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(54) **DISPLACEMENT MECHANISM FOR CLOSING MEMBER**

(57) A mechanism for moving a first and second closing element (30, 32) with respect to a closing position in which the closing elements are coplanar, is described.

The mechanism comprises two swinging arms (40, 42) movable within two different horizontal planes to form two opposite sides of an articulated quadrilateral which has the first closing element as the third side and an edge of the fixed body as the fourth side.

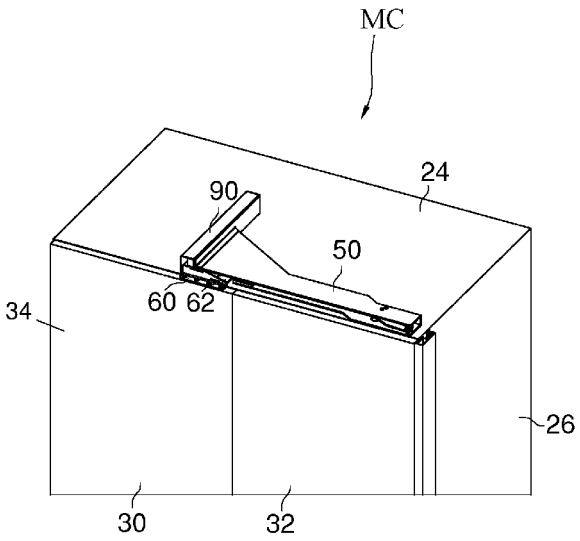

Fig. 1

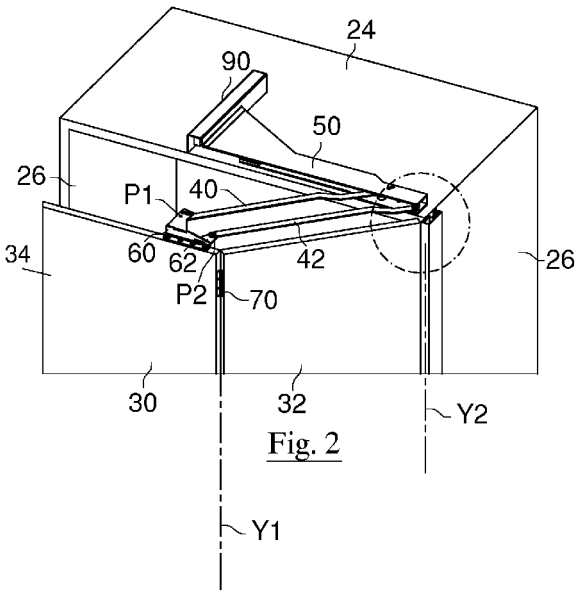

Fig. 2

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Description

[0001] The present invention relates to a motion mechanism for a book-like closing element such as a door, window, or cabinet door or movable barrier.

[0002] A known solution for a book-like openable, folding closing element is provided by EP 2 839 099. Two leaves, the first hinged to a fixed structure and the second leaf hinged to the first leaf, are movable between a closed configuration, in which they are coplanar to close a compartment, and an opened configuration, in which access to the compartment is permitted. An articulated quadrilateral mechanism supports both leaves and guides them from one configuration to the other. The mechanism is particular in that it has four pivot vertices, two approximately Z-shaped rotatable arms, and stiffening elements hinged at four points of the rotatable arms. In the end the mechanism is composed of three articulated quadrilaterals. The result is a complex construction to assemble and with many components (expensive).

[0003] It is the object of the present invention to improve upon this state of the art, in particular to provide a new swinging closing element and/or system for a door, window or similar, that is easier to construct.

