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(54) Steering device of folding door

(57) The invention relates to a folding door arrangement (1) comprising two door sections (2), said sections being arranged by a guiding device (6) to a guide (3) and being guidable from a closed position to an open position describing, during said movement, a folding operation of said two door sections about an essentially vertical section joint (5) of said sections (2).
A steering element (15) of a steering device (10) is arranged in supporting contact with said guide (3) at a distance in the normal direction from a panel face plane of the closest door section when said door panel is in a substantially fully open condition, said distance being greater than that of the thickness of said door section and said steering device being provided to said closest door section (2).
The invention also relates to a method of providing smooth closing and opening of such folding door arrangement.

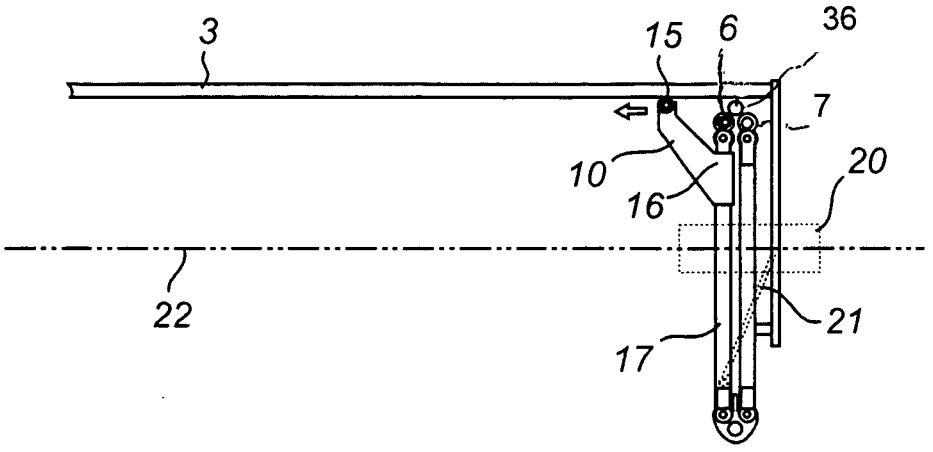

Fig. 2a

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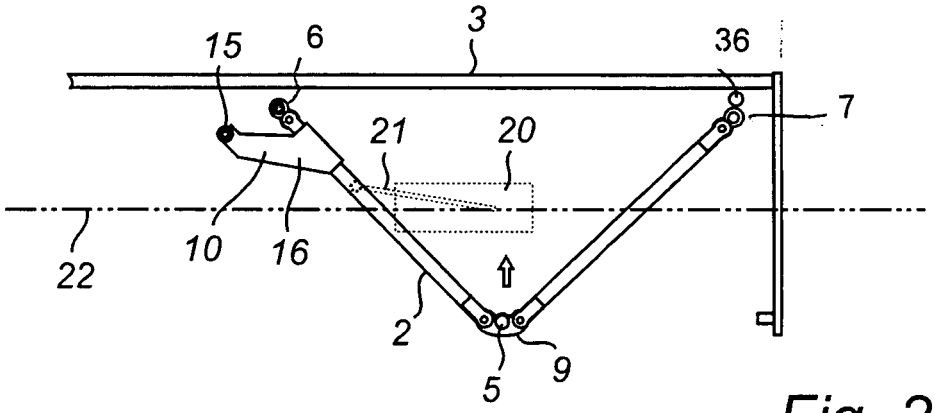

Fig. 2b

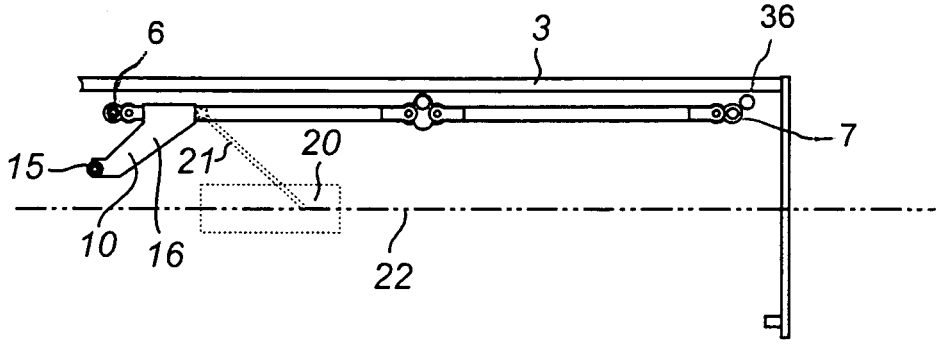

Fig. 2c

Description

Field of the Invention

[0001] The invention discloses a folding door arrangement comprising two door sections, said sections being arranged by a guiding device to a guide and being guidable from a closed position to an open position describing, during said movement, a folding operation of said two door sections about an essentially vertical section joint of said sections.

