



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
28.09.2016 Bulletin 2016/39

(51) Int Cl.:
E05B 63/24 (2006.01) **E05B 47/00** (2006.01)
E05C 9/02 (2006.01) **E05B 47/02** (2006.01)

(21) Application number: **15160336.2**

(22) Date of filing: **23.03.2015**

(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

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(54) **A MANUALLY AND ELECTRICALLY OPENABLE ROOF WINDOW WITH A MANUALLY AND ELECTRICALLY OPERABLE LOCK**

(57) A top hung roof window (1) with a rectangular frame (2) and sash (3). The sash (3) is pivotable about a horizontal axis at the top of the roof window (1). The sash (3) is manually movable and electrically movable. A handle (18) allows moving the sash (3) manually. A motorized electrically operated linear actuator (40) can move the sash (3) electrically. The sash actuator (40) is not self-locking and is movable by the sash (3) when the latter is manually moved by an operator. The sash (3) is configured to be electronically locked and unlocked and to be manually unlockable. A motorized electronically operated lock is provided for locking and unlocking the sash (3). The lock comprises two cooperating parts, a first part at or in the vicinity of the bottom of the frame (2) and a

second part at or in the vicinity of the bottom of the sash (3). The second part is operably connected to a handle (18) or button (29) for manual unlocking of the sash (3). At least the first part or the second part is motorized for electric operation of the lock. The first part is provided with a first engagement member and the second part is provided with a second engagement member. At least one of the engagement members is electrically movable between an unlocking position wherein the engagement members can engage one another and a locking position wherein engagement members can interlock but neither engage- nor disengage one another. The second engagement member is manually movable from its locking position to its unlocking position.

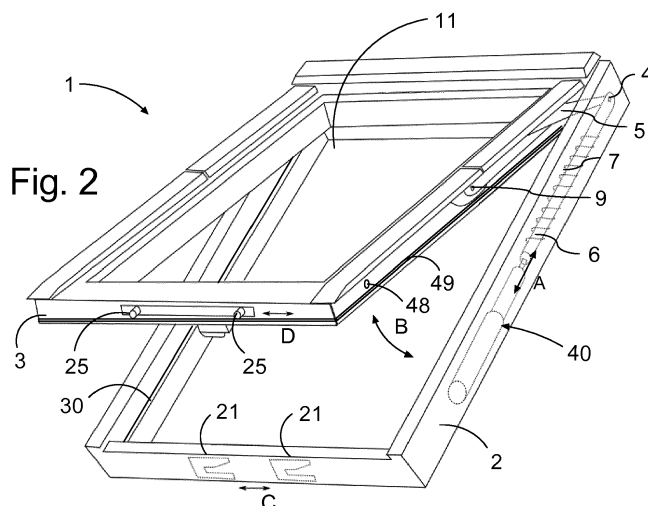


Fig. 2

Description

TECHNICAL FIELD

[0001] The present disclosure relates to an openable a top hung roof window with a lock to secure or lock the window in a closed position.

BACKGROUND ART

[0002] Conventional roof windows are provided with a locking mechanism that is manually operated by a handle for locking the sash in a closed position. Often, the possibility to manually lock the sash in a ventilation position is also provided. A compressible seal or gasket is provided between the frame and the sash in order to seal the sash to the frame in the closed position of the frame. The seal or gasket is typically provided along the complete circumference of the opening in the frame and the gasket requires considerable force to be compressed to the state it has when the sash is closed and sealed to the frame.

[0003] The locking mechanism needs to provide the force that is needed to compress the gasket to the state it has when the sash is closed and sealed to the frame, so that the locking mechanism can both tighten and lock the sash to the frame.

[0004] There is an increasing market for top or pivot hung roof windows that are electronically operated, such as e.g. a roof window provided with an actuator for moving the sash between the closed and open positions and vice versa, and with the possibility to electrically lock and unlock the sash to the frame.

[0005] However, roof windows often formed escape routes in case of emergency and therefore sash must be openable manually and without the need of electric power being available. Further, the user experience is often better when an operator can freely choose between moving the sash manually or electrically and when an operator can freely choose between locking and unlocking the sash manually or electrically.

[0006] Also during installation of the roof window it is of great advantage if the sash can be moved manually, because the sash has to be removed during installation of the frame to the roof, i.e. before the roof window is connected to electric power.

SUMMARY

[0007] According to a first aspect the above problems are at least partially solved and other objects and advantages are obtained by providing top hung roof window. This a aspect is provided by a roof window comprising a rectangular frame and a rectangular sash, the frame comprising top and bottom frame members connected by two frame side members, the sash comprises top and bottom sash members connected by two sash side members, the sash being pivotally suspended from the frame

by a horizontal pivot axis that is located at or near the top of the roof window and the sash is pivotally movable relative to the frame about the horizontal pivot axis between a fully closed position, a nearly closed position where the sash is proximate to the frame and open positions, the sash being configured to be manually movable and electrically movable about the horizontal pivot axis, a handle provided with the sash for allowing an operator to engage the handle for manually moving the sash between the fully closed and open positions, a motorized electrically operated linear actuator operatively connected to the sash and configured to move the sash between the nearly closed position and the open positions, the electrically operated sash actuator being not self-locking and being configured to be movable by the sash when the sash is manually moved by an operator, the sash being configured to be electronically locked and unlocked and to be manually unlockable, a motorized electronically operated lock for selectively locking and unlocking the sash in its closed position to the frame, the lock comprising two cooperating parts, a first part at or in the vicinity of the bottom of the frame and a second part at or in the vicinity of the bottom of the sash, the second part being operably connected to a handle or button for manual unlocking of the sash, at least the first part or the second part being motorized for electric operation of the lock, the first part being provided with a first engagement member and the second part being provided with a second engagement member, at least the first engagement member or the second engagement member being electrically movable between an unlocking position wherein the first engagement member and the second engagement member can engage one another, and a locking position wherein the first engagement member and the second engagement member can interlock but neither engage nor disengage one another, the second engagement member being manually movable between its unlocking position and its locking position the second engagement member being manually movable to from its locking position to its unlocking position by an operator by manipulating the handle or pressing the button.

[0008] By providing a top hung roof window with an electric actuator that allows manual movement of the sash and with an electric lock that allows manual unlocking seamless electric and manual operation is achieved.

[0009] In a first implementation of the first aspect the lock is configured so that the first engagement member and the second engagement member automatically assume a position wherein the first engagement member and the second engagement can engage one another when the sash is in an open position. Thus, when the roof window is open the lock is always ready for engaging and subsequent locking.

[0010] In a second implementation of the first aspect the second engagement member is operably connected to a handle or button so that pressing the button or manipulating the handle will move the second engagement member from the locking position to the unlocking position.

tion. Thus, roof window can always be opened, regardless of the availability of electrical power.

[0011] In a third implementation of the first aspect the lock further comprises a balancing arrangement operably connected to the sash, the balancing arrangement preferably comprising a resilient member such as a helical wire spring or a gas spring for at least partially balancing the sash. Thus, the sash can be moved with relatively low force, e.g. by an operator.

[0012] In a fourth implementation of the first aspect the balancing arrangement is configured to allow the sash to remain in any open position with the assistance of friction with at least a portion of the friction being provided by the electrically operated sash actuator and/or by a brake. Thus, the sash will remain in position at which it is left by the operator regardless whether the sash is moved electrically or manually.

[0013] In a fifth implementation of the first aspect the first and second engagement members are configured to engage one another when the sash arrives from an open position at the nearly closed position.

[0014] In a sixth implementation of the first aspect the first engagement member or the second engagement member being configured to carry out a motorized movement that pulls the sash from the nearly closed position to the fully closed position upon the first engagement member and the second engagement member engaging one another. Thus, the lock assists the actuator in the last part of the closing movement, i.e. the part where the gasket between the sash and the frame needs to be compressed and a high closing force is required.

[0015] In a seventh implementation of the first aspect the first engagement member and the second engagement member interlock during the motorized movement that pulls the sash from the nearly closed position to the fully closed position.

[0016] In a eighth implementation of the first aspect the first engagement member and the second engagement member are configured to both assume and retain their locking position and to interlock when an operator pulls the sash from the nearly closed position to the fully closed position. Thus, the roof window will securely lock when it is manually closed

[0017] In a ninth implementation of the first aspect the sash actuator comprises a spindle actuator driven by an electric drive motor.

[0018] In a tenth implementation of the first aspect the second engagement member comprises at least one rod that projects from the bottom member of the sash, the rod being configured be manually displaceable between the unlocking and locking positions by movement parallel with the longitudinal extent of the sash bottom member.

[0019] In a eleventh implementation of the first aspect the first engagement member is disposed at the bottom frame member and the first engagement member comprising a catch that defines a slot for receiving the rod, the catch member being electrically displaceable between its unlocking and locking position by movement

parallel with the longitudinal extent of the frame bottom member.

[0020] In a twelfth implementation of the first aspect the rod is mechanically biased to return to its locking position. Thus, the rod is always ready to be engaged the catch.