[0004] A mechanism is then proposed for moving a first and second closing element relative to a closing position in which the closing elements are coplanar,
the two closing elements being hinged to each other, in particular to one vertical edges thereof, to fold over each other book-like when they move away from the closing position,
the first closing element having a free end and the second closing element having an end hinged to a fixed body,
the mechanism comprising
two arms swinging movable within two different horizontal planes to form two opposite sides of an articulated quadrilateral that has as its third side the first closing element and as its fourth side an edge of the fixed body,
the swinging arms being hinged, with fixed and - in use - vertical hinging axes, to
the fixed body, and
to the first closing element at hinging points located in the same half-space defined by an imaginary plane that is

orthogonal to the centerline of the first closing element and
parallel to said fixed hinging axes.

[0005] Another aspect of the invention relates to a furniture item equipped with the above-mentioned mechanism, wherein the closing elements are leaves of the furniture item. The furniture item thus comprises

- a first and second closing element relative to a closing position in which the closing elements are coplanar,
  the two closing elements being hinged to each other, in particular to one vertical edge thereof, to fold over each other book-like when they move away from the closing position,
  the first closing element having a free end and the second closing element having an end hinged to a fixed body, and
- a mechanism in turn comprising
  two swinging arms movable within two different horizontal planes to form two opposite sides of an articulated quadrilateral that has as its third side the first closing element and as its fourth side an edge of the fixed body,
  the swinging arms being hinged with fixed and - in use - vertical hinging axes
  to the fixed body, and
  to the first closing element at hinging points located in the same half-space defined by an imaginary plane that is

  orthogonal to the centerline of the first closing element and
  parallel to said fixed hinging axes.

[0006] In a variant, said half-space comprises the free end of the first closing element. In a different variant, said half-space comprises the end of the first closing element that is hinged to the second closing element.

[0007] In order to facilitate the trajectory of the closing elements, in a variant, said hinging points are placed on stand-off brackets attached to the first closing element, so that the hinging axis relative to each hinging point is at a certain distance from the closing element. In a more preferred variant, the distances of the closing element from said hinging axes are different, in particular the distance of the hinging axis which is closer to the free end of the first closing element, is greater.

[0008] In a simple variant, the arms are substantially parallel to each other, swinging and movable within two different horizontal, vertically-offset planes.

[0009] In a variant, the arms are mounted so as to form two opposite sides of an articulated quadrilateral having as third side a closing element and as fourth side an edge of the fixed body. Preferably said fourth side comprises a box-shaped casing which houses the arms when the closing elements are in the closing position (i.e. coplanar to each other); in this configuration the arms being substantially aligned, overlapping with each other and contained in the casing. The casing prevents the accumulation of dirt on the arms and protects them.

[0010] To facilitate the packing of the arms at rest and/or inside the casing, preferably they are not straight but form a kind of Z. That is, the arms are formed by two straight end segments that are parallel to each other but misaligned, and by a central straight segment that connects the two end segments.

[0011] In a variant, the first and second closing elements are hinged to each other by means of a retractable hinge, for example like the one in EP 2 719 851.

[0012] In a variant, the second closing element is

hinged to the fixed body by means of a retractable hinge, for example like the one in EP 2 719 851.

[0013] In particular, a or each of said retractable hinges comprises:

a fixed element on each closing element,
two hinging elements that are hinged to each other and each hinged to one of the fixed elements respectively, the hinging axes of the retractable hinge being all parallel and - in use- vertical.

[0014] According to a preferred variant, said first and second closing elements are hinged to each other through hinging means comprising two movable hinging axes, said axes being all parallel and - in use - vertical, and in particular rigidly translatable in space during a relative movement between the first and second closing element.

[0015] According to a preferred variant, said first and second closing element are doors or leaves, in particular flat ones.

[0016] Preferably, the mechanism comprises a braking and/or damping device for said arms. In particular, a braking and/or damping device is mounted to intervene when the closing elements are setting themselves coplanar. In particular, the braking and/or damping device is mounted inside said casing.

[0017] In particular, said casing is mounted above the top member - or highest horizontal panel - of a furniture item.

[0018] Preferably the mechanism comprises magnets or electromagnets for locking the door in the opening position, with the advantage of obviating an incorrect assembly of the parts to be synchronized.

[0019] Preferably, the fixed body is a compartment of a furniture item.

