(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 806 113 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
26.11.2014 Bulletin 2014/48

(51) Int Cl.:
F01D 25/16 *(2006.01)* ***F01D 25/30*** *(2006.01)*

(21) Application number: **13169126.3**

(22) Date of filing: **24.05.2013**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

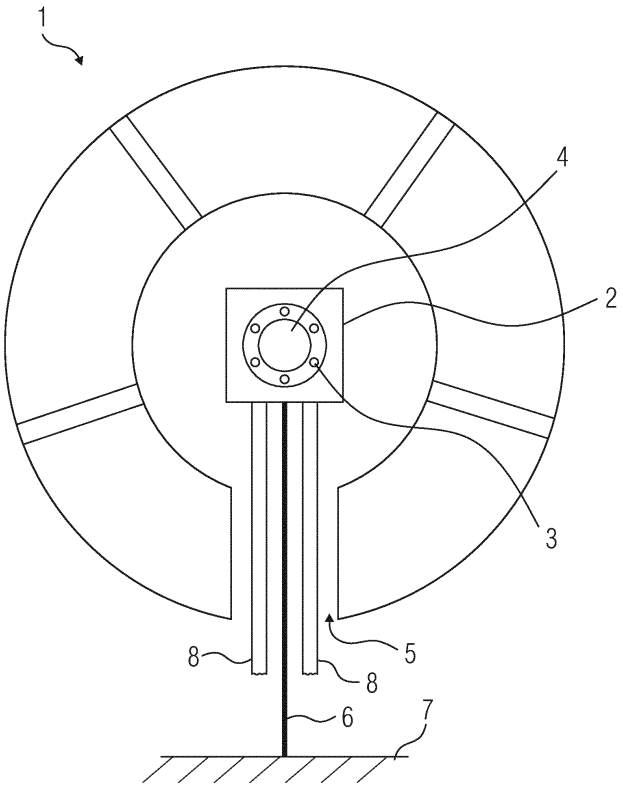
(71) Applicant: **Siemens Aktiengesellschaft**
80333 München (DE)

(72) Inventor: **Chadha, Pankaj**
121003 Faridabad (IN)

(54) An exhaust casing of a turbomachine and a method for assembling the exhaust casing into the turbomachine

(57) An exhaust casing (1) of a turbo-machine includes a bearing housing (2), an opening (5) and a housing damping element (6). The bearing housing (2) includes bearings (3); the bearing housing (2) mechanically couples to a rotor (4) of the turbo-machine. The opening (5) allows access from an outer environment into the exhaust casing (1) up to the bearing housing (2). The housing damping element (6) elongate through the opening (5) and mechanically couples a surface (7) in the outer environment and a surface of the bearing housing (2) and it resistively compresses or decompress whenever the exhaust casing (1) vibrates.

FIG 2



EP 2 806 113 A1

Description

[0001] The invention relates to an exhaust casing of a turbo-machine. More specifically, the invention relates to vibrations in the exhaust casing of the turbo-machine.

[0002] Whenever a turbo-machine is functional, it has a tendency to vibrate due to exciting forces on various parts of the turbo-machine. Such vibrations may be dangerous to the functioning of the turbo-machine and may lead to damage of turbine. More specifically, the vibrations of exhaust casing system may lead to malfunctioning, and even failure of rotor placed into bearing housing of the exhaust casing system. Available possible ways to avoid such vibration of exhaust casing is to employ checks through prior computer simulations, which are not that reliable, especially with various combinations of parts.

[0003] The object of the invention is to manage vibrations of an exhaust casing system of a turbo-machine.

[0004] The object of the invention is achieved by an exhaust casing system of turbo-machine of claim 1 and a method for assembling the exhaust casing into the turbo-machine according to claim 9.

[0005] According to an embodiment of the exhaust casing system, the exhaust casing system includes a bearing housing, an opening into the exhaust casing, and a housing damping element. The bearing housing includes bearings, and is mechanically coupled to a rotor of the turbo-machine. The opening allows access from an outer environment into the exhaust casing up to the bearing housing. The housing damping element elongates through the opening and mechanically couples a surface in the outer environment and a surface of the bearing housing. The housing damping element resistively compresses or decompresses whenever the exhaust casing vibrates along a direction substantially parallel to the elongation of damping element to mechanically couple the surface in the outer environment and the surface of the bearing housing. This helps to reduce vertical vibrations of the exhaust casing system.

