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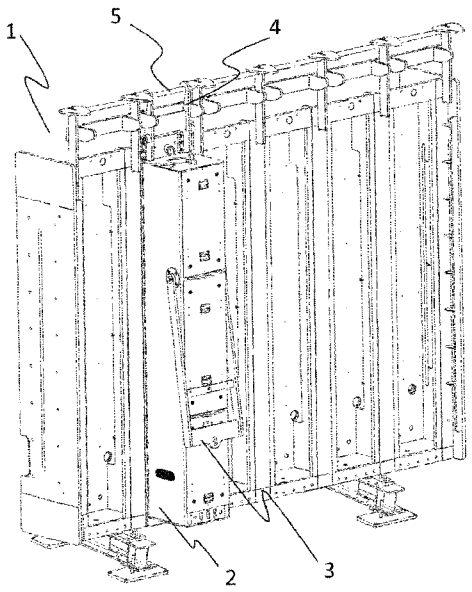


FIG. 1

(57) Abstract: The present invention concerns a kit of parts for mounting a chamber for a surface treatment apparatus comprising a static body (1) and a movable lid (2) wherein said movable lid (2) comprises a handling portion (3), said handling portion (3) being coupled to said movable lid (2) such that said handling portion (3) is rotatable about a first transverse axis Y1 with respect to said movable lid (2), and said movable lid (2) comprises at least one hooking element (4) for being mechanically coupled to at least one coupling portion (5) of said static body (1). The present invention further concerns a chamber for a surface treatment apparatus comprising said kit of arts and a method for mounting said surface treatment chamber.

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Description

Kit for mounting a surface treatment chamber

Technical Field

[0001] The present invention relates to a chamber for implementing a physical or chemical surface treatment process, such as for example PVD, magnetron sputtering, LPCVD, PECVD, ALD, ion implantation, or plasma surface treatment. In particular, it relates to a kit of parts for mounting such a surface treatment chamber, said kit comprising at least two main parts, which are a static body and a movable lid.

Background Art

[0002] Surface treatment processes are widely used for a broad variety of purposes and in different industries. They include many different techniques such as physical vapor deposition (PVD), magnetron sputtering, low pressure chemical vapor deposition (LPCVD), plasma enhanced vapor deposition (PECVD), atomic layer deposition (ALD), ion implantation, or plasma surface treatment for activation or cleaning. Apparatuses for implementing the surface treatment process of a substrate generally include at least one chamber wherein the substrate is coated or treated thanks to various equipments. Such equipments can be located in said chamber or be in electrical or fluid communication with said chamber.

[0003] For maintenance and cleaning purposes, a wall section of the chamber needs generally to be removed or disassembled from time to time. Subsequently, the interior of the chamber can be cleaned or inner equipments of the chamber can be replaced when required. Meanwhile, the apparatus is at a standstill. The downtimes are relatively long since access to the interior of a chamber is restricted, and moreover awkward.

[0004] Document EP 2 387 063 discloses a chamber for physical vapor deposition comprising a housing and a door for opening and closing the housing. The housing and the door supplement with each other in shape thanks to mating surfaces configured to close the chamber. The housing and the door can be coupled to each other by means of a hinge-like device or can be separate elements. When the housing and the door are

separate elements, it is disclosed in this document that the housing comprises protruding sidewalls ("reinforcing ribs") adapted to mate the sidewalls of the door. For maintenance purposes, the chamber can be opened and closed by a lifting device such as a crane. Such systems for accessing the interior of the chamber present some inconveniences. In case a hinge is arranged between the housing and the door, the important mechanical stress generated on the hinge due to the heavy weight of the door makes the system prone to wear. This mechanical stress also limits the upscalability of this arrangement. Furthermore, the possibilities for the maintenance of the entire door or of individual elements of the door are quite limited since the door cannot be fully decoupled from the housing without complex mechanical work in order to disassemble the hinges. In case the housing and the door are separate elements, more flexibility is obtained for the maintenance and replacement of the door. However, with the arrangement described in this prior art document, the opening and closing of the chamber is an awkward procedure wherein the door has to be manipulated with a high accuracy in the three spatial dimensions. The assembly and disassembly of the housing and of the door in this arrangement are consequently complex procedures which are not easily performed by a single operator in a typical industrial environment.

[0005] Document US 2006/0226004 discloses a coating apparatus wherein the chamber is formed by a housing and a movable cover mounted on rails. The cover is movable between a position wherein it closes the chamber and a position wherein it opens the chamber. Such kind of system for accessing the interior of the chamber is quite cumbersome. It requires also an important initial investment for building the highly precise mechanical arrangement comprising the rails and the movable parts of the cover guided on the rails. Furthermore, the system disclosed in this document does not provide a solution for an easy replacement of the cover of the chamber. In this case, a complex mechanical work in order to disassemble the cover from the rails is indeed required.

Summary of invention

[0006] It is an object of the present invention to provide a mechanical arrangement for mounting the chamber of a surface treatment apparatus, wherein the chamber comprises a housing and a lid which can be disassembled from the housing such that the interior of the chamber can be accessed for maintenance purposes and such that the lid can be replaced when required. The arrangement of the present invention is also easily upscalable for surface treatment apparatuses vertically handling 2, 3, or even 4 m wide substrates. The mounting and dismounting of the chamber with the mechanical arrangement according to the present invention must be easy to carry out by an actuator such as an industrial crane.

[0007] The present invention is defined in the appended independent claims. Preferred embodiments are defined in the dependent claims. In particular, the invention concerns a kit of parts for mounting a chamber for a surface treatment apparatus comprising a static body (1) and a movable lid (2). Said movable lid (2) comprises a handling portion (3), said handling portion (3) configured for being coupled to said movable lid (2) such that said handling portion (3) is rotatable about a first transverse axis Y1 with respect to said movable lid (2). Said movable lid (2) further comprises at least one hooking element (4) configured for for being mechanically coupled to at least one coupling portion (5) of said static body (1) extending along a second transverse axis Y2 perpendicular to a vertical axis Z downwardly oriented, Said mechanical coupling is such that said movable lid (2) is rotatable about said second transverse axis Y2 with respect to said static body (1) and such that said second transverse axis Y2 is parallel to said first transverse axis Y1, the position of the center of mass (M) of the movable lid (2) with respect to the first axis Y1 is such that the movable lid (2) is oriented at a hooking angle (Θ_h) with respect to the vertical axis Z when it is held by said handling portion (3), the hooking angle (Θh) being an orientation of the movable lid (2) with respect to the vertical axis Z such that the hooking element (4) can be coupled to said at least one coupling portion (5) by a translation of said movable lid (2)

toward said static body (1) along a coupling direction C1, said coupling direction C1 being perpendicular to transverse axes Y1 and Y2. The movable lid (2) is configured such that when coupled to the static body (1), said movable lid (2) can be downwardly rotated about the second transverse axis Y2 up to a closing angle (Θ_c) with respect to the vertical axis Z such that the movable lid (2) and the static body (1) define an enclosure, the closing angle (Θ_c) being smaller than the hooking angle (Θ_h) and the movable lid (2) being stabilized against the static body (1) at said closing angle (Θ_c) under the action of the gravity. The shape of the of the at least one hooking element (4) and of the at least one coupling portion (5) is configured such that the mechanical coupling can be decoupled by a 2D decoupling motion of the movable lid 2 comprising an upward translation along the vertical axis Z, a translation along an axis X perpendicular to axes Y2 and Z, and a rotation about the transverse axis Y1, wherein said 2D decoupling motion of the movable lid 2 is generated by an upward translation of the handling portion 3 along the vertical axis Z. Said kit of parts comprises sealing means for insulating said enclosure from the external environment such to form a surface treatment chamber.

