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(54) **Household refrigerating appliance**

(57) A household refrigerator has a compartment provided with a double-leafed door and a movable mullion bar (10) is hinged at one of the two door leaves. At least one of the hinges (20) for hinging the mullion bar to the respective door leaf comprises a first couple (23, 29) and a second couple (24, 30) of cooperariting cam members, each cam member including a fixed cam member (23, 29) and a movable cam member (24, 30). The opening and closing of the door leaf causes relative rotating and translating motions between the movable cam members (24, 30) and the fixed cam members (23, 29) in opposition to a biasing force of a respective spring element (32).

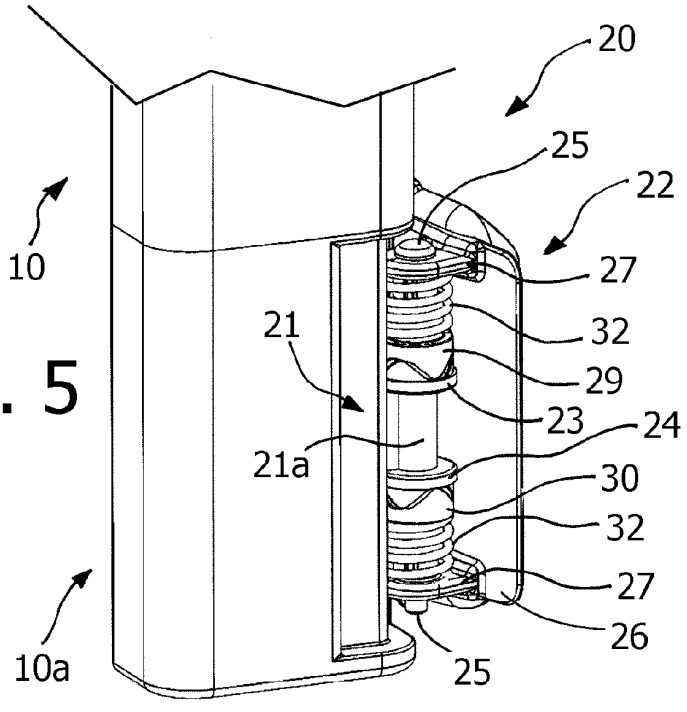


Fig. 5

EP 2 672 209 A1

Description

Field of the invention

[0001] The present invention refers to household refrigerating appliances, such as refrigerators, freezers and freezer-refrigerators. The invention was developed with particular attention being paid to a refrigeration apparatus having a preservation compartment provided with a double-leafed door, i.e. of the type also known as a French-style door.

Background art

[0002] A refrigerator of the indicated type is known from US-B-7,008,032, upon which the preamble of claim 1 is based. As is also explained in the introduction of the mentioned document, a mullion bar must be provided in the apparatuses of the indicated type, essentially having the function of supplying a seal surface: a vertical section of a gasket borne by a respective member of the door is intended to abut against this surface, in order to ensure a substantially sealed closure of the preservation compartment.

[0003] The presence of a fixed mullion bar does not facilitate access to the preservation compartment and for this reason US-B-7,008,032 proposes to hinge the mullion bar to one of the two door leaves: in such a manner, the opening of the aforesaid door leaf causes theremoval of the mullion bar from the opening of the preservation compartment, thereby facilitating the accessibility to the latter.

[0004] The refrigerator according to US -B-7,008,032 is also provided with means for determining and guiding a rotation movement of the mullion bar during the opening and closing of the related door leaf, so that each of the two door leaves can be opened without having to open the other. For such purpose, a guide member is associated to at least one of the upper wall and the lower wall of the preservation compartment of the refrigerator, such guide member being intended to cooperate with a guided appendage or projection provided at a respective end of the mullion bar. The guide member defines a surface against which the of the mullion bar abuts and interacts, at least during the closing of the door leaf, in order to cause a forced rotation of the mullion bar. To obtain this guided movement, also a further element of the guide member is exploited, which is spaced from the surface of the guide and the guided projection abuts thereon during the opening of the door leaf.

[0005] In the solution provided in US-B-7,008,032, the mullion bar is hinged to the related door leaf by means of an upper hinge and a lower hinge. Each of these hinges has a fixed hinge element and a movable hinge element, and each hinge element integrates a cam with a trilobed surface. The cams of the two hinge parts are coaxial to each other and with respect to the hinge pin, and they are maintained in the respective mutual engagement condition by means of a helical spring. With this arrangement, during the opening and closing of the door leaf, the forced rotation of the mullion bar causes rotating and translating motions of one of the two cams, which is mounted axially movable with respect to the other cam, opposing the action of the related spring. The rotation movement set for the mullion bar can substantially occur with controlled pitches or steps, due to the snapping of the movable cam with respect to the fixed cam.

Summary of the invention

[0006] In the solution described in US-B-7,008,032, the closure steps of the door leaf, which entail a mechanical interference between the guided projection of the mullion bar and the related guide member, give rise to possible damage of the parts in question and movements of the mullion bar that are relatively sharp, not very gradual, which is poorly perceived by the user. The present invention mainly aims at solving the aforesaid drawback in a simple and inexpensive manner. Such aim is achieved by a refrigeration apparatus having the characteristics indicated in claim 1.

[0007] The previous solution also leads to, above all in the mid-long term use of the refrigerator, occasional breakage or damage of the hinge system of the mullion bar. Another drawback of the mentioned prior art solution is represented by the fact that the forced rotation of the mullion bar, during the openings and closings of the related door leaf, occurs with relatively sharp snaps or movements, poorly perceived by the user. According to a different aspect, the present invention aims at solving this drawback in a simple and inexpensive manner. Such aim is achieved by a refrigeration apparatus having the characteristics indicated in claim 21.

[0008] The attached claims form an integral part of the technical teaching provided herein in relation to the invention.

Brief description of the drawings

[0009] Further objects, characteristics and advantages of the invention shall be apparent from the following description and from the attached figures, provided herein strictly for exemplifying and non-limiting purposes, wherein:

- Figures 1 and 2 are schematic perspective views of a refrigeration apparatus according to the present invention, in two different conditions;
- Figure 3 is a schematic perspective view of a movable mullion bar of the apparatus of figure 1, in enlarged scale, with related hinges and upper guide member;
- Figures 4 and 5 are schematic perspective views of end portions of the mullion bar of figure 3, in enlarged scale;

- Figures 6 and 7 are exploded schematic views of hinges of the portions of figures 4 and 5, in smaller scale;
- Figure 8 is a perspective view similar to that of figure 4, but without the upper guide member;
- Figures 9 and 10 are a schematic perspective view and a schematic plan view of the guide member of figure 4;
- Figure 11 is a schematic exploded view of the mullion bar of figure 3.

Description of preferred embodiments of the invention

[0010] In figures 1 and 2, a household refrigerator with several compartments is indicated with 1 as a whole, according to the present invention. As said, the invention is also applicable to freezers and freezer-refrigerators provided with a double-leafed door.

[0011] The refrigerator 1 has a fixed structure or cabinet 2, defining a plurality of compartments for the preservation of food products, comprising a compartment for fresh foods, indicated with 3 in figure 2. In the depicted example, the refrigerator 1 also comprises a drawer compartment 4 for defining a variable temperature space, which can function at 0°C or -18°C (for example similar to that described in the Italian patent application, owned by the same Applicant, having filing number RN2007A000056, in which the functioning mode at 0°C is obtained by means of an electrical resistance and an insulating separator which counter the heat dispersions) and a drawer compartment 5 for preserving frozen and/or chilled food products (such compartment can for example use the teachings of the Italian patent application, owned by the same Applicant, having filing number TO2007A000911, regarding a space for containing foods in a refrigeration apparatus, the space being openable as a drawer and provided with a cover, preferably transparent, which defines a containment space for foods at its interior). Of course, different configurations of the refrigerator 1 are possible, as well as different uses of the compartments obtained therein: for example, the compartment 3 can be a freezer space, or the compartment 4 can be a refrigerator space usable as vegetable container.

