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(54) **A BUILDING APERTURE COVER WITH A HANDLE COMPRISING A USER INTERACTION SENSOR ARRANGEMENT**

(57) The present disclosure relates to A building aperture cover, such as a window (1), comprising

- a fixation frame (2) and a movable unit (3), wherein the movable unit (3) is configured to be moved relative to the fixation frame (2) between a closed unit position (CPOS) and an open unit position (OPOS),
- an electric actuator arrangement (8) configured to provide said movement of the movable unit (3) between the closed unit position (CPOS) and the open unit position (OPOS),
- a handle (5), wherein the handle (5) is attached to a part of the movable unit (3), wherein the handle (5) comprises a gripping part (5a) configured to be grasped by human hand, and
- a control system (7) comprising one or more hardware processors.

The handle (5) comprises a user interaction sensor arrangement (6, 6a, 6b) configured to detect physical user interactions (F1, F2) applied at the gripping part (5a),

and provide sensor data (SDA) based thereon, and the control system (7) is configured to receive and process the sensor data (SDA). The control system (7) is configured to provide first control output (OP1) based on said processing of the sensor data (SDA) if the sensor data (SDA) comprises information indicating that a first user interaction comprising a first activation force (F1) in a first force direction is applied to the gripping part (5a). The control system (7) is configured to provide second control output (OP2) based on said processing of the sensor data (SDA) if the sensor data (SDA) comprises information indicating that a second user interaction comprising a second activation force (F2) in a second force direction is applied to the gripping part (5a). The electric actuator arrangement (8) is configured to apply an opening force (OF) to the movable unit (3) if the first control output (OP1) is provided, and the actuator arrangement (8) is configured to apply a closing force (CF) to the movable unit (3) if the second control output (OP2) is provided.

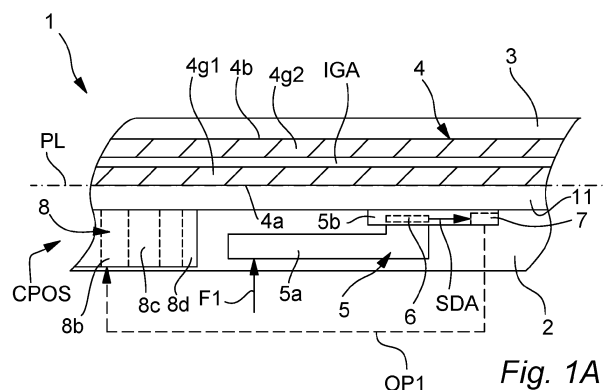


Fig. 1A

Description

[0001] The present disclosure relates to a building aperture cover. Moreover, the present disclosure relates to a method of controlling an actuator arrangement of a building aperture cover.

Background

[0002] Various building aperture cover types such as e.g. windows, comprise a glass unit that enable sunlight passing into the building when the building aperture cover is installed to cover a building aperture in an outer wall or in a roof structure of the building. These windows may comprise a handle that is configured to operated by human hand in order to open or close a movable unit, such as a sash, of the window, to provide ventilation, where the movable unit comprises the glass unit. The window may also comprise an actuator arrangement comprising an actuator configured to move the movable unit between an open or closed position.

[0003] An actuator arrangement configured to open and close the movable unit of a building aperture cover may e.g. be remote controlled and/or controlled by a central controller.

[0004] US 2007/0170729 discloses a handle. The handle comprises control elements and/or sensors and a handle part which can be displaced into various positions of the handle which correspond to different operational positions. The handle is connected to electromagnetic or electromechanical locking elements. This solution may e.g. be considered less user friendly.

[0005] It may e.g. be an object of the present disclosure to provide a solution for a building aperture cover that may be intuitive to use by a human user. It may additionally or alternatively e.g. be an object of the present disclosure to provide a building aperture cover solution that is user friendly.

Summary

[0006] The present disclosure relates to a building aperture cover comprising a fixation frame and a movable unit. The movable unit is connected to the fixation frame by means of a hinge arrangement so that the movable unit is configured to be moved relative to the fixation frame between a closed unit position and an open unit position. The movable unit comprises an insulated glass unit. The building aperture cover comprises an electric actuator arrangement configured to provide the movement of the movable unit between the closed unit position and the open unit position. Additionally, the building aperture cover comprises a handle. The handle is attached to a part of the movable unit, and the handle comprises a gripping part configured to be grasped by human hand. Moreover, the building aperture cover comprises a control system comprising one or more hardware processors. The handle comprises a user interaction sensor

arrangement configured to detect physical user interactions applied at the gripping part, and provide sensor data based thereon. The control system is configured to receive and process the sensor data. The control system is configured to provide first control output based on the processing of the sensor data, if the sensor data comprises information indicating that a first user interaction comprising a first activation force in a first force direction is applied to the gripping part. The control system is configured to provide second control output based on said processing of the sensor data if the sensor data comprises information indicating that a second user interaction comprising a second activation force in a second force direction is applied to the gripping part. The electric actuator arrangement is configured to apply an opening force to the movable unit if the first control output is provided, and the actuator arrangement is configured to apply a closing force to the movable unit if the second control output is provided.

[0007] The above solution may e.g. provide an opening/closing solution for a building aperture cover that may be intuitive to use by a human user, and may hence help to provide a solution where user operation mistakes are reduced. For example guests may often struggle with windows because most window control solutions are un-intuitive.

[0008] Additionally or alternatively, the solution may provide that human users may be relieved from needing to manually providing a substantial lifting force onto the movable unit in order to open or close the window as the actuator arrangement provides the opening force and/or closing force dependent on the detected activation force.

[0009] Additionally or alternatively, the present solution may provide advantages when compared to wireless, separate, hand held remote controls as these may e.g. be displaced and lost or be less intuitive because it is not clear which remote control opens which window or the remote control existence may be unknown to a human user (e.g. a visitor in the building).

[0010] Physical user interactions may enable an intuitive and user friendly control.

[0011] Providing that the user interaction sensor arrangement is arranged in the handle, and that forces are detected directly in/at the handle arrangement may e.g. help to provide a solution that is easy to install. Additionally or alternatively, it may help to reduce the risk of erroneously registering forces that should not induce the actuator to move the movable unit. Additionally or alternatively, it may enable an intuitive and user friendly control.

[0012] A building aperture, such as a building aperture cover according to embodiments of the present disclosure, such as a door or a window, may comprise a movable unit that is configured to be opened and closed. In open unit position, air can travel through the building aperture, for example between a fixation frame and the movable unit. In closed unit position, air may be prevented from traveling through the building aperture, or the

amount of air that may be allowed to travel through the building aperture may be significantly reduced when compared to the open unit position. In some situations, a door or a window may comprise a ventilation solution that may allow a reduced amount of air to travel through the ventilation solution of the aperture cover although the movable unit is arranged in the closed position.

[0013] In one or more embodiments of the present disclosure, the building aperture cover comprises a locking system. This locking system is configured to be arranged in a locked state and an unlocked state, respectively. The movable unit is configured to be movable towards the open position from the closed position when the locking system is in the unlocked state. Moreover, the movable unit is configured to be in a locked unit state in the closed unit position by means of the locking system when the locking system is in the locked state. The handle, such as the gripping part, is configured to be operated by human hand so as to control in which of said states the locking system is arranged.

[0014] This may e.g. help to provide a user friendly solution as both the actuator arrangement and the locking system is controllable by means of user interaction with the handle such as with the gripping part. The locking system may e.g. help to provide a more burglary safe solution and/or a solution that may be safe during extreme weather conditions.

[0015] Said control/manipulation of the locking system may comprise e.g. comprise controlling the gripping part, such as moving the gripping part relative to the movable unit, e.g. by rotation of the gripping part around a rotation axis, so as to shift the state of the locking system between the locked state and an unlocked state.

[0016] In the locked unit state, the movable unit is directly or indirectly prevented by the locking system from moving towards the open position, this is the case when the movable unit is in the closed position and the locking system is in the locked state.

[0017] In one or more embodiments if the present disclosure, the handle, such as the gripping part may be configured to be moved relative to the movable unit, such as by means of the actuator system and/or human hand so as to control the in which state the locking system is arranged.

[0018] In one or more embodiments of the present disclosure, the gripping part is configured to be moved, such as by displacement and/or rotation, relative to the movable unit between a first gripping part position and a second gripping part position, respectively. The locking system is configured to be arranged in the locked state when the gripping part is arranged in the first gripping part position. The locking system is configured to be arranged in the unlocked state when the gripping part is arranged in the second gripping part position.

[0019] This may e.g. help to provide a user friendly and/or intuitive solution. Additionally or alternatively, it may enable providing a mechanically simple and/or cost efficient solution.

[0020] The handle, such as the gripping part, may in embodiments of the present disclosure be directly or indirectly coupled to the locking system so as to be configured to switch the locking system between the locked state and the unlocked state in response to a movement of the gripping part relative to the movable unit.

[0021] In one or more embodiments of the present disclosure, the gripping part may be configured to be moved, such as by displacement and/or rotation, relative to the movable unit between a first gripping part position and a second gripping part position by human hand, so that a disengagement of a lock between the fixation frame and the movable unit is provided and/or so that a disengagement of an electric actuator arrangement lock connection between the fixation frame and the movable unit is provided.

[0022] This may e.g. help to provide a safe and/or user friendly, such as intuitive, solution.

[0023] In one or more embodiments of the present disclosure, the gripping part may be configured to be moved, such as by displacement and/or rotation, relative to the movable unit between a first gripping part position and a second gripping part position by human hand, so that a disengagement of a lock between the fixation frame and the movable unit is provided.

[0024] In one or more embodiments of the present disclosure, the gripping part is configured to be moved, such as by displacement and/or rotation, relative to the movable unit between a first gripping part position and a second gripping part position by human hand, so that a disengagement of an electric actuator arrangement lock connection between the fixation frame and the movable unit is provided.

[0025] In some embodiments of the present disclosure, the gripping part may be configured to be moved, such as by displacement and/or rotation, relative to the movable unit between a first gripping part position and a second gripping part position by human hand, so that a disengagement of a lock between the fixation frame and the movable unit is provided, and so that a disengagement of an electric actuator arrangement connection between the fixation frame and the movable unit is provided.

[0026] In one or more embodiments of the present disclosure, the gripping part is configured to be placed in two positions relative to the movable unit, when the movable unit is in the closed unit position. These two positions may comprise a first gripping part position where the electric actuator arrangement is engaged so as to move the movable unit during closing and/or opening, and a second gripping part position where the actuator is disengaged so as to not move, such as unable to close and/or open, the movable unit.

[0027] Additionally or alternatively, the handle may be configured to have two gripping part positions comprising a first gripping part position where a lock is engaged and the movable unit is therefore unable to move, and a second gripping part position where a lock is released/disengaged and the movable unit is therefore configured to

move.

[0028] In one or more embodiments of the present disclosure, the handle, such as the gripping part, may be directly or indirectly mechanically coupled to the locking system so as to be configured to mechanically switch the locking system between the locked state and the unlocked state by movement of the gripping part relative to the movable unit.

[0029] This may e.g. help to provide a reliable and/or cost efficient control of the locking system. It may additionally or alternatively help to provide a mechanically simple locking system solution.

[0030] In other embodiments of the present disclosure, the handle, such as the gripping part, may be electrically, such as wirelessly, coupled to the locking system so as to switch the locking system between the locked state and the unlocked state.

[0031] In other embodiments, the gripping part may be substantially unmovable relative to the handle, and alone the forces provided at the handle may control the opening and closing of the movable unit. A locking system may be provided, and in that case, the locking system may be e.g. magnetically, electrically, and/or wirelessly controlled and/or the like, e.g. in response to detecting the forces.

[0032] In one or more embodiments of the present disclosure, operation of the actuator arrangement may be configured to be omitted despite the first and/or second activation force being provided onto the gripping part, when the gripping part is arranged in a first gripping part position or when the gripping part in a second gripping part position.

[0033] This may e.g. be relevant in situations where the actuator is decoupled from the movable unit when the handle is arranged in the second gripping part position. For example in response to moving the gripping part from the first gripping part position to the second gripping part position. In this case it may not be desired that the actuator arrangement will be activated by pulling or pushing forces provided by human hand on the gripping part, as the hand may here be used for manually opening and closing the movable unit independently of the actuator.

[0034] In one or more embodiments of the present disclosure, a handle state sensor may be arranged at the handle in order to detect/determine the handle position, for example by detecting directly or indirectly whether the gripping part is in the first or second gripping part position (relative to the movable unit).

[0035] If the handle/gripping part is detected by the handle state sensor to be in the second gripping part position, said omission of operating the actuator arrangement may be provided. On the other hand, if the handle/gripping part is detected by the handle state sensor to be in the first gripping part position, actuator operation may be accepted when an activation force is provided at the gripping part. In the latter case, the first and/or second control output may be provided in response to an activation force.

[0036] A unit position sensor may in embodiments of the present disclosure be provided in order to determine the position of the movable unit. For example, said omission of operation of the actuator arrangement may occur if the gripping part is detected to be in the first gripping part position and if the movable unit is detected to be in a closed position. If, on the other hand, the movable unit is detected to be in an open position, the closing force and/or opening force provided by the actuator arrangement may still be allowed to be provided.

[0037] In other embodiments of the present disclosure, operation of the actuator arrangement may be configured to be omitted despite the first and/or second activation force being provided onto the gripping part, when the gripping part is arranged in the first gripping part position. This may e.g. be relevant in a solution where the handle is of a configuration where a latch or the like of the locking system mechanically connected/coupled to the position of the gripping part in a way so that that the gripping part needs to be arranged in the second gripping part position to enable a movement of the movable unit from a closed position to an open position. In this case, it may be undesirable that the actuator system provides the opening force when the gripping part is in the first position, as the locking system will here be in the locked position, and the locking system will hence will prevent opening of the movable unit.

[0038] In one or more embodiments of the present disclosure, the actuator arrangement may be configured to provide the opening force in response to the first activation force being provided onto the gripping part while the gripping part is arranged in the first gripping part position.

[0039] This may e.g. enable automatic control of the movable unit, for example without first needing manual control of the handle.

[0040] In one or more embodiments of the present disclosure, the actuator may be able to control/switch the locking system state. In further embodiments of the present disclosure, this may be enabled even though the gripping part is arranged in the first gripping part position. Hence, when the handle is in a first gripping part position, the locking system may be arranged in the locked state, but may still be switched to the unlocked state by means of the actuator arrangement. Hence, for example, the actuator arrangement may, when the first activation force is applied at the handle, in response to the activation force unlock the locking system, i.e. control, such as move, it to the unlocked state. In some embodiments, this may be obtained by the actuator being configured to directly or indirectly move the gripping part relative to the movable unit.

[0041] In one or more embodiments of the present disclosure, the user interaction sensor arrangement is configured to detect an opening first user interaction, such as an activation force, applied at a first surface of the gripping part, and is moreover configured to detect a closing second user interaction, such as an activation force, applied at a second opposite surface of the gripping part.

This may e.g. provide an intuitive control solution.

[0042] In one or more embodiments of the present disclosure, the user interaction sensor arrangement comprises two or more sensors provided to detect user interactions at two opposite surfaces of the handle. A first of the sensors may here, in embodiments, be configured to detect an opening first user interaction, such as an activation force, applied at a first surface of the gripping part. A second opposite sensor may be configured to detect a closing second user interaction, such as an activation force, applied at a second opposite surface of the gripping part. This may e.g. help provide a reliable and/or cost efficient sensor solution for detection of user interactions at the gripping part.

