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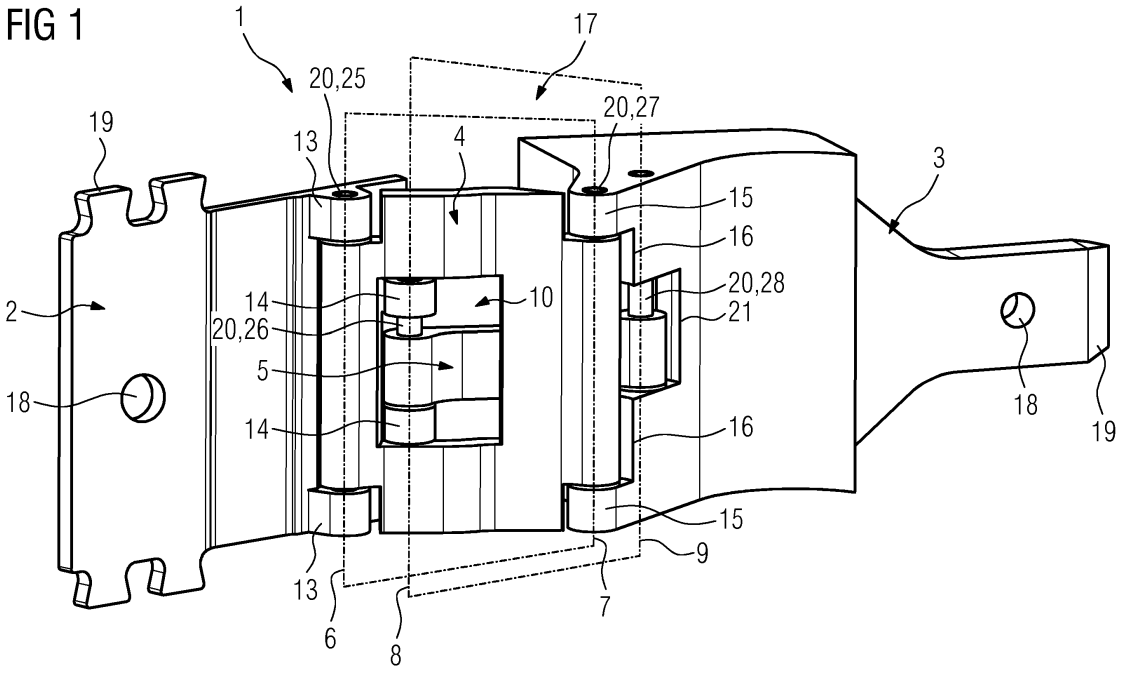
(54) Multi-link hinge

(57) A multi-link hinge, for the articulation of a door of a kitchen appliance, preferably for a laterally opening door, comprising
- a first mounting part and a second mounting part,
- at least two hinge links, preferably a first hinge link and a second hinge link, for connecting the first mounting part to the second mounting part, and

wherein the first hinge link is connected to the first mounting part pivotable about a first axis,
wherein the first hinge link is connected to the second mounting part pivotable about a second axis,
wherein the second hinge link is connected to the first mounting part pivotable about a third axis,
wherein the second hinge link is connected to the second mounting part pivotable about a fourth axis, and
wherein the first hinge link comprises an opening, and, preferably, wherein in a maximum opening position the third axis is in or moved through the opening of the first hinge link.

FIG 1



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Description

[0001] The present invention relates to a multi-link hinge, for the articulation of a door of a kitchen appliance, preferably for a laterally opening door, a kitchen appliance comprising a hinge and a method for operating a hinge for an opening or opening/closing cycle of a door of a kitchen appliance.

[0002] Many cooking appliances, such as ovens, have a simple door hinge with a single axis of rotation.

[0003] Such hinges have different disadvantages in stability, handling, limited opening angle, particularly if the cooking appliance is a built-in model, i.e. to be positioned in a kitchen cabinet, and the like. This is, as such hinges are positioned within the clear opening of such cabinet and thus abut to the door leaf if the kitchen appliance is to be opened.

[0004] In furniture manufacturing, four-bar linkage hinges are widely used. Such four-bar linkage hinges allow door opening angles of up to about 110°. In order to achieve higher door opening angles more complex and, thus, more expensive mechanisms or mechanisms having much larger dimensions are used.

[0005] Moreover, solutions provided in furniture manufacturing are often not readily transferable to an application of such hinges in the door opening of kitchen appliances, as, e.g. insulation or integrity of the structure of the kitchen appliance has to be kept, or as the trajectory of such furniture door open/closing cycles is unusable for the opening of doors of kitchen appliances, such as an oven.

[0006] This is, particularly, as the desired outreach and/or working radius of such door of a kitchen appliance opening is to be determined by a moving sideways from the kitchen appliance and/or the cabinet and not to the front. Therefore, in a maximum opening position the distance of the edge of the door and the cabinet is often either too small to allow a desired opening, because of interference with the cabinet and/or structure of the kitchen appliance or, probably additionally, has the risk of finger entrapment.

[0007] Still, known door hinges, particularly in furniture manufacturing, concern mechanisms, e.g. using spring bodies, for keeping such doors in a closed position. Nevertheless, in kitchen appliances it is often also desired, e.g. when removing a hot cake from an oven, to keep the door in an open position, e.g. for safety reasons.

[0008] The document DE 31 20 065 A1 describes a furniture four-bar linkage hinge having two hinge parts which are to be fastened to a furniture body or to a door and which are connected to one another in an articulated manner via an inner and an outer hinge link, comprising a leaf spring which overcomes a dead centre and is intended for keeping the door shut in the closed position and which has a V-like or U-like bow-shaped form. However, this document discloses a hinge used in furniture and, moreover, discloses a leaf spring provided to overcome a dead centre and intended for keeping the door shut in the closed position. This document does not provide any means for keeping the door opened.

[0009] The document US 4,236,272 describes a hinge comprising a compression spring, which is adapted to balance the weight of a hinged door. However, this document provides a hinge which is adapted to oppose torques exerted by or on leaves which are hinged on a horizontal or vertical axis. Also this document does not provide any means for keeping the door opened.

[0010] Moreover, none of the above documents discloses a hinge for use in a kitchen appliance allowing an opening angle of more than 110°.

[0011] It is an object of the present invention to provide a hinge for the articulation of a door of a kitchen appliance allowing a maximum opening angle of more than 110°, preferably up to at least 135°, and wherein, preferably, the kitchen appliance is a built-in kitchen appliance to be positioned in a cabinet, or the like.

[0012] It is a further object of the present invention to avoid possible interference and to ensure a good opening, preferably, where the kitchen appliance is a built-in kitchen appliance to be positioned in a cabinet, or the like.

[0013] It is a still further object of the present invention to a hinge which is less complex in construction and/or made of a manageable number of parts.

[0014] It is a still further object of the present invention to provide a hinge for the articulation of a door of a kitchen appliance, whereby a safety lock is provided in a maximum open position.

[0015] The above objects of the invention are achieved by a multi-link hinge according to claim 1, a kitchen appliance according to claim 13, and a method for operating a hinge for an opening or opening/closing cycle of a door of a kitchen appliance according to claim 15.

[0016] A multi-link hinge, preferably a four-bar linkage hinge, for the articulation of a door of a kitchen appliance or a cabinet, preferably for a laterally opening door, comprises

- A first mounting part and a second mounting part,
- at least two hinge links, preferably a first hinge link and a second hinge link, for connecting the first mounting part to the second mounting part, and

wherein the first hinge link is connected to the first mounting part pivotable about a first axis,
wherein the first hinge link is connected to the second mounting part pivotable about a second axis,
wherein the second hinge link is connected to the first mounting part pivotable about a third axis,

wherein the second hinge link is connected to the second mounting part pivotable about a fourth axis, and wherein the first hinge link comprises an opening, and, preferably, wherein in a maximum opening position the third axis is in or moved through the opening of the first hinge link.

[0017] Such a hinge is useful for the articulation of a door of a kitchen appliance allowing a maximum opening angle of more than 110°, preferably such hinge allows a maximum opening angle of at least 135°. Thereby, such hinge ensures a good opening and possible interference with the structure of the kitchen appliance and/or the cabinet, particularly if it is a built-in kitchen appliance, is avoided. This is particularly the case as such hinge allows the door to realize an opening and closing trajectory of the door relative to the structure of the kitchen appliance which eliminates the many constraints of the known hinges, particularly with a single axis of rotation. It will also be immediately understood that such hinge comprises a manageable number of parts, which basically are, in a preferred embodiment two hinge links, namely the first hinge link and the second hinge link, which are connected to two mounting parts, i.e. the first mounting part and the second mounting part, and means for fixing the hinge to the door and structure of the kitchen appliance. The connection of each hinge link with each mounting part is designed as an axis, and preferably, is mediated without any additional parts. In an embodiment, preferably, the first hinge link is an internal hinge link and the second hinge link is an external hinge link.

[0018] By providing an opening in the first hinge link which is to be entered by the third axis, i.e. the one end of the second hinge link, where it is connected to the first mounting part pivotable, in a maximum opening position a maximum opening angle of more than 110° is made possible, in that the hinge allows for a wider angle, particularly without interference of the door and the cabinet and/or the structure of the kitchen appliance.

