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(54) **A lifting device and a window comprising such a lifting device**

(57) The lifting device (10) has a lifting arm (14), one end of which is intended to be pivotally connected with the first or second member of the structure and the other

end associated with a biased slide shoe (20) intended to be mounted on the second or first member of said structure. In order to modulate the force from the bias, a braking device is provided in the slide shoe.

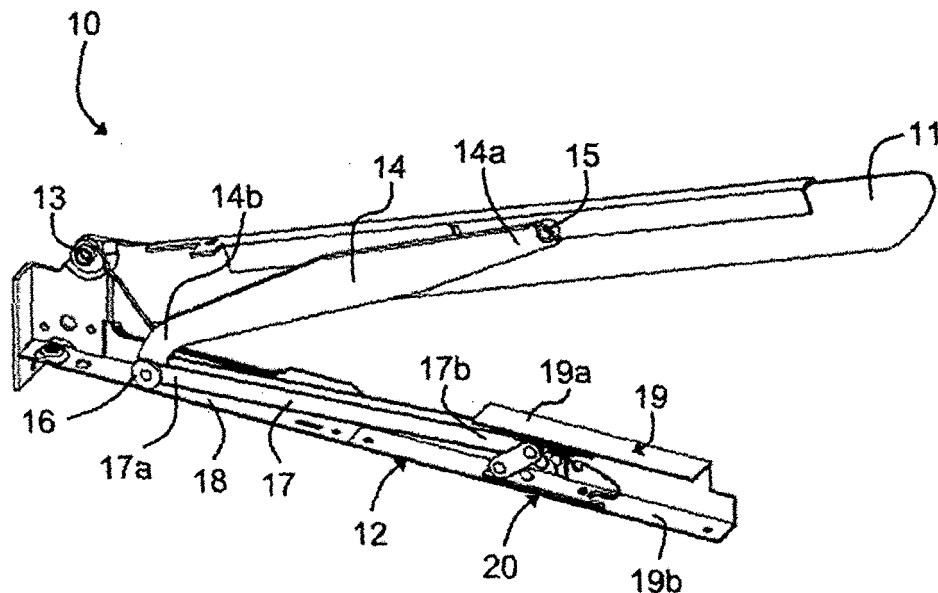


Fig. 2

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Description

[0001] The present invention relates to a lifting device for an openable structure for assisting in opening a first member of the structure relative to a second member of the structure, comprising a lifting arm having two ends, one end intended to be pivotally connected with the first or second member of the structure and the other end associated with a biased slide shoe intended to be movable with respect to the second or first member of said structure. The invention furthermore relates to a window comprising such a lifting device.

[0002] Such structures are traditionally installed in inclined surfaces such as for instance roofs of a building. Different installation situations include different inclinations of the structure with respect to the horizontal. In turn, this entails that the moment resulting from the weight of the first member differs from one installation situation to another. The lifting device is usually chosen such that the bias is adapted to the installation situation. For instance, if the structure is to be installed in a surface having only a small inclination with respect to the horizontal a high degree of bias is usually required in order to assist the opening movement during the initial movement of the first member, i.e. when the first member still forms a small angle relative to the second member. However, as the moment resulting from the weight peaks when the first member is horizontal, the bias will be too high for the remaining part of the opening movement and it is not, without further measures, possible to place the first member in an arbitrary position outside this interval. It is thus desirable that the moment resulting from the bias, via the lifting arm, on the first member during the opening movement corresponds in substance to but does not exceed the weight moment. Furthermore, when closing a structure both the bias and the friction must be overcome, and the resulting moment during closing is thus higher than the moment during opening.

[0003] A lifting device and a window of this kind is disclosed in, i.a., Applicant's WO-A-89/10460 and EP 0 733 146 B1. By applying certain measures, it is possible to adapt one and the same lifting device to different installation situations. However, although the lifting devices disclosed in these documents have proven to function well for most fields of application, the adjustment possibilities are not always controllable to the desired extent.

[0004] With this background it is an object of the present invention to improve a lifting device of the kind mentioned in the introduction with respect to flexibility regarding different installation conditions.

[0005] This and further objects are met by the provision of a lifting device, which is characterized in that the slide shoe comprises a braking device, and that said braking device modulates the force resulting from the bias.

[0006] In this manner, it is possible to provide a larger span in the range of the overall force resulting from the braking device and the bias acting on the slide shoe of the lifting device in accordance with the installation situ-

ation. In this manner, one and the same lifting device may be utilized in structures built into surfaces of different inclinations.

[0007] In an embodiment, which is particularly simple with respect to manufacture, the braking device of the slide shoe comprises a linkage mechanism having two brake members connected with each other by a link extending at an angle with respect to a guidance portion forming at least one face in contact with a respective brake member.

[0008] In an embodiment, which in addition to being simple with respect to manufacturing is very simple to install, the lifting device further comprises a first plate member and a second plate member intended to be connected with the first and second structure member, respectively, the first and second plate members being connected with each other by means of a hinge.

[0009] In a further development of this embodiment, the second plate member comprises said guidance portion, said guidance portion being preferably situated at a distance from the hinge, said slide shoe being movably accommodated in the guidance portion. As an alternative, however, the slide shoe may be made movable along the first and second member of the structure itself. In this respect it is noted that the term "movable" is to be interpreted as covering any kind of displacement, including sliding, rolling or any combination of such movements.

[0010] Preferably, the brake members are movable along opposed faces of the guidance portion. This provides for a reliable function of the lifting device.

[0011] In one embodiment, the guidance portion is substantially U-shaped, one brake member is movable along one leg of the U-shape and the other along the opposite leg of the U-shape, the link extends from the one brake member towards the other brake member forming an acute angle with the one leg, said other brake member being connected with the bias of the slide shoe.

[0012] In an alternative embodiment, the guidance portion is substantially rod-shaped, that one brake member is movable along one side of the rod and the other along the opposite side of the rod, that the link extends from the one brake member towards the other brake member forming an obtuse angle with the one side, said other brake member being connected with the bias of the slide shoe.

