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(71) Applicant: **dormakaba Deutschland GmbH**
58256 Ennepetal (DE)

(72) Inventors:
- **CHIN, Teck Liang Francis**
  58256 Ennepetal (DE)
- **YANG, Yong Teck**
  58256 Ennepetal (DE)

(74) Representative: **Balder IP Law, S.L.**
Paseo de la Castellana 93
5ª planta
28046 Madrid (ES)

(54) **DOOR ASSEMBLY**

(57) The invention is related to a door assembly comprising a first door (1), a second door (2), a connecting element (4) and a biasing element (5). The first door (1) is pivotally arranged around a main pivoting axis (10) and the second door (2) is arranged slidably along a sliding guide (3). The connecting element (4) has a first point being pivotally attached to the first door (1) and a second point being pivotally attached to the second door (2); wherein one of the first (1) and the second door (2) comprises a channel (6) so that the corresponding first or second point is arranged to slide along the channel (6). The biasing element (5) is located in one of the first (1) and the second door (2), the biasing element (5) being arranged to exert a force against the first point or the second point of the connecting element (4).

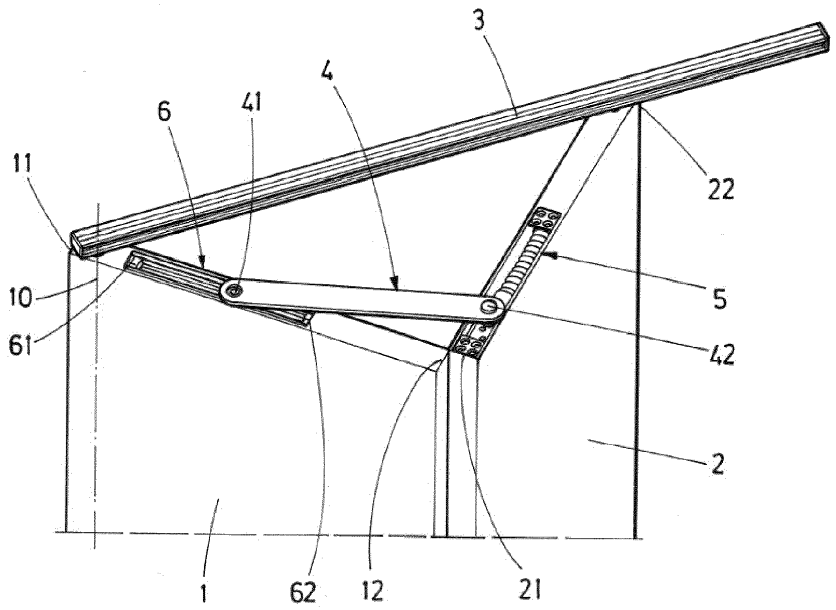

FIG.1

EP 3 670 803 A1

Description

TECHNICAL FIELD

[0001] This invention is related to the field of door systems, e. g., those used in wardrobes or inner applications, and more particularly, to the devices which are in charge of adjusting the power size of those systems.

STATE OF THE ART

[0002] Wardrobes and other facilities are usually closed by pivot doors, which turn around a hinge to be opened and closed.

[0003] These pivot doors are usually assisted by door closing systems, which are in charge of closing the doors once they are released. These door closing systems use one or two bars which are pivotally attached to a fixed point and, by means of a spring, exert a force to turn the doors back to the closing position.

[0004] These elements are difficult to conceal and therefore require some extra space in the device where the doors are installed. This may be a problem in some applications, where space is valuable.

[0005] Some solutions, such as the one disclosed in DE 3404576 A1, use more than one door to close the opening of the wardrobe, with one articulated connecting element between doors and a door closer which is fixed to the lintel of the wardrobe. This solution is quite compact but requires many elements to work.

[0006] Other examples of door assemblies, such as the one disclosed in DE 20103299 U1, close the doors in groups of two, but also fix a door closer to a fixed point in the wardrobe, thus taking some space inside the wardrobe.

[0007] An alternative solution for this problem is therefore sought.