[0019] In an advantageous embodiment of the inventive multi-link hinge, wherein in a maximum opening position of the multi-link hinge, the third axis is in or moved through the opening such that, the notional plane formed by the third axis and the fourth axis is intersecting the notional plane formed by the first axis and the second axis.

[0020] The opening in the first hinge link as used herein, preferably is a recess, a window or a pocket in the first hinge link, preferably a window or a recess. Said opening is for taking up the third axis, i.e. the one end of the second hinge link, where it is connected to the first mounting part pivotable.

[0021] The first hinge link preferably is a plate-like element. The second hinge link preferably is a plate -like element. Thus,, in a maximum opening position a maximum opening angle of more than 110° is made possible, in that the hinge allows for a wider angle, as the one end of the second hinge like element, i.e. the third axis, is passed through the opening such that the notional plane formed by the third axis and the fourth axis, which is the notional planar extension of the second hinge link, is intersecting the notional plane formed by the first axis and the second axis, which is the notional planar extension of the first hinge link. Said configuration of intersecting notional planes, facilitated by passing through the opening of the third axis.

[0022] In a further advantageous embodiment of the invention the first mounting part is for fixing the multi-link hinge to the door of the kitchen appliance and wherein the second mounting part is for fixing the multi-link hinge to the structure of the kitchen appliance.

[0023] It will be understood that said hinge has an opening direction which is predetermined by its configuration. Of course, a door, particularly of a kitchen appliance, is normally to be opened to the outside. Nevertheless, it will be understood that by arranging the hinge at the side walls of a kitchen appliance, it can be chosen whether the door is to be opened to the left or to the right side, i.e. a laterally opening door. Accordingly, the hinge can also be arranged at the bottom wall, i.e. resulting in a door which can be opened by folding down, or the hinge can also be arranged at the upper wall of the kitchen appliance, i.e. resulting in a door which is to be opened by folding up the door. Thus, the second mounting part is for fixing the multi-link hinge to the structure of the kitchen appliance and the first mounting part is for fixing the multi-link hinge to the door of the kitchen appliance.

[0024] In a further advantageous embodiment of the invention the kitchen appliance is selected from the group comprising an oven, a microwave, a refrigerator, or a freezer.

[0025] A cabinet as used herein preferably is a piece of furniture where the kitchen appliance is put in. It will be understood that such cabinet can be particularly made for built in kitchen appliances or can be an ordinary kitchen cabinet which can be equipped with the hinge of the present invention.

[0026] In a further advantageous embodiment of the invention, the first mounting part and/or the second mounting part, preferably the first mounting part is a mounting plate.

[0027] In a further advantageous embodiment of the invention, the first mounting part and/or the second mounting part, preferably the second mounting part has a cuboid shaped body.

[0028] A mounting part as understood herein, preferably is for mounting the hinge to the door, cabinet and/or structure of the kitchen appliance.

[0029] In an embodiment where a mounting part is fixed to the door, cabinet and/or structure of the kitchen appliance it is preferred that said mounting part comprises fixing means, such as fastening holes, where, for example, a screw or a pin, or the like is to be plugged or screwed in. Such fixing means can be arranged in a space saving manner, but preferably are accessible for the fitter. Moreover, such fixing means preferably is selected from the group comprising

framing, lip, fastening hole.

[0030] In a preferred embodiment the first mounting part is a mounting plate and the second mounting part is cuboid shaped.

[0031] More preferably, the second mounting part being cuboid shaped may have at least one rounded or beveled edge and/or at least one surface, preferably the surface facing away from the surface which is to be fixed to the door, cabinet and/or structure of the kitchen appliance, may be curved shaped.

[0032] In a further advantageous embodiment of the invention, the multi-link hinge comprises

- a first pair of limbs projecting from the first mounting part
- and a first axis element for connecting the first hinge link to the first mounting part pivotable about the first axis, and/or
- a second pair of limbs projecting from the first mounting part and a second axis element for connecting the second hinge link to the first mounting part pivotable about the third axis, and/or
- a third pair of limbs projecting from the second mounting part and a third axis element for connecting the first hinge link to the second mounting part pivotable about the second axis, and/or
- a fourth pair of limbs projecting from the second mounting part and a fourth axis element for connecting the second hinge link to the second mounting part pivotable about the fourth axis.

[0033] In connection therewith it will be immediately understood that such pair of limbs is preferably a structure for holding and/or for mounting the axis. Therefore, the pair of limbs preferably is arranged parallel to each other, and, more preferably having a distance which is about the length of the axis to be mounted.

[0034] Said axis preferably is mounted to the limbs using at least one rivet pin. For mounting said axis to the limbs the mounting part or the hinge link comprising said axis may provide a passage into which the rivet pin is introduced.

[0035] It will be understood that the axis can also be mounted to the limbs using one first rivet pin on each end of said passage, i.e. connecting one first limb with the mounting part or the hinge link on one end of the passage and axis, and using one second rivet pin on a second end of said passage and axis, i.e. connecting the second limb with the mounting part or the hinge link on the second side of the axis.

[0036] In an embodiment at least one rivet pin, preferably, is not a separate part. The rivet pin preferably is projecting from the mounting part or the hinge link as part of and/or prolongation of the axis.

[0037] In a preferred embodiment at least one pair of limbs, preferably the fourth pair of limbs is attached to formed by a cuboid shaped mounting part, preferably the second mounting part, such that the third pair of limbs projects from the second mounting part and the third axis element connects the first hinge link to the second mounting part pivotable about the second axis, and the projecting third pair of limbs is formed such that the fourth pair of limbs is formed, at least partially by the third pair of limbs, more preferably the fourth pair of limbs is formed by and/or arranged in a notch, wherein the notch preferably is formed by, at least partially the projecting third pair of limbs.

[0038] In a further advantageous embodiment of the invention, wherein the second mounting part has a cuboid shaped body, and wherein the third pair of limbs projecting from the second mounting part and/or the fourth pair of limbs projecting from the second mounting part are arranged such that,

- in an opening cycle of the door a predetermined opening and closing trajectory of the door relative to the structure of the kitchen appliance is realized, wherein, more preferably, the opening and closing trajectory is a roto-translational trajectory, and/or
- the third pair of limbs and/or the fourth pair of limbs projects from a surface of the second mounting part which faces away from a side of the second mounting part for facing the structure of the kitchen appliance, and/or
- a distance between the point on the second mounting part and the structure of the kitchen appliance is selected such that in an opening and/or closing cycle of the door, the door moves away from the structure of the kitchen appliance and/or cabinet, without interference, wherein, preferably, the distance between the second mounting part and the structure of the kitchen appliance is between 20 mm and 30 mm, preferably, 21 and 26 mm, more preferably between 22 mm and 25 mm, and most preferably is 25 mm.

[0039] It will be understood that, preferably, in such configuration of the hinge according to the present invention the door, during the opening, moves away from the cabinet and/or structure of the kitchen appliance first in a front direction and second sideways, thereby avoiding possible interference and ensuring a good opening.

[0040] In a preferred embodiment the second axis and/or the fourth axis is arranged such that, if the second mounting part is fixed to the corpus or structure of the kitchen appliance a distance between the corpus or structure of the kitchen appliance is selected such that Said opening and closing movement of the door, preferably, the opening and closing trajectory is a roto-translational trajectory, more preferably as shown in Fig. 4 a and 4 b.

[0041] Said opening and closing movement of the door, preferably, the opening and closing trajectory is a roto-translational trajectory, more preferably as shown in Fig. 4 a and 4 b.

[0042] Preferably, the second mounting part has a cuboid shaped body and is arranged such that a first point thereof is located 25 mm in vertical from a cabinet housing the kitchen appliance, and 0 mm in horizontal.

[0043] Where the third pair of limbs and/or the fourth pair of limbs projects from a first surface of the second mounting part which faces away from a second side, i.e. a second surface of the second mounting part for facing the structure of the kitchen appliance, more preferably, the first surface and the second surface face away from each other.

[0044] The term "structure of a kitchen appliance" as used herein, preferably, means the body, the frame, the framework or part thereof, of such kitchen appliance where the hinge can be attached to.

[0045] In a further advantageous embodiment of the invention, the first hinge link and/or the second hinge link are made of an elastic material, preferably a material selected from the group comprising plastic, metal, preferably metal having small thickness, or combinations thereof.

[0046] It will be understood that such elastic material can be deformed by applying a deformation pressure. Accordingly, the first hinge link and/or the second hinge link made of an elastic material can be deformed by applying a deformation pressure. The elastic material, also exhibits a restoring force which will restore the natural shape of the deformed material, e.g. the deformed first hinge link and/or the deformed second hinge link, respectively.

[0047] In a further advantageous embodiment of the invention, an opening angle at a maximum opening position is 135°.

[0048] In a preferred embodiment the maximum opening position is at least 111°, at least 115°, at least 120°, at least 125°, at least 130°, at least 135°.

[0049] In a further advantageous embodiment of the invention, at a maximum opening position, preferably, wherein the third axis is in or moved through the opening, more preferably such that, the notional plane formed by the third axis and the fourth axis is intersecting the notional plane formed by the first axis and the second axis, the door is in a safety lock position.