[0043] In one or more embodiments of the present disclosure, said control system may be configured to refrain from providing said control output if the user interaction sensor arrangement detects an opening first user interaction, such as an activation force, applied at a first surface of the gripping part, and moreover detects a closing second user interaction, such as an activation force, applied at a second opposite surface of the gripping part. If both user interactions related to both opening and closing of the movable unit are detected simultaneously (e.g. in some embodiments, if a human hand grasps around the gripping part), this may indicate a manual control of the handle and/or movable unit, and hence, the actuator may refrain from activating the actuator.

[0044] In one or more embodiments of the present disclosure, said control system may be configured to refrain from providing said control output if the first sensor detects a opening first user interaction and the second opposite sensor simultaneously detects a closing second user interaction. If the first and second sensors are activated simultaneously (e.g. in some embodiments, if a human hand grasps around the gripping part), this may indicate a manual control of the handle and/or movable unit, and hence, the actuator may refrain from activating the actuator.

[0045] In one or more embodiments of the present disclosure, the locking system may be configured to be switched from a locked state to an unlocked state in response to the first control output. In some further embodiments, this may be provided by means of the opening force provided by the actuator arrangement. For example, it may be provided by means of an actuator of the actuator arrangement moving the gripping part from the first gripping part position to the second gripping part position.

[0046] The actuator and lock may be sequential hereby understood such that part of the actuator displacement controls the lock state between locked or unlocked while another part of the actuator displacement moves the movable unit e.g. the window.

[0047] In alternative embodiments two separate actuators may be used to control the lock state and movement of the movable unit.

[0048] In one or more embodiments of the present dis-

closure, the first activation force may be a force comprising a force vector component in a handle movement direction, where said handle movement direction is the movement direction of the handle that will occur when a movement of the movable unit from the closed unit position towards the open unit position is initiated by the actuator arrangement.

[0049] In one or more embodiments of the present disclosure, the second activation force may be a force comprising a force vector component in a handle movement direction, where said handle movement direction is the movement direction of the handle that will occur when a movement of the movable unit from the open unit position towards the closed unit position is initiated by the actuator arrangement.

[0050] This may e.g. provide a "natural mapping" solution which is intuitive to the user. For example, if the first activation force is designed to be in the direction of the handle movement when the movable unit initially starts to move towards an open position from the closed position, this may represent an intuitive and inherently expected force direction to be applied in order to obtain opening of the movable unit. Thus, erroneous user operation and/or risks of damaging the handle due to incorrect usage may be reduced. The same is the case if the second activation force is a force in the movement direction of the handle when the movable unit moves to the closed position.

[0051] The first and second activation forces may in embodiments of the present disclosure be forces that are configured to initiate opening and closing, respectively, of the movable unit.

[0052] Preferably the force vector component is the major force vector component. Hereby the majority of the opening and closing force direction must match the actual movement of the movable unit.

[0053] The first and second activation forces may in embodiments of the present disclosure be substantially oppositely directed.

[0054] In one or more embodiments of the present disclosure, the control system may be configured to provide a control output configured to induce the actuator unit to stop providing the opening force if the second activation force is provided by a human user at the gripping part while the actuator arrangement provides the opening force. In further embodiments of the present disclosure, the control system may be configured to provide a control signal so as to induce the actuator arrangement to provide the closing force if a consecutive second activation force provided by a human user at the gripping part is detected.

[0055] In one or more embodiments of the present disclosure, the building aperture cover may comprise comprises a locking system configured to be wirelessly controlled in response to the first user interaction, so as to enter an unlocked state.

[0056] In one or more embodiments of the present disclosure, the locking system may be wirelessly controlled,

such as electrically and/or magnetically controlled, by means of a lock controller, wherein the lock controller is configured to switch the locking system from a locked state to an unlocked state, for example prior to the opening force being applied by the actuator arrangement.

[0057] This may enable a user friendly solution and/or a solution that enables advantageous implementation

[0058] In this embodiment, the locking system may in some embodiments, e.g. be or comprise an electrically controlled, such as an electromechanically and/or electromagnetically controlled, locking system.

[0059] In one or more embodiments of the present disclosure, the first control output may be configured to induce the lock controller to switch the locking system from the locked state to an unlocked state while the gripping part is arranged in the first gripping part position.

[0060] This may e.g. enable a user friendly and intuitive solution.

[0061] In one or more embodiments of the present disclosure, the first control output may be configured to induce the lock controller to switch the locking system from the locked state to an unlocked state while the gripping part is arranged in the first gripping part position. In further embodiments of the present disclosure, the switching of the locking system may be configured to be provided prior to the actuator arrangement provide the opening force, and/or by means of the opening force.

[0062] In one or more embodiments of the present disclosure, the actuator arrangement may be configured to move the movable unit from the closed unit position towards the open unit position by means of said opening force and/or

[0063] In one or more embodiments of the present disclosure, the actuator arrangement may be configured to move the movable unit from the open unit position towards the closed unit position by means of the closing force.

[0064] In one or more embodiments of the present disclosure, the locking system comprises a latch and an engagement part, such as a notch, wherein the handle is connected to the locking system so as to operate the locking system in response to a movement of the gripping part relative to the movable unit.

[0065] In one or more embodiments of the present disclosure, the handle may be mechanically, electrically and/or wirelessly connected, to the locking system so as to operate the locking system in response to a movement of the gripping part relative to the movable unit.

[0066] In one or more embodiments of the present disclosure, the locking system may be configured to mechanically interlock the movable unit and the fixation frame.

[0067] In one or more embodiments of the present disclosure, the locking system may be configured to mechanically interlock the movable unit and the actuator arrangement.

[0068] In one or more embodiments of the present disclosure, the building aperture cover, such as the handle,

may comprise the control system, such as one or more hardware processors of the control system.

[0069] In one or more embodiments of the present disclosure, the handle may comprise transmissions means, such as transmission means for transmitting wireless signals, wherein the transmission means are configured to transmit the first and second control output and/or the sensor data.

[0070] In one or more embodiments of the present disclosure, the first control output and/or the second control output may comprise an electric signal, a wirelessly transmitted signal and/or a software parameter stored in a data storage, for example as part of a software control code.

[0071] In one or more embodiments of the present disclosure, the electric actuator arrangement may comprise an actuator and an electric motor configured to drive the actuator in response to a control signal, such as in response to said control output or a signal based on said control output.

[0072] The electric actuator may in some embodiments comprise a gear (8c), such as a reduction gear, that transfers rotary forces from the electric motor to the actuator. The actuator arrangement may additionally or alternatively comprise an actuator controller configured to receive the control output (OP 1 OP2) or a signal based thereon, wherein the actuator controller is configured to control the electric motor.

[0073] The one or more actuators may e.g. comprise one or more of one or more chain actuator, one or more spindle actuators and/or one or more piston actuators. Another/other type(s) of actuator may also be used in other embodiments.

[0074] In one or more embodiments of the present disclosure, the control system comprises a user interaction detection system comprising one or more predefined user interaction criteria represented in a data storage,

wherein said control system is configured to process the sensor data based on the user interaction criteria in order to determine if said control output should be provided,

wherein said control system is configured to provide said control output if the user interaction criteria is determined to be complied with.

[0075] In one or more embodiments of the present disclosure said control system may be configured to refrain from providing said control output if the user interaction criteria is determined to not be complied with.

[0076] In one or more embodiments of the present disclosure, said predefined user interaction criteria may comprise one or more of:

- one or more predefined thresholds, such as one or more force thresholds,
- one or more predefined time demands, such as one or more minimum time periods that a physical user

interaction must be continuously applied onto the gripping part before it is categorized as an activation force,

- one or more predefined time demands, such as one or more maximum time limits, that indicate when an applied user interaction should not be categorized as an activation force,
- one or more predefined user interaction patterns, such as tapping patterns.

[0077] In one or more embodiments of the present disclosure, said predefined user interaction criteria comprises a predefined time demand such as a maximum time limit, wherein the control system is configured to refrain from providing said control output if the physical user interactions have been provided for more than said predefined time demand such for more than said maximum time limit.

[0078] In one or more embodiments of the present disclosure, the user interaction sensor arrangement comprises one or more of

- one or more capacitive sensors,
- one or more switches such as energy harvesting switches,
- one or more strain gauges,
- one or more touch sensors.

[0079] In one or more embodiments of the present disclosure, the handle comprises a base part, wherein the gripping part is fixed to, such as movably fixed to, to said base part, wherein said base part is fixed to the movable unit.

[0080] This may e.g. provide a mechanically and/or aesthetically advantageous handle solution.

[0081] In one or more embodiments of the present disclosure, said user interaction sensor arrangement is arranged in or at the base part and/or in or at the gripping part.

[0082] In one or more embodiments of the present disclosure, the gripping part may be elongated and be arranged with a distance to the movable unit so that a human hand is able to extend around the elongated gripping member and in between the movable unit and the gripping part so as to grasp around the gripping member to provide the first and/or second activation force.

[0083] In one or more embodiments of the present disclosure, the glass unit comprises a major outer surface comprised in a first plane, wherein the first activation force is configured to be in a direction towards said plane, and wherein said second activation force is configured to be in a direction away from said plane.

[0084] The handle may in embodiments be placed at the interior side of the building aperture cover configured to face the interior of the building when the building aperture cover is installed in a building.

[0085] In one or more embodiments of the present disclosure, the glass unit comprises a major outer surface

comprised in a first plane, wherein the first and/or second activation force is/are configured to be in a direction parallel to said plane, such as wherein said first and second activation force are oppositely directed. This may e.g. be relevant for a sliding door or sliding window solution where the movable unit moves in a direction parallel to the first plane during opening and/or closing.

[0086] In one or more embodiments of the present disclosure, the building aperture cover is a window, such as a roof window.

[0087] Roof windows may require substantial opening force dependent on roof slope and additional devices such as roller shutter etc. Here an actuator arrangement with a user interaction handle is advantageous.

[0088] In one or more embodiments of the present disclosure, the building aperture cover is a door, such as a sliding door, such as a sliding door configured to move towards the open position in a direction substantially parallel to a plane defined by a major outer surface of the glass unit, such as by being displaced along a longitudinal rail.

[0089] Sliding doors and windows may require substantial opening force and present difficulty for the inhabitants. Sometimes complex hardware also results in operation errors. Here an actuator arrangement with a user interaction handle is advantageous.

[0090] In one or more embodiments of the present disclosure, the insulated glass unit comprises at least two glass sheets and at least one sealed, heat insulating gap arranged between major surfaces of the glass sheets.

[0091] In one or more embodiments of the present disclosure, said at least one sealed, insulating gap is evacuated to a pressure below 0.001 mbar, or wherein the gap is filled with a gas such as argon.

[0092] In one or more embodiments of the present disclosure, the gripping part is longitudinal and comprises a longitudinal direction, wherein the gripping part is configured to be rotated around an axis that is substantially parallel to a plane comprising a major outer surface of the insulating glass unit.

[0093] In one or more embodiments of the present disclosure, the gripping part may be configured to be rotated around an axis that is substantially perpendicular to a plane comprising a major outer surface of the insulating glass unit.

[0094] In one or more embodiments of the present disclosure, said building aperture cover may be arranged to cover a building aperture in an outer wall or in a roof structure of the building.

[0095] In one or more embodiments of the present disclosure, the user interaction sensor arrangement comprises at least one capacitive sensor, such as at least two capacitive sensors, configured to detect said user interactions provided at the gripping part.

[0096] In one or more embodiments of the present disclosure, the user interaction sensor arrangement comprises at least one touch sensor, such as at least two touch sensors, configured to detect said user interactions

provided at the gripping part.

[0097] Touch sensors, such as .g. a capacitive sensor solution or another touch sensor solution, may enable user friendly control of the movable unit, according to embodiments of the present disclosure.

[0098] In one or more embodiments of the present disclosure, the user interaction sensor arrangement may comprise at least one touch sensor, such as at least two touch sensors, configured to detect said user interactions provided at the gripping part.

[0099] In one or more embodiments of the present disclosure, the actuator arrangement is hidden in the window aperture cover.

[0100] In one or more embodiments of the present disclosure, an actuator housing of the actuator arrangement may be hidden in the top part of the window.

[0101] In one or more embodiments of the present disclosure, an actuator housing of the actuator arrangement may be hidden below a top cover, such as below a weather shield cover, of the building aperture cover.

[0102] In one or more embodiments of the present disclosure, an actuator housing of the actuator arrangement may be hidden between the movable unit and the fixation frame.

[0103] The present disclosure moreover relates to a method of controlling an actuator arrangement of a building aperture cover installed in a building, wherein the building aperture cover comprises

- an electric actuator arrangement,
- a movable unit comprising an insulated glass unit, and
- a handle, wherein the handle is attached to the movable unit and wherein the handle comprises a gripping part and a user interaction sensor arrangement.

[0104] The method comprises the steps of:

registering by means of the user interaction sensor arrangement that a first activation force in a first force direction has been applied at the gripping part, wherein the user interaction sensor arrangement provides first sensor data to a control system, wherein said first sensor data comprises information of that the first activation force in the first force direction is applied to the gripping part, wherein the control system processes the information of the first sensor data, and wherein the control system provides a first control output based on said processing of the first sensor data, wherein the electric actuator arrangement applies an opening force to the movable unit in response to the first control output.

[0105] The method moreover comprises registering by means of the user interaction sensor arrangement that a second activation force in a second force direction has been applied at the gripping part, and wherein the user

interaction sensor arrangement provides second sensor data to a control system, wherein said second sensor data comprises information of that the second activation force in the second force direction is applied to the gripping part,

wherein the control system processes the information of the second sensor data, and wherein the control system provides a second control output based on said processing of the second sensor data, wherein the electric actuator arrangement applies a closing force to the movable unit in response to the second control output.

[0106] In one or more embodiments of the above mentioned method, the building aperture cover may be a building aperture cover according to one or more of the previously described embodiments.

[0107] In one or more embodiments of the present disclosure, the control system provides the first control output when the first activation force in the first force direction is applied to the gripping part by human hand, and wherein the electric actuator arrangement applies said opening force to the movable unit in response to the first control output, wherein the control system provides the second control output when the second activation force in the second force direction is applied to the gripping part by human hand, and wherein the electric actuator arrangement applies said closing force to the movable unit in response to the second control output.

Figures

[0108] Aspects of the present disclosure will be described in the following with reference to the figures in which:

- fig. 1A-2B : illustrates a building aperture cover, according to various embodiments of the present disclosure,
- fig. 3 : illustrates a building aperture cover comprising a locking system, according to embodiments of the present disclosure,
- fig. 4 : illustrates schematically an embodiment of the present disclosure where a handle arrangement is configured to wirelessly control a locking system,
- figs. 5-6B : illustrates various embodiments of the present disclosure where a locking system part is configured to receive and interlock with a locking part of an actuator, according to embodiments of the present disclosure,

- figs. 7-10 : illustrates a roof window according to various embodiments of the present disclosure,
- figs. 11-12 : illustrates flow charts according to various embodiments of the present disclosure,
- fig. 13 : illustrates user interaction criteria that may be required to be fulfilled before control output is provided, according to various embodiments of the present disclosure,
- fig. 14 : illustrates a top hung building aperture cover, according to embodiments of the present disclosure,
- fig. 15 : illustrates a building aperture cover configured to be installed vertically in e.g. an exterior wall of a building, according to embodiments of the present disclosure,
- figs. 16A-16B : illustrates a sliding door, according to embodiments of the present disclosure,
- fig. 17 : illustrates a flow chart according to further embodiments of the present disclosure,
- fig. 18 : illustrates a capacitive sensor solution, such as a touch sensor solution, according to embodiments of the present disclosure, and
- fig. 19 : illustrates a building comprising building aperture covers according to embodiments of the present disclosure.
- fig. 20 : illustrates a maximum time limit according to embodiments of the present disclosure, and
- fig. 21 : illustrates a flow charts according to further embodiments of the present disclosure.

