

Description

[0001] The invention generally relates to a displacement system for two panels, in particular for building shading panels, an application chosen in the following as an example. The displacement system can be exploited to move in general two generic panels or concealment elements bellow-hinged to each other like doors or sectional doors.

[0002] To reduce the energy consumption due to heating and cooling, in constructions external shading systems are used, as in DE102009014579, exploiting two hinged panels that can pack as a bellow on each other to uncover a window. When the panels are coplanar (obscured window), these structures have not only the problem that to pack them and lift them one must avoid their sticking using expensive and bulky auxiliary mechanisms (with the function to move outside the panels and brake their alignment), but also the hinge of the panels is not blocked. Therefore, a pressure on the central hinge is enough to make the panels swing, with obvious security and stability problems. Finally, the lifting mechanisms for the panels generally consist of mechanisms being either complicated or difficult to adapt to different models or sizes of panels.

[0003] E.g. devices are known which move two liftable panels in front of an opening. They use a rack mounted to the sides of the opening and a pinion driven by an electric motor set on board the bottom panel. The motor runs on the rack in order to vertically lift the panels. This system, in particular, is quite primitive. To endow it with sophisticated or additional controls on the dynamics of the panels, it is necessary to use sensors or switches, long wiring and a management control unit. It would be desirable to assist the electronic control unit with a mechanical feedback indicative of the dynamics of the panels, thereby saving expensive and complicated electronic sensors.

[0004] The main object of the invention is to improve the functionality of a known displacement system for the above panels.

[0005] Another object is to solve the problem of moving said panels in a simple and inexpensive way. Another object is to solve the problem of moving the above-mentioned panels with a simple to build and reliable device, and with a method for moving (e.g. only) two panels which is simple to implement and reliable.

[0006] An aspect of the invention includes a device, capable of implementing the method, destined to move (e.g. only) two panels hinged to each other on an edge thereof and mounted to vertically folding book-like one on the other in front of an opening to be obscured, comprising:

- a rack mounted to the sides of the opening;
- an electric motor located on the bottom panel;
- a rotatable pinion driven by the motor and engageable on the rack to translate on the rack and thereby

vertically lifting the bottom panel;

wherein the rack is mounted to be able to move linearly along its longitudinal axis.

[0007] In the prior art the rack is fixed, immovable on the side uprights of the opening. By making the rack movable instead, it, as a reaction to the momentum imparted to it by the pinion, can instead move as a function e.g. of the position of the panels and/or of the force imparted by the pinion. The stroke of the rack can then indicate a status variable of the system, easily exploitable for the control of the panels (e.g. by coupling a microswitch to the rack to be read by the control unit) or other functions. The rack can move e.g. either by reaction to the momentum of the pinion and/or because of the weight of the panels. This is useful e.g. within the peripheral monitoring of an anti-theft system and/or as position or speed detection system for the panels, e.g. as a control included in an end-of-travel regulation.

[0008] According to a preferred embodiment, the device comprises a (first) locking and unlocking mechanism or device for (e.g. temporarily) locking and unlocking of the rack with respect to the sides of the opening to allow or prevent the movement of the rack in some conditions. In this way the rack can both remain integral with the uprights of the opening, acting e.g. as a fixed guide for the pinion and enabling a stable translation for it, and move to perform other functions.

[0009] According to a preferred embodiment, the device comprises an element which is integral with a panel and destined to trigger the mechanism for locking and unlocking. In this way one can synchronize the condition of motion allowed or denied to the rack with the dynamics of a panel (e.g. position and/or speed).

[0010] Preferably, said integral element is mounted on the bottom panel to activate the locking and unlocking mechanism or device in correspondence of the closing end-of-travel limit of the panels.

[0011] Preferably, said integral element comprises or consists of a carriage on which the pinion is rotatably mounted.

[0012] According to a preferred embodiment, the mechanism for locking and unlocking comprises or consists of a lever movable between two positions: a first position in which by interference it blocks the displacement of the rack and a second position in which it leaves the rack free to translate. The lever may be pivotally mounted and/or linearly translatable, and e.g. mounted on a vertical upright.