[0050] Preferably, the second hinge link is made of elastic material. It will be understood that such safety lock in the above described configuration is achieved in the maximum opening position. More preferably, when the hinge of the present invention is rotated to a door opening position having an opening angle of 60°, the first hinge link is brought in contact with the second hinge link, and if the hinge is rotated to a door opening angle of from 80° to 100°, the second hinge link abuts against the first hinge link. If the first and/or the second hinge link is made of elastic material, the second hinge link exerts a deformation force on the first hinge link, and/or vice versa, preferably mediated by the rotational movement, wherein the first and/or second hinge link is elastically deformed, which allows the second hinge link to enter the opening in the first hinge link; and if the hinge is rotated to a maximum door opening angle, wherein the third axis is moved through the opening, preferably such that, the notional plane formed by the third axis and a fourth axis is intersecting the notional plane formed by a first axis and a second axis, the deformed first and/or second hinge link returns to its neutral position such that without again deforming the first and/or the second hinge link by applying a deformation force, the first hinge link and the second hinge link are wedged such that a back rotation of the door without applying an impulse with at least a force sufficient to mediate said second deforming is not possible.

[0051] It will be understood that, preferably, the dimensions of the opening in the first hinge link are chosen such that the first hinge link cannot enter or pass the opening without elastic deformation of the first and/or the second hinge link. Accordingly, the opening is slightly smaller in diameter as the second hinge link, preferably including the limbs mounting the third axis.

[0052] At a maximum opening angle of, most preferably 135°, the safety lock is thus achieved.

[0053] In a further advantageous embodiment of the invention, a distance between the second axis and the fourth axis is from 10 mm to 12 mm and/or
a distance between the third axis and the fourth axis is from 28 mm to 30 mm and/or
a distance between the first axis and the second axis is from 28 mm to 30mm and/or
a distance between the first axis and the third axis is from 6 mm to 9 mm and/or
the angle of the second mounting part to the second hinge link is from 116° to 118° in a closed position.

[0054] In a preferred embodiment the hinge of the present invention comprises no spring, spring body or the like.

[0055] The above described problems are also advantageously solved by a kitchen appliance, preferably an oven, comprising at least one door and at least one hinge, wherein the door is pivoted to the structure of the kitchen appliance by means of a hinge, wherein the structure of the kitchen appliance preferably is an oven structure, and wherein the hinge is a multi-link hinge according to the present invention.

[0056] In an advantageous embodiment of the invention, said hinge comprises a first mounting part and a second mounting part,

wherein the first mounting part is fixed to the door of the kitchen appliance directly or indirectly, and
wherein the second mounting part is fixed to the structure of the kitchen appliance and
wherein, more preferably, the hinge is for realizing a predetermined opening and closing trajectory of the door relative to the structure of the kitchen appliance.

[0057] It will be understood that the mounting part can be fixed to the door, cabinet or structure of the kitchen appliance, respectively, directly using a fixing means. It is also an embodiment of the present invention that a mounting part is to the door, cabinet or structure of the kitchen appliance, respectively, indirectly, preferably using a further mounting part, such as a guiding rail, a mounting plate, a further hinge link, or the like.

[0058] The above described problems are also advantageously solved by a method for operating a hinge for an opening or opening/closing cycle of a door of a kitchen appliance, comprising the following steps:

- a step a) of rotating the hinge to a door opening position having an opening angle of 60°, wherein, preferably, the first hinge link is brought in contact with the second hinge link;
- a step b) of rotating the hinge to a door opening angle of from 80° to 100°, wherein, preferably,

the second hinge link abuts against the first hinge link, more preferably, the second hinge link exerts a deformation force on the first hinge link, wherein the second hinge link is elastically deformed,
the second hinge link enters an opening in the first hinge link; and

- a step c) of rotating the hinge to a maximum door opening angle, wherein

a third axis is moved through the opening, preferably such that, the notional plane formed by the third axis and a fourth axis is intersecting the notional plane formed by a first axis and a second axis,
preferably, the second hinge link returns to its neutral position
Wherein in the opening or opening/closing cycle of the door, the door realizes, a predetermined opening and closing trajectory of the door relative to the structure of the kitchen appliance, more preferably, the opening and closing trajectory is a roto-translational trajectory,

- optionally, a step d) of closing the door by performing step a) to c) in reverse order;

wherein the hinge, preferably, is a multi-link hinge according to the present invention, and wherein, more preferably, the kitchen appliance is a kitchen appliance according to the present invention.

[0059] It will be immediately understood that a deformed elastic body such as a deformed first and/or second hinge link made of elastic material returns to its neutral position due to a restoring force.

[0060] Thus, if the second hinge link is located in the opening, pocket, recess or the like, of the first hinge link, an interference of the first hinge link and/or the second hinge link is not present, thus the first hinge link and/or the second hinge link will return into its natural position and shape and, thus, the door is in the safety lock.

[0061] All described embodiments of the invention have the advantage, that a maximum opening angle of more than 110°, preferably up to at least 135°, is allowed and, independent form whether the kitchen appliance is a built-in kitchen appliance to be positioned in a cabinet, or the like, or not.

[0062] Moreover, possible unwanted interferences of hinge, door and structure of the kitchen appliance are avoided and a good opening is ensured. The door with the hinge of the invention during the opening moves away from the cabinet mounted to the sides avoiding possible interference.

[0063] The present invention provides a hinge is less complex in construction and made of a manageable number of parts, basically a first mounting part and a second mounting part, and a first hinge link and a second hinge link, wherein limbs, axis elements, rivet pins or the like may be formed as parts of the mounting parts and/or hinge links, or formed as separate parts. Only fixing means, such as screws or the like, have to be provided additionally.

[0064] The present invention also provides a hinge for the articulation of a door of a kitchen appliance, whereby a safety lock is provided in a maximum open position.

[0065] The present invention will be described in further detail with reference to the drawings, in which

FIG 1	illustrates a perspective view of a hinge showing a first inventive embodiment;
FIG 2a, 2b, 2c, 2d	illustrate perspective views of a hinge in different opening angel positions showing a second inventive embodiment, wherein
FIG 2e	illustrates a side sectional few of the second inventive embodiment in an opening angle positing as in Fig 2d,

FIG 3a, 3b, 3c and 3d illustrate principle presentations of a hinge of the present invention

FIG 4a and 4b illustrate principle presentation and graphs showing the trajectory of the inventive hinge

FIG 5a and 5b illustrate perspective views of a kitchen appliance according to the present invention

[0066] FIG 1 shows a multi-link hinge 1 of the present invention, wherein the multi-link hinge 1 comprises a first mounting part 2 and a second mounting part 3, as well as a first hinge link 4 and a second hinge link 5. The first hinge link 4 is connected to the first mounting part 2 pivotable about a first axis 6, and to the second mounting part 3 pivotable about a second axis 7, the second hinge link 5 is connected to the first mounting part 2 pivotable about a third axis 8, and to the second mounting part 3 pivotable about a fourth axis 9, and the first hinge link 4 comprises an opening 10. Here the multi-link hinge 1 is shown in a position having an opening angle α of about 60°. To reach a maximum opening position the third axis 8 is moved through the opening 10 of the first hinge link 4 such that, the notional plane formed by the third axis 8 and the fourth axis 9 is intersecting the notional plane formed by the first axis 6 and the second axis 7. Here the two described notional planes do not intersect as the multi-link hinge is in a position having an opening angel of 60° and the third axis 8 is not yet moved through the opening 10 of the first hinge link 4. Moreover the first mounting part 2 which is for fixing the multi-link hinge to a not shown door of a kitchen appliance, and the second mounting part 3 which for fixing the multi-link hinge 1 to an also not shown structure of said kitchen appliance both comprise a fastening hole 18 for fixing the first and the second mounting part to the door or structure of said kitchen appliance, respectively. For facilitated fastening the first mounting part 2 comprises 4 lips 19, wherein said four lips are to be mounted to a fastening reception structure, preferably being present at the door. The second mounting part 3 also comprises a lip 19. Here the lip is for providing the fastening hole 18, as the second mounting part 3 has a cuboid shaped body and the lip is configured as a flat lip. The first mounting part and/or the second mounting part, preferably the first mounting part 2, here is a mounting plate. The multi-link hinge 1 also comprises a first pair of limbs 13 projecting from the first mounting part 2, and a first axis element 25 which connects the first hinge link 4 to the first mounting part 2 pivotable about the first axis 6 and a second pair of limbs 14 which project from the first mounting part 2 and a second axis element 26 for connecting the second hinge link 5 to the first mounting part 2 pivotable about the third axis 8, and a third pair of limbs 15 projecting from the second mounting part 3 and a third axis element 27 for connecting the first hinge link 4 to the second mounting part 3 pivotable about the second axis 7, and a fourth pair of limbs 16 projecting from the second mounting part 3 and a fourth axis element 28 for connecting the second hinge link 5 to the second mounting part 3 pivotable about the fourth axis 9. Here, the fourth pair of limbs 16 is formed by the cuboid shaped second mounting part 3 such that the third pair of limbs 15 projects from the second mounting part 3 and the third axis element 27 connects the first hinge link 4 to the second mounting part 3 pivotable about the second axis 7, and the projecting third pair of limbs 15 is formed such that the fourth pair of limbs 16 is formed, at least partially by the third pair of limbs 15. More precisely, the fourth pair of limbs 16 is formed by and arranged in a notch 21, wherein the notch 21 is formed by, the projecting third pair of limbs 15. In the shown embodiment the axis elements are formed as rivet pins 20 which are formed as projecting parts of the mounting parts and/or hinge links, respectively, projecting from the mounting part or the hinge link, respectively as part of and prolongation of the axis.