Detailed description

[0109] Figs. 1A and 1B and 2A-2B illustrates a schematically a building aperture cover 1, such as a window, for example a roof window, according to embodiments of the present disclosure.

[0110] The building aperture cover 1 comprises a fixation frame 2 and a movable unit 3. The movable unit 3 is connected to the fixation frame 2 by means of a hinge

arrangement 14 (not illustrated in fig 1, see e.g. figs. 10, 14 or 15) so that the movable unit 3 is configured to be moved relative to the fixation frame 2 between a closed unit position CPOS (Fig. 1A) and an open unit position OPOS (Fig. 1B). The movable unit 3 comprises an insulated glass unit 4. The insulated glass unit 4 comprises oppositely directed outer, major surfaces 4a, 4b. The insulating glass unit 4 comprises at least two glass sheets 4g1, 4g2 and at least one sealed, insulating gap IGA arranged between major surfaces of the glass sheets. The glass unit 4 may in embodiments of the present disclosure be a vacuum insulated glass unit, and in that embodiment, the insulating gap IGA may be evacuated to a pressure below 0.001 mbar, and spacers/pillars (not illustrated) may be distributed in the gap in order to maintain a distance between the glass sheets 4g1, 4g2. In other embodiments of the present disclosure, the glass unit 4 may be a glass unit where the gap IGA is filled with a gas such as argon. It is understood that the glass unit 4 in further embodiments (not illustrated) may comprise more than two glass sheets and hence comprise more than one insulating gap IGU, such as for example comprise two or three insulating gaps (IGU) separated by glass sheets. The glass unit 4 may in some embodiments be laminated (not illustrated in figs. 1A-2B)

[0111] The building aperture cover 1 comprises an electric actuator arrangement 8. This actuator arrangement 8 is configured to provide the movement of the movable unit 3 between the closed unit position CPOS and the open unit position OPOS. The building aperture cover 1 may also comprise more than one electric actuator arrangement 8 (not illustrated), in embodiments of the present disclosure. The one or more actuator arrangements 8 comprises an actuator 8a such as a linear actuator. In some embodiments, the actuator arrangement 8 may comprise one or more chain actuators, such as a push-pull chain actuator, one or more spindle actuators and/or one or more piston actuators. Another/other type(s) of actuator may also be used in other embodiments.

[0112] The building aperture cover 1 moreover comprises a handle 5. The handle 5 is attached to a part 11 of the movable unit 3, such as to a frame profile 11 or the like of the movable unit 3. This attachment may e.g. comprise use of mechanical fasteners such as screw, nails, clips and/or pop rivets, and/or use of a chemical fastener such as an adhesive. The frame provide 11 may e.g. comprise a wood profile and/or a polymer material profile.

[0113] The handle 5 comprises a gripping part 5a configured to be grasped by human hand.

[0114] The handle 5 may in some embodiments, as e.g. illustrated in fig. 1A-2B and other figures according to embodiments of the present disclosure, also comprises a base part 5b, and the gripping part 5a may in embodiments be fixed to, such as movably fixed to, the base part 5b. The base part 5b may be attached/fixed to the movable unit 3 such as to the frame profile 11.

[0115] The gripping part 5a may as illustrated be elongated and/or may be arranged with a distance to the movable unit 3 so that a human hand is able to extend around the elongated gripping member 5a and in between the movable unit 3 and the gripping part 5a so as to grasp around the gripping member 5a to provide the first and/or second activation force F1, F2. Other types of gripping parts may be provided in other embodiments of the present disclosure.

[0116] The building aperture cover 1 also comprises a control system 7 comprising one or more hardware processors such as one or more microprocessor(s), field-programmable gate array(s) (FPGA) and/or the like.

[0117] The handle 5 comprises a user interaction sensor arrangement 6 configured to detect physical user interactions F1, F2 applied at the gripping part 5a and provide sensor data SDA based thereon. The control system 7 is configured to receive and process the sensor data SDA. The control system 7 may receive the sensor data as raw sensor data. In other embodiments, the control system 7 may receive the sensor data after it has been pre-processed by a processing unit (not illustrated). In some embodiments, said pre-processing may comprise one or more of filtering, normalizing, converting, calculating one or more sensor output parameters and/or the like.

[0118] The user interaction sensor arrangement 6 may in embodiments of the present disclosure comprise one or more capacitive sensors/switches, one or more switches such as energy harvesting switches, one or more strain gauges, one or more resistance touch sensors, one or more piezo touch sensors and/or the like.

[0119] The user interaction sensor arrangement 6 may in embodiments of the present disclosure comprise, or be designed to provide, one or more touch sensors for registering the user interactions F1, F2.

[0120] In some embodiments, if the user interaction sensor arrangement 6 comprises a capacitive sensor, the capacitive sensor may be arranged in the gripping part 5a.

[0121] The user interaction sensor arrangement may in some embodiments of the present disclosure be in or at the base part 5b and/or in or at the gripping part 5a.

[0122] The control system 7 is configured to provide first control output OP1 based on the processing of the sensor data SDA. This first control output OP1 is provided if the control system 7 decides (by means of software processing of the received sensor data) that sensor data SDA comprises information indicating that a first user interaction comprising a first activation force F1 in a first force direction is applied to the gripping part 5a.

[0123] The first control output OP1 and/or the second control output OP2 may comprise an electric signal, a wirelessly transmitted signal and/or a software parameter stored in a data storage, for example as part of a software control code.

[0124] The control system 7 is additionally configured to provide second control output OP2 (see fig. 2A) based

on said processing of the sensor data SDA. This second control output OP2 is provided if the control system 7 decides (by means of software processing of the sensor data) that the sensor data SDA comprises information indicating that a second user interaction comprising a second activation force F2 in a second force direction is applied to the handle 5, such as to the gripping part 5a of the handle 5.

[0125] The electric actuator arrangement 8 is configured to apply an opening force OF (See fig. 1B) to the movable unit 3 if the first control output OP1 is provided, and the actuator arrangement 8 is configured to apply a closing force CF (See fig. 2B) to the movable unit 3 if the second control output OP2 is provided.

[0126] The opening force and the closing force may be oppositely directed.

[0127] The actuator arrangement 8 may thus be configured to move (Fig. 1B) the movable unit 3 from the closed unit position CPOS (see fig. 1A and 2B) towards the open unit position OPOS (see e.g. fig. 1B and Fig. 2A) by means of the opening force OF. Additionally, the actuator arrangement 8 is configured to move (Fig. 2B) the movable unit 3 from the open unit position OPOS towards the closed unit position CPOS by means of the closing force CF, see fig. 2B.

[0128] When the movable unit 3 is in the open position OPOS, ventilation air from the outside of the building in which the aperture cover 1 is arranged can pass into the building in between the movable unit 3 and the fixation frame 2.

[0129] In some embodiments of the present disclosure, the building aperture cover 1, such as the handle 5, may comprise the control system 7.

[0130] In some embodiments, the handle 5 may comprise transmissions means such as a transmitter, such as a transmitter and/or transceiver for transmitting wireless signals, wherein the transmission means are configured to transmit the first and second control output OP1, OP2 and/or the sensor data SDA. Hence the first and second control output OP1, OP2 may be a wireless control output. In other embodiments of the present disclosure, the first and second control output OP1, OP2 may be transmitted by means of a hardware connection such as a wired connection.

[0131] The actuator arrangement 8 comprises an electric motor 8b configured to drive the actuator 8a in response to a control signal, such as in response to said control output OP1 OP2 or a signal based on said control output OP1 OP2.

[0132] The electric actuator arrangement 8 may in some embodiments comprise a gear 8c, such as a reduction gear, that transfers rotary forces from the electric motor 8b to the actuator 8a. The actuator arrangement 8 may additionally or alternatively comprise an actuator controller configured to receive the control output OP1 OP2 or a signal based thereon, wherein the actuator controller is configured to control the electric motor 8b based thereon.

[0133] In some embodiments, the motor may be powered by a rechargeable battery (not illustrated). In other embodiments, it may be powered by mains.

[0134] It is understood that e.g. electric motor 8b, gear 8c, rechargeable battery (not illustrated) for driving the motor and/or the like may be arranged inside a common actuator housing 8d. This housing 8d may be attached to the fixation frame 2 (as illustrated) or the movable unit 3, while the actuator part 8a is attached to the other of the fixation frame 2 and the movable unit 3.

[0135] In some embodiments of the present disclosure (not illustrated), the sensor data SDA may be transmitted wired or wirelessly to the control system 7. In some embodiments, the control system 7 may be integrated in or considered a part of the actuator arrangement 8, and e.g. be arranged inside the same housing of the actuator arrangement 8 as the electric motor, gear, actuator storage and/or the like of the actuator arrangement 8 is arranged.

[0136] In some embodiments, the control system 7 may be integrated in or considered a part of the handle 5, as e.g. illustrated.

[0137] The first activation force F1 may in embodiments of the present disclosure be a force comprising a force vector component in a handle movement direction MD1. The handle movement direction MD 1 is the movement direction of the handle 5 that will occur when a movement of the movable unit 3 from the closed unit position CPOS towards the open unit position OPOS is initiated by the actuator arrangement 8. Additionally or alternatively, the second activation force F2 may be a force comprising a force vector component in a handle movement direction MD2 where said handle movement direction MD2 is the movement direction MD2 of the handle 5, 5a that will occur when a movement of the movable unit 3 from the open unit position OPOS towards the closed unit position CPOS is initiated by the actuator arrangement 8. This may e.g. provide a "natural mapping" solution which is intuitive to the user. For example, if the first activation force F1 is designed to be in the direction of the handle movement when the movable unit initially starts to move towards an open position from the closed position, this may represent an intuitive and inherently expected force direction to be applied in order to obtain opening of the movable unit 3. The same may be the case if the second activation force F2 is a force in the movement direction of the handle when the movable unit moves to the closed position.

[0138] The first and second activation forces F1, F2 may in embodiments of the present disclosure be forces that are configured to initiate opening and closing, respectively, of the movable unit.

[0139] It may be preferred that the force vector components mentioned above is/are the major force vector component. Hereby the majority of the opening and closing force direction should be designed to match the actual movement of the movable unit.

[0140] The first F1 and second activation forces F2 may in embodiments of the present disclosure be sub-

stantially oppositely directed.

[0141] The glass unit 4 comprises a major outer surface 4a comprised in a first plane PL. The major outer glass unit 4 surface 4a may be said to define the plane PL. The first activation force F1 may be configured to be in a direction towards said plane PL. The second activation force F2 may be configured to be in a direction away from said plane PL. See fig. 1A and 2A respectively.

[0142] The first F1 and/or second F2 activation force, may in some embodiments be configured to be primarily, such as substantially fully, perpendicular to the plane PL.

[0143] It is generally understood that in embodiments of the present disclosure, the building aperture cover 1 may comprises a locking system 9a, 9b, 19a, 19b. Various embodiments of a locking system according to various embodiments of the present disclosure are described in more details below.

[0144] Generally, the locking system 9a, 9b, 19a, 19b may be configured to be arranged in a locked state LS and an unlocked state US. The movable unit 3 is configured to be movable towards the open position OPOS from the closed position CPOS when the locking system 9a, 9b, 19a, 19b is in the unlocked state US. The movable unit 3 is additionally configured to be in a locked unit state in the closed unit 3 position CPOS by means of said locking system(s) 9a, 9b, 19a, 19b when the locking system is in the locked state LS.

[0145] User interaction with the handle may be provided in order to switch the locking system between the locked state and unlocked state. The handle 5, such as the gripping part 5a, may in embodiments of the present disclosure be configured to be operated by human hand so as to control in which of said states LS, US the locking system 9a, 9b, 19a, 19b is arranged.

[0146] In certain embodiments of the present disclosure, the control system 7 may be configured to provide a control output configured to induce the actuator unit 8 to stop providing the opening force OF if the second activation force F2 is provided by a human user at the gripping part 5a while the actuator arrangement 8 provides the opening force OF. In further embodiments, the control system 7 may be configured so as to provide a control signal OP2 so as to induce the actuator arrangement 8 to provide the closing force CF if a consecutive second activation force F2 provided by a human user at the gripping part 5a is detected.

[0147] Fig. 3 illustrates schematically and in perspective a building aperture cover 1 according to embodiments of the present disclosure, comprising a locking system 9a, 9b.

[0148] The gripping part 5a is configured to be moved around a rotation axis RAX1 relative to the movable unit 3 between a first gripping part position GP1 (not illustrated in fig. 3) and a second gripping part position GP2, respectively. In the second gripping part position GP2, the locking system 9a, 9b is in an unlocked state US.

[0149] The gripping part 5a may be configured to be rotated around an axis RAX that is substantially perpen-

dicular to a plane PL comprising a major outer surface of the insulating glass unit 4.

[0150] In other embodiments, the gripping part 5a may be longitudinal and comprise a longitudinal direction, where the gripping part 5a is configured to be rotated around an axis that is substantially parallel to a plane PL comprising a major outer surface of the insulating glass unit 4. See e.g. fig. 8.

[0151] The locking system 9a, 9b is configured to be arranged in the locked state when the gripping part 5a is arranged in the first gripping part position GP1 (not illustrated). In the present example, that will be the case if the gripping part 5a is rotated around the axis RAX in a counter clockwise direction. In fig. 3, the disengagement of the locking system 9a, 9b between the fixation frame 2 and the movable unit 3 is provided when the gripping part is in the second gripping part position GP2. On the other hand, engagement of the lock 9a, 9b between the fixation frame 2 and the movable unit 3 is provided when the gripping part is in the first gripping part position GP1.

[0152] The gripping part 5a may as illustrated, in embodiments, be longitudinal/elongated and comprises a longitudinal direction.

[0153] In the illustrated example, the handle 5 comprises a part 9a of the locking system 9a, 9b. The gripping part 5a comprises a latch 9a which is configured to engage with an engagement part 9b, such as a notch of the fixation frame 2. The engagement part 9b may be integrated in and/or attached to the fixation frame 2. When rotating the gripping part counter clockwise, the latch 9a engages with the notch 9b if the movable unit 3 is moved to the closed position.

[0154] In fig. 3, the handle 5 is mechanically connected to the latch 9a and the gripping part 5a and the latch 9a are integrated in the same part movable handle part.

[0155] The handle 5, 5a may in other embodiments of the present disclosure (not illustrated) be electrically or wirelessly connected, to the latch 9a, and be is configured to operate the locking system 9a, 9b, such as the latch 9a, in response to a movement of the gripping part 5a relative to the movable unit 3, and/or in response to a force F1, F2 applied to the handle.

[0156] The locking system 9a, 9b is configured to mechanically interlock the movable unit 3 and the fixation frame 2 when the gripping part 5 is in the first gripping part position GP1. In other embodiments (not illustrated), the latch 9a may be placed at the fixation frame, and a notch 9b may be provided by, such as arranged at, the handle 5 5a, such as by means of a combination of the gripping part 5a and base part 5b. Hence, rotating the gripping part 5a, 5b may provide that the latch 9a and notch 9b engages or disengages dependent on the orientation/positioning of the gripping part 5a and the movable unit 3.

[0157] In fig. 3, it is illustrated that the sensor data SDA is transmitted from the handle 5. In other embodiments, the data transmitted may e.g. comprise the control output OP1 and OP2 instead, see e.g. figs. 1A-2B. In further

embodiments, both sensor data SDA1 and control output OP1 and OP2 may be transmitted from the handle 5.

