



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
02.12.2015 Bulletin 2015/49

(51) Int Cl.:
F01D 25/28 (2006.01) F04D 29/60 (2006.01)

(21) Application number: **15166252.5**

(22) Date of filing: **04.05.2015**

(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
Designated Validation States:
MA

(72) Inventors:
• **Golubic, Damir**
47000 Karlovac (HR)
• **Aratori, Davide**
5415 Nussbaumen (CH)
• **Seng, Daniel**
5453 Busslingen (CH)
• **Rauch, Marc**
4402 Frenkendorf (CH)

(30) Priority: **26.05.2014 EP 14169780**

(71) Applicant: **ALSTOM Technology Ltd**
5400 Baden (CH)

(74) Representative: **Pesce, Michele et al**
ALSTOM Technology Ltd
Brown Boveri Strasse 7
5400 Baden (CH)

(54) **METHOD AND DEVICE FOR MOUNTING AND REMOVING OF A TURBINE COMPONENT**

(57) The disclosure pertains to a mounting arrangement (4) for installing and removing a turbine component (12). The mounting arrangement has a base cage (1a, 1b, 1c), a main cage (2), and an inner structure (3). The base cage (1a, 1b, 1c) comprises an interface (5a, 5b, 5c) for connection to a casing (21) of the turbine, and an interface for connection to the main cage (2). The main cage (2) comprises an inner structure interface (17i, 17ii) for movable connection to the inner structure (3). The

inner structure (3) is arranged at least partly inside the main cage and the inner structure interface (17i, 17ii) is configured to allow a movement of the inner structure (3) along a defined trajectory in the main cage (2). The inner structure (3) comprises a first face of a component interface (18a, 18b) for holding the turbine component (12).

The disclosure further refers to a method for mounting and removing a turbine component (12).

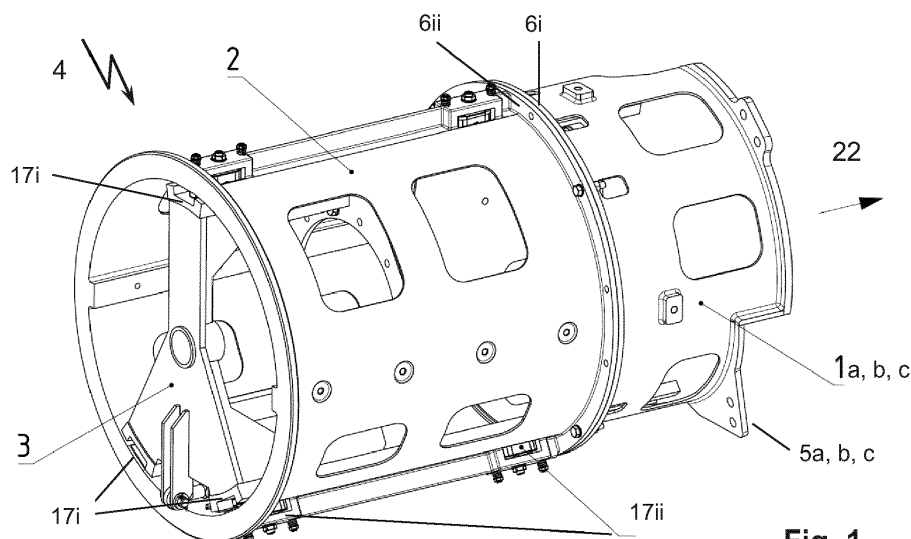


Fig. 1

Description

Technical field

[0001] The present invention relates to a replacing system for large parts or components of a turbine. It is applied for removing or mounting turbine components to inspect or repair these. Further, it relates to a method for removing or mounting turbine components.

Background of the disclosure

[0002] Turbine part or components need to be removed for inspection, repairment or replacement of the parts or components. Such components can for example be burners of a gas turbine for thermal power generation. Burners are typically arranged radially at equal intervals at the middle part of the main body of the gas turbine and are inserted and assembled via flanges thereto. Conventionally, such parts are replaced manually by constructing simple scaffolds after removing pipes and other obstacles around the part and by manipulating an overhead traveling crane to sling the part by workers who get on the scaffolds.

[0003] Parts or components such as burners can be far too heavy to be handled by workers without the use of cranes or other lifting tools. Such a removal and handling is time consuming and it is difficult to maintain an adequate position of the burner during the works in the narrow inner space of the turbine and on the unstable outside scaffolds.

[0004] In order to make this work easier, US patent 5,921,075 discloses a burner replacement system in which a rail is attached at a circumferential flange connection of two axially adjacent parts of the gas turbine housing, wherein a carriage of complex design can be moved along this rail in order to transport the burner to be installed. The carriage is equipped with an articulation and with a burner carrier which can be displaced in translation such that it can transport individual burners of the gas turbine to their intended location. With the aid of the known burner replacement system, the transition pipes can also be removed from inside the gas turbine or inserted inside the gas turbine. A disadvantage of the known device is, however, that it is very large and requires a comparatively large maneuvering space around the turbine housing. However, this maneuvering space is not always available. A further disadvantage of the known device is that, on account of the comparatively long and free-ending rod assembly on the carriage, and the considerable weights of the components to be replaced, such as burners and transition pipes, these can only be positioned with insufficient precision with respect to the component opening through which they are to be introduced into the turbine.

Summary of the disclosure

[0005] The object of the present disclosure is to provide a mounting arrangement for installing and removing a component on or in a turbine, which mounting arrangement, on one hand, is compact and, on the other hand, allows exact-fit positioning of the relevant component on or in the turbine. It is a further object of the disclosure to provide a method for mounting and removing a part or component of a turbine, which method can be carried out quickly without a particularly large installation space requirement.

[0006] According to a first embodiment a mounting arrangement for a turbine component comprises a base cage, a main cage and an inner structure. The base cage comprises a first face of a casing interface for connection of the base cage to a casing of the turbine, and first face of a main cage interface for connection to the main cage. The main cage comprises a second face of the main cage interface for connection to the base cage, and a first face of an inner structure interface for movable connection of an inner structure to the main cage. The inner structure is arranged at least partly inside the main cage and has a second face of the inner structure interface for movable connection to the main cage. The inner structure interface is configured for moving the inner structure along a defined trajectory in the main cage. Further, the inner structure comprises a first face of a component interface for holding the turbine component.