[0013] According to a preferred embodiment, the lever is mounted to be moved directly by the pinion or by the carriage, so as to minimize the components and ensure a safe and repeatable activation of the first mechanism or device.

[0014] Preferably, the first mechanism or device comprises an elastic element destined to generate an elastic force to trigger the mechanism or device itself. In particular, the elastic element may be mounted for pushing the

movable lever towards one of said two positions.

[0015] Preferably the rack is mounted to activate, by its movement, a second device or mechanism for locking and unlocking a panel with respect to the sides of the opening. The advantage is to exploit the displacement of the rack to lock a panel in the closed position to an upright.

[0016] Preferably, the second mechanism or device comprises one or more pins integral with the rack mounted to protrude from the uprights. The pins can then translate along with the rack and, according to their position, block a panel or not.

[0017] Preferably, a panel comprises grooves or slots, e.g. at an edge, in which one of said pins can enter during the closing movement of the panel itself.

[0018] Preferably, the rack is mounted to activate, by its movement, a third device or mechanism destined to generate a force on a panel, said force being adapted to tilt it relative to the vertical.

[0019] Preferably, the third mechanism or device comprises one or more pins integral with the rack mounted to protrude from the uprights. The pins can then translate together with the rack and, according to their position, slide on one or more inclined planes present on the side of a panel. The cooperation between a pin and an inclined plane creates a cam mechanism.

[0020] Another aspect of the invention also includes a displacement system comprising:

- (i) the device (destined to move the panels) as defined above or described below, and
- (ii) the panels to be displaced.

[0021] Another aspect of the invention includes a method for moving and/or locking (e.g. only) two panels hinged one to the other on an edge thereof and mounted to vertically fold book-like one on the other in front of an opening to be obscured, the panels being comprised in a drive system of the panels which comprises

- a rack mounted to the sides of the opening;
- an electric motor on the bottom panel;
- a rotatable pinion driven by the motor and engageable on the rack to move on the rack and thereby vertically lifting the bottom panel.

[0022] The method comprises the step of linearly moving the rack along its longitudinal axis.

[0023] Optional steps of the method are linearly moving the rack along its longitudinal axis to activate, e.g. by displacement, one or more locking members for a or each panel; and/or to activate, e.g. by displacement, one or more pushing members on a or each panel.

[0024] Positional terms such as e.g. *lower* or *higher* or *vertical* refer to the orientation that the system or the device have normally in use.

[0025] The following description regards a preferred embodiment of the system and will highlight further ad-

vantages, by reference to the accompanying drawings in which:

- Fig. 1 shows a side view of a displacement system for shading panels of a window with the panels in closed position;
- Fig. 2 shows a side view of the system of Fig. 1 with the panels in open position;
- Fig. 3 shows a front view of the system of Fig. 1 with the panels in closed position;
- Fig. 4 shows an enlarged view of the circle C1 of Fig. 1 for a first configuration of the system;
- Fig. 5 shows an enlarged view of the circle C1 of Fig. 1 for a second configuration of the system;
- Fig. 6 shows an enlarged view of the circle C1 of Fig. 1 for a third configuration of the system;
- Fig. 7 shows a side view of some components of the system;
- Fig. 8 shows a side view of a rack of the system.
- Fig. 9 shows a three dimensional view of a detail in the panel of the system.

[0026] In the figures identical numbers indicate identical or similar parts, and the system is described as being in use. In order not to crowd the drawings, not all of the equal elements are marked.

[0027] Figs. 1-3 show a displacement system MC for two panels 10, 12 connected together with a hinge 18 with horizontal axis X2 along a common edge. The panels 10, 12 are mounted to be stacked as a bellows and sliding vertically relative to the side uprights or struts 14 placed either on the masonry jambs or as a contour of a building opening. The displacement of the panels 10, 12 allows to obscure or uncover such opening.