[0021] In a thirteenth implementation of the first aspect the roof window further comprises a controller, the controller being configured to move the catch to the unlocking position when the sash is more open than the nearly closed position. Thus, the catch is always ready to be engaged abroad when the window is in sash is in an open position.

[0022] In a fourteenth implementation of the first aspect the catch comprises a ramp and the controller being configured to move the catch from the unlocking position to the locking position when the controller has detected that the sash has arrived at the nearly closed position from an open position, the ramp thereby engaging the rod and pulling the sash towards its closed position on the frame. Thus, the relatively high force that is needed to completely close the sash against the pressure of the gasket between the sash in the frame does not need to be generated by the actuator, which can only generate the relatively low closing force in this position of the actuator due to leverage effects.

[0023] In a fifteenth implementation of the first aspect the second engagement member comprises at least one retractable bolt that projects from the bottom member of the sash, the rod being configured be manually displaceable between a retracted unlocking position and an extended locking position. Thus, the sash can always be unlocked manually, regardless of the availability of electrical power.

[0024] In a sixteenth implementation of the first aspect the first engagement member is disposed at the bottom frame member and the first engagement member comprises a catch that defines a slot for receiving the bolt, the first engagement member being electrically displaceable between the unlocking and locking position by pivoting about an axis that is preferably parallel with the longitudinal extend of the frame side members.

[0025] In a seventeenth implementation of the first aspect the bolt is mechanically biased to return to its extended locking position. Thus, the bolt is always ready to engage the catch.

[0026] In a eighteenth implementation of the first aspect the first part is configured to move the catch to the unlocking position when the sash is more open than the nearly closed position. Thus, the catch is always ready to engage the bolt when the sash is in an open position.

[0027] In a nineteenth implementation of the first aspect further comprising a controller, the controller being configured to move the catch to the unlocking position when the sash is more open than the nearly closed position, and the controller further being configured to move the catch from the unlocking position to the locking position when the sash arrives at the nearly closed position from

an open position. Thus, the relatively high force that is needed to completely close the sash against the pressure of the gasket between the sash in the frame does not need to be generated by the actuator, which can only generate the relatively low closing force in this position of the actuator due to leverage effects.

[0028] In a twentieth implementation of the first aspect the first part is configured to retain the catch in the locking position when the catch is manually moved from the unlocking position to the locking position. Thus, the sash will securely lock when an operator manually pulls the sash to its closed position.

[0029] In a twenty-first implementation of the first aspect the first engagement member comprises at least one rod that projects from the frame bottom member.

[0030] In a twenty-second implementation of the first aspect the second engagement member is disposed at the bottom sash member and the second engagement member comprising a catch that defines a slot for receiving the rod, the catch being electrically displaceable between the unlocking and locking position by pivoting about an axis that is preferably parallel with the longitudinal extend of the sash side members.

[0031] In a twenty-third implementation of the first aspect second part is configured to move the catch mechanically, from the locking position to the unlocking position when the button is pressed by an operator, the catch preferably being resiliently urged to the unlocking position. Thus, the window can always be open by an operator, regardless of the availability of electrical power.

[0032] In a twenty-fourth implementation of the first aspect the roof window further comprises a controller, the controller being configured to move the catch from the unlocking position to the locking position when the sash arrives at the nearly closed position from an open position. Thus, the relatively high force that is needed to completely close the sash against the pressure of the gasket between the sash in the frame does not need to be generated by the actuator, which can only generate the relatively low closing force in this position of the actuator due to leverage effects.

[0033] In a twenty-fifth implementation of the first aspect the roof window further comprises a first sensor or switch configured to cause a first signal to be transmitted to the controller when the sash reaches the nearly closed position from one of the open positions.

[0034] In a twenty-six implementation of the first aspect the motorized electrically operated linear actuator comprises an electric drive motor operably connected to a revolution-counter, the revolution counter being preferably connected to the controller and the controller being configured to determine the position of the sash on the basis of a signal from the revolution counter.

[0035] In a twenty-seventh implementation of the first aspect the controller monitors the electrical current supplied to the electric drive motor and wherein the controller is configured to determine that the sash has reached an end position, such as e.g. the nearly closed position

and/or a fully open position when the current exceeds a threshold, the controller further being configured to store the determined position relative to the position derived from the signal from the revolution counter.

[0036] In a twenty-eight implementation of the first aspect the second engagement member is manually movable to from its locking position to its unlocking position by an operator by manipulating the handle or pressing the button also when there is no power to operate a the electronically operated lock.

[0037] In a twenty-ninth implementation of the first aspect the second engagement member is manually and purely mechanically movable to from its locking position to its unlocking position by an operator by manipulating the handle or pressing the button.

[0038] In a thirtieth implementation of the first aspect the sash is provided with a seal that is secured to the sash.

[0039] In a thirtieth implementation of the first aspect the sash can pivot about another horizontal axis via a pivot hinge that is arranged in the vicinity of center of the sash, the roof window being provided with releasable means to prevent pivoting of the sash about said other horizontal axis, and wherein said sash actuator is blocked when said sash is allowed to pivot about said other horizontal axis.

[0040] Further objects, features, advantages and properties of the pivot or top hung roof window according to the invention will become apparent from the detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0041] In the following detailed portion of the present description, the aspects and implementations will be explained in more detail with reference to the example embodiments shown in the drawings, in which

Fig. 1 is a schematic perspective inner view of a top hung window according to an example embodiment; Fig. 2 is a schematic perspective outer view of a top hung window according to Fig. 1;

Fig. 2a is a plane side view of an example embodiment of the openable top hung roof window of Fig. 1 with an a motorized automatic lock and with a sash actuator;

Fig. 3 to 5 form a diagram illustrating the operation of the lock of the window of Fig. 1;

Fig. 6 is a schematic perspective inner view of a top hung window according to another example embodiment;

Fig. 7 is a schematic perspective outer view of a top hung window according to Fig. 6;

Fig. 8 is a plane side view of an example embodiment of the openable top hung roof window of Fig. 6 with an a motorized automatic lock and with a sash actuator;

Fig. 9 is a perspective view of a part of a motorized

lock used in the top hung roof window of figure 6.

Fig. 10 is a schematic perspective inner view of a top hung window according to another example embodiment;

Fig. 11 is a schematic perspective outer view of a top hung window according to Fig. 10, and

Fig. 11a is a plane side view of an example embodiment of the openable top hung roof window of Fig. 10 with an a motorized automatic lock and with a sash actuator.

DETAILED DESCRIPTION

[0042] Figs. 1 and 2 show perspective views of an openable top hung roof window generally indicated by reference numeral 1. The roof window has been shown in an inclined position as if it is mounted on a fictive slanting roof. The roof window is neither intended nor suitable for mounting in vertical surfaces, such as e.g. a facade of a building or horizontal surfaces, such as e.g. a flat roof.

[0043] The roof window comprises a rectangular frame 2 defining an opening and a rectangular sash 3 matching the opening. The rectangular frame 2 has parallel frame top and bottom members and two parallel frame side members that connect the frame top and bottom members. The rectangular sash 3 has parallel sash top and bottom members and two parallel sash side members that connect the sash top and bottom members. The sash 3 is connected to the frame 2 at the top portion of the frame 2 by suitable hinge 4 that is arranged at the top of the roof window 1. The hinge 4 forms a horizontal pivot axis that is located near the top of the window 1. The frame members and the sash members can for example be wooden members, metal profiles, plastic (polymeric) material members or combinations thereof. Two arms 8 connect the sash 3 to the hinge 4. The sash 3 includes a window pane 11, such as for example double glazing. The sash 3 can undergo a pivotal movement relative to the frame 2 about the hinge 4 as indicated by the arrow B in Fig. 1 between a closed position and open positions. The sash 3 is connected to an elongated member 6 is via a link member 5 in such a manner that the elongated member 6 will make an axial movement as indicated by the arrow A when the sash 3 makes a pivotal movement relative to the frame 2 (Fig. 2a). A motorized electrically operated linear actuator 40 is operatively connected to the sash 3 and configured to move the sash 3 between a nearly closed position and open positions. In an embodiment the sash actuator 40 comprises a spindle actuator driven by an electric drive motor.

[0044] The elongated member 6 is axially displaceable in the frame 2, e.g. inside one of the frame side members, and biased in its movement by a resilient biasing means such as for instance a helical spring 7. In an embodiment the helical spring 7 encircles a portion of the elongated member 6 for balancing the sash 3 in various open positions thereof. The balancing is such that the amount of force that is needed to move the sash is substantially the

same in any position, regardless of the degree of opening of the sash. The balancing may need to be adjusted to the angle at which the roof window 1 is installed, i.e. depend on the inclination of the roof.