[0012] The compartment 3 has a front access opening, at which a double-leafed door is mounted. This door comprises a first and a second door leaf, indicated with 6 and 7, each of which is hinged to the cabinet 2 at a respective side of the access opening of the compartment 3. In the illustrated example, the two door leaves 6 and 7 have different size, the door leaf 6 having smaller width than the door leaf 7. By providing two door leaves 6 and 7 with different width (for example, the leaf 6 being about half as wide as the leaf 7), there is the advantage that the user can choose the degree of opening of the door depending on the bulk of the food products which he intends to introduce into, or draw from, the compartment 3, with clear advantages in terms of energy savings). The means for hinging the two door leaves 6 and 7 to the cabinet 2 can be of any known type and are thus not described here. The width of the refrigerator 1 can be equal to about 900 mm, or less than 900 mm, for example equal to about 700 mm, so as to be able to utilise, for manufacturing the refrigerator 1, a refrigerator cabinet identical to that usable for making the refrigerator apparatus whose doors are all made of single leaves.

[0013] Each door leaf 6 and 7 is provided on the inner face with a perimetr gasket, indicated with 6a and 7a. Three sections of each gasket 6a and 7a - and in particular the vertical section close to the hinging side of the related leaf to the cabinet 2 and the two upper and lower horizontal sections - are intended to operate in a sealing manner on respective portions of the edge of the compartment 3 opening, according to *per se* known manners. A vertical section of each gasket 6a and 7a is instead intended to operate on a front surface of a mullion bar.

[0014] This mullion bar is indicated with 10 as a whole in figure 2 and is hinged to the door leaf 6 in upper and lower regions thereof, by means of a lower hinge 20 and an upper hinge 40.

[0015] The refrigerator 1 also comprises a guide member, indicated with 50 in figure 2, which is fixed to the upper wall of the compartment 3 near the related front opening. This guide member 50 is designed for interacting with a respective guided member, indicated with 60, provided at the upper end of the mullion bar 10. As in the prior art, the guided member 60 is adapted for being engaged with the guide member 50 during opening and closing of the door leaf 6a, so as to cause a forced rotation of the mullion bar 10, around the axes of the hinges 20 and 40, with respect to the door leaf itself.

[0016] The mullion bar 10 is represented in enlarged scale in figure 3, together with the respective hinges 20, 40 and the guide member 50; figures 4 and 5 represent, in further enlarged scale, the two upper and lower end regions of the mullion bar 10.

[0017] As particularly visible in figures 5 and 7, the lower hinge 20 comprises a movable hinge portion 21 and a fixed hinge portion 22. In the assembled condition, the movable portion 21 is integral with the mullion bar 10 and the fixed portion 22 is fixed to the door leaf 6a, at the side of the latter opposite the hinging side to the cabinet 2.

[0018] In the depicted example, the movable portion 21 belongs to a structural component of the mullion bar 10, indicated with 10a (see also figure 11). The movable hinge portion 21 comprises a substantially tubular intermediate vertical portion 21a; the portion 21a is provided with an axial passage, at the two ends of which two fixed cams 23 and 24 are provided, having respective cam surfaces 23a and 24a (figure 7) directed in opposite directions, in particular multiple-lobed cam surfaces, still more preferably trilobed cam surfaces. The cams 23 and 24 are defined here as fixed with the sole purpose of distinguishing them from additional cams, defined below as movable.

[0019] The fixed cams 23 and 24 are coaxial with each

other and with respect to the axial passage of the portion 21a, which provides a reception seat for a hinge pin, indicated with 25, which defines the hinge axis. The cams 23 and 24, which are preferably formed integral with the tubular portion 22, are axially hollow for allowing the passage of the pin 25.

[0020] The fixed hinge member 22 has a fixing base 26, used for the anchoring, for example by means of screws, to the related edge of the door leaf 6a. This base 26 is provided with two cantilever formations, or brackets, indicated with 27, substantially parallel to each other. From each bracket 27, a cam-holder element respectively departs downward or upward and is indicated with 28; in the depicted example such element has a substantially cylindrical configuration. The two cam holders 28 are coaxial and spaced from each other, and are each provided with a related axial passage, which also crosses the related bracket 27.

[0021] Each cam-holder 28 is coupled with a movable cam, indicated with 29 and 30, having a respective cam surface 29a, 30a (figure 7), particularly a multiple-lobed cam surface, still more in particular a trilobed cam surface. The coupling is such that the movable cam 29 or 30 can axially translate with respect to the related cam-holder 28, without however being able to rotate. In the depicted example, the movable cams 29, 30 are thus configured as separate components, provided with an axial passage, so that they can be mounted on the cam-holders 28. Each cam-holder 28 has at least one axial channel 28a (figure 7) on the outer surface, designed to be coupled with a respective axial ribbing (not visible) of the passage of the related movable cam 29, 30, with a coupling that is thus of grooved type: as deducible, in this manner each movable cam 29, 30 is adapted for axially sliding on the related cam-holder 28, without however being able to rotate. Alternatively, it is possible to provide, for coupling a cam-holder 28 with the respective movable cam 29 or 30, that an axial ribbing is made on the former and an axial groove is made on the latter.

[0022] This sliding occurs in opposition to the elastic reaction of a spring element: in the depicted example, two of such elements are thus provided, configured as helical springs, indicated with 32. Each spring 32 is mounted on a related cam-holder 28, with one end abutting on a stop surface 27a defined by the related bracket 27, the other end of the same spring 32, on the other hand, abutting against the related movable cam 29, 30; advantageously, for this purpose, each movable cam 29, 30 has a respective spring-guide portion, 29b, 30b, here having substantially cylindrical configuration, which is received in the spiral of the related spring 32.

[0023] In the assembled condition of the hinge 20, as observable for example in figure 5, the two end portions of the pin 25 are each inserted through the brackets 27 and the cam-holders 28, on which the movable cams 29 or 30 are fit; arranged between the two movable cams 29 and 30 are the two fixed cams 23 and 24 and the related tubular portion 21a, crossed by the intermediate portion of the pin 25; the movable cams 29, 30 are each pressed on a respective fixed cam 23, 24 by means of the related spring 32, so as to keep the cam profiles 23a-29a and 24a-30a nested together. The pin 25 is conveniently provided with an enlarged upper head, not indicated in the figures but clearly visible for example in figure 5.

[0024] The trilobed characteristic of the cam surfaces 23a, 24a, 29a, 30a (with an angular pitch between the lobes equal to 120°) allows maintaining the springs 32 at rest in the open and closed positions of the mullion bar 10 and therefore ensures that such springs 32 maintain their elasticity even over the long term (by "long term" it is intended a use equal to at least 100,000 cycles). The springs 32 are in fact only compressed with the rotation of the mullion bar 10. Moreover, in case of three or in general a plurality of lobes, the friction forces are divided more uniformly with respect to the case of the single lobe, thus ensuring a lower wear over time of the cam surfaces 23a, 24a, 29a, 30a. The rotation angle of the mullion bar 10 being equal to 90°, the additional 30° of the pitch between the lobes can be equally divided between the open and closed positions, so as to obtain a good stability of the mullion bar 10 both in the open and closed positions.