[0013] The brake members of the slide shoe may take any suitable form. In one embodiment, at least one of said brake members is a sledge-shaped or box-shaped element having a substantially plane side facing the respective face of the guidance portion.

[0014] The smoothness of the operation is improved by a further development of this embodiment, in which at least one brake member is provided with a friction adjusting layer on its substantially plane side.

[0015] Alternatively, the other of said brake members may be a roller. A suitable combination of a sledge-shaped or box-shaped element and a roller may hence

be chosen according to the particular demands to the slide shoe in the lifting device in question.

[0016] The opposed faces of the guidance portion may be mutually parallel, or comprise portions having a mutually converging and/or diverging extension. This makes it possible to have different patterns of braking forces when the slide shoe moves along the guidance portion.

[0017] In one further embodiment, at least one of the opposed faces of the guidance portion is provided with a number of protrusions and/or depressions. This makes it possible to obtain a corresponding number of predefined positions, in which the braking force exerted is relatively larger, as the brake member must be moved past the protrusion and out of the depression, respectively.

[0018] Correspondingly, it is preferable that the second plate member comprises an abutment portion for the other end of the lifting arm. Alternatively, the lifting arm may be movable along the structure itself.

[0019] In an embodiment, which is particularly advantageous in structure having spatial limitations at the hinge, an intermediate arm is inserted between said other end of the lifting arm and the slide shoe. Such lifting devices are traditionally built into a structure, such as a window, near the hinge connection between the first and second members of the structure. In order to adapt to the spatial conditions in the structure the entire lifting device is normally designed with as low a height and width as possible, as it is particularly these dimensions of the lifting device that are crucial. It is thus possible to mount the lifting device in such a manner that the intermediate arm extends, in a mounted position, substantially in parallel with the second or first structure member. As the entire slide shoe is positioned further down on the structure member in question, i.e. at a distance from the hinge connection of the first and second structure members, the spare room at the hinge connection is not occupied more than strictly necessary. As the force from the bias acting on the slide shoe does not act directly on the lifting arm due to the separating intermediate arm it is furthermore possible to design the slide shoe according to for instance the installation situation.

[0020] In order to secure smooth operation of the lifting device, the other end of the lifting arm and the intermediate arm may be connected with each other by means of a wheel.

[0021] In a further aspect of the invention, a window comprising a frame and a sash is provided, said window being characterized in that at least one lifting device is mounted on the frame and the sash.

[0022] Preferably, the slide shoe is mounted on a side member of the frame and the lifting arm is pivotally connected with a side member of the sash.

[0023] In the following, the invention will be described in further detail with reference to the accompanying drawings, in which

position,

Fig. 2 shows a perspective view of an embodiment of a lifting device according to the invention,

Fig. 3 shows a side view of a detail of the lifting device of Fig. 2;

Figs. 4a and 4b show graphs showing the relationship between forces and distance travelled by parts of the lifting device;

Fig. 5 is a view corresponding to Fig. 3 of an alternative embodiment of the lifting device according to the invention;

Figs. 6, 7, 8 and 9 are schematic views, on a larger scale, of further embodiments of braking devices of the lifting device according to the invention.

[0024] In the embodiment of the window shown in Fig. 1, the window comprises a sash 1 and a frame 2. The window is intended to be built into a surface, which may be inclined with respect to the horizontal as is suggested by the angle of the window in Fig. 1. At the top of the frame 2 there is a hinge connection to the sash 1 carrying a glazing 3. The hinge connection will be described in further detail below. In a manner known per se, the frame 2 and sash 1 is each formed by four members of which the frame side member 2a and the sash side member 1a and sash bottom member 1b are indicated. The sash 1 is openable with respect to the frame 2, as the sash 1 may be moved from a closed position, in which e.g. the sash side member 1a is substantially parallel with the frame side member 2a, to an open position, in which the sash side member 1a forms an angle with the frame side member 2a. During this movement the sash 1 rotates about at hinge axis situated at the hinge connection at the top of the frame 2 and the sash 1. For assisting the movement of the sash 1 from the closed position to an open position, a lifting device generally designated 10 is mounted between the sash 1 and the frame 2 in a manner that will be described in further detail below. Other embodiments of the window are conceivable; e.g. the frame could be connected, at the top, with an intermediate frame constituting a support to a glass-carrying pivotal sash which is able to rotate or pivot about a central hinge axis of the sash. The pivotal sash would, in this case, be connected with the intermediate frame by means of an upper closing means, the hinges at the top thus being in use at normal operation of the sash during opening and closing, while the pivoting function is mainly used for cleaning the outside of the glass.

[0025] Referring now to Figs. 2 and 3, in which the lifting device 10 in the shown embodiment comprises a first plate member 11 and a second plate member 12. The first and second plate members 11, 12 are connected with each other by means of a hinge 13. In the embodiment of the window shown in Fig. 1, the first plate member 11 is connected with the sash side member 1a whereas the second plate member 12 is connected with the frame side member 2a. There may be a similar, possibly mirror-inverted lifting device at the other side members of the

Fig. 1 shows a perspective view of an embodiment of a window according to the invention, in an open

sash and frame. The first plate member may be connected with the stationary part of the structure in question, *in casu* the frame 2. In case the window is provided with an intermediate frame as described in the above, the connection between the intermediate frame and the glass-carrying sash could, e.g., be situated at the end of the first plate member 11 opposite relative to the hinge 13.

[0026] A lifting arm 14 of the lifting device 10 is at one end 14a pivotally connected at 15 with the first plate member 11 and at the other end 14b connected with a wheel 16 and one end 17a of an intermediate arm 17. As will be described in detail in connection with the below description of the operation of the lifting device, the wheel 16 is displaceable along an abutment portion 18 of the second plate member 12.