[0007] The first face of the casing interface for connection of the base cage to the casing of the turbine can be a flange for ridged connection of the base cage to the casing. The first and second face of the main cage interface and of the can also be flanges for a ridged connection of the main cage to the base cage. The interfaces can also comprise other connection types like for example clamps, plug connection, bar or framework connections or toothed connections. Any other type of ridged connection is also possible. Also a connection using a strong magnet for fixation of the arrangement to the casing or for fixation of components of the arrangement to each other is conceivable.

[0008] The main cage and base cage can for example have a cylindrical structure with a tube like outer wall and hollow inside. The cages can also have a framework structure or be constructed based on a cantilever arrangement. A component can for example be a combustor, burner or transition piece of a gas turbine. It can be also be an internal valve of a turbine or any part or assembly of part, which typically is too heavy for manual handling.

[0009] The trajectory along which the inner structure is moved relative to the main cage can for example be a straight line; it can also be a curved line to move the turbine component around obstacles when inserting it into the casing or removing it from the casing.

[0010] According to one embodiment the mounting arrangement comprises a plurality of base cages. Each

base cage has one first face of the casing interface adapted for connection to different contours of different sections of the turbine casing.

[0011] In a further embodiment the inner structure of the mounting arrangement comprises a sledge. The sledge can be moved relative to the main cage and base cage.

[0012] According to yet another embodiment of the mounting arrangement the inner structure interface comprises a rail roller system which guides the inner structure, in particular the sledge, inside the main cage. Preferably the rail roller system has three rail roller pairs. One rail roller pair is in vertically top position of the main cage and two rail roller pairs are in a lower half of the cage spaced apart from a vertical bottom position. The lower rails can be inclined towards the vertical top position. Alternatively the a rail roller system has a rail roller pair in a vertical bottom position of the main cage and two rail roller pairs in an upper half of the main cage spaced apart from a vertical top position. The upper rails can be inclined towards the vertical bottom position.

[0013] The inner structure can for example be a y-shaped sledge with a single leg towards the top and two legs angled apart towards the bottom.

[0014] The rail roller pairs can for example be arranged along a rail extending in an axial direction of the inner structure and rollers pressed against the rail at two or more axial spaced apart locations.

[0015] In yet another embodiment of the mounting arrangement the rail roller system comprises two planes spaced apart along a longitudinal axis of the inner structure. In each plane three roller rail pairs in each plane. In such a mounting arrangement the longitudinal axis of the inner structure can be adjustable relative to a longitudinal axis of the main cage by adjusting the position of each roller relative to the inner structure in a direction of main load transferred via the respective roller for rollers connected to the inner structure. Alternatively or in combination the longitudinal axis of the inner structure can be adjustable relative to a longitudinal axis of the main cage can be adjusted by adjusting the position of each roller relative to the main cage in a direction of main load transferred via the respective roller for rollers connected to the main cage. Connected in this context means for example that the roller is mounted to the inner structure respectively to the main cage with a bearing. An adjustment of the roller relative to the inner structure respectively to the main cage can for example be realized by a countered screw fixing a distance of the bearing to the respective structure.

[0016] The forth interface for connection of the turbine component to the inner structure of the mounting arrangement can comprise two planes spaced apart in axial direction of the inner structure.

[0017] To reduce the time needed for installing and/or removing the gas turbine part the second interface comprises at least two toggle clamps for quick locking of the interface, i.e. quick connection of the main cage to the

base cage.

[0018] According to another embodiment of the mounting arrangement the main cage comprises a fix point, and the inner structure comprises a pivot support. A shifting system for moving the inner structure relative to the main cage is arranged between the inner structure and main cage and connected to the fix point and the pivot support.

[0019] According to a further embodiment the mounting arrangement comprises a shifting system with screw jack system form moving the inner structure relative to the main cage.

[0020] According to yet another embodiment of the mounting arrangement the shifting system comprises at least one of a manual handle, an electro motor, or pneumatic motor to drive the shifting system.

[0021] Besides the mounting arrangement a method for mounting, respectively a method for removing a turbine component from a turbine is an object of the disclosure.

[0022] The method for mounting, respectively removing a turbine component from a turbine comprises the step of providing a mounting arrangement for a turbine component. Such a mounting arrangement has a base cage, a main cage and an inner structure. The base cage comprises a first face of a casing interface for connection of the base cage to a casing of the turbine, and first face of a main cage interface for connection to the main cage. The main cage comprises a second face of the main cage interface for connection to the base cage, and a first face of an inner structure interface for movable connection of the inner structure to the main cage. The inner structure is arranged at least partly inside the main cage and has a second face of the inner structure interface for moveable connection to the main cage. The inner structure interface is configured for moving the inner structure along a defined trajectory in the main cage. Further, the inner structure comprises a first face of a component interface for holding the turbine component.

[0023] Depending on the connection of the turbine component to turbine the method further comprises the step of disconnecting turbine component from the turbine, respectively connecting the turbine component to the turbine. If the turbine component is connected by a form fit to the turbine no particular steps have to be carried out. If the component is for example bolted the bolts have to be removed, respectively bolted.

[0024] The Method for mounting further comprises the steps of connecting the first face of the casing interface of the base to the casing of the turbine, connecting the second face of the main cage interface of the main cage to the first face of the main cage interface of the base cage. The main cage is holding the inner structure and the inner structure can be moved inside the main cage such that the component interface of the inner structure can be connected to the turbine component. In subsequent steps the turbine component is connected to the inner structure at the component interface, the turbine

component is pulled out of the casing by moving the inner structure along a trajectory in the main cage, and finally the main cage holding the inner structure and turbine component is detached from the casing. For detaching the main cage can be detached from the base case by opening the main cage interface or the whole mounting arrangement can be detached including the base cage by opening the casing interface.

[0025] A further embodiment of the method comprises a step of aligning a longitudinal axis of the inner structure with a longitudinal axis of the turbine component before connecting the turbine component to the inner structure at the component interface.

[0026] Besides providing a mounting arrangement the method for mounting further comprises the steps of connecting the first face of the casing interface of the base cage to the casing of the turbine, connecting the turbine component to the inner structure at the component interface, and at least partly pulling the turbine component in the main cage by moving the inner structure along a trajectory in the main cage. Thus an assembly holding the turbine component is obtained which can be easily handled and moved to the turbine and in particular to the vicinity of the base cage. In subsequent steps the second face of the main cage interface which is holding the inner structure and the turbine component is connected to the first face of the main cage interface on the base cage, and the turbine component is pushed into the casing by moving the inner structure along a trajectory out of the main cage towards the casing. The turbine component can be fixed in its installed position. Finally, the main cage which is holding the inner structure is detached from the casing.