[0045] It is apparent to those skilled in the art that other resilient biasing means can be used, such as a gas spring, a leaf spring or a torsion spring. Braking means 13 (Fig. 2a) such as frictional braking means can also be provided and the brake can act directly or indirectly on the elongated member 6. The breaking means can be in the form of the internal friction/resistance to movement of a sash actuator that will be described in greater detail further below. The break 13 can be part of a guide plate 14 that guides the movement of the elongated member 6, with one end of the helical spring 7 abutting on to the plate 14 with the brake force increasing when the helical spring 7 increases its pressure on the plate 14 and vice versa. Thus, the brake force is adjusted to the force of the balancing arrangement and to the position of the sash three.

[0046] The resilient means and/or the braking means are in an embodiment an integral part of the motorized electric sash actuator 40.

[0047] The combination of the resilient biasing means and the braking means ensures that the sash 3 can assume and maintain any open position and will not change such an assumed open position due to the influence of gravity, wind or any other forces that can be expected to act on the sash 3 during normal use. However, the combination of the resilient biasing means and the braking means is such that an operator applying a manual force to the sash 3 will be able to move the sash with relative ease.

[0048] The sash 3 can in this embodiment also pivot about another horizontal axis close to the center of the sash 3 via a hinge 9 at the free end of arms 8 so that the sash 3 can be reversed, e.g. for cleaning the outer side of window pane 11 from the inner side of the roof window 1. A mechanism prevents pivoting of the sash 3 about the other horizontal axis unless the mechanism is released by an operator by pressing a button 48.

[0049] The frame 2 is provided with an opening that matches the sash 3 and in this embodiment the frame 2 is provided with a compressible seal or gasket 30 that surrounds the opening and provides for a tight seal with the sash 3 when the sash is in a fully closed position. The seal or gasket 30 can be made of compressible material or can be made of resilient material that is arranged to fold or bend when it is compressed. Typically, the seal or gasket 30 that is secured to the frame 2 is made from an elastomeric material.

[0050] In an embodiment the sash 3 is provided with a flexible and/or compressible seal 49. The seal 49 is secured to the sash 3. The seal 49 is configured to engage the frame 2 when the sash 3 is in its closed position. Typically, the seal or gasket 49 that is secured to the sash 3 is made from an elastomeric material. The seal 49 on the sash 4 forms together with the seal 30 on the

frame 2 a double barrier for tightness and preventing ingress.

[0051] When the sash 3 is in a nearly closed position, the sash 3 is proximate to the frame 2. In this position the opening in the frame 2 is almost closed, and the seal or gasket 30 is not- or only to a minor extent compressed (e.g. only compressed in the area of the gasket closest to the hinge 4). The compressible seal 30 is at least partially compressed in most of its extent around the opening when the sash 3 is in the fully closed position.

[0052] With reference to Fig. 2a there is shown a schematic plane side view of a first example embodiment of an openable top or pivot hung roof window 1. In the frame 2 there is provided a linear sash actuator 40 with an operable free end. The linear sash actuator 40 is in an embodiment be a spindle actuator with an electric drive motor. In an embodiment the balancing and breaking mechanism that allows the sash 3 to maintain a given position is integrated in the sash actuator 40.

[0053] In this embodiment one end of the sash actuator 40 is connected to the frame 2 and the free end of the sash actuator 40 is connected to a first end of the elongated member 6 and the second end of the elongated member 6 is connected to a free end of the link member 5 that is in turn connected with its opposite end to the arm 8. Thus, linear movement in the direction of the arrow A on sash actuator 40 will cause rotational movement of the sash 2 in the direction of the curved arrow B and vice versa. The linear actuator 40 is not self-locking, so rotational movement of the sash 3, e.g. by an operator moving the sash with a handle 18, will cause linear movement of the linear actuator 40. Thus, the internal friction and construction of the sash actuator 40 is such that it allows the sash 3 to be moved manually with the sash actuator 40 following the movement of the sash 3.

[0054] The linear sash actuator 40 is connected to a source of electrical power, such as the mains (not shown) and to a controller 50. The controller 50 is configured to control the linear actuator and thus the position of the sash 3. Further, the controller 50 is configured to electronically lock and unlock the sash 3. The sash actuator 40 is blocked when the sash 3 is allowed to pivot about the other horizontal axis. Hereto, the controller 50 can be configured to prevent movement of the sash actuator 40 when the button 48 is pressed or when a sensor indicates to the controller 50 that the sash 3 is not in its default position relative to the other horizontal axis.

[0055] The controller 50 is in an embodiment provided with a user interface or connected to a device with a user interface such as a remote control unit which could e.g. be a smartphone with an app installed thereon for controlling the operation of the roof window 1 via the controller 50. Via the user interface the controller 50 receives instructions from an operator to move the sash 3 to a desired position, such as the fully closed and locking position, or any open position. The controller 50 may also be connected to other sensors, such as a rain, storm or squeeze protection sensor and the controller 50 may be

configured to automatically reduce the opening or even to close and lock the window when rain or storm is detected and the controller 50 may be configured to stop movement of the sash 3, or even partially withdraw the last movement of the sash 3 when the squeeze sensor signals a squeeze event, i.e. detects that an object obstructs the closing of the sash and the object, such as the body part of an operator, is being squeezed. The controller 50 may also receive other external signals that do not come directly from an operator for changing the position of the sash 3, or for locking the sash 3.

[0056] The controller 50 is also connected to a first sensor that detects when the sash 3 is in a nearly closed position where it is proximate to the frame 2, and in an embodiment the first sensor detects whether the sash 3 arrives at the nearly closed position from an open position.

[0057] The roof window 1 is provided with a motorized electronically operated lock for selectively locking and unlocking the sash 3 in its closed position to the frame 2. The lock comprises a first part 20 arranged in or near the bottom of the frame 2, e.g. in the bottom frame member (as shown) or at the lower end of one of the frame side members (not shown), and second part 24 arranged in or near the bottom of the sash 3, e.g. in the bottom member of the sash 3 (as shown) or at the lower end of the sash side member (not shown). The first part 20 and the second cooperating part 24 can engage and disengage one another, i.e. the first cooperating part 22 and second cooperating part 24 are configured to engage one another when the sash 3 arrives from an open position at the nearly closed position. In an embodiment the first sensor 32 is configured to detect that the first cooperating part 22 and the second cooperating part 24 have engaged.

[0058] The second part 24 is operably connected to a handle 18 so that it can also be operated manually. Thus, second part is operably connected to the handle 18 for manual unlocking of the sash 3. The handle 18 also allows for manual operation of the sash 3 in order to move it between closed, nearly closed and open positions, although in the embodiments there can be provided a separate handle (not shown) for the lock operation and for moving the sash 3.

[0059] The second part 24 is provided with an engagement member in the form of two spaced rods 25 that project from the sash 3. The 2 space rods 25 can move back and forth between the locking position and an unlocking position by manipulation of the handle 18. In this embodiment the movement between the locking position and the unlocking position of the rods 25 is a linear movement parallel with the bottom member of the sash 3, as indicated by the arrow D. Hereto, the second part is provided with a mechanism that translates movement of the handle 18 into a linear movement of the rods 25. The rods 25 can be manually moved to the unlocking position, also when there is no electric power available to operate the electric parts of the lock. The opening action of the second part is completely mechanical.

[0060] The second part is resiliently biased so that the rods 25 and the handle 18 are automatically returned to the locking position after an operator has moved the rods 25 to the unlocking position.

[0061] The rods 25 are configured to engage the engagement member of the first part 20. Hereto, the first part 20 is provided with two catches 21 that each define a slot for receiving a rod 25. Each catch 21 is also provided with a ramp for pulling the sash 3 from a nearly closed position to a completely closed position. The two catches 21 are spaced at equal spacing as the rods 25. The first part 20 is motorized and includes a lock motor (not shown) that can move the catches 21 simultaneously between a locking position and an unlocking position as illustrated by the arrow C.

[0062] Thus, least the first engagement member is electrically movable between an unlocking position wherein the first engagement member and the second engagement member can engage one another, and a locking position wherein the first engagement member and the second engagement member can interlock but neither engage nor disengage one another and the second engagement member is manually movable between its unlocking position and its locking position.

[0063] The first and second engagement members are configured to engage one another when the sash 3 arrives from an open position at the nearly closed position.

[0064] The first part 20 is connected to the controller 50. The first part 20 is configured carry out a motorized movement that pulls the sash 3 from the nearly closed position to the fully closed position when, i.e. as soon as the first and second cooperating parts 20, 24 engage one another. Hereto, the controller 50 receives a signal from a sensor that indicates to the controller 50 that the sash 3 has arrived at the nearly closed position from an open position. In an embodiment the signal from the first sensor can also indicate to the controller 50 that the first and second cooperating parts 22, 24 have engaged one another. Upon receipt of the signal from the first sensor the controller 50 issues a signal to the first cooperating part 22 to carry out the motorized movement that pulls the sash 3 from the nearly closed position to the fully closed position and interlocks the catches 21 and rods 25, thus locking the sash 3 to the frame 2.

[0065] The sash 3 is configured to be electronically locked and unlocked and to be manually unlockable.