[0025] In the normal use of the refrigerator 1, during the opening and closing of the door leaf 6, the guided member 60 is adapted to engage with the guide member 50 (figure 2), so as to cause the forced rotation of the mullion bar 10 with respect to the door leaf 6, around the hinge axis given by the pin 25. This rotation of the mullion bar 10, and thus of the movable hinge portion 21, causes rotating and translating motions of the movable cam 29 on the fixed cam 23, and simultaneously of the movable cam 30 on the fixed cam 24, these roto-translational movements occurring in opposition to the biasing forces of the springs 32.

[0026] As said, in fact, the fixed cams 23 and 24 are in intermediate position with respect to the movable cams 29 and 30, with the latter in turn in intermediate position with respect to the springs 32: the springs 32 thus respectively bias the cams 29 and 30 downward and upward, so as to keep the cam profiles 23a-29a and 24a-30a nested together.

[0027] In an advantageous embodiment, therefore, and unlike the prior art mentioned above, at least one of the hinges 20, 40 of the mullion bar of the refrigerator 1 is provided with two pairs of interacting cams, which precisely distinguish the various rotation pitches of the mullion bar during the opening and closing of the door leaf 6.

[0028] In the mentioned prior art, the hinges of the mullion bar each comprise a single pair of interacting cams, on which the mechanical stresses due to the angular movements of the mullion bar are entirely unloaded. It was observed that this known arrangement is subject to occasional breakage of the hinge over the medium-long range period, as well as to early wear of the two interacting cam profiles, in consideration of the fact that the single spring provided for according to the prior art must develop a significant force; additionally, for this reason,

in the prior art, the subsequent roto-translational pitches of the movable cam on the fixed cam are perceived as sharp releases, producing an unpleasant effect during refrigerator use.

[0029] These drawbacks are solved due to the aforesaid advantageous embodiment, by means of which a division is obtained of the mechanical stresses on the two cam pairs 23, 29 and 24, 30, and this allows improving the reliability and functioning precision of the rotation system of the mullion bar 10, even in the long term. The two springs 32 can each develop a force which is comparatively lower with respect to that of the single spring provided in the refrigerator according to the prior art, and this allows both facilitating the rotation movement of the mullion bar, while ensuring an improved precision and reliability of the system, and making the roto-translational pitches of the cams less noticeable. The opening and closing movements of the door leaf 6 are generally smoother and more gradual, respectively in the final and initial step.

[0030] In the preferred embodiment, the fixed cams 23 and 24 are obtainable in a single piece with the related tubular element 21a and with the body of the component 10a, for such purpose preferably using a mouldable thermoplastic material. Also the movable hinge portion 22 given by the base 26, by the brackets 27 and by the cam-holders 28 is easily obtainable in a single piece, particular in mouldable thermoplastic material. Similarly, the movable cams 29, 30 are obtainable by means of moulding of thermoplastic material. On the other hand, the springs 32 and the pin 25 are commercial components. The manufacturing of the lower hinge 20 is thus simple and economical from the industrial standpoint. Advantageously, the coupling elements - and especially at least the cams - are made of plastic materials that are different from each other, so as to reduce the friction during the opening and closing phases of the door leaf 6. In particular, the component 10a including the fixed cams 23 and 24 and the tubular element 21a is made of ABS, polycarbonate, polystyrene or SAN, while the movable hinge portion 22 including the base 26, the brackets 27 and the cam-holders 28 is made of acetal resin (for example, the material known commercially with the name of Hostaform®, by Ticona GmbH, can be used), polyamide-6 or polyamide-6,6 (the use of the materials for the fixed portion and the movable portion can be reversed with respect to that exemplified).

[0031] Thanks to the aforesaid division of the mechanical stresses due to the rotation of the mullion bar, in a preferred embodiment of the invention only the lower hinge of the mullion bar 10 can be provided with the two aforesaid cam pairs. The upper hinge 40 can therefore be differently conceived, simpler with respect to the lower hinge 20 and even lacking cam members.

[0032] In the example illustrated in figures 4 and 6, the upper hinge 40 also has a movable hinge portion 41, integral with the mullion bar 10, and a fixed hinge portion 42, fixed to the door leaf 6. The movable portion 41 is also integrated into a structural component of the mullion bar 10, and specifically an upper component, indicated with 10b having general configuration similar to that of the component 10a (of course, apart from the specific configuration of the hinge). The movable hinge portion 41 essentially comprises a reception seat 43, provided with an axial cavity of circular section, this cavity having an opening in the inner portion of the component 10b, i.e. the portion not visible in the figures, in order to allow the passage of a cable, in particular an electric cable, as will be clear below.

[0033] The fixed hinge portion 42 includes a base 44 for fixing to the door leaf 6, having a substantially cantilever formation 45, from which a cylindrical portion departs downward, which provides a hinge pin 46 having the same fulcrum as the pin 25 of the lower hinge 20. The formation 45 and the pin 46 are internally hollow, with the respective cavities that communicate with each other; the cavity of the formation 45 opens in the inner portion of the base 44, not visible in the figures, while the pin 46 is open at its lower end.

[0034] With this embodiment, through the formation 45, the pin 46 and the related reception seat 43 of the hinge 40, the power supply cable of an electrical resistance is made to pass inside the mullion bar 10, schematically represented in figure 4, where it is indicated with 47; such electrical resistance 47 has the function of preventing the forming of ice and/or condensate on the mullion bar 10 during the functioning of the refrigerator 1 (ice can in fact be formed if the compartment 3 is a freezer space). The path of the aforesaid cable is represented in a merely schematic manner in figure 6, by means of the line indicated with 47a. As can be seen, in this embodiment the upper hinge 40 is also conceived for performing the cable-guide function, and the proposed configuration actually allows working of the cable 47a by twisting rather than bending, reducing the stresses which act on the cable 47a and consequently ensuring a greater duration of such component.

[0035] Also in the case of the upper hinge, the coupling elements can be advantageously made of plastic materials that are different from each other, so as to reduce the friction during the phases of opening and closing of the door leaf 6. The component 10b with the reception seat 43 is obtainable in moulded thermoplastic material, for example in ABS, polycarbonate, polystyrene or SAN; the movable hinge portion 42 including the base 44, the formation 45 and the pin 46 can be made of acetal resin (for example, the already mentioned Hostaform®), polyamide-6 or polyamide-6,6 (the use of the materials for the fixed portion and the movable portion can be reversed with respect to that exemplified).

[0036] In figure 8, the guided member of the mullion bar 10 is visible. In US-B-7,008,032, the guided member is formed by joining the different components of the mullion bar 10: over the long term, and following repeated interactions of the guided member with the guide member, misalignments of the two components can occur,

above all if the door leaf which bears the mullion bar is sharply closed. In a preferred solution according to the present invention, this drawback is solved due to the fact that the guided member 60 is fully obtained in one and the same component of the mullion bar 10, and in particular it is made integrally with the component 10b which also makes the movable hinge portion 41. The guided member 60 is essentially configured as an appendage or projection, whose external profile makes a first and a second cam surface, indicated with 61a and 61b in figure 8, substantially opposite each other, designed to cooperate with different parts of the guide member 50.

[0037] In figures 9 and 10, the guide member 50 is visible, which is formed so as to have a guide surface 51 which defines a guide path for the guided member 60, and especially for at least part of its cam surface 61a during the closing of the door leaf 6. The member 50 also has a guide element, shaped as a projection 52, which is spaced from the guide surface 51: the cam surface 61b of the guided member 60 abuts against this guide element 52 following the opening of the door leaf 6. For a general description of the type of interaction that occurs between the guide member and the guided member of an intermediate door leaf of the type considered here, reference can be made to US-B-7,008,032 (see, for example, figures 7-11 thereof).