[0158] It is generally understood that the data transmission of data SDA, OP1 and/or OP2 may be wired or wireless. If wireless, e.g. Zigbee, Bluetooth, Bluetooth LE, Wi-Fi, MATTER and/or the like may be used. In one example three handle sensor data can be transmitted directly to the motor controller. In another example the handle sensor data can be transmitted to a smart home server such as locally or cloud based.

[0159] In embodiments of the present disclosure, the open position OPOS of the movable unit, that the actuator arrangement 8 puts the movable unit 3 in, may be a predefined, open position having a predefined magnitude.

[0160] Fig. 4 illustrates schematically a further embodiment of the present disclosure. Here, the handle arrangement 5 wirelessly 14 controls the locking system 9a, 9b by means of a lock controller 7. For example, the first control output OP1 may be configured to induce the lock controller 7 to switch the locking system 9a, 9b from the locked state LS to an unlocked state US, for example prior to the opening force OF being applied by the actuator arrangement 8. For example, the locking system 9a, 9b may e.g. be or comprise a magnetically and/or electrically controlled locking system such as an electromechanically and/or electromagnetically controlled, locking system. The locking system 9a, 9b may comprise a receiver 13 for receiving a control command, and based thereon, the locking part is moved between engagement with the part 9b and disengagement from the part 9b to enable opening of the movable unit 3.

[0161] The unlocking of the locking system 9a, 9b may be provided prior to that the actuator 8 starts to apply the opening force.

[0162] The actuator arrangement 8 may hence be configured so as to provide the opening force OF in response to the first activation force F1 being provided onto the gripping part 5a while the gripping part 5a is arranged in the first gripping part position GP1. Hence, an opening force F1 will trigger the lock controller 7 to unlock the lock 9a, 9b. The unlocking may e.g. comprise moving the latch 9a. Alternatively, it may comprise (not illustrated) releasing a retaining part so that the latch 9a can be released from the notch 9b.

[0163] Moving the gripping part 5a to the second gripping part position GP2 may also induce the lock controller 7 to unlock the lock 9a, 9b, e.g. by moving the latch or releasing a part providing the notch, so that the movable unit 3 can be opened manually.

[0164] It is generally to be understood that in some embodiments of the present disclosure, the gripping part 5a may be configured to be substantially unmovable relative to the movable unit 3. Hence, the activation forces F1, F2 applied by a user may trigger that the actuator arrangement 8 opens or closes the movable unit and an unlocking of one or more locking systems 9a, 9b.

[0165] Fig. 5 (See also figs. 6A and 6B) illustrates schematically embodiments of the present disclosure ena-

bling disengagement of an electric actuator arrangement 8 lock connection 19a, 19b between the fixation frame 2 and the movable unit 3. Here, the locking system 19a, 19b comprises a part 19b arranged at or in the handle 5 which is configured to receive and interlock with a locking part 19a of the actuator 8a, such as a locking part 19a arranged at an actuator 8a end of the actuator/actuator arrangement 8, or the like.

[0166] To interlock the locking system 19a, 19b, the locking part 19a at the actuator 8a is pushed/provided into the opening 19c of the handle 5. This is provided when/while the gripping part 5a is in the second gripping part position GP2 (not illustrated in fig. 5). Then the gripping part 5a is moved to the first gripping part position GP1 whereby a locking part 19b of the handle interlocks with the locking part 19a at the actuator 8a. See fig. 6B.

[0167] When returning the gripping part 5a to the second gripping part position GP2, the locking part 19a disengages from the locking part 19a at the actuator 8a again (see fig. 6A), thereby allowing the movable unit 3 to be released from the actuator 8 and moved by hand independently of the actuator 8.

[0168] When the gripping part 5a is in the first gripping part position GP1 and the locking system 19a, 19b interlocks (see fig. 6B), The actuator arrangement 8 can move the movable unit 3 when activation forces F1, F2 are applied to the gripping part 5a as e.g. described above and/or below.

[0169] In fig. 5, the opening 19c is provided in the gripping part 5a. In other embodiments of the present disclosure (not illustrated), it may e.g. be placed at the base part 5b instead or at another suitable location.

[0170] In some embodiments, the locking system 9a, 9b and/or 19a, 19b solution(s) described above may be omitted and a locking system may be provided in or by means of the actuator arrangement 8 (not illustrated) instead. Hence, when the movable unit 3 is in the closed position CPOS, the actuator arrangement 8 may provide that the movable unit 3 is in a locked unit state in the closed unit position CPOS. This may e.g. be provided by means of a mechanical lock in or of the actuator arrangement 8, such as at or in an actuator housing 8d and/or by means of e.g. self-locking gear 8c, motor 8b and/or the like of the actuator arrangement 8.

[0171] In some embodiments, the locking system 9a, 9b and/or 19a, 19b may be present and a further locking system (not illustrated) may be provided in or by means of the actuator arrangement 8 (not illustrated). Hence, when the movable unit 3 is in the closed position CPOS, both one or both of the locking system(s) 9a, 9b, 19a, 19b and a locking system of the actuator arrangement 8 may provide that the movable unit 3 is in a locked unit state in the closed unit position CPOS.

[0172] Figs. 7-10 illustrates schematically a building window 1, such as a roof window, according to various embodiments of the present disclosure. The roof window 1 in these figures is of the type that is centre hung, and where the movable unit 3 is thus centre hung by means

of a hinge arrangement (not illustrated in fig. 7, see reference 14 of fig. 10) to rotate (by means of the hinge arrangement) and thus pivot around an axis RAX3 (not illustrated in fig. 7, see fig. 10) placed between the top and bottom of the movable frame 3 as indicated by the dashed arrows in fig. 2 and 3. Fig. 7 illustrates a cross sectional view of a roof window 1 with a centre hung movable unit 3 while fig. 10 illustrates a roof window with a centre hung movable unit 3 seen in perspective. The design of e.g. the handle arrangement 5 varies a bit between fig. 7 and 10, but the general/overall functionality of the locking system 9a, 9b as such, the handle arrangement 5, the window 1 and/or the like may in general be identical.

[0173] The longitudinal direction of the rotation axis of the movable frame 3 may extend between, such as extend through, side frame profiles of the movable frame 3. The axis RAX3 is normally placed to extend substantially horizontal when the window 1 is installed.

[0174] In fig. 7, at the upper part of the movable unit 3, the handle arrangement 5 is arranged with the gripping part 5a configured to be grabbed and operated by human hand.

[0175] The gripping part 5a of the handle may be a gripping part that extends in a longitudinal direction that is substantially parallel with/to the pivot axis of the movable frame 3. Hence a user may grab and pull the handle 5 to open the window 1, and may push the handle to close the window 1.

[0176] In fig. 7, the window 1 is in a closed CPOS and locked state, and the window 1 is thus not in a ventilation position. In fig. 10, the window 1 is in an open state and the movable frame 3 is hence in an open position where it has been opened and rotated relative to the fixation frame 2 around the axis RAX3.

[0177] In fig. 9, the locking system is in an unlocked state, and the movable unit 3 can hence be arranged in an open position OPOS as illustrated in fig. 10.

[0178] The handle arrangement 5 of the window 1 of figs. 7-9 is attached to and/or comprises a hinged ventilation valve 15, such as a valve plate.

[0179] The handle arrangement 5 and valve plate 15 are configured to move and thus pivot relative to the movable unit 3. In the embodiments of figs. 7-10, the movement/pivoting of the handle arrangement 5 relative to the movable frame 3 comprises a rotation around a rotation axis RAX2 that is substantially parallel to a plane PL1 defined by a major surface of the insulating glass unit 4.

[0180] This rotation axis of the handle arrangement / handle 5 may be substantially parallel with/to the pivot axis of the movable frame 3.

[0181] The handle 5 is directly or indirectly mechanically connected the locking part 9a of the locking system 9a, 9b of the window 1 by means of a linking part 16 that is placed between a lock housing 9x and the handle arrangement 5 and/or ventilation valve 15. Hence, when pivoting the handle 5 relative to the movable unit 3, such as a movable frame, such as a sash, by human hand (or

by means of an electric actuator arrangement - not illustrated in fig. 7-9), the locking part 9a is displaced by the handle arrangement 5 between different states comprising a locking state/ engaged state LS (see fig. 7 and 8) and an unlocked/disengaged state US (see fig. 9).

[0182] In fig. 7, the window 1 is in the predefined closed, locked state CPOS. Here, the ventilation valve 15 is also in a closed state/position to prevent ventilation air to pass between the movable frame 3 and the fixation frame 2, into the interior INT of the building.

[0183] Fig. 7 moreover illustrates a further embodiment of the present disclosure wherein the actuator arrangement 8 is hidden in the window aperture cover 1. The actuator arrangement 8, such as an actuator housing 8d is in this example hidden in the top part of the window 1. The actuator arrangement 8 housing 8d is in this example fixed to the fixation frame 2. The actuator part 8a is not illustrated in fig. 8 in order to improve clarity of the figure, see e.g. instead fig. 10. The actuator arrangement 8 may in some embodiments, as e.g. illustrated in fig. 7 (and not illustrated in figs. 8 and 9), be hidden behind a top cover 17 of the window 1, such as behind a weather shield cover 17 of the building aperture cover, and/or may be hidden between the movable unit 3 and the fixation frame 2. The weather shield cover 17 extends over and covers a space 18 located between the movable unit 3 and a part of the fixation frame 2. In some embodiments, the actuator arrangement 8, such as the actuator housing, may be arranged somewhere in a space 18 between the movable frame and the fixation frame.

[0184] In fig. 8 (illustrating a part of the window of fig. 7), the handle 5, and hence the hinged ventilation valve 15, is moved from a closed valve position HCP relative to the movable frame 3 to a predefined ventilation position HVP where the valve 15 is in an open position//state, so that the window 1 is in a ventilation state. Here, ventilation air VA (dashed/dotted lines of fig. 8) is allowed to pass into the building through an opening in the window 1. However, this handle movement does not move the movable frame 3, and does not move the locking part 9a to an unlocked state. Thus, the building window 1 is thus still in a predefined, closed CPOS and the locking system is in a locked state LS. The ventilation air VA may enter the window through a filter or the like (not illustrated) at the top of the window.

[0185] However, moving the handle 5 and ventilation valve 15 further from the ventilation position of fig. 8, relative to the movable frame 3, as illustrated in fig. 9, provides that the handle arrangement 5 interact with the locking part 9a of the locking system 5, so that the locking part 9a is moved to an unlocked state US. This enables a human user to pull the handle 6 to open the window as illustrated in fig. 10, or an actuator arrangement 8 can now open the movable unit by providing the opening force.

[0186] The linking part 16 controls the locking system of the lock housing 5c. The locking system 9a, 9b may be configured so as to maintain the ventilation valve 15

in a predefined angular a1 position in the ventilation state relative to a closed position (see fig. 7) as illustrated in fig. 8. One or more spring mechanisms, latch/notch solutions and or the like in the locking housing 9x may be configured to provide this. In some embodiments of the present disclosure, the locking system 9a, 9b may be of a type as described in patent document EP3848540 A1 and/or EP2281984 A1.

[0187] For example, a rotation of the handle 5a around a rotation axis relative to the movable unit 3 by an angle a1 e.g. between 10° and 45°, such as between 20° and 45°, for example around 30° relative to a closed position of the handle/valve 5a may place the handle and the valve 15 in a predefined ventilation position HVP relative to the movable unit 3. Upon further moving the handle arrangement 5a, and thus also the valve 15 to a further, larger angle a1 relative to the movable frame to an opening position HOP, this provides that the handle 5, by means of the linking part 16, disengages the locking system so that the locking part 9a moves to an disengaged state, so that the locking system is in an unlocked state UL. This enables a human user to pull the handle 5a.

[0188] For example, in embodiments, a rotation of the handle 5 around a rotation axis of e.g. between 50° to 80°, such as between 55° and 65°, for example around 60° relative to a closed position of the handle/valve 15 may place the handle 5 and the valve 15 in an opening handle position HOP relative to the movable frame 3.

[0189] The angles a1 in the ventilation position HVP and the open position HOP may in preferred embodiments of the present disclosure be predetermined, e.g. by means of a spring arrangement and/or the like of the locking system 9a, 9b, such as arranged in the housing 9x.

[0190] In some embodiments of the present disclosure, the valve 15 may comprise a handle base part 5b or be a handle base part 5b.

[0191] The valve 15 may in some embodiments comprise a resilient gasket or the like 5d such as a foam gasket or rubber gasket for tightening when the valve 15 is closed (fig. 7).

[0192] In the embodiments of figs. 7-9, the user interaction sensor arrangement 6 may be arranged at a suitable location. For example, the user interaction sensor arrangement 6 may be arranged at the handle 5. For example, the user interaction sensor arrangement 6 may be arranged at the gripping part 5a. In some embodiments, the user interaction sensor arrangement 6 may be arranged between the gripping part 5a and the valve 15. For example, as illustrated in figs. 7-9, the user interaction sensor arrangement 6 may be arranged at a handle interconnecting part 5c interconnecting the valve 15 and the gripping part 5a. In other embodiments, the user interaction sensor arrangement 6 may be arranged at or between the handle interconnecting part 5c and the valve 15. In still further embodiments, the user interaction sensor arrangement 6 may be arranged between the gripping part 5a and the handle interconnecting part 5c.

[0193] The gripping part 5b may be directly or indirectly mechanically coupled 16 to the lock by means of the linking part 16 which interconnects the handle 5 and the lock 9a, 9b.

[0194] It is understood that in some embodiments, the ventilation feature illustrated in fig. 8 may be omitted, and hence, the handle 5 may be moved so as to lock LS and unlock US the locking system 9a, 9b as illustrated in figs. 7 and 9 respectively.

[0195] It is understood that in some embodiments of the present disclosure, the locking system 9a, 9b, and/or 19a, 19b may be configured to be switched from a LS locked state to an unlocked state US in response to the first control output OP1. This may e.g. be obtained by means of the opening force OF provided by the actuator arrangement 8. For example, in figs. 7-10, the actuator 8a of the actuator arrangement (not illustrated) may be directly or indirectly connected to the handle 5, such as to the valve 15. Hence, when a human user interact with the gripping part 5a, such as pulls it or pushes it, this force asserted by the human user is detected by the user interaction sensor arrangement 6 and sensor data SDA is transmitted or used at the handle, e.g. as previously described. If the force complies with user interaction criteria, the actuator 8 moves the movable unit in response to the first or second control output OP1 OP2. The actuator 8 may be connected to the valve 15 or the like (see fig. 10), and pushes the valve 15 so that the valve and handle 5 undergo a movement relative to the movable frame 5 as illustrated in figs. 8 and 9. This provides that the locking system 9a, 9b disengages, and thereafter that the actuator arrangement opens the movable unit 3 by means of the actuator 8a.

[0196] Common to the various embodiments of figs. 7-10, is that the gripping part 5a, may be directly or indirectly mechanically coupled to the locking system 9a, 9b so as to be configured to mechanically switch the locking system(s) between the locked state LS and the unlocked state US due to movement of the gripping part 5a relative to the movable unit 3.

[0197] Fig. 11 illustrates a simplified flowchart according to embodiments of the present disclosure. The control system 7 detects if a force have been provided at test TE111. If a force have been provided, the control system tests whether the force provided fulfil the requirements of the first force F1, see test TE112. If the requirements are not complied with, the first control output is not provided. On the other hand, the requirements are complied with Test TE 112, the first control output OP1 is provided, see step S111.

[0198] Substantially the same solution may in embodiments of the present disclosure be provided with regard to detecting if the force F2 and providing the second control output OP2, however, with other requirements in the second test 112 with regards to e.g. force direction, force magnitude and/or the like.