[0008] In an embodiment of the present invention the at least one hooking element (4) of the kit of parts of the present invention comprises a hook-shaped portion wrapping around a hooking axis Y1' parallel to said first transverse axis Y1, the hook-shaped portion having an opening, wherein the projection of the opening onto a plane P perpendicular to the coupling direction C1, when the movable lid (2) is at the hooking angle (Θ_h), with respect to the vertical axis Z, has a hook projection width, Wh1, and the coupling portion (5) comprises a rod wherein the projection of the rod onto a plane P perpendicular to the coupling direction C1 has a rod projection width, Wr1, said rod projection width Wr1 being smaller than the hook projection width Wh1 such that the mechanical coupling between the movable lid (2) and the static body (1) can be obtained by translating said hooking axis Y1' in the coupling direction C1 onto the second transverse axis Y2.

[0009] In an embodiment of the present invention the movable lid (2) comprises a protruding portion (6) configured for being inserted in the static body (1) when the movable lid (2) is coupled to the static body (1) and rotated to the closing angle, the static body (1) and the movable lid (2) comprise abutting means (7, 8), said abutting means (7, 8) being configured to limit the range of the sliding motion of the movable lid (2) on the coupling portion (5) of the static body (1) such that the protruding portion (6) of the movable lid (2) does not contact the static body (1) when the movable lid (2) is decoupled from the static body (1).

[0010] In an embodiment of the present invention the static body (1) comprises at least one guiding element for guiding the hooking element (4) with respect to the second transverse axis Y2, such that the hooking element (4) becomes aligned with respect to the coupling portion (5) in the coupling direction C1, when the movable lid (2) is held by said handling portion (3) and is moved toward the static body (1) for being coupled to said static body (1), in an approach direction A perpendicular to said second transverse axis Y2.

[0011] In an embodiment of the present invention the at least one guiding element comprises two lateral elements forming a funnel section in a plane comprising said approach direction A and parallel to, or comprising, said second transverse axis Y2.

[0012] In an embodiment of the present invention the movable lid (2) is configured such that the vertical axis passing by the center of mass (M) of the movable lid (2) intersects the first axis Y1 when the movable lid (2) is held by said handling portion (3) and is freely hanging.

[0013] In an embodiment of the present invention the movable lid (2) is configured such that the vertical axis passing by the center of mass (M) of the movable lid (2) is in a forward position with respect to the first axis Y1 when the movable lid (2) is held by said handling portion (3) and is freely hanging, said movable lid (2) comprising blocking means for preventing the forward tilt of the movable lid (2) around the first axis Y1 out of the hooking/coupling orientation when the movable lid (2) is held by said handling portion (3).

[0014] In an embodiment of the present invention the sealing means comprise a vacuum system for generating a vacuum in said enclosure.

[0015] In an embodiment of the present invention the sealing means comprise fastening means for fastening the movable lid (2) to the static body (1).

[0016] The present invention further concerns a chamber for a surface treatment apparatus comprising a static body (1) and a movable lid (2) of a kit of parts according to any embodiment of the present. Said static body (1) is mechanically coupled to said movable lid (2).

[0017] The present invention also concerns a movable lid (2) in a kit of parts according to any embodiment hereinabove. Said movable lid (2) comprises a handling portion (3), said handling portion (3) being coupled to said movable lid (2) such that said handling portion (3) is rotatable about a first transverse axis Y1 with respect to said movable lid (2). Said movable lid (2) comprises at least one hooking element (4) for being mechanically coupled to at least one coupling portion (5) of a static body (1), the at least one hooking element (4) comprising a hook-shaped portion wrapping around a hooking axis Y1' parallel to said first transverse axis Y1, said hook-shaped portion comprising an opening for the passage of the at least one coupling portion (5).

[0018] The present invention further comprises a method for mounting a surface treatment chamber by coupling a movable lid (2) to a static body (1) of a kit of part according to anyone of claims 1 to 10, wherein the method comprises the steps of:

a. Handling the handling portion (3) of said movable lid (2) with a mechanical actuator,
b. Ensuring that second transverse axis Y2 of the movable lid (2) is in the proper orientation, that is, in the plane XY perpendicular to the vertical direction Z, for the coupling with the static body (1),
c. Translating the movable lid (2) with respect to the static body (1) in an approach direction A such that the hooking element (4) becomes aligned with respect to the coupling portion (5) in the coupling direction C1,

d. Translating the movable lid (2) with respect to the static body (1) in the coupling direction C1 such that the hooking element (4) becomes coupled to the coupling portion (5),
e. Rotating the movable lid (2) about the first transverse axis Y1 such that the movable lid (2) becomes oriented at the closing angle (Θ_c) with respect to the vertical axis Z,
f. Sealing the movable lid (2) to the static body (1) such as to form a surface treatment chamber.

[0019] According to the present invention further comprises a method for opening a surface treatment chamber by decoupling a movable lid (2) from a static body (1) of a kit of part according to anyone of claims 1 to 10, wherein the method comprises the steps of:

a. Handling the handling portion (3) of said movable lid (2) with a mechanical actuator,
b. Lifting and/or translating the movable lid (2) in the vertical direction Z until the hooking element (4) becomes decoupled from the coupling portion (5),
c. Translating the movable lid (2) in a transverse direction perpendicular to the vertical direction Z to move the movable lid (2) away from the static body (1) for opening fully the surface treatment chamber.

[0020] It is noted that the invention relates to all possible combinations of features recited in the claims.

Brief description of drawings

[0021] These and further aspects of the invention will be explained in greater detail by way of example and with reference to the accompanying drawings in which:

a. Figure 1 shows a perspective view of an example of a kit according to the invention;
b. Figure 2 shows a lateral view of the kit according to Figure 1 before the coupling between the static body and the movable lid;

c. Figure 3 shows a lateral view of the kit according to Figure 1 before the coupling when the movable lid is moved in an approach direction A;
d. Figure 4 shows a lateral view of the kit according to Figure 1 before the coupling when the movable lid is moved in the coupling direction C1;
e. Figure 5 shows a lateral view of the kit according to Figure 1 when the movable lid is coupled to the static body and is being rotated about transverse axis Y2;
f. Figure 6 shows a lateral view of the kit according to Figure 1 when the movable lid is coupled to the static body and is oriented at the closing angle Θ_c;
g. Figure 7 shows a lateral view of the kit according to Figure 1 when the movable lid being decoupled from the static body;
h. Figure 8 shows an enlarged view of the coupling area when the movable lid is being decoupled from the static body;

[0022] The figures are not drawn to scale.

Description of embodiments

[0023] As represented in Figures 1 and 2, the invention relates to a kit of parts for mounting a chamber for a surface treatment apparatus comprising a static body 1 and a movable lid 2.

[0024] The movable lid 2 comprises a handling portion 3 being coupled to the movable lid 2. The handling portion 3 is rotatable about a first transverse axis Y1 with respect to the movable lid 2.

[0025] The movable lid 2 also comprises at least one hooking element 4 for being mechanically coupled to at least one coupling portion 5 of the static body 1. The at least one coupling portion 5 extends along a second transverse axis Y2 perpendicular to a vertical axis Z. As represented in Figure 1, the at least one hooking element 4 is advantageously located at the top of the movable lid 2 while the at least one coupling portion 5 is advantageously located at the top of the static body 1.