[0027] Before connecting the turbine component to the inner structure it can be disconnected or partly disconnected from the turbine itself. Depending on the turbine component design and accessibility the disconnection can be done after the turbine component is attached to the inner structure.

Brief description of the drawings

[0028] The disclosure, its nature as well as its advantages, shall be described in more detail below with the aid of the accompanying schematic drawings. Referring to the drawings:

Fig. 1 shows a perspective view of an exemplary mounting arrangement;

Fig. 2a, 2b, 2c different variants of base cages from Fig. 1;

Fig. 3 shows cut out of the main cage and inner structure with a shifting mechanism;

Fig. 4 shows the inner structure of Fig. 1 with a turbine component connected to it;

Fig. 5 shows an example of an inner structure interface with a rail and adjustable roller;

Fig. 6a, 6b, 6c, 6d shows examples of the alignment of the inner structure;

Fig. 7a, 7b shows the mounting of a base cage and main cage on a casing for removal of combustor.

Embodiments of the disclosure

[0029] An exemplary embodiment of the mounting arrangement 4 is shown in Fig. 1. The base cage 1 is used as an adaptor to connect the main cage 2 towards a casing of a turbine (direction towards casing 22). This part is configured to support the complete mounting arrangement 4 with main cage 2, inner structure 3 and a combustor during mounting or removal of a combustor. The base cage 1 has a cylindrical body with first face of a casing interface 5a, b, c on one end of the cylindrical body and a main cage interface 6i at the other end of the cylindrical body. The casing interface 5a, b, c is configured as a flange, which is adapted to the casing section to which it is to be connected. The first face of the main cage interface 6i is a circular flange.

[0030] In the example the core of the tool consists of a main cage 2 with an inner structure 3. The main cage 2 has a cylindrical body and 2 is a support structure for holding and moving the inner structure 3. The inner structure 3 is movably connected to the main cage 2 via an inner structure interface. The inner structure interface consists of a first face of inner structure interface 17i which in this case consists of three rails which are integrated into the inner structure 3, and a second face of inner structure interface 17ii which in this example consists of six rollers attached to the main cage 2.

[0031] The main cage 2 comprises a second face of main cage interface 6ii for connection to the base cage 1. The second face of the main cage interface 6ii is a circular flange adopted for connection to the flange of the first face of the main cage interface 6i with a bolt hole pattern to secure and connect the main cage 2 in a defined vertical orientation (direction of gravity). In this position one rail of the a first face of inner structure interface 17i is on a vertical top position inside the main cage 2 while the other two rails are in the lower half of the main cage 2.

[0032] The Fig. 2a, 2b, and 2c show different variants of base cage 1. The first face of casing interface 5a, 5b, 5c is in each case adopted for connection to different parts of the casing. The bolt hole pattern of the flange from first face of main cage interface 6i is identical and orientated in the same way for all base cages 1a, 1b, 1c when attached and connected to a casing via the first face of casing interface 5a, 5b, and 5c. As a result the main cage 2 can be connected to any of the base cases 1a, 1b, 1c and will in all cases have the same orientation. In particular the inner structure 3 can be arranged vertical

(parallel to a line of gravity), i.e. a top of the inner structure 3 is always arranged on top.

[0033] Fig. 3 shows a cut out of the main cage 2 and inner structure 3 with a shifting system 7 for moving the inner structure 3 relative to the main cage 2. For moving the inner structure 3 the shifting system 7 is connected to the main cage (2) via a pivot support 8 and connected to the inner structure 3 via a fix point 9. In this example the fix point 9 is configured as spherical joint.

[0034] The shifting system 7 pushes or pulls the inner structure 3 along the rails of the first face of inner structure interface 17i. In this example the shifting system 7 is configured as a screw jack system.

[0035] View X of Fig. 3 shows a detail of the shifting system 7. In this detail one can see connect hands 16 of the shifting system 7 which allow the connection of a manually operated tool or automatic tool to drive the shifting system 7.

[0036] Fig. 4 shows the inner structure 3 of Fig. 1, respectively of Fig. 3 with a turbine component 12 connected to it. For illustrative purposes the main cage is not shown in this perspective view of the mounting arrangement as it would block the view on the inner structure 3 and component 12. The component interface 18a, 18b, i.e. in this example the connection to a combustor can be divided into two areas/planes (plane of component interface 18a, and of component interface 18b). At the first connection plane a cylindrical flange is used as component interface 18a. The flange is connected via an intermediate ring 10 which can be installed on the turbine component 12 (in this case combustor). In this example a 4x bolt connection is shown. In the second plane, i.e. the plane of component interface 18b, another type of connection is shown. This connection consists of three brackets 11 which can be preassembled on the combustor. For connection to the inner structure 3 cut outs are provided on ears of the inner structure 3. Two rotatable bolts 13 can be rotated towards centerline of the bracket 11, and tightly connected with nuts 14 to available pockets 15 on the inner structure 3 (in this example the ears with pockets 15 form the first face of the component interface 18b). The bracket connection of the component interface 18b is shown with open bolts in detail A and with closed bolts in detail B.

[0037] For alignment of the inner structure 3 with the turbine component 12 for connection of the turbine component 12 to the inner structure 3 the position of the six rollers of the second face of inner structure interface 17ii can be adjusted relative to the inner structure 3. This adjustment can be carried out from outside of the main cage 2. It also allows an alignment of the turbine component 12 connected to the inner structure 3 with the casing 21 for moving the turbine component at least partly into the casing 21 and mounting it to the casing 21.

[0038] The three rollers of each plane are adjusted as a group. One roller is vertical on top of the section and two rollers are arranged in the lower half of the cross section with opposite angular positions. For adjusting the

position of the inner structure 3 relative to the main cage 2 the rollers of are settable relative to the inner structure 3 in a direction of main load transmitted via the respective roller.

