



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
15.06.2016 Bulletin 2016/24

(51) Int Cl.:
E05D 15/38 ^(2006.01) **E05F 15/59** ^(2015.01)
E05F 15/668 ^(2015.01) **E05D 15/58** ^(2006.01)

(21) Application number: **15198184.2**

(22) Date of filing: **07.12.2015**

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**
Designated Extension States:
BA ME
Designated Validation States:
MA MD

(71) Applicant: **Guobys, Remigijus**
St. Albans, Hertfordshire AL3 6RT (GB)

(72) Inventor: **Guobys, Remigijus**
St. Albans, Hertfordshire AL3 6RT (GB)

(74) Representative: **Pranevicius, Gediminas**
Law firm VARUL
Konstitucijos pr. 7
09308 Vilnius (LT)

(30) Priority: **08.12.2014 LT 2014512**

(54) **A GARAGE DOOR OPENER**

(57) The invention relates to a garage door opener designed for moving the planar garage door by lifting and rotating movements from the vertical closed position to the horizontal lifted up and open position. The opener consists of two lifter columns arranged at the opposite edges of a garage door having the vertical slides installed therein; garage door having rotational axes and support levers with rolling wheels; two wedge-shaped guides, installed in lifter columns, with edges for rolling wheels of the support levers of the garage door.

The present garage door opening device, using the lifter columns and diagonal guides installed therein, is useful for the fact that no additional external and visually visible door driving and guiding mechanisms, installed inside the garage, are necessary. In addition, the garage door of this structure does not need any lock because the lifter column drive, support levers and guides in combination play the role of the lock, reliably blocking the closed garage door.

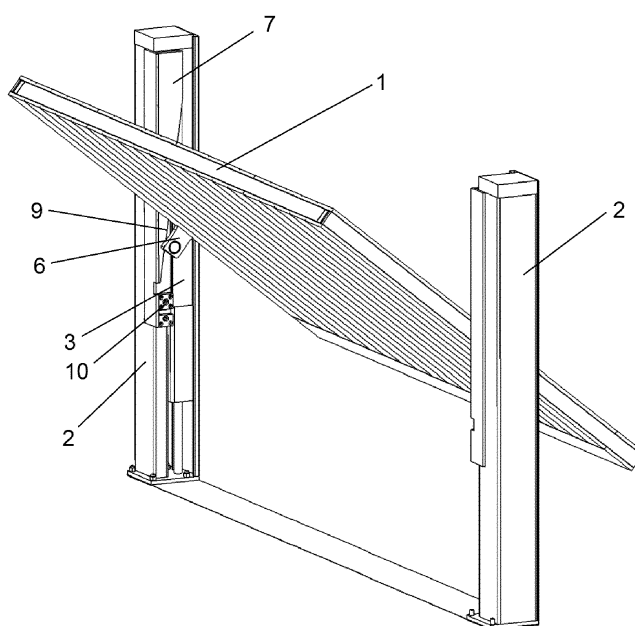


Fig. 6

Description

[0001] The invention relates to planar door opening and closing devices for garage or other structures.

[0002] There is known a garage opening device, where the garage door is opened by lifting and rotational movements described in US5239776. The garage door is a one-piece door which is lifted from a closed vertical position to an open horizontal position by a rotational motion and reciprocating motion.

[0003] The drawback at the technical level of the prior art is the fact that the door opening mechanism, consisting of an electric motor and levers and guides, connecting it with a door, is installed inside the garage, thus occupying additional internal space of the garage.

[0004] The aim of this invention is to design such automatic garage door opening and closing device, where there would be no additional external door control elements - motors, guides, levers, etc., installed inside the garage at the internal plane of garage door.

[0005] The proposed goal was realized by rotatably installing two electrohydraulic or electromechanical lift columns at two opposite edges of the garage door, which lift the door up or down the vertical slides. The garage door rotation axes are made below the middle of height of the door, i.e., the bottom part of the garage door is narrower than the upper part. The lower part of the door below the rotation axes is made heavier than the upper section of the door.

[0006] Along each axis in a rotational lifter column slide there is a short support lever, oriented perpendicular to the plane of the garage door and horizontally to the inside of a garage, when the garage door is closed. At each end of a support level, at the side, directed towards lifter column, there is a rolling wheel. At each internal side of lifter column, facing the garage door, there is a vertical wedge-shaped guide, the point end is directed downward, the rolling wheel of a support lever of the garage door is leaned on the internal edge. A wedge-shaped guide starts from the position of a door support lever, when the garage door is closed, and goes up widening to the top of the column. The edge of the guide, where the rolling wheel is leaned on, goes sideways from external edge of the column towards the top of the column axis, whereby vertical slide moves. The diagonal edge of the guide in the upper part, where the rolling wheel of a support lever of the garage door runs, changes its configuration from diagonal to a strictly vertical one.

[0007] As lifter columns start lifting the garage door to the top, the support levers, scrolling by rolling wheels along diagonal guide edges up, gradually change its position from the initial horizontal position to a vertical position while rotating the adjoining garage door about its horizontal axes arranged in vertical slides, and moving the door from a vertical closed position to a horizontal open position.

[0008] As the lifter columns start moving the garage door down, the part of a garage door, facing away from

the rotational axes of the door to the outside the garage, begins to descend itself down as it is heavier than that part of the garage door facing away from the rotation axes to the inside of the garage. Door support levers, scrolling down by rolling wheels at diagonal guides, located at inside of each lifter column, gradually change their position from vertical to horizontal. Since the support levers are rigidly attached to the garage door, they at the same time move door from the horizontal open position to the vertical closed position.

[0009] This planar garage door opening device, using the lifter columns diagonal guides, is useful for the fact that no additional external and visually visible door driving and guiding mechanisms, installed inside the garage, are necessary. In addition, the garage door of this structure does not need any lock because the lifter column drive, support levers and guides play in combination the role of the lock, reliably blocking the closed garage door.

[0010] Hereinafter, the invention will be described with references to the enclosed drawings, where:

Fig. 1 shows the general view of the garage door of this invention from the top of the garage;

Fig. 2 shows the partial view of the garage door section through Fig. 1 line A-A, showing the structure of the garage door attachment in lifter columns;

Fig. 3-9 show the gradual positions of the garage door and their position control elements, when the lifter columns lift the door to the top;

Fig. 10-11 show the garage door in the fully open position.