[0066] The different possible positions for the lock are shown in Figs. 3 to 5. In Fig. 3 both the rods 25 and the catches 21 are in their respective locking position. This position will normally only occur when the sash 3 is in its closed position and the sash will accordingly be locked to the frame. In figure 4 the rods 25 have been moved to their unlocking position, by an operator moving the handle 18 against the resilient force towards its unlocking position, and the operator has moved the sash to a slightly open position. When the operator will release the handle, the handle and the rods 25 automatically returned to their locking position so that the second 24 part is ready

again for engagement with the second part 20.

[0067] The controller 50 commands the first part 20 to move the catches 21 to their unlocking position when the sash is open, so that the catches 21 not hinder the sash from returning to its closed position. Thus, the controller 50 is configured to move the catch 21 to its unlocking position when the sash 3 is more open than its nearly closed position. Thereby, the lock is configured so that the first engagement member and the second engagement member automatically assume a position wherein the first engagement member and the second engagement can engage one another when the sash is in an open position. When the controller 50 detects that the sash returns to its closed position or at least arrives at the nearly closed position, the controller 50 commands the first part 20 to move the catches to their unlocking position, the slots with their ramps in the catches 21 thereby engaging the rods 25 to thereby pulled the sash to its closed position against the force of the gasket 30 and interlocking the rods 25 and the catches 21.

[0068] The embodiment of Figs 1, 2 and 2a is illustrated with a pair of spaced rods 25 and a pair of corresponding catches 21. However, it should be understood that this embodiment will work just as well with a single rod 25 matched to a single catch 21. For wide windows a pair of spaced rods and catches 21 can be advantageous.

[0069] In an embodiment the motorized electrically operated linear actuator 40 comprises an electric drive motor operably connected to a revolution-counter with the revolution counter being preferably connected to the controller 50 and the controller 50 being configured to determine the position of the sash 3 on the basis of a signal from the revolution counter.

[0070] In an embodiment the controller 50 monitors the electrical current supplied to the electric drive motor 43 and the controller 50 is configured to determine that the sash 3 has reached an end position, such as e.g. the nearly closed position and/or a fully open position when the current exceeds a threshold, the controller 50 further being configured to store the determined position relative to the position derived from the signal from the revolution counter.

[0071] Figs 6 to 9 show another embodiment of the roof window 1 with a different lock construction but otherwise the construction and operation of the roof window 1 of this embodiment is quite similar to the roof window 1 as described above with reference to Figs. 1, 2 and 2a.

[0072] In this embodiment the first engagement member is a rod 35 that projects from the frame bottom member and the second engagement member is disposed at the bottom sash member and the second engagement member comprising a catch 33 that defines a slot for receiving the rod 35. The catch 33 is electrically displaceable between the unlocking and locking position by pivoting about an axis that is preferably parallel with the longitudinal extend of the sash side members.

[0073] The second part is provided with a button 29 for manually unlocking the sash, without the need of electri-

cal power being present. Thus, the second part is configured to move the catch 33 mechanically from the locking position to the unlocking position, e.g. by spring action when the button 29 is pressed by an operator.

[0074] The second part is connected to a controller 50. The controller 50 is configured to move the catch 33 from the unlocking position to the locking position when the sash 3 arrives at the nearly closed position from an open position. When the sash arrives at a nearly closed position the slot in the catch 3 engages the rod 35. Thereupon, the catch 33 pivots towards its locking position and thereby interlocks with the rod 35 and pulls the sash 3 to its completely and locked position.

[0075] In this embodiment the sash 3 can be provided with a seal 49, as described in more detail above.

[0076] Fig 9 shows an example embodiment of a motorized electronic lock 31 that can be used as the first part with the roof window 1 of the embodiment shown in Figs 6 to 8. The motorized lock 31 includes an electric drive motor 51 with a worm 52 on its drive shaft. The worm 52 drives a wormwheel and through a further reduction gear a linkage 54 that allows the catch 33 to perform a reciprocal pivotal movement between its locking position and unlocking position. The catch 33 is spring loaded towards its unlocking position and the motorized lock 31 is provided with a release mechanism 57 that can disengage the catch 33 from the electric drive and allow the spring loaded catch 33 to move to its unlocking position when the release mechanism 57 is moved against the action of the spring 56 in the direction of the arrow E. The button 29 is connected to the release mechanism 57, via e.g. a link or cable so that a simple pressing on the button 29 by an operator will activate the release mechanism and cause the catch 33 to move to its unlocking position thereby unlocking the sash 3 without any electric power needed to be available.

[0077] Figs 10, 11 and 11a show another embodiment of the roof window 1 with a different lock construction but otherwise the construction and operation of the roof window 1 of this embodiment is quite similar to the roof window 1 as described above with reference to Figs. 1, 2 and 2a.

[0078] In this embodiment the second engagement member comprises a retractable bolt 45 that projects from the bottom member of the sash. The retractable rod 45 is configured to be manually displaceable between a retracted unlocking position and an extended locking position by manipulation of the handle 18. Hereto the second part is provided with a mechanism that translates the movement of the handle into a linear movement of the retractable bolt to allow the retractable bolt 45 to move between retracted and extended positions, with the retracted position corresponding to an unlocking position and the extended position corresponding to a locking position. The retractable bolt 45 and the handle 18 are resiliently biased returned to their locking position after the retractable bolt 45 has been moved to its retracted position by an operator manipulating the handle 18. Thus,

the second engagement member is always ready in its extended position to engage the first engagement member.

[0079] The first engagement member is disposed at the bottom frame member and the first engagement member comprises a catch 43 that defines a slot for receiving the bolt 45. The first engagement member is electrically displaceable between the unlocking and locking position by pivoting about an axis that is preferably parallel with the longitudinal extend of the frame side members.

[0080] The controller 50 is connected to the first part and configured to move the catch 43 to its unlocking position when the sash 3 is more open than the nearly closed position. Hereto the controller 50 receives a signal from a position sensor (that can be integral part of the linear actuator 40) on the position of the sash.

[0081] The controller 50 is configured to move the catch to the unlocking position when the sash 3 is more open than the nearly closed position, and the controller 50 is configured to move the catch 43 from its unlocking position to its locking position when the sash 3 arrives at the nearly closed position from an open position.

[0082] The first part is configured to retain the catch 42 in the locking position when the catch is manually moved from the unlocking position to the locking position, e.g. by an operator pulling the sash 3 to the frame. This will be dictated by the controller 50 and the control construct the first part to move the catch to its locking position, thereby interlocking with the retractable bolt 45 and thus locking the sash 3 to the frame 2. The controller 50 is configured to retain the catch 43 in its locking position after the catch 43 is manually moved from the unlocking position to the locking position to ensure that the sash 2 is properly locked to the frame when an operator manually closes the sash 3.

[0083] In this embodiment the sash 3 can be provided with a seal 49, as described in more detail above.

[0084] In an embodiment the top or pivot hung roof window 1 is provided with means for protecting operators or other persons in the vicinity of the roof window 1 to get body parts stuck in the window. Hereto, the roof window 1 is provided with sensors that detect the amount of force that is applied to the sash 3 by the respective actuators or motors and the controller 50 is configured to determine on the basis of the magnitude of the force, the time during which the force has been applied and the position of the sash 3 whether an object is stuck in the roof window 1. If such an event has been determined the controller 50 will stop the operation of the actuators and motors or even reverse the last part of the movement of the sash 3. One further advantage of the disclosed motorized lock is that the high closing force of 10-50 Kg that is applied in the end of the closing movement occurs in the period where the sash is pulled from its nearly closed position to its completely closed position. When the sash is in nearly closed position the gap between the sash and

the frame is very small in the likeness of any body parts of an operator being placed between the sash in the frame at this point of time is very small due to the small. Thus, it is prevented that large force is applied to body parts between the frame and sash during the open positions. Another advantage of the disclosed motorized lock is that it allows the user to physically operate the window handle so seamless manual and electric operation is provided.

[0085] Relatively wide windows can be provided with 2 locks at the bottom sash member and bottom frame member to ensure proper and hermetic closing of the sash 3 to the frame 2.

[0086] None of the embodiments above is more preferred than others and the embodiments above all can be combined without any preference to a given combination.

[0087] The embodiments above have been described with a single actuator placed at one side of the frame, it is however understood that the roof window may just as well be provided with two actuators, one at each side of the frame.

[0088] Although the present invention has been described in detail for purpose of illustration, it is understood that such detail is solely for that purpose, and variations and combinations can be made therein by those skilled in the art without departing from the scope of the appended claims. For example, the embodiments have been described with reference to a single controller, and with a single sensor for detecting the position of the sash. However, as will be apparent by those skilled in the art, there is more than one controller could be used to control the sash actuator and the motorized lock, respectively, and separate sensors could be provided for detecting the position of the sash and for detecting the position of the motorized lock and for detecting the state of the motorized lock, i.e. the lock being engaged or not engaged.

[0089] The term "comprising" as used in the claims does not exclude other elements or steps. The term "a" or "an" as used in the claims does not exclude a plurality.