[0199] Fig. 12 illustrates a flow chart according to further embodiments of the present disclosure. Here, the

first and second test TE 121, 122 may be substantially identical to the tests 111, 112 of fig. 11. However, if the force F1 has been detected, the control system 7 moreover registers the state of the gripping part 5a, i.e. if it is in the first GP1 or second GP2 gripping part position.

[0200] If the gripping part is determined to be in the second gripping part position (test TE123), the locking system 9a, 9b should/may already have been disengaged by the handle when the gripping part was moved from the first gripping part position GP1 to the second gripping part position GP2, and hence, the first control output OP1 is provided to the actuator so that the actuator opens the building aperture cover.

[0201] If the gripping part is instead detected to be in the first gripping part position (test TE124), the locking system 9a, 9b may be disengaged (Step 122 - DEG LSY) prior to providing the first control output OP1 (Step S123) to the actuator.

[0202] Fig. 13 illustrates schematically various user interaction criteria/requirements that may be required to be fulfilled before control output OP1, OP2 is provided. For example according to the test 112, 121 described above.

[0203] Force F is placed on Y-axis, and time t along x-axis. In the example of fig. 13, at time t0, a pushing force F/touch is applied at the handle, e.g. in the direction of the glass unit, see e.g. user interaction F1 illustrated in fig 1A. The user interaction sensor arrangement 6 registers this user interaction, and at time t1, the applied force gets above a predetermined threshold THR1. This may in some embodiments of the present disclosure trigger that the first control output OP1 is provided.

[0204] However, in the example of fig. 13, a further condition is required to be fulfilled before the first control output OP1 is provided. This condition comprises that a force larger than the threshold THR1 must have been applied for a certain amount of time, e.g. a predefined time period Tim1.

[0205] Hence, when the force F applied exceeds the threshold THR1 at t1, a timer or the like is started, and if the force provided gets below the threshold THR1 again before the timer runs out t2, the first control output OP1 is not provided. However, in fig. 13, the force F remains above the threshold THR1 for the time period Tim1, and hence, the first control output OP1 is provided at t2, thereby inducing the actuator to start opening the movable unit since the force F/user interaction applied can now be categorized as an activation force F1, F2.

[0206] The user then let go of the gripping part of the handle again between t2 and t3, and at t3, the force F gets below the threshold. However, the actuator continues to open the movable unit 3 to a predefined open position OPOS as the force F was in the force direction (See e.g. fig. 1A) related to opening of the movable unit 3, and the threshold THR1 was exceeded for the time period Tim 1.

[0207] At time t4, the user pulls the gripping part 5a, hence providing an oppositely directed force F2, see e.g.

fig. 2A. This is illustrated in fig. 13 below the x-axis.

[0208] At time t_5 , the force F exceeds the threshold THR_2 , and at time t_6 , the timer Tim_2 (starting at t_5) has run out. Hence, as the pulling force having a magnitude exceeding the threshold THR_2 for the time period Tim_2 has been provided, the second control output OP_2 is provided at time t_6 . This induces the actuator to stop if moving or if stopped then close the movable unit again, see e.g. fig. 2B, since the force F /user interaction applied can now be categorized as an activation force F_1 , F_2 .

[0209] The user let go of the handle, and at t_7 , the force F gets below threshold THR_2 . The actuator however continues to close the movable unit until it reaches the closed unit position $CPOS$ as the force direction and conditions THR_2 , Tim_2 for closing the movable unit 3 have been complied with. In some embodiments, e.g. the time period Tim_2 may be omitted and hence, the only requirement may be that the pulling force exceeds the threshold THR_2 .

[0210] The thresholds THR_1 THR_2 values and/or timer Tim_1 , Tim_2 periods may in some embodiments be identical for opening and closing the movable unit 3. The thresholds THR_1 THR_2 values and/or timer Tim_1 , Tim_2 periods may in other embodiments be configured to be different dependent on if the movable unit 3 should be opened or closed, respectively. For example, the threshold THR_2 value may be lower than the THR_1 value and/or the time period Tim_2 may be lower/shorter than the time period Tim_1 . One, more than one, or all of THR_1 THR_2 , Tim_1 Tim_2 may in embodiments of the present disclosure be predefined, for example predefined values stored in a data storage. The thresholds THR_1 THR_2 values may in some embodiments be binary such as a switch 0/1.

[0211] Hence, in the embodiments of fig. 13, the control system 7 comprises a user interaction detection system comprising one or more predefined user interaction criteria THR_1 , THR_2 , Tim_1 , Tim_2 represented in a data storage. The control system is configured to process the sensor data SDA based on the user interaction criteria Such as the threshold THR_1 , THR_2 and/or timer setting Tim_1 , Tim_2 , in order to determine if the control output OP_1 , OP_2 should be provided.

[0212] The control system 7 is configured to provide the control output OP_1 , OP_2 if the user interaction criteria is determined to be complied with (at time t_2 and t_6). On the other hand, the control system 7 is configured to refrain from providing the control output OP_1 , OP_2 if the user interaction criteria is determined to not be complied with.

[0213] It is understood that in further embodiments, the threshold THR_1 , THR_2 may be omitted, and a time setting Tim_1 , Tim_2 may be provided, so that a user induced activation force (not needing to comply with a threshold) in a force direction needs to be provided in a predetermined time before the control output OP_1 , OP_2 is provided.

[0214] The time Tim_1 , Tim_2 may in embodiments be between 0.1 seconds and 1 seconds, such as between

0.1 seconds 0.7 seconds, such as between 0.1 second and 0.5 seconds.

[0215] In some embodiments, the opening and/or closing of the movable unit 3 may first be provided when one or more predefined user interaction patterns, such as tapping patterns have been detected. For example, in case of the user interaction sensor arrangement 6 comprising for example one or more capacitive sensors and/or one or more one or more strain gauges, a controller 7 may, based on software program code, be configured to detect a predefined user interaction pattern, and first when this is complied with, the control output OP_1 and/or OP_2 is provided. The pattern may e.g. comprise a series of consecutive taps on the gripping unit, it may comprise a combination of long and short taps and/or the like.

[0216] Fig. 14 illustrates schematically a building aperture 1 according to embodiments of the present disclosure, wherein the building aperture cover 1 is a top hung roof window according to embodiments of the present disclosure. Hence, a hinge arrangement 14 is arranged at the upper part, such as at the top TO , of the roof window 1, when the roof window is installed in a building roof structure (not illustrated). The handle 5 is arranged at the lower part, such as the bottom part of the movable frame 3, For example as illustrated in fig. 1A-2B. As can be seen, the longitudinal direction LDF of the fixation frame 2 (extending between top and bottom of the window) is arranged with an angle that is neither perpendicular to, nor parallel with, horizontal HZ , but may e.g. be between 10° and 80° , such as between 20° and 80° to horizontal HX . The actuator 8a may open and close the movable unit 3 based on input from a user interaction sensor arrangement 6 as e.g. previously described, based on forces (not illustrated in fig. 14, see e.g. figs 1A-2B) provided at the handle. When inducing a force F_1 by hand at the handle 5, the actuator 8a starts closing the movable unit

[0217] Fig. 15 illustrates schematically a building aperture 1 according to embodiments of the present disclosure, wherein the building aperture cover 1 is a window configured to be installed vertically in e.g. an exterior wall of a building. The fixation frame 2 has a longitudinal direction LDF extending between top and bottom of the window, and this direction is substantially perpendicular to horizontal HZ when the window is installed in an exterior wall of a building. A hinge arrangement 14 is arranged at the lower part, such as at the bottom part BO , of the window 1, when the window is installed in an exterior, vertical building wall (not illustrated). The handle 5 is arranged at a side part of the movable unit 3 between top TO and bottom BO of the movable unit 3, such as substantially midway between TO and BO . The actuator 8a may open and close the movable unit 3 based on input from a user interaction sensor arrangement 6 as e.g. previously described, based on forces F_1 , F_2 provided at the handle.

[0218] Fig. 16A-16B illustrates schematically an embodiment of the present disclosure, wherein the building aperture cover 1 is a door, such as a sliding door. The

sliding door 1 comprises a movable unit 3 configured to move towards the open position OPOS from the closed position CPOS in a direction substantially parallel to a plane defined by a major outer surface 4a of the glass unit 4 of the movable unit 3.

[0219] This may e.g. be provided by sliding the movable unit 3 along a longitudinal rail (not illustrated) of the door. The movable unit 3 comprises a handle 5 with a gripping part 5a as described according to one or more embodiments above. When a force F1, F2 is induced by human hand at the gripping part 5a of the handle, the user interaction sensor arrangement 6 (not illustrated in figs. 16A-16B) detects this and provides sensor data based thereon as e.g. previously described. A control system as e.g. previously described receives and processes the sensor data SDA and provides control output OP1, OP2 based thereon (see e.g. figs. 1A-2B). The actuator arrangement 8 receives this and opens or closes the movable unit 3 dependent on the direction of the force applied on the handle. In fig. 16A-16B, the force provided at the gripping part 5a of the handle is a force F1 (See fig. 16A) in the movement direction MD1 of the movable unit 3 when the movable unit is opened, and hence, the actuator arrangement 8 moves (see fig. 16b) the movable unit from a closed position CPOS to the open position OPOS.

[0220] In figs. 16A-16B, the first F1 and/or second activation force F2 is/are configured to be in a direction parallel to a plane PL comprising the outer major surface 4a.

[0221] It is generally understood that according to various embodiments of the present disclosure as e.g. described above, the first F1 and second F2 activation forces may be substantially oppositely directed.

[0222] In some embodiments of the present disclosure, operation of the actuator arrangement 8 may be configured to be omitted despite the first and/or second activation force F1, F2 being provided onto the gripping part 5a. This may depend on circumstances and the design of the building aperture cover 1.

[0223] For example, operation of the actuator arrangement 8 may be configured to be omitted despite the first and/or second activation force F1, F2 being provided onto the gripping part 5a if the gripping part 5a is arranged in a second gripping part position GP2, such as when arranged manually in the second gripping part position GP2 by means of human hand, since this may provide/indicate that a human user intends to control such as open the movable unit manually. As another example, such as illustrated in fig. 5-6B, moving the gripping part to the second gripping part position GP2 may disengage the actuator 8a from the movable unit 3. Also here, it may not be desired to activate the actuator arrangement 8.

[0224] In some other embodiments of the present disclosure, as illustrated in the flow chart of fig. 17, operation of the actuator arrangement 8 may be configured to be omitted despite the first and/or second activation force F1, F2 being provided onto the gripping part 5a if the

gripping part 5a is in the first gripping part position GP1. For example, if a locking system 9a, 9b (see e.g. fig. 3) is engaged, (and configured to be e.g. alone manually controlled), the opening force OF1 should not be provided by the actuator arrangement 8. Hence, in test TE171, it is tested whether an activation force, such as activation force F1 is applied. When an activation force F1 is detected (e.g. based on conditions/requirements such as one or more of those described above in relation to e.g. one or more of figs. 11-13), it is tested (directly or indirectly) if the gripping part 5a is in the second gripping part position GP2. If it is, the activation force is acknowledged, and the opening force is provided by the actuator arrangement 8. However, if the gripping part is not detected to be in the second gripping part position GP2, no operation of the actuator arrangement is initiated, as this may for example indicate that the locking system is still engaged.

[0225] Instead of detecting the state of the gripping part, a state of the locking system may instead be detected.

[0226] If the locking system is provided by the actuator arrangement, the locking system may automatically be disengaged before the opening force is provided, or the activation of the actuator arrangement 8 may provide that the locking system disengages.

[0227] The omission of operating the actuator arrangement if the gripping part is arranged in the first or second gripping part position, despite that an activation force is provided to the gripping arrangement, may e.g. in one or more embodiments of the present disclosure be obtained by means of

- omitting transmission of the first and/or second control output arranged in the first gripping part position.
- disregarding the first and/or second activation force although detected, and/or
- by means of disregarding the sensor data (SDA) if the gripping part is arranged in the first gripping part position.

[0228] In one or more embodiments of the present disclosure, a handle state sensor (not illustrated) may be provided, e.g. integrated in the handle 5. This handle state sensor is configured to detect/determine the handle position, for example by detecting directly or indirectly whether the gripping part is in the first or second gripping part position (relative to the movable unit). This may e.g. be provided by means of an accelerometer, a Hall sensor and/or the like. If the handle 5/gripping part 5a is detected by the handle state sensor to be in the first gripping part position GP1, an omission of operating the actuator arrangement 8 may be provided. On the other hand, if the handle/gripping part is detected by the handle state sensor to be in the second gripping part position GP2, actuator operation may be accepted when an activation force F1/F2 is provided at the gripping part 5a. In the latter case, the first and/or second control output may be pro-

vided in response to an activation force.

[0229] A unit position sensor, such as an accelerometer, an angular sensor and/or the like, may in embodiments of the present disclosure be provided in order to determine the position of the movable unit 3. For example, an omission of operation of the actuator arrangement may occur if the gripping part 5a is detected to be in the first gripping part position GP1 and if the movable unit is detected to be in a closed position CPOS. If, on the other hand, the movable unit 3 is detected to be in an open position, the closing force and/or opening force provided by the actuator arrangement 8 may still be allowed to be provided, e.g. dependent or independent on the handle 5 position/state.

[0230] It is understood that in some embodiments of the present disclosure, a "filtering" may be provided so as to neglect force vectors in other directions than pre-defined force directions. For example force components other than force components extending normal to a major surface of the glass unit (or a plane PL1 as previously described), may be neglected. The relevant force components to be monitored may e.g. depend on window type, handle type and/or window installation angle.

[0231] The user interaction sensor arrangement 6 may in embodiments comprise one user interaction sensor. In other embodiments, the user interaction sensor arrangement 6 may comprise two or more sensors configured to detect user interactions.

[0232] Fig. 18 illustrates schematically an embodiment of the present disclosure, wherein the user interaction sensor arrangement 6 comprises two sensors 6a, 6b, for example capacitive sensors or the like. The sensors may be touch sensors. These sensors 6a, 6b are configured to detect user interactions F1, F2 provided at two opposite surfaces SP1, SP2 of the handle 5. These surfaces comprises a surface part SP1 of the gripping part 5a facing the plane PL1 (provided/defined by the glass sheet surface 4a), and a surface part SP2 of the gripping part 5a facing away from the plane PL1, respectively.

[0233] It is generally understood that the capacitive sensor or sensors 6a, 6b of the handle may not as such detect the force applied to the gripping part, but may rather detect/register the touching of the gripping part 5a itself. This will however also reflect an activation force F1, F2 provided to the handle by human hand.

[0234] For example, one of the sensors 6a of the user interaction sensor arrangement 6, may be configured to detect an opening first user interaction F1. This is when the user pushes the surface SP2. This is when the user pushes the surface SP1 facing away from the plane PL1.

[0235] The other of the sensors 6b of the user interaction sensor arrangement 6 may be configured to detect a closing second activation force F2. This is when the user pushes the surface SP1 facing the plane PL. The output from the sensors, i.e. the sensor data, is provided to the control system 7, and an actuator arrangement 8 (not illustrated in fig. 1) is operated based thereon.

[0236] It is generally understood that user interactions

F1, F2 configured to be detected for opening or closing the movable unit 3 (respectively), may vary dependent on the type and/or design of building aperture cover 1 and/or handle type. This is also the case according to the various embodiments described above. For example, in some embodiments, a pulling force applied/induced at the gripping part 5a by human hand at the gripping part 5a may induce the actuator arrangement 8 to open the movable unit 3 (see e.g. F1 in fig. 7), whereas a pushing force applied/induced at the gripping part 5a by human hand may induce the actuator to close the movable unit 3. The opposite may be the case for other building aperture covering solutions such as e.g. as illustrated in figs. 1A-2B and other embodiments described above.