[0028] The top panel 10 is oscillating in a known manner by means of pins about an axis X1 passing a bit below the upper horizontal margin SP of the opening.

[0029] Inside the uprights 14, on both sides, there is mounted a vertical rack 30 on which meshes a pinion 60 rotatably arranged on a skid or carriage 36 also provided with rolling wheels 22. For simplicity, the pinion toothing 60 is omitted from the figures.

[0030] Each pinion 60 is driven by a shaft 62, rotatable about an axis X3, connected to an electric motor 64 housed in the lower side of the panel 12. Preferably, the system MC is symmetrical with respect to a vertical axis Y passing through the centerline of the panels 10, 12 so as to balance the stresses.

[0031] The rack 30 is not fixed to the uprights 14 but can slide vertically for a short distance when it is released by a locking/unlocking mechanism, and preferably the rack 30 can slide along its longitudinal axis R, parallel to the axis Y. The locking/unlocking mechanism is formed by or comprises a lever or tooth 70 hinged on the uprights 14 so that one of its ends 78 can swing (arrow F). A spring (not shown) pushes the lever 70 towards the rack 30 (to the right in Figures 4-6).

[0032] The free end 78 of the lever 70 can reach (Fig.

8) an undercut or counter-tooth 80 formed on the rack 30 on the surface opposite to the toothing. The pinion 60 or a wheel 22 can push the lever 70 overcoming the spring force when the carriage 36 is in front and on the side of the lever 70 (Fig. 4), e.g. by exploiting a tapered portion or an inclined plane 72 comprised in the lever 70.

[0033] On the frame of rack 30 there are mounted protrusions or protruding pins 88, 92 (Fig. 1 and 2) that protrude from the surface of the upright 14 by means of suitable grooves or pass-through slots 58 present in the upright 14 itself. Therefore, at some points on the upright 14 the pins 88, 92 are exposed, and move integrally with the rack 30.

[0034] The pins 92 serve to lock a or each panel 10, 12 when the panels 10, 12 are coplanar. The pins 92 during, and thanks to, the movement of the panels 10, 12 can in fact enter into slots 98 present on the peripheral surface of the panel to be locked (Fig. 9), in correspondence of the edge of the panel adjacent to the uprights 14.

[0035] Once inside the slots 98, the pins 92 can then move "behind" an edge 99 of the slot itself to end up in a groove or recess or guide 97 in which they remain trapped. The guide or groove or recess 97 is formed in the side of the panel and develops parallel to the major surface of the panel, without openings in a direction perpendicular to such major surface.

[0036] The pin 88 serves to overcome the dead point of the panels 10, 12 in the opening phase. This pin 88 can cooperate with a groove or inclined plane 86 present on a side of the top panel 10. The groove or inclined plane 86 indeed constitute for the pin 88 a track, which has an entry for the pin 88 on the side edge of the panel 10, that is, the edge facing down when the panel 10 is raised. In the proposed example the groove or inclined plane 86 is a simple guide which develops along the thickness (or side) of the panel 10 with oblique direction with respect to the planes of its major surfaces.

OPERATION

[0037] With the panels 10, 12 packed (window not obscured), the system MC is in the configuration of Fig. 2.

[0038] The rack 30 is maximally displaced downwards (in abutment against the bottom of an upright 14) and the lever 70 engages the undercut 80.

[0039] To lower the panels 10, 12 the motor 64 is activated, and the shaft 62 rotates dragging the pinion 60, which descends along the rack 30 divaricating the panels 10, 12, which therefore begin to move away from each other and the window gets increasingly covered.

[0040] When the panels 10, 12 are almost coplanar the carriage 36 reaches the proximity of the lever 70 (Fig. 6), so that a wheel 22 or the pinion is able to touch the lever 70 causing it to lower.

[0041] Then the lever 70 begins to move away from the rack 30, until its end 78 comes out of the undercut 80 (Fig. 5), and accordingly the rack 30 is now free to move.