[0067] FIG 2a shows a second embodiment of the multi-link hinge 1 at an opening angle α of 60° is shown. In this embodiment the rivet pins 20 are metal pins which are inserted into an axis passage. Here at an opening angle α of 60° the first hinge link 4 is in contact with the second hinge link 5. FIG 2b shows the multi-link hinge of FIG 2a at an opening angle α of 80° and FIG 2c shows the multi-link hinge of FIG 2a and FIG 2b at an opening angle α of 100°, whereas FIG 2d and FIG 2e shows the multi-link hinge of FIGS 2a, 2b, 2c and 2d at a maximum of 140°. FIG 2e is a side sectional view of FIG 2d. The series of FIGS 2a to 2e represent the different stations of an opening cycle. It can be seen that at an open position having an opening angle α of 60° as shown in FIG 2a , the first hinge link 4 is brought in contact with the second hinge link 5 and that at an opening angle α of 80° and 100° as shown in FIG 2b and Fig 2c, respectively, the second hinge link 5 and the first hinge link 4 interfere in that the second hinge link 5 abuts against the first hinge link 4, where the second hinge link 5 exerts a deformation force on the first hinge link 4, wherein the second hinge link 5 is elastically deformed, the second hinge link 5 enters the opening 10 in the first hinge link4 ; and at a maximum door opening angle α as shown in FIGS 2d and 2e, the third axis 8 is moved through the opening 10, such that, the notional plane formed by the third axis 8 and 10 fourth axis 9 is intersecting the notional plane formed by the first axis 6 and the second axis 7, whereby the second hinge link 5 returns to its neutral position. Now the door, as shown in FIGS 2d and 2e is in a safety lock position.

[0068] FIGS 3a to d illustrate a series of principle presentations of an opening cycle of the embodiment of the hinge of the present invention shown in FIGS 2a to 2e. In Fig 3a the door 11 comprises an estetic glass 22, wherein the door 11 is fixed to the first mounting part 2. Here a built-in kitchen appliance is considered placed in a cabinet 23 having a front frame 24. The distance d between the point on the second mounting part 3 and the structure of the kitchen appliance, here at the inner edge of the cabinet 23 is selected such that in an opening and/or closing cycle of the door, the door

11 moves away from the structure of the kitchen appliance and the cabinet 23, without interference, wherein the distance d between the second mounting part 3 and the the inner edge of the cabinet 23 is 25 mm. Here the first point of the second mounting part is located at a distance of 25 mm in vertical from the cabinet 23 and 0 mm in horizontal.

[0069] The opening and closing movement of the door, and the opening and closing trajectory is a roto-translational trajectory. Fig 3a shows the hinge in a position where the door is closed, Fig 3b shows the arrangement shown in Fig 3a at an opening angle α of 45°, Fig 3c shows the arrangement shown in Figs 3a and 3b at an opening angle α of 90° and Fig 3d shows the arrangement shown in Figs 3a, 3b, and 3c at an opening angle α of 135°. Again it can be seen that at an opening angle α of 90° as also shown in FIG 2b and Fig 2c, respectively, the second hinge link 5 and the first hinge link 4 interfere, whereby at a maximum door opening angle α as also shown in FIGS 2d and 2e, the third axis 8 is moved through the opening 10, such that, the notional plane formed by the third axis 8 and fourth axis 9 is intersecting the notional plane formed by the first axis 6 and the second axis 7. Now the door, as shown also in FIGS 2d and 2e is in a safety lock position, see Fig 3d. As in a particular embodiment of the multi-link hinge according to the invention a distance between the second axis and the fourth axis preferably is from 10 mm to 12 mm and a distance between the third axis and the fourth axis preferably is from 28 mm to 30 mm and a distance between the first axis and the second axis preferably is from 28 mm to 30mm and a distance between the first axis and the third axis preferably is from 6 mm to 9 mm and the angle of the second mounting part to the second hinge link preferably is from 116° to 118'. The embodiment shown here has a distance between the second axis and the fourth axis is from 10.991 mm and a distance between the third axis and the fourth axis is 29.199 mm and a distance between the first axis and the second axis is 29.211 mm and a distance between the first axis and the third axis is 7.635 mm and, the angle of the second mounting part to the second hinge link is 117.123' in a closed position as shown in Fig 3a.

[0070] FIG 4a and 4b illustrate principle presentation and graphs showing the trajectory of the inventive hinge shown in Figs 3a to 3d, wherein the line in the graph of Fig 4b represents the path point on the glass. Here it can be seen that in the opening or opening/closing cycle of the door, the door realizes, a predetermined opening and closing trajectory of the door relative to the structure of the kitchen appliance, being a roto-translational trajectory as shown in Fig 4b.

[0071] FIG 5a and 5b illustrate perspective views of a kitchen appliance, here an oven according to the present invention. More particularly, the oven 12 comprises a door 11 and the inventive hinge 1, wherein the door is pivoted to the structure of the oven 12 by the hinge 1, the hinge 1 is for realizing a predetermined opening and closing trajectory of the door relative to the structure of the kitchen appliance and advantageously allows a maximum opening angle α of 135°. As shown in Fig. 5b the glass on the door in a position having an opening angle α of 40° is a at a distance d of 22 mm from the cabinet.

List of reference numerals

[0072]

1	multi-link hinge
2	first mounting part
3	second mounting part
4	first hinge link
5	second hinge link
6	first axis
7	second axis
8	third axis
9	fourth axis
10	opening
11	door
12	kitchen appliance
13	first pair of limbs
14	second pair of limbs
15	third pair of limbs
16	fourth pair of limbs
17	side of the second mounting part for facing the structure of the kitchen appliance
18	fastening hole
19	lip
20	rivet pin
21	notch
22	estetic glass
23	cabinet

24 front frame
25 First axis element
26 Second axis element
27 Third axis element
28 Fourth axis element

α opening angle
d distance

Claims

1. A multi-link hinge (1), preferably a four-bar linkage hinge, for the articulation of a door (11) of a kitchen appliance (12) or a cabinet (23), preferably for a laterally opening door (11), comprising

- a first mounting part (2) and a second mounting part (3),
- at least two hinge links, preferably a first hinge link (4) and a second hinge link (5), for connecting the first mounting part (2) to the second mounting part (3), and

wherein the first hinge link (4) is connected to the first mounting part (2) pivotable about a first axis (6),
wherein the first hinge link (4) is connected to the second mounting part (3) pivotable about a second axis (7),
wherein the second hinge link (5) is connected to the first mounting part (2) pivotable about a third axis (8),
wherein the second hinge link (5) is connected to the second mounting part (3) pivotable about a fourth axis (9), and
wherein the first hinge link (4) comprises an opening (10), and, preferably, wherein in a maximum opening position the third axis (8) is in or moved through the opening (10) of the first hinge link (4).

2. The multi-link hinge (1) according to claim 1, wherein in a maximum opening position of the multi-link hinge (1), wherein the third axis (8) is in or moved through the opening (10) such that, the notional plane formed by the third axis (8) and the fourth axis (9) is intersecting the notional plane formed by the first axis (6) and the second axis (7).

3. The multi-link hinge (1) according to any one of claims 1 to 2, wherein the first mounting part (2) is for fixing the multi-link hinge (1) to the door (11) of the kitchen appliance (12) and wherein the second mounting part (3) is for fixing the multi-link hinge (1) to the structure of the kitchen appliance (12).

4. The multi-link hinge (1) according to any one of claims 1 to 3, wherein the kitchen appliance (12) is selected from the group comprising an oven, a microwave, a refrigerator, or a freezer.

5. The multi-ink hinge (1) according to any one of claims 1 to 4, wherein the first mounting part (2) and/or the second mounting part (3), preferably the first mounting part (2), is a mounting plate.

6. The multi-link hinge (1) according to any one of claims 1 to 5, wherein the first mounting part (2) and/or the second mounting part (3), preferably the second mounting part (3), has a cuboid shaped body.

7. The multi-link hinge (1) according to any one of claims 1 to 6, wherein the multi-link hinge (1) comprises
a first pair of limbs (13) projecting from the first mounting part (2), and a first axis element (25) for connecting the first hinge link (4) to the first mounting part (2) pivotable about the first axis (6), and/or
a second pair of limbs (14) projecting from the first mounting part (2) and a second axis element (26) for connecting the second hinge link (5) to the first mounting part (2) pivotable about the third axis (8), and/or
a third pair of limbs (15) projecting from the second mounting part (3) and a third axis element (27) for connecting the first hinge link (4) to the second mounting part (3) pivotable about the second axis (7), and/or
a fourth pair of limbs (16) projecting from the second mounting part (3) and a fourth axis element (28) for connecting the second hinge link (5) to the second mounting part (3) pivotable about the fourth axis (9).