[0011] As it is shown in fig. 1, the planar garage door 1 is rotatably installed on vertical slides 3 of lifter columns 2 on rotation axes 4, showed in more details in fig. 2, which is the partial view of the garage door 1 section through line A-A of fig. 1, showing the structure of the garage door attachment in lifter columns 2. As it is shown in fig. 2, there are vertical hydraulic or mechanical drives 5 in lifter columns 2, connected with slides 3, and, thus, controlling the movement of the slides 3, as well as the garage door 1, attached to the slides at pivotally installed axes 4, in lifter columns 2 vertically from the top to the bottom.

[0012] The bottom part of the door 1, below the rotational axes, which are at the height of a section line A-A, is made heavier than the top part above the rotational axes 4.

[0013] On the inside part of the garage door 1, directed towards inside the garage, at the rotation axes, there are two short support levers 6, installed to the plane of the garage door 1 at a right angle and directed horizontally towards inside of the garage when the garage door 1 is closed.

[0014] At each internal side of a lifter column 2 directed towards inside of the garage, there is a wedge-shaped guide 7, an acute angle of which is directed downwards. The lower end of a wedge-shaped guide 7 starts from

the position of a support lever 6, where it appears when the garage door 1 is closed, and goes up to the top of the lifter column 2. Fig. 1 shows only one guide 7, however, as it is shown in fig. 4, where the inside view of a partially uncovered lifter column 2 is shown, the identical guide 7 is installed in another lifter column 2.

[0015] The respective support lever 6 of the garage door 1 is leaned on each guide 7 through the rolling wheel 8, installed on its external side. The edge 9 of the guide 7, where the rolling wheel 8 of the support lever 8 is leaned on and rolls through, goes sideways up from the lifter column 2 external edge towards the top point of the path along which the axis 4 of the garage door 1 moves when it is lifted up. The edge 9 changes its configuration from diagonal to vertical at the upper part of a guide 7, clearly visible in fig. 4 and 5.

[0016] Hereinafter, the principle of operation of a garage door opener and interaction of lifting elements will be described in more details with reference to fig. 3-9.

[0017] When the garage door is closed and the drives of column lift 2, which can be electrohydraulic or electromechanical, are turned on, the slides 3 start going up by lifting the garage door 1. This position is illustrated in fig. 3, 4 and 5. In fig. 4, the right column is partially uncovered to show the interaction of support levers 6 of the garage door 1 with the guide 7. a

[0018] Support levers 6, attached to the door 1, start going up together with the door 1. While going up, the support levers 6, the rolling wheels 8 of which are leaned on edges 9 of the guides 7, start rotating about axes 4, simultaneously rotating the garage door 1.

[0019] As the lower part of the garage door 1 is heavier than the upper part, the rolling wheels 8 of the support levers 6 will always be leaned on and roll through the edges 9 of guides 7.

[0020] Fig. 6 and 7, and fig. 8 and 9 illustrate the positions of the garage door 1 when it is lifted approximately 1/4 their way up (fig. 6 and 7,) and 3/4 their way up (fig. 8 and 9). These positions differ from the position illustrated in fig. 2 and 3 by the fact that in each position the door 1 is even more rotated about the axes 4 because of the respectively changed positions of support levers 6, the rolling wheels 8 of which roll along the edges 9 of guides 7, and lifted up, thus opening the entrance to the garage.

[0021] Fig. 10 and 11 illustrate the position when the garage door 1 is completely lifted. The support levers 6 in this position are lifted to the top vertical part of the edge 9 of the guide 7 and go to the completely vertical position simultaneously rotating the door 1 to the horizontal position, where the lower part of the closed door 1 goes to the external side of the garage, while the upper part - inside the garage. In this position, the entrance to garage is completely open.

[0022] The garage door is closed by a reverse procedure. As it has been mentioned with reference to fig. 1 and 2, the lower part of the garage door 1, located below the rotation axes 4, which are at the height of a section

line A-A, is heavier than the upper part above the rotation axes 4. As slides 3, operated by drives, installed in lift columns 2, starting getting down, the support levers 6, the rolling wheels 8 of which roll along the edges 9 of guides 7, gradually move from an upper vertical position, illustrated in fig. 10 and 11, to the bottom horizontal position, illustrated in fig. 1 and 2, simultaneously rotating the garage door 1 about its axes 4.

[0023] At the lowered position the levers 6 are between guides 7 and their lowered position limiters 10, where wheels 8 of rolling support levers 6 are leaned on.

[0024] This planar garage door opening device, comprising lifter columns 2 with vertical slides 3, installed at the opposite sides of the garage door 1, the garage door 1 with axes 4 in slides 3 of rotating lifter columns 2 and support levers 6 with rolling wheels 8, the wedge-shaped guides 7 with rolling edges 9 for wheels 8, is useful for the fact that no additional external and visually visible door driving and guiding mechanisms, installed inside the garage, are necessary. In addition, the garage door of this structure does not need any lock because the lifter columns 2, support levers 6, guides 7, and limiters 10 in combination play the role of the lock reliably blocking the closed garage door.

Claims

1. A garage door opener designed for moving the planar garage door by lifting and rotating movements from a vertical closed position to a horizontal lifted up and open position, thus opening the entrance to a garage, the garage door opener **characterised by** comprising:
 - lifter columns (2) with vertical slides (3) installed at opposite edges of a garage door (1);
 - a garage door (1) with rotational axes (4), installed in slides (3) of lifter columns (2), and support levers (6) with rolling wheels (8);
 - wedge-shaped guides (7) with edges (9) for rolling wheels (8) of the support levers (6) of the garage door (1);
 - bottom position limiters (10) for rolling wheels (8) of support levers (6) of the garage door (1).
2. The garage door opener according to claim 1, **characterised in that** the support levers (6) are attached at a right angle to the inner side of the frame of the garage door (1) at its rotational axes (4).
3. The garage door opener according to claim 1, **characterised in that** the rolling wheels (8) are attached to the support levers (6) at their sides directed to the edges (9) of guides (7).
4. The garage door opener according to claim 1, **characterised in that** the guides (7) start with their lower

tapered ends from the position of support levers (6) of the door (1), where they appear when the garage door (1) is closed, and go up till the top of lifter columns (2).