[0026] The mechanical coupling between the at least one hooking element 4 and the at least one coupling portion 5 is such that:

a. said movable lid 2 is rotatable about the second transverse axis Y2 with respect to said static body 1;
b. said second transverse axis Y2 is parallel to said first transverse axis Y1;

[0027] The position of the center of mass M of the movable lid 2 with respect to the first axis Y1 is such that the movable lid 2 is oriented at a hooking angle Θ_h with respect to the vertical axis Z when it is held by the handling portion 3, and in particular freely hanging, wherein the hooking angle Θ_h is an orientation of the movable lid 2 with respect to the vertical axis Z such that the hooking element 4 can be coupled to the at least one coupling portion 5 by a translation of the movable lid 2 toward the static body 1 along a coupling direction C1 which is perpendicular to transverse axes Y1 and Y2.

[0028] In the examples represented in Figures 1-8, the center of mass M of the movable lid 2 is located below and is vertically aligned with the transverse axis Y1, when the movable lid 2 is held by its handling portion 3. Alternatively, the center of mass can be positioned such that the vertical axis passing by the center of mass M of the movable lid 2 is in a forward position with respect to the first axis Y1 when the movable lid 2 is held by said handling portion 3 and is freely hanging. In this configuration, the movable lid comprising blocking means for preventing the forward tilt of the movable lid 2 around the first axis Y1 out of the hooking orientation when the movable lid 2 is held by said handling portion 3.

[0029] As represented in Figure 8, the at least one hooking element 4 can comprise a hook-shaped portion wrapping around a hooking axis Y1' parallel to said first transverse axis Y1. The hook-shaped portion has an opening. The coupling portion 5 comprises a rod. When the movable lid 2 is at the hooking angle Θ_h with respect to the vertical axis Z,

a. the projection of the opening, onto a plane P perpendicular to the coupling direction C1, has a hook opening projection width, Wh1,
b. the projection of the rod, onto a plane P perpendicular to the coupling direction C1, has a rod projection width Wr1,

wherein the hook opening projection width Wr1 is smaller than the hook projection width Wh1 such that the mechanical coupling between the movable lid 2 and the static body 1 can be obtained by translating the hooking axis Y1' in the coupling direction C1 onto the second transverse axis Y2. In order to obtain a proper coupling between the hook-shaped portion of the hooking element 4 and the rod of the coupling portion 5, the radius of curvature of the hook-shaped portion is advantageously equal to the radius of curvature of the rod.

[0030] In the example represented in Figure 4, the coupling direction C1 can be equal to the Z direction because the hook-shaped portion of the at least one hooking element 4 can be coupled to the coupling portion 5 by a downward vertical translation of the movable lid 2 with respect to the static body 1. Alternatively, the hooking element 4 and coupling portion 5 can be configured such that the coupling can be obtained by a translation of the movable lid 2 in the XZ plane.

[0031] When the movable lid 2 needs to be coupled to the static body 1, it is first necessary to:

a. bring the hooking element 4 above the coupling portion 5,
b. align the hooking element 4 and the coupling portion 5 in the coupling direction C1,
c. ensure that the projections of the hooking element 4 and of the coupling portion 5 in a plane perpendicular to the coupling direction C1 are in a proper relative orientation for the coupling,

In the example of Figure 4, these preliminary steps result in a position of the movable lid 2 wherein its hooking element 4 is above and vertically aligned with the coupling portion 5 of the static body 1, and wherein its hooking axis Y1' is parallel to the transverse axis Y2 of the static body 1. Once such position of the movable lid 2 is obtained, the movable lid 2 can be translated along the coupling direction C1, which is the Z direction in the example of Figures 2-8, in order to obtain the mechanical coupling between the movable lid 2 and the static body 1.

[0032] As represented in Figure 2, the static body 1 can comprise at least one guiding element for guiding the hooking element 4 with respect to the

second transverse axis Y2, such that the hooking element 4 becomes aligned with respect to the coupling portion 5 in the coupling direction C1, when the movable lid 2 is held by said handling portion 3 and is moved toward the static body 1 for being coupled to said static body 1, in an approach direction A perpendicular to said second transverse axis Y2. The at least one guiding element can comprise two lateral elements forming a funnel section in a plane comprising said approach direction A and parallel to the second transverse axis Y2.

[0033] As represented in Figure 5, once the movable lid 2 is coupled to the static body 1, the movable lid 2 can be rotated downwardly about the second transverse axis Y2 up to a closing angle Θ_c with respect to the vertical axis Z. The expression “downward rotation” used throughout this text used has to be construed as a “clockwise rotation” in the example of the Figures 1-8. At the closing angle Θ_c, the movable lid 2 and the static body 1 define an enclosure. The closing angle Θ_c is an angle smaller than the hooking angle Θ_h at which the movable lid 2 is stabilized against the static body under the action of the gravity. The static body 1 and the movable lid 2 consequently supplement each other thanks to mating surfaces configured to form an enclosure when the movable lid 2 is coupled to the static body 1 and rotated to the closing angle Θ_c. The enclosure results from a concavity present in at least one of the static body 1 and the movable lid 2.

[0034] The preliminary steps described supra, as well as the coupling translation in the direction C1 and finally the rotation between the hooking angle Θ_h and the closing angle Θ_c, can all be performed by a general-purpose industrial actuator, such as a crane, holding the handling portion 3 of the movable lid 2. This feature of the mechanical arrangement according to the invention is highly advantageous because it means that no specific facility or equipment must be provided for mounting the surface treatment chamber. In order to mount the chamber, the industrial actuator must just be able to couple the movable lid 2 to the static body 1 by performing successive translations with respect to the spatial axes X, Y, Z and a rotation with respect to the vertical axis Z.

[0035] The accuracy/precision of the successive translations and rotation which need to reached by the industrial actuator can be tuned by designing the hooking element 4 and the coupling portion 5 such that the coupling between them is tolerant to small misalignments. In this regard, the hooking element 4 and the coupling portion 5 are advantageously shaped such that potential misalignments between them do not prevent the hooking element 4 to be coupled to the coupling portion 5. It is furthermore very advantageous that these potential misalignments cancel automatically, advantageously under the action of the gravity on the movable lid 2, when the hooking element 4 contacts the coupling portion 5 and is rotated about the axis Y1 to form the enclosure. In this configuration, even if misalignments can be present initially when coupling the hooking element 4 to the coupling portion 5 due to inaccuracies of the mechanical actuator moving the movable lid 2, the subsequent cancellation of these misalignments will allow forming the enclosure of the chamber when the movable lid 2 is rotated at the closing angle Θ_c about the axis Y2.

[0036] Once the movable lid 2 is rotated to the closing angle Θ_c, as represented in Figure 6, the enclosure can be sealed such to form a surface treatment chamber. The sealing can be implemented in different ways. Fastening means, such as nuts and bolts, can for example be used. Alternatively, when the process to be implemented in the surface treatment chamber is a vacuum process, a vacuum system generating the vacuum in the enclosure can be sufficient for implementing the sealing between the static body and the movable lid 2.

[0037] As discussed supra in the prior art section, from time to time it is necessary to dismount the surface treatment chamber for maintenance or cleaning purposes. In this regard, the shape of the of the at least one hooking element 4 and of the at least one coupling portion 5 is such that the mechanical coupling can be decoupled by a 2D motion of the movable lid 2 in the XZ plane comprising: an upward translation along the vertical axis Z, a translation with along horizontal axis X and a rotation, downward, about the transverse axis Y1. This 2D decoupling motion is the motion of

the movable lid 2 induced by an upward vertical motion of the handling portion 3.

[0038] The dismounting of the chamber thanks to the decoupling of the movable lid 2 from the static body 1 is consequently a low complexity mechanical operation because. This upward vertical motion of the handling portion 3 can indeed be performed once again by a general-purpose actuator, such as an industrial crane, up to point wherein the hooking element 4 is no longer coupled to the coupling portion 5. The movable lid 2 can then the freely translated in the directions X and Y by the same actuator.