[0042] The pinion 60 continues to roll on the rack 30, which by reaction begins to rise (Fig. 4) and to move the pins 88, 92 upwards. Meanwhile the slots 98 on the panels 10, 12 have moved closer to the pins 92 so that the pins 92 get in the empty space of the slot (see schematic position P1 of a hatched pin 92 in Fig. 9). The last rotation amount of the pinion 70 concludes the descent of the panels 10, 12 (Fig. 1), and the pins 92 move from the empty space of the slot 98 beyond the edges 99 inside the guide or groove 97, which in this phase is practically aligned with the rack 30. Now the pins 92 are blocked, through interposing parts, by the walls of the guide 97, and the retrograde angular movement of the panel is then prevented (see schematic position P2 of the same pin hatched 92 in fig. 9).

[0043] In the opening phase the operations take place in reverse order.

[0044] To lift up the panels 10, 12, the motor 64 is activated in opposite direction, and the shaft 62 rotates dragging the pinion 60 in the opposite direction. The rack 30 is now free to translate (Fig. 4), and gets lowered by the pinion 60 which, consequently, moves forward slightly. The pins 92 and the slots 98 follow equal and opposite trajectories as the previous ones, so that the pins 92 first come out from the guide 97 and then from the slots 98, thereby freeing the panels 10, 12.

[0045] Together with the rack 30 also the pin 88 descends, which meets the inclined plane 86 and slides over it generating a force to move the panel 10 away from the opening (clockwise rotation in Fig. 2). That is, the cooperation of the pin 88 and the inclined plane 86 generate a momentum able to rotate the panel 10 in the direction that brings it upwards. So the deadlock on the vertical of the panels 10, 12 when they are coplanar, is overcome.

[0046] The rack 30 reaches the bottom of the upright 14 and stops there, the carriage 36 begins to climb the rack 30 until it moves away from, and no longer presses on, the lever 70, which pushed by the spring returns its end 78 inside the undercut 80. Now the rack 30 is locked and the carriage 30 reaches the upper end-position (fig. 2).

Claims

1. Device (MC) destined to move two panels (10, 12) hinged to each other on an edge thereof and mounted to vertically folding book-like one on the other in front of an opening to be obscured, comprising:

- a rack (30) mounted to the sides of the opening;
- an electric motor (64) located on the bottom panel (12);
- a rotatable pinion (60) driven by the motor and engageable on the rack to translate on the rack and thereby vertically lifting the bottom panel;

characterized in that

the rack is mounted to be able to move linearly along its longitudinal axis.

2. Device according to claim 1, comprising a mechanism for locking and unlocking (70) of the rack with respect to the sides of the opening, the locking and unlocking device being destined to prevent or allow the movement of the rack. 5
3. Device according to claim 2, comprising an element (36) which is integral with a panel and destined to trigger the mechanism for locking and unlocking. 10
4. Device according to claim 3, wherein said integral element comprises or consists of a carriage (36) on which the pinion is rotatably mounted. 15
5. Device according to claim 2 or 3 or 4, wherein the mechanism for locking and unlocking comprises or consists of a lever (70) movable between two positions: a first position in which by interference it blocks the displacement of the rack and a second position in which it leaves the rack free to translate. 20
6. Device according to claim 5, wherein the lever is mounted to be moved directly by the pinion or by the carriage. 25
7. Device according to claim 5 or 6, comprising an elastic element destined to generate an elastic force to trigger the mechanism for locking and unlocking. 30
8. Device according to any one of the preceding claims, wherein the rack is mounted to activate, by its movement, a device for locking and unlocking (92) a panel with respect to the sides of the opening. 35
9. Device according to any one of the preceding claims, wherein the rack is mounted to activate, by its movement, a device (88) destined to generate a force on a panel to tilt it relative to the vertical. 40
10. Method for moving and/or locking two panels (10, 12) hinged one to the other on an edge thereof and mounted to vertically fold book-like one on the other in front of an opening to be obscured, the panels being comprised in a drive system (MC) of the panels which comprises 45
 - a rack (30) mounted to the sides of the opening;
 - an electric motor (34) on the bottom panel (12);
 - a rotatable pinion (60) driven by the motor and engageable on the rack to move on the rack and thereby vertically lifting the bottom panel; 50

the method comprising the step of linearly moving the rack along its longitudinal axis. 55