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5. The garage door opener according to claim 1, **characterised in that** the edges (9) of guides (7), along which the rolling wheels (8) of support levers (6) run, go diagonally up from the external edges of lifter columns (2) towards the upper corners on opposite sides of lifter columns (2). 10
6. The garage door opener according to claim 5, **characterised in that** the edges (9) of guides (7), along which the rolling wheels (8) of support levers (6) run, go diagonally up from the external edges of lifter columns (2) towards the top point of the path along which the axes (4) of the garage door (1) move when the door is lifted up. 15
7. The garage door opener according to claims 5 and 6, **characterised in that** at the upper part of each guide (7) the edge (9) changes its direction from diagonal to vertical. 20
8. The garage door opener according to claim 1, **characterised in that** the lower part of the door (1) below the rotational axes (4) is heavier than the upper part above the rotational axes (4). 25
9. The garage door opener according to claim 1, **characterised in that** lifter columns (2) are controlled electrohydraulically or electromechanically. 30

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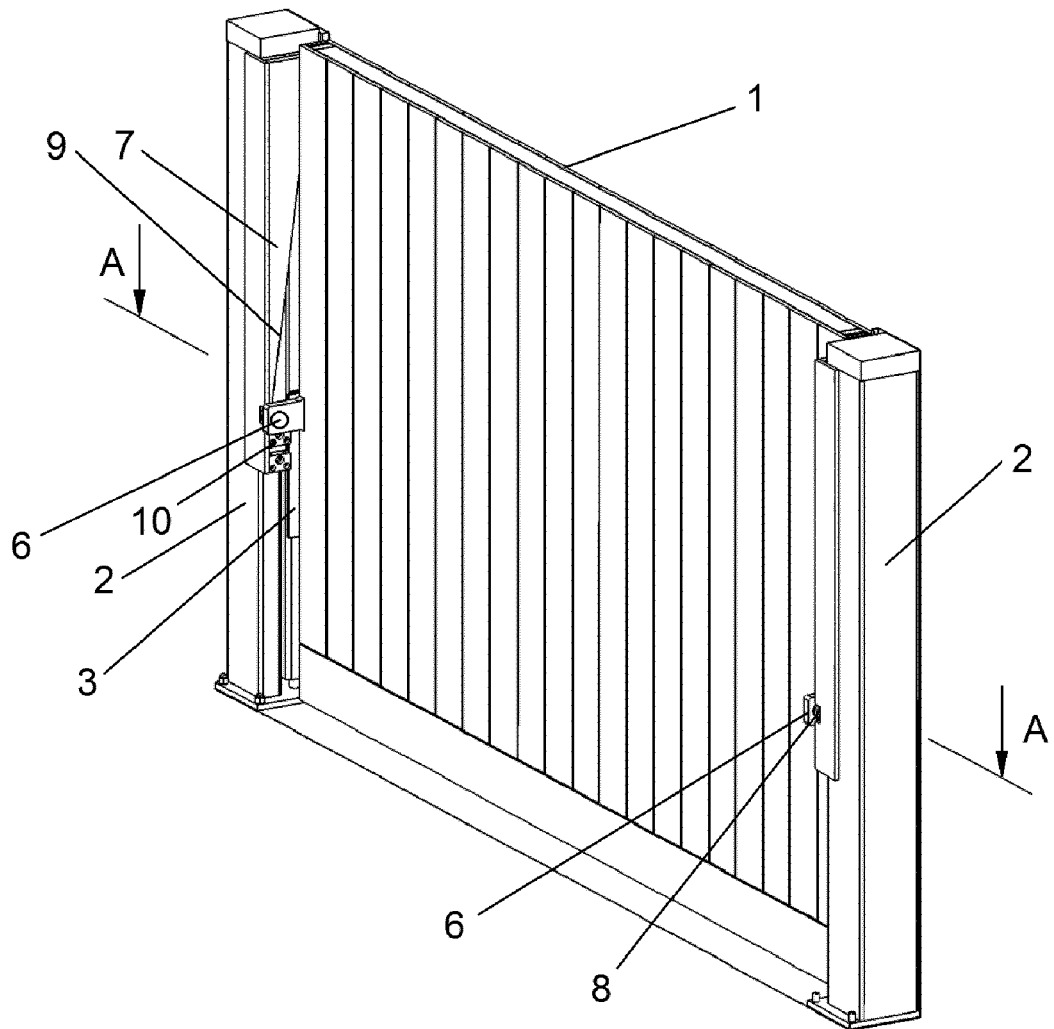