[0006] According to another embodiment of the exhaust casing system, wherein the opening provides access to a set of oil pipes leading to the bearing housing. This allows for usage of already available opening of exhaust casing system to be used for placing the housing damping element between the external environment and the bearing housing.

[0007] According to yet another embodiment of the exhaust casing system, the exhaust casing system includes a casing damping element which mechanically couples the surface in the outer environment and a part of the exhaust casing other than the bearing housing. The casing damping element resistively compresses or decompresses whenever the exhaust casing vibrates. This provides for a way to further dampen the vibrations of the exhaust casing.

[0008] According to one embodiment of the exhaust casing system, wherein the part of the exhaust casing other than the bearing housing is an outer surface of the exhaust casing. This provides an easy way for coupling the surface in the outer environment and the part of the exhaust casing other than the bearing housing through the casing damping element. It also eases maintenance of the exhaust casing for replacing the casing damping element.

[0009] According to another embodiment of the exhaust casing system, wherein the outer surface of the exhaust casing lies at an exhaust side of the exhaust casing. It provides wholesome support for reducing vibrations of the exhaust casing. According to yet another embodiment of the exhaust casing system, the exhaust casing system includes a plurality of casing damping elements which mechanically couples the surface in the outer environment and the other part of the exhaust casing and resistively compresses or decompresses whenever the exhaust casing vibrates. Presence of couplings of the surface in the outer environment and the other part of the exhaust casing by multiples casing damping element further reduces the vibrations of the exhaust casing.

[0010] According to one embodiment of the exhaust casing system, wherein the surface in the outer environment is a base frame of the turbo-machine. Creating mechanical coupling between a base frame of turbo-machine and the exhaust casing provides for reduction of vibrations of the exhaust casing without support from elements external to the turbo-machine.

FIG 1 shows front view of the exhaust casing system with damping elements.

FIG 2 shows partial internal view of the exhaust casing system with damping elements.

[0011] The embodiments herein and the various features and advantageous details thereof are explained more fully with reference to the non-limiting embodiments that are illustrated in the accompanying drawings and detailed in the following description. Descriptions of well-known components and processing techniques are omitted so as to not unnecessarily obscure the embodiments herein. The examples used herein are intended merely to facilitate an understanding of ways in which the embodiments herein may be practiced and to further enable those of skill in the art to practice the embodiments herein. Accordingly, the examples should not be construed as limiting the scope of the embodiments herein.

[0012] Further we will discuss the FIG 1 and FIG 2 together for describing a exhaust casing system of a turbo-machine.

[0013] The exhaust casing 1 of a turbo-machine includes a bearing housing 2, an opening 5 into the exhaust casing 1 and a damping element 6.

[0014] The bearing housing 2 includes bearings 3 and is mechanically coupled to a rotor 4 of the turbo-machine for allowing sliding of a shaft of the rotor 4 onto bearing surface. The opening 5 allows access to the housing el-

ement 6 from an outer environment into the exhaust casing 1 up to the bearing housing 2. The housing damping element 6 is assembled to the exhaust casing 1 by elongating through the opening 5 to mechanically couple a surface 7 in the outer environment and a surface of the bearing housing 2. The housing damping element 6 resistively compresses or decompresses whenever the exhaust casing 1 vibrates to providing damping effect to reduce vibrations of the exhaust casing 1.

[0015] The surface 7 in the outer environment is a base frame of the turbo-machine. In an alternate embodiment the surface 7 in the outer environment can be ground or platform on which the turb0-machine is placed.

[0016] While the turbo-machine is functional, it creates vibrations of exhaust casing 1. More specifically, vertical vibrations are required to be taken care of, as the vertical vibrations may cause dislocation of the rotor 4 or may lead to fracture of the rotor 4. To take care of the vertical vibrations, the housing damping element 6 compresses or decompresses, and damps vibrations whenever the exhaust casing 1 vibrates along a direction substantially parallel to the elongation of housing damping element 6 to mechanically couple the surface 7 in the outer environment and the surface of the bearing housing 2.