[0020] Another aspect of the invention relates to an access in a wall provided with the above mechanism, wherein the closing elements are leaves to open or close the access.

[0021] The advantages of the invention will be clearer from the following description of a preferred embodiment of the mechanism, reference being made to the attached drawing wherein

- Fig. 1 shows a partial three-dimensional view of a furniture item equipped with a mechanism according to the invention;
- Figs. 2-5 show an opening sequence for a compartment of the item in Fig. 1;
- Fig. 6 shows an enlargement of the dotted circle in Fig. 1.

[0022] In the figures equal numbers indicate equal or conceptually similar parts, and elements are described as in use.

[0023] In the illustrated example, the mechanism is applied to a cabinet MC comprising a compartment 20 defining an outwardly-opened space bounded by a bottom (not shown), a ceiling 24, two vertical side walls 26 spaced from each other by the width of the compartment 20, and a rear wall 28. The compartment 20 forms a front opening that can be closed by two leaves 30, 32 slidable in front of the compartment 20.

[0024] By means of a mechanism according to the invention the leaves 30, 32 can move in front of the compartment 20 to close it or to leave it accessible from the outside.

[0025] It is understood that the compartment 20 could instead be the entrance or access in a wall, where the leaves would be used to open or close the access.

[0026] During the movement the leaves 30, 32 always remain vertical and vary their relative position and that with respect to the compartment 20. When the compartment 20 is closed, the leaves 30, 32 are adjacent and coplanar to each other (fig. 1), while to uncover the compartment 20 the leaves 30, 32 are movable to end up packed book-like one on top of the other on a side of the compartment 20 (fig. 5), i.e. ending up one superimposed on the other on two parallel planes (fig. 5). These two parallel planes of fig. 5 are parallel to the plane that contained the leaves 30, 32 in the closed position of fig. 1.

[0027] We conventionally denote by 30 the farthest leaf from the side of the compartment 20 in which the leaves 30, 32 can be stacked, and by 32 the leaf closest to such side.

[0028] The adjacent sides (the closest to each other) of the leaves 30, 32 are hinged to each other about a vertical hinging axis Y1 (the axis Y1 is movable with the leaves 30, 32). Thus, the leaf 30 has a free end 34 and the leaf 32 has an end hinged to the cabinet MC about a fixed vertical hinging axis Y2 which is parallel to Y1.

[0029] The mechanism comprises two arms 40, 42 which are substantially parallel to each other, swinging and movable within two different horizontal, vertically-offset planes. The arms 40, 42 are mounted to form two opposite sides of an articulated quadrilateral having as a third side the leaf 30 and as a fourth side an edge of the cabinet MC. Preferably said fourth side comprises a box-shaped casing 50 mounted on the ceiling 24 which houses the arms 40, 42 when the leaves 30, 32 are in the closed position. In this position, the arms 40, 42 are substantially aligned and superimposed to each other and remain contained within the casing 50.

[0030] The arms 40, 42 are hinged to the cabinet MC (i.e. to the compartment 20), preferably on the ceiling 24, with fixed, and - in use - vertical, hinging axes which are parallel to Y1 and Y2.

[0031] The arms 40, 42 are also hinged with the leaf 30 by means of fixed, and - in use - vertical, hinging axes, parallel to Y1 and Y2. The hinging points P1, P2 with the leaf 30 are placed in the same half-space defined by an imaginary plane that is orthogonal to the centerline of the leaf 30 and parallel to said fixed hinging axes. In other words, imagining to divide the leaf 30 vertically into two equal half-leaves, the arms 40, 42 are hinged to the leaf

30 at points that are both on the same half-leaf. In the illustrated example, said same half-leaf is the one comprising the hinge with the leaf 32, but the same half-leaf could also be the one comprising the free end 34.

[0032] The points P1, P2 are preferably placed, respectively, on spacer brackets 60, 62 attached to the leaf 30. The brackets 60, 62 serve to distance the hinging axis from the leaf 30, which facilitates the articulation of the arms 30, 32 and allows them to completely disappear inside the casing 50.