Claims

1. A top hung roof window (1), said roof window (1) comprising:

a rectangular frame (2) and a rectangular sash (3),
said frame (2) comprising top and bottom frame members connected by two frame side members,
said sash (3) comprises top and bottom sash members connected by two sash side members,
said sash (3) being pivotally suspended from said frame (2) by a horizontal pivot axis that is located at or near the top of the roof window (1) and said sash (3) is pivotally movable relative

to the frame (2) about said horizontal pivot axis between a fully closed position, a nearly closed position where said sash (3) is proximate to said frame (2) and open positions,

said sash (3) being configured to be manually movable and electrically movable about said horizontal pivot axis,

a handle (18) provided with said sash (3) for allowing an operator to engage said handle (18) for manually moving said sash (3) between said fully closed and open positions,

a motorized electrically operated linear actuator (40) operatively connected to said sash (3) and configured to move said sash (3) between said nearly closed position and said open positions, said electrically operated sash actuator (40) being not self-locking and being configured to be movable by the sash (3) when said sash (3) is manually moved by an operator,

said sash (3) being configured to be electronically locked and unlocked and to be manually unlockable,

a motorized electronically operated lock for selectively locking and unlocking the sash (3) in its closed position to the frame (2),

said lock comprising two cooperating parts, a first part at or in the vicinity of the bottom of said frame (2) and a second part at or in the vicinity of the bottom of said sash (3),

said second part being operably connected to a handle (18) or button (29) for manual unlocking of the sash (3),

at least said first part or said second part being motorized for electric operation of said lock,

said first part being provided with a first engagement member and said second part being provided with a second engagement member,

at least said first engagement member or said second engagement member being electrically movable between:

an unlocking position wherein the first engagement member and the second engagement member can engage one another, and
a locking position wherein the first engagement member and the second engagement member can interlock but neither engage nor disengage one another,

said second engagement member being manually movable between its unlocking position and its locking position

said second engagement member being manually movable from its locking position to its unlocking position by an operator by manipulating said handle (18) or pressing said button (29).

2. A top hung roof window according to claim 1,

wherein said lock is configured so that said first engagement member and said second engagement member automatically assume a position wherein the first engagement member and the second engagement can engage one another when said sash (3) is in an open position.

3. A top hung roof window according to claim 1 or 2, wherein said second engagement member is operably connected to a handle (18) or button (29) so that pressing the button or manipulating the handle (18) will move said second engagement member from said locking position to said unlocking position.

4. A top hung roof window according to any one of claims 1 to 3, further comprising a balancing arrangement operably connected to said sash (3), said balancing arrangement preferably comprising a resilient member such as a helical wire spring (13) or a gas spring for at least partially balancing said sash (3).

5. A top hung window according to claim 4, wherein the balancing arrangement is configured to allow the sash (3) to remain in any open position with the assistance of friction with at least a portion of said friction being provided by said electrically operated sash actuator (40) and/or by a brake (13).

6. A top hung window according to any one of claims 1 to 5, wherein said first and second engagement members are configured to engage one another when said sash (3) arrives from an open position at said nearly closed position.

7. A top hung window according to claim 6, wherein at least the first engagement member or the second engagement member being configured to carry out a motorized movement that pulls said sash (3) from said nearly closed position to said fully closed position upon said first engagement member and said second engagement member engaging one another.

8. A top hung window according to claim 7, wherein said first engagement member and said second engagement member interlock during said motorized movement that pulls said sash (3) from said nearly closed position to said fully closed position.

9. A top hung window according to claim 6, wherein said first engagement member and said second engagement member are configured to both assume and retain their locking position and to interlock when an operator pulls said sash (3) from said nearly closed position to said fully closed position.

10. A top hung window according to any one of claims

1 to 9, wherein said sash actuator (40) comprises a spindle actuator (53) driven by an electric drive motor (43).

11. A top hung window according to any one of claims 1 to 10, wherein said second engagement member comprises at least one rod (25) that projects from the bottom member of the sash, said rod (25) being configured (25) be manually displaceable between said unlocking and locking positions by movement parallel with the longitudinal extent of said sash bottom member.

12. A top hung window according to claim 11, wherein said first engagement member is disposed at said bottom frame member and said first engagement member comprising a catch (21) that defines a slot for receiving said rod (25), said catch (21) member being electrically displaceable between its unlocking and locking position by movement parallel with the longitudinal extent of said frame bottom member.

13. A top hung window according to claim 11 or 12, wherein said rod (25) is mechanically biased to return to its locking position.

14. A top hung window according to claim 13, further comprising a controller (50), said controller (50) being configured to move said catch (21) to said unlocking position when the sash (3) is more open than said nearly closed position.

15. A top hung window according to claim 14, wherein said catch comprises a ramp and said controller (50) being configured to move said catch (21) from said unlocking position to said locking position when said controller (50) has detected that the sash (3) has arrived at said nearly closed position from an open position, said ramp thereby engaging said rod (25) and pulling the sash (3) towards its closed position on the frame (2).

16. A top hung window according to any one of claims 1 to 10, wherein said second engagement member comprises at least one retractable bolt (45) that projects from the bottom member of the sash, said rod (25) being configured (25) be manually displaceable between a retracted unlocking position and an extended locking position.

17. A top hung window according to claim 16, wherein said first engagement member is disposed at said bottom frame member and said first engagement member comprises a catch (43) that defines a slot for receiving said bolt (45), said first engagement member (43) being electrically displaceable between said unlocking and locking position by pivoting about an axis that is preferably parallel with the lon-

itudinal extend of said frame side members.

18. A top hung window according to claim 16 or 17, wherein said bolt (45) is mechanically biased to return to its extended locking position.

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19. A top hung window according to claim 18, wherein said first part is configured to move said catch (43) to said unlocking position when the sash (3) is more open than said nearly closed position.

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20. A top hung window according to claim 19, further comprising a controller (50), said controller (50) being configured to move said catch to said unlocking position when the sash (3) is more open than said nearly closed position, and said controller (50) further being configured to move said catch (43) from said unlocking position to said locking position when the sash (3) arrives at said nearly closed position from an open position.

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22. A top hung window according to any one of claims 19 to 21, wherein said first part is configured to retain said catch (43) in said locking position when said catch is manually moved from said unlocking position to said locking position.

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23. A top hung window according to any one of claims 1 to 10, wherein said first engagement member comprises at least one rod (35) that projects from the frame bottom member.

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24. A top hung window according to claim 23, wherein said second engagement member is disposed at said bottom sash member and said second engagement member comprising a catch (33) that defines a slot for receiving said rod (35), said catch (33) being electrically displaceable between said unlocking and locking position by pivoting about an axis that is preferably parallel with the longitudinal extend of said sash side members.

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25. A top hung window according to claim 24, wherein said second part is configured to move said catch (33) mechanically, from said locking position to said unlocking position when said button (29) is pressed by an operator, said catch (33) preferably being resiliently urged to said unlocking position

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26. A top hung window according to claim 24 or 25, further comprising a controller (50), said controller (50) being configured to move said catch (33) from said unlocking position to said locking position when the sash (3) arrives at said nearly closed position from an open position.

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27. A top hung roof window according to claim 15, 19, 20, 25 or 26, further comprising a first sensor

or switch (32) configured to cause a first signal to be transmitted to said controller (50) when said sash (3) reaches said nearly closed position from one of said open positions.

28. A roof window according to any one of claims 1 to 27, wherein said motorized electrically operated linear actuator (40) comprises an electric drive motor (43) operably connected to a revolution-counter, said revolution counter being preferably connected to said controller (50) and said controller (50) being configured to determine the position of said sash (3) on the basis of a signal from said revolution counter.

