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(54) **Sectional overhead sliding door arrangement with braking device**

(57) An overhead sliding door arrangement (2), comprising a door panel, having a top door panel portion (8) and a lower door panel portion (9), and a set of guide rails (3) arranged on each side of said door panel, each set of guide rails (3) comprising at least an upper substantially horizontal guide section (4), a curved guide section (5) and a substantially vertical guide section (6). Said lower door panel portion (9) is provided with supporting runners (11) which runners are guided along at least part of said guide rails (3).

The overhead sliding door arrangement is characterized in a safety system (1) comprising said top door panel portion (8) and said upper substantially horizontal guide section (4), wherein said top door panel portion (8) is provided with a top runner (12) which is guided in said upper guide section (4), and a braking device (13) being arranged to said safety system (1) for enabling a mechanical braking action of said top door panel portion (8) for reducing a closing force of said lower door panel portion (9) during closing movement.

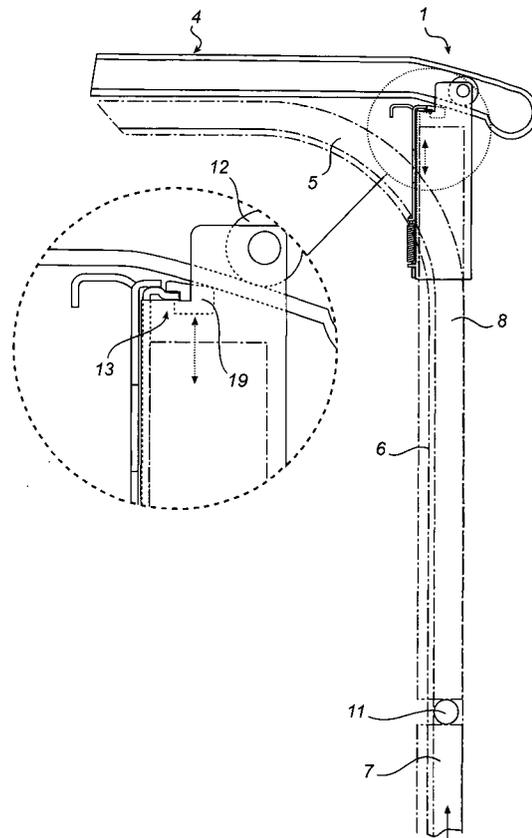


Fig. 4c

EP 1 467 053 A1

## Description

### Technical Field of Invention

**[0001]** The present invention relates to an overhead sliding door arrangement comprising a door panel, having a top door panel portion and a lower door panel portion, and a set of guide rails arranged on each side of said door panel, each set of guide rails comprising at least an upper substantially horizontal guide section, a curved guide section and a substantially vertical guide section. Said lower door panel portion is provided with supporting runners which are guided along at least part of said guide rails. The invention also relates to a method for enabling reduced closing force of an overhead sliding door arrangement.

### Technical Background

**[0002]** An overhead sliding door arrangement of the kind described in the introduction is previously known in the art. Doors of this kind usually have guide rails wherein runners, for example in the shape of rollers, are received so as to travel in tracks of the guide rails devised for that purpose. The rollers in turn are carried by supports, which are connected with the door panel. Further, the overhead sliding door can be motorized or manually handled.

**[0003]** One issue with such doors relates to when for example an obstacle occurs in the area between the lower end of the sliding door and the underlying floor during a closing operation of the overhead sliding door. The weight of the door and/or the power of the motorized door during closing movement present an evident risk for clamping injuries. For these reasons motorized overhead sliding doors are often provided with a safety current sensor which, at a predetermined current limit, stops the door.

**[0004]** In order to achieve a complete closing and yet utilize a maximum of roof height, the top door panel portion of the door panel is conveniently arranged to be guided in a substantially horizontal guide rail allowing the top door panel portion of the door to reach all the way out to form a vertical closing as seen from the side.

**[0005]** However, if a top roller of the top door panel portion is guided in the horizontal guide rail only, the horizontal speed of the top roller will be considerably larger than the simultaneous substantially vertical speed of a roller being connected to a lower door panel portion, when the door is approaching a closed position. The guided top panel portion and the remaining panel portions will form a so called knee-action gear at the end of the closing movement.

**[0006]** The safety current sensor of prior art doors is adapted to detect an obstacle by monitoring if a predetermined current limit is exceeded. However, the current sensor has to be very sensitive in order to detect the obstacle and stop the door quickly, especially at the end

of closing movement. Under normal operation conditions, a too sensitive sensor will result in maneuverability problems. Because of the knee-action gear effect, there is a great difference between normal operation condition and conditions at the end of the closing cycle, resulting in a situation where the demands on the sensor vary so much that it is difficult to find/make sensors that fulfill the demands for both conditions.

**[0007]** To overcome the problem of this knee-action gear effect, motorized overhead sliding doors can be arranged with complex "intelligent" driving arrangements, which are expensive. Thus in turn, a door using such driving arrangement will be costly. The knee-action effect and some of its related problems also occur with manually handled doors.

**[0008]** Thus, there is a need to achieve a controlled and safe closing movement of an overhead sliding door.

**[0009]** Further, it is desired to reduce the risk of clamping injuries during closing movement of the door and also to reduce the impact of said knee-action in the end of a closing movement.

**[0010]** Finally, it would be advantageous to provide a robust, cost effective, and safe high-quality overhead sliding door.

### Summary of the Invention

**[0011]** The object of the invention is to provide an overhead sliding door arrangement enabling improvement with regard to prior art arrangement in one or more of the above mentioned aspects.

**[0012]** This object is achieved in accordance with the teachings of the invention in that an overhead sliding door arrangement of the kind outlined in the introduction exhibits the characterising features in the appended claim 1. Preferred embodiments are presented in the dependent claims. The object of the invention is also achieved with a method for enabling reduced closing force of an overhead sliding door arrangement according to appended claim 14. Preferred embodiments of the method are presented in the method claims being dependent on claim 14.

**[0013]** The invention as defined by claims 1 and 14 offers several advantages, such as reducing the risk of clamping-injury hazards by reducing said closing force during closing movement in the area between for example a lower end of a lower door portion and an underlying floor. Further, the safety system as provided by the invention provides a mechanical braking action achieved by the braking device. For instance, if a closing force is applied to the top door panel portion, the braking device makes it possible to brake the substantially horizontal movement of the top door panel portion guided by the top runner in the horizontal guide section, and consequently reduce the closing force at a lower door panel portion.