Technical Background

[0002] In the prior art there is known a number of alternative folding door arrangements. One primary objective for such door arrangement is to enable a high degree of opening when the door arrangement has been slided to a side of the door opening. In the art there exist door arrangements that are foldable outwards or inwards.

[0003] The problem of environmental forces, especially wind, on a folded set of door panels, folded primarily on the outside of the door opening, in open condition, that may lead to that the guiding elements of the folding door arrangement are twisted or even distorted together with the risk for initial resistance and difficulties in performing a closing operation from a fully opened condition is recognised.

[0004] Furthermore, there is a risk of damage due to inappropriate closing actions, especially in the initial stage, since prior art folding doors that are designed to allow for a high degree of opening are quite sensitive to forces applied to the door arrangement when completely folded, which is e.g. the case in a fully open condition.

Summary of the Invention

[0005] The object of the present invention is to provide a folding door arrangement that overcomes the above issues, and present a folding door arrangement

[0006] These and other objects are achieved by a folding door arrangement according to claim 1 and a method according to independent claim 8. Preferred embodiments of the invention are defined in the dependent claims.

[0007] According to the invention there is provided a folding door arrangement comprising two door sections, said sections being arranged by a guiding device to a guide and being guidable from a closed position to an open position describing, during said movement, a folding operation of said two door sections about an essentially vertical section joint of said sections. A steering element of a steering device being arranged in supporting contact with said guide at a distance in the normal direction from a panel face plane of the closest door section when said door panel is in a substantially fully open condition, said distance being greater than that of the thickness of said door section and said steering device being provided to said closest door section.

[0008] Thus an improved folding door arrangement is provided for enabling smooth movement during initial closing operation as well as resistance towards damage due to bending caused by impact to the door panel section of the folded folding door arrangement in its substantially open condition.

[0009] Preferably, said distance is between 10 to 50 centimetres, and preferably 10 to 20 centimetres.

[0010] Advantageously, said steering device comprises a holder arm, said steering element being provided to the holder arm at an angle relative to the normal direction if said panel face plane of between 10 to 80 degrees, preferably between 30 to 60 degrees.

[0011] According to a preferred embodiment said steering element is arranged to follow along said guide in supporting contact with said guide at least in the initial closing operation from a substantially fully open condition.

[0012] More preferably, said steering element is a steering wheel adapted to roll against a portion of the guide surface. Suitably, said steering device is positioned on the top of a door section.

[0013] Advantageously, said steering device is fixed positioned to said door section and thus the steering element will follow the guide in close contact during the initial face of closing and during the later course of the closing operation of the door arrangement the steering device will follow the door section in non-contact with said guide.

[0014] It is also presented a method for controlling closing and opening of a folding door arrangement comprising two door sections, said sections being arranged by a guiding device to a guide and being guidable from a closed position to an open position describing, during said movement, a folding operation of said two door sections about an essentially vertical section joint of said sections. Said method comprising the steps of providing a steering element of a steering device in supporting contact with said guide at a distance in the normal direction from a panel face plane of the closest door section when said door panel is in a substantially fully open condition, said distance being greater than that of the thickness of said door section and said steering device being provided to said closest door section.

[0015] Thus an improved method for enabling smooth movement during initial closing operation as well as resistance towards damage due to bending caused by impact to the door panel section of the folded folding door arrangement in its substantially open condition is achieved in a simple and reliable manner.

[0016] Preferably, said steering element is following along said guide in supporting contact with said guide at least in the initial closing operation step from a substantially fully open condition.

[0017] According to a preferred method said steering device is fixed positioned to said door section and the steering element is following the guide in close contact

during the initial face of closing and during the later course of the closing operation of the door arrangement the steering device is following the door section but in non-contact with said guide. Advantageously, said distance is between 10 to 50 centimetres, and preferably 10 to 20 centimetres.

[0018] It is realised that the invention apply to any folding door arrangement comprising two panel sections or more and regardless of whether it is to be opened inwards or outwards, towards left or right. Furthermore, it may well be applied for folding door arrangements that are parted and openable towards both sides of the door opening.

[0019] Furthermore, the side edge/s of the side door panel section/s is/are preferably arranged pivotable around an axis by hinging means allowing said side panel section/s to pivot at a small distance from the sidewall or side of the door opening structure. The side edge/s of said side door panel section is/are further arranged to hinging means of any kind arranged at an angle in the horizontal plane in relation to the vertical plane of the door panel section. Thus, it is possible to obtain a more fully open door opening when the door is in its substantially fully open condition and the folding door arrangement is folded at the side.

[0020] Preferably, fixing means are provided in order to lock the position of the door in its closed position as well as in its open position. The fixing means are released before opening or closing begin. It is further realised that the folding door arrangement may be used for manually handled as well as motorized folding doors.

