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(54) **NEW SWING DOOR WITH ROTARY-TRANSLATORY DOOR LEAF MOVEMENT**

(57) Door (10) comprising a door leaf (12) movable between a closed and an open position and a system of movement (20) comprising in turn an upper coupling device (21) and a lower coupling device (22) of the pinion-rack type, for connecting the door leaf with a fixed frame (11) of the door, said coupling devices comprising a respective runner (21b, 22b) suitable for translating along the upper (12b) and lower (12c) horizontal edges of the door leaf, and a toothed pinion (21e, 22e), secured by a pin (21d, 22d) to the fixed frame and a rack (21f, 22f), fixed to the door leaf and engaged with the toothed pinion in which the runner of each coupling device has a circular seat that couples with the corresponding pin so as to define a rotoidal coupling, comparable to a hinge, between the runner and the fixed pin.

The door has the advantage of involving a space, of smaller size, subject to the risk of crushing objects along the side of hinging of the door leaf, and a wider passage with respect to current pivot doors with fixed axis of rotation.

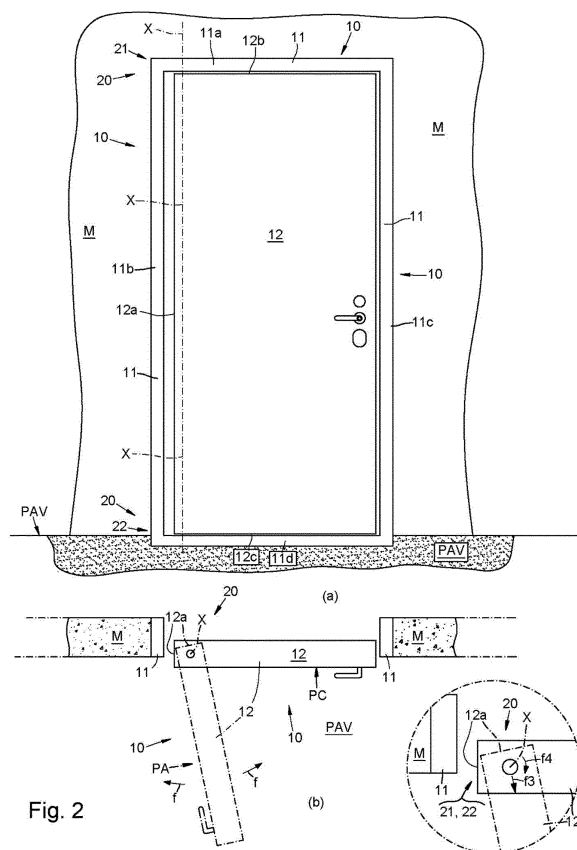


Fig. 2

DescriptionField of the invention

[0001] The present invention relates in general to the field of window and door frames, including industrial doors and closures, and more specifically relates to a door, of the swing or leaf type, that incorporates a new and innovative system of movement suitable for determining a rotating and translating movement at the leaf or wing of the door, when the door leaf is moved between an open position and a closed position with respect to a fixed structure, such as an exterior wall or interior wall, in which the door is installed and integrated.

Technical background of the invention

[0002] As is well known, rotatable swing or leaf doors, currently available on the market and in use, each typically comprise:

- a manually rotatable door leaf or wing, i.e., suitable for being rotated by a user around a respective vertical axis of rotation defined along a corresponding vertical lateral edge of the same leaf or wing of the door, in such a way as to selectively assume a closed position and an open position with respect to a fixed structure, such as an interior wall or exterior wall, in which the door is installed and integrated.

[0003] In this context, the prior art offers a wide variety of models and types of rotatable swing doors, designed to meet the most diverse requirements.

[0004] However, these known and used swing doors and the respective models, although they have been the subject of continuous improvements over time and having therefore reached a high level of optimisation and performances, are always ready to receive and implement further improvements, particularly in order to meet the continuous market demand for swing or leaf doors that are increasingly easy and convenient to use.

[0005] The state of the art also offers, in the sector of window and door frames, doors and opening/closing systems of the so-called "pivot" type, used in many applications, for example as doors of garages and warehouses, in which the door leaf or wing, when it is moved between the respective closed position and the open one, performs a more complex and articulated movement, usually around a fixed or movable horizontal rotation axis, compared to a simple rotation movement in relation to a fixed vertical axis.

[0006] These windows and doors of the pivoting type have, as is known, the advantage, in comparison with the leaf doors or swing doors that can be manually rotated around a fixed vertical axis, of facilitating the operations of opening and closing of the door, even when it has a considerable weight, and in particular of reducing the manual force necessary for moving the door, by appropriately balancing the respective masses that are moved, thus giving the user the sensation of exerting a continuous effort without spikes when opening and closing the door.

[0007] For the sake of completeness of information, along with garage doors, particularly of the pivot type, mention is also made of so-called industrial doors, i.e. those doors, usually of considerable size, which are typically installed in industrial and production buildings.

[0008] These industrial doors, currently offered by the market, although they have undergone considerable development and widespread use, are also always ready to receive and implement further improvements, in line with the demand for increasingly efficient and high-performance industrial doors with respect to the current ones.

[0009] Mention is also made, among the possible disadvantages that can affect in general rotating swing doors, particularly the pivot type with a fixed axis of rotation, currently available on the market, is that of "shearing", as it is called in the jargon of the industry. This disadvantage consists in the risk that the edge of the door leaf, adjacent to the area of the respective axis of rotation, co-operating with the jamb of the fixed structure into which the swing door is integrated, operates as a kind of shear, when the door leaf is closed or open, so as to capture and crush external objects accidentally present in this area which may therefore create impediments during closing/opening of the door.

[0010] More specifically, in pivot doors with a fixed axis of rotation, it happens that the more the centre of rotation or the axis of hinging of the door leaf of the pivot door, in order to optimise the distribution of the masses and therefore reduce the effort to open/close the door, is shifted towards the centre of the fixed frame on which the same door leaf of the pivot door is hinged (usually this centre of rotation is located at about 1/3 of the width of the fixed frame), the larger and wider the area or space, subject to the risk of shearing, that forms between the jamb or the upright of the fixed frame and the side of hinging of the door leaf of the pivot door.

[0011] In addition, by moving the centre of rotation, i.e. the axis of hinging, of the door leaf towards the centre of the fixed frame, on which the door leaf of the pivot door is hinged, the width of the passage available through the pivot door, when the respective door leaf is placed in the open position, is consequently reduced.

[0012] The problem therefore arises of limiting as much as possible the width of the area or space, subject to the risk

of shearing, between the side jamb of the fixed frame and the side of hinging of the door leaf of the pivot door, while at the same time maintaining as wide as possible the passage available through the pivot door, with the respective door leaf placed in the open position.

[0013] Therefore, in the aforementioned context that leaves room for innovation with respect to the prior art, the inventors have set themselves the problem, in addition to that of generally facilitating the movement of a swing door, of seeking to transfer the performances and corresponding advantages that are typical of the windows and doors of the pivot type, in particular as regards their ease of manoeuvre and the reduced effort that a user has to exert in order to move them, also to a usual swing or leaf door, used for example in the context of a normal domestic residence or for uses in similar applications.

[0014] Moreover, again with the intention of innovating with respect to the prior art, the inventors have set themselves the problem of realising a swing door capable of allowing a wider and easier passage through the swing door, when it is open, as also such as to involve a lower risk of shearing, in comparison with the pivot doors with fixed axis of rotation, with the same width of the fixed frame on which the swing door and the pivot door are hinged.

[0015] Finally, in a more general view, the inventors also set themselves the problem of developing improvements, for a rotating swing door, which were independent of the arrangement of the axis of rotation of the door leaf, i.e., were applicable to swing doors with both vertical and horizontal axis of rotation.

Summary of the invention

[0016] It follows that a primary object of the present invention is to propose a new door, of the leaf or swing type, designed to go beyond and improve the performances of the doors of this type currently offered and in use on the market, and in particular such as to offer the same advantages, in terms of convenience of use and capacity for facilitating the opening and closing of the door, as doors or opening/closing systems of the pivot type.

[0017] Another object of the invention is also to develop a novel rotary swing door that has a larger and wider angle of opening of the door leaf with respect to a conventional swing door with a fixed axis of rotation of the door leaf, so as to make the passage of a user through the door more convenient and easier.

[0018] A further object of the invention is also to make available a new and innovative rotatable leaf or swing door which, in addition to presenting improved performances, in particular as regards its manoeuvrability and movement between a respective closed position and an open one, is also easily installable and such as to involve an acceptable manufacturing cost, so as to be offered on the market as an advantageous alternative with respect to conventional swing doors already in use.

[0019] The above-mentioned objects can be considered fully achieved by the leaf door or swing door having the features defined by independent claim 1, therefore characterised by a rotary-translatory movement of the respective door leaf when it is moved manually by a user between a closed position and an open position relative to a fixed frame.

[0020] Particular embodiments of the present invention are moreover defined by the dependent claims.

[0021] Numerous advantages, in part already implicitly disclosed previously, are exhibited and offered by the new leaf door or swing door proposed by the present invention, such as those listed here below, purely by way of example:

- a smooth and easy movement of the door both to open and to close it, so as to give a user the feeling of exerting a relatively low and constant force when they open and close the door;
- an optimal distribution of the loads acting on the structure of the door, when the latter is moved between a closed position and an open position, which also reflects in a very convenient and easy opening and closing of the door leaf;
- a more convenient and wider passage through the door, when it is open, with respect to conventional pivot doors with a fixed axis of rotation, with the same width of the fixed frame on which the swing door of the invention and the conventional pivot door are hinged;
- a reduction in the so-called "risk of shearing", in particular with respect to pivot doors with fixed axis of rotation, due to the special rotary-translatory movement of the door leaf of the door which avoids the formation of narrow spaces and any possible interference, during the opening and closing of the door leaf, between the edge of the door leaf adjacent to its axis of rotation and the jamb of the fixed structure into which the door is integrated, so as to prevent the edge of the door leaf and the jamb of the fixed structure from acting as shears to catch items accidentally present in the area of the axis of rotation of the door leaf;
- a production cost substantially not dissimilar from that of a conventional leaf door or swing door manually rotatable around a fixed vertical rotation axis;
- substantially the same overall dimensions with respect to a standard leaf or swing door of conventional type;
- a configuration of the door compatible with the possibility of integrating into it most of the details exhibited by a conventional leaf or swing door;
- extension of the advantages and ease of manoeuvre and movement, which are typical of pivot doors, also to the usual doors that can be installed in a house and in a flat, such as the door of the present invention;

- easy automation and motorisation of the rotary-translatory movement of the door leaf, or of the kinematic mechanism, associated with the movable door leaf and the fixed frame of the door, which determines said rotary-translatory movement.