**[0014]** The term closing force signifies a force connected to the movement of the door, preferably the lower

door panel portion during a closing movement.

**[0015]** The invention also makes it possible to essentially reduce the impact of said knee-action in the end of the closing movement.

**[0016]** Preferably, said lower door panel portion comprises at least two door panel sections being hingedly interconnected via pivot joints.

**[0017]** Advantageously, said braking device may be resiliently arranged to the top door panel portion, such that the mechanical braking action is effected when the door is obstructed during closing movement. The resilient arrangement enables the safety device to react and brake quickly when the door for some reason is being obstructed. The safety device is preferably adapted for being activated, at least, at parts of said upper guide rail. The parts where the safety device is activated during a closing movement may for instance be specific zones related to risks of clamping injuries during the closing movement of the door. Partially for that reason the safety device is suitably adapted for being activated, at least, at a front end portion of said upper rail.

**[0018]** Said overhead sliding door is preferably, but not necessarily, provided with a drive unit to actuate the door panel for movement between a raised open position and a lowered closed position.

**[0019]** In terms of trying to use a maximum of the roof height of the building where the overhead sliding door is being mounted in, said upper horizontal section of the guide rails may advantageously comprise a first guide rail, wherein the supporting runners of the lower door panel portion are guided, and a second guide rail, wherein the top runner of said top door panel portion is guided. In this way, the top door panel portion can be guided all the way out at the upper front forming a vertical closing as seen from the side.

**[0020]** According to a preferred embodiment of the invention said braking device is adapted to cause a mechanical braking action against an outer portion of said second horizontal guide rail. Alternatively the braking device can be adapted to cause a mechanical braking action against an inner portion of said second horizontal guide rail or the braking device can be adapted to cause a mechanical braking action against at least one top runner at said top door panel portion.

**[0021]** Said braking device preferably comprises a friction element, wherein the friction element is suitably a rubber element in order to achieve the desired mechanical braking action. Alternatively said braking device is provided with a serrated surface for enabling said mechanical braking action.

**[0022]** Preferably, said mechanical braking action of the method according to the invention is effected when the door is obstructed during closing movement, using a resiliently arranged connection between said braking device and said top door panel portion. The resilient arrangement enables the safety device to react and brake quickly when the door for some reason is being obstructed.

**[0023]** Advantageously, said safety system is suitably adapted for being activated, at least, at a front end portion of said upper guide rail. When the top door panel portion is being restrain at said front end portion, the impact of the knee-action transmitted to the lower door panel portion is reduced.

**[0024]** The method advantageously achieves the closing movement by a drive unit in order to receive a good maneuverability.

**[0025]** Preferably, the method might comprise the step of applying a force to said top door panel portion for enabling said closing movement.

#### Brief Description of the Drawings

**[0026]** In the following, the invention will be described in more detail by means of exemplary embodiments with reference to the accompanying drawings. In the drawings:

Fig. 1 is a schematic perspective view of a conventional overhead sliding door as seen from the inside of a space having a door opening;

Fig. 2 is a schematic view of a part of an upper door panel portion of an overhead sliding door arrangement in accordance with a first embodiment of the invention;

Fig. 3 is a vertically sectional view showing a part of the overhead sliding door arrangement in accordance to a second embodiment of the invention;

Fig. 4a-4c are schematic vertically sectional views of three different steps of a door closing sequence of an overhead sliding door arrangement of fig 3;

Fig. 4a represents a first closing position of the overhead sliding door of fig 3;

Fig. 4b represents a second closing position of the overhead sliding door of fig 3;

Fig. 4c represents the closed position of the overhead sliding door and an enlarged area illustrates parts of the overhead sliding door arrangement of fig 3;

Fig. 5a is a vertically sectional view of parts of the overhead sliding door arrangement in accordance with a third embodiment of the invention;

Fig. 5b is a vertical sectional view of parts of an overhead sliding door arrangement in accordance with a fourth embodiment of the invention;

Fig. 5c is a vertical sectional view of parts of an overhead sliding door arrangement in accordance with a fifth embodiment of the invention;

Fig. 5d is a vertical sectional view of parts of an overhead sliding door arrangement in accordance with a sixth embodiment of the invention.

#### Detailed Description of Preferred Embodiments

**[0027]** A preferred embodiment of the invention will be described in the following. The examples described

should not be regarded as restricting but merely as examples.

**[0028]** Fig 1 illustrates a conventional overhead sliding door consisting of a door panel, generally designated by reference 2 and divided into a number of door panel sections 7, which are hingedly joined together along horizontal pivot elements 10. The number of door-panel sections depends on the height of the door opening for which the overhead sliding door is intended. At each of the side edges of the door panel sections 7 extend a set of guide rails 3. Each set of guide rails 3 comprises an upper substantially horizontal guide section 4, a curved guide section 5 and a substantially vertical guide section 6. The door panel sections 7 are connected with and guided by the guide rails via runners 11, which preferably are rollers disposed in said rails 3. Said rollers 11 are in this case mounted on shafts attached to the door panel sections 7. The weight of the door is preferably balanced by means of a balancing spring (not shown). Numeral reference 15 designates a drive unit designed to actuate the door panel for movement between a raised, open position and a lowered, closed position. The door panel comprises a top door panel portion 8 and a lower door panel portion 9. In this embodiment, the top door panel portion 8 is constituted by the uppermost door panel section 7, and the lower door panel portion 9 is constituted by the following door panel sections 7. The lowest point of the lower door panel portion 9 preferably comprises a safety strip normally made of rubber (not shown) for reducing the risk of clamping injuries.

**[0029]** Fig. 2 illustrates a part of said top door panel portion 8 being guided in a horizontal guide rail 4. The top door panel 8 is here in a vertical position. A top runner 12, in this case a roller, supports the top door panel 8 and is guided in the horizontal guide rail 4. The top door panel portion 8, the horizontal guide section 4 and the top runner, constitutes a safety system 1. A first bracket 20 is attached at the upper corner of the top door panel portion 8 and a second bracket 21 comprises the top runner 12. The second bracket 21 is preferable orthogonally flanged having a roller attachment portion 22 and a securing portion 23. The top roller 12 is rotatably mounted on said attachment portion 22.

**[0030]** As seen in fig. 2, a braking device 13 is arranged to said safety system 1. Here, the braking device 13 is L-shaped, having an attachment plate 27 and a friction element 19.