[0237] Fig. 19 illustrates schematically an embodiment of the present disclosure, wherein building aperture covers 1 are installed in a building. 35. The building aperture covers 1 are installed to cover an aperture in an outer wall 320 or in a roof structure 310, respectively, of the building 300.

[0238] Fig. 20 illustrates schematically an embodiment of the present disclosure, wherein a maximum time limit Maxt is applied. The control system is here configured to refrain from providing the control output OP1, OP2 if the physical user interaction F1, F2 applied to the gripping part 5a has been provided for more than the maximum time limit Maxt.

[0239] The maximum time limit Maxt may be predefined. In some embodiments, the maximum time limit Maxt may be more than 0.1 second and less than three seconds, such as more than 0.2 second and less than 1 second, such as less than 0.7 seconds.

[0240] For example, in fig. 20, at time t0 the human user pushes the gripping part. This starts/initiates a timer/counter counting from t0. As can be seen, the user releases the gripping part at time t1, before the timer expires at t2. This provides that the user interaction is acknowledged as an activation force, and hence, the control output OP1 or OP2 is provided.

[0241] On the other hand, at time t3 the human user pushes the gripping part 5a. This starts the timer/counter. As can be seen, the user does not release the gripping part before the timer expires at t4 (i.e. the maximum time limit Maxt is exceeded). This provides that the user interaction is not acknowledged as an activation force, and hence, the control output OP1 or OP2 is not provided.

[0242] Fig. 21 illustrates schematically an embodiment of the present disclosure, where the control system 7 is configured to refrain from providing said control output OP1, OP2 because a first sensor detects a opening first user interaction at the gripping part 5a and the second opposite sensor simultaneously detects a closing second user interaction at the gripping part 5a. In fig. 21, at test TE211, the control system tests if first user interaction F1 is present and the second user interaction F2 is absent. If this is the case (and other possible criteria are complied with, if relevant), the first control output OP1 is provided at step S211. If this is not the case, the control

system tests in test TE212 if the second user interaction F2 is present and the first user interaction F1 is absent. If this is the case (and other possible criteria are complied with, if relevant), the second control output OP2 is provided at step S212. This solution may provide that if both user interactions are detected, neither the first control output OP1 nor the second control output OP2 are provided.

[0243] Additionally or alternatively, a further or alternative test TE213 may in further or alternative embodiments of the present disclosure be provided.

[0244] In this test TE213, it is tested whether both user interactions are present. This may for example be the case if two sensors for detecting oppositely directed user interactions F1, F2, are activated simultaneously, for example because the gripping part 5a is grasped by hand. See for example the embodiment of fig. 18 comprising sensors 6a, 6b. If this test TE213 is positive, it is assured (Step S 213) that neither of the control outputs OP1, OP2 are provided, since this situation may reflect that a user manually wants to control the movable unit 3. The test TE213 may in some embodiments be unnecessary if the tests TE211, TE212 are provided, as these only will be positive (YES) if one of the user interactions are provided.

[0245] The test TE213 (and the associated step S213) may in some embodiments be provided instead of the tests TE211, TE212.

[0246] If the test TE212 is negative and the test TE213 is omitted, the flow chart may return to the upper circle from the test TE212 instead of from test TE213 as is the case in fig. 21.

[0247] If all the tests TE 211-213 turns out negative, this may indicate another operation or an error state of a force is still detected, or may indicate that no user interaction is present.

[0248] The test TE213 and/or tests TE211 and/or TE212 may in some embodiments be implemented in one of the flow charts of fig. 11 and/or 12.

Items.

[0249] Various embodiments of the present disclosure are moreover described in the below items.

1. A building aperture cover, such as a window (1), comprising

- a fixation frame (2) and a movable unit (3), wherein the movable unit (3) is connected to the fixation frame (2) by means of a hinge arrangement (14) so that the movable unit (3) is configured to be moved relative to the fixation frame (2) between a closed unit position (CPOS) and an open unit position (OPOS), wherein the movable unit (3) comprises an insulated glass unit (4),
- an electric actuator arrangement (8) configured

to provide said movement of the movable unit (3) between the closed unit position (CPOS) and the open unit position (OPOS),

- a handle (5), wherein the handle (5) is attached to a part of the movable unit (3), wherein the handle (5) comprises a gripping part (5a) configured to be grasped by human hand, and
- a control system (7) comprising one or more hardware processors,

wherein the handle (5) comprises a user interaction sensor arrangement (6, 6a, 6b) configured to detect physical user interactions (F1, F2) applied at the gripping part (5a), and provide sensor data (SDA) based thereon, and wherein the control system (7) is configured to receive and process the sensor data (SDA),

wherein the control system (7) is configured to provide first control output (OP1) based on said processing of the sensor data (SDA) if the sensor data (SDA) comprises information indicating that a first user interaction comprising a first activation force (F 1) in a first force direction is applied to the gripping part (5a),

wherein the control system (7) is configured to provide second control output (OP2) based on said processing of the sensor data (SDA) if the sensor data (SDA) comprises information indicating that a second user interaction comprising a second activation force (F2) in a second force direction is applied to the gripping part (5a),

wherein the electric actuator arrangement (8) is configured to apply an opening force (OF) to the movable unit (3) if the first control output (OP1) is provided, and wherein the actuator arrangement (8) is configured to apply a closing force (CF) to the movable unit (3) if the second control output (OP2) is provided.

2. A building aperture cover (1) according to item 1, wherein the building aperture cover (1) comprises a locking system (9a, 9b, 19a, 19b), wherein the locking system (9a, 9b, 19a, 19b) is configured to be arranged in a locked state (LS) and an unlocked state (US), respectively, wherein the movable unit (3) is configured to be movable towards the open position (OPOS) from the closed position (CPOS) when the locking system (9a, 9b, 19a, 19b) is in the unlocked state (US),

wherein the movable unit (3) is configured to be in a locked unit state in the closed unit position (CPOS) by means of said locking system (9a, 9b, 19a, 19b) when the locking system is in the locked state (LS),

wherein the handle (5), such as the gripping part (5a), is configured to be operated by human hand so as to control in which of said states (LS, US) the locking system (9a, 9b, 19a, 19b) is arranged.

3. A building aperture cover (1) according to item 2, wherein the gripping part (5a) is configured to be moved (RAX1), such as by displacement and/or rotation, relative to the movable unit (3) between a first gripping part position (GP1) and a second gripping part position (GP2), respectively, wherein the locking system (9a, 9b, 19a, 19b) is configured to be arranged in the locked state (LS) when the gripping part (5a) is arranged in the first gripping part position (GP1), wherein the locking system (9a, 9b, 19a, 19b) is configured to be arranged in the unlocked state (US) when the gripping part (5a) is arranged in the second gripping part position (GP2).

4. A building aperture cover (1) according to any of the preceding items, wherein the gripping part (5a) is configured to be moved (RAX1), such as by displacement and/or rotation, relative to the movable unit (3) between a first gripping part position (GP1) and a second gripping part position (GP2) by human hand, so that a disengagement of a lock (9a, 9b) between the fixation frame (2) and the movable unit (3) is provided and/or so that a disengagement of an electric actuator arrangement (8) lock connection (19a, 19b) between the fixation frame (2) and the movable unit (3) is provided.

5. A building aperture cover (1) according to any of items 2-4, wherein the handle (5), such as the gripping part (5a), is directly or indirectly mechanically coupled to the locking system (9a, 9b, 19a, 19b) so as to be configured to mechanically switch the locking system between the locked state and the unlocked state (US) by movement of the gripping part (5a) relative to the movable unit (3).

6. A building aperture cover (1) according to any of items 3-5, wherein operation of the actuator arrangement (8) is configured to be omitted despite the first and/or second activation force (F1, F2) being provided onto the gripping part (5a), when the gripping part (5a) is arranged in a first gripping part position (GP1) or when the gripping part (5a) in a second gripping part position (GP2).

7. A building aperture cover (1) according to any of items 3-6, wherein the actuator arrangement (8) is configured to provide the opening force (OF) in response to the first activation force (F1) being provided onto the gripping part (5a) while the gripping part (5a) is arranged in the first gripping part position (GP1).

8. A building aperture cover (1) according to any of the preceding items, wherein the user interaction sensor arrangement (6, 6a, 6b) comprises two or more sensors provided to detect user interactions (F1, F2) at two opposite surfaces (SP1, SP2) of the handle (5), wherein a first (6a) of the sensors is configured to detect an opening first user interaction (F1), such as an activation force, applied at a first surface (SP2) of the gripping part (5a) and wherein a second opposite sensor (6b) is configured to detect a closing second user interaction (F2), such as an activation force, applied at a second opposite surface (SP1) of the gripping part (5a).

9. A building aperture cover (1) according to item 8, wherein said control system (7) is configured to refrain from providing said control output (OP1, OP2) if the first sensor (6a) detects a opening first user interaction (F1) and the second opposite sensor (6b) simultaneously detects a closing second user interaction (F2).

10. A building aperture cover (1) according to any of items 2-8, wherein the locking system (9a, 9b, 19a, 19b) is configured to be switched from a locked state to an unlocked state in response to the first control output (OP1),

such as by means of the opening force (OF) provided by the actuator arrangement (8),
such as by means of an actuator (8a) of the actuator arrangement moving the gripping part (5a) from the first gripping part position (GP1) to the second gripping part position (GP2).

11. A building aperture cover (1) according to any of the preceding items, wherein the first activation force (F1) is a force comprising a force vector component in a handle movement direction (MD1), where said handle movement direction (MD1) is the movement direction of the handle (5) that will occur when a movement of the movable unit (3) from the closed unit position (CPOS) towards the open unit position (OPOS) is initiated by the actuator arrangement (8), and/or

wherein the second activation force (F2) is a force comprising a force vector component in a handle movement direction (MD2), where said handle movement direction (MD2) is the movement direction (MD2) of the handle (5, 5a) that will occur when a movement of the movable unit (3) from the open unit position (OPOS) towards the closed unit position (CPOS) is initiated by the actuator arrangement (8).

12. A building aperture cover (1) according to any of the preceding items, wherein, the control system (7)

is configured to provide a control output configured to induce the actuator unit (8) to stop providing the opening force (OF) if the second activation force (F2) is provided by a human user at the gripping part (5a) while the actuator arrangement (8) provides the opening force (OF),
such as

wherein the control system (7) is configured to provide a control signal (OP2) so as to induce the actuator arrangement (8) to provide the closing force (CF) if a consecutive second activation force (F2) provided by a human user at the gripping part (5a) is detected.

13. A building aperture cover (1) according to any of the preceding items, wherein the locking system (9a, 9b) is wirelessly controlled, such as electrically and/or magnetically controlled, by means of a lock controller (7), and wherein the lock controller is configured to switch the locking system (9a, 9b) from a locked state (LS) to an unlocked state (US), for example prior to the opening force (OF) being applied by the actuator arrangement (8).

14. A building aperture cover (1) according to items 3 and 13, wherein the first control output (OP1) is configured to induce the lock controller to switch the locking system (9a, 9b) from the locked state to an unlocked state while the gripping part (5a) is arranged in the first gripping part position (GP1).

15. A building aperture cover (1) according to items 3, 7 and 12, wherein the first control output (OP1) is configured to induce the lock controller to switch the locking system (9a, 9b) from the locked state to an unlocked state while the gripping part (5a) is arranged in the first gripping part position (GP1), such as
wherein the switching of the locking system (9a, 9b) is configured to be provided prior to the actuator arrangement (8) provide the opening force (OF).

16. A building aperture cover (1) according to any of the preceding items, wherein the actuator arrangement (8) is configured to move the movable unit (3) from the closed unit position (CPOS) towards the open unit position (OPOS) by means of said opening force (OF) and/or
wherein the actuator arrangement (8) is configured to move the movable unit (3) from the open unit position (OPOS) towards the closed unit position (CPOS) by means of the closing force (CF).

17. A building aperture cover (1) according to any of the preceding items, wherein the locking system comprises a latch (9a, 19a) and an engagement part (9b, 19b) such as a notch, wherein the handle (5, 5a) is connected, such as mechanically, electrically

or wirelessly connected, to the locking system so as to operate the locking system in response to a movement of the gripping part relative to the movable unit (3).

18. A building aperture cover (1) according to any of the preceding items, wherein the locking system (9a, 9b) is configured to mechanically interlock the movable unit (3) and the fixation frame (2).

19. A building aperture cover (1) according to any of the preceding items, wherein the locking system (19a, 19b) is configured to mechanically interlock the movable unit (3) and the actuator arrangement (8).

20. A building aperture cover (1) according to any of the preceding items, wherein the building aperture cover (1), such as the handle (5), comprises the control system (7), such as one or more hardware processors of the control system (7),

21. A building aperture cover (1) according to any of the preceding items, wherein the handle (5) comprises transmissions means, such as transmission means for transmitting wireless signals, wherein the transmission means are configured to transmit the first and second control output (OP1, OP2) and/or the sensor data (SDA).

22. A building aperture cover (1) according to any of the preceding items, wherein the first control output (OP1) and/or the second control output (OP2) comprises an electric signal, a wirelessly transmitted signal and/or a software parameter stored in a data storage, for example as part of a software control code.

23. A building aperture cover (1) according to any of the preceding items, wherein the electric actuator arrangement (8) comprises an actuator (8a) and an electric motor (8b) configured to drive the actuator (8a) in response to a control signal, such as in response to said control output (OP1 OP2) or a signal based on said control output (OP1 OP2).

24. A building aperture cover (1) according to any of the preceding items,

wherein the control system (7) comprises a user interaction detection system comprising one or more predefined user interaction criteria (THR1, THR2, Tim1, Tim2) represented in a data storage,
wherein said control system is configured to process the sensor data (SDA) based on the user interaction criteria in order to determine if said control output (OP1, OP2) should be provided,
wherein said control system (7) is configured to

provide said control output (OP1, OP2) if the user interaction criteria is determined to be complied with.

25. A building aperture cover (1) according to item 24, wherein said control system (7) is configured to refrain from providing said control output (OP1, OP2) if the user interaction criteria is determined to not be complied with.

26. A building aperture cover (1) according to item 24 or 25, wherein said predefined user interaction criteria comprises one or more of:

- one or more predefined thresholds (THR1, THR2), such as one or more force thresholds,
- one or more predefined time demands (Tim1, Tim2), such as one or more minimum time periods that a physical user interaction (F1, F2) must be continuously applied onto the gripping part (5a) before it is categorized as an activation force (F1, F2),
- one or more predefined user interaction patterns, such as tapping patterns.

27. A building aperture cover (1) according to item 24 or 25 or 26, wherein said predefined user interaction criteria comprises a maximum time limit (Maxt), wherein the control system (7) is configured to refrain from providing said control output (OP1, OP2) if the physical user interactions (F1, F2) have been provided for more than said maximum time limit.

28. A building aperture cover (1) according to any of the preceding items, wherein the user interaction sensor arrangement (6, 6a, 6b) comprises one or more of

- one or more capacitive sensors,
- one or more switches such as energy harvesting switches,
- one or more strain gauges.

29. A building aperture cover (1) according to any of the preceding items, wherein the handle comprises a base part (5b), wherein the gripping part (5a) is fixed to, such as movably fixed to, to said base part (5b), and wherein said base part is fixed to the movable unit (3).

30. A building aperture cover (1) according to item 29, wherein said user interaction sensor arrangement (6, 6a, 6b) is arranged in or at the base part (5b) and/or in or at the gripping part (5a).