Brief Description of the Drawings

[0021] A currently preferred embodiment of the present invention will now be described in more detail, with reference to the accompanying drawings.

[0022] Fig. 1 is a perspective schematic view of an example of a folding door arrangement according to an embodiment of the invention.

[0023] Fig. 2a is a schematic top plan view of an example of a folding door arrangement according to a first embodiment of the invention in a substantially fully open condition.

[0024] Fig. 2b is a schematic top plan view of an example of a folding door arrangement according to a first embodiment of the invention in a transition condition.

[0025] Fig. 2c is a schematic top plan view of an example of a folding door arrangement according to a first embodiment of the invention in a closed condition.

[0026] Fig. 3a is a schematic top plan view of an example of a folding door arrangement according to a second embodiment of the invention in a substantially fully open condition.

[0027] Fig. 3b is a schematic top plan view of an example of a folding door arrangement according to a second embodiment of the invention in a transition condition.

[0028] Fig. 3c is a schematic top plan view of an example of a folding door arrangement according to a second embodiment of the invention in a closed condition.

[0029] Fig. 4 is a perspective partial view of an embodiment of the invention in its substantially open condition.

Detailed Description of Preferred Embodiments

[0030] A first embodiment of the invention related to a folding door arrangement will be described in more detail in the following with reference to the accompanying drawings.

[0031] Referring now to Fig. 1, an automated folding door 1 for installation and use particularly in large entrances to businesses, commercial establishments, etc is disclosed. A folding door arrangement 1 is installed in a doorway having opposed first and second sides and a lintel, with the sides and lintel defining a doorway plane. The doorway is installed at the entrance to a building structure, and thus has an interior side and an opposite exterior side corresponding to those areas of the building structure.

[0032] The door assembly 1 is formed of four rigid panel sections, comprising first and second side panel section and first and second main panel section. Each of the side panel sections has a hinged side contact edge 7, respectively, an opposite hinged main panel section joint 5, an interior face and an exterior face, opposite the respective interior faces, with the opposite faces defining a door thickness there between. Each side contact edge 7 of the side panel sections is secured adjacent its respective side by a hinge pivot 36 at an angle towards the door opening when the door is fully open. The opposite main panel attachment edges of the two side panel sections and the corresponding side panel sections attachment edges of the respective main panels are secured to one another by some form of hinge means to allow the respective side and main panel sections to move arcuately or articulate relative to one another as the folding door arrangement are opened and closed.

[0033] Preferably, continuous section joint covers 9, are used to cover the section joint 5 of respective in- and outside, for greater security e.g. finger pinch protection for the installation. The operating geometry of the present folding door assembly results in an extremely compact folded condition for the doors, requiring very little space extending inwardly or outwardly from the door frame structure.

[0034] Figs. 2a through 2c provide a series of top plan views of the second door pair arrangement, comprising a side panel section and a main panel section, showing their articulation from a fully opened position (Fig. 2a) to a nearly closed position (Fig. 2c). Fig 2a-2c will present the method according to the invention in more detail. The present automated first folding door arrangement 1 is actuated by an automated drive means 20 in operative engagement with a main door section 2.

[0035] Further, it is illustrated in Figs. 2a through 2c, a guiding device 6 and generally aligned with the vertical

plane of the main door panel section. Each guiding device includes a guide roller, which rides in a main door panel guide 3. In order to illustrate the principle more clearly the guide is only shown partially in figs 2a to 2c, in order not to cover the visibility of the guiding device 6.

[0036] In fig 2a, illustrating the folding door arrangement in a substantially fully open condition, the folded door sections 2 are held in position by a lock pin or similar. The folding door section is hinged around an axis 36. The guiding device 6 is preferably arranged at the top corner at the side of the main panel section. A steering device 10 having a steering element 15 is provided in co-supporting contact with said guide 3 at a distance in the normal direction from the panel face plane of the closest door section. The distance being greater than that of the thickness of said door section and said steering device being provided to said closest door section 2. By applying this steering device 10 with an offset from the guiding device 6 and the side contact edge 7 of the side door panel section in the normal direction of the face of the door panel section it is accomplished a resistance to twist and distortion of the door panels in relation to the guiding device 6 and hinges 36 at the side panel section. The distance between the steering element 15 and the face of the closest door panel section is between 10 to 50 centimetres, and preferably 10 to 20 centimetres.

[0037] The steering device 10 comprises a holder arm 16, said steering element being provided to the holder arm at an angle relative to the normal direction to said panel face plane of between 10 to 80 degrees, preferably between 30 to 60 degrees. The steering element 15 is a steering wheel adapted to roll against a portion of the guide 3 outer surface. Furthermore, the steering device 10 is fixed positioned to said door section 2 and the steering element 15 follows the guide in close contact during the initial face of closing and during the later course of the closing operation of the door arrangement the steering device 10 will follow the door section 2 but in non-contact with said guide 3, as illustrated in fig 2b.