8. The multi-link hinge (1) according to any one of claims 1 to 7, wherein the second mounting part (3) has a cuboid shaped body, and wherein
the third pair of limbs (15) projecting from the second mounting part (3) and/or the fourth pair of limbs (16) projecting from the second mounting part (3) are arranged such that, in an opening cycle of the door (11), a predetermined opening and closing trajectory of the door (11) relative to the structure of the kitchen appliance (12) is realized,

wherein, more preferably, the opening and closing trajectory is a roto-translational trajectory, and/or wherein the third pair of limbs (15) and/or the fourth pair of limbs (16) projects from a surface of the second mounting part which faces away from a side (17) of the second mounting part for facing the structure of the kitchen appliance (12), and/or wherein
a distance d between the point on the second mounting part (3) and the structure of the kitchen appliance (12) is selected such that in an opening and/or closing cycle of the door (11), the door (11) moves away from the structure of the kitchen appliance (12) and/or cabinet (23), without interference, wherein, preferably, the distance d between the second mounting part (3) and the structure of the kitchen appliance (12) is between 20 mm and 30 mm, preferably, 21 and 26 mm, more preferably between 22 mm and 25 mm, and most preferably is 25 mm.

9. The multi-link hinge (1) according to any one of claims 1 to 8, wherein the first hinge link (4) and/or the second hinge link (5) are made of an elastic material, preferably a material selected from the group comprising plastic, metal, preferably metal having small thickness, or combinations thereof.

10. The multi-link hinge (1) according to any one of claims 1 to 9, wherein an opening angle (α) at a maximum opening position is 135°.

11. The multi-link hinge (1) according to any one of claims 1 to 10, preferably 10, wherein at a maximum opening position, preferably, wherein the third axis (8) is in or moved through the opening (10), more preferably such that, the notional plane formed by the third axis (8) and the fourth axis (9) is intersecting the notional plane formed by the first (6) axis and the second axis (7),
the door (11) is in a safety lock position.

12. The multi-link hinge (1) according to any one of claims 1 to 11, wherein
a distance between the second axis (7) and the fourth axis (9) is from 10 mm to 12 mm and/or
a distance between the third axis (8) and the fourth axis (9) is from 28 mm to 30 mm and/or
a distance between the first axis (6) and the second axis (7) is from 28 mm to 30mm and/or
a distance between the first axis (6) and the third axis (8) is from 6 mm to 9 mm and/or
the angle of the second mounting part (3) to the second hinge link 5 is from 116° to 118° in a closed position.

13. A kitchen appliance (12), preferably an oven, comprising at least one door (11) and at least one hinge (1), wherein the door (11) is pivoted to the structure of the kitchen appliance (12) by means of a hinge (1), wherein the structure of the kitchen appliance (12) preferably is an oven structure, and
wherein the hinge (1) is a multi-link hinge (1) according to any one of claims 1 to 12.

14. A kitchen appliance (12) according to claim 13, wherein the hinge (1) comprises a first mounting part (2) and a second mounting part (3),
wherein the first mounting part (2) is fixed to the door (11) of the kitchen appliance (12) directly or indirectly, and
wherein the second mounting part (3) is fixed to the structure of the kitchen appliance (12) and
wherein, more preferably, the hinge (1) is for realizing a predetermined opening and closing trajectory of the door (11) relative to the structure of the kitchen appliance (12).

15. A method for operating a hinge (1) for an opening or opening/closing cycle of a door (11) of a kitchen appliance (12), comprising the following steps:

- a step a) of rotating the hinge (1) to a door opening position having an opening angle (α) of 60°, wherein, preferably, the first hinge link (4) is brought in contact with the second hinge link (5);
- a step b) of rotating the hinge (1) to a door opening angle (α) of from 80° to 100°, wherein, preferably, the second hinge link (5) abuts against the first hinge link (4), more preferably, the second hinge link (5) exerts a deformation force on the first hinge link (4), wherein the second hinge link (5) is elastically deformed, the second hinge link (5) enters an opening (10) in the first hinge link (4); and
- a step c) of rotating the hinge (1) to a maximum door opening angle, wherein a third axis (8) is moved through the opening (10), preferably such that, the notional plane formed by the third axis (8) and a fourth axis (9) is intersecting the notional plane formed by a first axis (6) and a second axis (7), preferably, the second hinge link (5) returns to its neutral position,

wherein in the opening or opening/closing cycle of the door (11), the door (11) realizes, a predetermined opening and closing trajectory of the door (11) relative to the structure of the kitchen appliance (12), more preferably, the opening and closing trajectory is a roto-translational trajectory,

- optionally, a step d) of closing the door (11) by performing step a) to c) in reverse order;
wherein the hinge (1), preferably, is a multi-link hinge (1) according to any one of claims 1 to 12, and wherein, more preferably, the kitchen appliance (12) is a kitchen appliance (12) according to any one of claims 13 to 14.

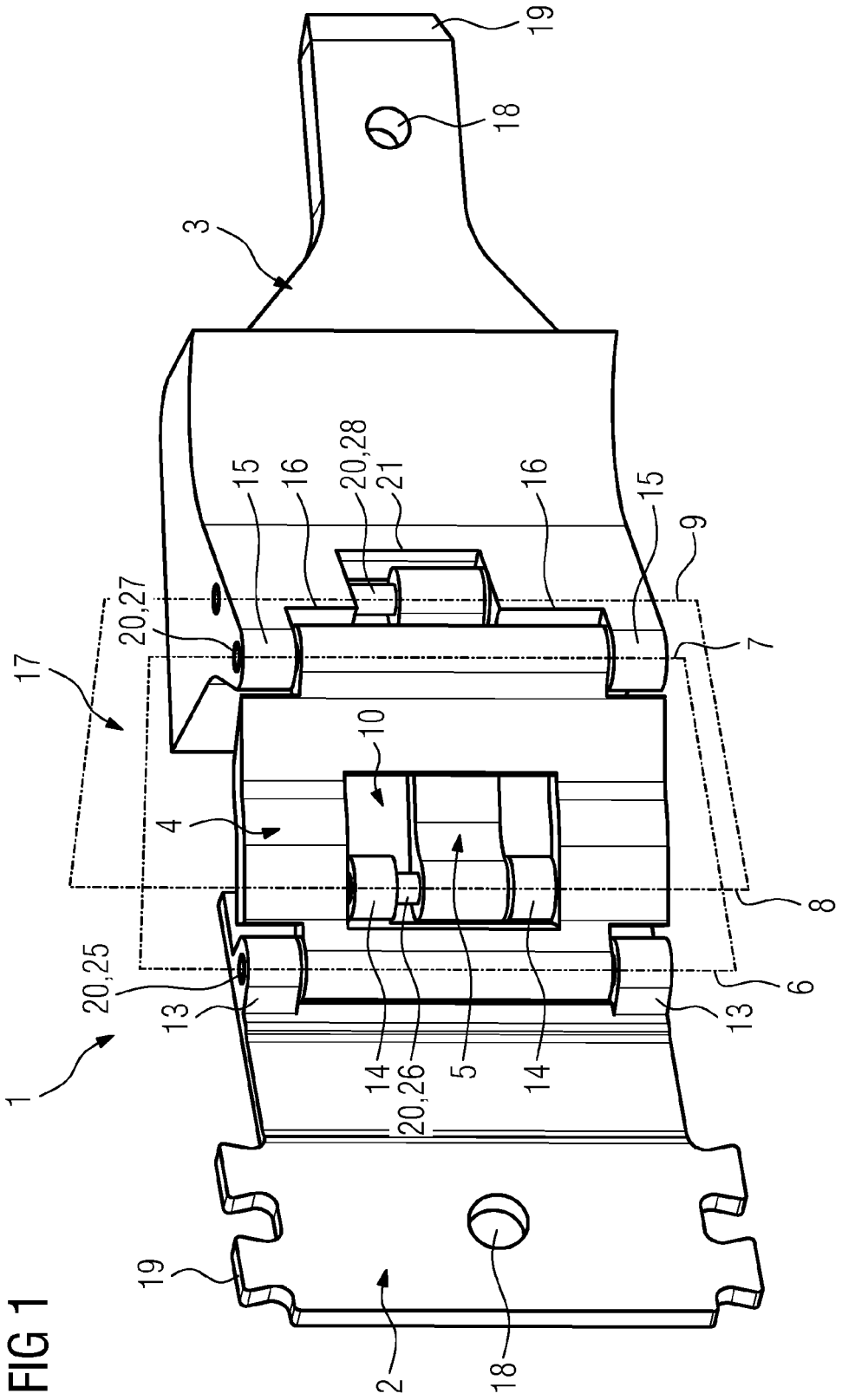
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FIG 1