[0038] According to the present invention, at least a portion of the guide surface 51 for the guided member 60 is defined by an elastic part of the guide member 50. This elastic part is indicated with 53 in figures 9 and 10 and is substantially configured as a flat flexure spring.

[0039] In the illustrated example, the portion of the guide surface 51 which is defined by the elastic part 53 belongs to a curvilinear section of the same guide surface, with the elastic part 53 which thus has a substantially curvilinear longitudinal axis.

[0040] The member 50 is preferably formed as a single piece, particularly of mouldable plastic material, so as to define a bottom wall 54 provided with holes 54a employed for fixing the member itself to the upper wall of the compartment 3 (figure 2), for example by means of screws. The plastic material used for making the guide member 50 is advantageously different from that used for making the guided member 60, so as to reduce the friction at the time of coupling between the two aforesaid components of the refrigerator 1: in particular, the guide member 50 can be made of acetal resin (for example, the material known commercially with the name of Hostaform®, by Ticona GmbH, can be used), polyamide-6 or polyamide-6,6, while the guided member 60 can be made of ABS, polycarbonate, polystyrene or SAM (the use of the materials for the fixed portion and the movable portion can be reversed with respect to that exemplified).

[0041] In the illustrated example, the elastic part 53 constitutes a kind of cantilever longitudinal extension of a substantially vertical wall 55 of the member 50. For this purpose, the bottom wall 54 is provided with a cavity 56, which in the represented example is configured as a through opening of the wall 54. The vertical wall 55 rises substantially orthogonal from the bottom wall 54 and the flexible portion 53 extends length-wise under the cavity 56 (naturally, if a guide member of the type indicated with 50 is mounted on the lower wall of the compartment 3, the flexible portion extends above the cavity 56). The cavity 56 is provided for facilitating the making of the cantilevered portion 53 by means of moulding the body of the member 50, but naturally the form of the body itself and the cavity 56 can be different from those exemplified in the figures.

[0042] In the normal use of the refrigerator 1, when the door leaf 6 is closed, the guided member 60 of the mullion door 10 - and especially its surface 61 - hits against the elastic part 53: this causes a bending of the elastic part 53, which firstly allows absorbing or cushioning the impact between the element 60 and the guide surface 51, and then precisely directs the element itself to its end stop position. Due to this characteristic, a sharp interference is thus prevented between the end of the mullion bar 10 and the related guide 50, and the angular movement of the mullion bar is facilitated and better guided, unlike that which occurs in the prior art solution of US-B-7,008,032. According to this preferred characteristic, the fact that the impact between the parts is cushioned allows reducing sharp stresses both on the guide member and on the guided member; this further reduces the risks of occasional breakage or damage of these components, which typically occurs in prior art solutions.

[0043] In figure 11, a possible type of modular structure of the mullion bar 10 is visible, such structure being formed by a plurality of separate components. A metal base plate is indicated with 11, on which a plastic material tubular body is fixed, indicated with 12, having substantially rectangular section here with rounded edges. For such purpose, the plate 11 is provided with hooks or joints, not represented, intended to cooperate with corresponding hooks or joints provided in the rear portion of the tubular body 12. The electrical resistance (not shown here) is glued on the plate 11, which remains locked between the plate 11 and the tubular body 12 after assembly.

[0044] Inside the tubular body 12, two insulation elements are inserted, indicated with 13. These bodies 13 have a first end 13a and a second end 13b; the ends 13b of the two bodies 13 have essentially complementary form for coupling together inside the tubular body 12; following assembly, the ends 13a of the two elements 13 instead project from the respective ends of the tubular body 12. In the case of insulation obtained by means of two bodies 13, the coupling zone between the ends 13b can be entirely orthogonal to the plane of the plate 11 (as illustrated in figure 11), or it can advantageously comprise at least one surface substantially parallel to the plane of the plate 11, in order to prevent that possible sliding between the elements 13b at the time of coupling can reduce the effectiveness of the insulation in the central zone of the mullion bar 10. In any case, and still more

advantageously, the insulation of the upper mullion 10 can be obtained by means of a single element, to be inserted in the tubular body 12.

[0045] At the two ends of the tubular element 12, coupling portions 14 are engaged of the components 10a and 10b, which make respective movable hinge portions, as explained above. Following this engagement, the end portions 13a of the insulation bodies 13 are interposed between the components 10a, 10b and the plate 11. The components 10a and 10b are fixed to the plate 11 by means of screws or similar mechanical fixing members (not represented): the two ends of the plate 11 are for such purpose equipped with flange formations provided with holes. As can be seen, therefore, the mullion bar 10 has substantially modular structure and is obtainable by means of components of easy industrial manufacture, whose length can vary according to the height of the compartment 3.

[0046] It is clear that the household refrigerating appliance described for exemplification purposes may be subjected to many variants by a man skilled in the art without departing from the scope of the invention as defined in the attached claims.

[0047] In the illustrated embodiment, the fixed cams 23, 24 are integral with the movable hinge portion 21, while the movable cams 29, 30 with the related springs 32 are provided on the fixed hinge member 22: nevertheless, it will be appreciated that the arrangement of the cams could be reversed with respect to that exemplified. In the provided example, moreover, only the lower hinge 20 is provided with two cam pairs, while in a possible variant the upper hinge is provided with at least two or four cams (such variant is advantageous if it is necessary to equip the mullion bar 10 with an electrical resistance). In another variant, the arrangement of the hinges is reversed with respect to that illustrated, i.e. with the hinges 20 and 40 provided in the upper and lower regions, respectively, of the movable mullion bar 10.

[0048] In a further embodiment, also or only the lower end of the mullion bar 10 is provided with a guide element of the type indicated with 60 and a guide member of the type indicated with 50 is provided in the bottom wall of the compartment 3, near its front access opening.

[0049] The elastic part 53 could comprise a lamina configured as a separate component with respect to the main body of the guide member 60, for example a metal lamina fixed with screws or similar mechanical fixing means to the aforesaid body.

[0050] Another variant that can be made to the present invention consists in providing that the guide member 50 also acts as a biasing member: in this case, the elastic part 53 constantly acts on the mullion bar 10, when the door leaf 6 is closed, in order to press it against the element 52 and then to retain it in the end stop position. In such a variant, it is not absolutely necessary that the cam surfaces 23a, 24a, 29a, 30a have multiple lobes for ensuring a correct closure of the door leaf 6, since the profile of the cams can also be simpler.

[0051] Further variant embodiments can also be determined by substitutions of mechanisms and/or materials and they are clear for those skilled in the art of the household refrigeration equipment field, in light of the present description and attached figures.