[0017] It is not required to create a separate opening for allowing access to the housing damping element 6; rather already existing openings 5 of the exhaust casing 1 can be used, like openings which allow oil pipes 8 to reach to the bearing housing 8 can also be used for allowing access to the housing damping element. However, optionally another opening in the exhaust casing 1 can be created to allow access to the housing damping element 6 separately.

[0018] For further reduction of the vibrations of the exhaust casing 1, another damping aspect is introduced, i.e., a casing damping element 9 is also provided which mechanically couples the surface 7 in the outer environment and a part 10 of the exhaust casing 1 other than the bearing housing 2. The casing damping element 9 resistively compresses or decompresses whenever the exhaust casing 1 vibrates. The part 10 of the exhaust casing 1 other than the bearing housing 2 is an outer surface of the exhaust casing 1. More specifically, the outer surface of the exhaust casing lies at an inlet side 11 of the exhaust casing 1. In an alternate embodiment, the outer surface of the exhaust casing can lie on the exhaust side of the exhaust casing. In yet alternate embodiment, the part 10 of the exhaust casing 1 need not be the outer surface of the exhaust casing; rather it can be any part internal to the exhaust casing.

[0019] In an alternate embodiment, the exhaust casing 1 includes plurality of casing damping elements 9 which mechanically couple the outer surface 7 in the outer environment and the part 10 of the exhaust casing 1. The casing damping elements 9 resistively compresses or decompresses whenever the exhaust casing 1 vibrates. This further helps to dampen the vibrations of the exhaust casing 1.

Claims

1. An exhaust casing (1) of a turbo-machine comprising:

   - a bearing housing (2) comprising bearings (3), the bearing housing (2) is adapted to be mechanically coupled to a rotor (4) of the turbo-machine,
   - an opening (5) adapted to allow access from an outer environment into the exhaust casing (1) up to the bearing housing (2),
   - a housing damping element (6) adapted to elongate through the opening (5) to mechanically couple a surface (7) in the outer environment and a surface of the bearing housing (2) and to resistively compress or decompress whenever the exhaust casing (1) vibrates.

2. The exhaust casing (1) according to the claim 1, wherein the housing damping element (6) is adapted to compress or decompress whenever the exhaust casing (1) vibrates along a direction substantially parallel to the elongation of housing damping element (6) to mechanically couple the surface (7) in the outer environment and the surface of the bearing housing (2).

3. The exhaust casing (1) according to the claim 1 or 2, wherein the opening (5) provides access to oil pipes (8) leading to the bearing housing (2).

4. The exhaust casing (1) according to any of the claims 1 to 3 comprising:

   - a casing damping element (9) adapted to mechanically couple the surface (7) in the outer environment and a part (10) of the exhaust casing (1) other than the bearing housing (2) and to resistively compress or decompress whenever the exhaust casing (1) vibrates.

5. The exhaust casing (1) according to the claim 4, wherein the part (10) of the exhaust casing (1) other than the bearing housing (2) is an outer surface of the exhaust casing (1).

6. The exhaust casing (1) according to the claim 5, wherein the outer surface of the exhaust casing lies at an exhaust side (11) of the exhaust casing (1).

7. The exhaust casing (1) according to any of the claims 4 to 6 comprising:

   - a plurality of casing damping elements (9) adapted to mechanically couple the outer surface (7) in the outer environment and the part (10) of the exhaust casing (1) and to resistively

compress or decompress whenever the exhaust casing (1) vibrates.

8. The exhaust casing (1) according to any of the claims 1 to 7, wherein the surface (7) in the outer environment is a base frame of the turbo-machine.

9. A method for assembling an exhaust casing (1) into a turbo-machine comprising:

- providing a bearing housing (2) comprising bearings (3), mechanically coupling the bearing housing (2) to a rotor of the turbo-machine,
- providing an opening (5) into the exhaust casing for allowing access from an outer environment into the exhaust casing (1) up to the bearing housing (2),
- providing a housing damping element (6), elongating the housing damping element (6) from a surface (7) in the outer environment and a surface of the bearing housing (2) through the opening (5), mechanically coupling the surface (7) in the outer environment and the surface of the bearing housing (2) through the housing damping element (6) for resistively compressing or decompressing whenever the exhaust casing (1) vibrates.