[0039] A detail of a settable roller attached to the main cage 2 is shown in Fig. 5. For adjustment of the roller, i.e. the second face of inner structure interface 17ii, the roller is mounted in a bearing block 25 which is movably housed in a recess 26 in the main cage 2. The bearing block 25 is retained in the recess 26 by spring loaded bolts 23 which pull the bearing block 25 in the direction of main load transferred via the respective roller towards the wall of the main cage 2. The bearing block 25 is stopped and kept in its position by an adjustment screw 24 which is screwed through the wall of the main cage 2 and reaches into the recess. By turning the adjustment screw 24 the bearing block can be moved in a direction of the main load transferred via the respective roller thus the distance between the inner wall surface of main cage 2 and the inner structure 3 can be adjusted.

[0040] Using three adjustable rollers in two plains the inner structure can be aligned as shown in the examples of Fig. 6a, 6b, 6c, and 6d.

[0041] In the example of Fig. 6a the inner structure 3 is adjusted in an upwards direction relative to the main cage 2. For upwards adjustment the top bearing block is pulled into the recess (in direction a1) and the lower bearing blocks are pushed out of the bearing block (direction a2 and a3).

[0042] In the example of Fig. 6b the inner structure 3 is adjusted in a downwards direction relative to the main cage 2. For downwards adjustment the top bearing block is pushed out of the recess (in direction b1) and the lower bearing blocks are pulled into the bearing block (direction b2 and b3).

[0043] In the example of Fig. 6c the inner structure 3 is adjusted towards the left side relative to the main cage 2. For leftwards adjustment the top bearing block is pulled into the recess (in direction c1) and the lower bearing block left of a vertical center line of the inner structure 3 is pulled into the recess of the bearing block (direction c2) while the lower bearing block right of a vertical center line of the inner structure 3 is pushed out of the recess of the bearing block (direction c3).

[0044] In the example of Fig. 6d the inner structure 3 is adjusted towards the right side relative to the main cage 2. For rightwards adjustment the top bearing block is pulled into the recess (in direction d1) and the lower bearing block left of a vertical center line of the inner structure 3 is pushed out of the recess of the bearing block (direction d2) while the lower bearing block right of a vertical center line of the inner structure 3 is pulled into the recess of the bearing block (direction d3).

[0045] Fig. 7a, 7b schematically show the main stages of the mounting of a base cage 1 and main cage 2 on a casing 21 for removal of a combustor 12. In Fig 7a the base case 1 is shown installed on the casing 21, with a combustor 12 still installed in the casing. The core of the

mounting arrangement 4 comprising of the main cage 2 and the inner structure 3 hangs on the hook 20 of a crane.

[0046] In Fig. 7b the main cage 2 together with the inner structure have been moved above the turbine component 12 (combustor) and the main cage interface 17 can be closed to remove the turbine component 12.

[0047] It will be appreciated by those skilled in the art that the present disclosure can be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The presently disclosed embodiments are therefore considered in all respects to be illustrative and not restrictive.

List of designations

[0048]

1a,b,c	base cage
2	main cage
3	inner structure
4	mounting arrangement
5	casing interface
5a,b,c	first face of casing interface
6	main cage interface
6i	first face of main cage interface (flange)
6ii	second face of main cage interface (flange)
7	shifting system (Gearbox)
8	pivot support
9	fix point (spherical joint)
10	intermediate ring
11	brackets
12	turbine component (combustor, burner)
13	rotatable bolts
14	nuts
15	pockets
16	connect hand
17	inner structure interface
17i	first face of inner structure interface (rail)
17ii	second face of inner structure interface (roller)
18a	component interface (first connection plane)
18b	component interface (second connection plane)
20	crane
21	casing
22	direction towards casing
23	spring loaded bolt
24	adjustment screw
25	bearing block
26	recess

Claims

1. A mounting arrangement (4) for installing and removing a turbine component (12), the mounting arrangement having a base cage (1 a, 1 b, 1 c), a main cage (2), and an inner structure (3), wherein the base cage (1 a, 1 b, 1 c) comprises a first face of a casing in-

terface (5a, 5b, 5c) for connecting the base cage (1 a, 1 b, 1 c) to a casing (21) of the turbine, and first face of a main cage interface (6i) for connection to the main cage (2), wherein the main cage (2) comprises a second face of the main cage interface (6ii) for connection to the base cage (1), and a first face of an inner structure interface (17i) for movable connection of the inner structure (3) to the main cage (2), wherein the inner structure (3) is arranged at least partly inside the main cage (2) and has a second face of the inner structure interface (17ii) for moveable connection to the main cage (2) wherein the inner structure interface (17i, 17ii) is configured to allow a movement of the inner structure (3) along a defined trajectory in the main cage (2), and wherein the inner structure (3) comprises a first face of a component interface (18a, 18b) for holding the turbine component (12).

2. Mounting arrangement (4) according to claim 1, **characterized in that** a plurality of base cages (1 a, 1 b, 1 c) is provided, wherein each base cage (1 a, 1 b, 1 c) has its first face of the casing interface (5a, 5b, 5c) adapted for connection to a different section of the casing (21).

3. Mounting arrangement (4) according to claim 1 or 2, **characterized in that** the inner structure (3) comprises a sledge.

4. Mounting arrangement (4) according to one of the claims 1 to 3, **characterized in that** a rail (17i) roller (17ii) system guides the inner structure inside the main cage (2) with a rail (17i) roller (17ii) pair in vertically top position of the main cage (2) and two rail (17i) roller (17ii) pairs in a lower half of the cage (2) spaced apart from a vertical bottom position or **in that** the a rail (17i) roller (17ii) system guides the sledge inside the main cage (2) with a rail (17i) roller (17ii) pair in vertically bottom position of the main cage (2) and two rail (17i) roller (17ii) pairs in an upper half of the main cage (2) spaced apart from a vertical top position.

5. Mounting arrangement (4) according to claim 4, **characterized in that** the rail (17i) roller (17ii) system comprises two planes spaced apart along a longitudinal axis of the inner structure (3), with three rail (17i) roller (17ii) pairs in each plane, and wherein the longitudinal axis of the inner structure (3) is adjustable relative to a longitudinal axis of the main cage (2) by adjusting the position of each roller (17ii) relative to the inner structure (3) in a direction of main load transferred via the respective roller (17ii) for rollers (17ii) connected to the inner structure (3) and/or by adjusting the position of each roller (17ii) relative to the main cage (2) in a direction of main load transferred via the respective roller (4) for rollers (17ii)

connected to the main cage (2).