31. A building aperture cover (1) according to any of the preceding items, wherein the gripping part (5a)

is elongated and is arranged with a distance to the movable unit so that a human hand is able to extend around the elongated gripping member (5a) and in between the movable unit and the gripping part (5a) so as to grasp around the gripping member (5a) to provide the first and/or second activation force (F1, F2).

32. A building aperture cover (1) according to any of the preceding items, wherein the glass unit (4) comprises a major outer surface (4a) comprised in a first plane (PL), wherein the first activation force (F1) is configured to be in a direction towards said plane (PL), and wherein said second activation force (F2) is configured to be in a direction away from said plane.

33. A building aperture cover (1) according to any of the preceding items, wherein the glass unit comprises a major outer surface (4a) comprised in a first plane (PL), wherein the first (F1) and/or second activation force (F2) is/are configured to be in a direction parallel to said plane (PL), such as wherein said first and second activation force (F1, F2) are oppositely directed.

34. A building aperture cover (1) according to any of the preceding items, wherein the building aperture cover (1) is a window, such as a roof window.

35. A building aperture cover (1) according to any of the preceding items, wherein the building aperture cover (1) is a door, such as a sliding door, such as a sliding door configured to move towards the open position (OPOS) in a direction substantially parallel to a plane (PL) defined by a major outer surface (4a) of the glass unit, such as by being displaced along a longitudinal rail.

36. A building aperture cover (1) according to any of the preceding items, wherein the insulated glass unit (4) comprises at least two glass sheets (4g 1, 4g2) and at least one sealed, insulating gap (IGA) arranged between major surfaces of the glass sheets, such as wherein said at least one sealed, insulating gap is evacuated to a pressure below 0.001 mbar or wherein the gap is filled with a gas such as argon.

37. A building aperture cover (1) according to any of the preceding items, wherein the gripping part (5a) is longitudinal and comprises a longitudinal direction, wherein the gripping part (5a) is configured to be rotated around an axis that is substantially parallel to a plane (PL) comprising a major outer surface of the insulating glass unit(4).

38. A building aperture cover (1) according to any of the preceding items, wherein the gripping part (5a)

is configured to be rotated around an axis that is substantially perpendicular to a plane (PL) comprising a major outer surface of the insulating glass unit.

39. A building aperture cover (1) according to any of the preceding items, wherein said building aperture cover (1) is arranged to cover a building aperture in an outer wall or in a roof structure of the building. 5

40. A building aperture cover (1) according to any of the preceding items, wherein the user interaction sensor arrangement (6, 6a, 6b) comprises at least one capacitive sensor, such as at least two capacitive sensors, configured to detect said user interactions (F1, F2) provided at the gripping part (5a). 10 15

41. A building aperture cover (1) according to any of the preceding items, wherein the user interaction sensor arrangement (6, 6a, 6b) comprises at least one touch sensor, such as at least two touch sensors, configured to detect said user interactions (F1, F2) provided at the gripping part (5a). 20

42. A building aperture cover (1) according to any of the preceding items, wherein the user interaction sensor arrangement (6, 6a, 6b) comprises at least one touch sensor, such as at least two touch sensors, configured to detect said user interactions (F1, F2) provided at the gripping part (5a). 25 30

43. A building aperture cover (1) according to any of the preceding items, wherein the actuator arrangement (8) is hidden in the window aperture cover (1).

44. A building aperture cover (1) according to item 43, wherein an actuator housing (8d) of the actuator arrangement (8) is hidden in the top part of the window (1). 35

45. A building aperture cover (1) according to item 43 or 44, wherein an actuator housing (8d) of the actuator arrangement (8) is hidden below a top cover (17), such as below a weather shield cover, of the window building aperture cover (1) and/or wherein an actuator housing (8d) of the actuator arrangement (8) is hidden between the movable unit 3 and the fixation frame 2. 40 45

46. A method of controlling an actuator arrangement (8) of a building aperture cover (1) installed in a building (300), 50

wherein the building aperture cover (1) comprises

- an electric actuator arrangement (8),
- a movable unit (3) comprising an insulated glass unit (4), and

- a handle (5), wherein the handle is attached to the movable unit (3) and wherein the handle (5) comprises a gripping part (5a) and a user interaction sensor arrangement (6, 6a, 6b),

the method comprising:

registering by means of the user interaction sensor arrangement (6, 6a, 6b) that a first activation force (F1) in a first force direction has been applied at the gripping part (5a), and wherein the user interaction sensor arrangement (6, 6a, 6b) provides first sensor data (SDA) to a control system (7), wherein said first sensor data comprises information of that the first activation force (F1) in the first force direction is applied to the gripping part (5a),

wherein the control system (7) processes the information of the first sensor data (SDA), and wherein the control system (7) provides a first control output (OP1) based on said processing of the first sensor data (SDA),

wherein the electric actuator arrangement (8) applies an opening force (OF) to the movable unit (3) in response to the first control output (OP1),

wherein the method moreover comprises

registering by means of the user interaction sensor arrangement (6, 6a, 6b) that a second activation force (F2) in a second force direction has been applied at the gripping part (5a), and wherein the user interaction sensor arrangement (6, 6a, 6b) provides second sensor data (SDA) to a control system (7), wherein said second sensor data comprises information of that the second activation force (F2) in the second force direction is applied to the gripping part (5a),

wherein the control system (7) processes the information of the second sensor data (SDA), and wherein the control system (7) provides a second control output (OP2) based on said processing of the second sensor data (SDA), wherein the electric actuator arrangement (8) applies a closing force (CF) to the movable unit (3) in response to the second control output (OP2).

47. A method according to item 46, wherein the building aperture cover is a building aperture cover according to any of the preceding items.

48. A method of opening and closing a movable unit of a building aperture cover (1) according to any of the preceding items,

wherein the control system (7) provides the first control output (OP1) when the first activation force (F1) in the first force direction is applied to the gripping part (5a) by human hand, and wherein the electric actuator arrangement (8) applies said opening force (OF) to the movable unit (3) in response to the first control output (OP1),
 wherein the control system (7) provides the second control output (OP2) when the second activation force (F2) in the second force direction is applied to the gripping part (5a) by human hand, and wherein the electric actuator arrangement (8) applies said closing force (CF) to the movable unit (3) in response to the second control output (OP2).

[0250] In general, it is to be understood that the present disclosure is not limited to the particular examples described above but may be adapted in a multitude of varieties within the scope of the present disclosure as specified in e.g. the items and/or claims. Accordingly, for example, one or more of the described and/or illustrated embodiments above may be combined to provide further embodiments of the invention.

Claims

1. A building aperture cover (1), such as a window, comprising
 - a fixation frame (2) and a movable unit (3), wherein the movable unit (3) is connected to the fixation frame (2) by means of a hinge arrangement (14) so that the movable unit (3) is configured to be moved relative to the fixation frame (2) between a closed unit position (CPOS) and an open unit position (OPOS), wherein the movable unit (3) comprises an insulated glass unit (4),
 - an electric actuator arrangement (8) configured to provide said movement of the movable unit (3) between the closed unit position (CPOS) and the open unit position (OPOS),
 - a handle (5), wherein the handle (5) is attached to a part of the movable unit (3), wherein the handle (5) comprises a gripping part (5a) configured to be grasped by human hand, and
 - a control system (7) comprising one or more hardware processors,
 wherein the handle (5) comprises a user interaction sensor arrangement (6, 6a, 6b) configured to detect physical user interactions (F1, F2)

applied at the gripping part (5a), and provide sensor data (SDA) based thereon, and wherein the control system (7) is configured to receive and process the sensor data (SDA),
 wherein the control system (7) is configured to provide first control output (OP1) based on said processing of the sensor data (SDA) if the sensor data (SDA) comprises information indicating that a first user interaction comprising a first activation force (F1) in a first force direction is applied to the gripping part (5a),
 wherein the control system (7) is configured to provide second control output (OP2) based on said processing of the sensor data (SDA) if the sensor data (SDA) comprises information indicating that a second user interaction comprising a second activation force (F2) in a second force direction is applied to the gripping part (5a),
 wherein the electric actuator arrangement (8) is configured to apply an opening force (OF) to the movable unit (3) if the first control output (OP1) is provided, and
 wherein the actuator arrangement (8) is configured to apply a closing force (CF) to the movable unit (3) if the second control output (OP2) is provided.

2. A building aperture cover (1) according to any of the preceding claims, wherein the building aperture cover (1) comprises a locking system (9a, 9b, 19a, 19b), wherein the locking system (9a, 9b, 19a, 19b) is configured to be arranged in a locked state (LS) and an unlocked state (US), respectively,

wherein the movable unit (3) is configured to be movable towards the open position (OPOS) from the closed position (CPOS) when the locking system (9a, 9b, 19a, 19b) is in the unlocked state (US),
 wherein the movable unit (3) is configured to be in a locked unit state in the closed unit position (CPOS) by means of said locking system (9a, 9b, 19a, 19b) when the locking system is in the locked state (LS),
 wherein the handle (5), such as the gripping part (5a), is configured to be operated by human hand so as to control in which of said states (LS, US) the locking system (9a, 9b, 19a, 19b) is arranged.

3. A building aperture cover (1) according to claim 2, wherein the gripping part (5a) is configured to be moved (RAX1), such as by displacement and/or rotation, relative to the movable unit (3) between a first gripping part position (GP1) and a second gripping part position (GP2), respectively,
 wherein the locking system (9a, 9b, 19a, 19b) is configured to be arranged in the locked state (LS) when

the gripping part (5a) is arranged in the first gripping part position (GP1), wherein the locking system (9a, 9b, 19a, 19b) is configured to be arranged in the unlocked state (US) when the gripping part (5a) is arranged in the second gripping part position (GP2).

4. A building aperture cover (1) according to any of the preceding claims, wherein the gripping part (5a) is configured to be moved (RAX1), such as by displacement and/or rotation, relative to the movable unit (3) between a first gripping part position (GP1) and a second gripping part position (GP2) by human hand, so that a disengagement of a lock (9a, 9b) between the fixation frame (2) and the movable unit (3) is provided and/or so that a disengagement of an electric actuator arrangement (8) lock connection (19a, 19b) between the fixation frame (2) and the movable unit (3) is provided.
5. A building aperture cover (1) according to any of claims 2-4, wherein the handle (5), such as the gripping part (5a), is directly or indirectly mechanically coupled to the locking system (9a, 9b, 19a, 19b) so as to be configured to mechanically switch the locking system between the locked state and the unlocked state (US) by movement of the gripping part (5a) relative to the movable unit (3).
6. A building aperture cover (1) according to any of claims 3-5, wherein operation of the actuator arrangement (8) is configured to be omitted despite the first and/or second activation force (F1, F2) being provided onto the gripping part (5a), when the gripping part (5a) is arranged in a first gripping part position (GP1) or when the gripping part (5a) is arranged in a second gripping part position (GP2).
7. A building aperture cover (1) according to any of claims 3-6, wherein the actuator arrangement (8) is configured to provide the opening force (OF) in response to the first activation force (F1) being provided onto the gripping part (5a) while the gripping part (5a) is arranged in the first gripping part position (GP1).
8. A building aperture cover (1) according to any of the preceding claims, wherein the user interaction sensor arrangement (6, 6a, 6b) comprises two or more sensors provided to detect user interactions (F1, F2) at two opposite surfaces (SP1, SP2) of the handle (5), wherein a first (6a) of the sensors is configured to detect an opening first user interaction (F1), such as an activation force, applied at a first surface (SP2) of the gripping part (5a) and wherein a second opposite sensor (6b) is configured to detect a closing second user interaction (F2), such as an activation force, applied at a second opposite surface (SP1) of the gripping part (5a),

such as

wherein said control system (7) is configured to refrain from providing said control output (OP1, OP2) if the first sensor (6a) detects a opening first user interaction (F1) and the second opposite sensor (6b) simultaneously detects a closing second user interaction (F2)

9. A building aperture cover (1) according to any of the preceding claims, wherein the first activation force (F1) is a force comprising a force vector component in a handle movement direction (MD 1), where said handle movement direction (MD 1) is the movement direction of the handle (5) that will occur when a movement of the movable unit (3) from the closed unit position (CPOS) towards the open unit position (OPOS) is initiated by the actuator arrangement (8), and/or wherein the second activation force (F2) is a force comprising a force vector component in a handle movement direction (MD2), where said handle movement direction (MD2) is the movement direction (MD2) of the handle (5, 5a) that will occur when a movement of the movable unit (3) from the open unit position (OPOS) towards the closed unit position (CPOS) is initiated by the actuator arrangement (8).
10. A building aperture cover (1) according to any of the preceding claims, wherein the locking system (9a, 9b) is wirelessly, such as electrically and/or magnetically controlled, by means of a lock controller (7), and wherein the lock controller is configured to switch the locking system (9a, 9b) from a locked state (LS) to an unlocked state (US), for example prior to the opening force (OF) being applied by the actuator arrangement (8).
11. A building aperture cover (1) according to claims 3 and 10, wherein the first control output (OP1) is configured to induce the lock controller to switch the locking system (9a, 9b) from the locked state to an unlocked state while the gripping part (5a) is arranged in the first gripping part position (GP1).
12. A building aperture cover (1) according to any of the preceding claims, wherein the control system (7) comprises a user interaction detection system comprising one or more predefined user interaction criteria (THR1, THR2, Tim1, Tim2, Maxt) represented in a data storage, wherein said control system is configured to process the sensor data (SDA) based on the user interaction criteria in order to determine if said control output (OP1, OP2) should be provided, wherein said control system (7) is configured to

provide said control output (OP1, OP2) if the user interaction criteria is determined to be complied with, such as wherein said predefined user interaction criteria comprises one or more of:

- one or more predefined thresholds (THR1, THR2), such as one or more force thresholds, 10
- one or more predefined time demands (Tim1, Tim2, Maxt), such as one or more minimum time periods (Tim1, Tim2) that a physical user interaction (F1, F2) must be continuously applied onto the gripping part (5a) before it is categorized as an activation force (F1, F2), 15
- one or more maximum time limits (Maxt), that indicate when an applied user interaction should not be categorized as an activation force, 20
- one or more predefined user interaction patterns, such as tapping patterns.