Claims

1. A household refrigerating appliance including:

- a cabinet (2), having at least one preservation compartment (3) provided with an access opening;
- a double-leafed door, having a first and second door leaf (6, 7) hinged to the cabinet (2) next to the access opening,
- seal means (6a, 7a) operating between each door leaf (6, 7) and the cabinet (2),
- a mullion bar (10) hinged to the first door leaf (6),
- at least one guide member (50) mounted in one of an upper part and a lower part of the compartment (3),
- at least one guided member (60) provided at one of the upper end and the lower end of the mullion bar (10),
- two hinges (20, 40) for hinging the mullion bar (10) to the first door leaf (6),

wherein at least a first one of the two hinges (20) comprises a fixed hinge portion (22) and a movable hinge portion (21), fixed to the first door leaf (6) and to the mullion bar (10), respectively, and a hinge pin (25) which connects the two hinge portions (21, 22) together and defines a hinge axis,

wherein the movable hinge portion (21) comprises a first cam member (23) and the fixed hinge portion (22) comprises a second cam member (29), the first and the second cam members (23, 29) being mounted substantially coaxial with each other and with the hinge pin (25) and being nested together with a first spring element (32) which biases the first and the second cam members (23, 29) against each other,

wherein the at least one guided member (60) is adapted for engaging with the at least one guide member (50) during the opening and closing of the first door leaf (6) to cause the forced rotation of the mullion bar (10) around the hinge axis with respect to the first door leaf (6) and to cause relative rotating and translating motions between the first and the second cam members (23, 29) in opposition to a biasing force of the first spring element (32),

characterised in that the movable hinge portion (21) comprises a third cam member (24) and the fixed hinge portion (22) comprises a

fourth cam member (30), the third and the fourth cam members (24, 30) being mounted substantially coaxial with each other and with the hinge pin (25), the third and the fourth cam members (24, 30) being nested together with a second spring element (32) which biases the third and the fourth cam members (24, 30) against each other, such that the aforesaid forced rotation of the mullion bar (10) during the opening and closing of the first door leaf (6) causes relative rotating and translating motions also between the third and the fourth cam members (24, 30) in opposition to a biasing force of the second spring element (32).

2. An apparatus according to claim 1, wherein

- the first and the third cam members (23, 24) have respective cam surfaces (23a, 24a) directed in opposite axial directions and are in an intermediate position with respect to the second and fourth cam members (29, 30),
- the second and fourth cam members (29, 30) are in an intermediate position with respect to the first and the second spring elements (32).

3. An apparatus according to claim 2, wherein one of the movable hinge portion (21) and the fixed hinge portion (22) comprises a hollow portion (21a) defining an axial passage for receiving the hinge pin (25), the first and the third cam members (23, 24) being provided at the two ends of the axial passage and being axially hollow.

4. An apparatus according to claim 3, wherein

- the second and fourth cam members (29, 30) are axially hollow,
- the other of the fixed hinge portion (21) and the movable hinge portion (22) comprises two coaxial cam-holders that are spaced from each other (23), each of which extends starting from a respective stop surface (27a), the second and fourth cam members (29, 30) each being coupled with a related cam-holder (28) so as to be able to axially slide without rotating, particularly by means of a coupling substantially of grooved type,
- each spring element is configured as a helical spring (32) and is mounted coaxially to a respective cam-holder (28), between the related stop surface (27a) and the related second or fourth cam member (29, 30).

5. An apparatus according to claim 4, wherein the cam-holders (28) are each provided with an axial cavity, the hinge pin (25) is configured as a separate component with respect to the movable hinge portion (21) and the fixed hinge portion (22) and extends between the two cam-holders (28), with the hollow portion (21a) and the first and the third cam members (23, 29) interposed.

6. An apparatus according to claim 4 or 5, wherein the second and the fourth cam members (29, 30) each have a guide part (29b, 30b) for the respective spring element (32).

7. An apparatus according to claim 4 or 5, wherein each stop surface (27a) is defined by a respective cantilever formation (27) of the related hinge portion (21, 22).

8. An apparatus according to claim 1, wherein each cam member (23, 24, 29, 30) has a multiple-lobed cam surface, in particular a trilobed cam surface.

9. An apparatus according to claim 3, wherein the hollow portion (21a), the first cam member (23) and the third cam member (24) are integrally formed with the related hinge portion (21).

10. An apparatus according to claim 7, wherein the cam-holders (28) and the cantilever formations (27) are integrally formed with the respective hinge portion (22).

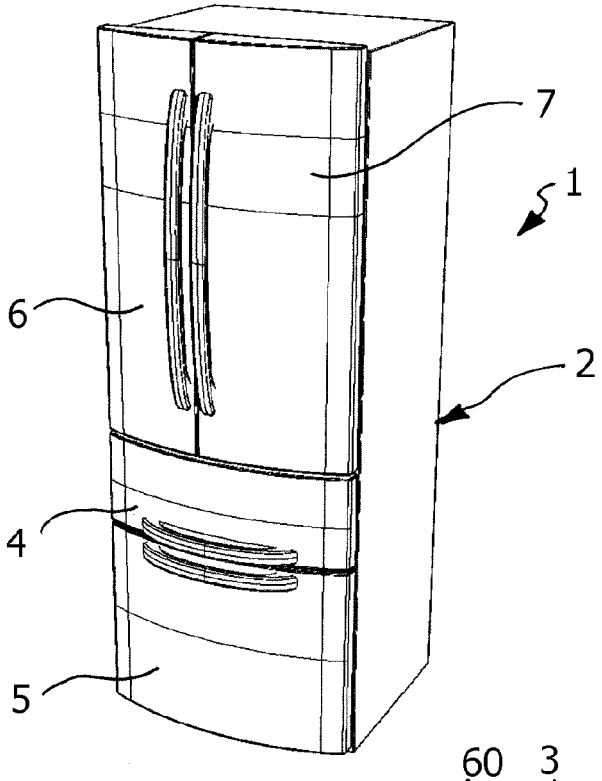


Fig. 1

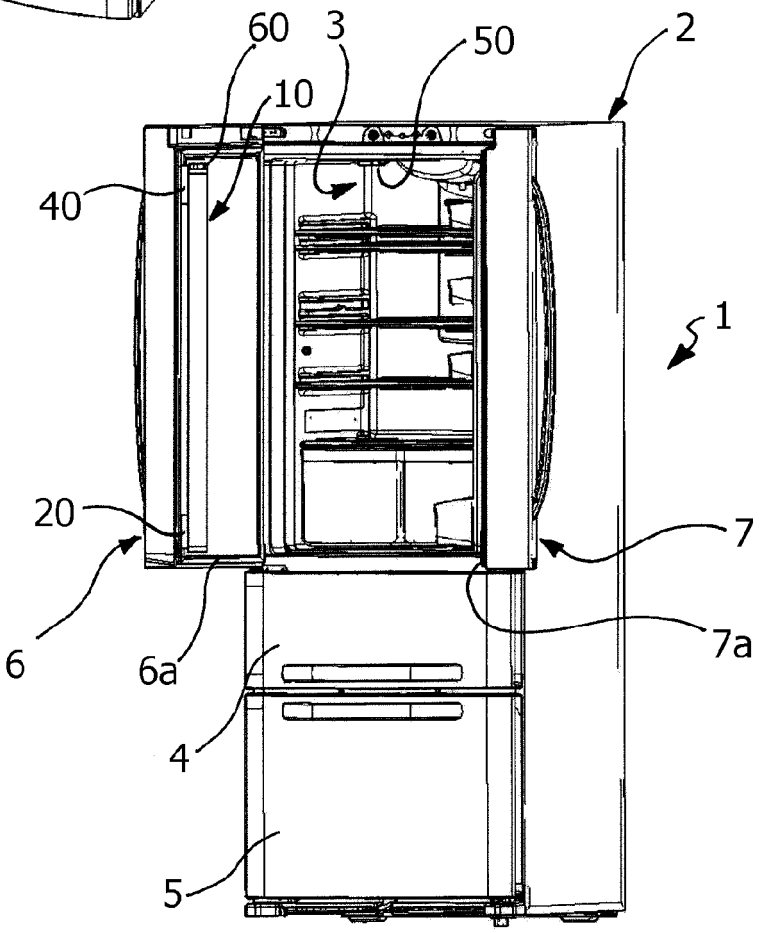
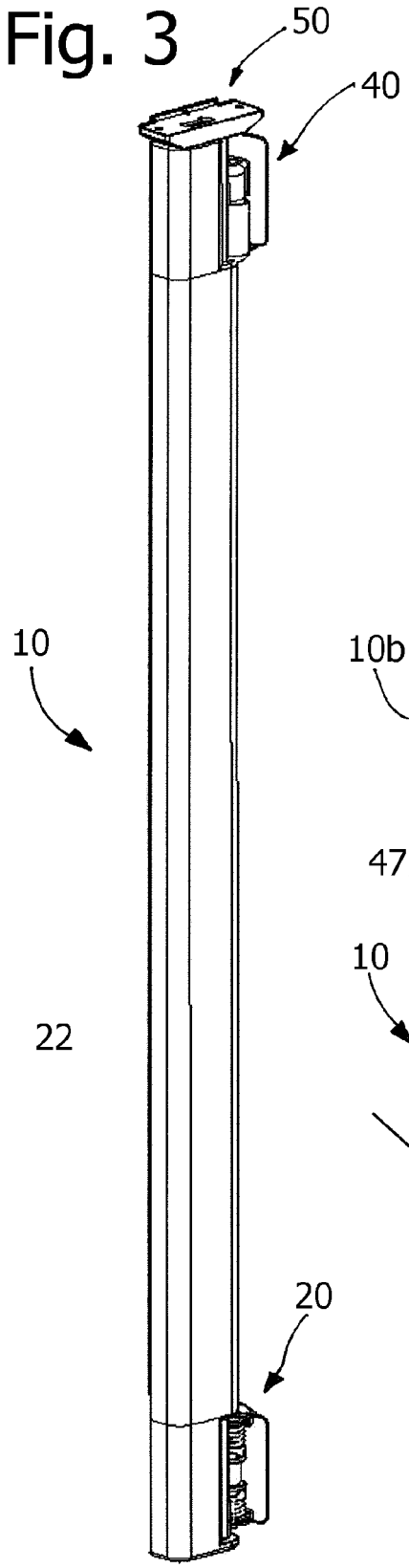