**[0031]** The slidable portion 23 has preferably a set of vertical recesses (not shown) situated behind the attachment plate 27. The first bracket 20 has a vertical slide bar 26 adapted to receive the free vertical edge of the sliding portion 23 and a first set of holes (not shown) situated behind the attachment plate 27. The first set of holes are positioned correspondingly behind said vertical recesses of the attachment plate 27 and are adapted to receive attachment pins in order to attach the second bracket 21 to optionally provide a fixed connection or a sliding vertical movement relatively the first 20 and the

second 21 brackets.

**[0032]** The attachment plate 27 comprises a second 28 and a third 29 set of holes both corresponding to the first set of holes for optional attachment opportunities to the first bracket 20. The friction element 19, is preferably, but not necessarily made of rubber.

**[0033]** When a force is applied at the top portion 8 for performing a closing movement, the braking device 13 is capable of braking the substantially horizontal movement of the top door panel portion 8 at the upper guide section 4 and consequently the closing force at the lower door panel portion 9 is reduced. Accordingly, the risk for clamping injuries if the lower door panel portion 9 is obstructed for some reason, is also reduced. The braking force is preferably accomplished by that the braking device 13 is brought in a frictional contact with the upper horizontal guide section 4.

**[0034]** A first braking possibility is to attach the braking device 13 at the upper second set of holes 28 of the bracket 21, at the first set of holes in the first bracket 20. This attachment will enable holding of the braking device 13 in a fixed position in relation to the first 20 and second 21 brackets. The first braking possibility can, for instance, enable a constant braking force of the braking device against some parts of, or the entire travel extension of, the upper guide rail 4.

**[0035]** A second braking possibility is to attach the braking device 13 at the lower third set of holes 29, at the first set of holes at the first bracket 20. This attachment will enable a sliding movement of the braking device in relation to the top roller on the second bracket 21. The second braking possibility will for instance effect a safety mode: If the closing movement is hindered at the lower point of the lower door panel portion 9, the top door panel 8 near the top roller 12 can be stopped quickly. The second braking possibility can of course also include a constant braking force with the braking device 13 operating against some parts of, or the entire travel extension of, the upper guide rail 4.

**[0036]** If the sliding door is motorized, it may also be provided with some kind of sensor, such as a safety current sensor. Such a sensor will, in combination with the mechanical braking possibilities, enable a safe handling of the door during a closing movement, especially avoiding the knee-action problem.

**[0037]** Fig. 3 is a vertically sectional view showing a part of the overhead sliding door arrangement according to a second embodiment of the invention.

**[0038]** The upper horizontal guide section 4 comprises in this case a first horizontal guide section and a second horizontal guide section 16. The first horizontal guide section is interconnected with the curved guide section 5, which in turn is connected to the vertical guide section 6. Thus, the supporting runners 11 of the lower door panel portion 7 are guided in a guide rail 3 comprising the first horizontal guide section, the curved guide section 5 and the vertical guide section 6. The second horizontal guide section 16 guides the top runner

12 of the top door panel portion 8. This embodiment enables good utilization of the roof height, and the top door portion 8 will reach all the way out to form a vertical closing as seen from the side.

**[0039]** The braking device 13 of the embodiment of fig. 3 includes a spring element 30 such as a tension spring wherein the ends are attached in the first and the second brackets 20, 21, respectively, enabling a controlled sliding movement at said second braking possibility. The tension spring 30 is preferably used in motorized overhead sliding doors but can of course also be used in manually handled doors. The tension spring coefficient is preferably being adapted to the weight and the number of the door panel sections 7 in order to perform a required braking action.

**[0040]** Fig. 4a-4c shows three different steps of a door closing sequence in vertically sectional views of the overhead sliding door arrangement of fig 3. Said second horizontal guide rail 16 has a front end portion 14 which is angled and slightly directed downwardly, towards the closing end of the sliding door arrangement. This shape of the front end portion 14 is advantageous for enabling the top door portion 8 to reach all the way out to form a tight vertical closing as seen from the side.

**[0041]** Fig. 4a illustrates a first closing position of the overhead sliding door, in which the rollers 11 of the lower door panel portion 9 are situated in the vertical guide section 6, and the top rollers 12 of the top door panel portion 8 are situated in the second horizontal guide section 16, at a distance from the front end portion 14. In this closing position, the braking device 13 can for example be activated according to the above-mentioned second braking possibility if, for instance, the closing movement is hindered by an obstacle. Naturally, also the first braking possibility, with a fixed braking device, may be used in this closing position. Fig. 4b shows the same door with the safety device in a later second closing position. In this position, the runners 11 of the lower door panel portion 9 has moved further down vertically. The top runners 12 of the top door panel portion 8 have moved towards the front end of the overhead sliding door system. Both the first and the second braking possibilities may be used. In particular, due to the elongated front end portion 14, an maneuvering possibility is provided which enables a constant brake to reduce the impact of the knee-action.

**[0042]** Fig. 4c illustrates the overhead sliding door of fig. 4a and 4b in a closed position. The enlarged area shows parts of the braking device 13 and the friction element 19. The braking device 13 is preferably, as seen in the figure, vertically moveable relatively the guided top roller 12 in order to activate the braking function if the closing movement is hindered.

**[0043]** In fig 5a, part of an overhead sliding door arrangement according to a third embodiment of the invention is depicted. Here, the frictional element 19 of the braking device 13 is applied against an outer portion 18 of said second horizontal guide rail 16 in order to

achieve the mechanical braking action.

**[0044]** In fig 5b, part of an overhead sliding door arrangement according to a fourth embodiment of the invention is depicted. This embodiment involves a mechanical braking action against an inner portion 17 of said second horizontal guide rail 16.

**[0045]** In fig 5c, part of an overhead sliding door arrangement according to a fifth embodiment of the invention is depicted. According to this embodiment, the braking device 13 causes a mechanical braking action against the top runners 12 at both lateral sides of said top door panel portion 8.

**[0046]** In fig 5d, part of an overhead sliding door arrangement according to a sixth embodiment of the invention is depicted. Here, the applied braking surface of the braking device 13 is provided with a serrated surface for enabling the mechanical braking action.

**[0047]** The invention has been described above in the form of various embodiments including some suggestions for alternative embodiments. However, it should be appreciated that it could be modified in a variety of ways without departing from the basic inventive idea. Thus, the overhead sliding door arrangement and the method in accordance with the invention obviously could be applied to doors designed differently from the one shown herein.