10. The method according to claim 9 comprising:

- mechanically coupling the surface (7) in the outer environment and a part (10) of the exhaust casing (1) other than the bearing housing (1) by a casing damping element (9) for resistively compressing or decompressing whenever the exhaust casing (1) vibrates.

11. The method according to the claim according to claim 10 comprising:

- mechanically coupling the surface (7) in the outer environment and an outer surface of the exhaust casing (1) by the casing damping element (9) for resistively compressing or decompressing whenever the exhaust casing (1) vibrates.

12. The method according to the claim according to claim 11 comprising:

- mechanically coupling the surface (7) in the outer environment and the outer surface at an inlet side (11) of the exhaust casing (1) by the casing damping element (9) for resistively compressing or decompressing whenever the exhaust casing (1) vibrates.

13. The method according to the claim according to claim 10 comprising:

- mechanically coupling the surface (7) in the outer environment and the part of the exhaust casing (1) other than the bearing housing (2) by a plurality of casing damping element (9) for resistively compressing or decompressing whenever the exhaust casing (1) vibrates.

14. The method according to any of the claims 10 to 12 comprising:

- mechanically coupling a base frame (7) of the turbo-machine and the part (10) of the exhaust casing (1) other than the bearing housing (2) by the casing damping element (9) for resistively compressing or decompressing whenever the exhaust casing (1) vibrates.

15. The method according to any of the claims 10 to 14 comprising:

- mechanically coupling a base frame (7) of the turbo-machine and the bearing housing (2) by the housing damping element (6) for resistively compressing or decompressing whenever the exhaust casing (1) vibrates.