[0039] During an upward vertical motion of the handling portion 3, the hooking element 4, initially resting against the coupling portion 5, engages in a sliding motion on said coupling portion 5. During this sliding motion, the coupling portion 5 of the static body 1 exerts a normal force and a friction force on the hooking element 4 of the movable lid 2. In the XY space, these forces result in a positive component along the X direction. Such resulting force in the positive X direction generates a translation, in the positive X direction, of the movable lid 2 with respect to the handling portion 3. In the example in Figure 2, such translation of the movable lid 2 results in a counterclockwise rotation, or left tilt, of the handling portion 3 about the axis Y1 with respect to the movable lid 2. This left tilt of the handling portion 3 results in the transmission of a force from the handling portion 3 to the movable lid 2 comprising a component in the negative X direction, which compensates for the component in the positive X direction of the resulting force exerted by the static body 1 on the movable lid 2. This explains why, following an upward vertical motion of the handling portion 3, there is a horizontal motion of the movable lid 2 in the positive X direction.

[0040] In the example represented in Figure 2, the movable lid 2 comprises a protruding portion 21. In this configuration, the static body 1 comprises a concavity forming at least a part of the chamber to be mounted with the mechanical arrangement according to the invention. The protruding portion 21 has to be inserted in the concavity of the static body 1 when the movable lid 2 is coupled to the static body 1 and rotated to the closing

angle. Such protruding portion 21 can for example be the cathode for a PVD process. When the movable lid 2 comprises such a protruding portion 21, the dismounting of the chamber, thanks to the 2D decoupling motion of the movable lid 2 as discussed supra, can be an awkward operation wherein the protruding portion 21 collides with the concavity of the static body. In this case, it is very advantageous that the static body 1 and the movable lid 2 comprise abutting means 7, 8. The abutting means 7, 8 are configured to limit the range of the sliding motion of the movable lid 2 on the static body 1 such that the protruding portion 6 of the movable lid 2 does not contact the static body 1 when the movable lid 2 is decoupled from the static body 1. In this configuration, at some point of the vertical motion of the movable lid 2, the abutting means 8 of the movable lid 2 contact the abutting means of the static body 1 and the abutting means 8 of the movable lid 2 engage in a sliding motion against the abutting means of the movable lid 7. The abutting means 7, 8 need to be shaped such that they contact each other before the protruding portion 21 contacts the static body 1 and such that the protruding portion 21 does not contact the static body 1 during the sliding motion between the abutting means 7, 8.

[0041] The present invention also relates to a movable lid 2 for a kit of parts as described supra, wherein

a. the movable lid 2 comprises a handling portion 3 being coupled to the movable lid 2 such that said handling portion 3 is rotatable about a first transverse axis Y1 with respect to said movable lid 2,
b. the movable lid 2 comprises at least one hooking element 4 for being mechanically coupled to at least one coupling portion 5 of a static body 1, the at least one hooking element 4 comprising a hook-shaped portion wrapping around a hooking axis Y1' parallel to said first transverse axis Y1, said hook-shaped portion comprising an opening for the passage of the at least one coupling portion 5.

[0042] The present invention also relates to a method for mounting a surface treatment chamber by coupling a movable lid 2 to a static body 1 of a kit of part as described supra, wherein the method comprises the steps of:

a. Handling the handling portion 3 of the movable lid 2 with a mechanical actuator,
b. Ensuring that second transverse axis Y2 of the movable lid 2 is in the proper orientation in the plane XY perpendicular to the vertical direction Z for the coupling with the static body 1,
c. Translating the movable lid 2 with respect to the static body 1 in an approach direction A such that the hooking element 4 becomes aligned with respect to the coupling portion 5 in the coupling direction C1,
d. Translating the movable lid 2 with respect to the static body 1 in the coupling direction C1 such that the hooking element 4 becomes coupled to the coupling portion 5,
e. Rotating the movable lid 2 about the first transverse axis Y1 such that the movable lid 2 becomes oriented at the closing angle Θ_c with respect to the vertical axis Z,
f. Sealing the movable lid 2 to the static body 1 such as to form a surface treatment chamber.

[0043] The method for mounting a surface treatment chamber can be implemented by a general-purpose industrial actuator, such as crane.

[0044] The present invention also relates to a method for opening a surface treatment chamber by decoupling a movable lid 2 from a static body 1 of a kit of part as described supra, wherein the method comprises the steps of:

a. Handling the handling portion 3 of said movable lid 2 with a mechanical actuator,
b. Lifting the movable lid 2 in the vertical direction Z until the hooking element 4 becomes decoupled from the coupling portion 5,
c. Translating the movable lid 2 in a transverse direction perpendicular to the vertical direction Z to move the movable lid 2 away from the static body 1 for opening fully the surface treatment chamber.

[0045] The method for opening a surface treatment chamber can be implemented by a general-purpose industrial actuator, such as crane.

Claims

Claim 1. Kit of parts for mounting a chamber for a surface treatment apparatus comprising:

a. a static body (1);

b. a movable lid (2);

characterized in that

c. said movable lid (2) comprises a handling portion (3), said handling portion (3) configured for being coupled to said movable lid (2) such that said handling portion (3) is rotatable about a first transverse axis Y1 with respect to said movable lid (2),

d. said movable lid (2) comprises at least one hooking element (4) configured for being mechanically coupled to at least one coupling portion (5) of said static body (1) extending along a second transverse axis Y2 perpendicular to a vertical axis Z downwardly oriented, wherein said mechanical coupling is such that said movable lid (2) is rotatable about said second transverse axis Y2 with respect to said static body (1) and such that said second transverse axis Y2 is parallel to said first transverse axis Y1,

e. the position of the center of mass (M) of the movable lid (2) with respect to the first axis Y1 is such that the movable lid (2) is oriented at a hooking angle (Θ_h) with respect to the vertical axis Z when it is held by said handling portion (3), the hooking angle (Θ_h) being an orientation of the movable lid (2) with respect to the vertical axis Z such that the hooking element (4) can be coupled to said at least one coupling portion (5) by a translation of said movable lid (2) toward said static body (1) along a coupling direction C1, said coupling direction C1 being perpendicular to transverse axes Y1 and Y2,

f. the movable lid (2) is configured such that when coupled to the static body (1), said movable lid (2) can be downwardly rotated about the second transverse axis Y2 up to a closing angle (Θ_c) with respect to the vertical axis Z such that the movable lid (2) and the static body (1) define an enclosure, the closing angle (Θ_c) being smaller than the hooking angle (Θ_h) and the movable lid (2) being stabilized against

the static body (1) at said closing angle (Θ_c) under the action of the gravity,

g. the shape of the of the at least one hooking element (4) and of the at least one coupling portion (5) is configured such that the mechanical coupling can be decoupled by a 2D decoupling motion of the movable lid (2) comprising an upward translation along the vertical axis Z, a translation along an axis X perpendicular to axes Y2 and Z, and a rotation about the transverse axis Y1, wherein said 2D decoupling motion of the movable lid (2) is generated by an upward translation of the handling portion (3) along the vertical axis Z,

h. said kit of parts comprises sealing means for insulating said enclosure from the external environment such to form a surface treatment chamber.

Claim 2. Kit of parts according to claim 1, wherein the at least one hooking element (4) comprises a hook-shaped portion wrapping around a hooking axis Y1' parallel to said first transverse axis Y1, the hook-shaped portion having an opening, wherein the projection of the opening onto a plane P perpendicular to the coupling direction C1, when the movable lid (2) is at the hooking angle (Θ_h), with respect to the vertical axis Z, has a hook projection width, Wh1, and the coupling portion (5) comprises a rod wherein the projection of the rod onto a plane P perpendicular to the coupling direction C1 has a rod projection width, Wr1, said rod projection width Wr1 being smaller than the hook projection width Wh1 such that the mechanical coupling between the movable lid (2) and the static body (1) can be obtained by translating said hooking axis Y1' in the coupling direction C1 onto the second transverse axis Y2.