Fig. 1

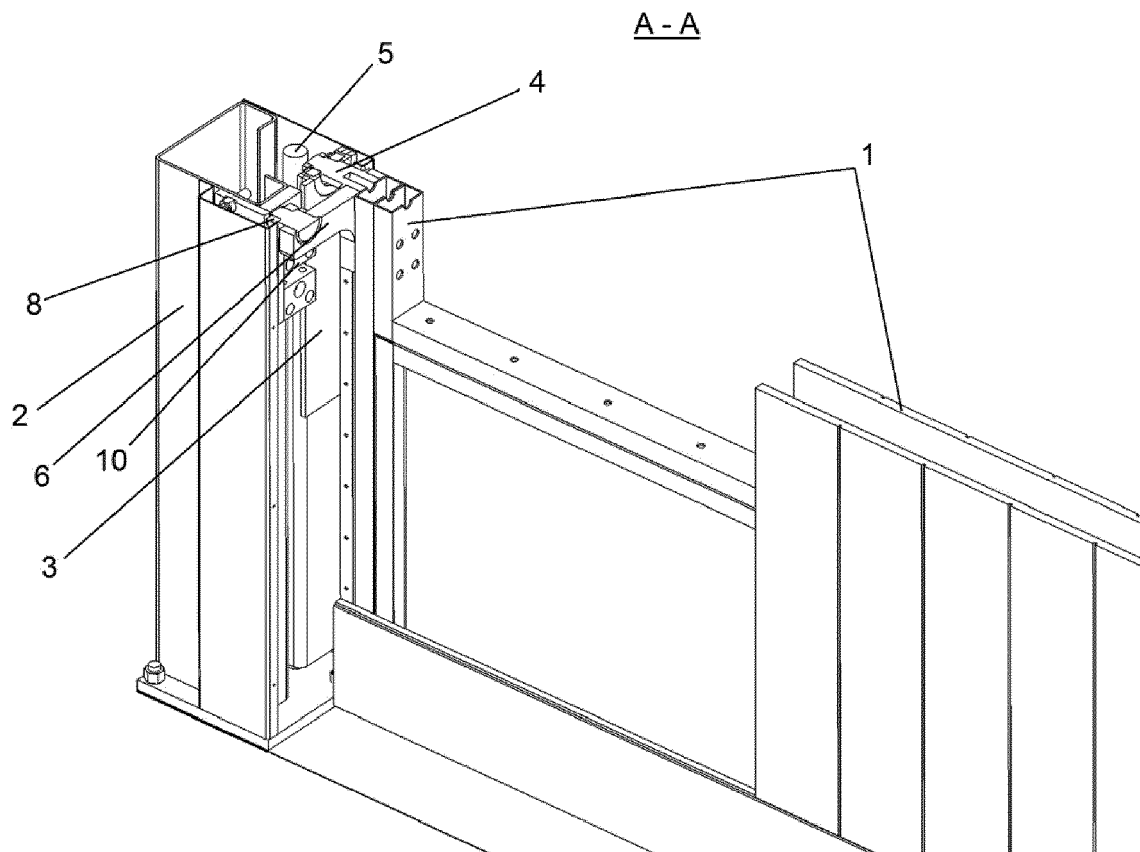


Fig. 2

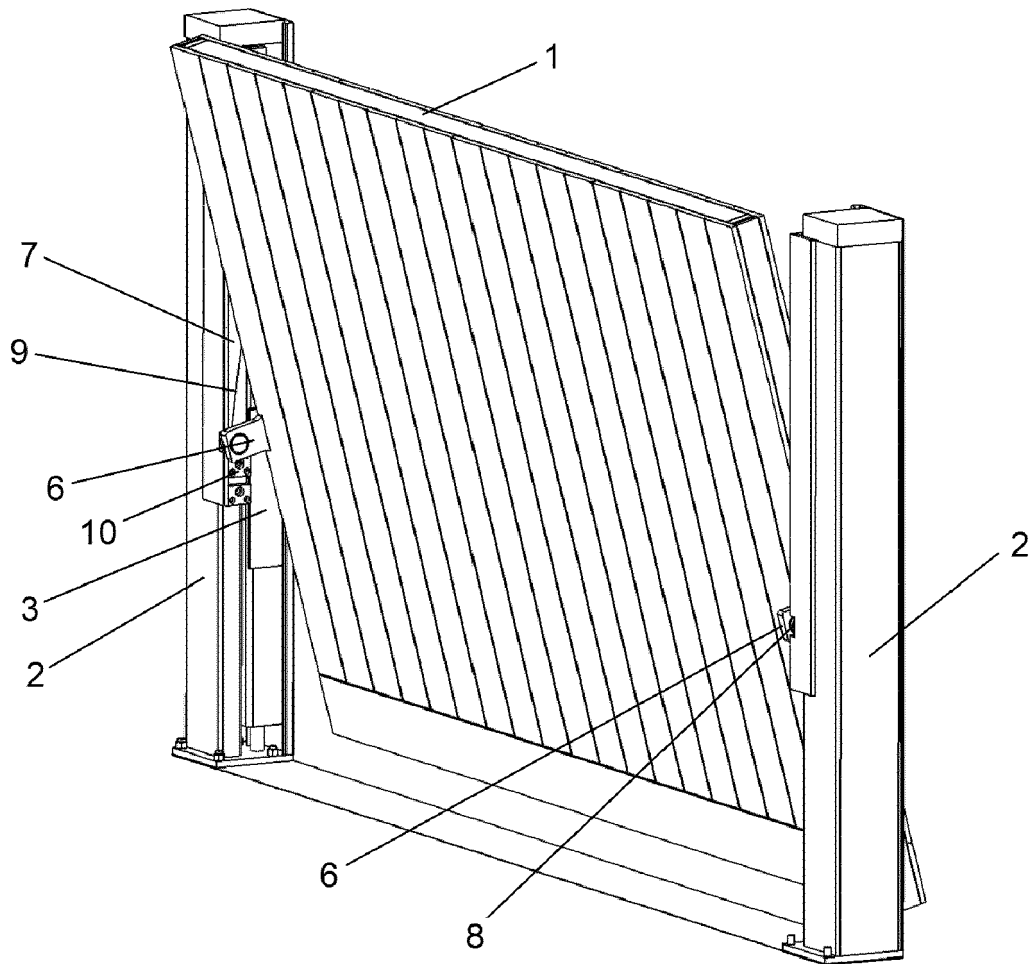


Fig. 3

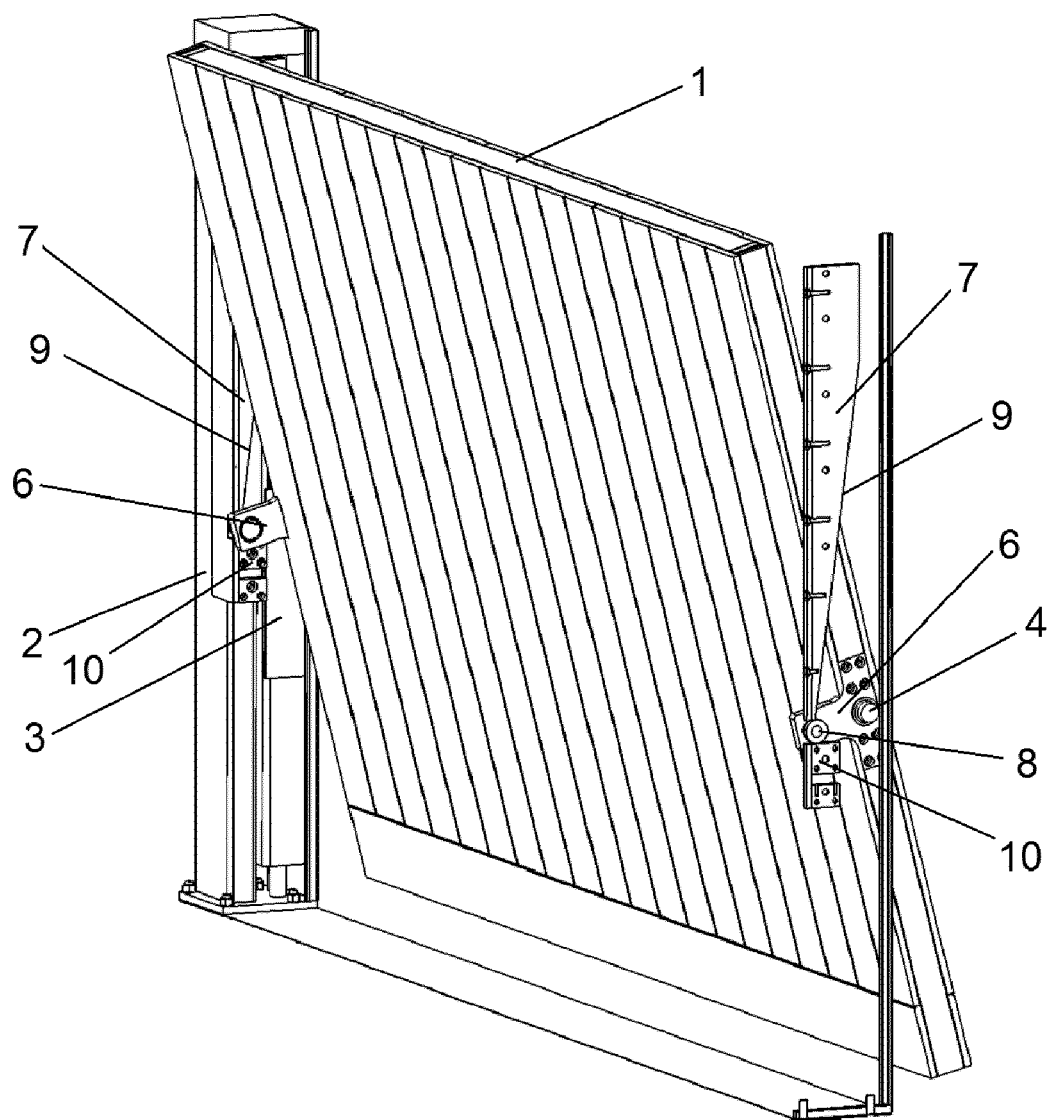


Fig. 4

