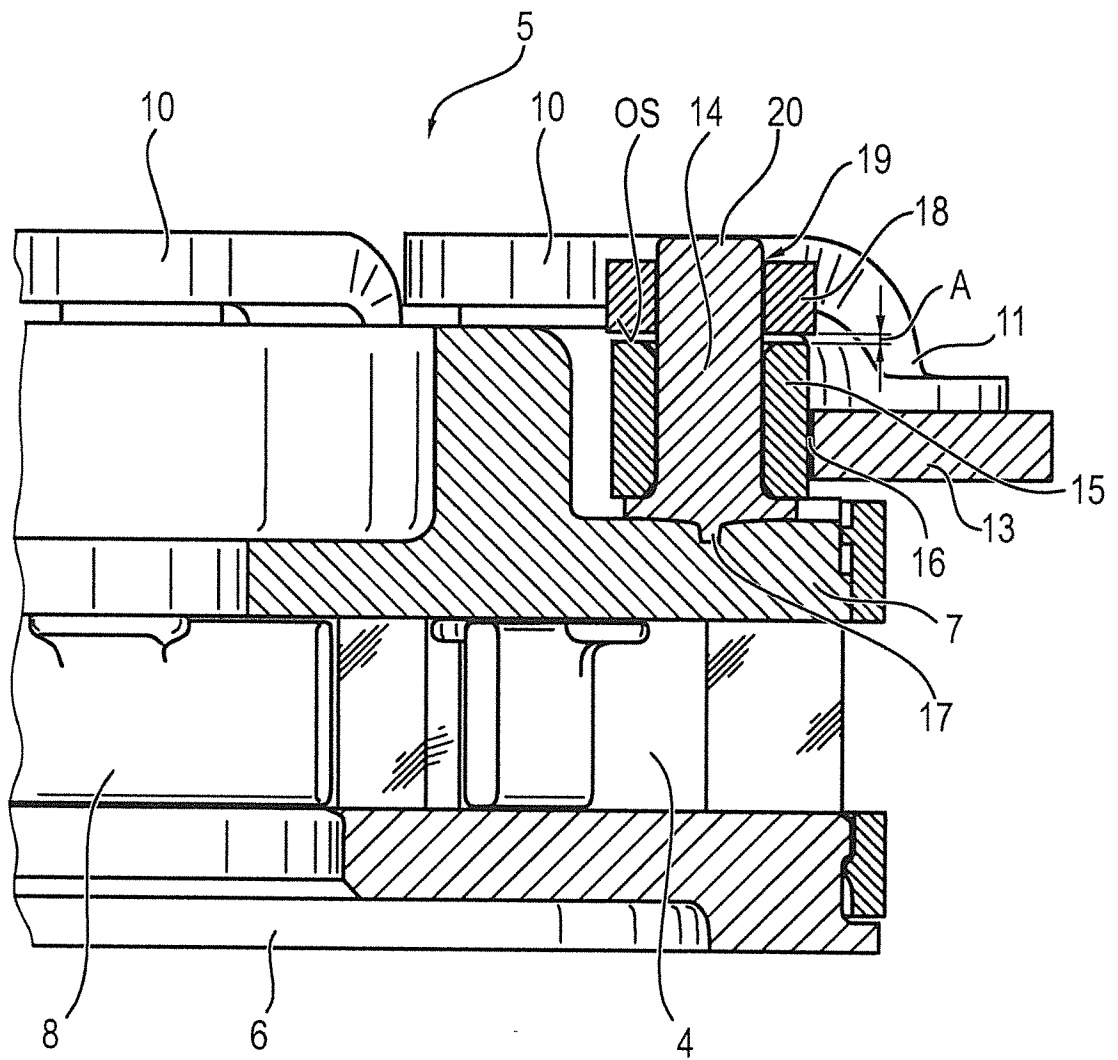


FIG. 4

## INTERNATIONAL SEARCH REPORT

International application No.  
**PCT/US2013/037325****A. CLASSIFICATION OF SUBJECT MATTER****F02B 37/12(2006.01)i, F02B 37/22(2006.01)i, F02B 37/24(2006.01)i, F02B 39/00(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 37/12; F03B 3/18; F01D 17/12; F03B 1/04; F02D 23/00; F01D 1/02; F02B 37/22; F02B 37/24; F02B 39/00

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) &amp; Keywords: turbocharger, turbine, guide vane, adjust, bearing and unison ring

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2008-0240906 A1 (BARTHELET et al.) 02 October 2008 See abstract; paragraphs [0028]-[0033],[0035],[0038],[0039]; figures 1-11.	9
Y		1-8, 10
Y	US 2006-0112690 A1 (HEMER, HANS-JOSEF) 01 June 2006 See abstract; paragraphs [0051]-[0059],[0061],[0063],[0067]; figures 1-8.	1-8, 10
A		9
A	US 2011-0138805 A1 (BARTHELET et al.) 16 June 2011 See abstract; paragraphs [0022]-[0025]; figures 1,2.	1-10
A	US 2004-0096317 A1 (SCHOLZ et al.) 20 May 2004 See abstract; paragraphs [0019]-[0023],[0038]; figures 1-8.	1-10
A	US 4,804,316 A (FLEURY, JEAN-LUC) 14 February 1989 See abstract; column 2 lines 56-67, column 3 lines 16-20,53-66; figures 1-11.	1-10
A	US 2010-0008774 A1 (SCHOLZ et al.) 14 January 2010 See abstract; paragraphs [0051]-[0053]; figures 8-20.	1-10



Further documents are listed in the continuation of Box C.



See patent family annex.

\* Special categories of cited documents:

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"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

"&amp;" document member of the same patent family

Date of the actual completion of the international search

22 July 2013 (22.07.2013)

Date of mailing of the international search report

**23 July 2013 (23.07.2013)**

Name and mailing address of the ISA/KR

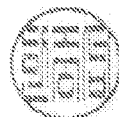
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189 Cheongsu-ro, Seo-gu, Daejeon Metropolitan City,  
302-701, Republic of Korea

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/US2013/037325**

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