SUMMARY OF THE INVENTION

[0008] The invention provides an alternative solution for providing a closing system by a door assembly according to claim 1. Preferred embodiments of the invention are defined in dependent claims.

[0009] Unless otherwise defined, all terms (including technical and scientific terms) used herein are to be interpreted as is customary in the art. It will be further understood that terms in common usage should also be interpreted as is customary in the relevant art and not in an idealised or overly formal sense unless expressly so defined herein.

[0010] In this text, the term "comprises" and its derivations (such as "comprising", etc.) should not be understood in an excluding sense, that is, these terms should not be interpreted as excluding the possibility that what is described and defined may include further elements, steps, etc.

[0011] In a first inventive aspect, the invention provides a door assembly which comprises

a first door and a second door, the first door being pivotally arranged around a main pivoting axis and the second door being arranged slidably along a sliding guide;

a connecting element, with a first point being pivotally attached to the first door and a second point being pivotally attached to the second door; wherein one of the first and the second door comprises a channel so that the corresponding first or second point is arranged to slide along the channel; and

a biasing element located in one of the first and the second door, the biasing element being arranged to exert a force against the first point or the second point of the connecting element.

[0012] This door assembly uses very few elements to create an automatic closing system. The biasing element may be concealed in one of the doors or located outside them but, since the connecting element does not require a fixed external point to be attached to, this system is compact and improves the space distribution in the device where it is installed.

[0013] In some particular embodiments, the biasing element is concealed in the corresponding door.

[0014] When the biasing element is concealed, this door system does not require any space in the device where it is installed.

[0015] In some particular embodiments, the connecting element is a rod with a first end and a second end, the channel is comprised in the first door and the first point of the connecting element is the first end of the rod, which is also arranged to slide along the channel.

[0016] This arrangement is one possibility to achieve a compact solution, with a minimum outstanding from the first door.

[0017] In some particular embodiments, the second point of the connecting element is the second end, which comprises a pinion which is pivotally attached to a hinge point in the second door and the biasing element comprises a gear which is meshed with the pinion and is located on the second door.

[0018] This arrangement provides a compact outcome regarding the second door, where the biasing element is concealed. The connecting element is pivotally attached to the second door, and the point of the second door where the pinion of the connecting element is pivotally attached is called hinge point.

[0019] In some particular embodiments, the biasing element comprises a spring which is arranged to exert a force against the gear when the gear compresses the spring.

[0020] The gear meshed with the pinion may follow a linear movement, thus causing a rotative movement in the pinion which is part of the second end of the connecting element.

[0021] In some particular embodiments, the biasing el-

ement further comprises a spring plate, the position of which may be adjusted to selectively pre-stress the spring.

[0022] A spring plate which limits the initial position of the spring is an easy way of choosing a predetermined pre-stressing force for this spring, thus making the door assembly being used in many different types of doors.

[0023] In some particular embodiments, the biasing element further comprises a damper arranged to soften the movement of the spring.

[0024] A damper is advantageous when a final door slam is to be avoided.

[0025] In some particular embodiments,

the first door comprises a first edge point and a second edge point;
the second door comprises a first edge point and a second edge point;
the second edge point of the first door is the closest edge to the second door and the first edge point of the second door is the closest edge to the first door;
the channel is comprised between a first channel point closer to the first edge point of the first door and a second channel point which is closer to the second edge point of the first door;
the distance between the first point of the connecting element and the second point of the connecting element is equal to the sum of the distance between the second channel point and the second end of the first door and the distance between the hinge point and the first end of the second door.

[0026] This arrangement makes that the second edge point of the first door and the first edge point of the second door are very close to each other during all the opening and closing stages.

[0027] In some particular embodiments, the distance between the hinge point and the first edge of the second door is constant and is lower than the distance between the second channel point and the second edge point of the first door.

[0028] This asymmetry is also convenient to ensure a small envelope during the opening and closing stages.

[0029] In some particular embodiments, the first door and the second door have the same width.

[0030] As a consequence, the two twin doors are stored in a very compact way when they are closed and follow a small envelope in this process.