Brief description of the drawings

[0022] These and other objects, features and advantages of the present invention will be made clearer and more evident by the following description of a preferred embodiment thereof, given by way of a non-limiting example, with reference to the accompanying drawings, wherein:

Fig. 1, divided into sections (a) and (b), is a photographic image of an example of a door, of the leaf or swing type, in accordance with the present invention, in a closed position and in an open position, respectively, wherein the door integrates and is characterised by a system of movement suitable for determining a rotary-translatory movement to the leaf or wing of the door, when the door leaf is manually moved by a user between the respective closed position and the open one relative to a fixed structure, such as an interior wall or exterior wall, in which the door is installed and integrated;

Fig. 1 - sect. (c) is a photographic image that shows, on an enlarged scale, an upper zone of the door of Fig. 1 sect. (b) in the open position;

Fig. 2, divided into sections (a) and (b), is a partial schematic view that shows, as an integration of Fig. 1, frontally and in plan view, the door, of the leaf or swing type, in accordance with the present invention, and, in enlarged form within a dotted and dashed circle, the zone of the system of movement suitable for determining the rotary-translatory movement at the leaf or wing of the door;

Fig. 3, divided into sections (a), (b), (c), shows schematically in plan view and in transversal and longitudinal section respectively along lines A-A and B-B of Fig. 3 - sect. (a) the system of movement suitable for determining the rotary-translatory movement at the leaf or wing of the door of the invention;

Fig. 4A, divided into sections (a) and (b), is a diagram that illustrates the functioning of the system of movement, integrated in the door, which determines the rotary-translatory movement of the respective door leaf, when it is moved from the closed position to the open one;

Fig. 4B, divided into sections (a) and (b), is a diagram that illustrates the functioning of the system of movement, integrated in the door, when the respective door leaf is moved from the open position to the closed one;

Fig. 5 is a series of graphic views that show from different observation points a coupling device, of the pinion-rack type, included in the system of movement, which characterises and is integrated in the leaf or swing door of the invention;

Fig. 6, divided into sections (a) - (e), is a series of photographic images that show in succession the configuration assumed by the system of movement, which determines the rotary-translatory movement of the door leaf of the door of the invention, in use, i.e. when the door leaf is moved manually by the user between the respective closed position and the open one;

Fig. 7, divided into sections (a) - (i), is a further series of photographic images that integrate Fig. 1 and in particular show in enlarged form the area and the parts of the system of movement, integrated in the door of the invention, suitable for determining the rotary-translatory movement of the respective door leaf; and

Fig. 8, divided into sections (a) - (f), is a series of graphic views that illustrate, in use, a variant of the swing door of the invention of Figs. 1-7, wherein this variant is also characterised by a rotary-translatory movement at the wing or leaf of the door, when the door leaf is moved manually by a user between the respective closed position and the open one relative to a fixed structure or frame.

Description of a preferred embodiment of the swing or leaf door of the invention

[0023] Referring to the drawings and in particular to Figs. 1 and 2, a door, of the rotary swing or leaf type, in accordance with the present invention, is denoted overall by 10.

[0024] The photographic images corresponding to sections (a), (b) and (c) of Fig. 1 show a material example of this door 10, of the swing or leaf type, also referred to in brief hereafter as door or swing door, while the schematic views corresponding to sections (a) and (b) of Fig. 2 in turn show, as integration of Fig. 1, frontally and in plan view the door 10 of the invention.

[0025] In particular, the swing door 10 comprises:

- a fixed frame 11, attached to and integrated in a fixed structure in which the door 10 is installed, wherein this fixed structure is, for example, constituted by an interior wall or exterior wall M rising on a floor PAV; and
- a rotatable door leaf or wing, denoted by 12, also referred to hereafter simply and in brief as leaf, wherein this leaf

12 is pivoted along a respective vertical edge 12a on the fixed frame 11, in turn integrated in the fixed structure M in which the door 10 is installed, so as to be suitable for being manually moved and rotated by an operator, as indicated by arrows f in Fig. 2 - sect. (b), around a generic vertical axis of rotation denoted by X, in turn corresponding to the vertical edge 12a of the leaf 12, between a closed position, denoted by PC, and an open position, denoted by PA, represented with a dotted and dashed line in the same Fig. 2 - sect. (b), with respect to said fixed structure M in which the door 10 is installed.

[0026] In particular, the fixed frame 11 has a rectangular shape with an upper horizontal base 11a, integrated in the fixed structure, i.e. the interior wall or the exterior wall M in which the door 10 is installed, two vertical elements, left and right, 11b and 11c, also integrated in the fixed structure M, of which one of these two vertical elements, in particular the vertical element 11b, corresponds to the vertical edge 12a of pivoting of the leaf 12 on the fixed frame 11, and a lower horizontal base 11d embedded or integrated in the floor PAV on which the interior wall or exterior wall M in which the door 10 is installed and integrated stands.

[0027] According to a salient feature of the present invention, the door 10 of the invention incorporates a novel and innovative system of movement, denoted in general by 20, suitable for conferring a rotary-translatory movement to the leaf 12, with respect to the frame 11 and to the fixed structure M on which the door 10 is installed, when the leaf 12 is moved between the respective closed position PC and the respective open position PA, as will be described in greater detail here below by illustrating the use and functioning of the swing door 10.

[0028] This system of movement 20, which characterises the door 10 of the invention, in turn comprises:

- a first coupling device, upper, of the pinion-rack type, denoted overall by 21, which is installed in an upper zone of the leaf 12 and in a corresponding upper zone of the frame 11 and has the function of coupling and connecting above these two zones of the door 10; and
- a second coupling device, lower, again of the pinion-rack type, denoted overall by 22, which is installed in a lower zone of the leaf 12 and in a corresponding lower zone of the frame 11 and has the function of coupling and connecting below these two zones of the door 10.

[0029] Referring to Fig. 3, the first upper coupling device 21 in turn comprises:

- a support 21a, rigidly fixed to the leaf 21, which has an L shape in cross section and extends longitudinally along an upper horizontal edge 12b of the leaf 12;
- a runner 21b, in the form of a flat body, capable of sliding axially in the two directions along the support 21a fixed to the upper horizontal edge 12b of the leaf 12, as indicated by a double arrow f and represented with a dotted and dashed line;
- a guide 21c, rigidly fixed to the support 21a, having the function of guiding the axial sliding of the runner 21b relative to the support 21a;
- a pin 21d rigidly fixed to the fixed frame 11, by means of which the door 10 is installed and integrated in the fixed structure M, and therefore prevented from rotating relative to the same fixed frame 11;
- a toothed pinion 21e keyed and rigidly fixed to the pin 21d, whereby the toothed pinion 21e is also rigidly fixed to the fixed frame 11 and consequently cannot rotate with respect to the latter; and
- a rack 21f, which is rigidly fixed to and extends along the support 21a, which is in turn fixed to the leaf 12 of the door 10,

wherein the rack 21f and the toothed pinion 21e are meshed one with the other and are apt to co-operate reciprocally, so as to determine a rotary-translatory movement of the leaf 12 when it is moved manually from the respective closed position PC to the open one PA and vice versa from the open position PA to the closed one PC, as hereinafter and here below will be described in greater detail, illustrating the use and functioning of the swing door 10 of the invention.

[0030] Advantageously, the runner 21b, designed to slide axially along the support 21a, and the guide 21c, rigidly fixed to the same support 21a, can be constituted by a commercially available linear recirculating ball guide.

[0031] The runner 21b, sliding along the support 21a and therefore along the upper horizontal edge 12b of the leaf 12, further comprises a circular compartment or seat 21b' which receives and couples with a protruding end, denoted by 21d', of the pin 21d rigidly fixed to the fixed frame 11, wherein this protruding end 21d' protrudes from the toothed pinion 21e which is keyed on the same pin 21d.

[0032] Therefore, in this way, the seat 21b', defined by the sliding runner 21b, and the protruding end 21d' of the pin 21d define a rotoidal coupling, comparable to a hinge, capable of allowing a reciprocal rotation between these two parts.

[0033] The second lower coupling device 22, placed in a lower area of the door leaf 12, is structurally and functionally wholly identical to the first upper coupling device 21, so that, as shown in Fig. 5, its parts are denoted by a numerical numbering similar to that of the corresponding parts of the first upper coupling device 21.

[0034] In particular, the second lower coupling device 22 comprises, similarly to the first upper coupling device 21:

- a support 22a, rigidly fixed to the leaf 21, which has an L shape in section and extends longitudinally along a lower horizontal edge 12c of the leaf 12;
- a runner 22b, in the form of a flat body, capable of sliding axially along the support 22a fixed to the lower horizontal edge 12c of the leaf 12;
- 5 - a guide 22c, rigidly fixed to the support 22a, having the function of guiding the axial sliding of the runner 22b;
- a pin 22d rigidly fixed to the lower horizontal base 11d, of the fixed frame 11, embedded in the floor PAV on which stands the fixed structure M in which the door 10 is installed;
- a toothed pinion 22e keyed and rigidly fixed to the pin 22d, whereby the toothed pinion 22e is also rigidly fixed to the floor PAV and consequently cannot rotate with respect to the latter; and
- 10 - a rack 22f, which is rigidly fixed to and extends along the support 22a, in turn fixed to the leaf 12 of the door 10;

wherein the rack 22f and the toothed pinion 22e are meshed one with the other and are suitable for co-operating reciprocally, so as to determine a rotary-translatory movement of the door leaf 12 when it is moved manually from the respective closed position PC to the open position PA and vice versa from the open position PA to the closed position PC, as hereinafter and here below will be described in greater detail illustrating the functioning of the door 10 of the invention.

[0035] Also the runner 21b, suitable for sliding axially along the support 21a, and the guide 21c, rigidly fixed to the same support 21a, of the second lower coupling device 22 can be advantageously constituted by a commercially available normal linear recirculating ball guide.

[0036] The pin 21d of the upper coupling device 21 and the pin 22d of the lower coupling device 22, both rigidly fixed to the frame 11, and therefore also the respective toothed pinions 21e and 22e, are aligned along a common vertical axis denoted by X.

[0037] Furthermore, similarly to the upper coupling device 21, the runner 22b, sliding along the support 22a and therefore along the lower horizontal edge 12c of the leaf 12, also comprises a circular compartment or seat 22b' (Fig. 5) which receives and couples with a protruding end, denoted by 22d', of the pin 22d rigidly fixed to the floor PAV, wherein this protruding end 22d' protrudes from the toothed pinion 22e which is keyed on the same pin 22d.

[0038] Therefore, in this way, the seat 22b', defined by the sliding runner 22b, and the protruding end 22d' of the pin 22d define a rotoidal coupling, comparable to a hinge, suitable for allowing a reciprocal rotation between these two parts.

[0039] The pin 21d carrying the toothed pinion 21e of the upper coupling device 21 and the pin 22d carrying the toothed pinion 22e of the lower coupling device 22 can be rigidly fixed to the frame 11 of the door 10 in various ways, for example by means of a usual screw fixing system, not shown in detail but only schematically shown in the drawings being obviously deducible from them and in particular from Fig. 3.

[0040] For the sake of clarity, Fig. 3, divided into sections (a), (b) (c), schematically shows in plan view and in cross and longitudinal section along lines A-A and B-B of Fig. 3 -section (a) the system of movement 20 suitable for determining the rotary-translatory movement at wing or leaf 12 of the door 10 of the invention.

[0041] As can be seen from Fig. 3, in this system of movement 20 and more specifically in the respective upper coupling device 21, the vertical axis X of the pin 21d, which is rigidly fixed to the frame 11 and on which the toothed pinion 21e is rigidly fixed, is placed at a distance D' and D" from the ends of the support 21a, wherein these distances D' and D" are subject to vary, in the use and functioning of the door 10, i.e. during the movement of the leaf 12 between the closed position PC and the open position PA, as described here below, while keeping constant their sum equal to $D' + D'' = D$, equal to the extension and axial length of the support 21a integral and fixed to the leaf 12 of the door 10.