**[0048]** It is for instance realized that the mechanical braking action may be accomplished in alternative manners. It is preferred to utilize a relative movement between the door panel and the braking device to induce the mechanical braking action. Although, the braking action may be accomplished by utilizing a fixed positioned, relatively to the door panel, braking device for a more evenly applied braking action. The features of various embodiments may be combined in other ways in order to provide additional embodiments of the invention within the scope of protection.

#### 40 Claims

1. An overhead sliding door arrangement (2), comprising
  - a door panel, having a top door panel portion (8) and a lower door panel portion (9),
  - a set of guide rails (3) arranged on each side of said door panel, each set of guide rails (3) comprising at least an upper substantially horizontal guide section (4), a curved guide section (5) and a substantially vertical guide section (6),
  - said lower door panel portion (9) being provided with supporting runners (11) which runners are guided along at least part of said guide rails (3),
  - characterised in**
  - a safety system (1) comprising said top door panel portion (8) and said upper substantially horizontal guide section (4), wherein said top door panel portion (8) is provided with a top runner (12) which

- is guided in said upper guide section (4),  
 and a braking device (13) being arranged to  
 said safety system (1) for enabling a mechanical  
 braking action of said top door panel portion (8) for  
 reducing a closing force of said lower door panel  
 portion (9) during closing movement.
2. The overhead sliding door arrangement as claimed  
 in claim 1, wherein said lower door panel portion (9)  
 comprises at least two door panel sections (7)  
 hingedly interconnected via pivot joints (10).
  3. The overhead sliding door arrangement as claimed  
 in claim 1 or 2, wherein said braking device (13) is  
 resiliently arranged to the top door panel portion (8),  
 such that the mechanical braking action is effected  
 when the door (2) is obstructed during closing  
 movement.
  4. The overhead sliding door arrangement as claimed  
 in any one of claims 1-3, wherein the safety device  
 (1) is adapted for being activated, at least, at parts  
 of said upper guide rail (4).
  5. The overhead sliding door arrangement as claimed  
 in any one of claims 1-4, wherein the safety device  
 (1) is adapted for being activated, at least, at a front  
 end portion (14) of said upper guide rail (4).
  6. The overhead sliding door arrangement as claimed  
 in any one of claims 1-5, wherein said door (2) is  
 provided with a drive unit (15).
  7. The overhead sliding door arrangement as claimed  
 in any one of claims 1-6, wherein the upper horizon-  
 tal sections (4) of the guide rails (3) comprise a first  
 guide rail, wherein the supporting runners (11) of  
 the lower door panel portion are guided, and a sec-  
 ond guide rail (16), wherein the top runner (12) of  
 said top door panel portion is guided.
  8. The overhead sliding door arrangement as claimed  
 in claim 7, wherein said braking device (13) is  
 adapted to cause a mechanical braking action  
 against an inner portion (17) of said second hori-  
 zontal guide rail (16).
  9. The overhead sliding door arrangement as claimed  
 in claim 7, wherein said braking device (13) is  
 adapted to cause a mechanical braking action  
 against an outer portion (18) of said second hori-  
 zontal guide rail (16).
  10. The overhead sliding door arrangement as claimed  
 in any one of claims 1-9, wherein said braking de-  
 vice (13) is adapted to cause a mechanical braking  
 action against at least one top runner (12) at said  
 top door panel portion (8).
  11. The overhead sliding door arrangement as claimed  
 in any one of claims 1-10, wherein said braking de-  
 vice (13) comprises a friction element (19).
  12. The overhead sliding door arrangement as claimed  
 in claim 11, wherein said friction element (19) is a  
 rubber element.
  13. The overhead sliding door arrangement as claimed  
 in any one of claims 1-12, wherein said braking de-  
 vice (13) is provided with a serrated surface for en-  
 abling said mechanical braking action.
  14. Method for enabling reduced closing force of an  
 overhead sliding door arrangement (2) having  
 a door panel, having a top door panel portion  
 (8) and a lower door panel portion (9),  
 a set of guide rails (3) arranged on each side  
 of said door panel, each set of guide rails (3) com-  
 prising at least an upper substantially horizontal  
 guide section (4), a curved guide section (5) and a  
 substantially vertical guide section (6),  
 said lower door panel portion (9) being pro-  
 vided with supporting runners (11), which runners  
 are guided along at least part of said guide rails (3),  
 a safety system (1) comprising said top door  
 panel portion (8) and said upper substantially hori-  
 zontal guide section (4), wherein said top door  
 panel portion (8) is provided with a top runner (12) which  
 is guided in said upper guide section (4), and  
 a braking device (13) being arranged to said  
 safety system (1),  
 comprising the step of initiating a closing  
 movement of said overhead sliding door arrange-  
 ment,  
 wherein, for effectuating reduced closing  
 force of said overhead sliding door arrangement,  
 said braking device (13) enables a mechanical  
 braking action of said top door panel portion during  
 said closing movement.
  15. Method as claimed in claim 14, wherein said me-  
 chanical braking action being effected when the  
 door (2) is obstructed during closing movement, us-  
 ing a resiliently arranged connection between said  
 braking device (13) and said top door panel portion  
 (8).
  16. Method as claimed in any one of claims 14-15,  
 wherein the safety system (1) is adapted for being  
 activated, at least, at a front end portion (14) of said  
 upper guide rail (4).
  17. Method as claimed in any one of claims 14-16,  
 wherein the closing movement is achieved by a  
 drive unit (15).
  18. Method as claimed in any one of claims 14-17,

wherein a force for enabling said closing movement  
is applied to said top door panel portion (8).