[0027] The other end 17b of the intermediate arm 17 is connected with a slide shoe generally designated 20. In the embodiment shown, the slide shoe 20 is displaceable in a longitudinal direction of the second plate member 12 and hence, in the embodiment of Fig. 1, in the longitudinal direction of the frame side member 2a by slidable accommodation in a guidance portion 19 of the second plate member 12. However, the term "slide shoe" should be interpreted to cover any element which is capable of performing such a displacement by means of any combination of movements including sliding, rolling etc.

[0028] In the embodiment shown in Fig. 2, the guidance portion 19 is substantially U-shaped having a first leg 19a forming a first face of the guidance portion 19 and a second leg 19b forming a second face of the guidance portion 19. The second leg 19b is formed integrally with the abutment portion; however, other configurations are of course conceivable. The slide shoe 20 is biased, i.e. influenced by any means providing a load on the slide shoe. This bias may be provided in any suitable manner. In the embodiment shown in Fig. 2, the bias is represented by a spring arrangement (not shown in this Figure). Most commonly, the spring arrangement comprises a spring, or two springs, as is described in further detail in Applicant's above-mentioned European patent No. 0 733 146 B1, the contents of which are hereby incorporated by reference.

[0029] As shown more clearly in Fig. 3, in which the second plate member and the spring arrangement have been removed for clarity reasons, the slide shoe 20 comprises a braking device. The braking device comprises a linkage mechanism having two brake members 21 and 22 connected with each other by a link 23 extending at an angle with respect to each brake member such that the brake members 21, 22 and the link 23 may assume a number of angular positions relative to each other. The brake members 21 and 22 are slidable along opposed faces of the guidance portion 19, viz. along the first and second legs 19a and 19b, respectively. The link 23 extends from the one brake member 21 towards the other brake member 22 forming an acute angle with respect to the contact surface between the brake member in

question and the relevant face of the guidance portion, i.e. in the embodiment shown between the brake shoe 21 and the first leg 19a and/or between the brake shoe 22 and the second leg 19b. The intermediate arm 17 is connected with the slide shoe 20 at the connection between the one brake member 21 and the link 23, the other brake member 22 being connected with the bias of the slide shoe 20. To this end, the brake member 22 has a hook-shaped recess 24, the point of action of the load from the bias thus being positioned at the recess 24. From the recess 24 in the brake member 22, the load is transferred to the lifting arm 14 and hence, in the embodiment shown, to the window sash 1 via the link 23, brake member 21 and the intermediate arm 17. Each or both brake members may be provided with a friction adjusting layer on the respective side facing the face of the guidance portion to reduce the wear on the brake members and the guidance portion.

[0030] The operation of the lifting device when installed in the embodiment of the window shown in Fig. 1 is as follows:

From a closed position, the user operates the operating device of the window. The operating device may be a handle (not shown) connected with the sash bottom member 1b, or include auxiliary opening means such as one or more pressure medium cylinders, chain operators etc. The bias of the lifting device acts on the slide shoe 20, the point of action being, as described in the above, the recess 24 in the other brake member 22. This load is transmitted, via the link 23 and the one brake member 21, to the intermediate arm 17 and, in turn, to the lifting arm 14. The lifting arm 14 exerts a moment on the sash 1 relative to an axis, which in the embodiment shown is the hinge axis of the window located at the hinge 13 of the lifting device 10. In combination with the force, and hence moment, exerted by the user operating the operating device, the moment resulting from the weight of the sash 1 is overcome. During this movement, the slide shoe 20 and the wheel 16 at the connection between the intermediate arm 17 and the lifting arm 14 are displaced along the guidance portion 19 and the abutment portion 18, respectively, of the second plate member 12. All in all, this operation entails that the sash 1 is moved from a closed position to an open position as represented by Fig. 1.

[0031] Closing the window from the open position entails the opposite movements of the sash 1 and relevant parts of the lifting device.

[0032] During the opening and the closing of the window, the braking device incorporated into the lifting device 10 modulates the force resulting from the bias acting on the slide shoe of the lifting device.

[0033] In order to explain the fundamental principles underlying the lifting device according to the invention,

reference is made to Figs. 4a and 4b which show graphs indicating the relationship between force and distance travelled in a conventional spring arrangement and a spring arrangement forming part of the lifting device according to the invention, respectively.

[0034] In the conventional spring arrangement shown in Fig. 4a, the force is proportional to the distance travelled and no hysteresis effect occurs. That is, the compressive force required to preload or bias the spring corresponds to the tensional force resulting from the relief of the load or relaxation of the spring (indicated by arrows A and B, respectively).

[0035] The effect occurring in a lifting device having a slide shoe comprising a braking device to modulate the force is indicated in Fig. 4b. As with the conventional spring arrangement, the force during preloading and relief of the load, respectively, is proportional to the distance travelled by the spring. However, during relief of the load, i.e. during opening of for instance a window, the force follows a curve starting in point A' and ending in point B'. The reason for this is that the braking device modulates the force from the spring. During preloading or biasing of the spring, i.e. during closing of the window, the resulting force describes a curve extending from point B" to A". Hence, the resulting curve describes different paths when relieving and biasing the spring arrangement, thus resulting in a hysteresis.

[0036] In a structure, such as a window, incorporating a lifting device according to the invention, this effect provides for a larger span of the resulting force from the spring arrangement and the braking device. The moment relative to the hinge axis originating from this resulting force describes corresponding curves (not shown) during opening and closing, respectively, depending on other factors as well, such as the current angle between the sash and the lifting arm. This, in turn, results in that the sash of the window may be placed in a stable ventilation position within a larger number of opening angles for windows installed in roofs having different roof inclinations.

[0037] The hysteresis effect may be optimized in accordance with the requirements of the chosen installation conditions. The lifting device may be modified in that the second plate member 12 may be provided with an increased distance between the first and second legs of the guidance portion 19. This would result in an even more pronounced hysteresis effect.