6. Mounting arrangement (4) according to one of the claims 1 to 5, **characterized in that** the forth interface (18a, 18b) for connection of the turbine component (12) to the inner structure (3) comprises two planes spaced apart in axial direction of the inner structure (3). 5
7. Mounting arrangement (4) according to one of the claims 1 to 6, **characterized in that** the second interface (6i, 6ii) comprises at least two toggle clamps for quick locking of the interface (6i, 6ii). 10
8. Mounting arrangement (4) according to one of the claims 1 to 7, **characterized in that** main cage (2) comprises a fix point (9), the inner structure (3) comprises a pivot support (8) and **in that** a shifting system (7) for moving the inner structure (3) relative to the main cage (2), is arranged between and connected to the fix point (9) and the pivot support (8). 15 20
9. Mounting arrangement (4) according to claim 8, **characterized in that** the shifting system (7) comprises a screw jack system. 25
10. Mounting arrangement (4) according to claim 8 or 9, **characterized in that** the shifting system (7) comprises at least one of a manual handle, an electro motor, and a pneumatic motor. 30
11. Method for removing a turbine component (12) from a turbine comprising the steps of
 - providing a mounting arrangement (4) having a base cage (1 a, 1 b, 1 c), a main cage (2), and an inner structure (3), wherein the base cage (1 a, 1 b, 1 c) comprises a first face of a casing interface (5a, 5b, 5c) for connection of the base cage (1 a, 1 b, 1 c) to a casing (21) of the turbine, and first face of a main cage interface (6i) of a main cage interface (6) for connection to the main cage (2), wherein the main cage (2) comprises a second face of the main cage interface (6ii) for connection to the base cage (1), and a first face of an inner structure interface (17i) for movable connection of the inner structure (3) to the main cage (2), wherein the inner structure (3) is arranged at least partly inside the main cage (2) and has a second face of the inner structure interface (17ii) for moveable connection to the main cage (2) wherein the inner structure interface is configured to allow a movement of the inner structure (3) along a defined trajectory in the main cage (2), and wherein the inner structure (3) comprises a first face of a component interface (18a, 18b) for holding the turbine component (12), 35 40 45 50 55

- connecting the first face of the casing interface (5a, 5b, 5c) of the base cage (1 a, 1 b, 1 c) to the casing (21) of the turbine,
- connecting the second face of the main cage interface (6ii) of the main cage (2) which is holding the inner structure (3) to the first face of the main cage interface (6i) of the base cage (1 a, 1 b, 1 c),
- connecting the turbine component (12) to the inner structure (3) at the component interface (18a, 18b),
- pulling the turbine component (12) out of the casing (21) by moving the inner structure (3) along a trajectory in the main cage (2),
- and detaching the main cage (2) which is holding the inner structure (3) and turbine component (12) from the casing (21).

12. Method according to claim 11 **characterized in that** it comprises a step of aligning a longitudinal axis of the inner structure (3) with a longitudinal axis of the turbine component (12) before connecting the turbine component (12) to the inner structure (3) at the component interface (18a, 18b). 20

13. Method for mounting of a turbine component (12) comprising the steps of

- providing a mounting arrangement (4) having a base cage (1a, 1b, 1c), a main cage (2), and an inner structure (3), wherein the base cage (1a, 1b, 1c) comprises a first face of a casing interface (5a, 5b, 5c) for connection of the base cage (1a, 1b, 1c) to a casing (21) of the turbine, and first face of a main cage interface (6i) of a main cage interface (6) for connection to the main cage (2), wherein the main cage (2) comprises a second face of the main cage interface (6ii) for connection to the base cage (1), and a first face of an inner structure interface (17i) for movable connection of the inner structure (3) to the main cage (2), wherein the inner structure (3) is arranged at least partly inside the main cage (2) and has a second face of the inner structure interface (17ii) for moveable connection to the main cage (2) wherein the inner structure interface is configured to allow a movement of the inner structure (3) along a defined trajectory in the main cage (2), and wherein the inner structure (3) comprises a first face of a component interface (18a, 18b) for holding the turbine component (12),
- connecting the first face of the casing interface (5a, 5b, 5c) of the base cage (1 a, 1 b, 1 c) to the casing (21) of the turbine,
- connecting the turbine component (12) to the inner structure (3) at the component interface (18a, 18b)

- at least partly pulling the turbine component (12) in the main cage (2) by moving the inner structure (3) along a trajectory in the main cage (2),
- connecting the second face of the main cage interface (6ii) of the main cage (2) which is holding the inner structure (3) and the turbine component (12) to the first face of the main cage interface (6i) of the base cage (1 a, 1 b, 1 c),
- pushing the turbine component (12) into the casing (21) by moving the inner structure (3) along a trajectory out of the main cage (2),
- and detaching the main cage (2) holding the inner structure (3) from the casing (21).