[0031] In some particular embodiments, the connecting element has a length which is lower than the width of the first door and the second door.

[0032] This connecting element also contributes to the compacity of the solution, increasing simplicity and lowering costs.

[0033] In some particular embodiments, the main pivoting axis is supported in the sliding guide.

[0034] In these embodiments, the sliding guide is used for both doors: when the doors are closed, they are parallel to the sliding guide, and when the doors are being opened, the first door has a first edge turning around the main pivoting axis which remains fixed in one end of the sliding guide and the second door has an opposed edge which slides along the same sliding guide.

BRIEF LIST OF DRAWINGS AND REFERENCE NUMBERS

[0035] To complete the description and in order to provide for a better understanding of the invention, a set of drawings is provided. Said drawings form an integral part of the description and illustrate an embodiment of the invention, which should not be interpreted as restricting the scope of the invention, but just as an example of how the invention can be carried out. The drawings comprise the following figures:

Figure 1 shows a general perspective view of a door assembly according to the invention, in a semi-opened position.

Figure 2 shows a simple scheme of the envelope of a door closing system according to the invention, in the opening and closing stage.

Figure 3 shows a detailed scheme of the elements and operation of the biasing element belonging to a door assembly according to the invention.

Figure 4 shows a graphic of the kinematics of the opening and closing stage of a door assembly according to the invention.

[0036] Elements of the example embodiments are consistently denoted by the same reference numerals throughout the drawings and detailed description where appropriate:

1	First door
11	First edge point of the first door
12	Second edge point of the first door
2	Second door
21	First edge point of the second door
22	Second edge point of the second door
3	Sliding guide
4	Connecting element
41	First end of the connecting element
42	Second end of the connecting element
5	Biasing element
6	Channel
61	First channel point
62	Second channel point
7	Pinion
8	Gear
9	Spring
10	Main pivoting axis
15	Damper

16 Spring plate

DETAILED DESCRIPTION OF THE INVENTION

[0037] The example embodiments are described in sufficient detail to enable those of ordinary skill in the art to embody and implement the systems and processes herein described. It is important to understand that embodiments can be provided in many alternate forms and should not be construed as limited to the examples set forth herein.

[0038] Accordingly, while embodiment can be modified in various ways and take on various alternative forms, specific embodiments thereof are shown in the drawings and described in detail below as examples. There is no intent to limit to the particular forms disclosed. On the contrary, all modifications, equivalents, and alternatives falling within the scope of the appended claims should be included.

[0039] Figure 1 shows a general perspective view of a door assembly according to the invention, in a semi-opened position.

[0040] This door assembly comprises a first door 1, a second door 2, a connecting element 4 and a biasing element 5.

[0041] The connecting element 4 has a first end 41 being pivotally attached to the first door 1 and a second end 42 which comprises a pinion which is pivotally attached to a hinge point in the second door 2. The pivoting attachment between the first end 41 of the connecting element and the first door is such that the first end 41 of the connecting element 4 is also arranged to slide along the channel 6, which is concealed in the top portion of the first door 1.

[0042] The second end 42 of the connecting element 4 is pivotally attached to the second door 2, where a biasing element 5, concealed in the top portion of the second door, exert a force against the second end 42 of the connecting element to make it turn and cause the opening of the doors. The operation of this biasing element against the second end 42 of the connecting element 4 will be more thoroughly analysed when describing figure 3. Following with the description of figure 1, the first door 1 is pivotally arranged around a main pivoting axis 10. The second door 2 is in turn arranged slidably along a sliding guide 3. The pivoting axis 10 finds support in the same sliding guide 3, so that the first door 1 and the second door 2 form an assembly to cover the opening of a wardrobe. When the two doors are in the closing position, they are parallel to the sliding guide 3, and when the doors are in the open position, they are piled against each other at one of the sides of the wardrobe.

[0043] The first door 1 comprises a first edge point 11 and a second edge point 12, and the second door 2 comprises a first edge point 21 and a second edge point 22. As may be seen in this figure, the second edge point 12 of the first door 1 is the closest edge to the second door 2 and the first edge point 21 of the second door 2 is the closest edge to the first door 1. Further, the channel 6 is comprised between a first channel point 61 closer to the first edge point 11 of the first door 1 and a second channel point 62 which is closer to the second edge point 12 of the first door 1.