Fig. 2

Fig. 3



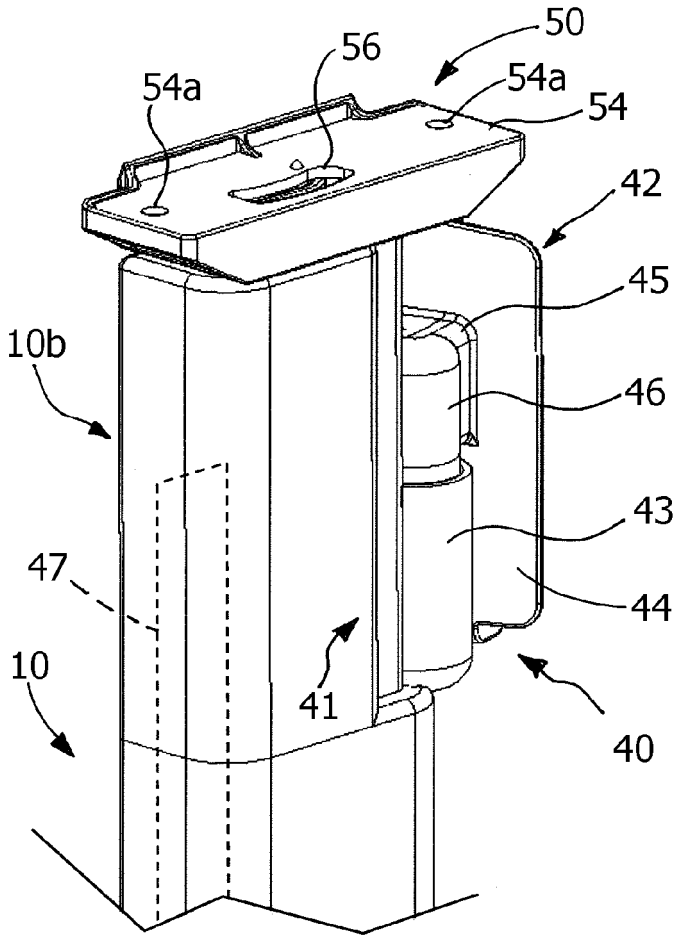
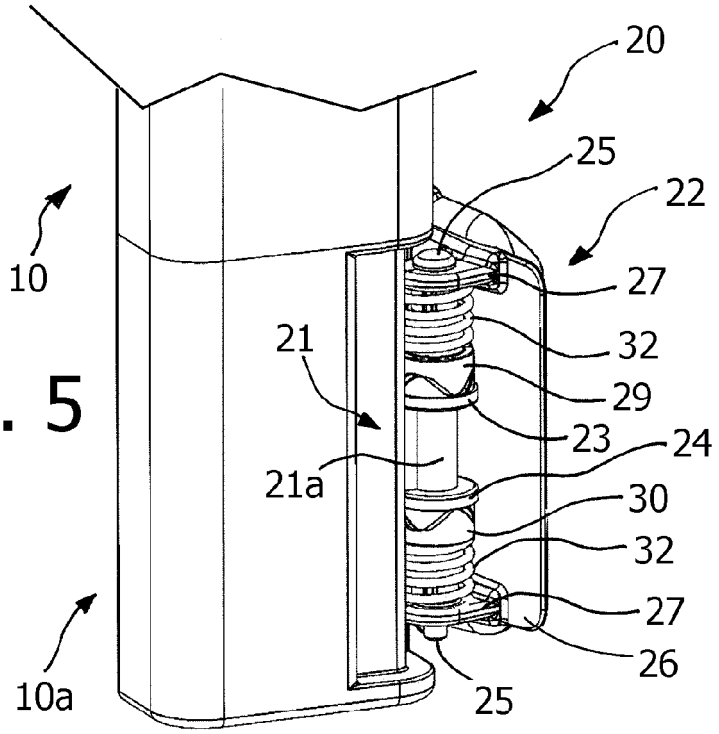


Fig. 4

Fig. 5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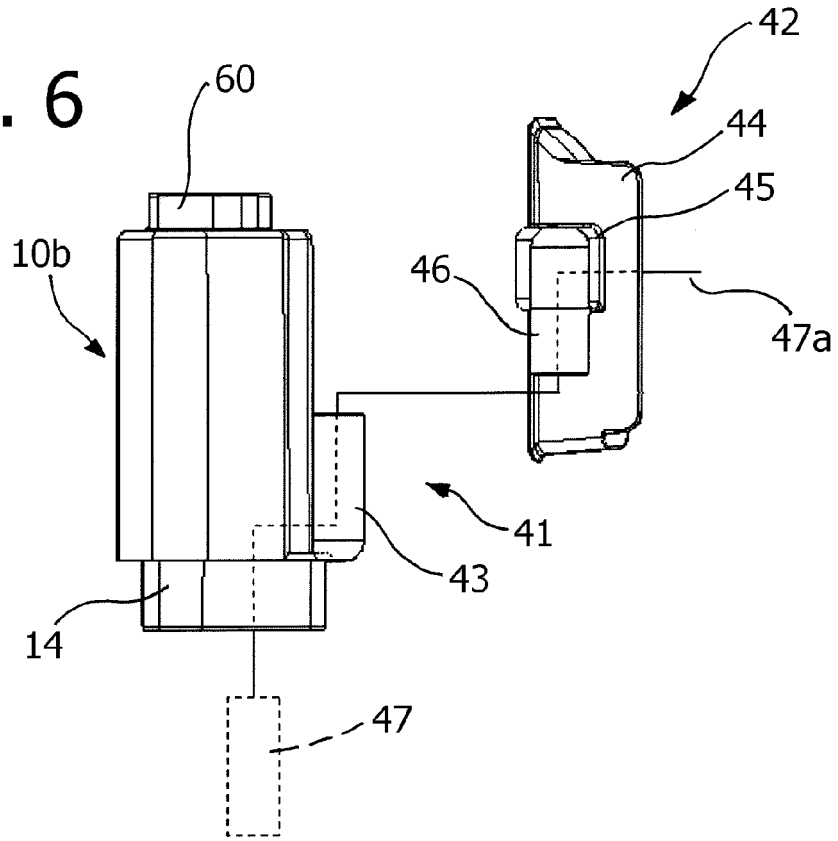
27
21
32
29
23
24
21a
30
32
27
26
10a
25