Claim 3. Kit of parts according to anyone of the preceding claims wherein

a. the movable lid (2) comprises a protruding portion (6) configured for being inserted in the static body (1) when the movable lid (2) is coupled to the static body (1) and rotated to the closing angle,

b. the static body (1) and the movable lid (2) comprise abutting means (7, 8), said abutting means (7, 8) being configured to limit the range of the sliding motion of the movable lid (2) on the coupling portion (5) of the static body (1) such that the protruding portion (6) of the

movable lid (2) does not contact the static body (1) when the movable lid (2) is decoupled from the static body (1).

Claim 4. Kit of parts according to anyone of the preceding claims wherein the static body (1) comprises at least one guiding element configured for guiding the hooking element (4) with respect to the second transverse axis Y2, such that the hooking element (4) becomes aligned with respect to the coupling portion (5) in the coupling direction C1, when the movable lid (2) is held by said handling portion (3) and is moved toward the static body (1) for being coupled to said static body (1), in an approach direction A perpendicular to said second transverse axis Y2.

Claim 5. Kit of parts according to claim 4 wherein the at least one guiding element comprises two lateral elements forming a funnel section in a plane comprising said approach direction A and parallel to, and/or comprising, said second transverse axis Y2.

Claim 6. Kit of parts according to anyone of the preceding claims wherein the movable lid (2) is configured such that the vertical axis passing by the center of mass (M) of the movable lid (2) intersects the first axis Y1 when the movable lid (2) is held by said handling portion (3) and is freely hanging.

Claim 7. Kit of parts according to anyone of claims 1 to 5 wherein the movable lid (2) is configured such that the vertical axis passing by the center of mass (M) of the movable lid (2) is in a forward position with respect to the first axis Y1 when the movable lid (2) is held by said handling portion (3) and is freely hanging, said movable lid (2) comprising blocking means for preventing the forward tilt of the movable lid (2) around the first axis Y1 out of the hooking/coupling orientation when the movable lid (2) is held by said handling portion (3).

Claim 8. Kit of parts according of the preceding claims wherein the sealing means comprise a vacuum system for generating a vacuum in said enclosure.

Claim 9. Kit of parts according of the preceding claims wherein the sealing means comprise fastening means for fastening the movable lid (2) to the static body (1).

Claim 10. Chamber for a surface treatment apparatus comprising a static body (1) and a movable lid (2) of a kit of parts according to anyone of the preceding

claims, wherein said static body (1) is mechanically coupled to said movable lid (2).

Claim 11. Movable lid (2) in a kit of parts according to anyone of the preceding claims, wherein

a. said movable lid (2) comprises a handling portion (3), said handling portion (3) being coupled to said movable lid (2) such that said handling portion (3) is rotatable about a first transverse axis Y1 with respect to said movable lid (2),
b. said movable lid (2) comprises at least one hooking element (4) for being mechanically coupled to at least one coupling portion (5) of a static body (1), the at least one hooking element (4) comprising a hook-shaped portion wrapping around a hooking axis Y1' parallel to said first transverse axis Y1, said hook-shaped portion comprising an opening for the passage of the at least one coupling portion (5).

Claim 12. Method for mounting a surface treatment chamber by coupling a movable lid (2) to a static body (1) of a kit of part according to anyone of claims 1 to 10, wherein the method comprises the steps of:

a. Handling the handling portion (3) of said movable lid (2) with a mechanical actuator,
b. Ensuring that second transverse axis Y2 of the movable lid (2) is in the proper orientation for the coupling with the static body (1),
c. Translating the movable lid (2) with respect to the static body (1) in an approach direction A such that the hooking element (4) becomes aligned with respect to the coupling portion (5) in the coupling direction C1,
d. Translating the movable lid (2) with respect to the static body (1) in the coupling direction C1 such that the hooking element (4) becomes coupled to the coupling portion (5),
e. Rotating the movable lid (2) about the first transverse axis Y1 such that the movable lid (2) becomes oriented at the closing angle (Θ_c) with respect to the vertical axis Z,
f. Sealing the movable lid (2) to the static body (1) such as to form a surface treatment chamber.

Claim 13. Method for opening a surface treatment chamber by decoupling a movable lid (2) from a static body (1) of a kit of part according to anyone of claims 1 to 10, wherein the method comprises the steps of:

a. Handling the handling portion (3) of said movable lid (2) with a mechanical actuator,
b. Lifting and/or translating the movable lid (2) in the vertical direction Z until the hooking element (4) becomes decoupled from the coupling portion (5),
c. Translating the movable lid (2) in a transverse direction perpendicular to the vertical direction Z to move the movable lid (2) away from the static body (1) for opening fully the surface treatment chamber.