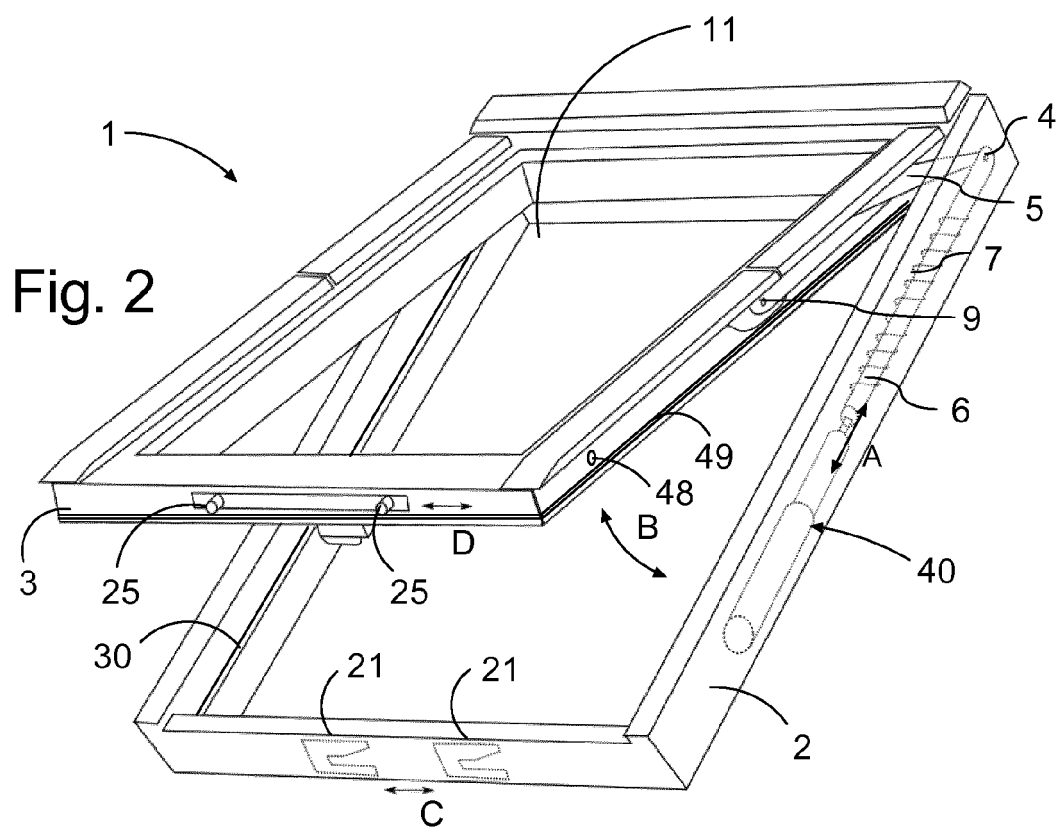
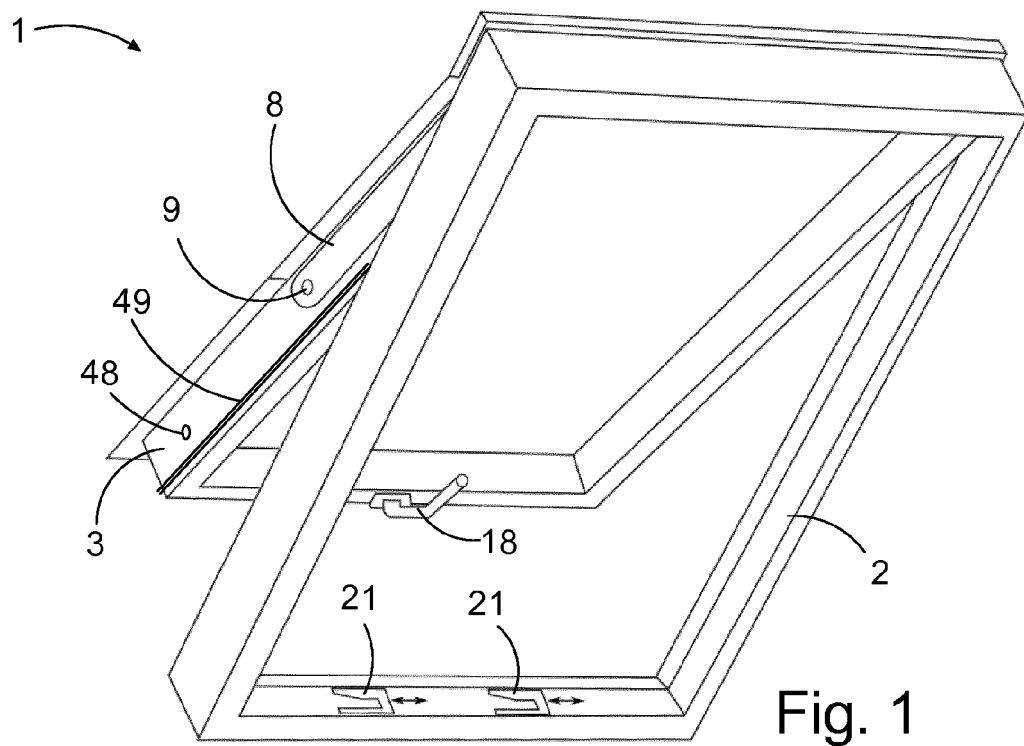
29. A roof window according to claim 28, wherein said controller (50) monitors the electrical current supplied to said electric drive motor (43) and wherein said controller (50) is configured to determine that the sash (3) has reached an end position, such as e.g. said nearly closed position and/or a fully open position when said current exceeds a threshold, said controller (50) further being configured to store the determined position relative to the position derived from the signal from the revolution counter.

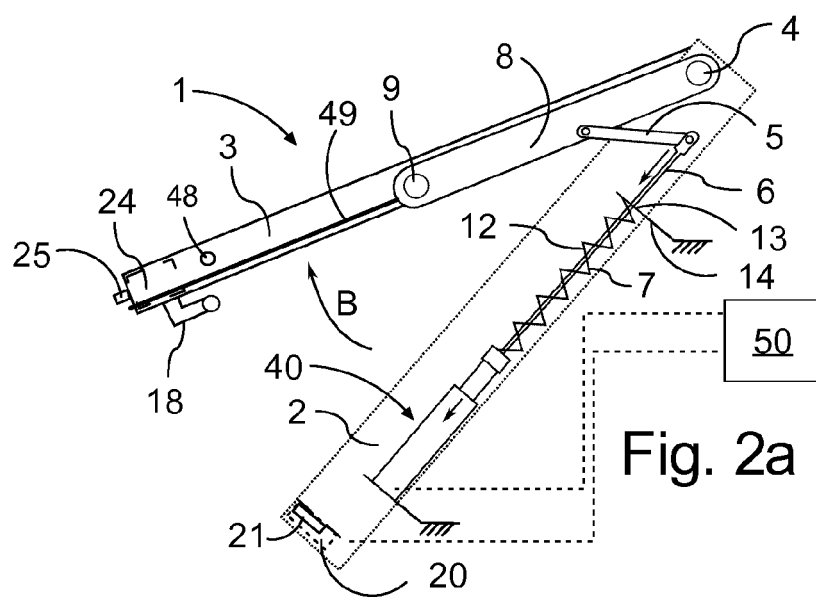
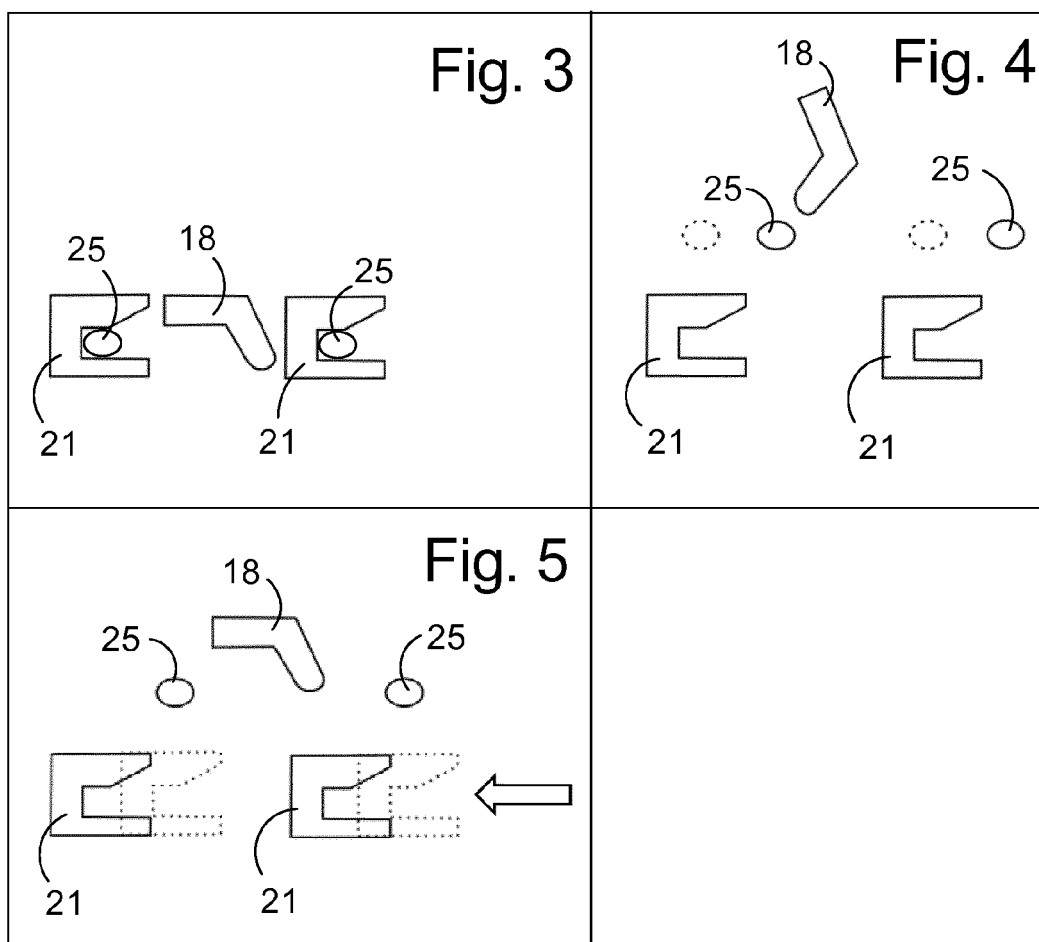
30. A roof window (1) according to any one of claims 1 to 29, wherein said second engagement member is manually movable to from its locking position to its unlocking position by an operator by manipulating said handle (18) or pressing said button (29) also when there is no power to operate the electronically operated lock.