[0042] The variation of these distances D' and D" in turn corresponds to a translation movement of the sliding runner 21b relative to the guide 21c integral with the door leaf 12 of the door 10, as schematised by the double arrow f and represented by dotted and dashed line in Fig. 3.

[0043] The same applies to the lower coupling device 22 of the system of movement 20, whereby also the vertical axis X of the pin 22d, which is rigidly fixed to the frame 11 and on which the toothed pinion 22e is rigidly fixed, is placed at a distance D' and D" from the ends of the support 22a, wherein these distances D' and D" are subject to vary, in the use and functioning of the door 10, that is, during the movement of the leaf 12 between the closed position PC and open position PA, as described here below, while keeping constant their sum equal to $D' + D'' = D$, equal to the extension and axial length of the support 22a integral and fixed to the leaf 12 of the door 10.

[0044] Moreover, also for the lower coupling device 22, the variation of these distances D' and D" in turn corresponds to a translation movement of the sliding runner 22b relative to the guide 22c integral with the door leaf 12 of the door 10.

Use and functioning of the swing or leaf door of the invention

[0045] The use and functioning of the swing or leaf door 10 of the invention will now be described, in particular with reference to Figs. 4A and 4B.

[0046] At the outset, it is assumed that the door 10 is arranged with its leaf 12 in the respective closed position PC,

corresponding to the schematic view of Fig. 4A - sect. (a).

[0047] In this initial closed position PC, the upper coupling device 21, which couples and connects above the movable leaf 12 and the fixed frame 11 of the door 10, is in a configuration in which the vertical axis X of the respective pin 21d, which is rigidly fixed to the frame 11 and on which the toothed pinion 21e is rigidly fixed, is placed at a distance D1 and D2 from the two ends of the support 21a, the sum of these distances D1 + D2 being equal to D, i.e. to the axial length and extension of the support 21a, rigidly fixed to the leaf 12 of the door 10.

[0048] The same applies to the lower coupling device 22, which couples and connects below the movable leaf 12 and the fixed frame 11 of the door 10.

[0049] Therefore, in the closed position PC of the leaf of the door 10, the lower coupling device 22 is also in a configuration in which the vertical axis X of the respective pin 22d, which is rigidly fixed to the frame 11 and therefore to the floor PAV and on which the toothed pinion 22e is rigidly fixed, is placed at a distance D1 and D2 from the ends of the support 22a, the sum of these distances D1 and D2 being equal to D, i.e. $D1 + D2 = D$, i.e. to the axial length and extension D of the support 22a, fixed to the leaf 12 of the door 10.

[0050] At this point, an operator or user manually moves the leaf 12 of the door 10 so as to place it from the initial closed position PC to the final open position PA, as indicated by an arrow f1 and shown by the schematic view of Fig. 4A - sect. (b).

[0051] During this movement of the leaf 12, imposed by the user of the door 10, the toothed pinion 21e of the upper coupling device 21 being rigidly fixed to the fixed frame 11, and the pinion 22e of the lower coupling device 22 being rigidly fixed to the floor PAV, and therefore both being prevented from rotating, the racks 21f and 22f of these two coupling devices 21 and 22, co-operating respectively with the toothed pinion 21e and with the toothed pinion 22e, determine both a translation of the two runners 21b and 22b, of the same two coupling devices 21 and 22, along the respective supports 21a and 22a, and consequently also along the corresponding horizontal edges 12b and 12c, upper and lower, of the leaf 12, and a rotation of the racks 21f and 22f around the toothed pinion 21e and the toothed pinion 22e respectively, fixed, that is, around the respective common vertical axis X.

[0052] In this way, as shown in Fig. 4A - sect. (b), i.e. due to this translation of the two runners 21b and 22b induced by the movement of the leaf 12 from the closed position PC to the open position PA, both the distances D1 and D2 of the vertical axis X of the pin 21d, included in the upper coupling device 21 and rigidly fixed to the fixed frame 11, from the ends of the support 21a, and the distances D1 and D2 of the vertical axis X of the pin 22d, included in the lower coupling device 22 rigidly fixed to the floor PAV, from the ends of the support 22a, vary, and in particular the distance D1 is reduced to D1', that is $D1' < D1$, and the distance D2 is increased to D2', that is $D2' > D2$, the sum of these new distances always being equal to D, that is $D1' + D2' = D$.

[0053] It follows that the leaf 12, while it is moved by the user of the door 10 from the closed position PC to the open position PA, is subject to a rotary-translatory movement, that is a composite movement constituted by the combination of a rotatory movement and a translatory movement.

[0054] In order to better clarify the dynamics and the evolution of the rotary-translatory movement to which the leaf 12 is subjected when it is moved from the closed position PC to the open position PA, Fig. 4A shows how, in the closed position PC of the leaf 12, the fixed toothed pinion 21e and the rack 21f are in contact one with the other in a respective point P1 and P1', which therefore coincide, and how, in the open position PA reached by the door leaf 12 at the end of this rotary-translatory movement, these two points P1 and P1' are separated, with the fixed toothed pinion 21e and the rack 21f in contact one with the other in a respective second point P2 and P2'.

[0055] The functioning of the door 10, when it is closed, i.e. when the respective leaf 12 is moved by the user from the open position PA to the closed position PC, is exactly the inverse of the previous functioning, described previously, when the leaf 12 is moved from the closed position PC to the open position PA.

[0056] In detail, in the open position PA first reached, corresponding to the schematic view of Fig. 4B - sect. (a), the upper coupling device 21, which couples and connects above the movable leaf 12 and the fixed frame 11 of the door 10, is, as illustrated before, in a configuration in which the vertical axis X of the respective pin 21d, which is rigidly fixed to the frame 11 and on which the toothed pinion 21e is rigidly fixed, is placed at a distance D1' and D2' from the two ends of the support 21a, the sum of these distances D1' + D2' being equal to D, i.e. to the axial length and extension of the support 21a, rigidly fixed to the leaf 12 of the door 10.

[0057] The same applies to the lower coupling device 22, which couples and connects below the movable leaf 12 and the fixed frame 11 of the door 10.

[0058] Therefore, in the open position PA of the leaf of the door 10, the lower coupling device 22 is also in a configuration in which the vertical axis X of the respective pin 22d, which is rigidly fixed to the frame 11 and therefore to the floor PAV, on which the toothed pinion 22e is rigidly fixed, is placed at a distance D1' and D2' from the ends of the support 22a, the sum of these distances D1' and D2' being equal to D, i.e. $D1 + D2 = D$, i.e. to the axial length and extension D of the support 22a, fixed to the leaf 12 of the door 10.

[0059] At this point, the operator manually moves the leaf 12 of the door 10 so as to place it from the open position PA, previously reached, to the position PC, as indicated by an arrow f2 and shown in the schematic view of Fig. 4B -

sect. (b).

[0060] During this movement of the leaf 12, imposed by the user of the door 10, the toothed pinion 21e of the upper coupling device 21 rigidly fixed to the fixed frame 11, and the pinion 22e of the lower coupling device 22 rigidly fixed to the floor PAV, and therefore both being prevented from rotating, the racks 21f and 22f of these two coupling devices 21 and 22, co-operating respectively with the toothed pinion 21e and with the toothed pinion 22e, determine both a translation of the two runners 21b and 22b, of the same two coupling devices 21 and 22, along the respective supports 21a and 22a, and consequently also along the corresponding horizontal edges 12b and 12c, upper and lower, of the leaf 12, and a rotation of the racks 21f and 22f around the toothed pinion 21e and the toothed pinion 22e respectively, fixed, i.e. around the respective common vertical axis X.

[0061] In this way, as shown in Fig. 4B - sect. (b), i.e. due to the effect of this translation of the two runners 21b and 22b induced by the movement of the leaf 12 from the open position PA to the closed position PC, both the distances D1' and D2' of the vertical axis X of the pin 21d, included in the upper coupling device 21 and rigidly fixed to the fixed frame 11, from the ends of the support 21a, and the distances D1' and D2' of the vertical axis X of the pin 22d, included in the lower coupling device 22 rigidly fixed to the floor PAV, from the ends of the support 22a, vary, and in particular the distance D1' increases to D1, that is $D1 > D1'$, and the distance D2' reduces to D2, that is $D2 < D2'$, the sum of these new distances being always equal to D, that is $D1 + D2 = D$.

[0062] It follows that the leaf 12, when it is moved by the user of the door 10 from the open position PA to the closed position PC, is subject, similarly to when it is moved from the closed position PC to the open position PA, to a rotary-translatory movement, that is a composite movement constituted by the combination of a rotatory movement and a translatory movement.

[0063] In order to better clarify the dynamics and the evolution of the rotary-translatory movement to which the leaf 12 is subjected when it is moved from the open position PA to the closed position PC, Fig. 4B shows how, in the open position PA of the leaf 12, the fixed toothed pinion 21e and the rack 21f are in contact one with the other in a respective point P2 and P2', which therefore coincide, and how, in the closed position PC reached by the leaf 12 at the end of this rotary-translatory movement, these two points P2 and P2' are separated, with the fixed toothed pinion 21e and the rack 21f in contact one with the other in a respective second point P1 and P1'.

[0064] Furthermore, in order to better clarify the use and the functioning of the door 10 of the invention, Fig. 6, divided into sections (a) - (e), presents a series of photographic images that show in succession the configuration assumed by the system of movement 20, which determines the rotary-translatory movement of the leaf 12 of the door 10, when the leaf 12 is moved manually by the user between the respective closed position PC and the open position PA.

[0065] As can be seen from these photographic images, this rotary-translatory movement of the leaf 12 of the door 10 corresponds to and is constituted by the combination of a translation movement, as indicated by an arrow f3, and of a rotation movement, as indicated by an arrow f4, of the same leaf 12 respectively relative to the fixed frame 11 and around the vertical axis X of the toothed pinion 21e fixed to the frame 11.

[0066] The rotary-translatory movement of the leaf 12, indicated by the arrows f3 and f4, is also schematised in Fig. 2 - sect. (b), which shows in enlarged form, inside a dotted and dashed circle, the zone of the system of movement 20 suitable for determining this rotary-translatory movement.

[0067] Again, for reasons of clarity and to provide more precise and complete information, the photographic images of Fig. 7 - sections (a)-(i), described in the following table, of a prototype of the swing door 10 of the invention, show in enlarged form, as an integration of the photographic images of Figs. 1 and 6, the zone and the parts of the system of movement 20, which characterises the same door 10, suitable for determining the rotary-translatory movement of the respective leaf 12.

Section of Fig. 7	Description of the photographic image
(a)	Zone of the upper coupling device 21 which couples and connects above the leaf 12 with the fixed frame 11 integrated in the fixed structure M in which the door 10 is installed.
(b)	Zone of the lower coupling device 22 that couples and connects below the leaf 12 with the fixed frame 11, integrated in the fixed structure M in which the door 10 is installed, and therefore also with the floor PAV on which the fixed structure M stands.
(c)	Photographic image of the toothed pinion 22e and of the respective pin 22d, included in the lower coupling device 22, which are fixed to the fixed frame 11 of the door 10 and therefore also to the floor PAV on which the fixed structure M integrating the swing door 10 stands.
(d)	Photographic image of the toothed pinion 21e and of the respective pin 22d, included in the upper coupling device 21, which are fixed to the fixed frame 11 of the door 10.