15

20

25

30

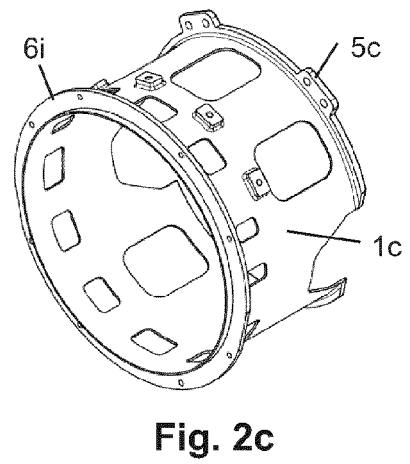
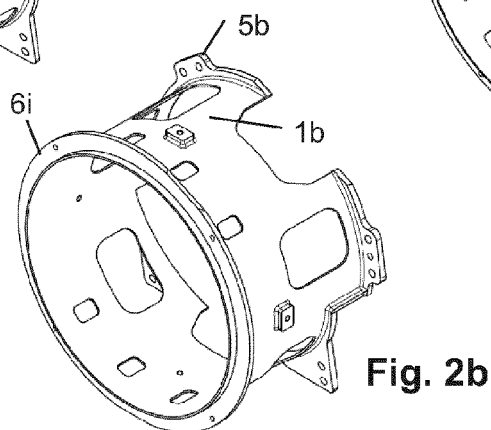
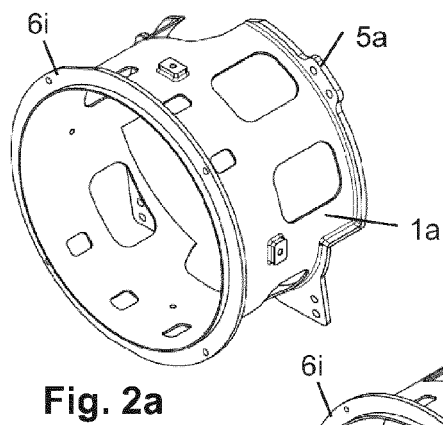
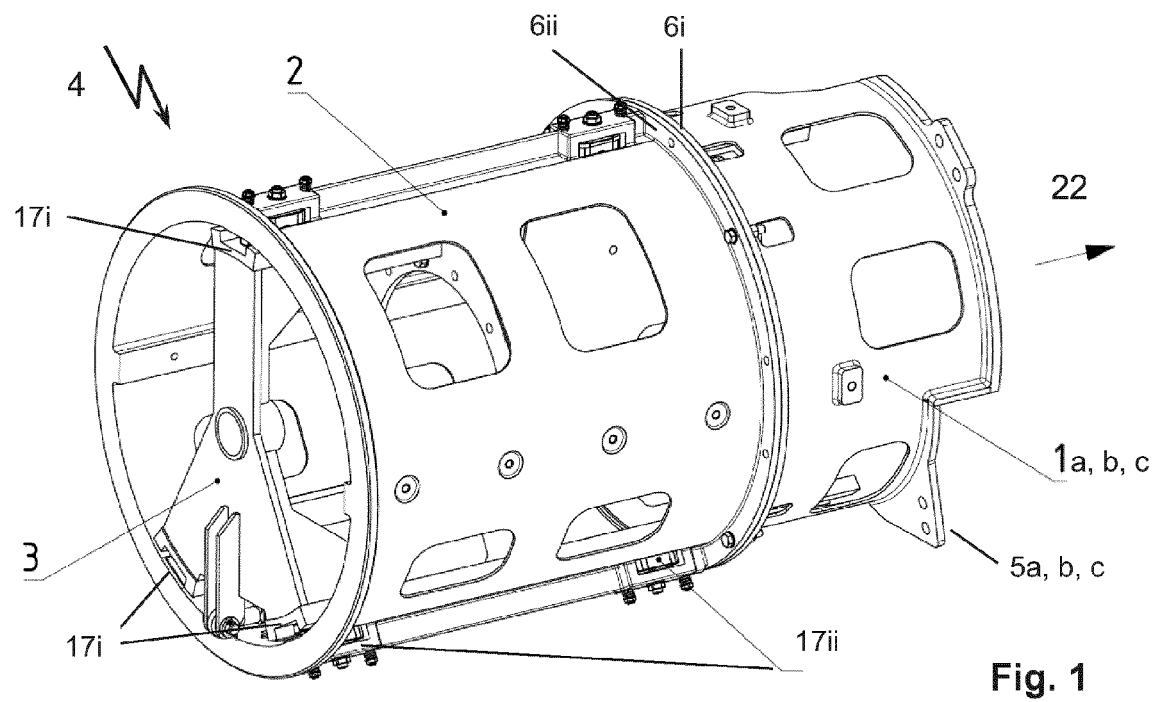
35

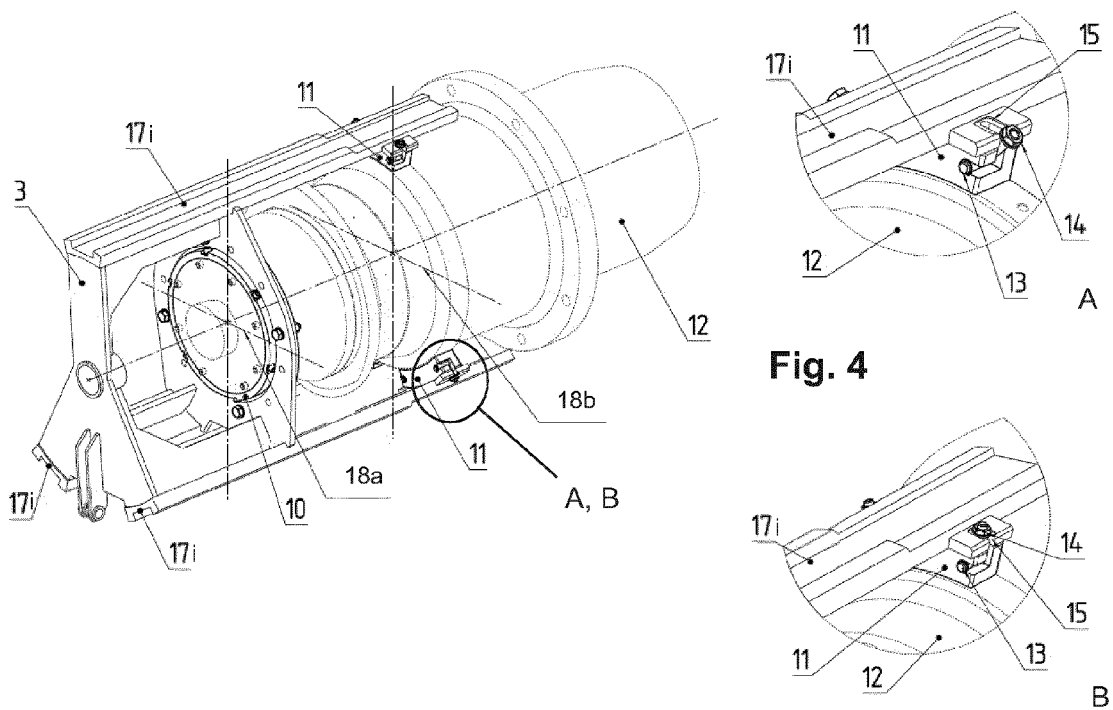
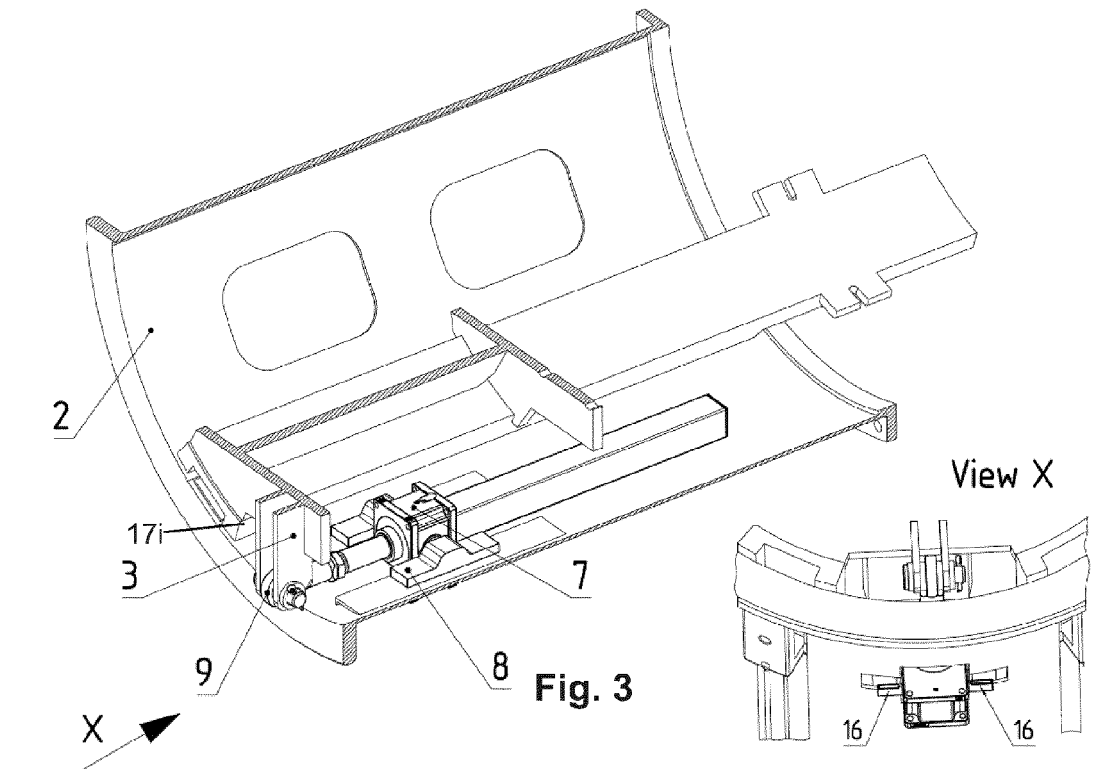
40