FIG 1

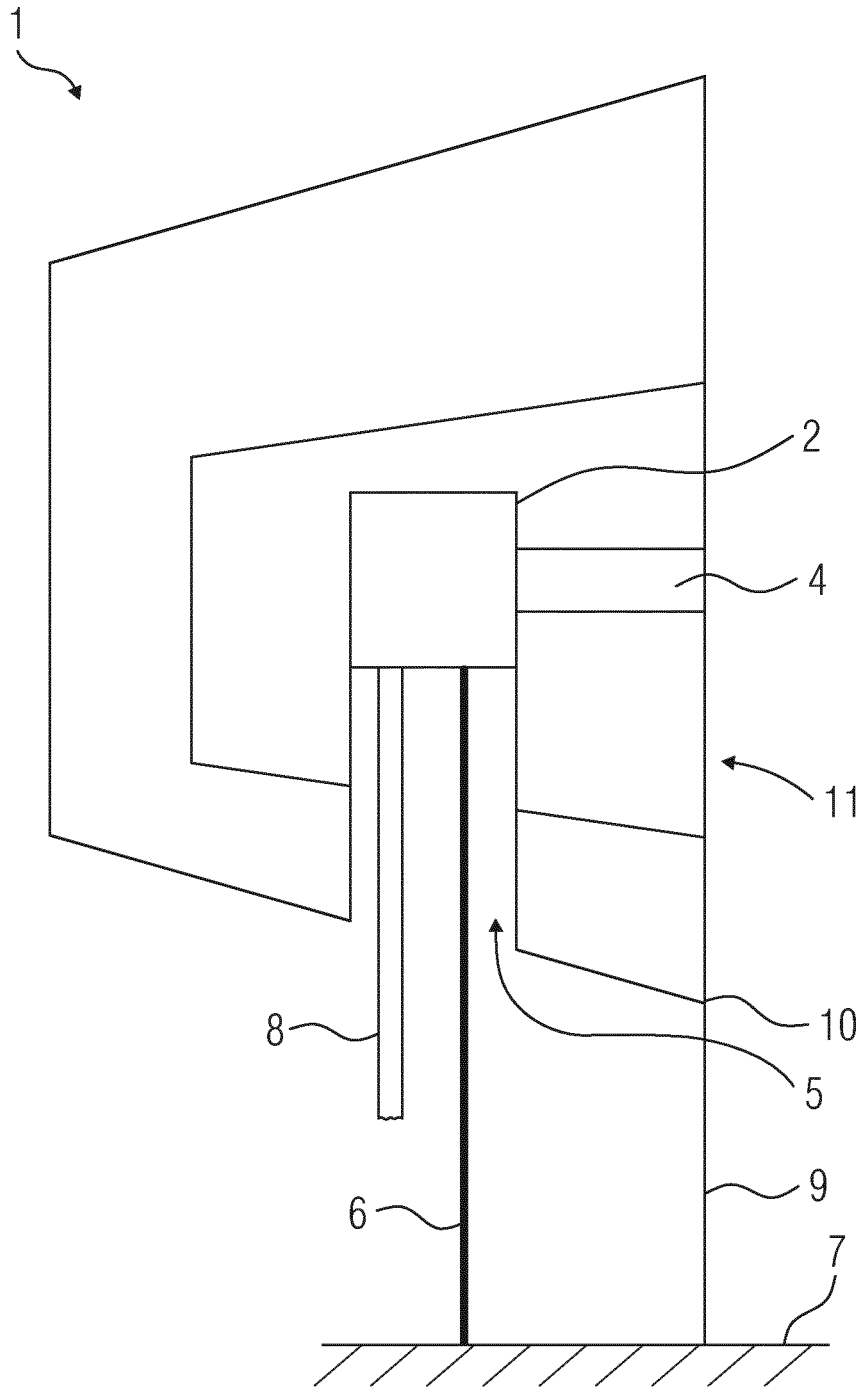
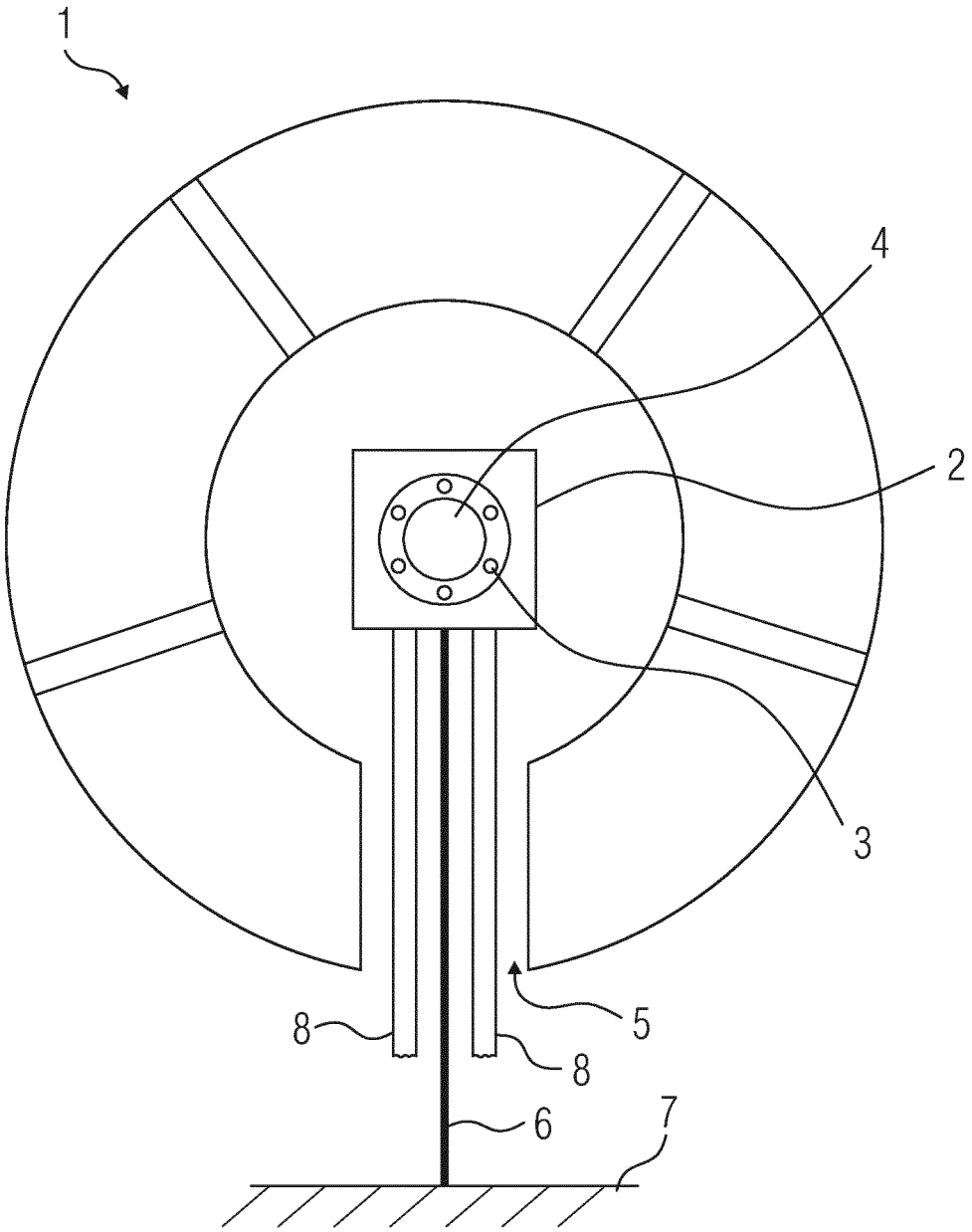