[0038] It is desired when the two door assemblies are closed, such as is the case in fig 2c, that all door panels be aligned in a coplanar configuration for proper sealing of the doorway and for optimum security. However, the handle 8 is positioned for "breaking" the respective side and main panel sections from their coplanar orientation, when the doors are initially opened.

[0039] A second preferred embodiment of the invention is disclosed in Figs. 3a through 3c. For simplicity of reading the numbering is equivalent to that of the claims and in the first preferred embodiment apart from that the numbering starts from 100. The folding door arrangement comprises a side panel section and a main panel section, showing their articulation from a fully opened position (Fig. 3a) to a closed position (Fig. 3c). The present automated first folding door arrangement 101 is actuated by an automated drive means 120 in operative engagement with a main door section 102.

[0040] Further, it is illustrated in Figs. 3a through 3c, a guiding device 106 generally aligned with the vertical axis of the main door panel section. Each guiding device includes a guide trolley or roller, which rides in a main door panel guide 103.

[0041] In fig 3a, illustrating the folding door arrangement in a substantially fully open condition, the folded door sections 102 are held in position by a lock pin, fixing means (not shown) or similar. The folding door section is hinged around an axis 136. Guiding devices 106 are arranged at the top centre at the panel section 102. The side panel element is of less width compared to the main panel section. The guiding device (not shown) is located at the top side centre of the main panel section. A steering device 10 having a steering element 115 is provided in co-operating engagement with said guide 103 at a distance in the normal direction from the panel face plane of the closest door section. The distance being greater than that of the thickness of said door section and said steering device being provided to said closest door section 102. By applying this steering device 110 with an offset from the guiding devices 106 in the normal direction of the face of the door panel section it is accomplished a resistance to twist and distortion of the door panels in relation to the guiding devices 6 and hinges 136 at the side panel section. The distance between the steering element 115 and the face of the closest door panel section is between 10 to 50 centimetres, and preferably 10 to 20 centimetres.

[0042] The steering device 110 comprises a holder arm 116, said steering element being provided to the holder arm at an angle relative to the normal direction if said panel face plane of between 10 to 80 degrees, preferably between 30 to 60 degrees. The steering element 15 is a steering wheel adapted to roll against a portion of the guide 103 surface. Furthermore, the steering device 110 is fixed positioned to said door section 102 and the steering element 115 follows the guide in close contact during the initial face of closing and during the later course of the closing operation of the door arrangement the steering device 110 will follow the door section 102 but in non-contact with said guide 103, as illustrated in fig 3b.

[0043] It is desired that when the two door assemblies are closed, such as is the case in fig 3c, that all door panel sections be aligned in a coplanar configuration for proper sealing of the doorway and for optimum security.

[0044] It is realised that the principle described with reference to fig 2a-2c and 3a-3c apply to any folding door arrangement 1 comprising two section panels or more and regardless of whether it is to be opened inwards or outwards, towards left or right. Furthermore, it may well be applied for folding door arrangements that similar to the embodiment of fig 1 are parted and openable towards both sides of the door opening.

[0045] Furthermore, the side edge/s 7, 107 of the side door panel section/s is/are preferably arranged pivotable around an axis by hinging means 36, 136 allowing said side panel section/s to pivot at a small distance from the

sidewall or side of the door opening structure. The side edge/s of said side door panel section is/are further arranged to hinging means of any kind arranged at an angle in the horizontal plane in relation to the vertical plane of the door panel section. Thus, it is possible to obtain a more fully open door opening when the door is in its substantially fully open condition and the folding door arrangement is folded at the side.

[0046] Preferably, fixing means (not shown) are provided in order to lock the position of the door in its closed position as well as in its open position. The fixing means are released before opening or closing begin. It is further realised that the folding door arrangement may be used for manually handled as well as motorized folding doors.

[0047] In order to provide resistance to bending from the other side when the door is in substantially fully open condition a supporting device 11 is present. The supporting device 11 according to a preferred embodiment is provided with a door stopper 12. An arm 13 arranged at an angle will provide support to this outer supporting device 11. An example of the supporting device is best illustrated in fig 4.

Claims

1. A folding door arrangement (1) comprising two door sections (2), said sections being arranged by a guiding device (6) to a guide (3) and being guidable from a closed position to an open position describing, during said movement, a folding operation of said two door sections about an essentially vertical section joint (5) of said sections (2),
   characterised in that
   a steering element (15) of a steering device (10) being arranged in supporting contact with said guide (3) at a distance in the normal direction from a panel face plane of the closest door section when said door panel is in a substantially fully open condition, said distance being greater than that of the thickness of said door section and said steering device being provided to said closest door section (2).

2. The folding door arrangement (1) according to claim 1, wherein said distance is between 10 to 50 centimetres, and preferably 10 to 20 centimetres.