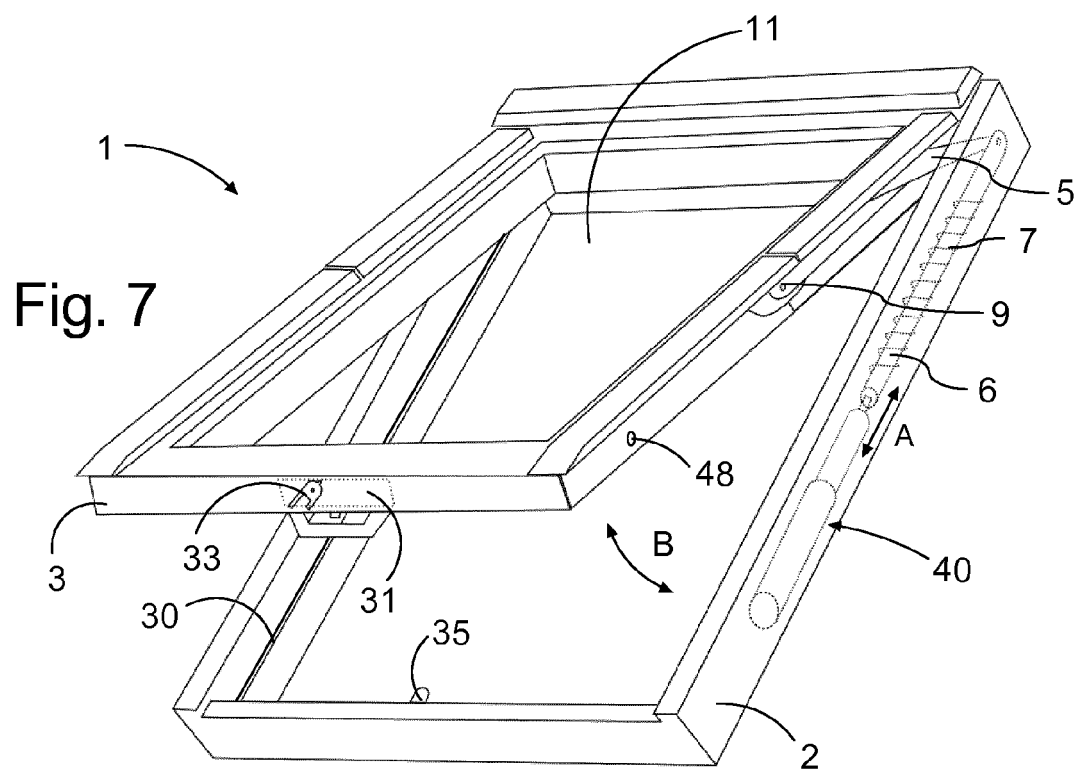
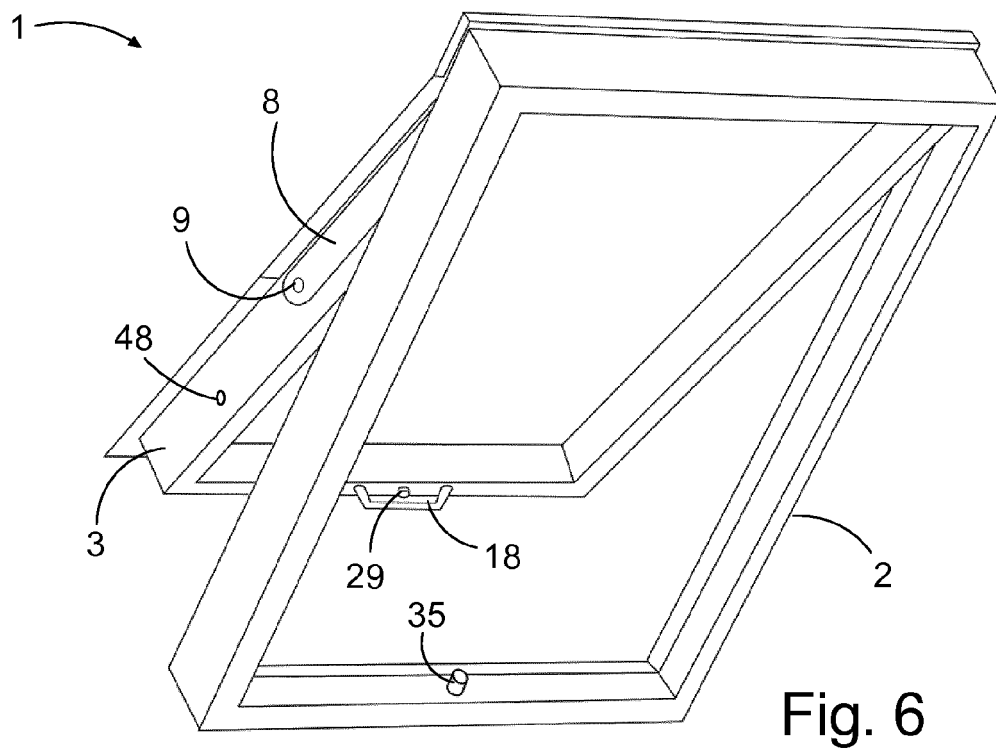
31. A roof window (1) according to any one of claims 1 to 30, wherein said second engagement member is manually and purely mechanically movable from its locking position to its unlocking position by an operator by manipulating said handle (18) or pressing said button (29).

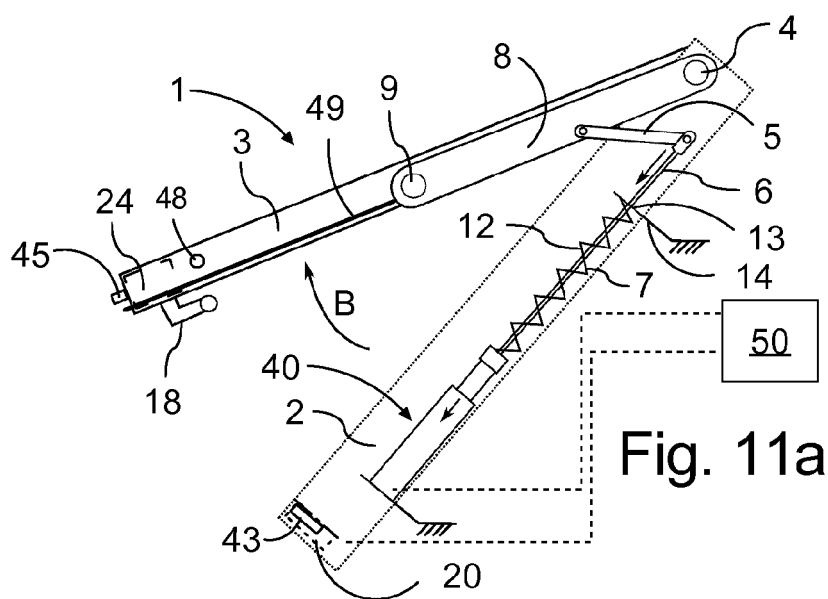
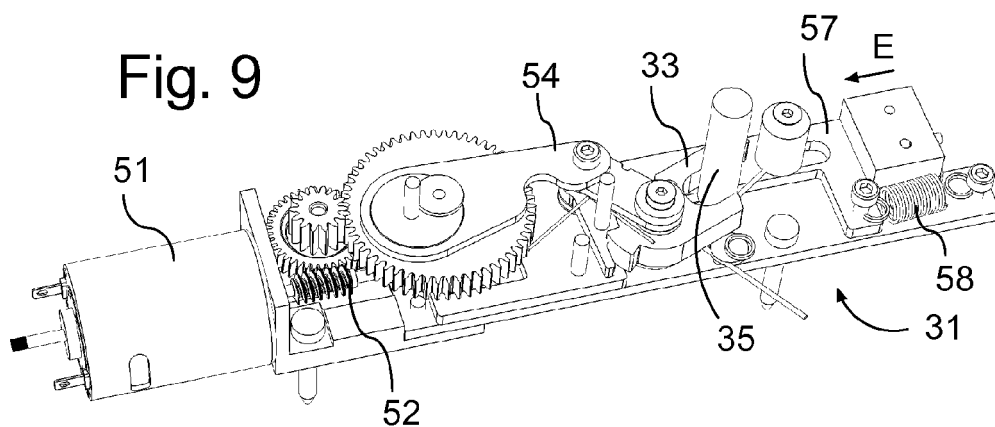
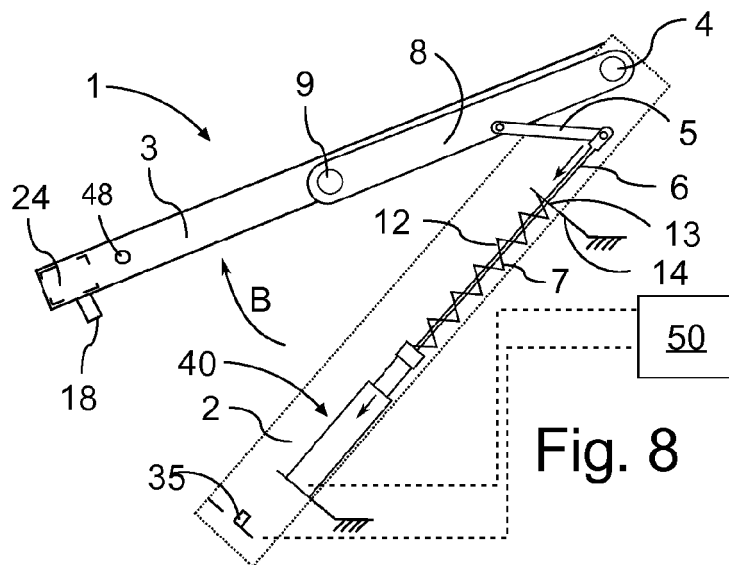
32. A roof window (1) according to any one of claims 1 to 31, wherein said sash (3) is provided with a seal (49) that is secured to the sash (3).