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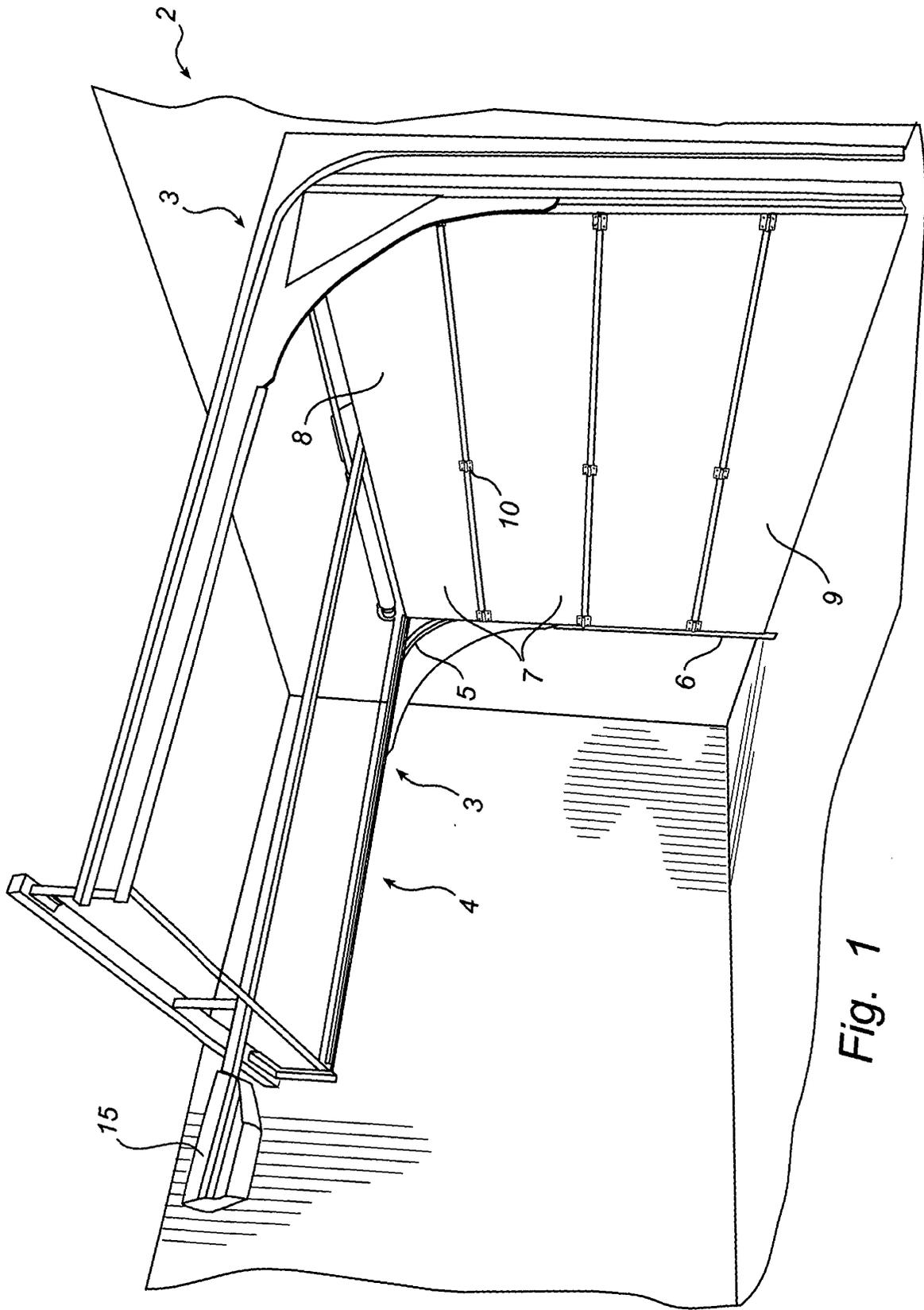