Fig. 6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44
45
10b
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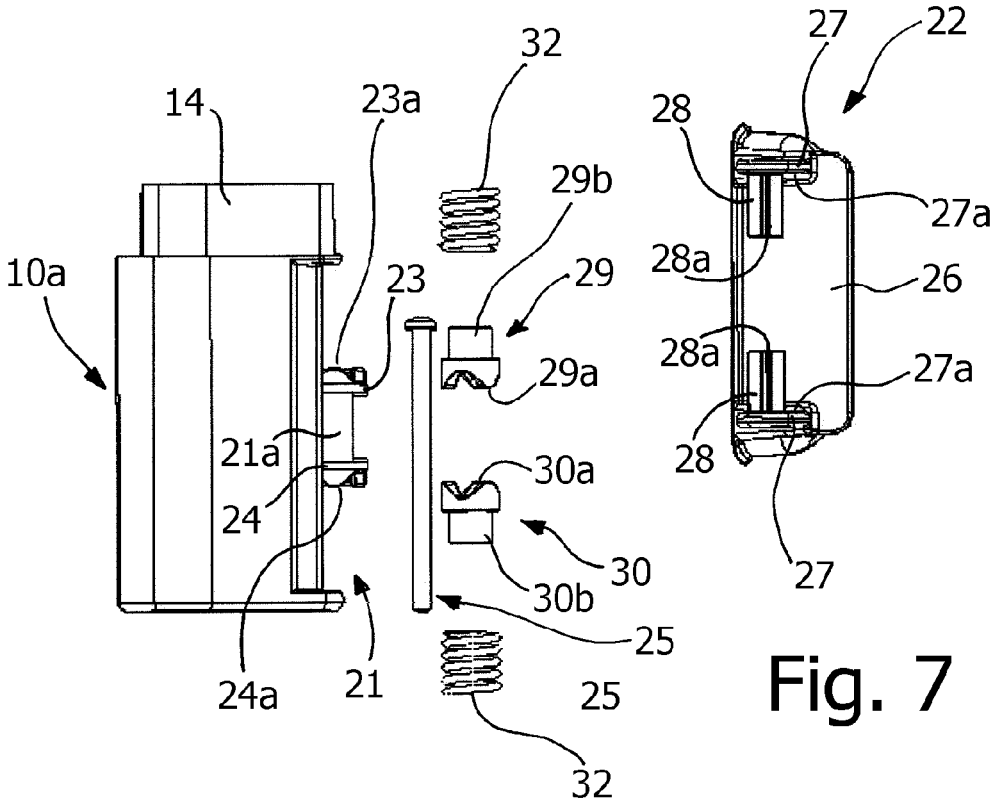
47a
41
43
14
47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23a
29b
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23
29
29a
21a
30a
24
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22
28
27a
28a
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28a
27a
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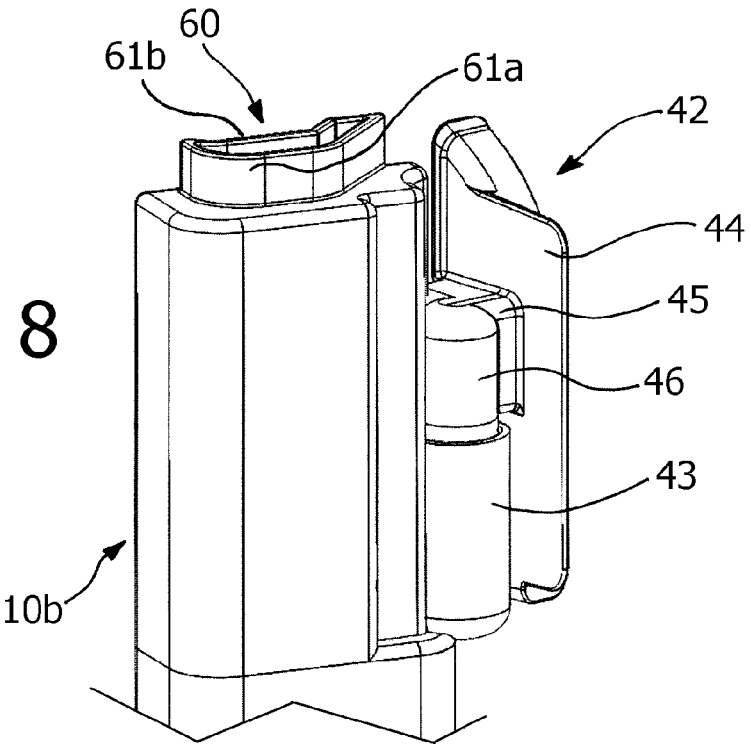
27