FIG 2a

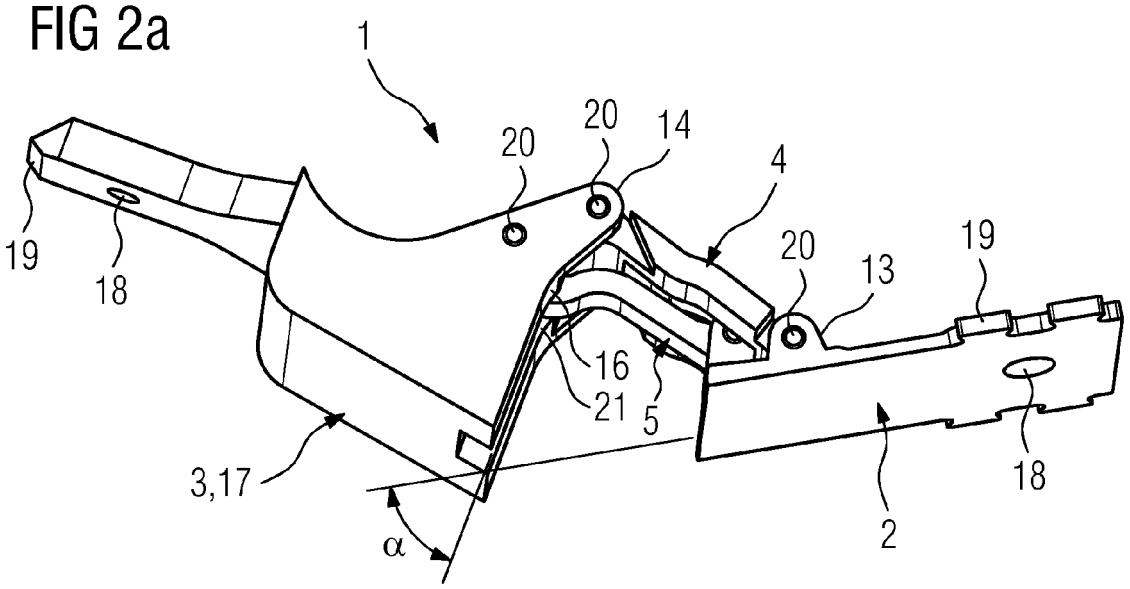


FIG 2b

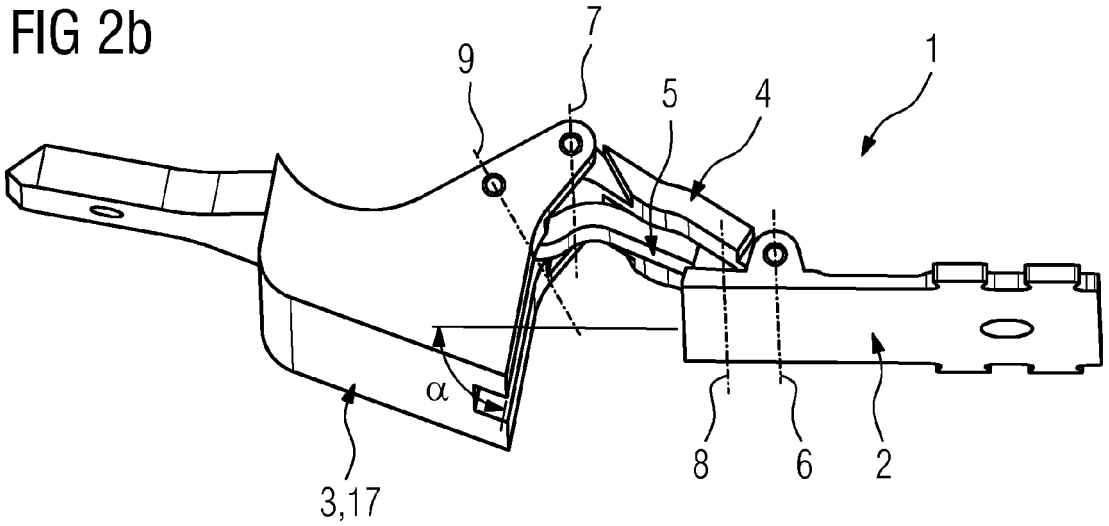


FIG 2c

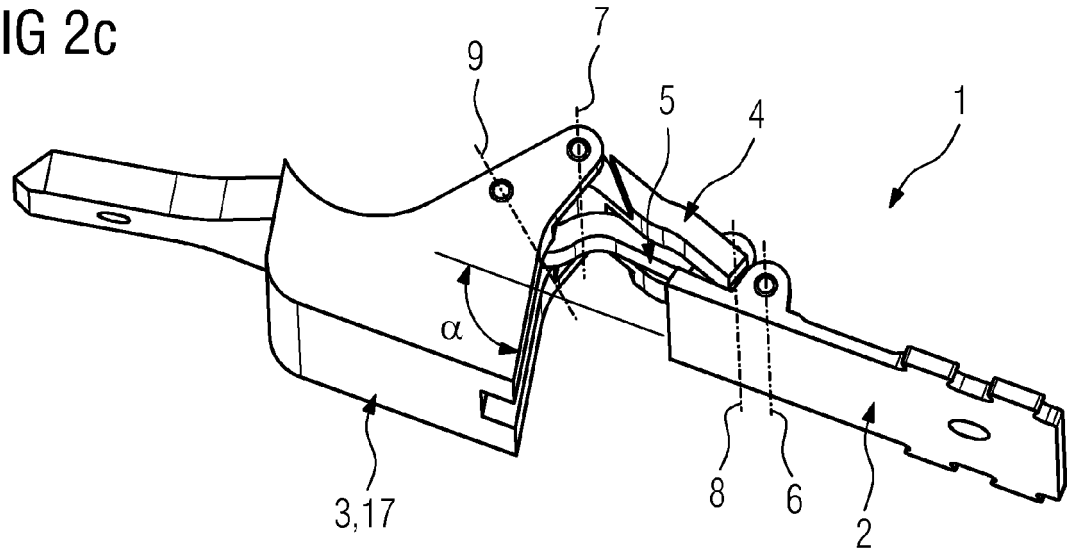


FIG 2d

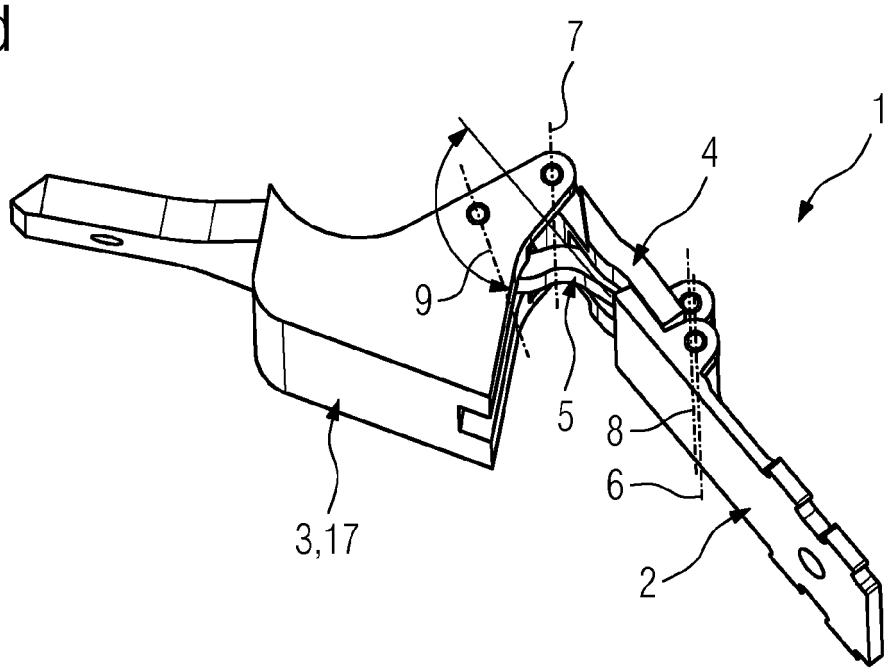


FIG 2e

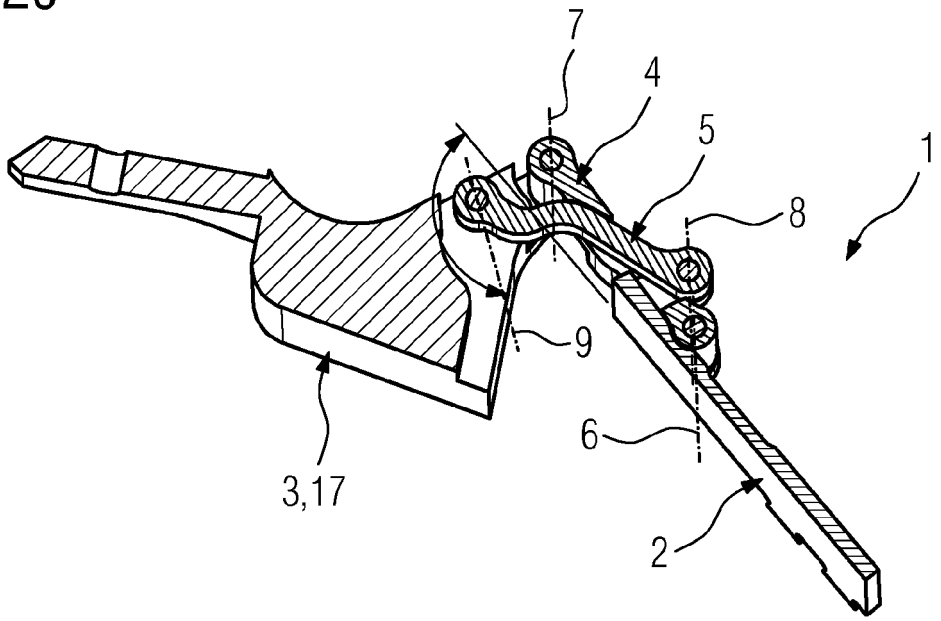


FIG 3a

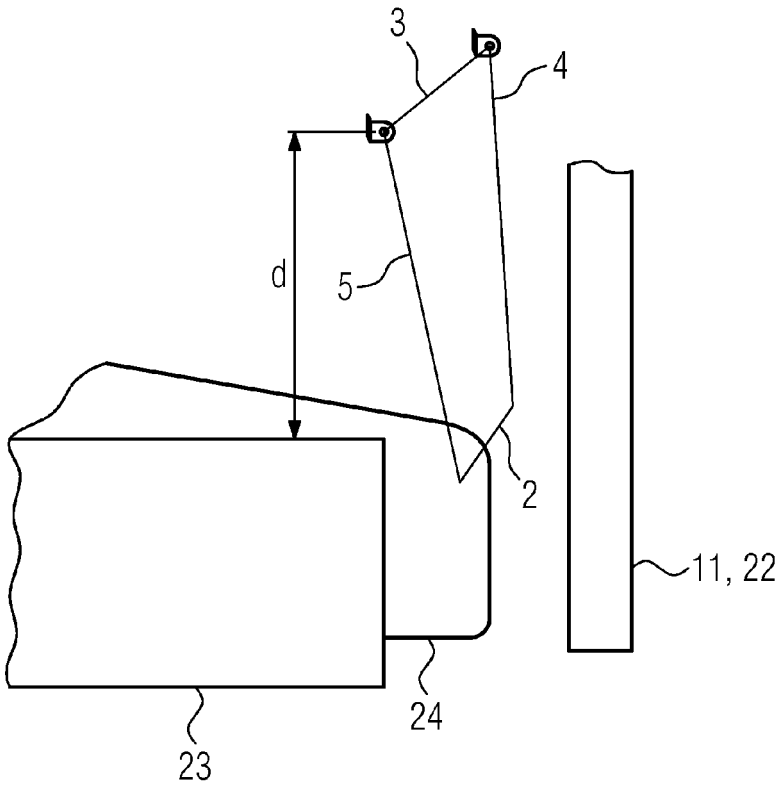


FIG 3b

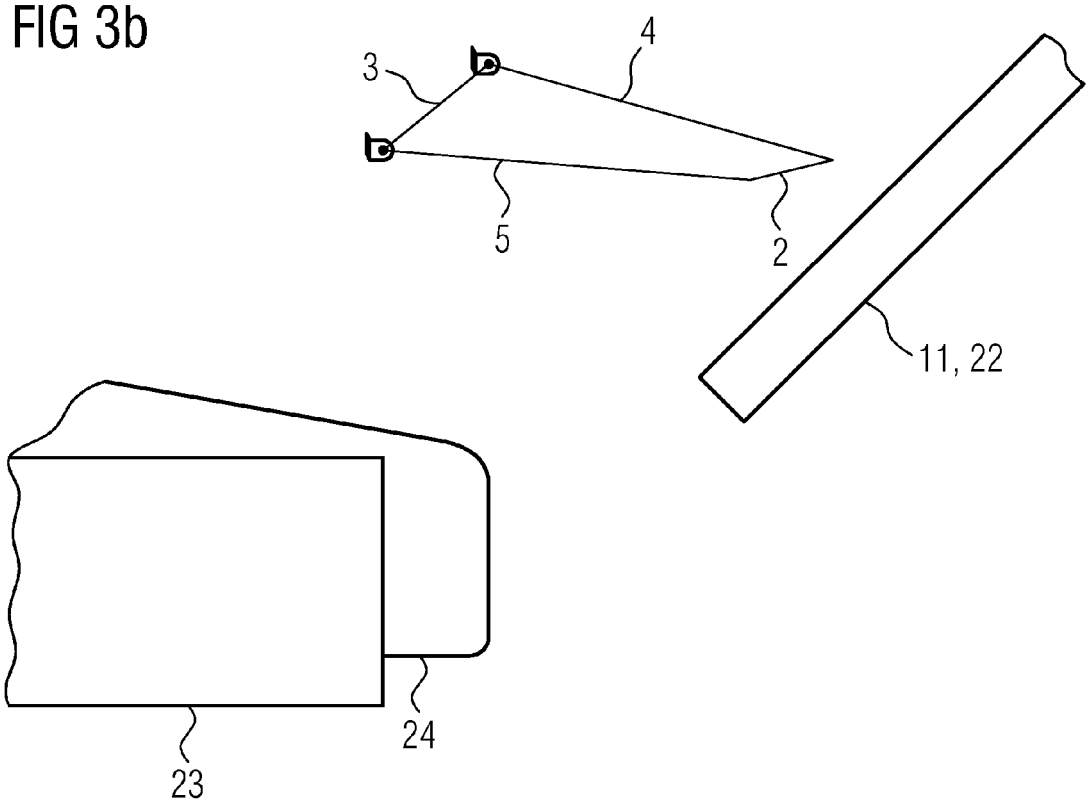


FIG 3c

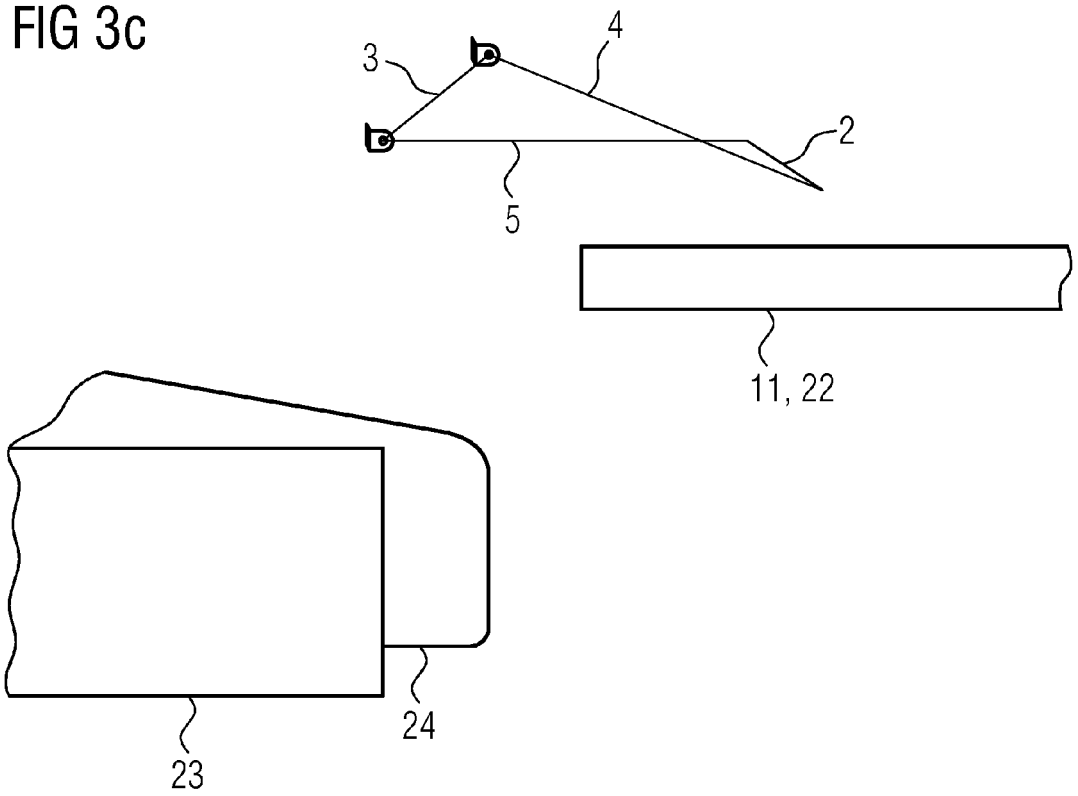