(continued)

Section of Fig. 7	Description of the photographic image
(e)	Photographic image of the runner 21b, sliding axially along the guide 21c, and of the rack 21f, included in the upper coupling device 21.
(f)	Further photographic image, from a different viewpoint, of the runner 21b, sliding axially along the guide 21c, and of the rack 21f, included in the upper coupling device 21.
(g)	Overall photographic image of the upper coupling device 21 of the system of movement 20 of the door 10.
(h)	Overall photographic image of the lower coupling device 22 of the system of movement 20 of door 10.
(i)	Photographic image of the swing door 10 of the invention as a whole.

[0068] It is therefore clear, from what has been described, that the present invention fully achieves the objects set, and in particular proposes, in comparison with the known swing doors currently in use on the market, a novel and innovative swing door suitable for offering great convenience of use and in particular suitable for being easily moved by an operator between a respective open position and a respective closed position.

[0069] The door of the invention, in accordance with the embodiment 10, characterised by a rotary-translatory motion of the leaf 12, has also the advantage, in particular in comparison with the pivot doors with fixed rotation axis currently offered on the market, of involving, with the same width of the fixed frame on which both the door leaf part of the invention and the conventional pivot one are hinged, a wider passage between the leaf 12 in the open position and the jamb or post, i.e. the vertical element 11c, of the fixed frame 11, placed on the side of the lock and handle of the leaf 12, and therefore a less wide area or space, subject to the risk of "shearing", between the leaf 12 and the jamb or post, i.e. the vertical element 11b, of the fixed frame 11, placed on the side of hinging of the leaf 12 around the X axis.

[0070] It should however be specified that, for the same width of the fixed frame, the door 10 of the invention involves, with respect to a conventional pivot door with a fixed axis of rotation, a worse and less optimal leverage ratio, and therefore an increase in the shearing force.

[0071] Furthermore, the wider passage through the door 10, when the respective leaf 12 is in the open position, and the smaller lateral space subject to the risk of shearing, which distinguish the door 10 from the present pivot doors with fixed axis of rotation, also involve a smaller angle of opening of the door leaf for being moved from the closed to the open position.

[0072] Notwithstanding the basic concepts of the present invention, it is also clear that changes and further improvements can be made to the door described hitherto, exhibiting improved thermal features, without departing from the scope of the same invention.

[0073] For example, the coupling between the runner 21b and the pin 21d of the upper coupling device 21 and the coupling between the runner 22b and the pin 22d of the lower coupling device 22 can be realised in any form or configuration suitable for constituting a rotoidal coupling between these two parts, so as to allow the rotary-translatory movement of the leaf 12 when it is moved between the respective closed position PC and the respective open position PA.

[0074] Furthermore, both the pin 21d and the toothed pinion 21e of the upper coupling device 21e and both the pin 22d and the toothed pinion 22e of the lower coupling device 22 may be made as a single part and not be constituted by two distinct parts rigidly fixed one to the other.

Variants

[0075] It is clear that the inventive concept of the present invention should not be limited and confined to the specific embodiment 10, of the swing door, described above, but it appears suitable to include further embodiments and variants that share and apply the same inventive concept.

[0076] Fig. 8 illustrates precisely a variant, denoted overall by 110, of the swing door or leaf door of the invention, wherein also this variant 110 of the swing door is characterised, like the previously described embodiment form 10 of the swing door, by a rotary-translatory movement of the respective door leaf when manually moved by a user between a respective closed position and a respective open position relative to a fixed structure or frame.

[0077] For reasons of brevity, this variant 110 of the swing door of the invention will not be described in detail as it is clearly deducible from the preceding description of the swing door 10 and from Fig. 8, made up of a series of graphic views showing in succession the use and the functioning of this variant 110, when the respective door leaf is moved manually by a user between a respective closed position and a respective open position relative to a fixed structure or

frame, so that only the salient and essential features that distinguish it from the previously described swing door 10 will be described of this variant 110 with reference to Fig. 8.

[0078] Furthermore, for reasons of clarity, as shown in Fig. 8, the parts and elements which constitute this variant 110 of the swing door of the invention and correspond to the parts and elements of the embodiment 10 will be denoted by the same reference numerals.

[0079] In detail, the swing door or leaf door 110 differs essentially with respect to the swing door or leaf door 10 in that, in the swing door 110, the parts of the system of movement 20 that controls and determines the rotary-translatory movement of the leaf 12 are placed and fixed, on the fixed parts and on the movable parts of the same door 110, that is, on the respective fixed frame 11 and on the respective movable leaf 12, in an inverted manner with respect to the swing door 10.

[0080] It follows, again as shown in Fig. 8, that in the swing door 110, the racks 21f, 22f, respectively of the upper coupling device 21 and of the lower coupling device 22, are rigidly fixed to the fixed frame 11 of the door 110, whereas, in the swing door 10, the racks 21f, 22f respectively of the upper coupling device 21 and of the lower coupling device 22 are instead rigidly fixed to the movable leaf 12 of the door 10.

[0081] Furthermore, in the swing door 110, the toothed pinions 21e, 22e of the upper coupling device 21 and of the lower coupling device 22 respectively are rigidly fixed to the movable leaf 12 of the door 110, whereas, in the swing door 10, the toothed pinions 21e, 22e of the upper coupling device 21 and of the lower coupling device 22 respectively are rigidly fixed to the fixed frame 11 of the door 10.

[0082] Again, in the swing door 110, the runner 21b, 22b and the relative linear guide systems of the upper coupling device 21 and of the lower coupling device 22, respectively, are integral with the fixed frame 11 of the swing door 110, whereas, in the swing door 10, the runner 21b, 22b and the relative linear guide systems of the upper coupling device 21 and of the lower coupling device 22, respectively, are instead rigidly fixed to the movable leaf 12 of the door 10.

[0083] In summary, in this variant 110, the movements of the parts and of the elements of the system of movement 20 that determine the rotary-translatory motion of the leaf 20, and therefore also the degrees of freedom to which these movements are subject, when the leaf 12 of the door 110 is moved between the respective closed position and the open one, are reversed with respect to the movements of the corresponding parts and elements of the swing door 10.

[0084] Consequently, in the use of the swing door 110, i.e. during the opening/closing of the respective leaf 12, the toothed pinions 21e, 22e, integral and rigidly fixed to the movable leaf 12, engage respectively with the racks 21f, 22f, rigidly fixed to the fixed frame 11 together with the recirculating ball guide system of the runners 21b, 22b, so as to determine the rotary-translatory movement of the leaf 12.

[0085] With regard to this variant 110, it is observed that, even if from an aesthetic/dimensional point of view it may have some limitations, it has however the advantage with respect to the swing door 10, thanks to the inversion of the fixing on the fixed frame 11 and on the movable leaf 12 of the parts of the system of movement 20 that determine the rotary-translatory movement of the movable leaf 12, of allowing a greater and wider angle of opening of the same movable leaf 12 and therefore of allowing an equally wider and more convenient passage of a user through the swing door 110.

[0086] In particular, as shown by the graphic views in Fig. 8 and indicated by an arrow f10, the sliding of the axis of rotation X along the axis of the threshold of the leaf 12 of the door 110, as determined by the rotary-translatory motion of the leaf 12 during its opening and movement from the closed position PC to the open position PA, distances the axis of rotation X of the leaf 12 from the jamb ST of the fixed structure, such as a wall, in which the door 110 is integrated, so as to create the space for a greater angle of rotation of the same leaf 12.

[0087] It follows that this variant 110 of the door of the invention, in certain aspects more technically complex than the embodiment 10, presents with respect to the latter a greater angle of opening for placing the leaf 12 of the door 110 from the closed to the open position, wherein this greater angle of opening is precisely determined by the displacement and sliding of the axis of rotation X of the leaf 12 along the longitudinal axis of the leaf 12, sliding in turn determined by the rotary-translatory movement of the same leaf 12.

Claims

1. Swing or leaf door (10) comprising:

- a fixed frame (11) adapted to be integrated into a fixed structure (M) in which the swing door (10) is installed; and
- a movable leaf or wing (12), able to assume a closed position (PC) and an open position (PA) with respect to said fixed structure (M) in which the swing door (10) is installed;

wherein the door (10) integrates a system of movement (20, 21, 22) able to cause a rotary-translatory movement of said movable leaf (12), when it is moved between the respective closed position (PC) and the respective open position (PA);

characterised in that said system of movement (20) in turn includes:

- a first upper coupling device (21), of the pinion-rack type, for coupling and connecting, above, the movable leaf (12) of the door to said fixed frame (11); and
- a second lower coupling device (22), of the pinion-rack type, for coupling and connecting, below, the movable leaf (12) of the door to said fixed frame (11);

wherein each of said two upper and lower coupling devices (21, 22), in turn comprises:

- a respective runner (21b, 22b) able to slide and translate (f) along a corresponding upper horizontal edge (12b) and a corresponding lower horizontal edge (12c) of the movable leaf (12);
- a pin (21d, 22d) rigidly fixed to said fixed frame (11);
- a toothed pinion (21e, 22e), rigidly fixed by means of said pin (21d, 22d) to the fixed frame (11) of the door (10), and therefore prevented from rotating; and
- a rack (21f, 22f), rigidly fixed to the movable leaf (12) and meshed with the corresponding toothed pinion (21e, 22e) of the upper and lower coupling device (21, 22);

wherein the two pins (21d, 22d), that fix the two toothed pinions (21e, 22e) of the two upper and lower coupling devices (21, 22), and therefore also the same two toothed pinions (21e, 22e), to the fixed frame (11), are aligned along a common vertical axis (X) which extends vertically along a corresponding vertical lateral edge (12a) of the movable leaf (12) of the door (10); and

wherein the runner (21b, 22b) of each upper and lower coupling device, (21, 22) has a circular seat (21b', 22b') which receives and couples with the corresponding pin (21d, 22d), fixed, of the coupling device (21, 22), so as to define a rotoidal coupling, comparable to a hinge, between the runner (21b, 22b) and the fixed pin (21d, 22d), whereby the leaf (12), when it is moved (f1, f2) between the closed position (PC) and the open position (PA), is subject to a rotary-translatory movement consisting of the combination of the rotary movement of the same movable leaf (12) around said vertical axis (X) common to said two fixed pins (21d, 22d) and of the translation of the two runners (21b, 22b) of the two upper and lower coupling devices (21, 22), respectively along the upper horizontal edge (12b) and the lower horizontal edge (12c) of the movable leaf (12).

2. Door (10) according to claim 1, wherein the upper coupling device (21) further comprises a support (21a) which is fixed and extends longitudinally along the upper horizontal edge (12b) of the movable leaf (12) of the door (10) and the lower coupling device (22) further comprises a support (22a) which is fixed and extends longitudinally along the lower horizontal edge (12c) of the movable leaf (12) of the door (10),

wherein said supports (21a, 22a) of the upper coupling device (21) and of the lower coupling device (22) each have an L-shape in cross section, wherein the racks (21f, 22f) of the upper coupling device (21) and of the lower coupling device (22) each consist of a bar which is rigidly fixed and extends along a first side of the L-shape of the respective support (21a, 22a); and wherein the runner (21b, 22b) of the upper coupling device (21) and of the lower coupling device (22) are slidably associated with a second side of the L-shape of the respective support (21a, 22a).