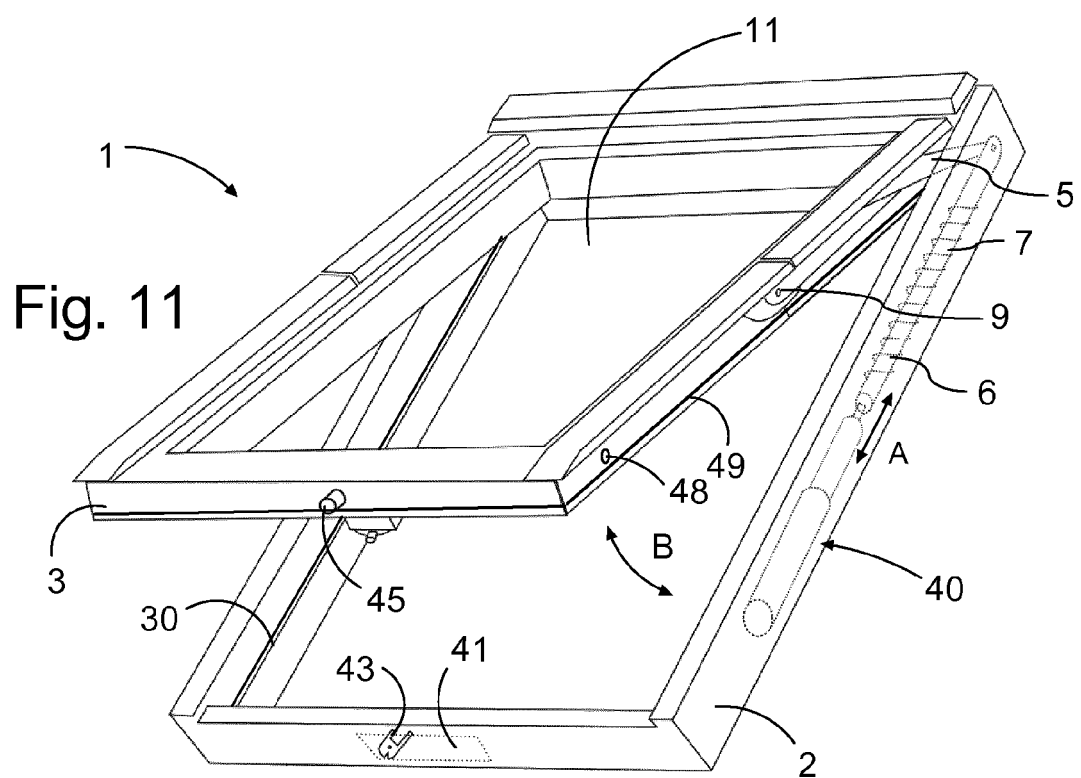
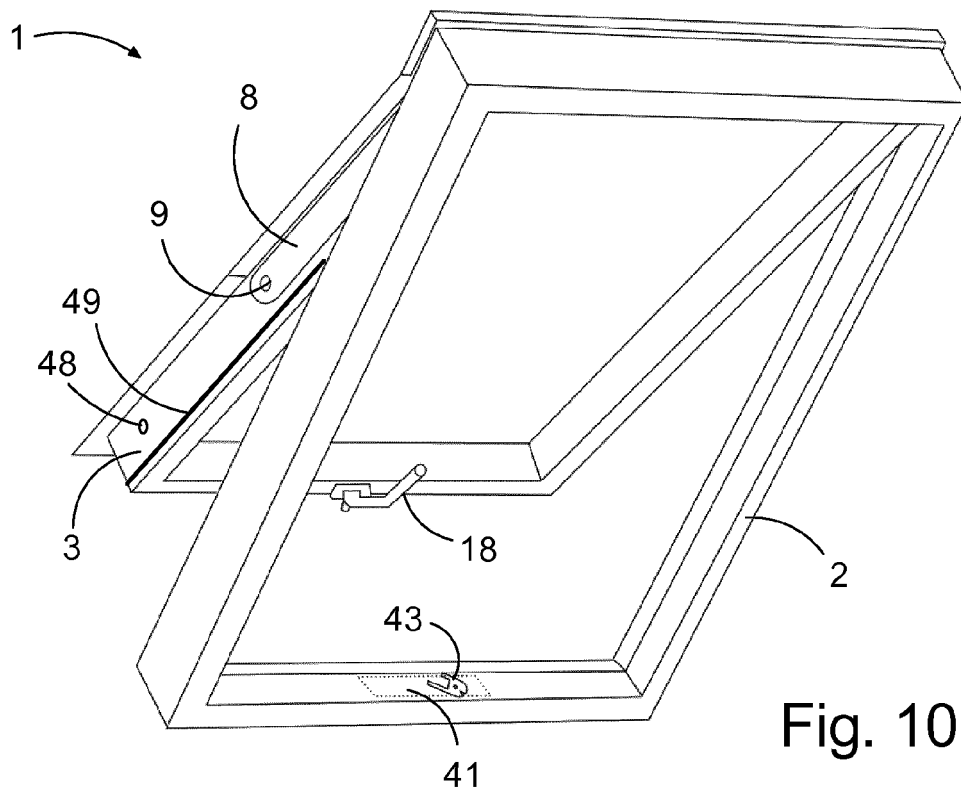
33. A roof window (1) according to any one of claims 1 to 32, wherein said sash (3) can pivot about another horizontal axis via a pivot hinge (9) that is arranged in the vicinity of center of the sash (3), said roof window (1) being provided with releasable means (48) to prevent pivoting of the sash (3) about said other horizontal axis, and wherein said sash actuator (40) is blocked when said sash (40) is allowed to pivot about said other horizontal axis.













EUROPEAN SEARCH REPORT

Application Number
EP 15 16 0336

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	EP 2 752 549 A1 (VKR HOLDING AS [DK]) 9 July 2014 (2014-07-09) * paragraph [0009] * * paragraph [0020] - paragraph [0021] * * paragraph [0025] - paragraph [0030] * * figures 1-2 *	1-20, 22-33	INV. E05B63/24 E05B47/00 ADD. E05C9/02 E05B47/02
Y	FR 2 845 109 A1 (RENT SARL SOC [FR]) 2 April 2004 (2004-04-02) * page 1, line 1 - line 5 * * page 2, line 30 - page 4, line 18 * * figures 1-6 *	1-20, 22-33	
Y	US 2007/227204 A1 (SHOENFELD NORMAN A [US]) 4 October 2007 (2007-10-04) * paragraph [0024] * * paragraph [0027] - paragraph [0031] * * paragraph [0034] * * paragraph [0037] - paragraph [0038] * * figures 2-5 *	1-20, 22-33	
Y	US 2014/300116 A1 (HELLWIG ALEXANDER [DE] ET AL) 9 October 2014 (2014-10-09) * paragraph [0039] - paragraph [0047] * * figures 1-12 *	1-20, 22-33	TECHNICAL FIELDS SEARCHED (IPC) E05B E05C
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 7 September 2015	Examiner Antonov, Ventseslav
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
ON EUROPEAN PATENT APPLICATION NO.**

EP 15 16 0336

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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07-09-2015

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 2752549 A1	09-07-2014	NONE	
FR 2845109 A1	02-04-2004	NONE	
US 2007227204 A1	04-10-2007	NONE	
US 2014300116 A1	09-10-2014	CN 104100144 A	15-10-2014
		DE 102013103316 A1	09-10-2014
		EP 2787153 A2	08-10-2014
		US 2014300116 A1	09-10-2014