FIG 3d

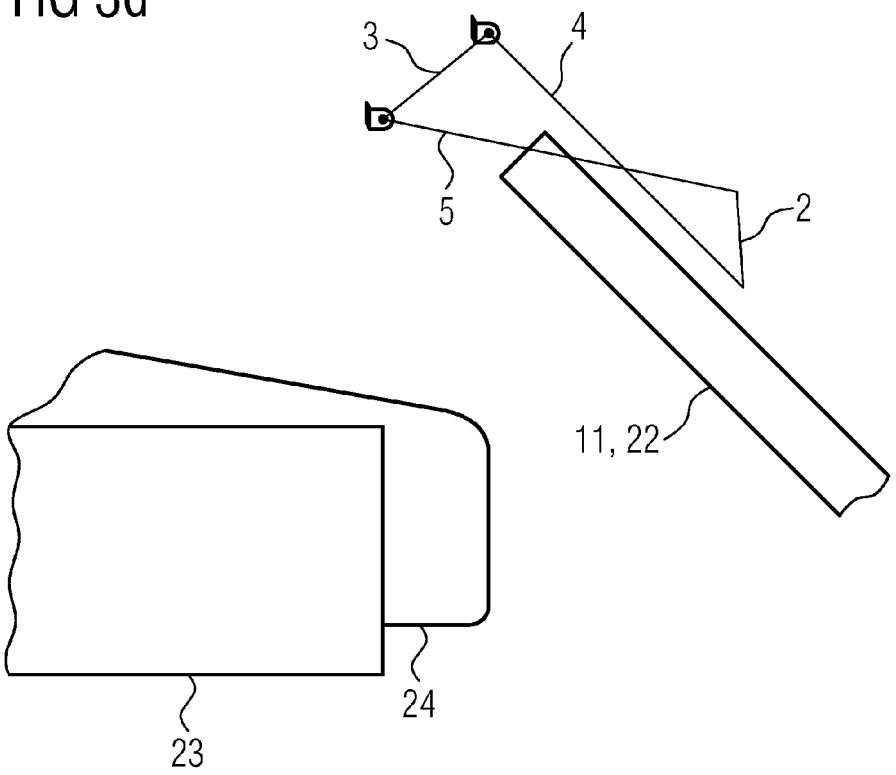


FIG 4a

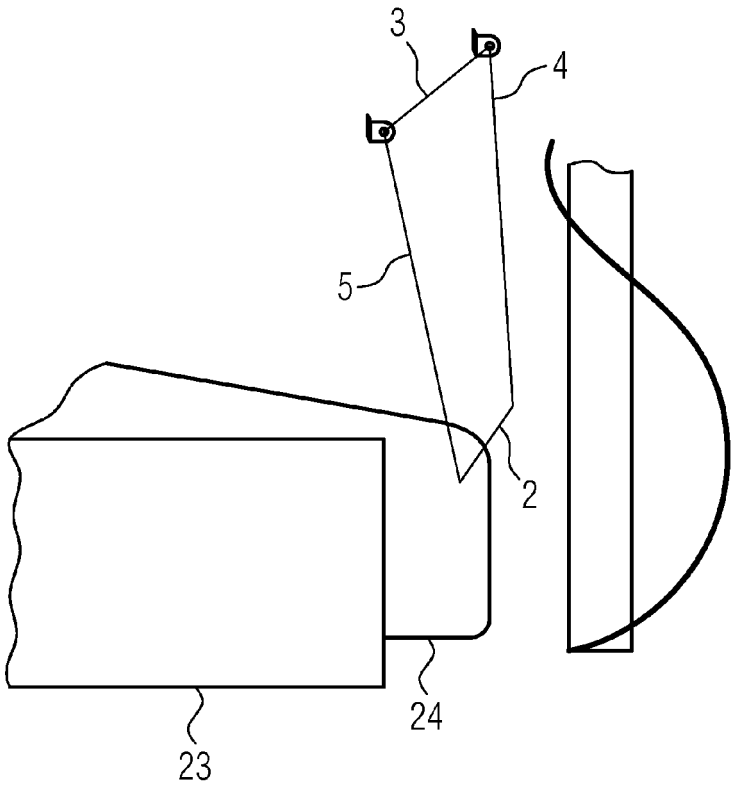


FIG 4b

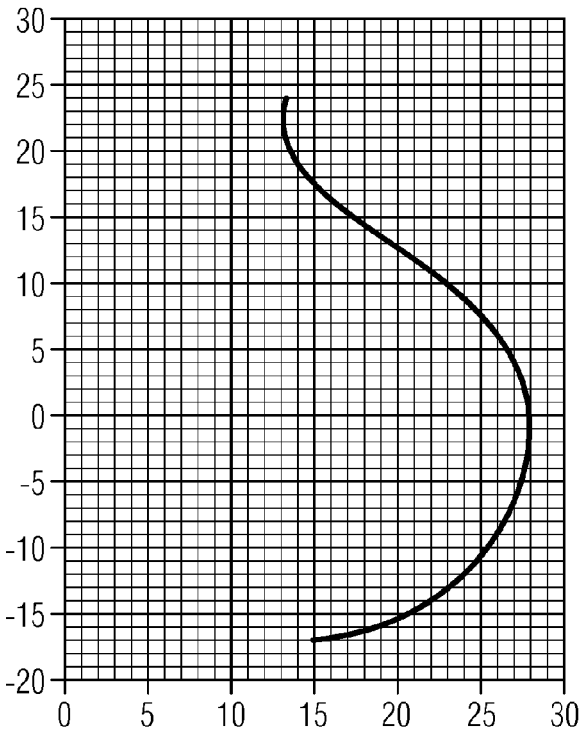


FIG 5a

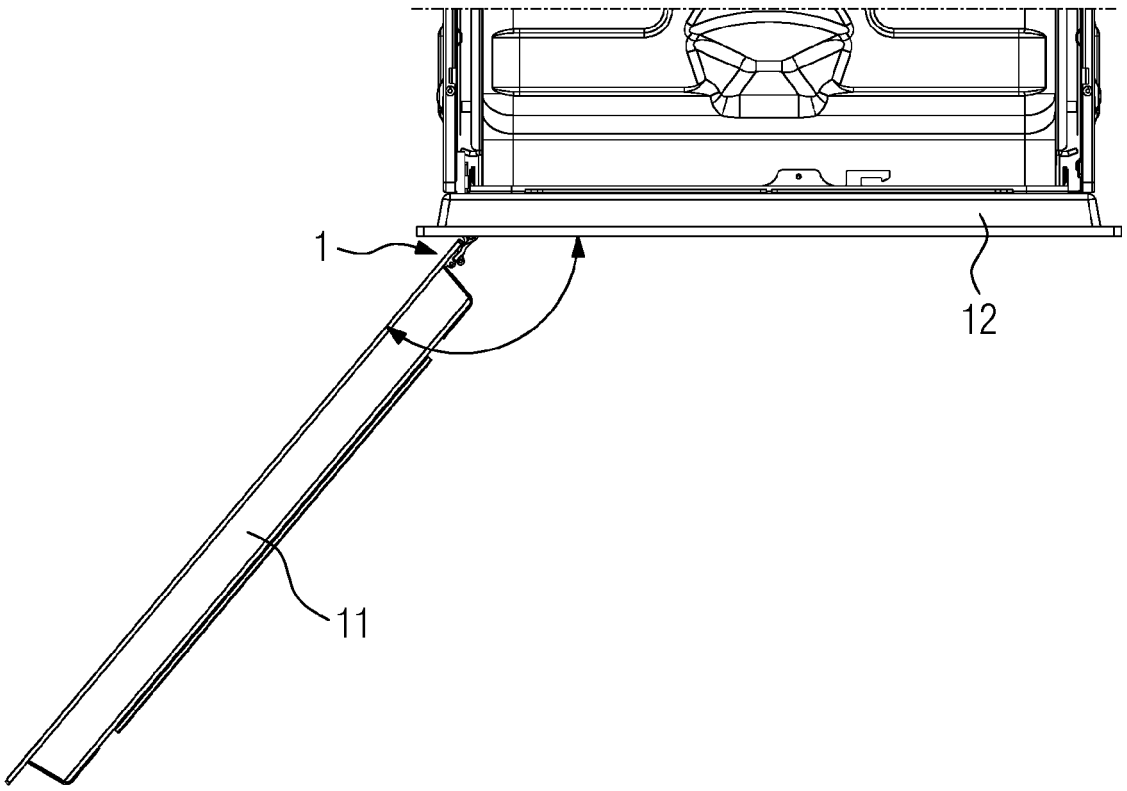
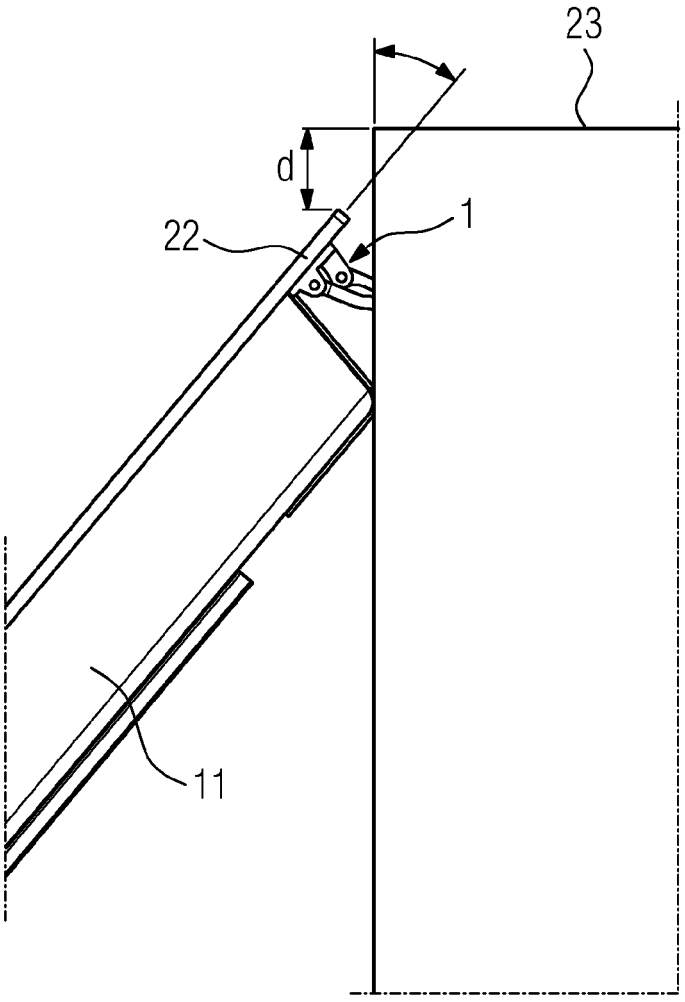


FIG 5b



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EUROPEAN SEARCH REPORT

Application Number
EP 13 19 8942

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 2 336 467 A1 (WHIRLPOOL EUROP S R L [IT]; MOLLI GIANCARLO IND S P A DE [IT]) 22 June 2011 (2011-06-22) * paragraphs [0001], [0013] - [0035]; figures 1-7 *	1-8, 10-14	INV. E05D3/14
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E05D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	21 March 2014	Rémondot, Xavier

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