3. Door (10) according to claim 1 or 2, wherein the runner (21b) of the upper coupling device (21) and the runner (22b) of the lower coupling device (22) are each associated with a respective guide (21c) apt to guide the sliding of the same runner (21b, 22b), and wherein both the runner (21b) of the upper coupling device (21) with the respective guide (21c) and the runner (22b) of the lower coupling device (22) with the respective guide (22c) consist of a linear guide with recirculating balls.

4. Door (10) according to any one of the preceding claims, wherein the pin (21d) carrying the toothed pinion (21e) of the upper coupling device (21) and the pin (22d) carrying the toothed pinion (22e) of the lower coupling device (22) are rigidly fixed to the frame (11) of the door (10) by means of a screw fixing system.

5. Door (10) according to any one of the preceding claims, wherein the runner (21b, 22b) of each upper (21) and lower (22) coupling device comprises a flat body able to slide and translate (f') along the corresponding upper (12b) and lower (12c) horizontal edge of the movable leaf (12), and wherein said flat body exhibits said circular seat (21b', 22b') which is coupled with the corresponding pin (21d, 22d) of the upper (21) and lower (22) coupling device to define said toroidal coupling.

6. Swing or leaf door (110) comprising:

- a fixed frame (11) adapted to be integrated into a fixed structure (M) in which the swing door (10) is installed; and
- a movable leaf or wing (12), able to assume a closed position (PC) and an open position (PA) with respect to said fixed structure (M) in which the swing door (10) is installed;

wherein the door (10) integrates a system of movement (20, 21, 22) able to cause a rotary-translatory movement of said movable leaf or wing (12), when it is moved between the respective closed position (PC) and the respective open position (PA);

characterised in that said system of movement (20) in turn comprises:

- a first coupling device (21), upper, of the pinion-rack type, for coupling and connecting, above, the leaf (12) of the door with said fixed frame (11); and
- a second lower coupling device (22), of the pinion-rack type, for coupling and connecting, below, the leaf (12) of the door with said fixed frame (11);

wherein each of said two upper and lower coupling devices (21, 22), in turn comprises:

- a respective runner (21b, 22b) able to slide and translate (f) along a corresponding upper horizontal edge (12b) and a corresponding lower horizontal edge (12c) of the leaf (12);
- a pin (21d, 22d) rigidly fixed to said movable leaf (12);
- a toothed pinion (21e, 22e), rigidly fixed, by means of said pin (21d, 22d), to the movable leaf (12) of the door (10); and
- a rack (21f, 22f), rigidly fixed to the fixed frame (11) and meshed with the corresponding toothed pinion (21e, 22e) of the upper and lower coupling device (21, 22);

wherein the two pins (21d, 22d), which fix the two toothed pinions (21e, 22e) of the two coupling devices, upper and lower (21, 22), and therefore also the same two toothed pinions (21e, 22e), to the movable leaf (12), are aligned along a common vertical axis (X) which extends vertically along a corresponding vertical lateral edge (12a) of the leaf (12) of the door (10);

wherein the runner (21b, 22b) of each upper and lower coupling device (21, 22) has a circular seat (21b', 22b') which receives and couples with the corresponding pin (21d, 22d), fixed, of the coupling device (21, 22), so as to define a rotoïdal coupling, comparable to a hinge, between the runner (21b, 22b) and the fixed pin (21d, 22d), wherein the runner (21b, 22b) of each upper (21) and lower (22) coupling device comprises a flat body apt to slide and translate (f) along the corresponding horizontal upper (12b) and lower (12c) edge of the movable leaf (12), and

wherein said flat body has said circular seat (21b', 22b') which is coupled with the corresponding pin (21d, 22d) of the upper (21) and lower (22) coupling device, to define said toroidal coupling, whereby the leaf (12), when it is moved (f1, f2) between the closed position (PC) and the open position (PA), is subject to a rotary-translatory movement consisting of the combination of the rotary movement of the same leaf (12) around said vertical axis (X) common to said two fixed pins (21d, 22d), and of the translation of the two runners (21b, 22b) of the two upper and lower coupling devices (21, 22), respectively along the upper horizontal edge (12b) and the lower horizontal edge (12c) of the leaf (12).

7. Door (110) according to claim 6, wherein the upper coupling device (21) further comprises a support (21a) which is fixed and extends longitudinally along the upper horizontal edge (12b) of the movable leaf (12) of the door (10) and the lower coupling device (22) further comprises a support (22a) which is fixed and extends longitudinally along the lower horizontal edge (12c) of the movable leaf (12) of the door (10),

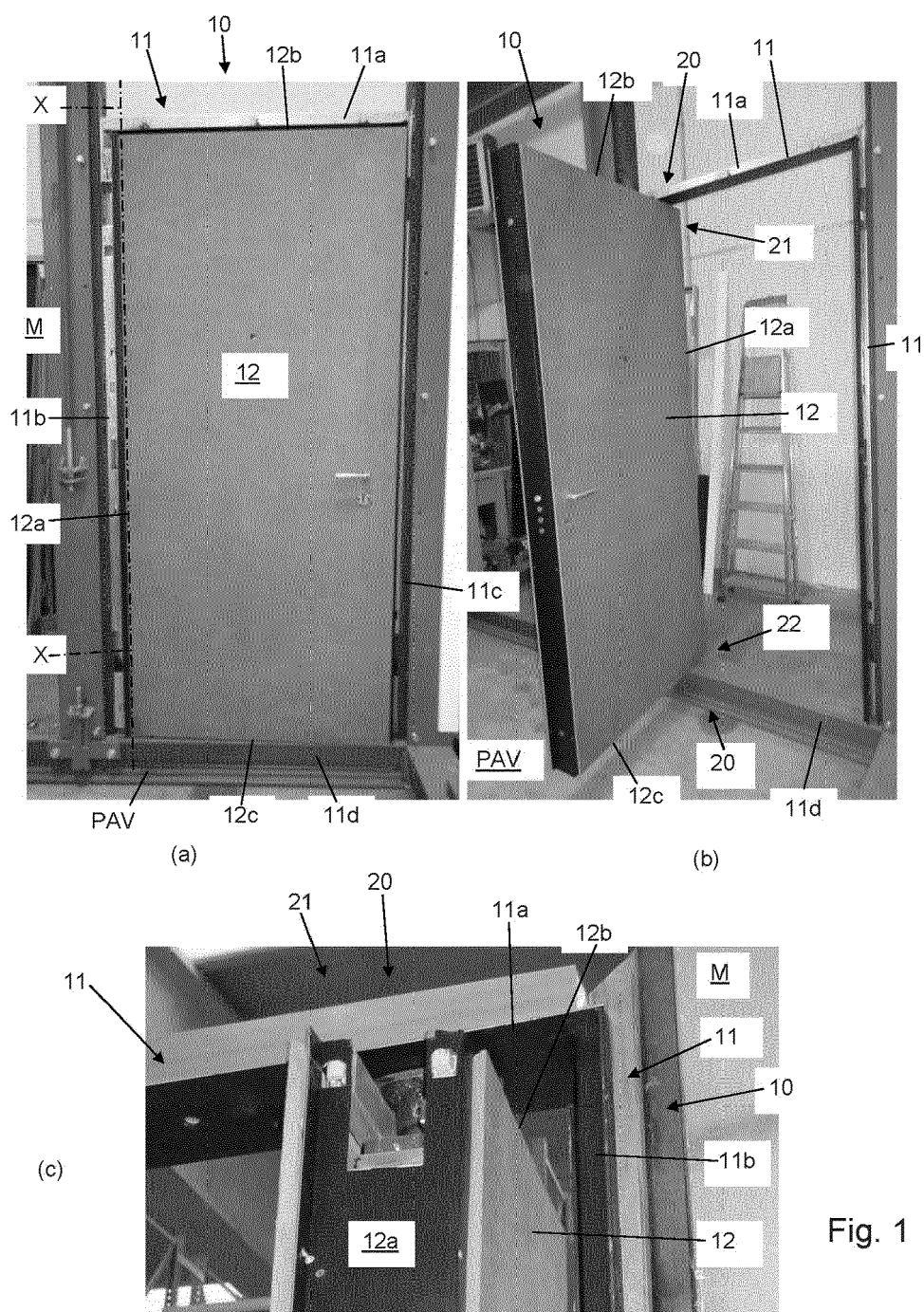
wherein said supports (21a, 22a) of the upper coupling device (21) and of the lower coupling device (22) each have an L-shape in cross section,

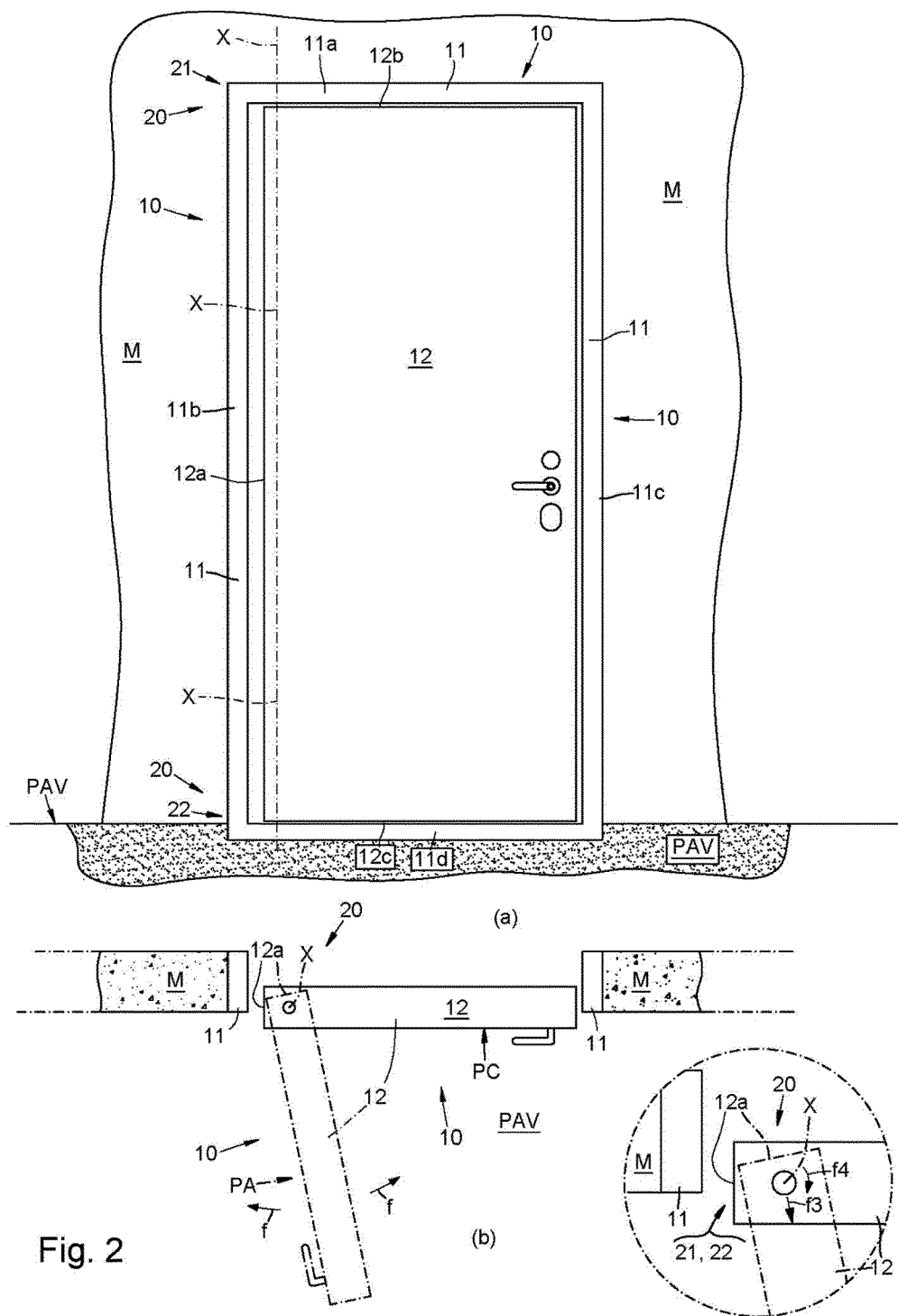
wherein the racks (21f, 22f) of the upper coupling device (21) and of the lower coupling device (22) each consist of a bar which is rigidly fixed and extends along a first side of the L-shape of the respective support (21a, 22a); and wherein the runner (21b, 22b) of the upper coupling device (21) and of the lower coupling device (22) are slidingly associated with a second side of the L-shape of the respective support (21a, 22a).