FIG 2



Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 13 16 9126

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2013/064647 A1 (HASHIMOTO SHINYA [JP]) 14 March 2013 (2013-03-14) * paragraph [0028] - paragraph [0045]; figures *	1-15	INV. F01D25/16 F01D25/30
X	US 2010/278465 A1 (KLUSMAN STEVEN ARLEN [US] ET AL) 4 November 2010 (2010-11-04) * paragraph [0035] - paragraph [0041]; figures *	1-15	
X	EP 2 261 468 A1 (MITSUBISHI HEAVY IND LTD [JP]) 15 December 2010 (2010-12-15) * paragraph [0020] - paragraph [0047]; figures *	1-15	
X	US 6 030 176 A (OEYNHAUSEN HEINRICH [DE]) 29 February 2000 (2000-02-29) * column 6, line 24 - column 7, line 57; figures *	1-15	
X	DE 198 42 811 A1 (SIEMENS AG [DE]) 15 July 1999 (1999-07-15) * the whole document *	1-15	TECHNICAL FIELDS SEARCHED (IPC) F01D
X	GB 739 474 A (BLACKBURN & GEN AIRCRAFT LTD; FRANCIS ROBERT BELL) 26 October 1955 (1955-10-26) * the whole document *	1-15	
X	FR 1 437 906 A (UNITED AIRCRAFT CORP) 6 May 1966 (1966-05-06) * the whole document *	1-15	
X	US 2 869 941 A (SHOUP JR EDGAR C ET AL) 20 January 1959 (1959-01-20) * the whole document *	1-15	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	18 November 2013	Teissier, Damien

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 13 16 9126

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

18-11-2013

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2013064647 A1	14-03-2013	CN 103109045 A	15-05-2013
		EP 2610442 A1	03-07-2013
		JP 5222384 B2	26-06-2013
		JP 2013057302 A	28-03-2013
		KR 20130036742 A	12-04-2013
		US 2013064647 A1	14-03-2013
		WO 2013035391 A1	14-03-2013
US 2010278465 A1	04-11-2010	NONE	
EP 2261468 A1	15-12-2010	CN 101978138 A	16-02-2011
		EP 2261468 A1	15-12-2010
		JP 4969500 B2	04-07-2012
		JP 2009243311 A	22-10-2009
		KR 20100116672 A	01-11-2010
		US 2011020116 A1	27-01-2011
		WO 2009119126 A1	01-10-2009
US 6030176 A	29-02-2000	NONE	
DE 19842811 A1	15-07-1999	NONE	
GB 739474 A	26-10-1955	NONE	
FR 1437906 A	06-05-1966	NONE	
US 2869941 A	20-01-1959	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82