[0044] As may be seen in this figure, the distance between the first end 41 of the connecting element 4 and the second end 42 of the connecting element 4 is equal to the sum of the distance between the second channel point 62 and the second end 12 of the first door 1 and the distance between the hinge point and the first end 21 of the second door 2.

[0045] The distance between the hinge point and the first edge point 21 of the second door 2 is lower than the distance between the second channel point 62 and the second edge point 12 of the first door 1.

[0046] Figure 2 shows a simple scheme of the envelope of a door closing system according to the invention, in the opening and closing stage.

[0047] As may be seen in this figure, the first door 1 and the second door 2 have the same width, and the connecting element 4 has a length which is lower than the width of the first door 1 and the second door 2.

[0048] The geometric conditions described in figures 1 and 2 make the opening and closing process envelope quite compact, so the doors take a reduced room during the opening and closing stages.

[0049] Figure 3 shows a detailed scheme of the elements and operation of the biasing element.

[0050] The second end 42 of the connecting element 4 comprises a pinion 7 and the biasing element 5, which is located on the second door comprises a gear 8 meshed with the pinion 7.

[0051] The biasing element 5 also comprises a spring 9 which is arranged to exert a force against the gear 8 when the gear 8 compresses the spring 9. When the connecting element 4 turns, the pinion 7 rotates and displaces the gear 8, which compresses the spring 9. The spring 9 exerts a back force to the gear 8, which will make the pinion 7 to rotate in the opposite direction and therefore cause the closing of the doors. The biasing element further comprises a damper 15 arranged to soften the movement of the spring 9.

[0052] The biasing element 5 further comprises a spring plate 16, the position of which may be adjusted to selectively pre-stress the spring 9. The position of the spring plate 16 is selected depending on the weight and inertia of the first and second doors.

[0053] Figure 4 shows a graphic of the kinematics of the opening and closing stage of a door assembly according to the invention.

[0054] The rotation angle of the pinion against the angular movement of the doors follows an almost linear relation, which is similar to the one of a conventional slide channel door closer. No strange reactions or forces are therefore expected.

Claims

1. Door assembly comprising

   a first door (1) and a second door (2), the first door (1) being pivotally arranged around a main pivoting axis (10) and the second door (2) being arranged slidably along a sliding guide (3);
   a connecting element (4), with a first point being pivotally attached to the first door (1) and a second point being pivotally attached to the second door (2); wherein one of the first (1) and the second door (2) comprises a channel (6) so that the corresponding first or second point is arranged to slide along the channel (6); and
   a biasing element (5) located in one of the first (1) and the second door (2), the biasing element (5) being arranged to exert a force against the first point or the second point of the connecting element (4).

2. Door assembly according to claim 1, wherein the biasing element (5) is concealed in the corresponding door.

3. Door assembly according to any of the preceding claims, wherein

   the connecting element is a rod with a first end (41) and a second end (42),
   the channel (6) is comprised in the first door (1); and
   the first point of the connecting element (4) is the first end (41) of the rod, which is also arranged to slide along the channel (6).

4. Door assembly according to any of the preceding claims, wherein

   the second point of the connecting element (4) is the second end (42), which comprises a pinion (7) which is pivotally attached to a hinge point in the second door (2); and
   the biasing element (5) comprises a gear (8) meshed with the pinion (7) and is located on the second door (2).

5. Door assembly according to claim 4, wherein the biasing element (5) comprises a spring (9) which is arranged to exert a force against the gear (8) when the gear (8) compresses the spring (9).

6. Door assembly according to claim 5, wherein the biasing element (5) further comprises a spring plate (16), the position of which may be adjusted to selectively pre-stress the spring (9).

7. Door assembly according to any of claims 5 or 6, wherein the biasing element further comprises a damper (15) arranged to soften the movement of the spring (9).