[0033] The distances from the leaf 30 of the hinging axes on the brackets 60, 62 (or of the points P1, P2) may vary from what is illustrated: they may be equal or different distances; in particular, the distance relative to the hinging axis that is closer to the free end 34 (point P1), is greater. This allows the arms 30, 32 at rest to arrange themselves approximately parallel inside the housing 50. For this purpose, the hinging axes of the arms 30, 32 on the cabinet MC also have different distances relative to the edge of the compartment 20.

[0034] In order to facilitate the packing of the arms 30, 32 at rest and/or inside the casing 50, preferably they are not straight but form a kind of Z. That is, the arms 30, 32 are formed by two straight end segments that are parallel to each other but misaligned, and by a central straight segment that connects the two end segments.

[0035] In a variant, the leaves 30, 32 are hinged to each other via a (known) retractable hinge 70, to improve the freedom of movement of the leaves 30, 32. For the same purpose, in a variant, the leaf 32 is hinged to the cabinet MC via a (known) retractable hinge. This also gives the advantage of achieving coplanarity between the leaf 32 and an optional vertical element 80 (e.g. a profile, see Fig. 6) to which the leaf 32 may optionally be hinged. The vertical element 80 is coupled to a side wall 26 and frontally projects as much as the depth of the leaf 32. Thus, when the leaf 32 closes the compartment 20 (fig. 1), the leaf 32 becomes flush with the vertical element 80. And the leaf 32 can also smoothly rotate around the vertical element 80 when uncovering the compartment 20.

[0036] Preferably, the casing 50 accommodates a, e. g. pneumatic or spring-loaded, shock absorber 90 which dampens the movement of the brackets 60, 62 when they reach the end-stops (Fig. 1) and touch the edge of the compartment 20.

Claims

1. Mechanism for moving a first and second closing element (30, 32) with respect to a closing position in which the closing elements are coplanar,
   the two closing elements being hinged to each other to fold over each other book-like when they move away from the closing position,
   the first closing element (30) having a free end and the second closing element (32) having an end hinged to a fixed body (MC),
   the mechanism comprising:

   two swinging arms (40, 42) movable within two different horizontal planes to form two opposite sides of an articulated quadrilateral which has the first closing element as the third side and an edge of the fixed body as the fourth side,
   the swinging arms being hinged with fixed and - in use - vertical hinging axes to the fixed body, and
   to the first closing element at hinging points (P1. P2) placed in the same half-space defined by an imaginary plane which is orthogonal to the center line of the first closing element and parallel to said fixed hinging axes.

2. Mechanism according to claim 1, wherein said half-space comprises the free end of the first closing element.

3. Mechanism according to claim 1, wherein said half-space comprises an end of the first closing element which is hinged to the second closing element.

4. Mechanism according to any preceding claim, wherein said hinging points are placed on stand-off brackets fixed to the first closing element, so that the hinging axis relative to each hinging point is at a certain distance from the closing element.

5. Mechanism according to claim 4, wherein the distances from the closing element of said hinging axes are different.

6. Mechanism according to any preceding claim, wherein said fourth side comprises a box-shaped casing (90) which houses the arms when the closing elements are in the closing position.

7. Mechanism according to any preceding claim, wherein the arms are formed by two rectilinear end segments which are parallel to each other but misaligned, and by a central rectilinear segment which connects the two end segments.

8. Mechanism according to any preceding claim, wherein the first and second closing elements are hinged to each other by means of a retractable hinge.

9. Mechanism according to any preceding claim, wherein the second closing element is hinged to the fixed body by means of a retractable hinge.

10. Mechanism according to any preceding claim 6 to 9, comprising a braking and/or dampening device for said arms located inside said casing.