3. The folding door arrangement (1) according to any one of the preceding claims, wherein said steering device (10) comprises a holder arm (16), said steering element being provided to the holder arm (16) at an angle relative to the normal direction if said panel face plane of between 10 to 80 degrees, preferably between 30 to 60 degrees.

4. The folding door arrangement (1) according to any one of the preceding claims, wherein said steering element (15) is arranged to follow along said guide (3) in supporting contact with said guide (3) at least in the initial closing operation from a substantially fully open condition.

5. The folding door arrangement (1) according to any one of the preceding claims, wherein said steering element (15) is a steering wheel adapted to roll against a portion of the guide (3) surface.

6. The folding door arrangement (1) according to any one of the preceding claims, wherein said steering device (10) is positioned on the top of a door section (2).

7. The folding door arrangement (1) according to any one of the preceding claims, wherein said steering device (10) is fixed positioned to said door section (2) and thus the steering element (15) will follow the guide in close contact during the initial face of closing and during the later course of the closing operation of the door arrangement the steering device (10) will follow the door section (2) in non-contact with said guide (3).

8. A method for controlling closing and opening of a folding door arrangement (1) comprising two door sections (2), said sections being arranged by a guiding device (6) to a guide (3) and being guidable from a closed position to an open position describing, during said movement, a folding operation of said two door sections about an essentially vertical section joint (5) of said sections (2), c h a r a c t e r i s e d in that said method comprising the steps of providing a steering element (15) of a steering device (10) in supporting contact with said guide (3) at a distance in the normal direction from a panel face plane of the closest door section when said door panel is in a substantially fully open condition,
   said distance being greater than that of the thickness of said door section and said steering device being provided to said closest door section (2).

9. The method according to claim 8, in which said steering element (15) is following along said guide (3) in supporting contact with said guide (3) at least in the initial closing operation step from a substantially fully open condition.

10. The method according to any one of claims 8-9, in which said steering device (10) is fixed positioned to said door section (2) and the steering element (15) is following the guide in close contact during the initial face of closing and during the later course of the closing operation of the door arrangement the steering device (10) is following the door section (2) but in non-contact with said guide (3).

11. The method according to any one of claims 8-10, in

which said distance is between 10 to 50 centimetres,
and preferably 10 to 20 centimetres.