8. Door assembly according to any of claims 4 to 7, wherein

   the first door (1) comprises a first edge point (11) and a second edge point (12);
   the second door (2) comprises a first edge point (21) and a second edge point (22);
   the second edge point (12) of the first door (1) is the closest edge to the second door (2) and the first edge point (21) of the second door (2) is the closest edge to the first door (1);
   the channel (6) is comprised between a first channel point (61) closer to the first edge point (11) of the first door (1) and a second channel point (62) which is closer to the second edge point (12) of the first door (1);
   the distance between the first point of the connecting element (4) and the second point of the connecting element (4) is equal to the sum of the distance between the second channel point (62) and the second end (12) of the first door (1) and the distance between the hinge point and the first end (21) of the second door (2).

9. Door assembly according to claim 8, wherein the distance between the hinge point and the first edge of the second door (2) is constant and is lower than the distance between the second channel point (62) and the second edge point (12) of the first door (1).

10. Door assembly according to any of the preceding claims, wherein the first door (1) and the second door (2) have the same width.

11. Door assembly according to claim 10, wherein the connecting element (5) has a length which is lower than the width of the first door (1) and the second door (2).

12. Door assembly according to any of the preceding claims, wherein the main pivoting axis (10) is supported in the sliding guide (3).

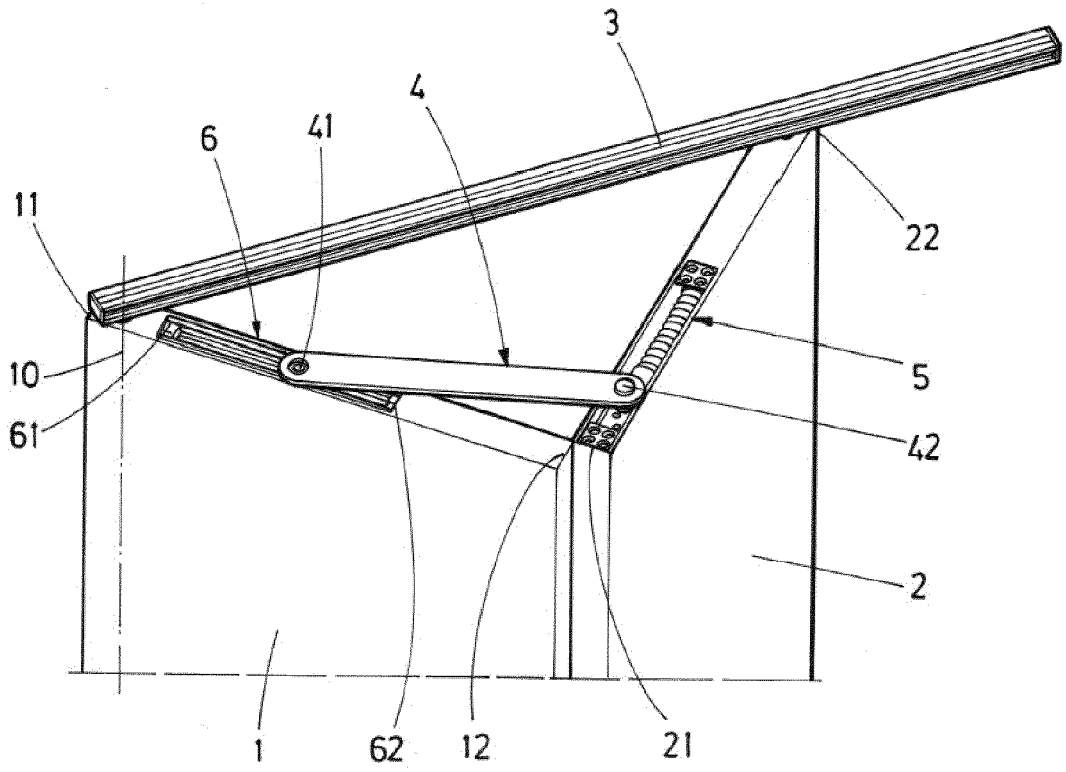

FIG.1

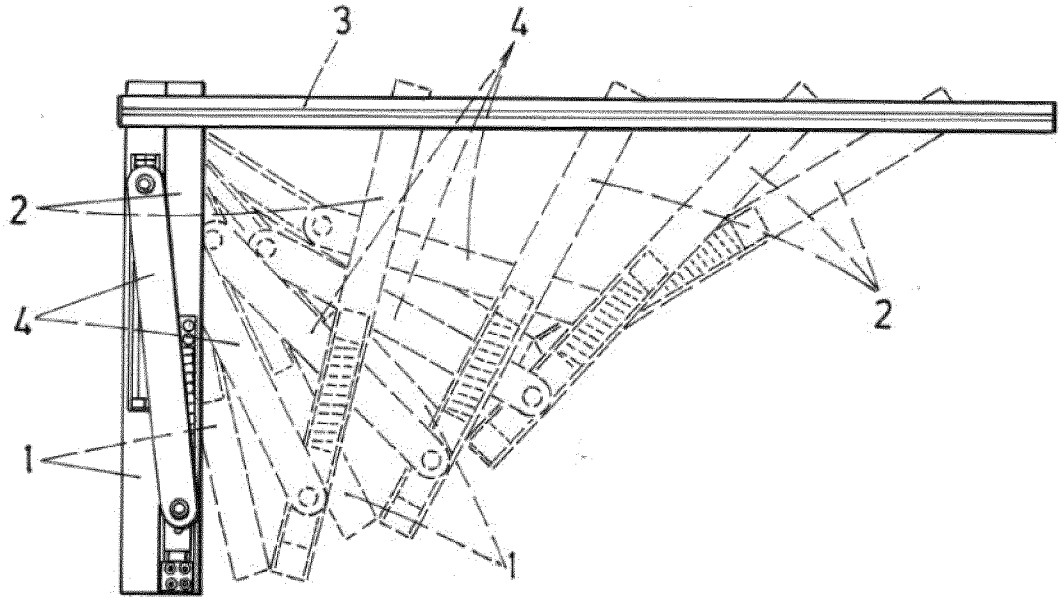

FIG.2

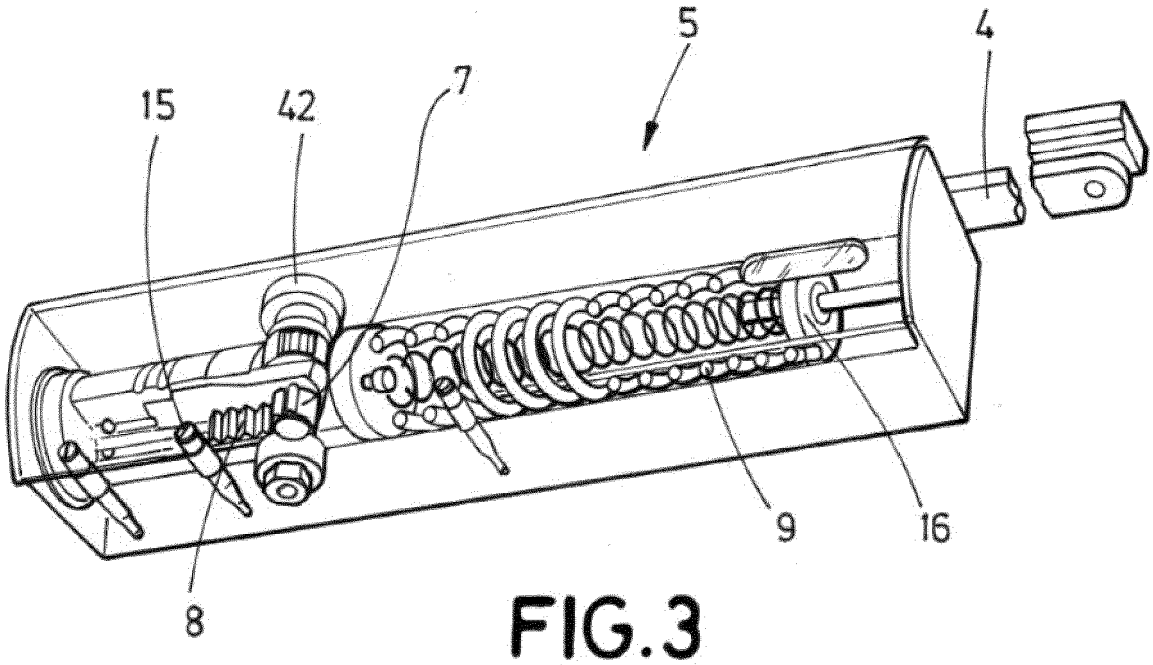
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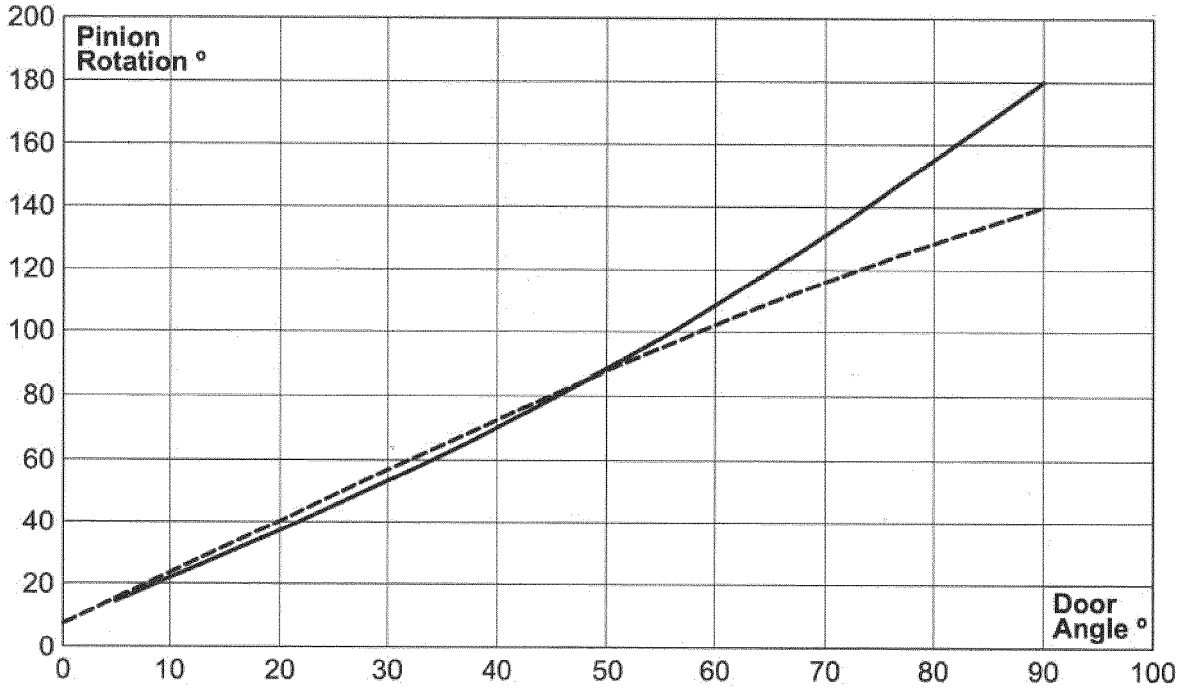
FIG.3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Door Angle °
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180
160
140
120
100
80
60
40
20
0
0
10
20
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50
60
70
80
90
100

FIG.4

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EUROPEAN SEARCH REPORT

Application Number
EP 18 21 4273

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 2001/015033 A1 (MINAMI SABURO [JP]) 23 August 2001 (2001-08-23) * paragraphs [0076] - [0079], [0133] - [0147]; figures 1,19 *	1-12	INV. E05D15/26 E05F3/10 E05F3/22

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	17 June 2019	Rémondot, Xavier

CATEGORY OF CITED DOCUMENTS

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17-06-2019

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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		US 2001015033 A1	23-08-2001

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REFERENCES CITED IN THE DESCRIPTION

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- DE 20103299 U1 **[0006]**