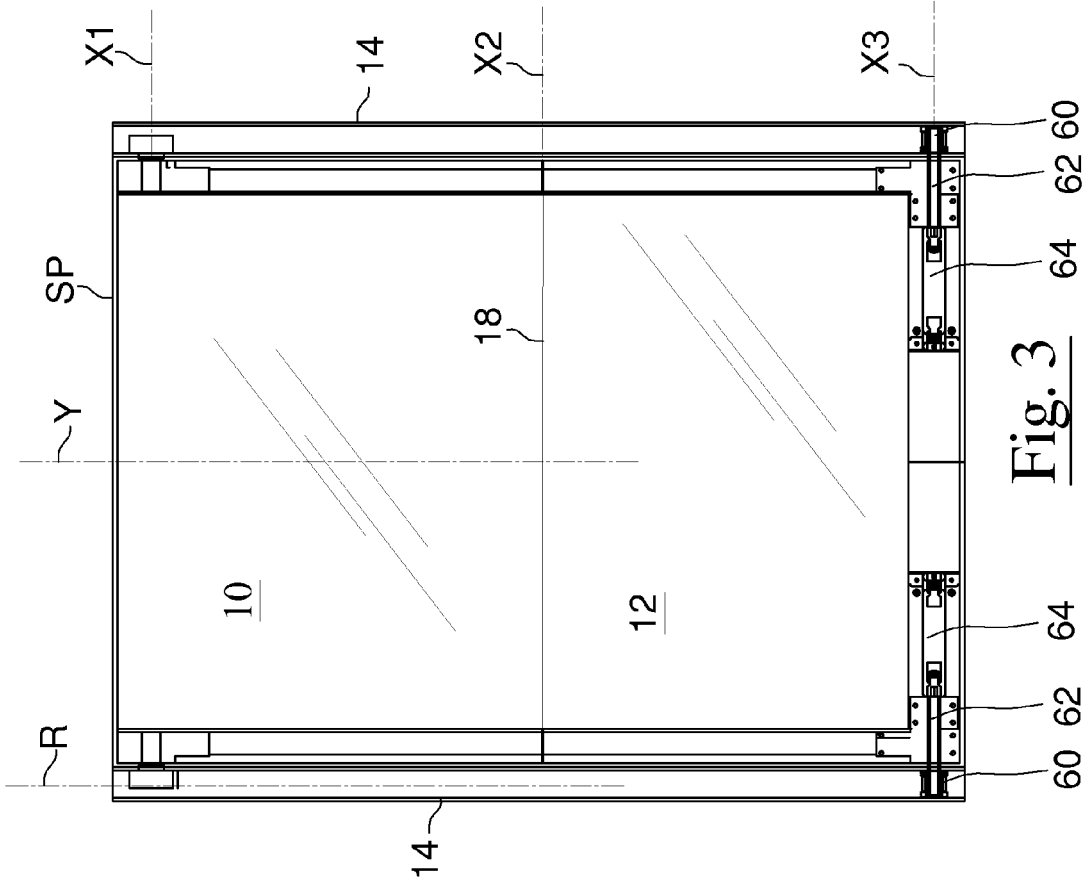


Fig. 3

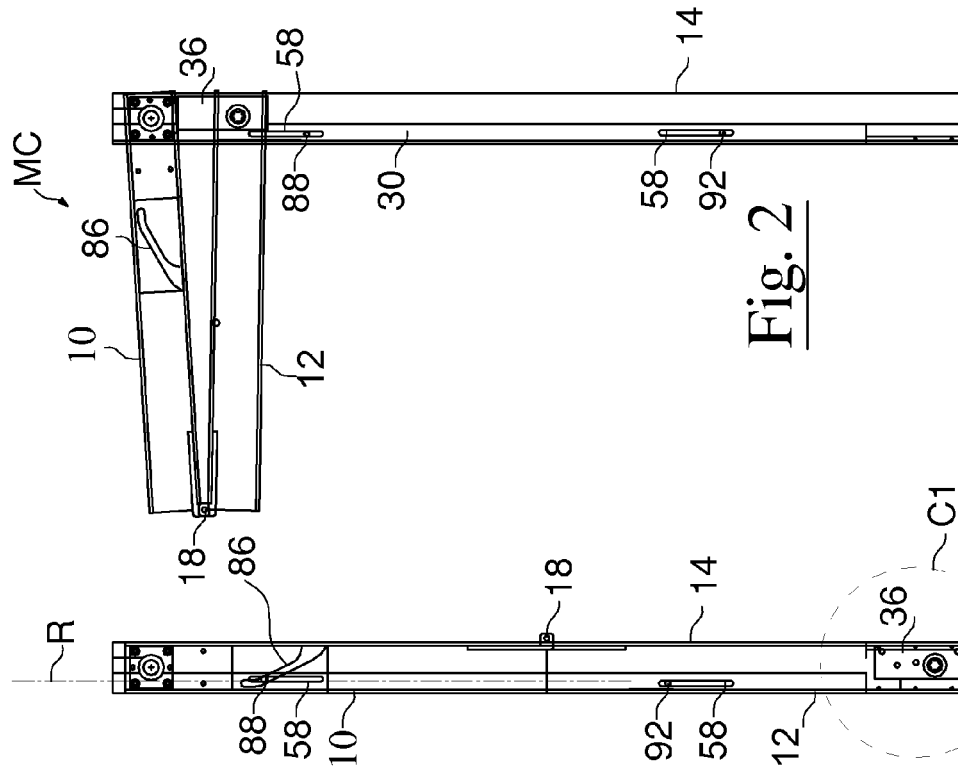


Fig. 2

Fig. 1

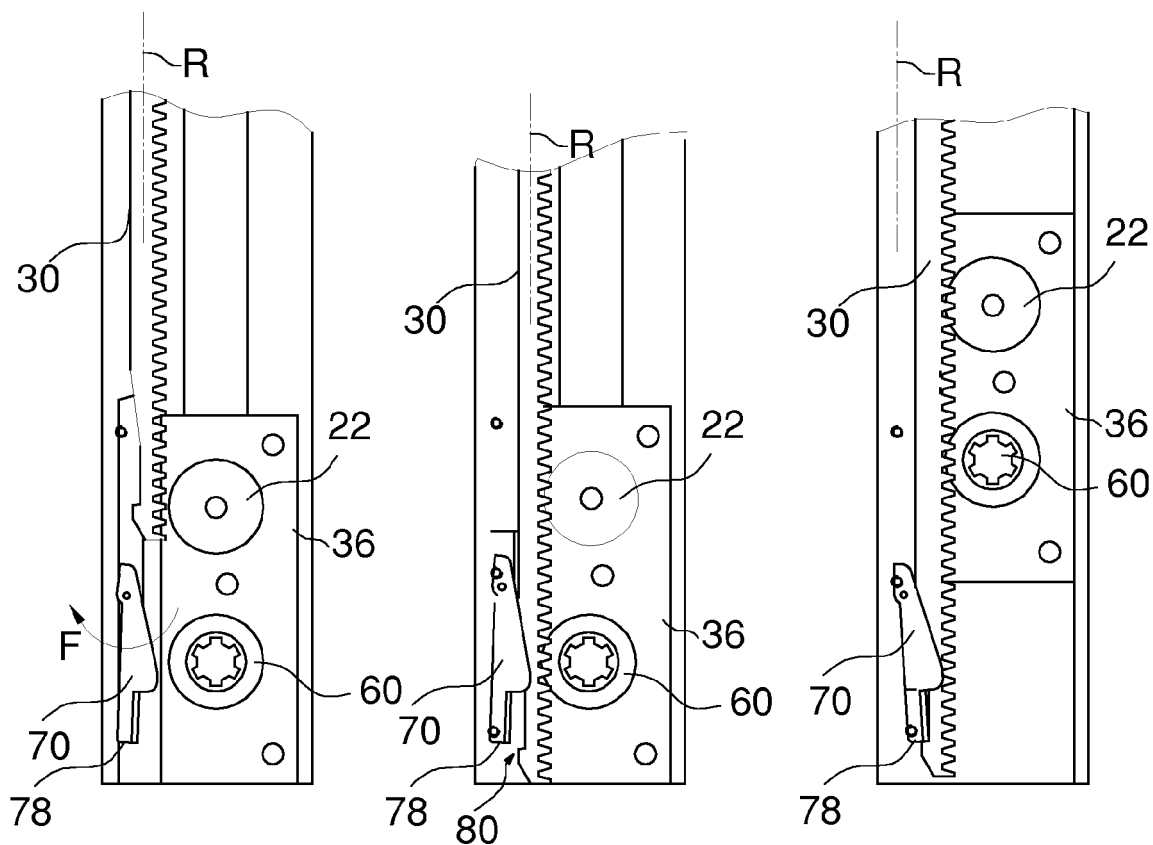


Fig. 4

Fig. 5

Fig. 6

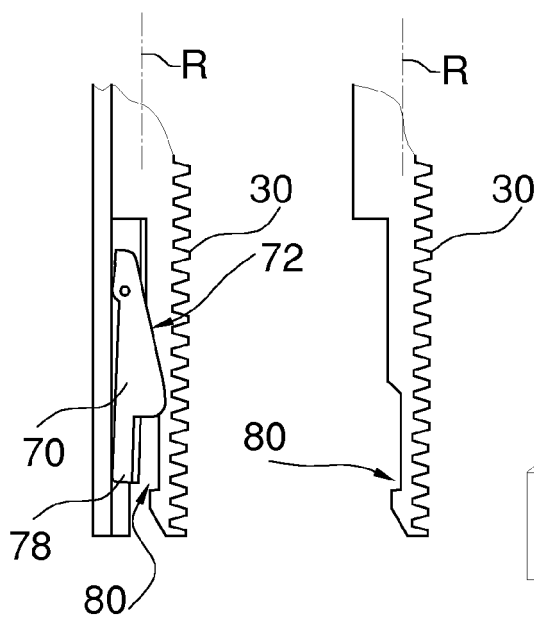