8. Door (110) according to claim 6 or 7, wherein the runner (21b) of the upper coupling device (21) and the runner

(22b) of the lower coupling device (22) are each associated with a respective guide (21c) apt to guide the sliding of the same runner (21b, 22b); and
wherein both the runner (21b) of the upper coupling device (21) with the respective guide (21c) and the runner (22b) of the lower coupling device (22) with the respective guide (22c) consist of a linear guide with recirculating balls.

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9. Door (110) according to any one of claims 6 to 8, wherein the pin (21d) carrying the toothed pinion (21e) of the upper coupling device (21) and the pin (22d) carrying the toothed pinion (22e) of the lower coupling device (22) are rigidly fixed to the frame (11) of the door (10) by means of a screw fixing system.
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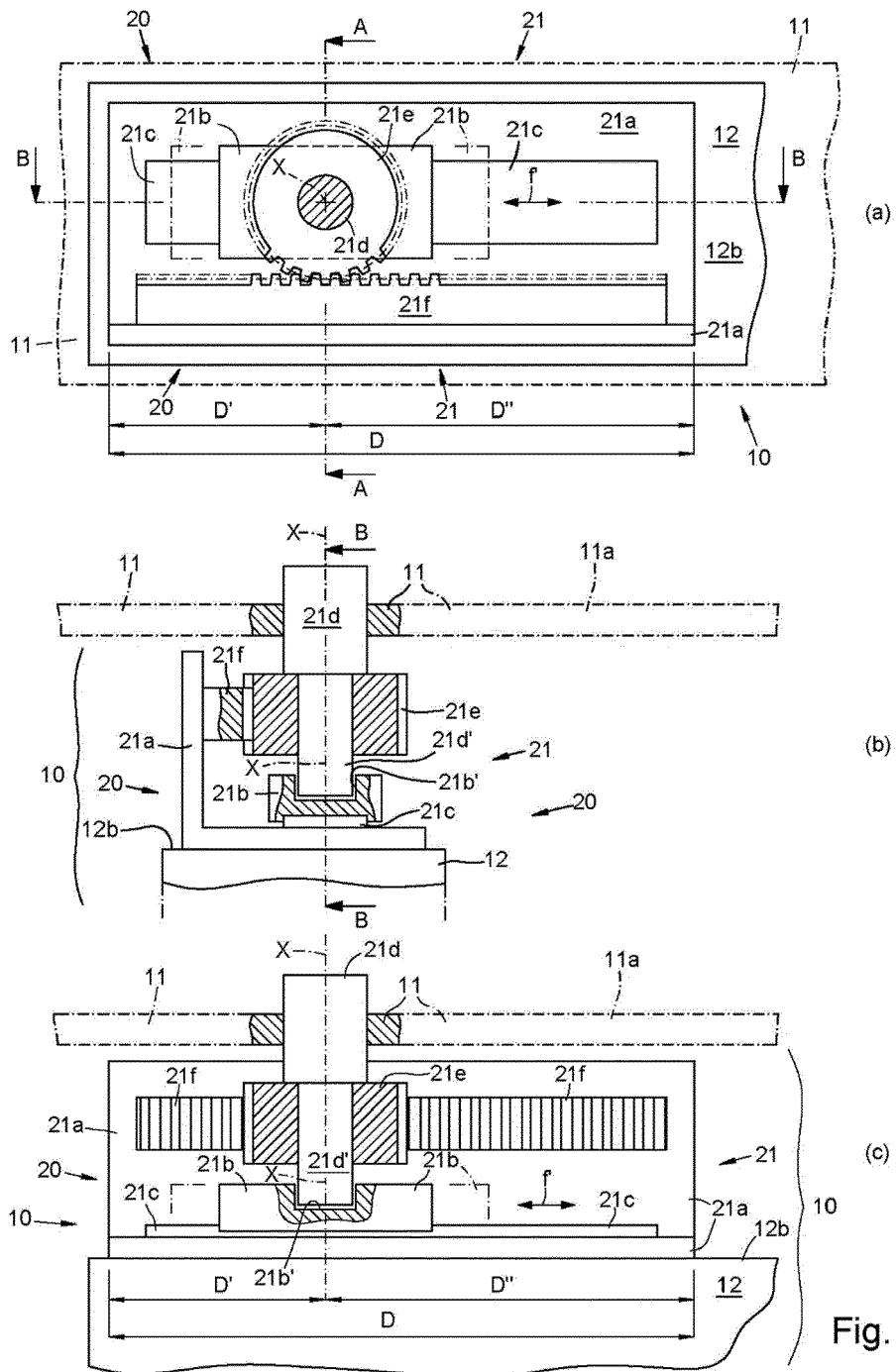
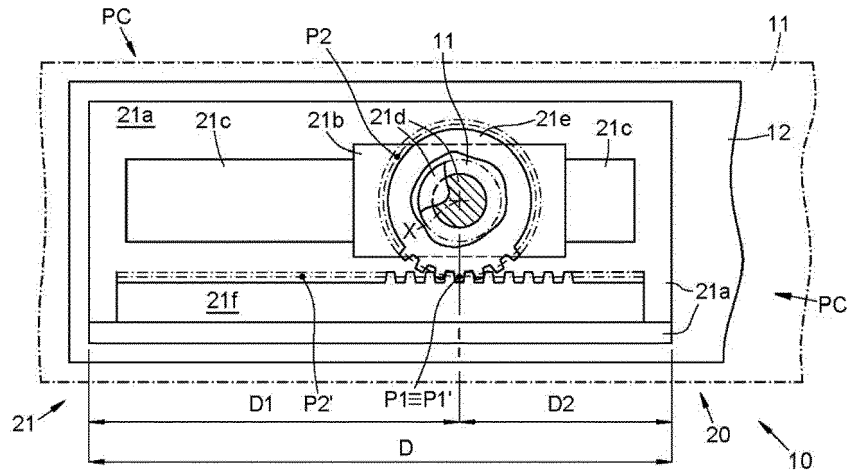


Fig. 3



(a)