Fig. 1

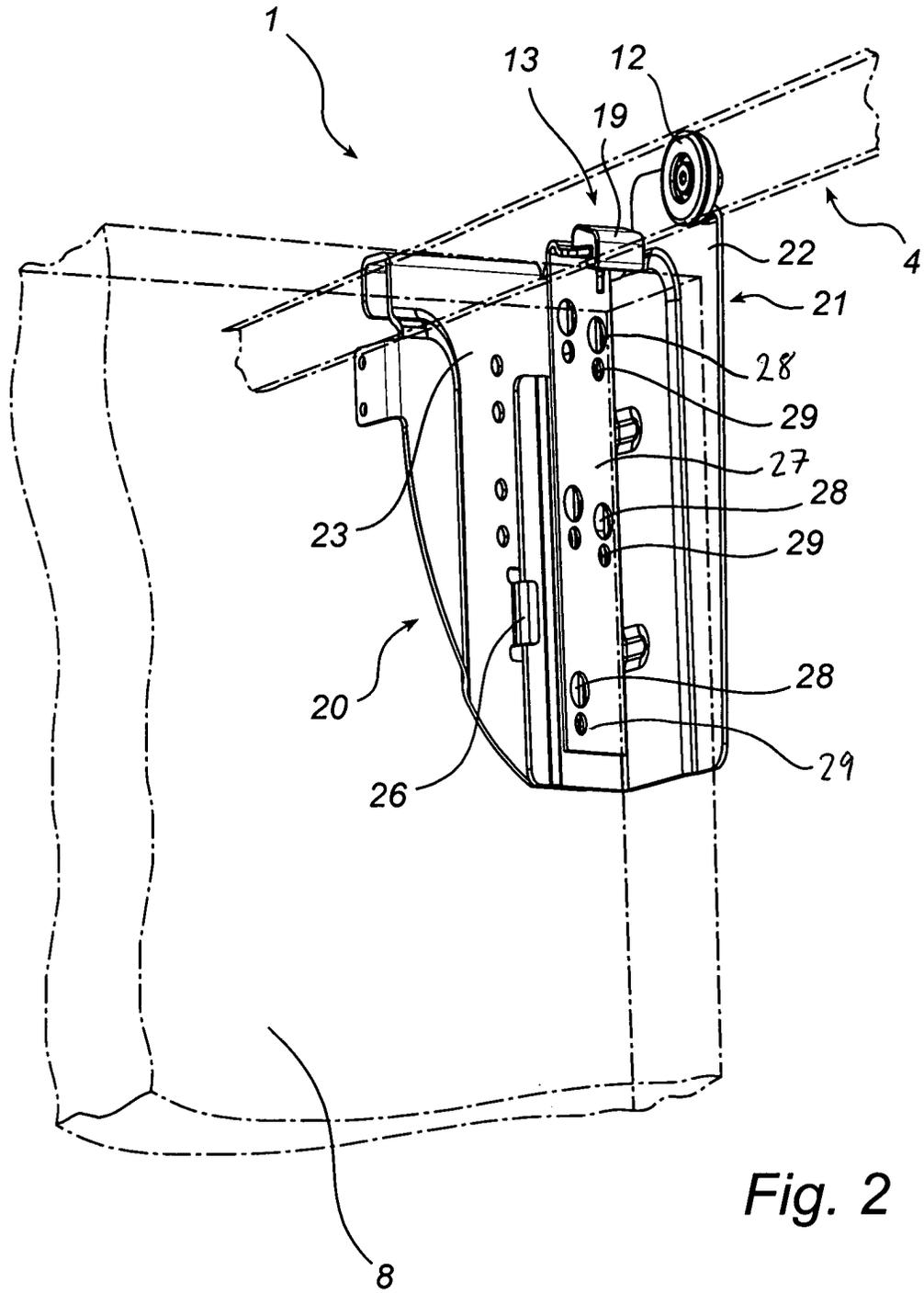


Fig. 2

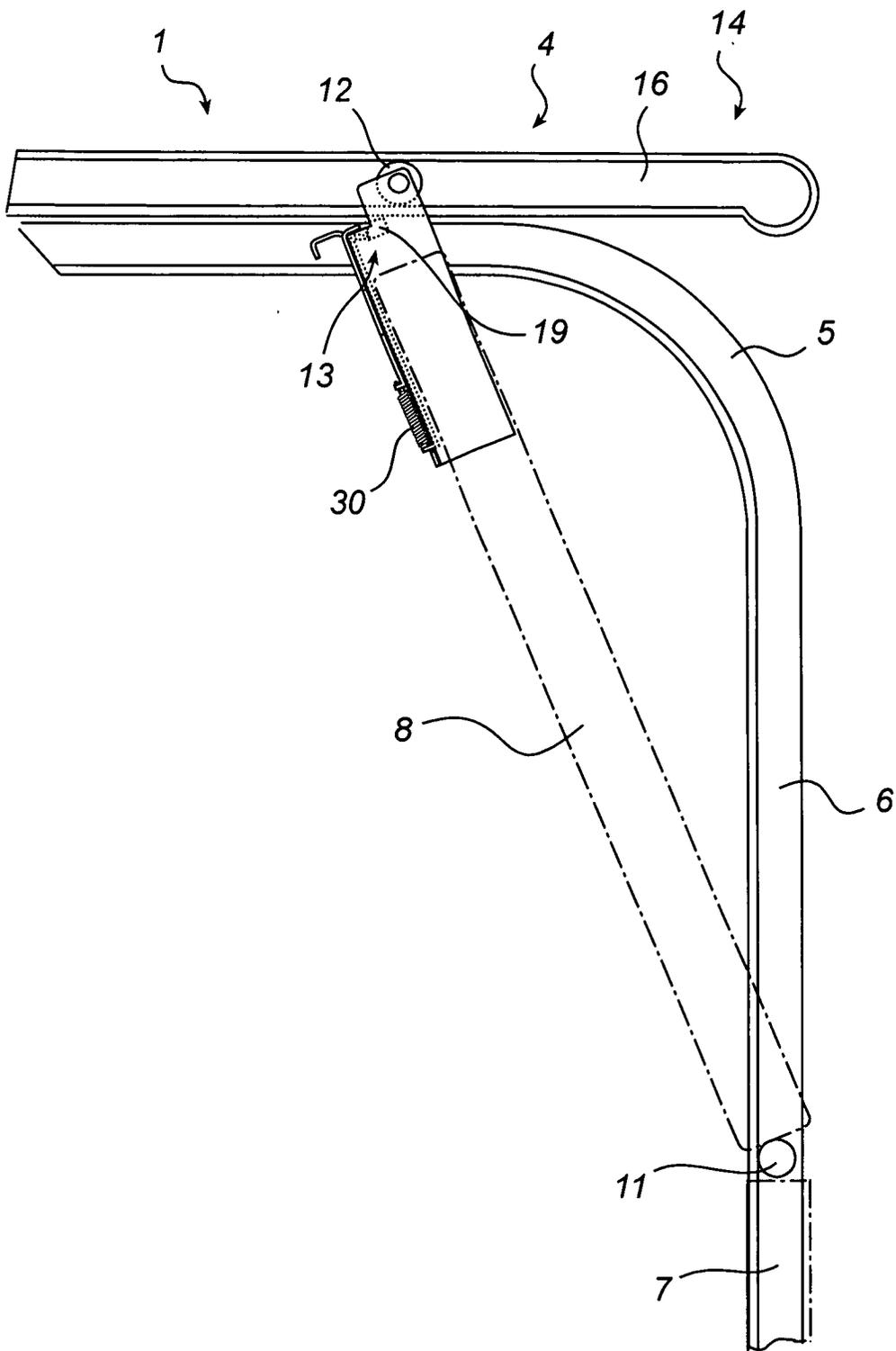


Fig. 3

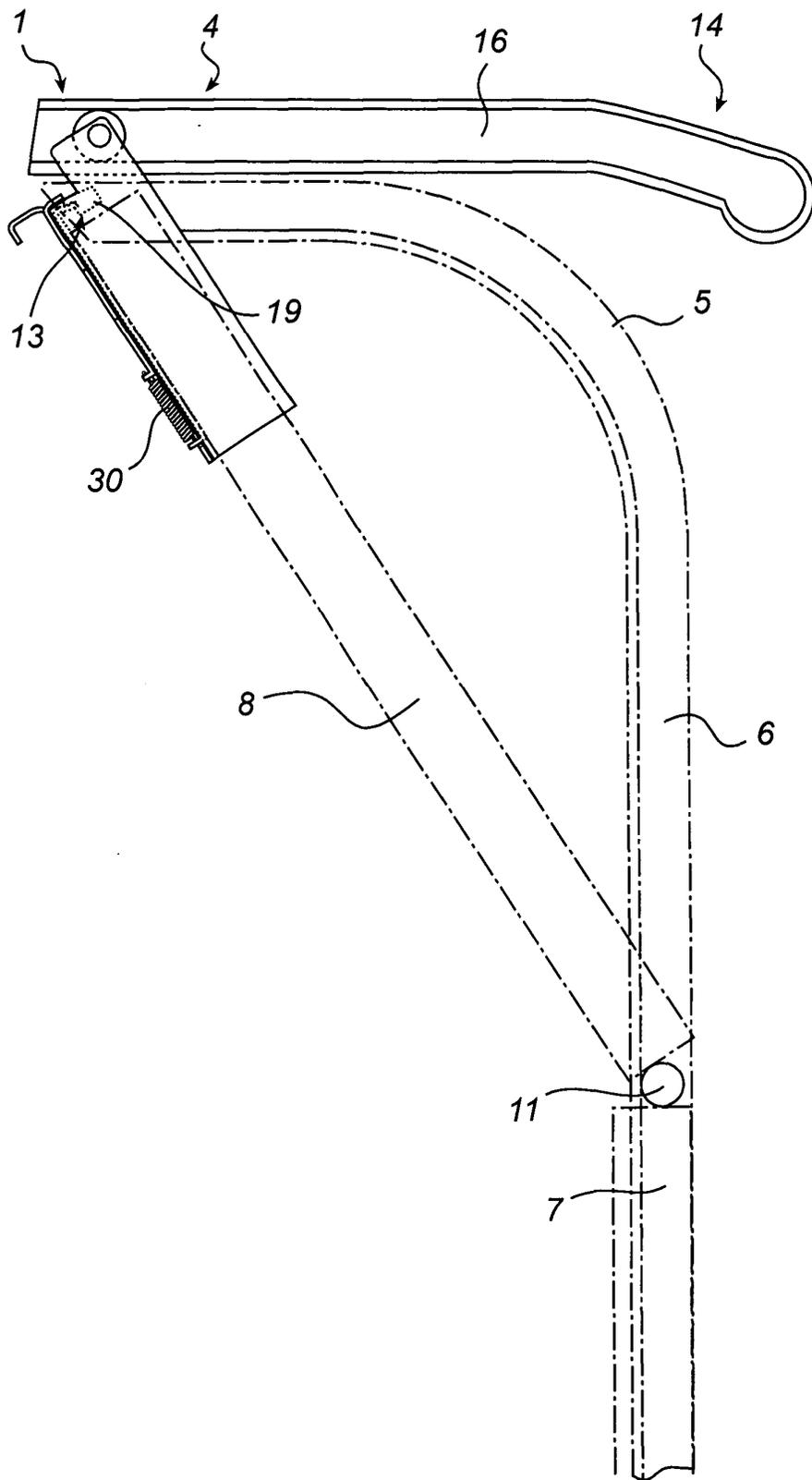


Fig. 4a

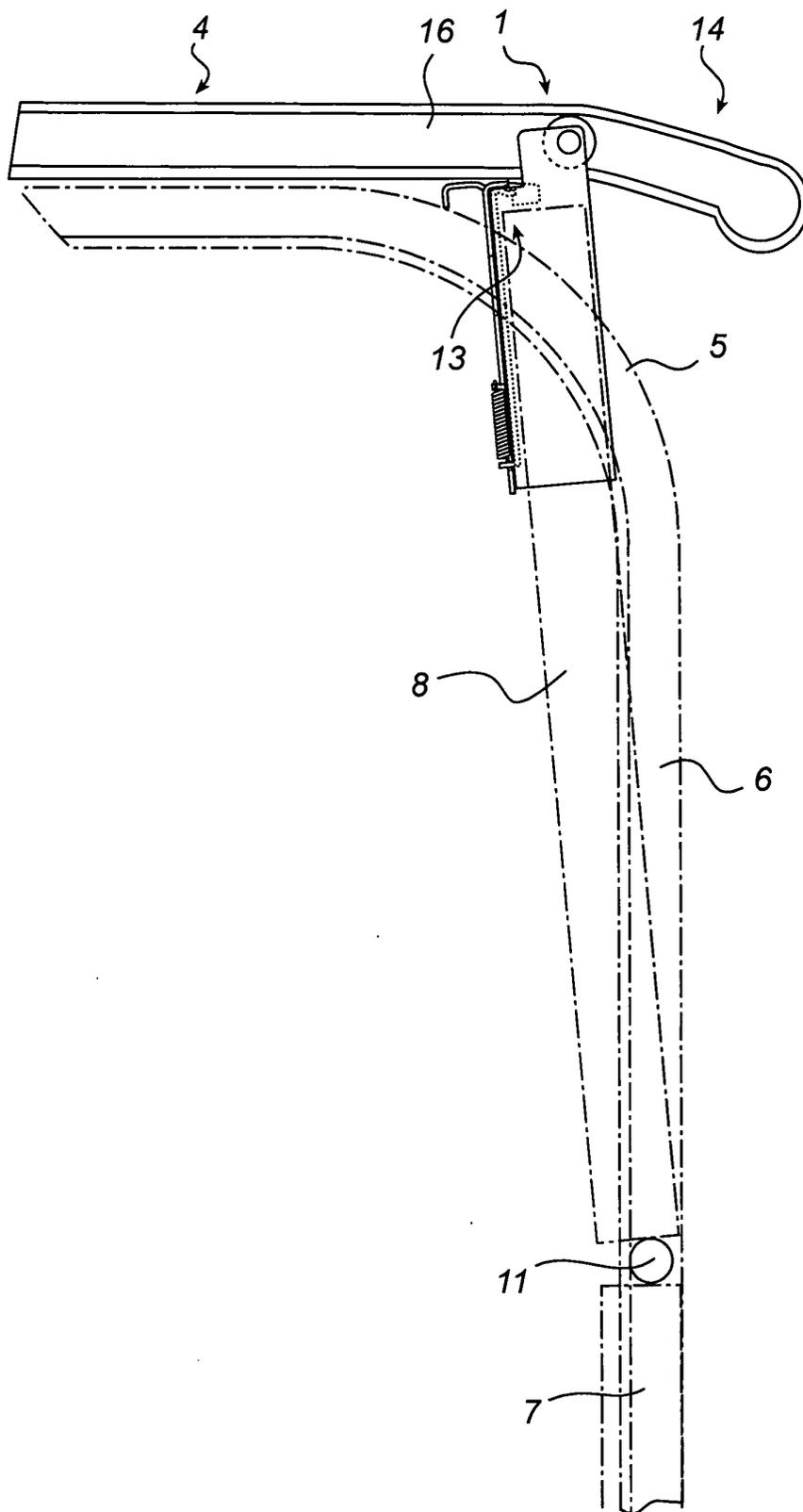


Fig. 4b

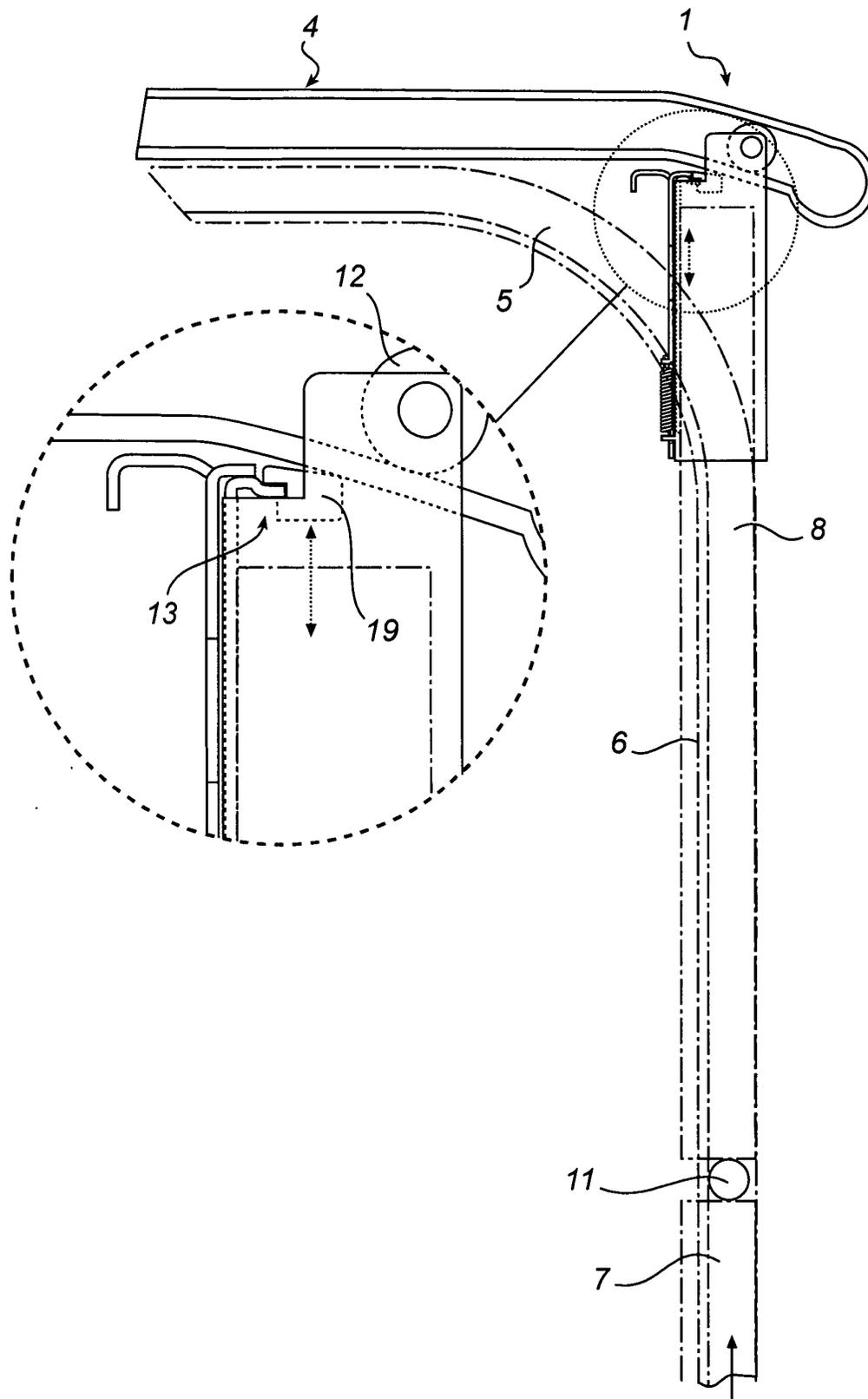
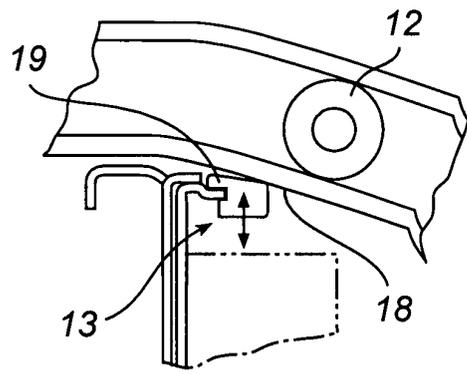
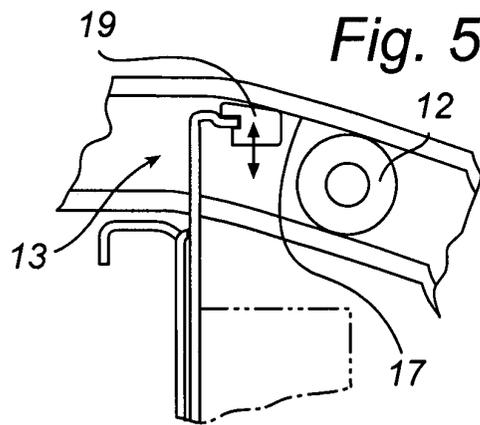


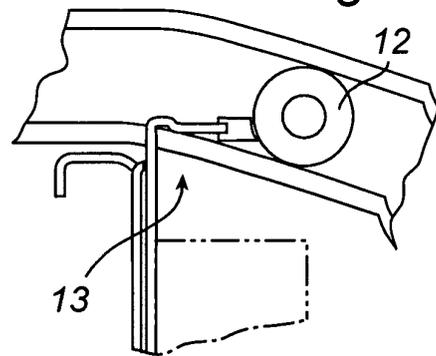
Fig. 4c