[0038] Obviously, the limit of the distance between the two legs of the guidance portion is when the two brake members 21 and 22 do not perform any braking against the legs of the guidance portion any longer, i.e. when the link 23 no longer forms an acute angle with respect to the contact surface between the brake member in question and the relevant face of the guidance portion, i.e. in the embodiment shown between the brake shoe 21 and the first leg 19a and/or between the brake shoe 22 and the second leg 19b.

[0039] It is noted that instead of varying the distance between the legs of the guidance portion, the length of

the link 23 could have been varied.

[0040] In the alternative embodiment shown in Fig. 5 elements having the same or analogous function as in the embodiment of Figs. 2 and 3 carry the same reference numerals to which 100 has been added. Only differences with respect to the first embodiment will be described in detail.

[0041] In the embodiment of the lifting device 110 shown in Fig. 5 the guidance portion 119 is substantially rod-shaped. For instance, the guidance portion or rod 119 may be connected with a second plate member (not shown) as in the embodiment of Figs. 2 and 3. One brake member 121 is slidable along one side 119a of the rod 119 and the other 122 along the opposite side 119b of the rod. The sides 119a and 119b thus form the opposed faces of the rod 119 forming the guidance portion. Link 123 extends from the one brake member 121 towards the other brake member 122 forming an obtuse angle with the one side 119a of the rod 119, the one side 119a thus constituting the face in contact with a respective brake member. As in the embodiment of Figs. 2 and 3, the intermediate arm 117 is connected with the slide shoe 120 at the connection between the one brake member 121 and the link 123, the other slide shoe 122 being connected with the bias schematically indicated by 125.

[0042] In the above embodiments, each brake member slidable along opposed faces of the guidance portion is shown as a sledge-shaped or box-shaped element having a substantially plane side facing the respective face of the guidance portion. Furthermore, the opposed faces of the guidance portion are shown as mutually parallel and plane faces.

[0043] However, the brake members and the opposed faces of the guidance portion may in principle assume any form suitable for the purpose. Examples of modifications of the braking device are shown in Figs. 6, 7 8, and 9 below. In each of these embodiments, elements having the same or analogous function as corresponding elements in the embodiment of Figs. 2 and 3 carry the same reference numerals to which 200, 300, 400 and 500, respectively, has been added. Only differences with respect to the first embodiment will be described in detail.

[0044] In the embodiment of Fig. 6, the slide shoe 220 has one brake member in the form of a roller 221 and another brake member shown as a box-shaped element 222. In a manner corresponding to that of the first embodiment, the roller 221 is connected with the box-shaped element 222 by link 223 extending at an angle with respect to each brake member such that the brake members 221, 222 and the link 223 may assume a number of angular positions relative to each other. The brake members 221 and 222 are movable, i.e. in this embodiment displaceable in a rolling and slidable manner, respectively, along opposed faces 219a and 219b of the guidance portion 219. The intermediate arm 217 is connected with the slide shoe 220 at the connection between the one brake member 221 and the link 223, the other brake member 222 being connected with the

bias of the slide shoe 220 (not shown) via an arm 226. The box-shaped brake member 222 may be provided with a friction adjusting layer on the side facing the face 219b of the guidance portion 219.

[0045] As is indicated schematically in Fig. 6, the first face 219a and the second face 219b converge towards the right-hand side of the Figure. In an installation situation of the lifting device corresponding to that of Fig. 1, this implies that brake members 221 and 222 of the braking device are pressed towards each other as the slide shoe 220 is moved along the guidance portion 219 during the opening movement of the window sash. The braking force is thus reduced. This convergence may constitute a part only of the entire guidance portion. The convergence may even be so pronounced that the movement of the window sash comes to a complete stop when the slide shoe 220 cannot travel any further along the guidance portion 219.

[0046] Furthermore, in order to provide a number of predefined positions, in which the braking force exerted is relatively larger, at least one of the opposed faces of the guidance portion is provided with a number of protrusion and/or depressions. In the embodiment of Fig. 6, this is accomplished by a depression 227 and a protrusion 228 in the first face 219a of the guidance portion 219. During the movement of the slide shoe 220, roller 221 is temporarily arrested by its engagement with the depression 227 and the protrusion 228. When the window sash is to be moved further, the brake member in the form of roller 221 must be moved past the protrusion 228 and out of the depression 227, respectively.

[0047] The first and second faces 219a and 219b may be formed integrally, for instance by means of a cross-sectionally U-shaped guidance portion as in the embodiment of Figs. 2 and 3, the U-shape thus tapering from the left to the right; however, other configurations are of course conceivable.

[0048] A further variation is shown in the embodiment of Fig. 7, in which one brake member is formed as a box-shaped element 321 and the other as a roller 322. The opposed faces 319a and 319b of the guidance portion 319 are formed as a plane surface and a convex surface, respectively. This provides for a variation in the braking force during the movement of the slide shoe 320 along the guidance portion 319, the braking force thus reaching a lowest point when the slide shoe 320 passes the narrowest place. The convex surface may have any suitable radius of curvature. The radius of curvature may be constant or vary along the path along which the slide shoe travels.

[0049] The embodiment of Fig. 8 is a variation of the embodiment of Fig. 5 to show that it is obviously also possible to provide a rod-shaped guidance portion 419 with brake members in the form of one roller 421 and one box-shaped element 422. Furthermore, the rod-shaped guidance portion 419 may be provided with protrusions/and or depressions, in the example one protrusion 427.

[0050] In a still further embodiment, shown in Fig. 9, the lifting arm 514 is connected directly with one of the brake members and hence not via an intermediate arm. This brake member 521 is formed as a box-shaped brake member, to which the bias 525 is furthermore connected. As in the above-mentioned embodiments, the brake member 521 is connected with the other brake member 522, formed as a roller, by means of link 523. The brake members 521 and 522 are movable along opposed faces 519a and 519b, respectively, of the guidance portion 519. In a manner similar to the one already described, the braking force provided by the braking device of the slide shoe 520 depends on the angle between link 523 and the respective faces 519a, 519b, and on other factors such as for instance the presence of a friction adjusting layer on the face of the box-shaped brake member 521 facing the guidance portion face 519a.