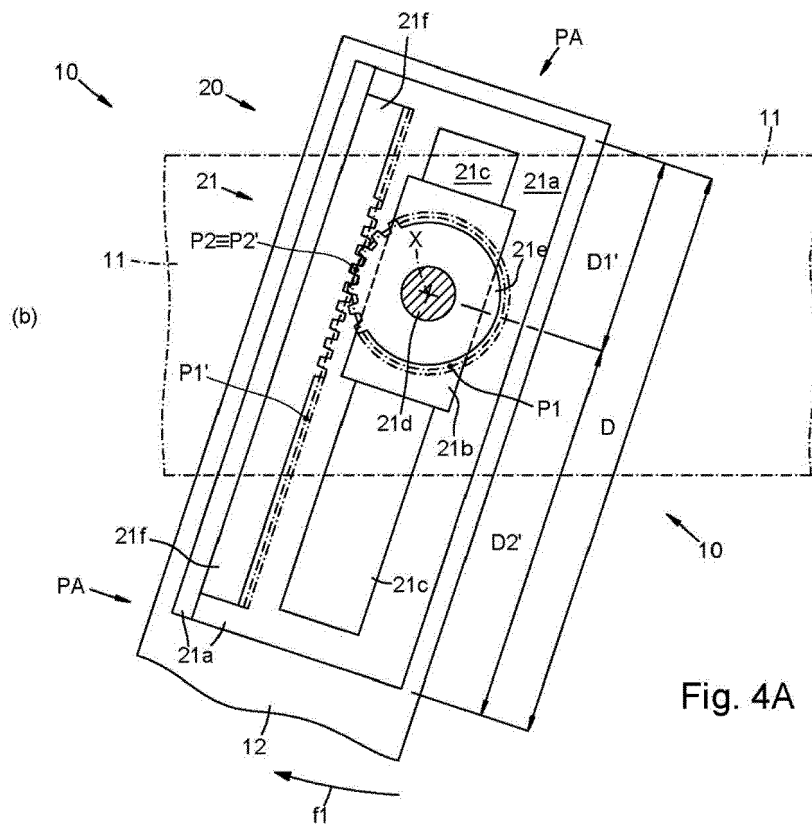


Fig. 4A

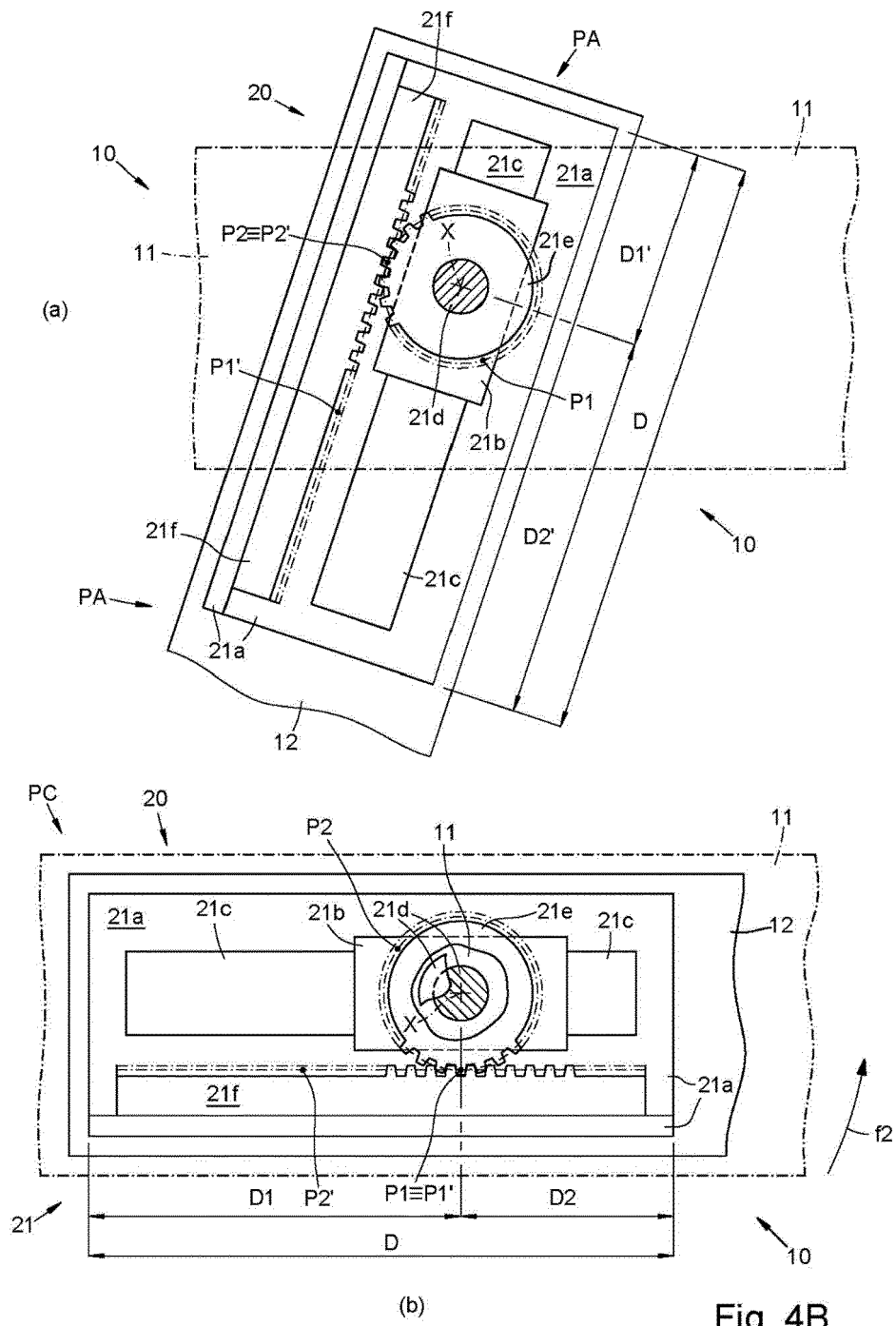
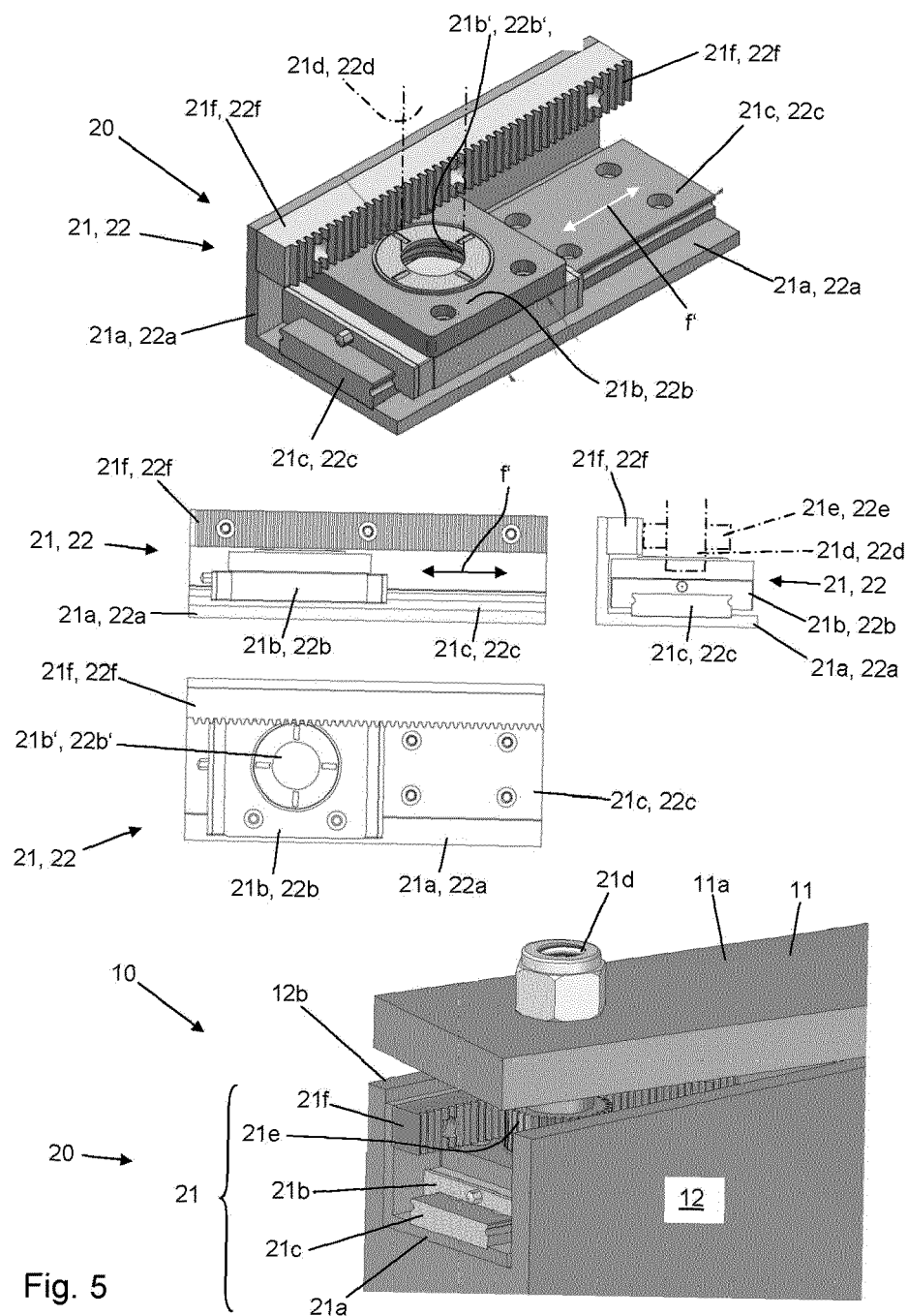