Fig. 7


60
61b
61a
42
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46
43
10b

Fig. 8

Fig. 9

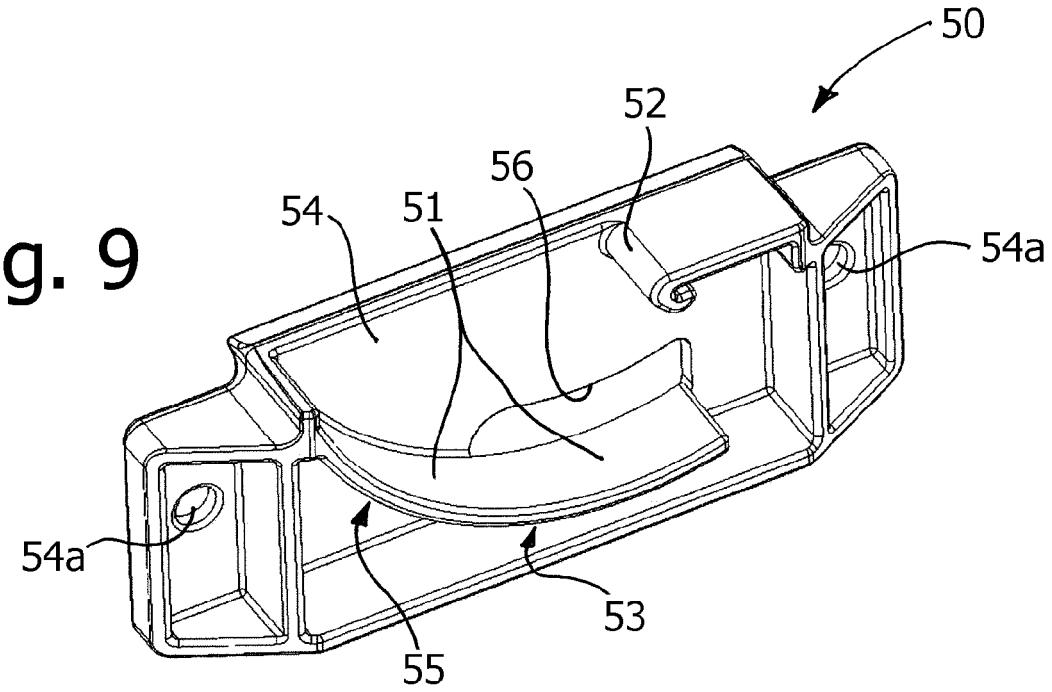


Fig. 10

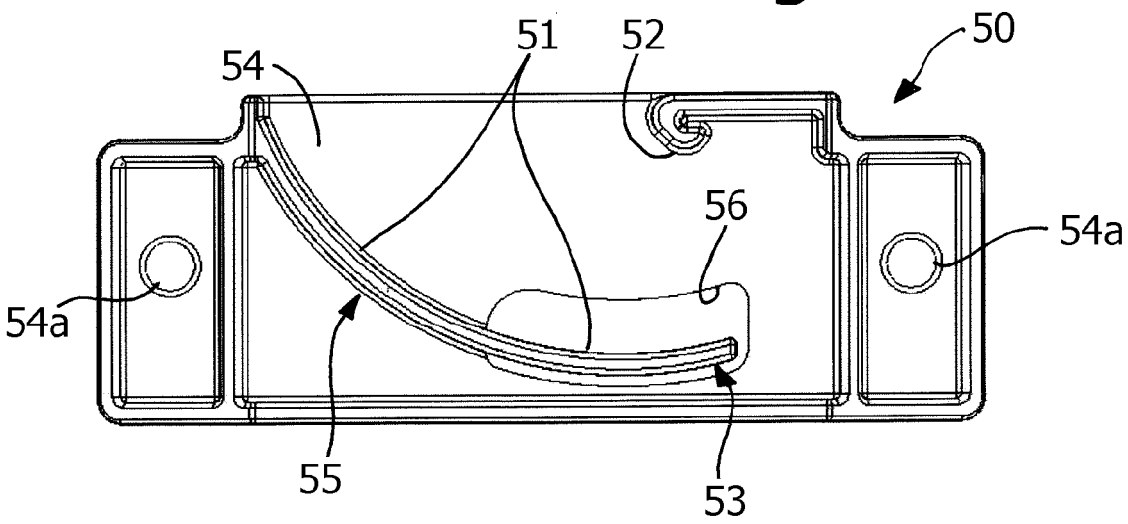
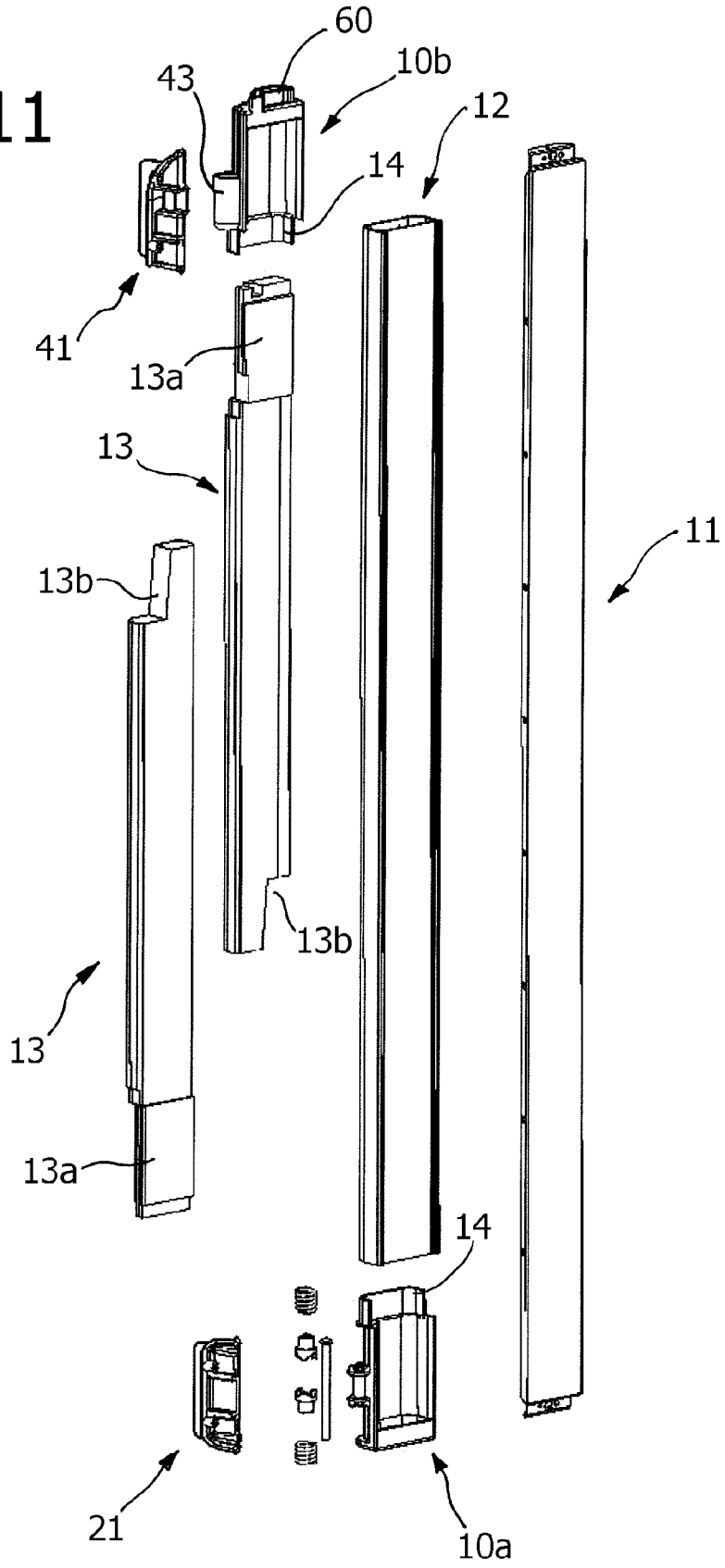


Fig. 11



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EUROPEAN SEARCH REPORT

Application Number
EP 13 18 3244

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	US 7 008 032 B2 (CHEKAL RAYMOND J [US] ET AL) 7 March 2006 (2006-03-07) * figures 1,5,6 * -----	1-10	INV. F25D23/02 E05D11/10 E05F1/12
Y	WO 2006/036044 A1 (I ONE INNOTECH CO LTD [KR]; CHOI SOON-WOO [KR]) 6 April 2006 (2006-04-06) * page 1, lines 20-27; figures 1,2 * -----	1-10	
A	KR 2003 0078137 A (HOIL PREC CO LTD [KR]) 8 October 2003 (2003-10-08) * figures 3,4,5 * -----	1-10	
A	DATABASE WPI Week 200739 Thomson Scientific, London, GB; AN 2007-404658 XP002539101, -& CN 1 888 364 A (LEJIN ELECTRONIC TIANJIN ELEC APPLIANCE) 3 January 2007 (2007-01-03) * abstract; figure 3 * -----	1-10	

TECHNICAL FIELDS SEARCHED (IPC)

F25D
E05F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	27 September 2013	Léandre, Arnaud

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3

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27-09-2013

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 7008032 B2	07-03-2006	CA 2438766 A1	28-02-2005
		US 2005046319 A1	03-03-2005
WO 2006036044 A1	06-04-2006	CN 101018924 A	15-08-2007
		KR 20060018461 A	02-03-2006
		WO 2006036044 A1	06-04-2006
KR 20030078137 A	08-10-2003	NONE	
CN 1888364 A	03-01-2007	NONE	

EPO FORM P0459

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Patent documents cited in the description

- US 7008032 B **[0002] [0003] [0004] [0005] [0006] [0036] [0037] [0042]**
- IT RN20070056 A **[0011]**
- IT TO20070911 A **[0011]**