[0051] The person skilled in the art will appreciate that several modifications and combinations of the embodiments shown and described are conceivable.

Claims

1. A lifting device for assisting in opening a first member of a structure relative to a second member of the structure, comprising a lifting arm having two ends, one end intended to be pivotally connected with the first or second member of the structure and the other end associated with a biased slide shoe intended to be movable with respect to the second or first member of said structure, **characterized in that** the slide shoe comprises a braking device, and that said braking device modulates the force resulting from the bias.
2. A lifting device according to claim 1, **characterized in that** the braking device of the slide shoe comprises a linkage mechanism having two brake members connected with each other by a link extending at an angle with respect to a guidance portion forming at least one face in contact with a respective brake member.
3. A lifting device according to claim 2, **characterized in further** comprising a first plate member and a second plate member intended to be connected with the first and second structure member, respectively, the first and second plate members being connected with each other by means of a hinge.
4. A lifting device according to claim 3, **characterized in that** the second plate member comprises said guidance portion, said guidance portion being preferably situated at a distance from the hinge, said slide shoe being movably accommodated in the guidance portion.

5. A lifting device according to claim 4, **characterized in that** the brake members of the slide shoe are movable along opposed faces of the guidance portion.
6. A lifting device according to claim 5, **characterized in that** the guidance portion is substantially U-shaped, that one brake member is movable along one leg of the U-shape and the other along the opposite leg of the U-shape, and that the link extends from the one brake member towards the other brake member forming an acute angle with the one leg of the U-shape, said other brake member being connected with the bias of the slide shoe.
7. A lifting device according to claim 5, **characterized in that** the guidance portion is substantially rod-shaped, that one brake member is movable along one side of the rod and the other along the opposite side of the rod, and that the link extends from the one brake member towards the other brake member forming an obtuse angle with the one side, said other brake member being connected with the bias of the slide shoe.
8. A lifting device according to any one of claims 2-7, **characterized in that** at least one of said brake members is a sledge-shaped or box-shaped element having a substantially plane side facing the respective face of the guidance portion.
9. A lifting device according to claim 8, **characterized in that** said at least one brake member is provided with a friction adjusting layer on its substantially plane side.
10. A lifting device according to any one of claims 2-9, **characterized in that** at least one of said brake members is a roller.
11. A lifting device according to any one of claims 5 to 10, **characterized in that** the opposed faces of the guidance portion are mutually parallel.
12. A lifting device according to any one of claims 5 to 10, **characterized in that** the opposed faces comprise portions having a mutually converging and/or diverging extension.
13. A lifting device according to any one of claims 11 and 12, **characterized in that** at least one of the opposed faces of the guidance portion is provided with a number of protrusions and/or depressions.
14. A lifting device according to any one of claim 3 to 13, **characterized in that** the second plate member comprises an abutment portion for the other end of the lifting arm.
15. A lifting device according to any one of the preceding claims, **characterized in that** an intermediate arm is inserted between said other end of the lifting arm and the slide shoe.
16. A lifting device according to claim 15, **characterized in that** the other end of the lifting arm and the intermediate arm are connected with each other by means of a wheel.
17. A window comprising a frame and a sash, **characterized in that** at least one lifting device according to any one of claims 1 to 16 is mounted on the frame and the sash.
18. A window according to claim 17, **characterized in that** the slide shoe is mounted on a side member of the frame and the lifting arm is pivotally connected with a side member of the sash.