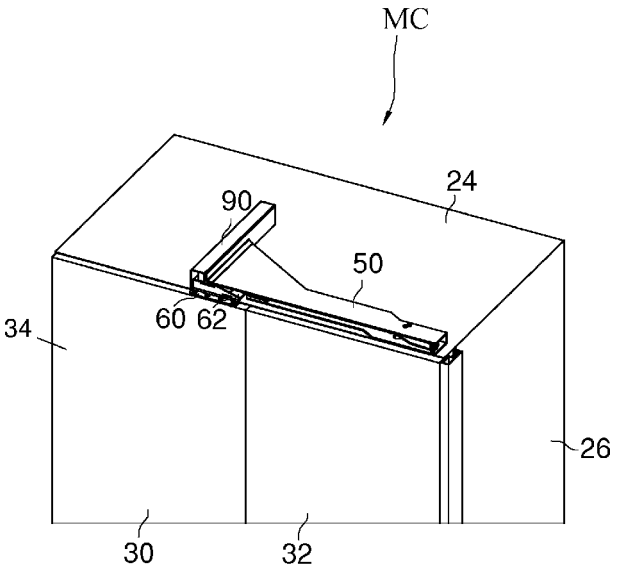
MC
24
90
50
60
62
34
26
30
32

Fig. 1

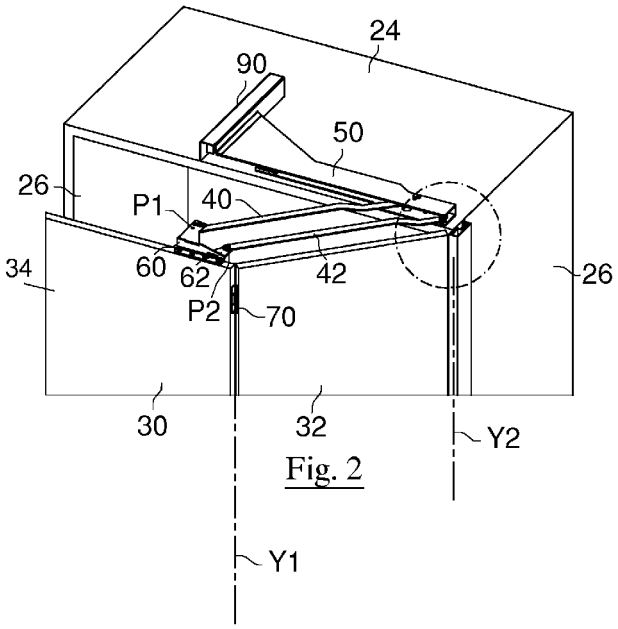
24
90
50
26
P1
40
34
60
62
42
26
P2
70
30
32
Y2
Y1

Fig. 2

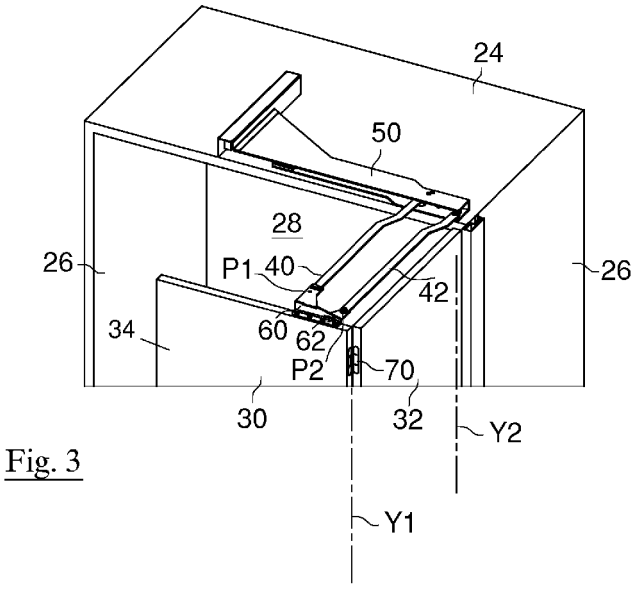
24
50
28
26
P1
40
42
26
34
60
62
P2
70
30
32
Y2
Y1