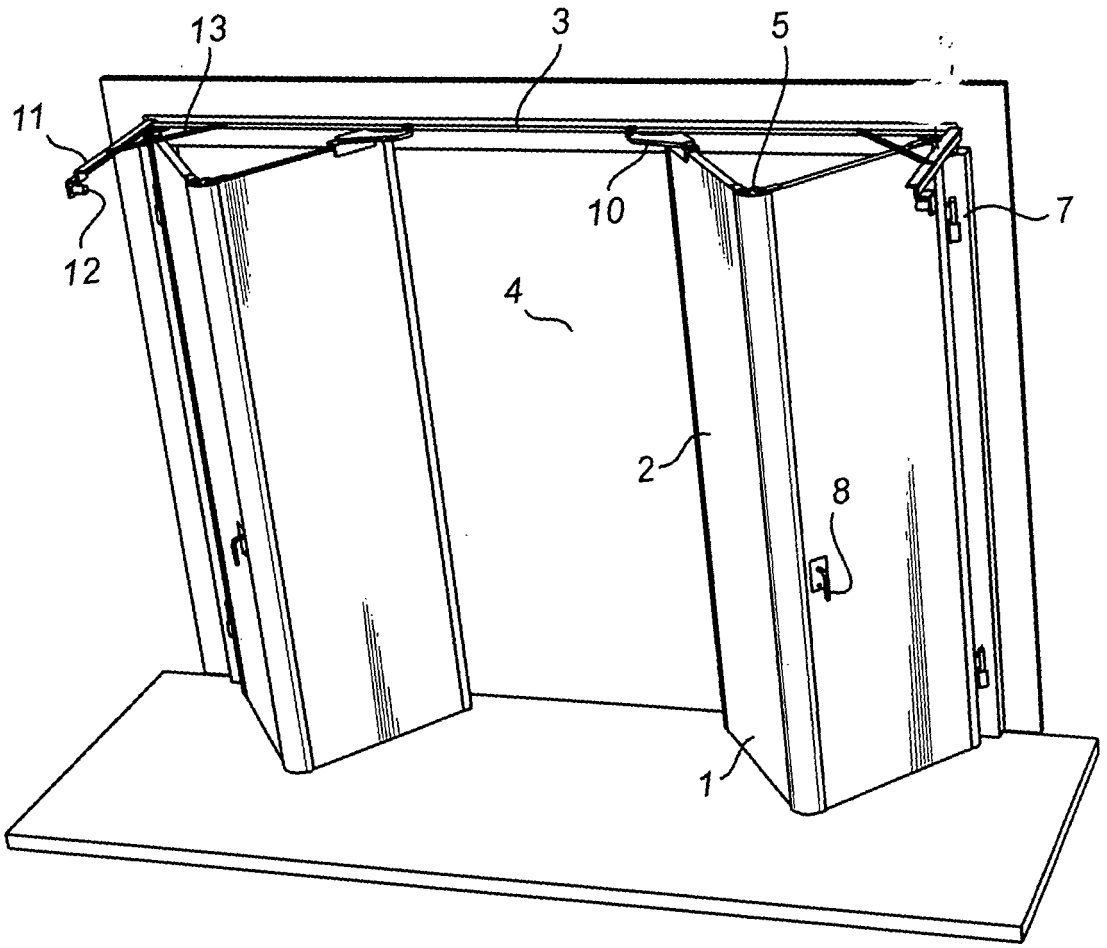

Fig. 1

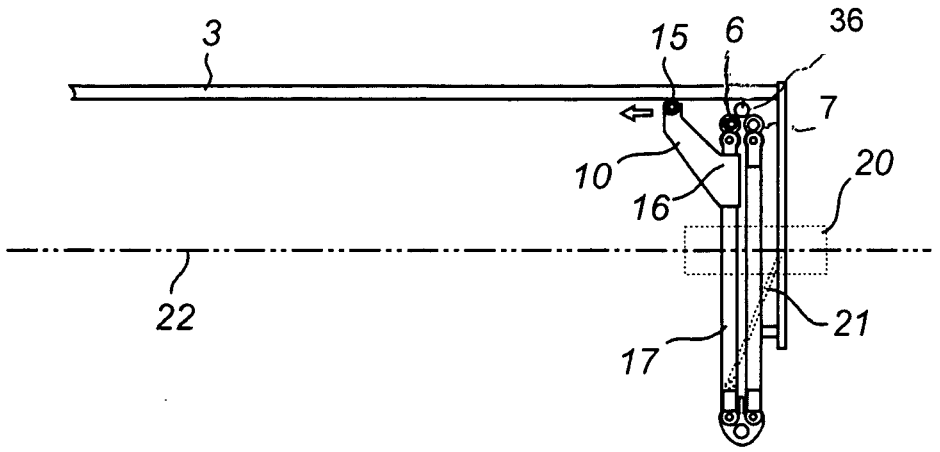

Fig. 2a

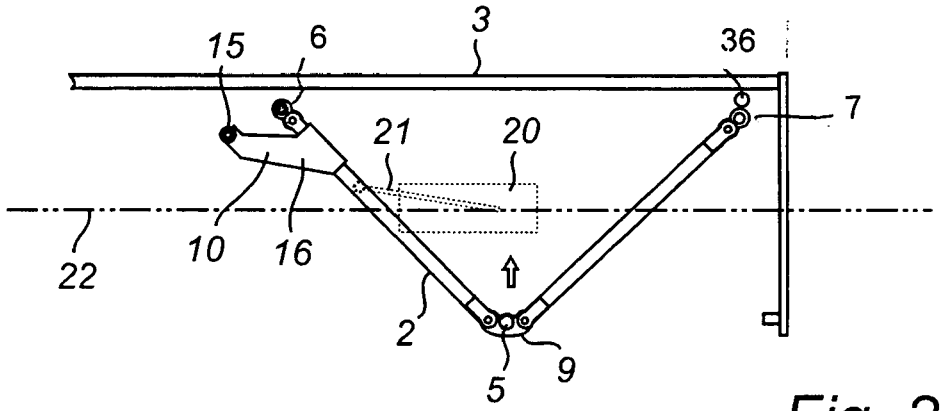

Fig. 2b

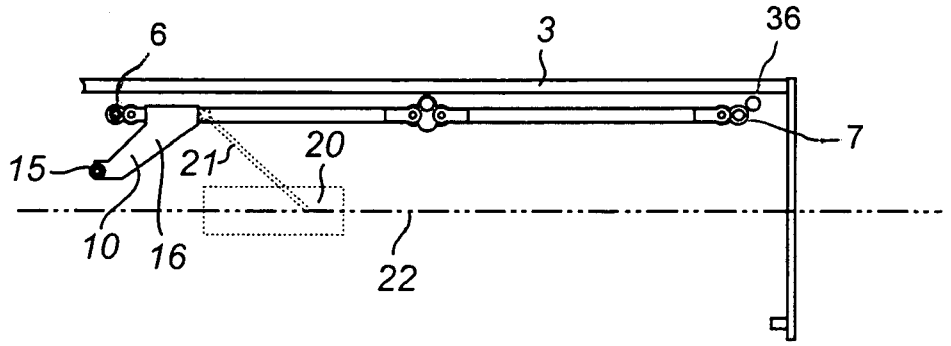

Fig. 2c

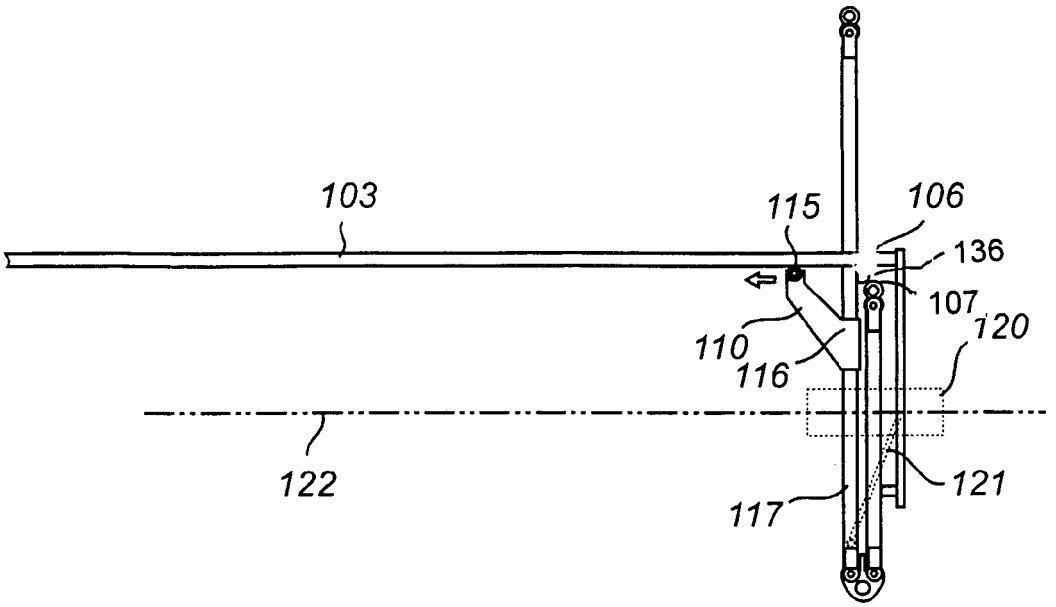

Fig. 3a

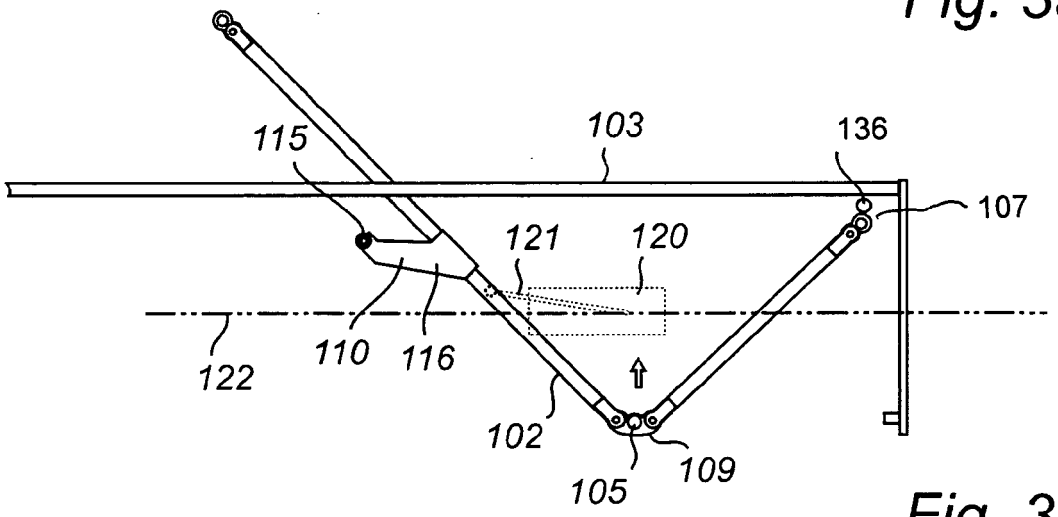

Fig. 3b

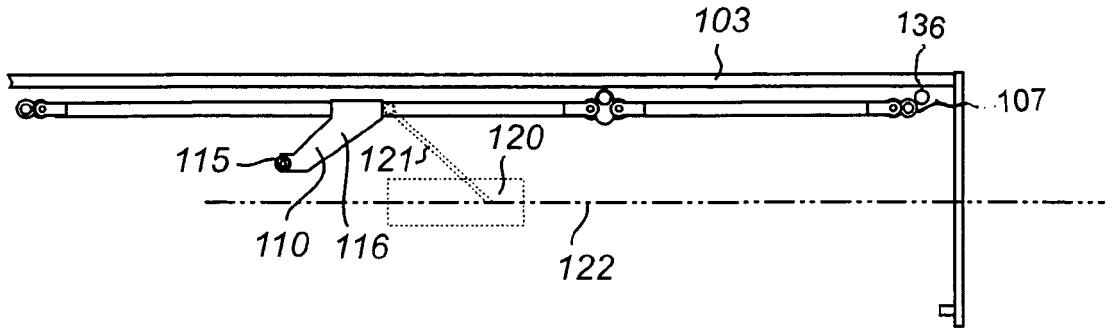

Fig. 3c

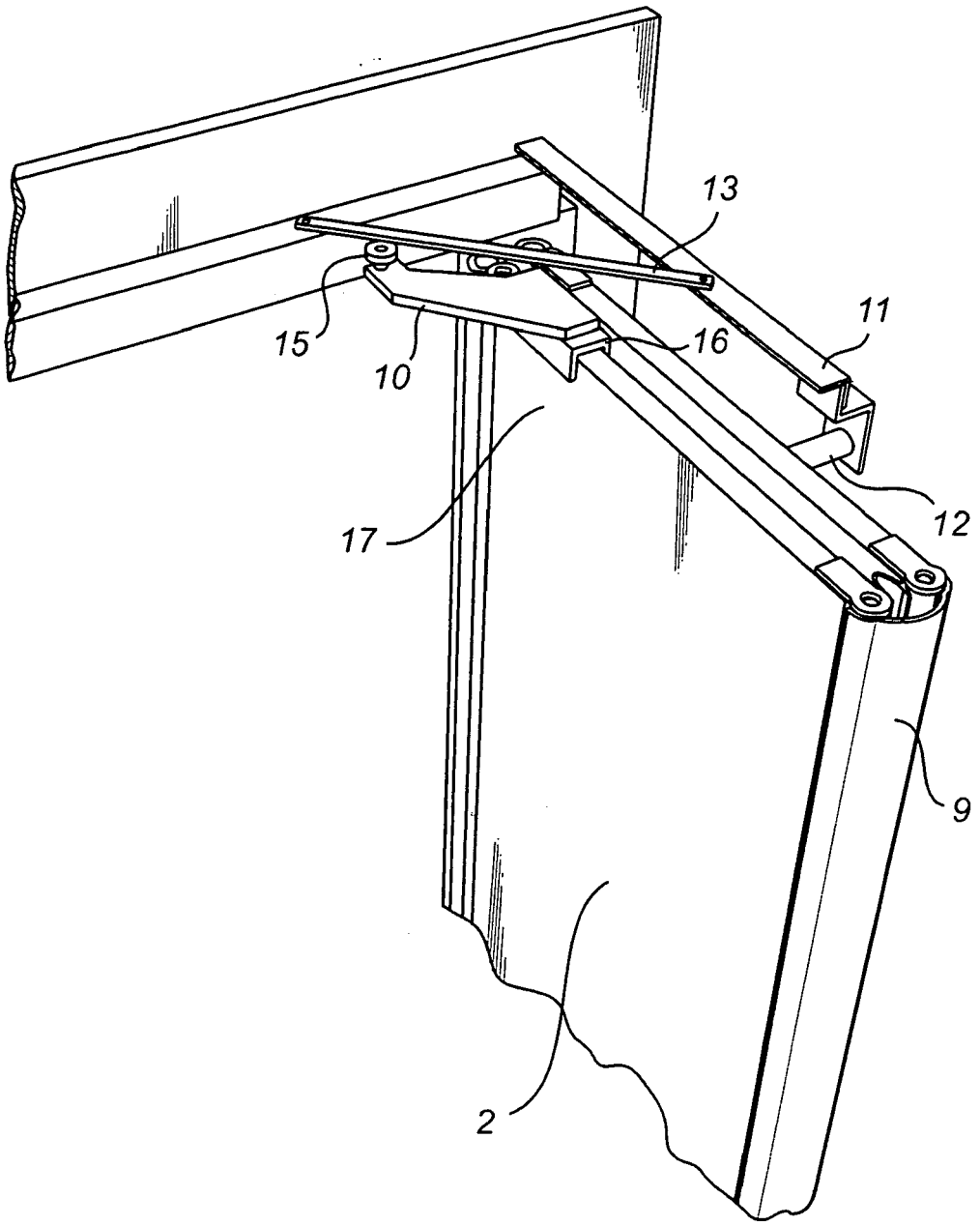

Fig. 4

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 05 00 2688

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	EP 0 370 437 A (A. ARTWEGER GESELLSCHAFT M.B.H) 30 May 1990 (1990-05-30) * column 4, lines 1-34; figures 6-8 * -----	1-6,8,9, 11	E05D15/26 E05F15/10
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Y	GB 803 706 A (PAUL ANDRE MEGE) 29 October 1958 (1958-10-29) * page 2, lines 90-131; figure 2 * -----	5,7,10	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)
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	28 June 2005	Witasse-Moreau, C

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

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 05 00 2688

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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28-06-2005

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82