Drawings

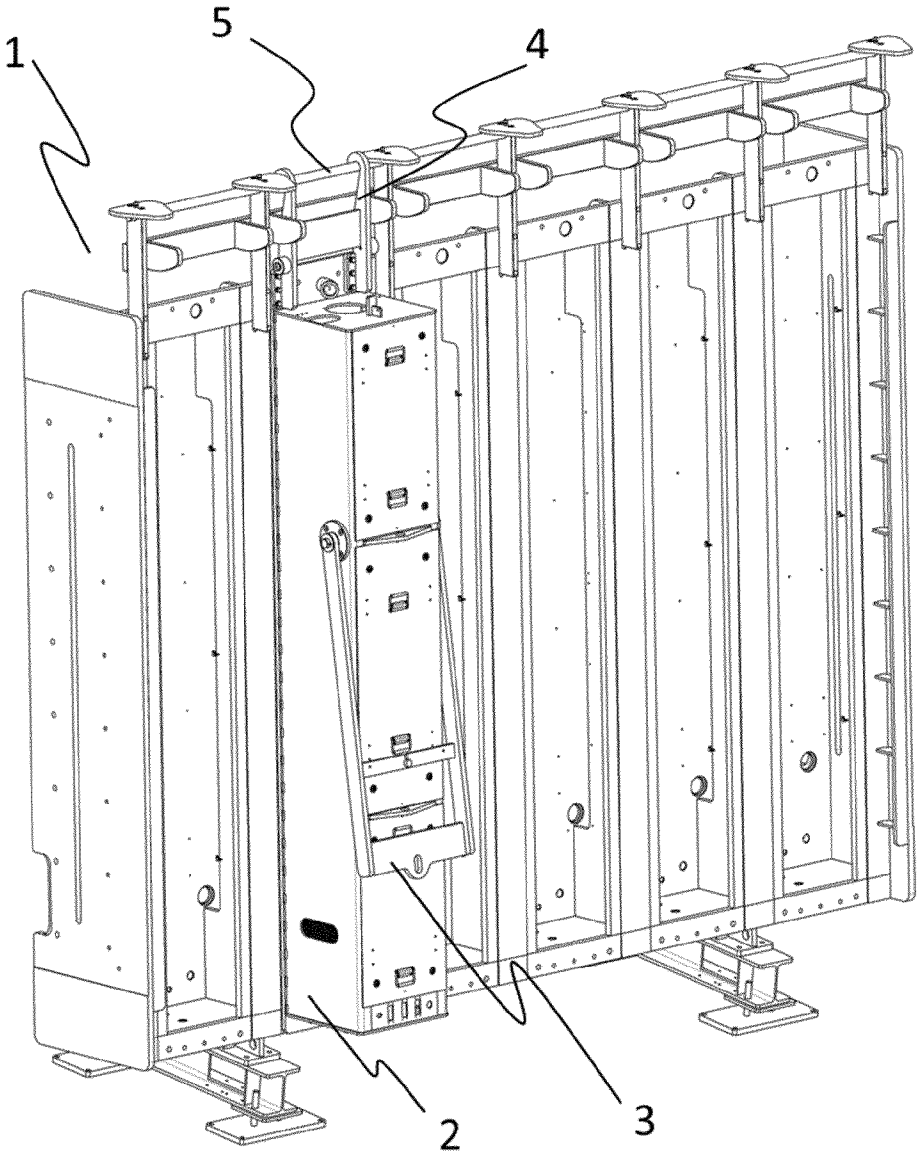


FIG. 1

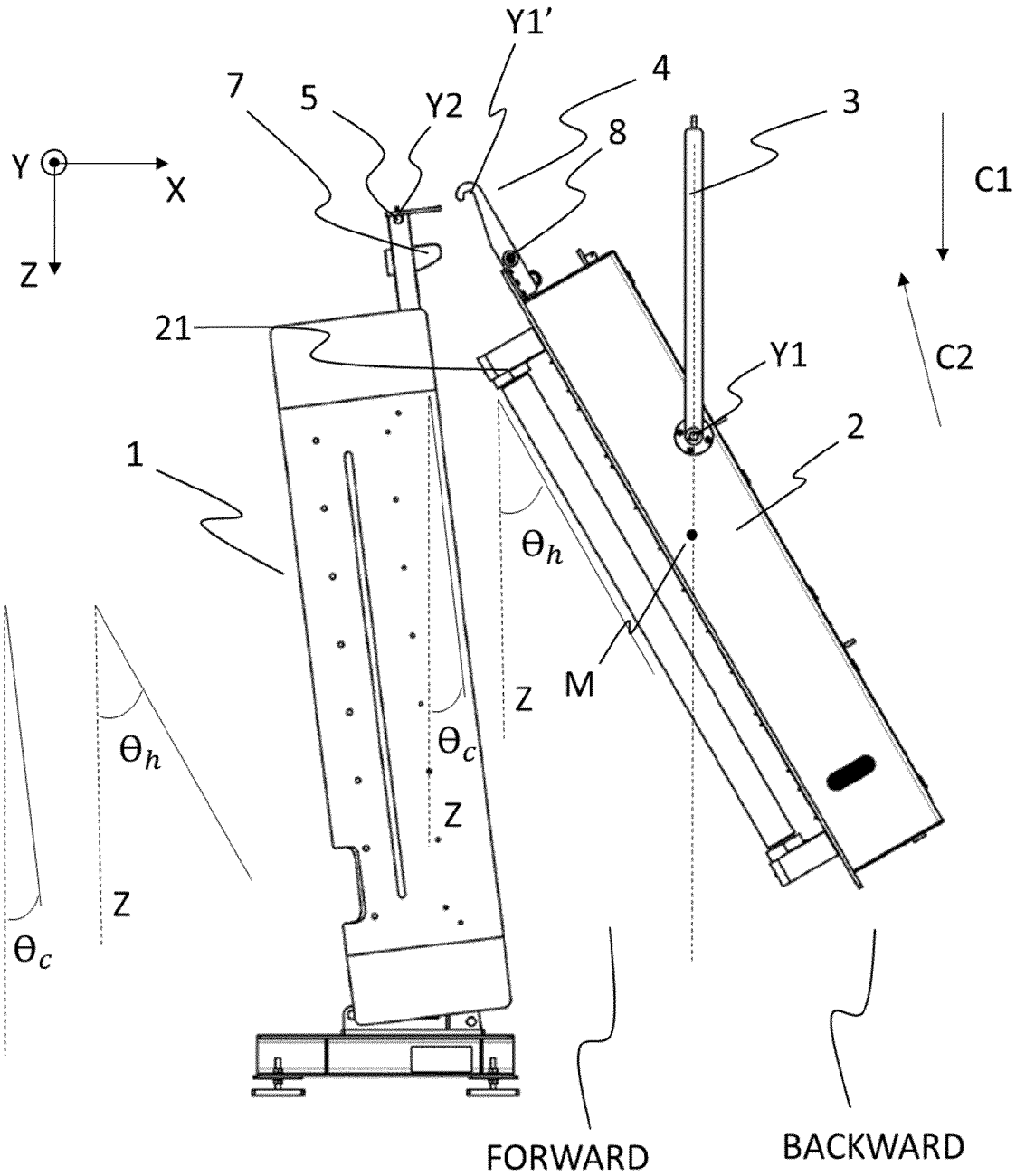

Y1'
7
5
Y2
4
8
3
C1
Y
X
Z
21
Y1
C2
2
1
θ_h
M
Z
θ_h
θ_c
Z
Z
θ_c
FORWARD
BACKWARD

FIG. 2

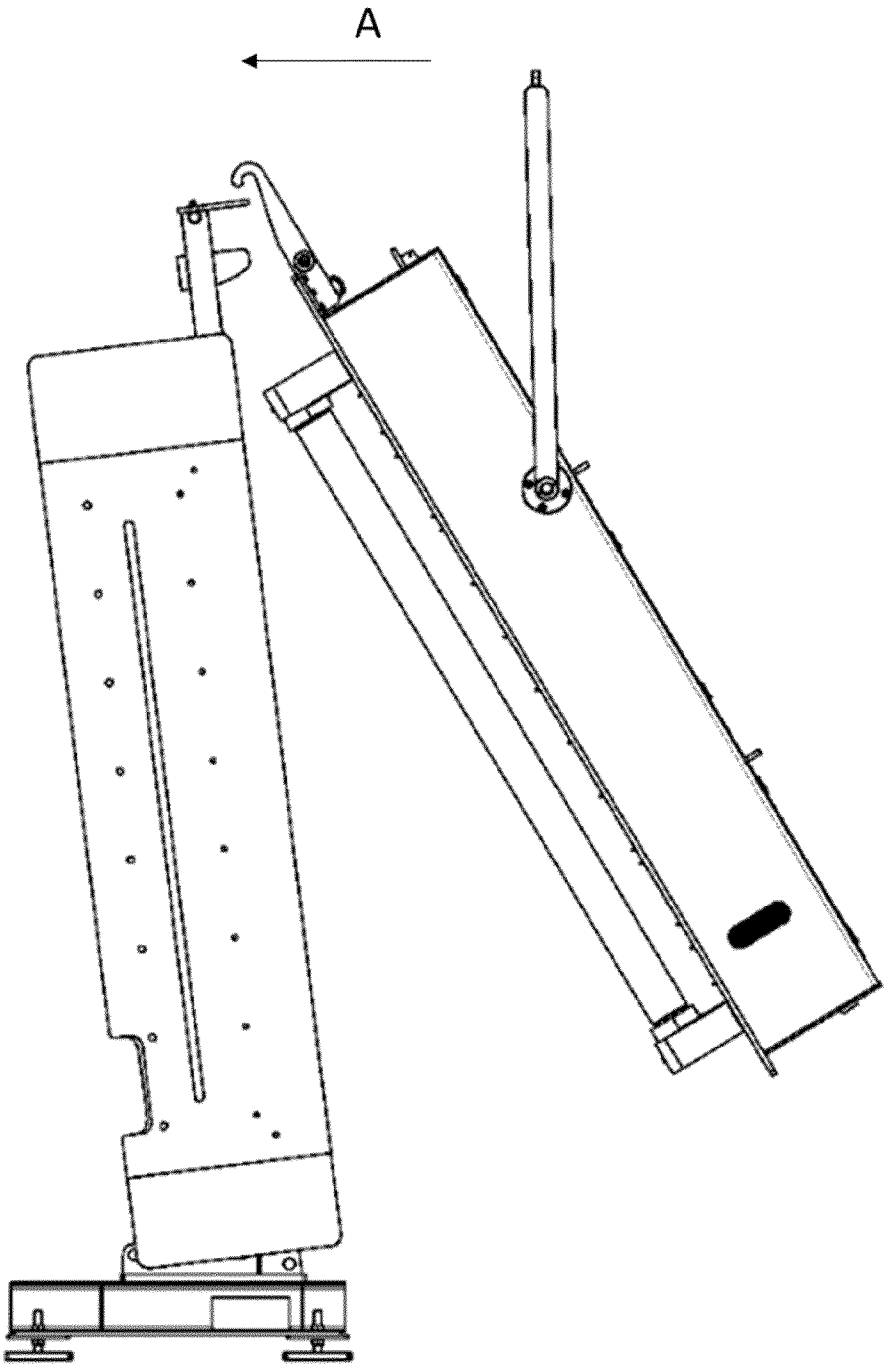


FIG. 3

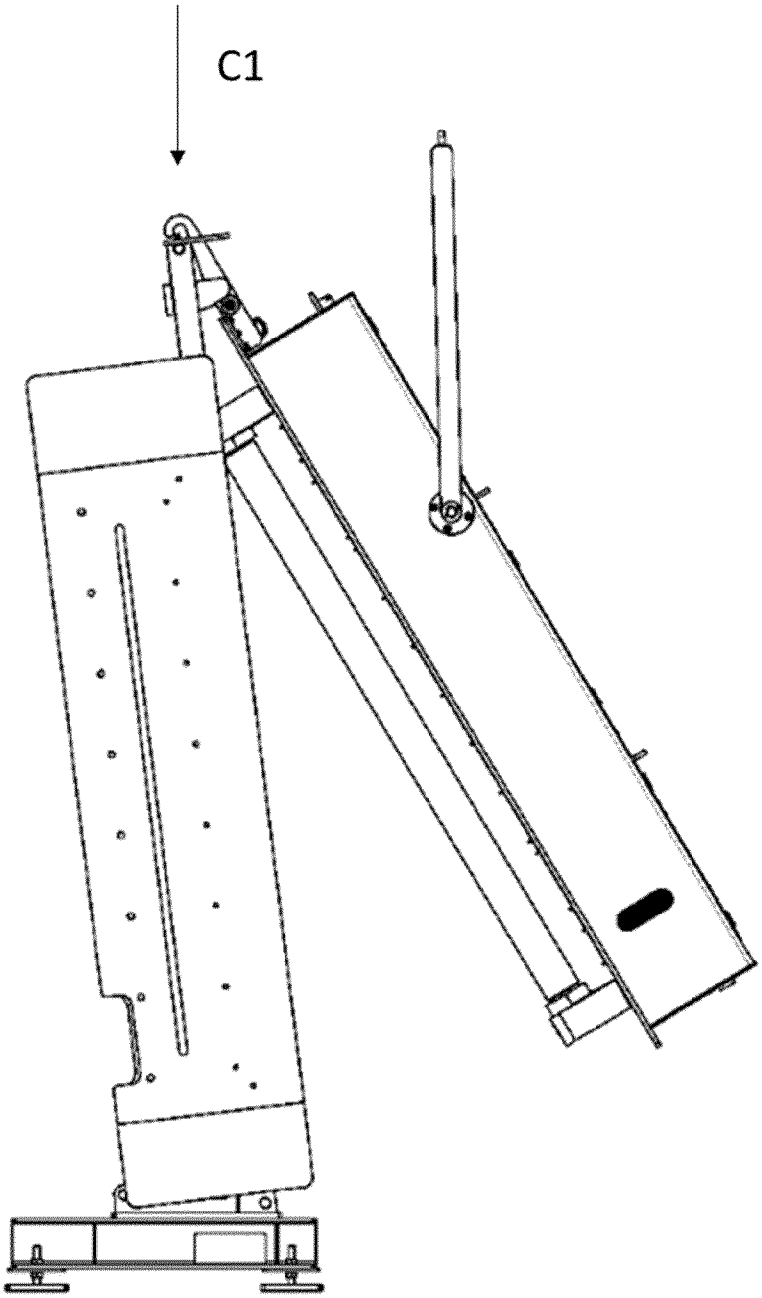


FIG. 4

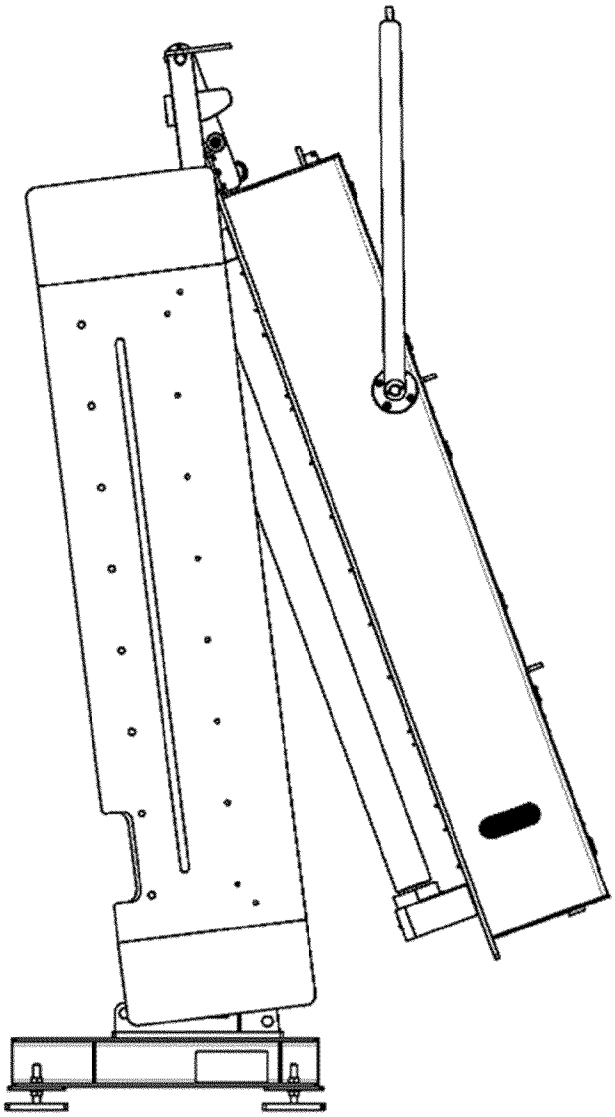


FIG. 5

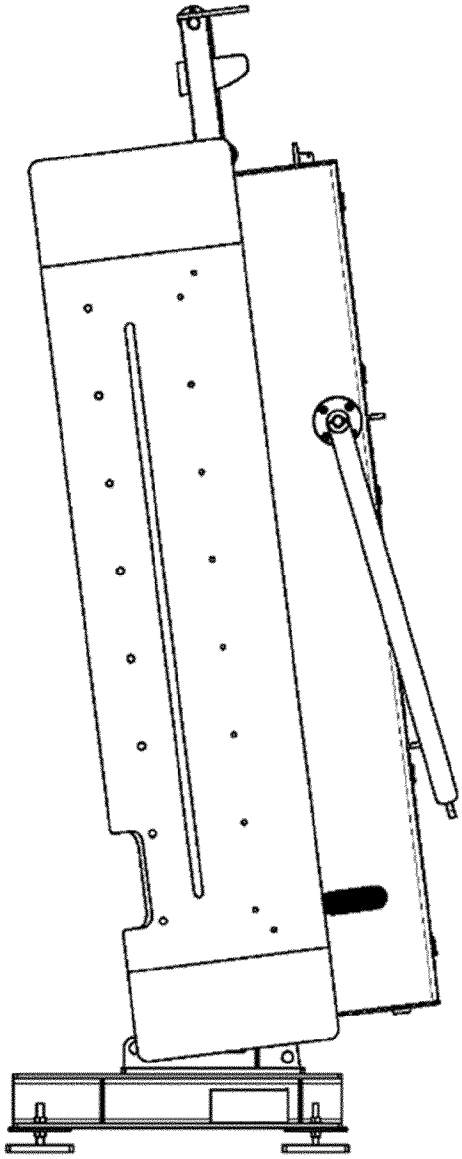


FIG. 6

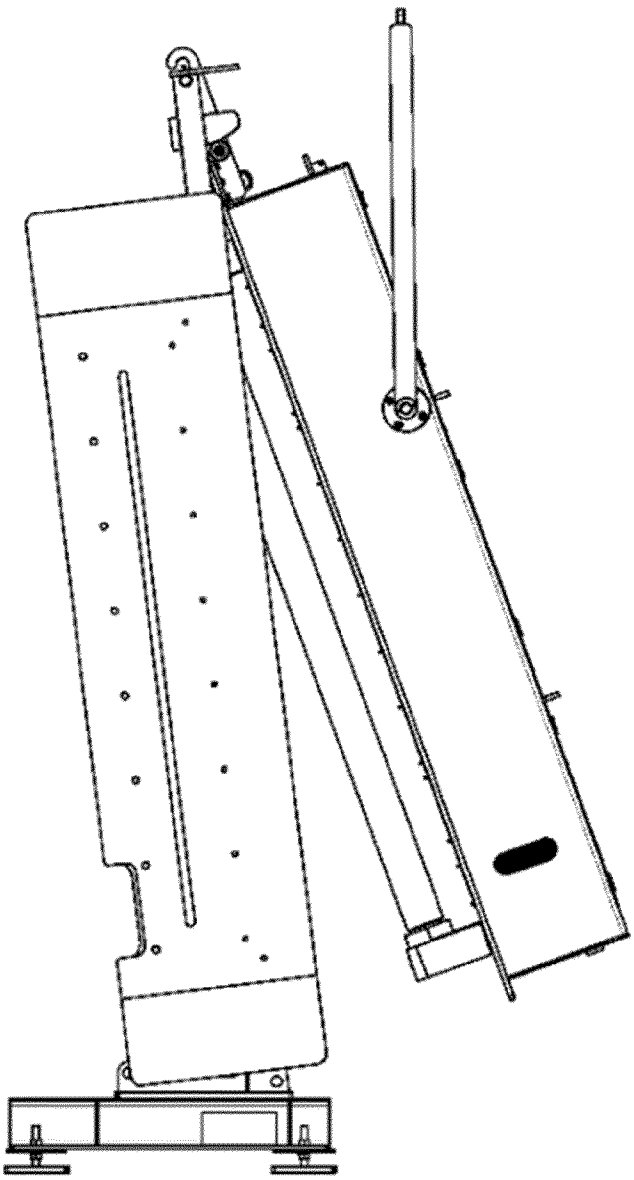


FIG. 7

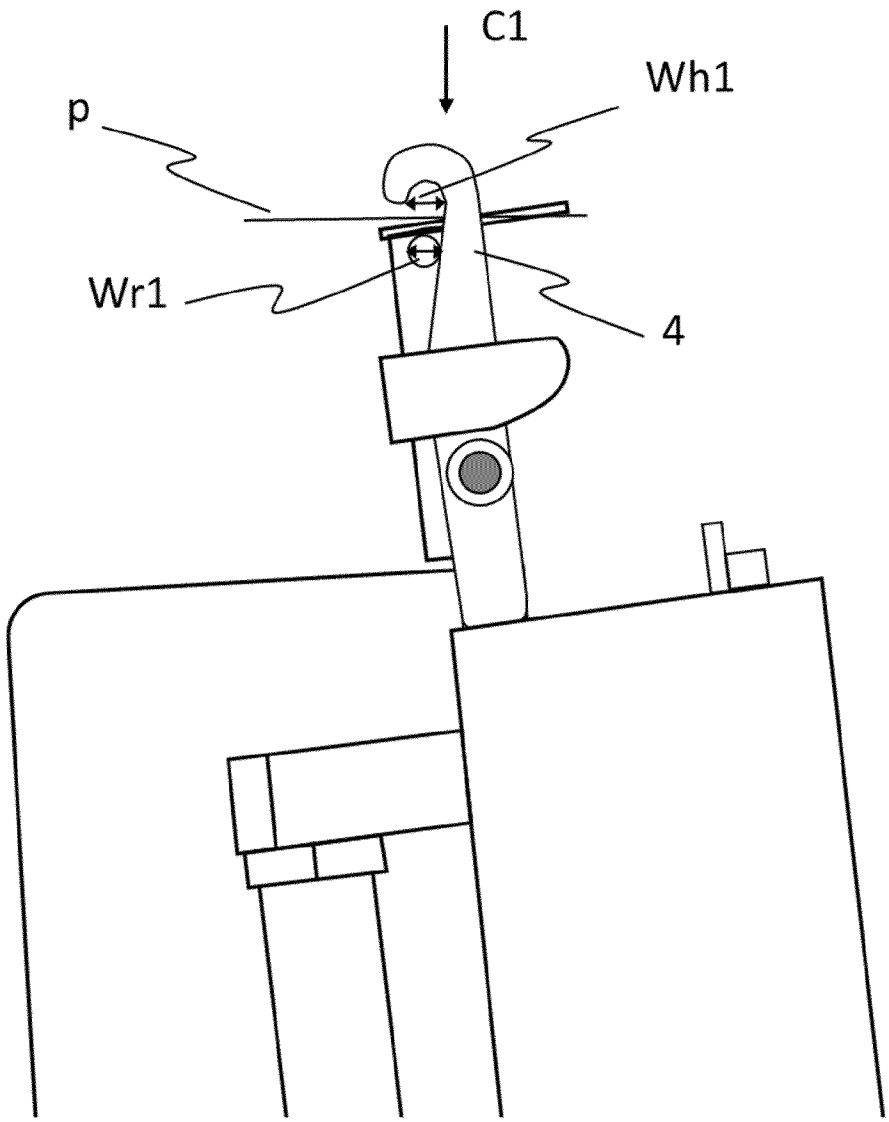


FIG. 8

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2019/072972

A. CLASSIFICATION OF SUBJECT MATTER
INV. C23C16/44 C23C16/54 C23C14/56 B01J3/03
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)
C23C B01J H01J C03C H01L B23Q E05D

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.
A	US 2004/258584 A1 (CHOI JIN-HYUK [KR] ET AL) 23 December 2004 (2004-12-23) paragraph [0043]; figure 2 paragraphs [0003], [0005] paragraph [0064]; figure 9 paragraph [0050]; figure 5	1-13
A	US 7 001 468 B1 (SHEYDAYI ALEXEI [US]) 21 February 2006 (2006-02-21) column 1, line 18 - line 22 column 4, line 18 - column 5, line 18; figure 2	1-13
A	US 2006/071384 A1 (LEE YOUNG J [KR] ET AL) 6 April 2006 (2006-04-06) paragraph [0038] - paragraph [0043]; figure 3	1-13

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

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"E" earlier application or patent but published on or after the international filing date

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"P" document published prior to the international filing date but later than the priority date claimed

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
22 November 2019	29/11/2019

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Kudelka, Stephan

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Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2019/072972

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6 009 667 A (MIZUKAMI MASAMI [JP]) 4 January 2000 (2000-01-04) column 3; figures 1,2 -----	1-13

1

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Information on patent family members

International application No
PCT/EP2019/072972

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