Fig. 3

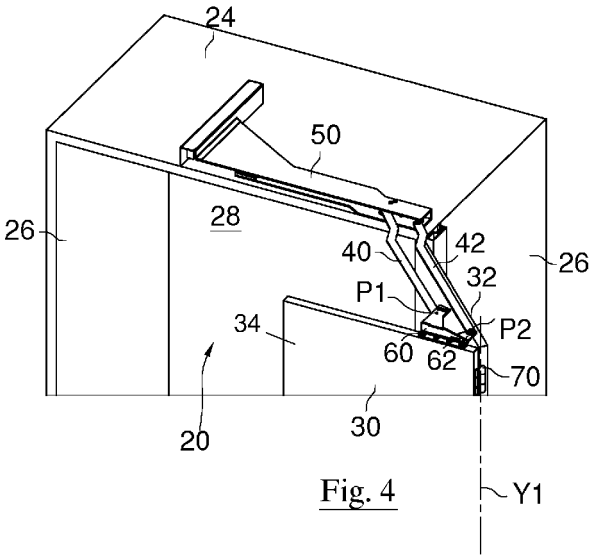
24
50
26
28
40
42
26
P1
32
34
P2
60
62
70
20
30
Y1

Fig. 4

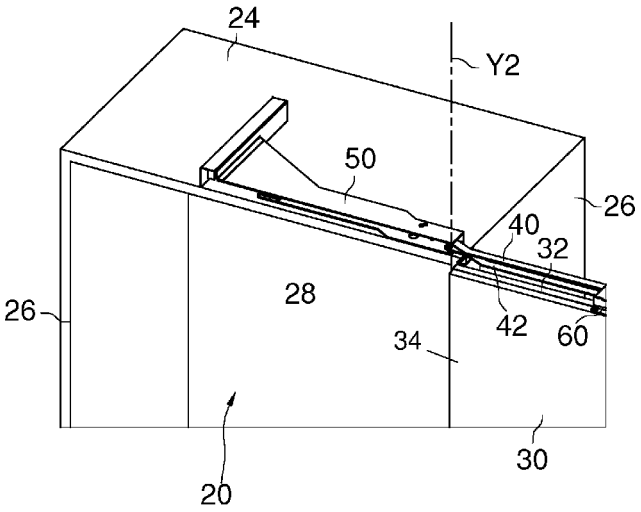

Fig. 5

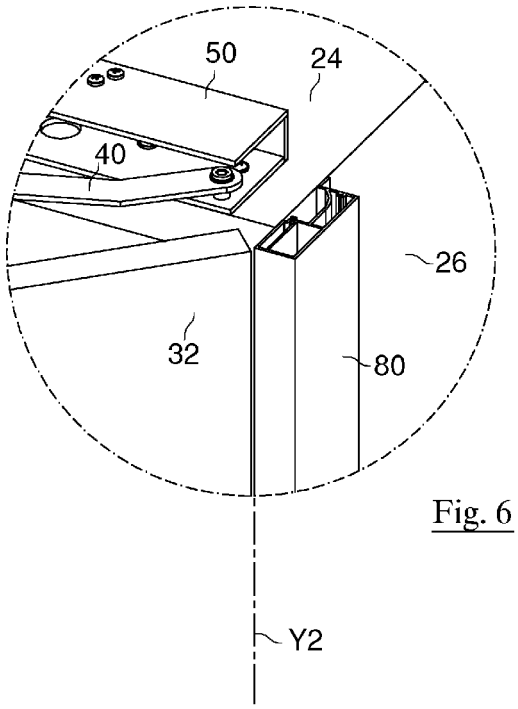

Fig. 6

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EUROPEAN SEARCH REPORT

Application Number
EP 21 15 7353

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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TECHNICAL FIELDS SEARCHED (IPC)
E05D
E05F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	23 June 2021	Viethen, Lorenz

CATEGORY OF CITED DOCUMENTS

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- EP 2719851 A **[0011] [0012]**