Fig. 4B



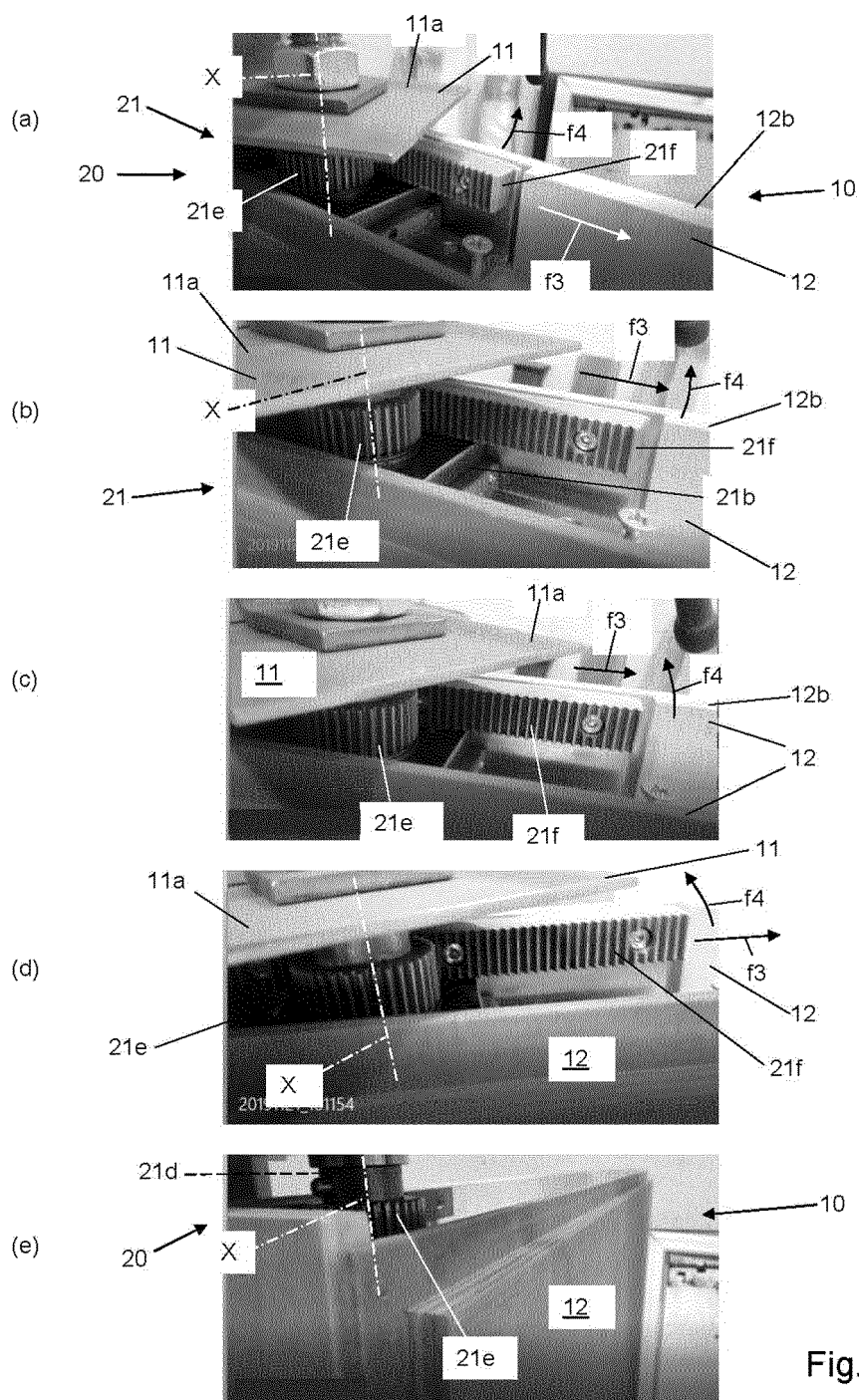


Fig. 6

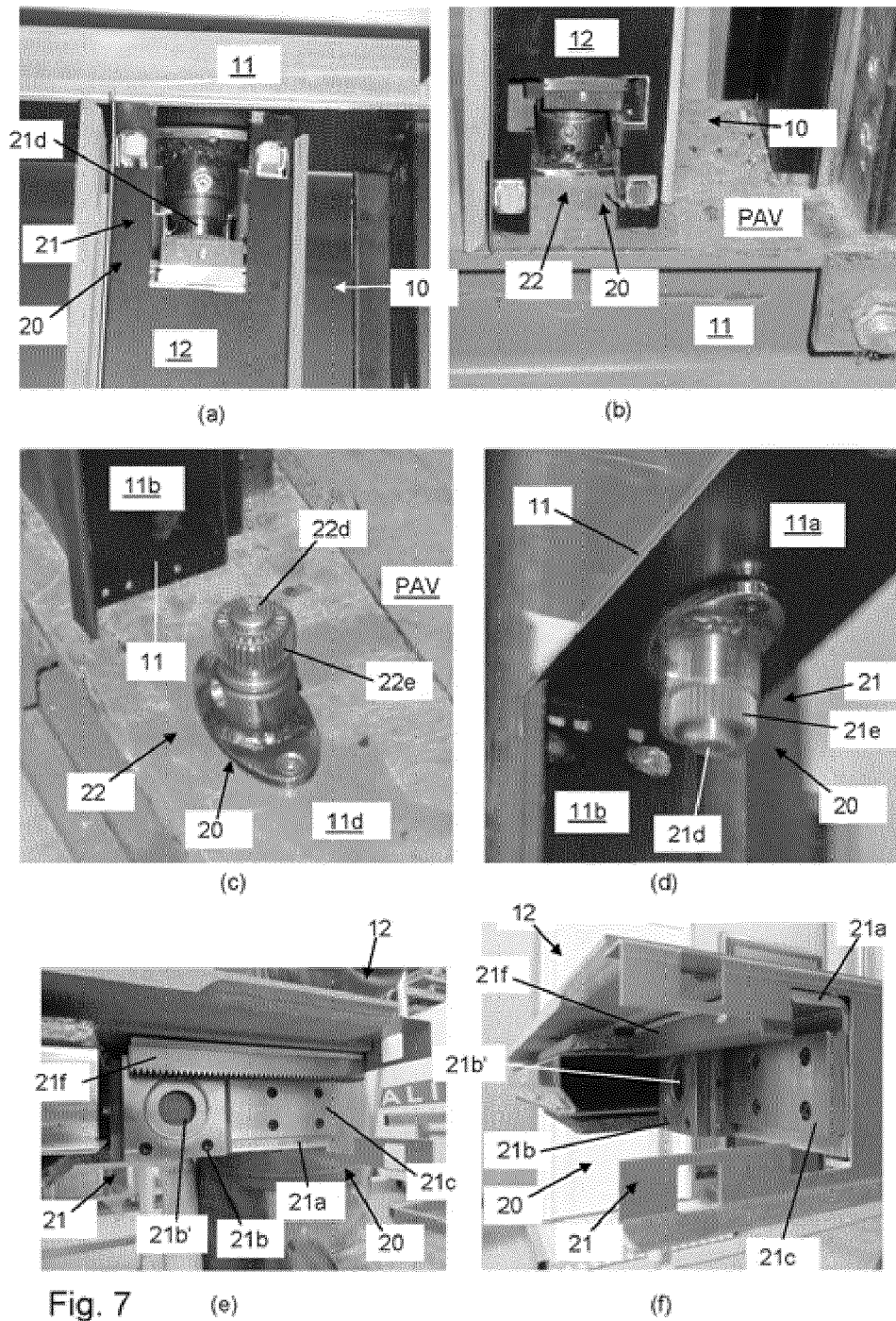


Fig. 7

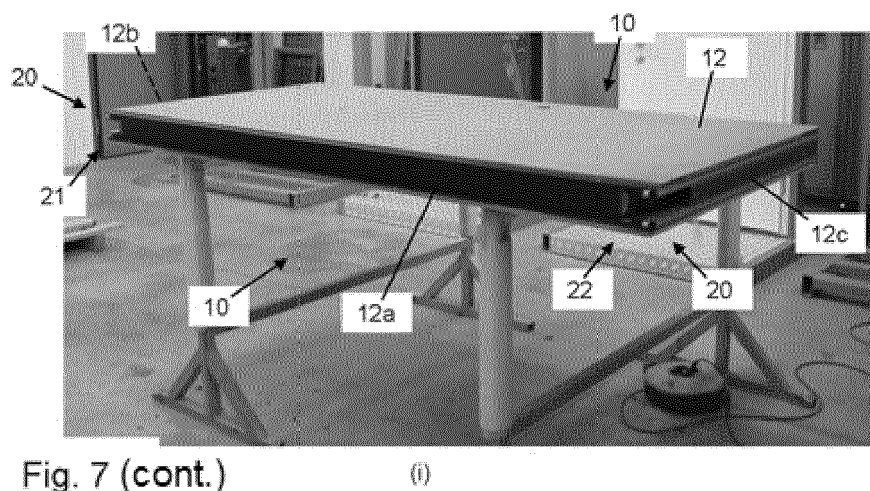
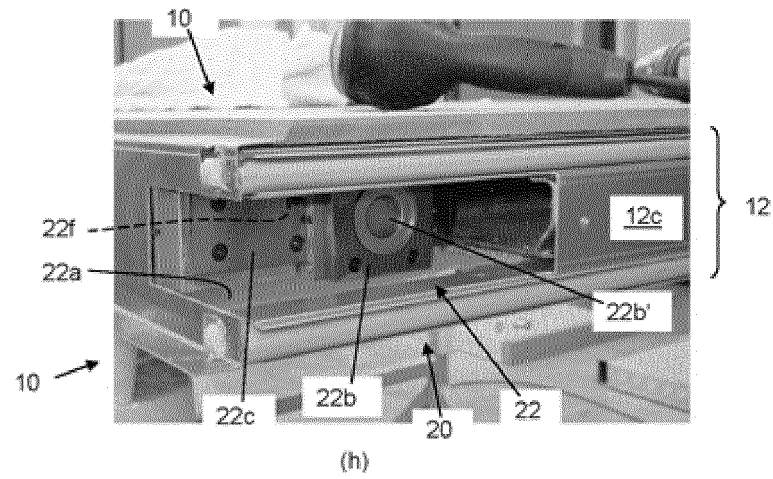
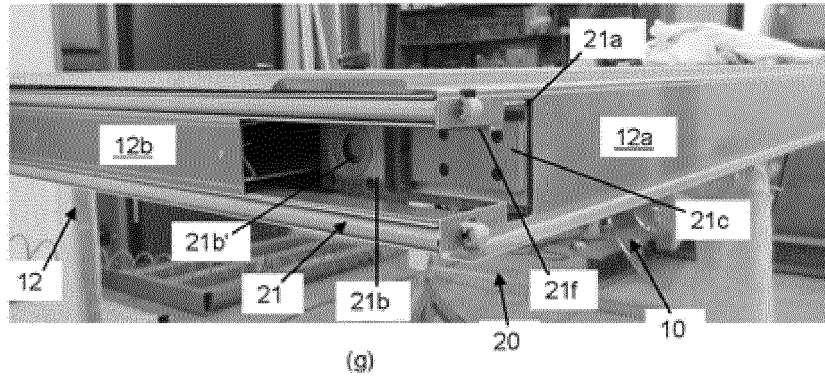


Fig. 7 (cont.)

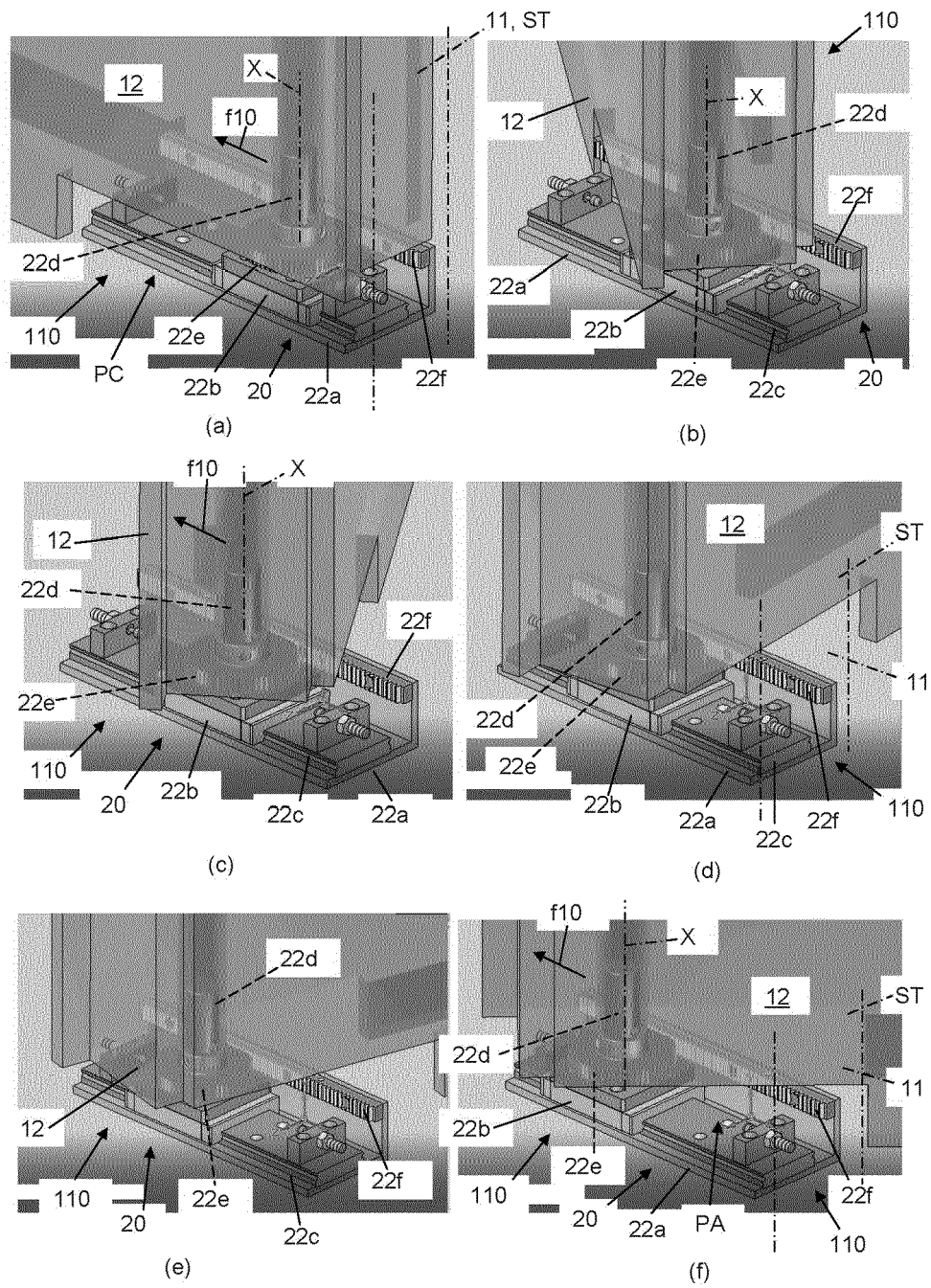


Fig. 8



EUROPEAN SEARCH REPORT

Application Number

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 1 910 344 A (ANNA KOTLER) 23 May 1933 (1933-05-23) * figures 2-4, 8 *	6-9	INV. E06B3/50 E06B3/70 E05D7/081
A	KR 101 932 938 B1 (KUMOH NAT INST TECHNOLOGY IND ACAD COOP FOUND [KR]) 27 December 2018 (2018-12-27) * figures 6, 7a, 7b *	1-5	
A	WO 95/23270 A2 (ONTARIO LTD 420820 [CA]; DAVIES BOB [CA]; DAVIES SEAN [CA]) 31 August 1995 (1995-08-31) * figures 1A-1B *	6-9	
			TECHNICAL FIELDS SEARCHED (IPC)
			E06B E05G E05D
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 16 June 2022	Examiner Crespo Vallejo, D
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

**ANNEX TO THE EUROPEAN SEARCH REPORT
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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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