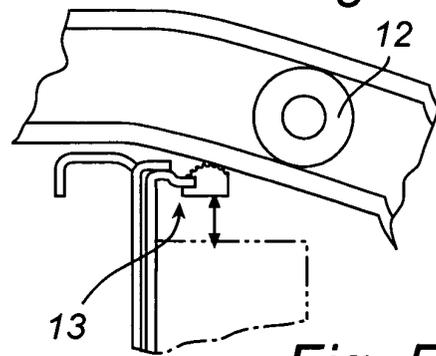
*Fig. 5a*



*Fig. 5b*



*Fig. 5c*



*Fig. 5d*



European Patent  
Office

EUROPEAN SEARCH REPORT

Application Number  
EP 03 00 8273

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	DE 40 03 218 A (SCHNEIDER RUDOLF ING GRAD) 14 August 1991 (1991-08-14)  * column 5, line 41 - column 6, line 16 * * column 8, line 27 - line 52 * * claims 6,7 * * figure 1 * ---	1,2, 4-10,13, 14,16-18	E05D15/24 E05F5/00
X	EP 1 076 144 A (HENKENJOHANN JOHANN) 14 February 2001 (2001-02-14)  * column 3, line 42 - column 4, line 2 * Y * column 5, line 6 - line 22 * * column 5, line 40 - line 46 * * column 6, line 22 - column 7, line 45 * * figures 3,4 * ---	1,2,4-6, 10,13, 14,16-18  3,15	
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