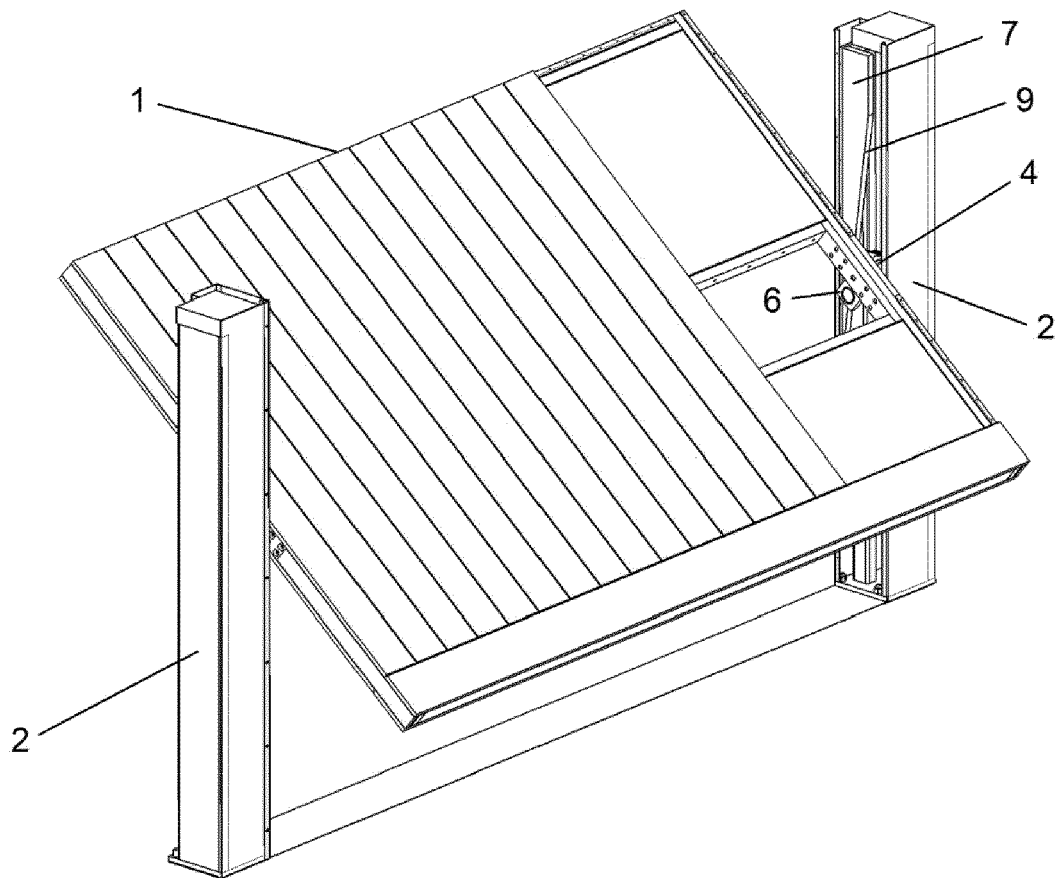


Fig. 5

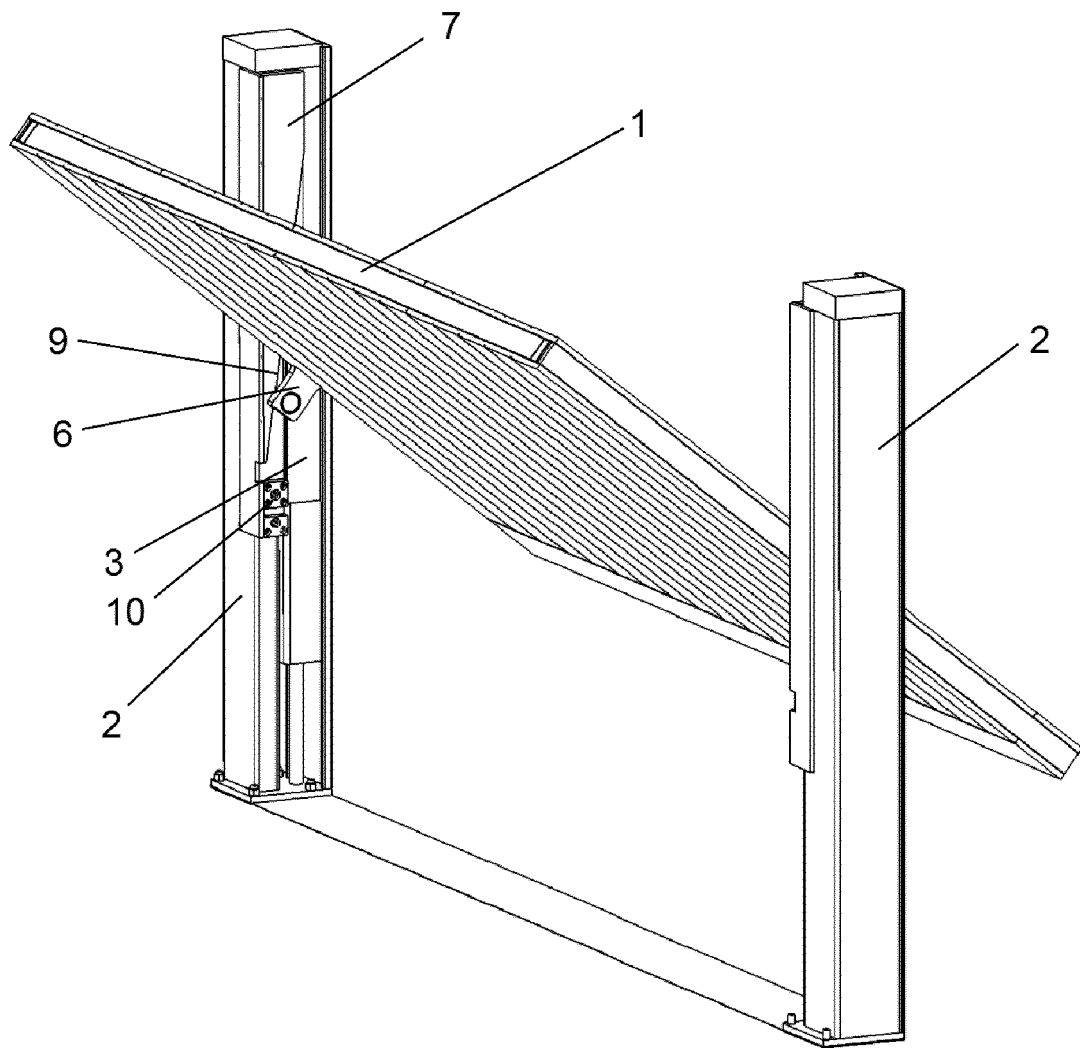


Fig. 6

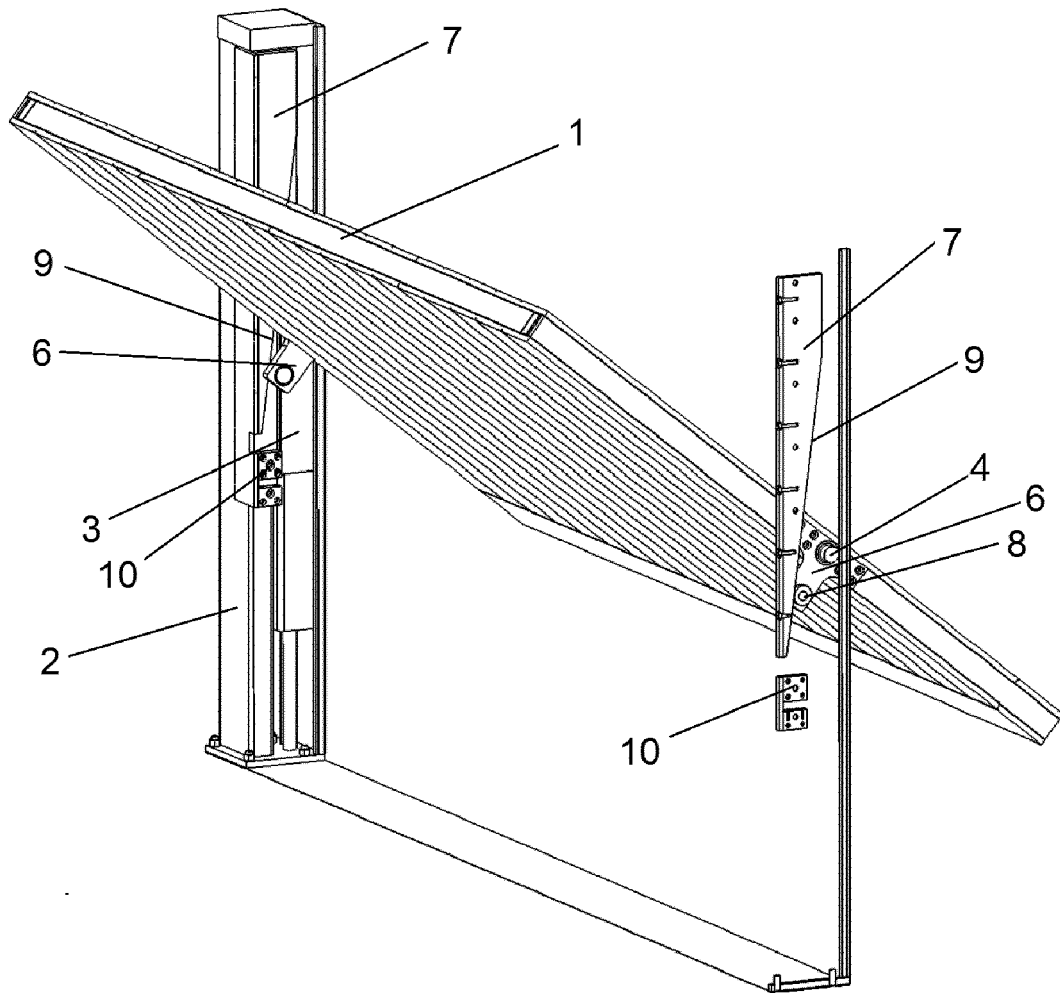


Fig. 7

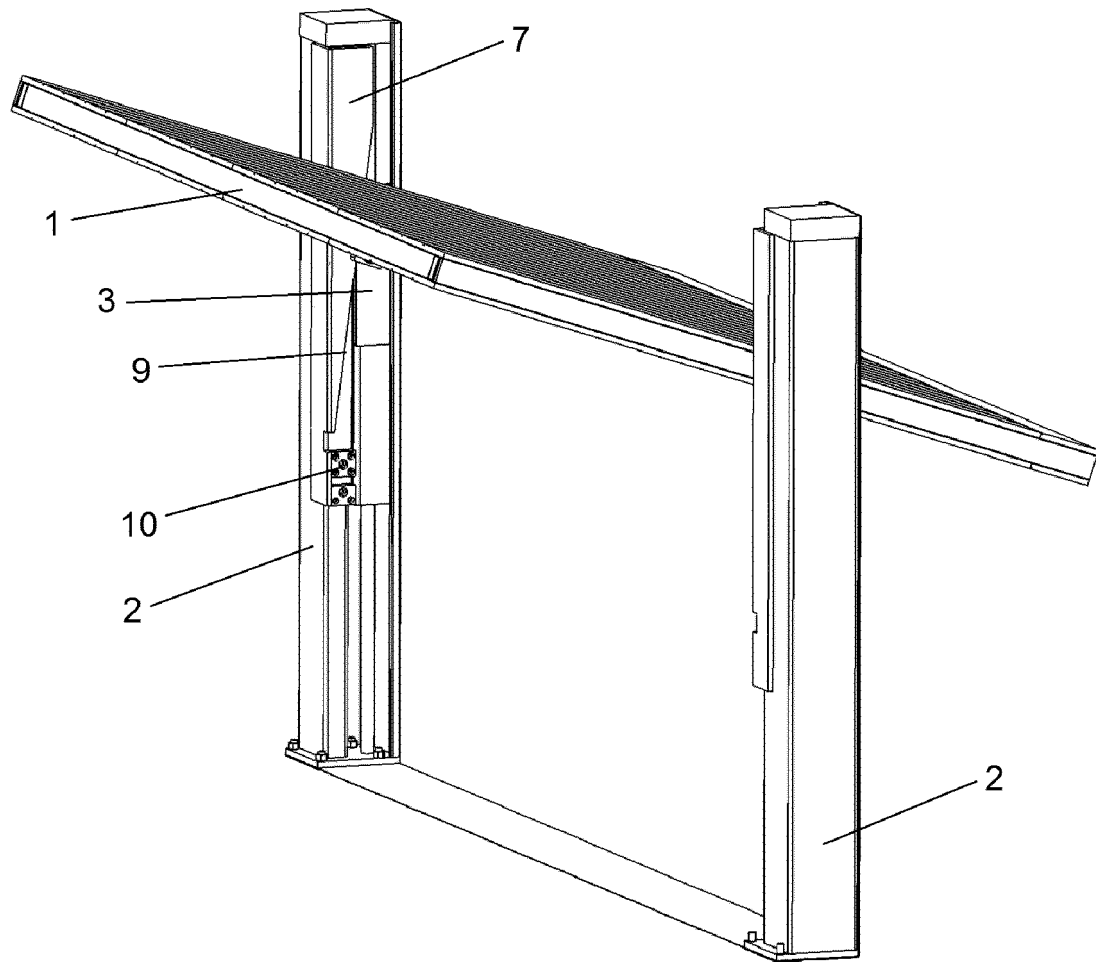


Fig. 8