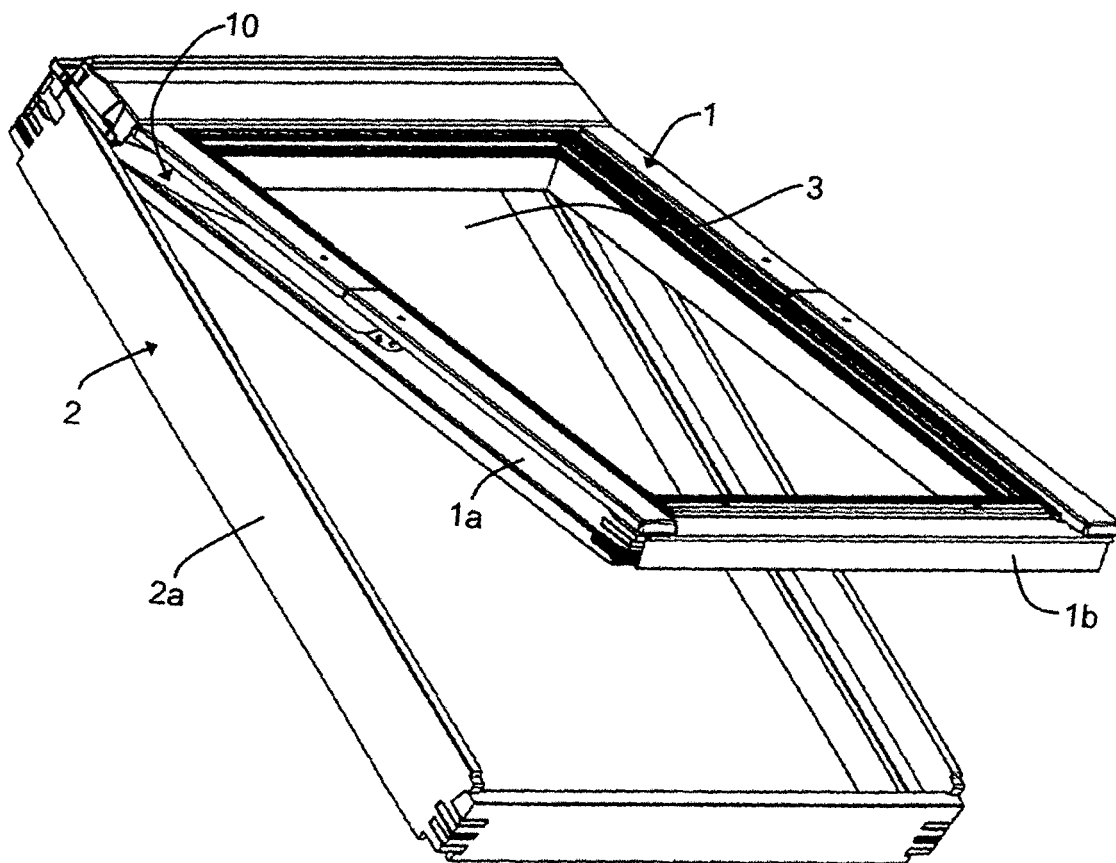
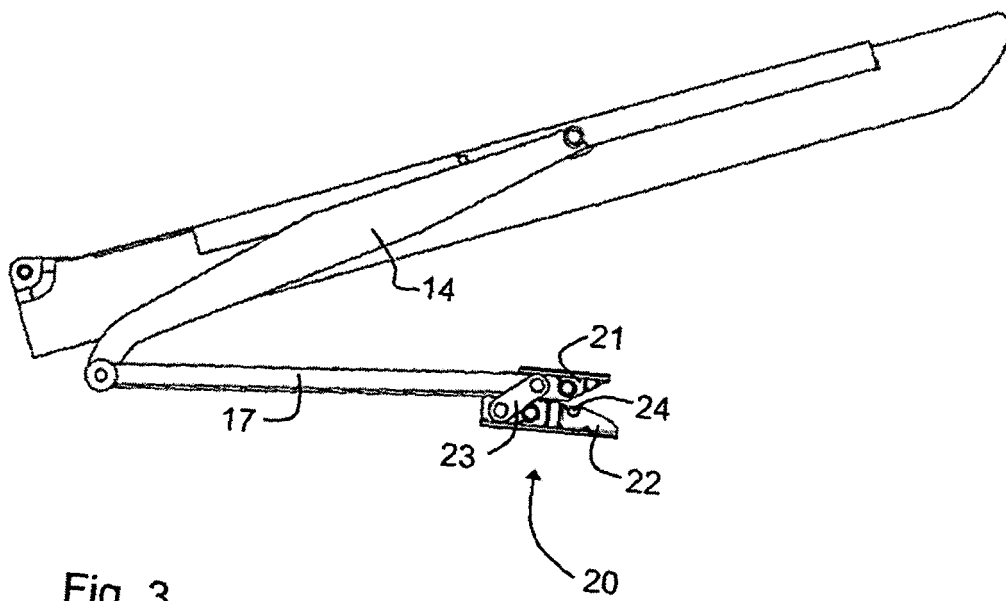
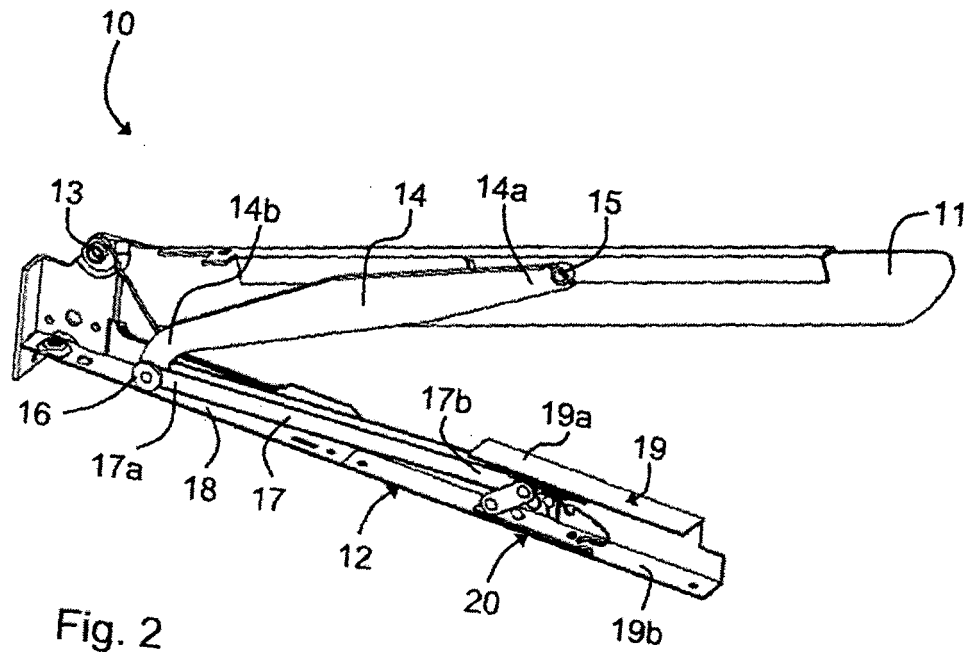