45

50

55





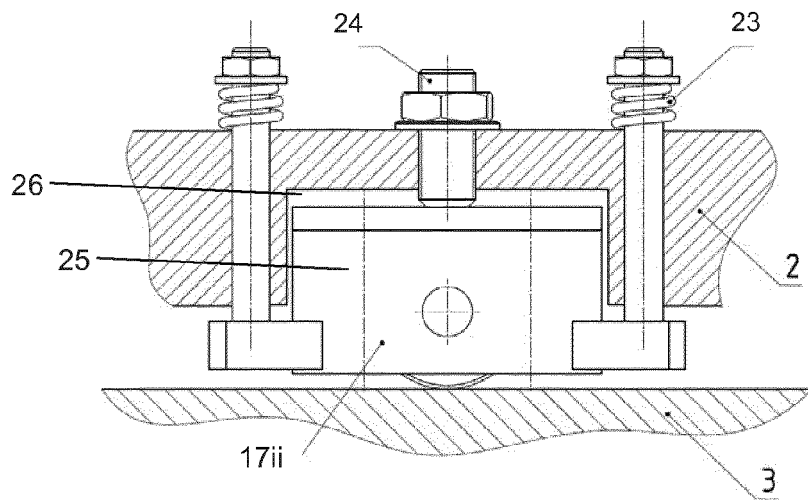


Fig. 5

Fig. 6a

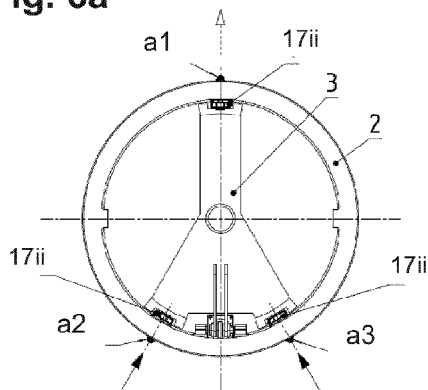


Fig. 6c

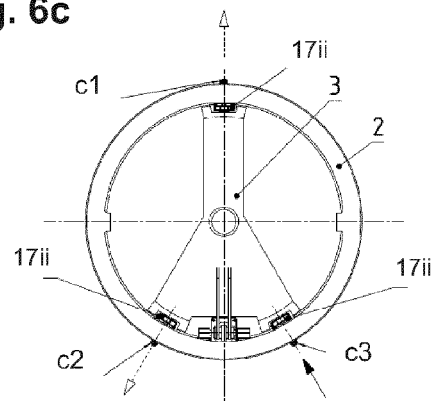


Fig. 6b

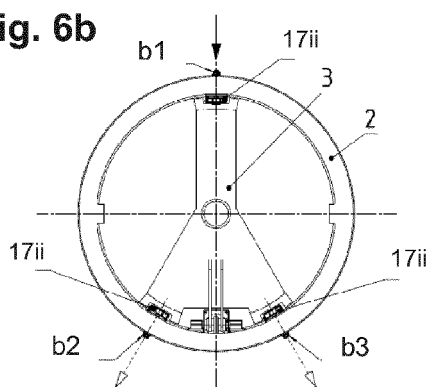
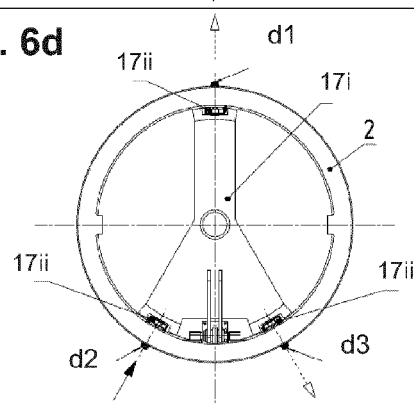