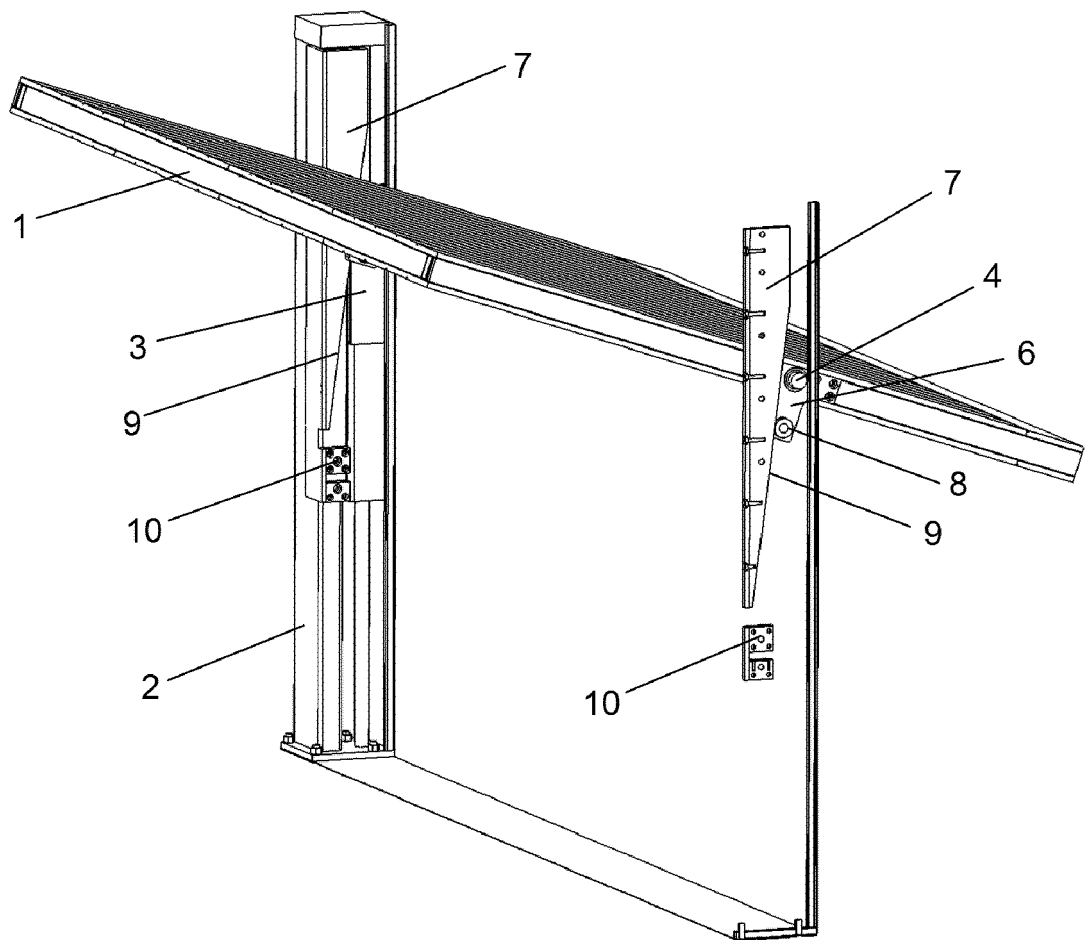


Fig. 9

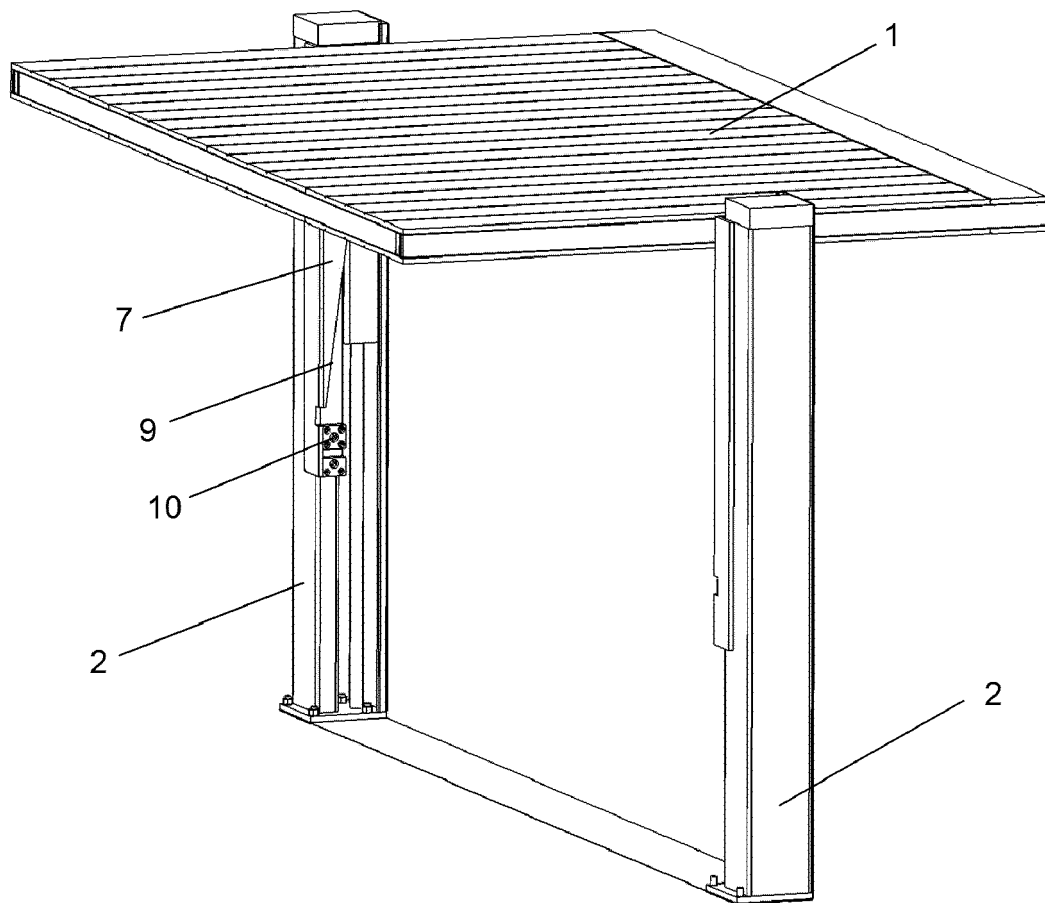


Fig. 10

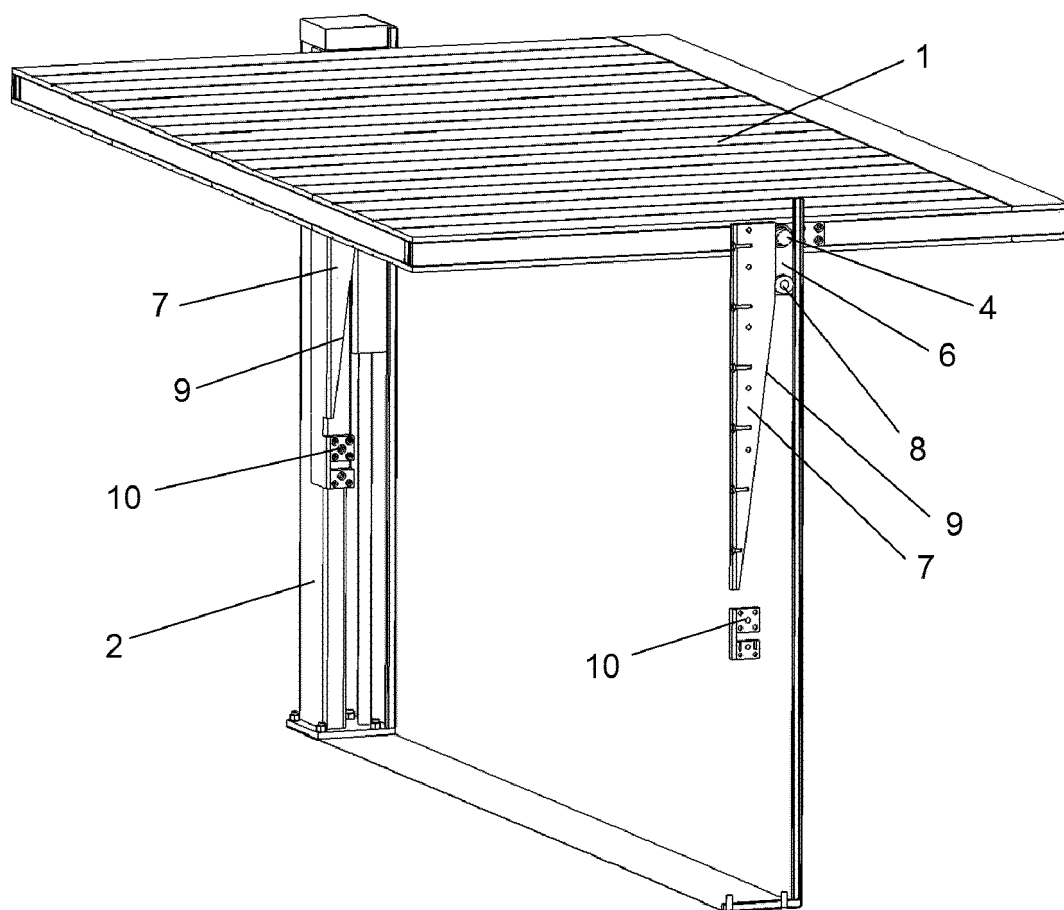


Fig. 11



EUROPEAN SEARCH REPORT

Application Number
EP 15 19 8184

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			E05D E05F
Place of search		Date of completion of the search	Examiner
The Hague		15 April 2016	Wagner, Andrea
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			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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