Fig. 7

Fig. 8

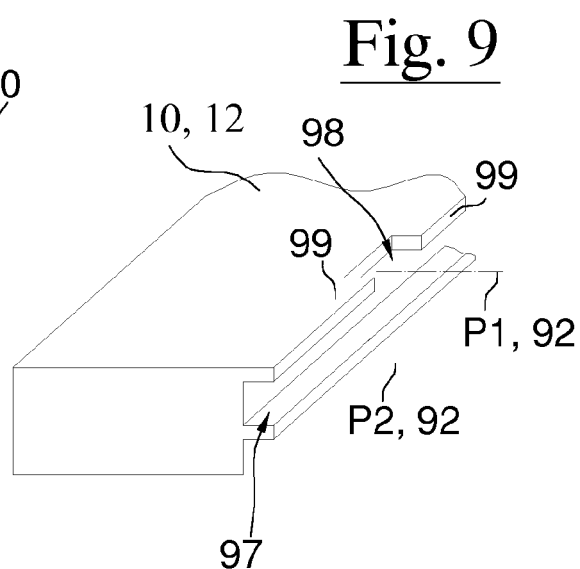


Fig. 9



EUROPEAN SEARCH REPORT

Application Number
EP 16 18 6736

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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 9 January 2017	Examiner Guillaume, Geert
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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