Fig. 6d



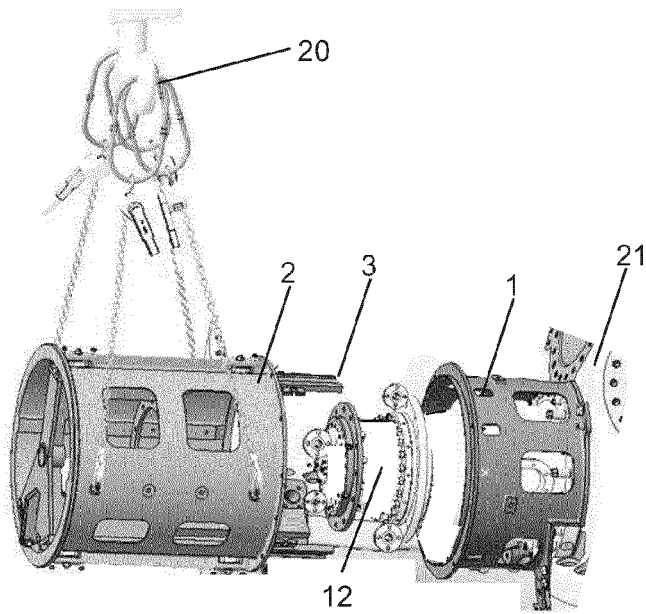


Fig. 7a

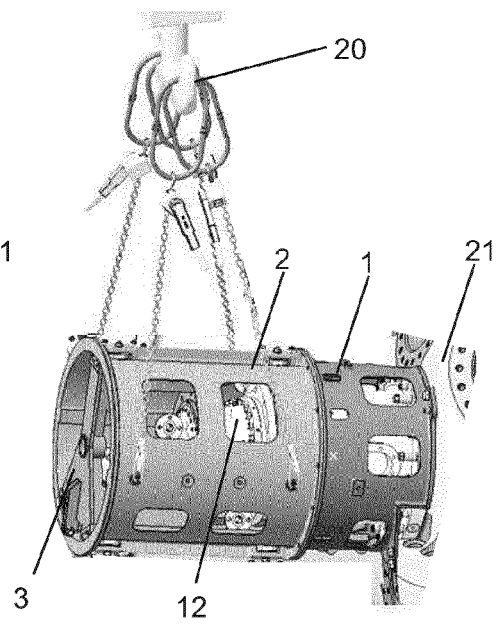


Fig. 7b



EUROPEAN SEARCH REPORT

 Application Number
EP 15 16 6252

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 2012/159955 A1 (SHIOTANI SHIGETOSHI [JP] ET AL) 28 June 2012 (2012-06-28)	1-3,6,11-13	INV. F01D25/28
Y	* figures 1-32 *	4,5,7-10	F04D29/60
X	EP 2 565 399 A1 (SIEMENS AG [DE]) 6 March 2013 (2013-03-06) * the whole document *	1-3,11,13	
X	EP 2 236 939 A1 (SIEMENS AG [DE]) 6 October 2010 (2010-10-06)	1-3	
Y	* paragraph [0029] - paragraph [0040]; figures 1-7 *	4,8-10,12	
Y	GB 2 109 461 A (OCCIDENTAL PETROLEUM CORP) 2 June 1983 (1983-06-02) * the whole document *	1-13	
Y	JP H10 196959 A (TOSHIBA CORP) 31 July 1998 (1998-07-31) * abstract; figures 1-9 *	1-3,7,9-11,13	
Y	US 5 971 702 A (AFTON BRIAN W [US] ET AL) 26 October 1999 (1999-10-26) * column 3, line 25 - column 4, line 26; figures 1-8 *	3-6,8,12	TECHNICAL FIELDS SEARCHED (IPC) F01D F04D F02C F23R B23P
Y	US 4 506 549 A (THOME PAUL [FR]) 26 March 1985 (1985-03-26) * figures 2,5 *	4,5	
Y	EP 1 982 792 A1 (THERMODYN [FR]) 22 October 2008 (2008-10-22) * claim 1; figures 1-5 *	1,3,11-13	
Y	US 2012/243982 A1 (SASAKI MASASHI [JP] ET AL) 27 September 2012 (2012-09-27) * figures 1-3 *	4,8-10,12	
	-/--		
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 23 September 2015	Examiner Koch, Rafael
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)



EUROPEAN SEARCH REPORT

Application Number
EP 15 16 6252

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	EP 2 045 472 A1 (SIEMENS AG [DE]) 8 April 2009 (2009-04-08) * paragraph [0019] - paragraph [0025]; figures 1-6 *	3,8-10	
			TECHNICAL FIELDS SEARCHED (IPC)
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 23 September 2015	Examiner Koch, Rafael
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			

 1
EPO FORM 1503.03.82 (P04G01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 15 16 6252

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.

23-09-2015

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2012159955 A1	28-06-2012	CN 102498274 A	13-06-2012
		EP 2479407 A1	25-07-2012
		JP 5495687 B2	21-05-2014
		JP 2011064112 A	31-03-2011
		KR 20120054071 A	29-05-2012
		US 2012159955 A1	28-06-2012
		WO 2011033697 A1	24-03-2011

EP 2565399 A1	06-03-2013	CA 2847324 A1	07-03-2013
		CN 103764955 A	30-04-2014
		EP 2565399 A1	06-03-2013
		JP 2014525542 A	29-09-2014
		KR 20140053237 A	07-05-2014
		US 2014215800 A1	07-08-2014
		WO 2013030230 A2	07-03-2013

EP 2236939 A1	06-10-2010	NONE	

GB 2109461 A	02-06-1983	NONE	

JP H10196959 A	31-07-1998	NONE	

US 5971702 A	26-10-1999	CA 2273058 A1	03-12-1999
		DE 19919650 A1	09-12-1999
		FR 2779488 A1	10-12-1999
		GB 2340183 A	16-02-2000
		IT RM990343 A1	30-11-2000
		JP 3049059 B2	05-06-2000
		JP 2000038988 A	08-02-2000
		US 5971702 A	26-10-1999

US 4506549 A	26-03-1985	EP 0053984 A2	16-06-1982
		FR 2495777 A1	11-06-1982
		US 4506549 A	26-03-1985

EP 1982792 A1	22-10-2008	EP 1982792 A1	22-10-2008
		FR 2914964 A1	17-10-2008

US 2012243982 A1	27-09-2012	JP 5554130 B2	23-07-2014
		JP 2011220307 A	04-11-2011
		US 2012243982 A1	27-09-2012

EP 2045472 A1	08-04-2009	NONE	

EPO FORM P0459

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

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 5921075 A [0004]