Fig. 1



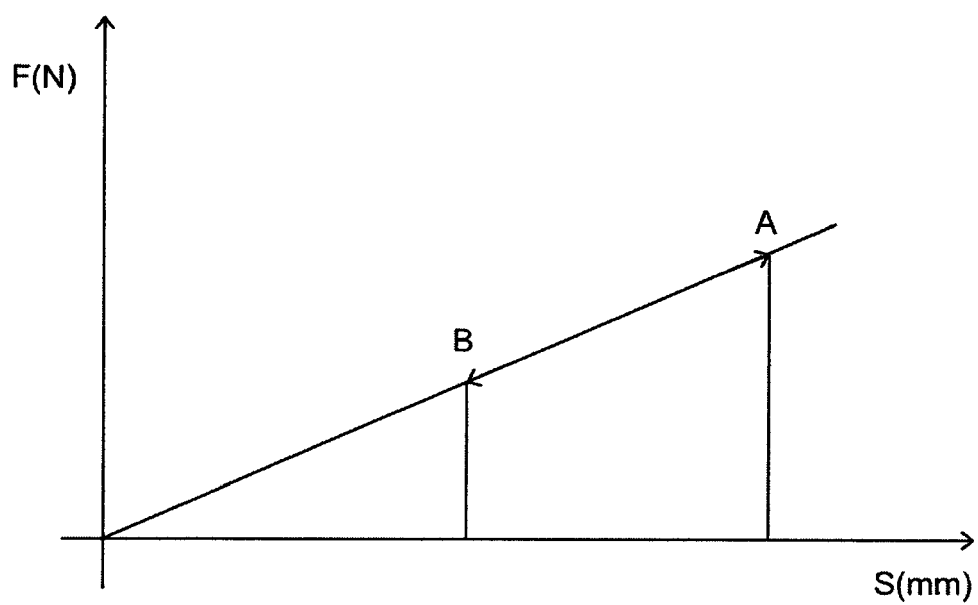


Fig. 4a

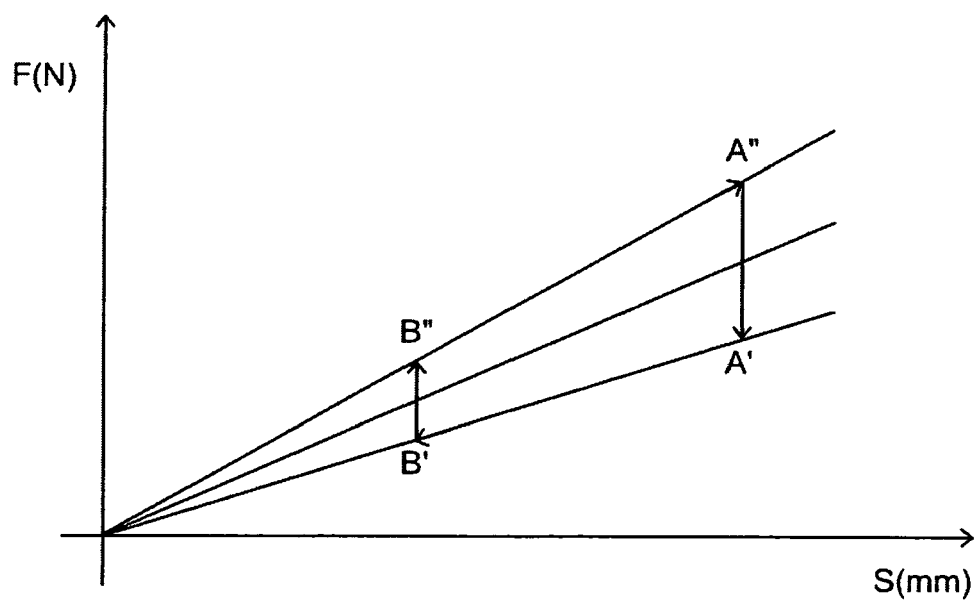


Fig. 4b

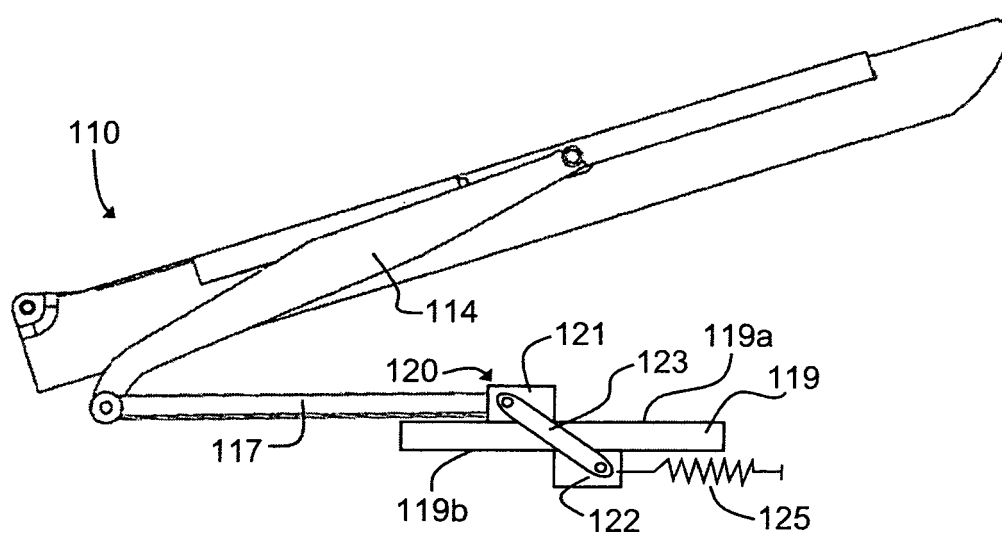
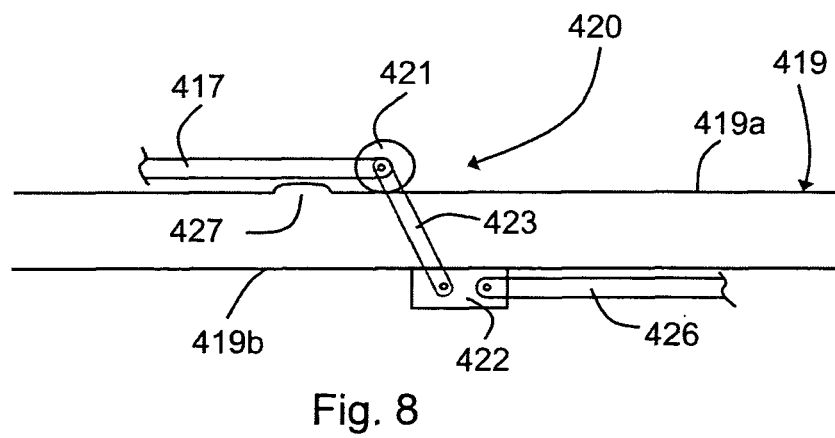
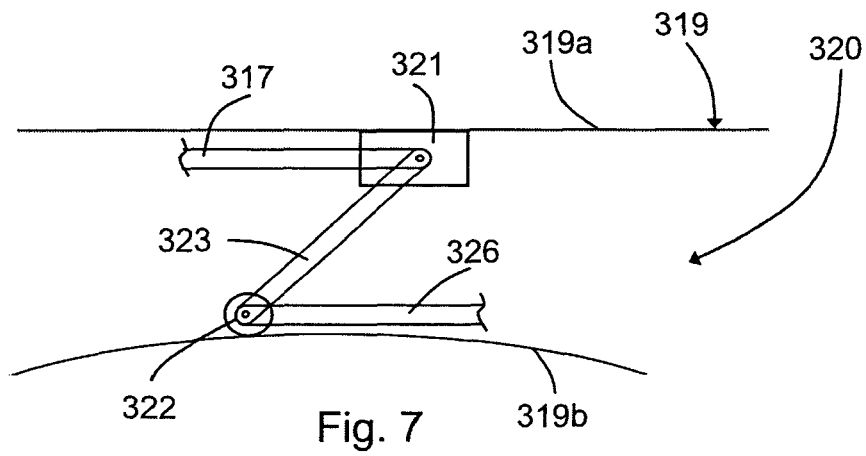
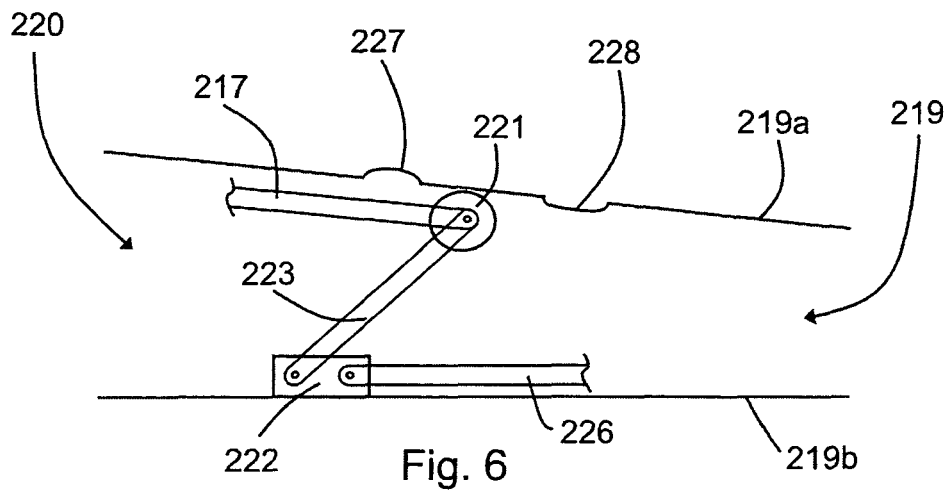
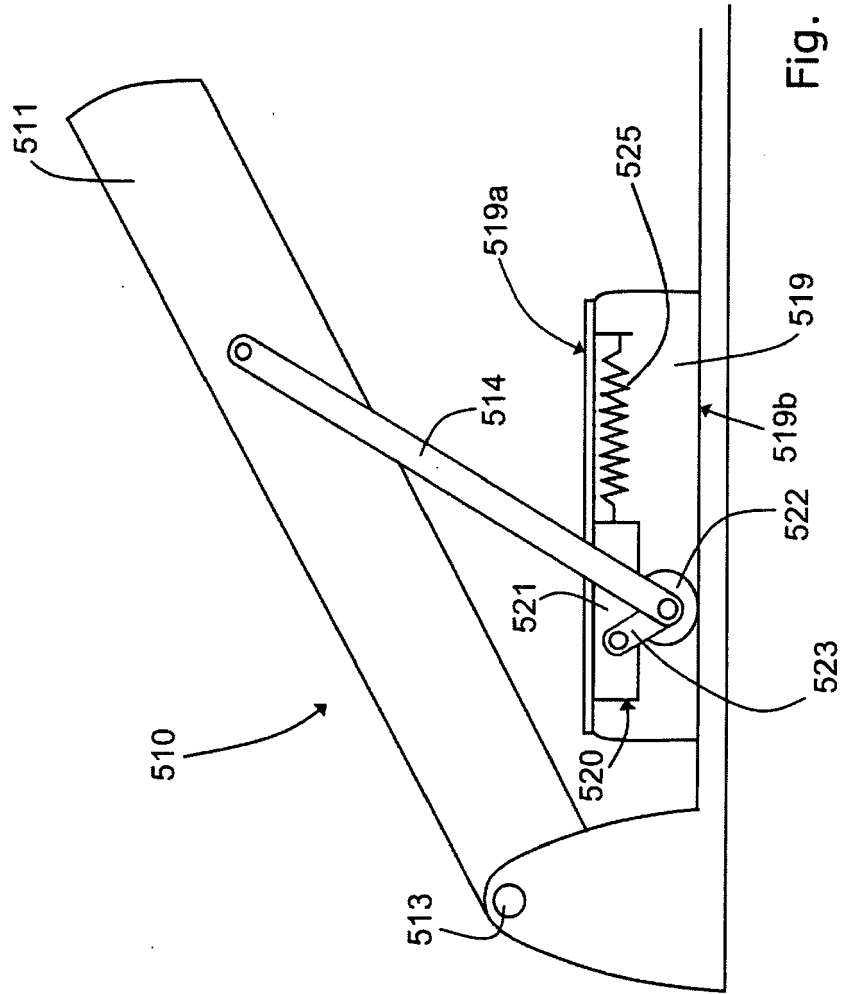


Fig. 5







European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 06 38 8046

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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Place of search The Hague		Date of completion of the search 12 December 2006	Examiner Righetti, Roberto
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