13. A building aperture cover (1) according to any of the preceding claims, wherein the user interaction sensor arrangement (6, 6a, 6b) comprises one or more of 25

- one or more capacitive sensors,
- one or more switches such as energy harvesting switches, 30
- one or more strain gauges,
- one or more touch sensors

14. A building aperture cover (1) according to any of the preceding claims, wherein the user interaction sensor arrangement (6, 6a, 6b) comprises at least one capacitive sensor, such as at least two capacitive sensors, configured to detect said user interactions (F1, F2) provided at the gripping part (5a), and/or 40 wherein the user interaction sensor arrangement (6, 6a, 6b) comprises at least one touch sensor, such as at least two touch sensors, configured to detect said user interactions (F1, F2) provided at the gripping part (5a). 45

15. A method of controlling an actuator arrangement (8) of a building aperture cover (1) installed in a building (300), 50

wherein the building aperture cover (1) comprises

- an electric actuator arrangement (8),
- a movable unit (3) comprising an insulated glass unit (4), and 55
- a handle (5), wherein the handle is attached to the movable unit (3) and wherein

the handle (5) comprises a gripping part (5a) and a user interaction sensor arrangement (6, 6a, 6b),

the method comprising:

registering by means of the user interaction sensor arrangement (6, 6a, 6b) that a first activation force (F1) in a first force direction has been applied at the gripping part (5a), and

wherein the user interaction sensor arrangement (6, 6a, 6b) provides first sensor data (SDA) to a control system (7), wherein said first sensor data comprises information of that the first activation force (F1) in the first force direction is applied to the gripping part (5a),

wherein the control system (7) processes the information of the first sensor data (SDA), and

wherein the control system (7) provides a first control output (OP1) based on said processing of the first sensor data (SDA), wherein the electric actuator arrangement (8) applies an opening force (OF) to the movable unit (3) in response to the first control output (OP1),

wherein the method moreover comprises

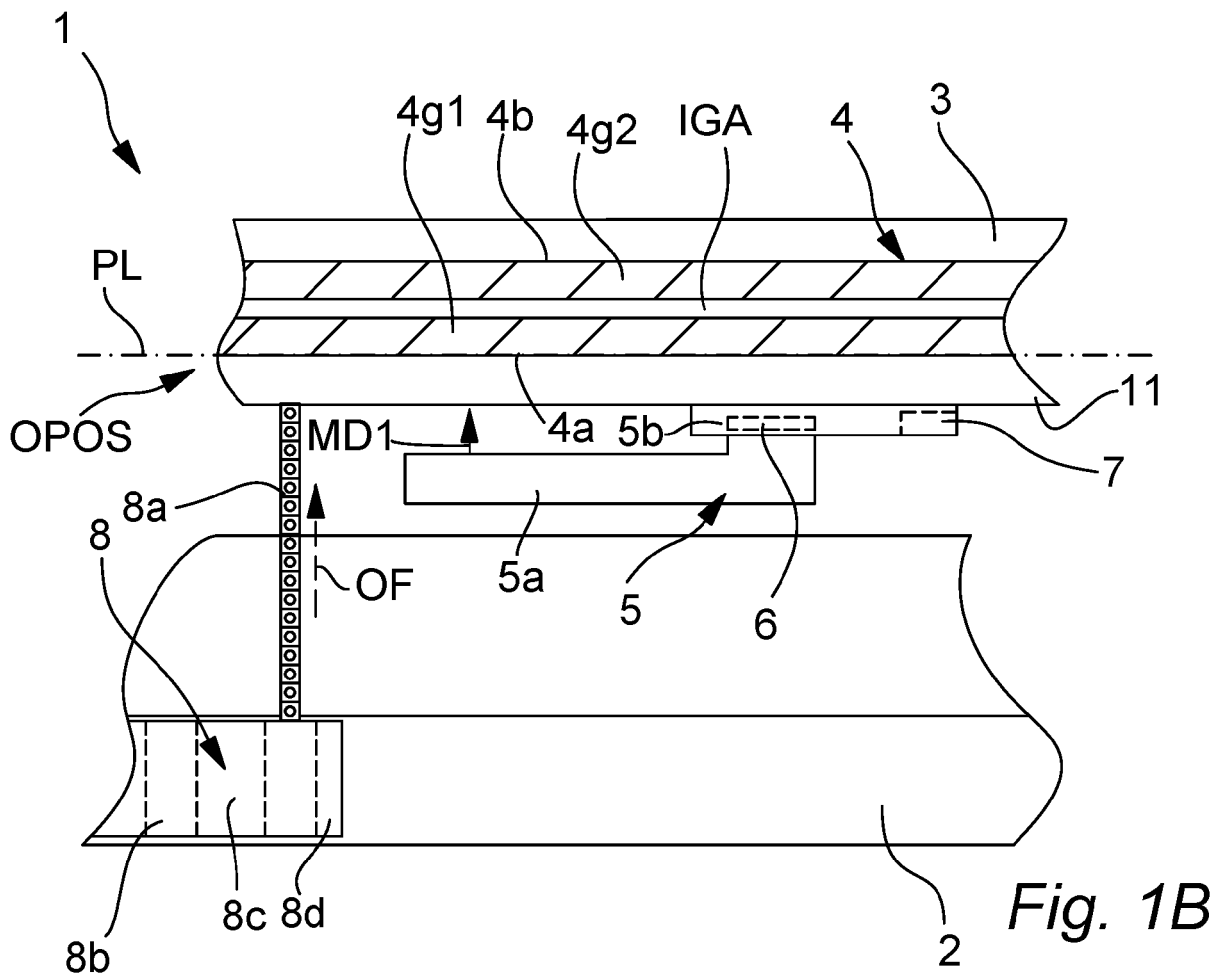
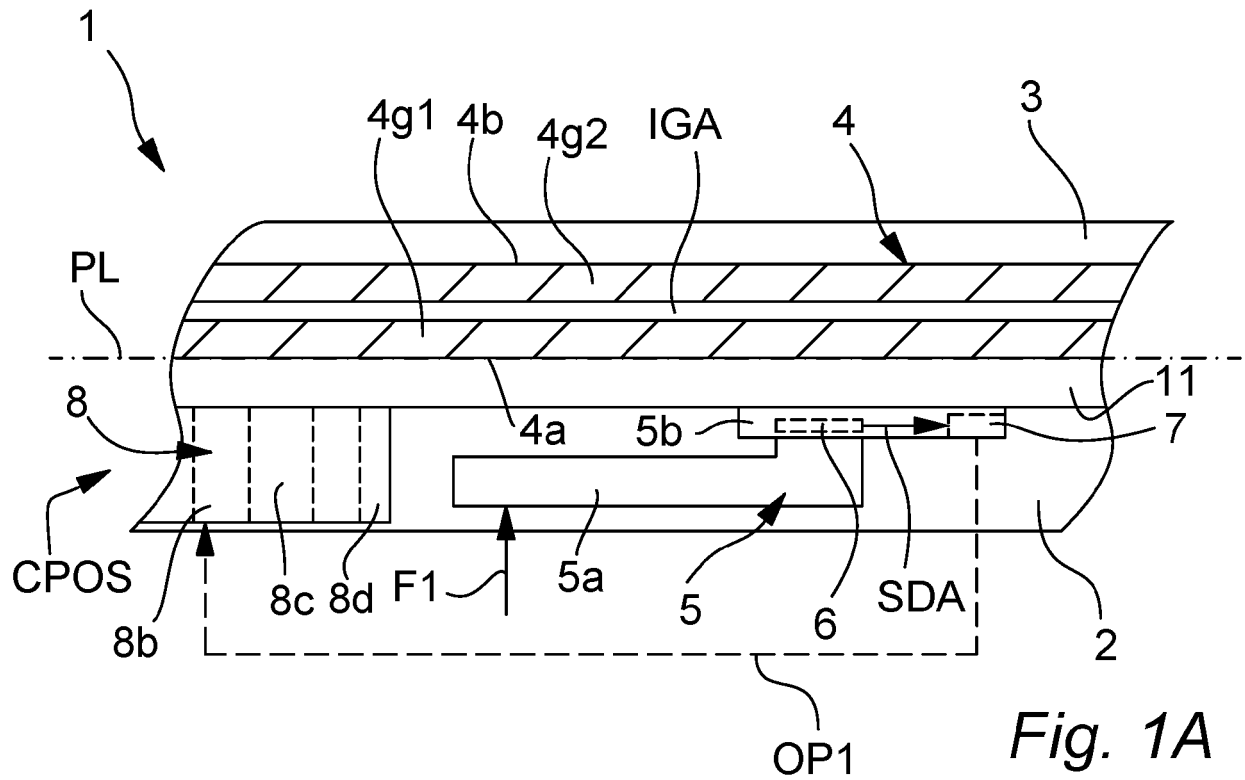
registering by means of the user interaction sensor arrangement (6, 6a, 6b) that a second activation force (F2) in a second force direction has been applied at the gripping part (5a),

and wherein the user interaction sensor arrangement (6, 6a, 6b) provides second sensor data (SDA) to a control system (7), wherein said second sensor data comprises information of that the second activation force (F2) in the second force direction is applied to the gripping part (5a),

wherein the control system (7) processes the information of the second sensor data (SDA),

and wherein the control system (7) provides a second control output (OP2) based on said processing of the second sensor data (SDA),

wherein the electric actuator arrangement (8) applies a closing force (CF) to the movable unit (3) in response to the second control output (OP2).



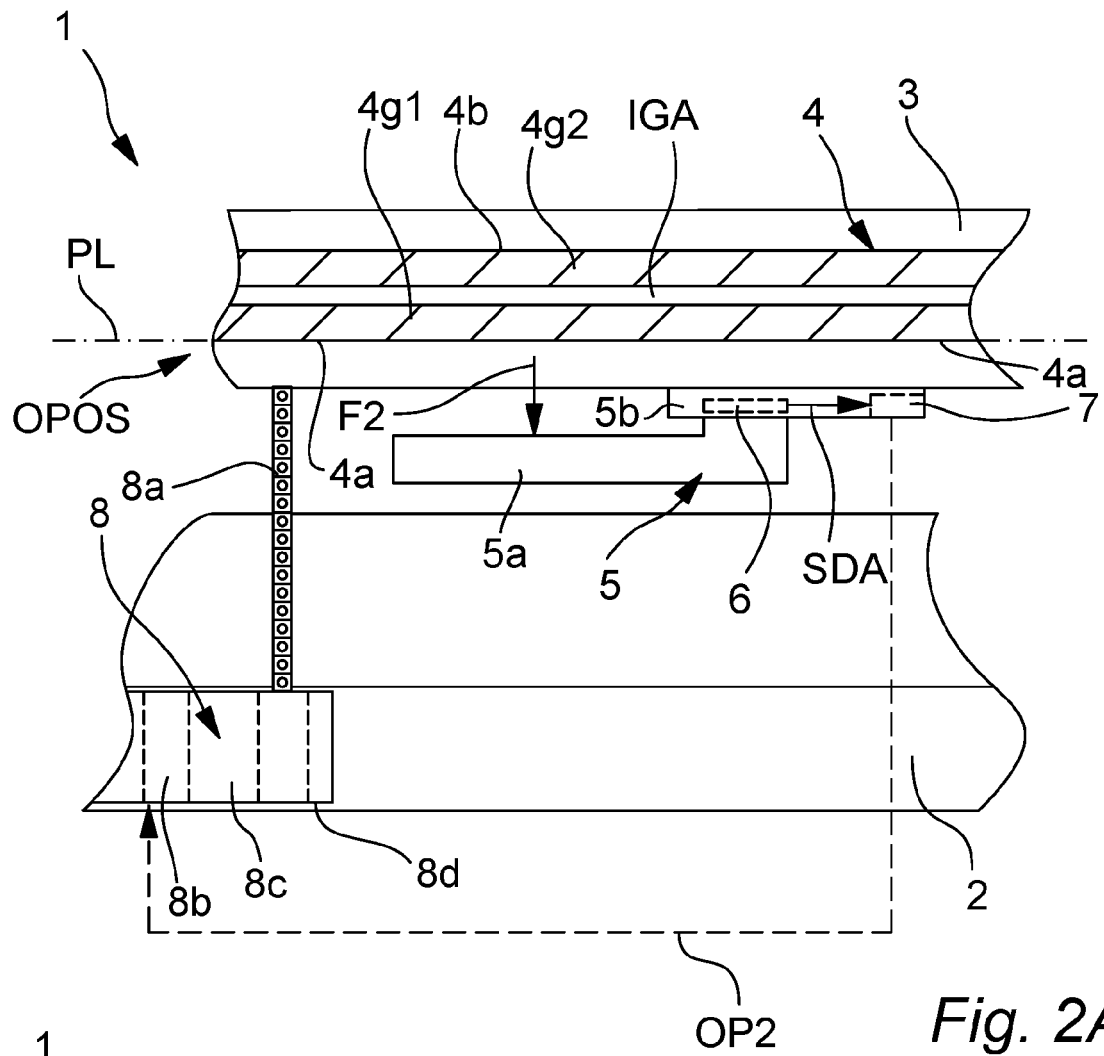
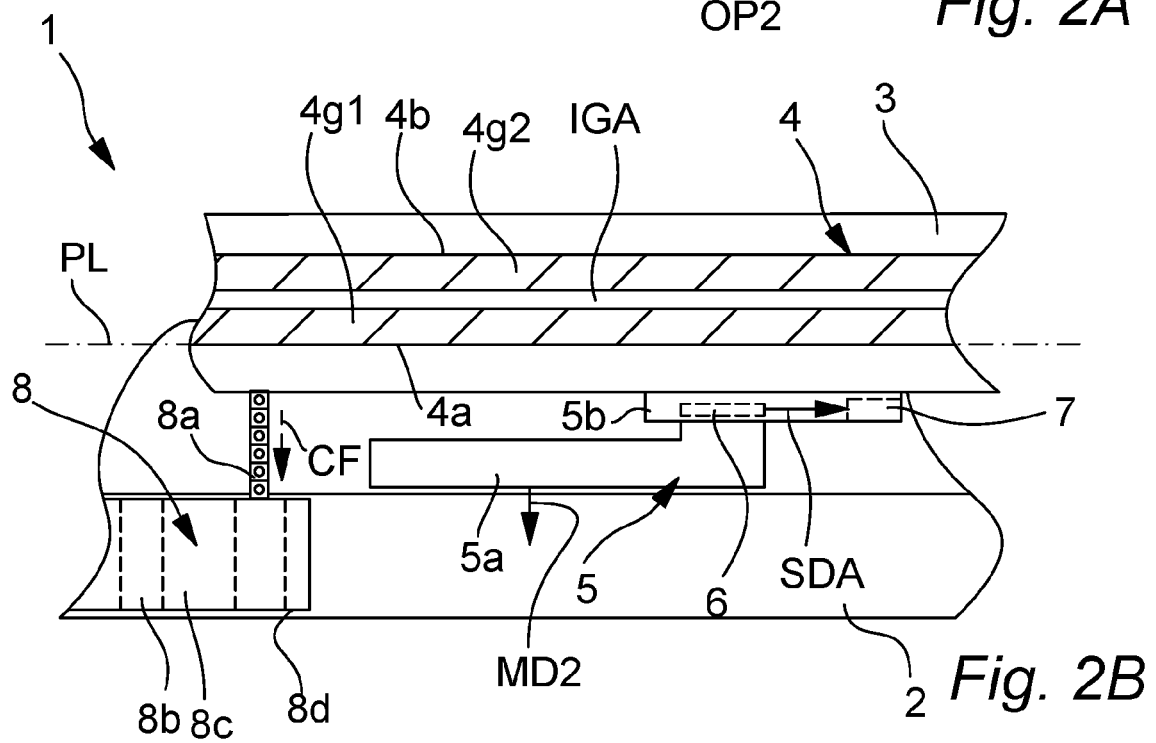
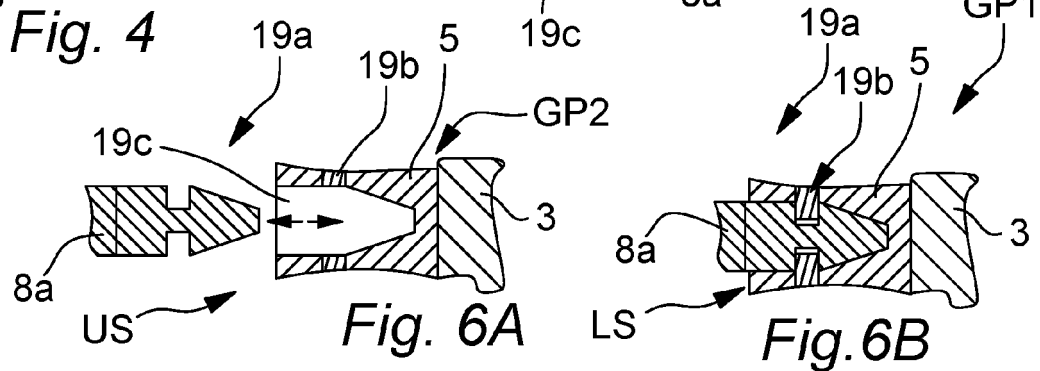
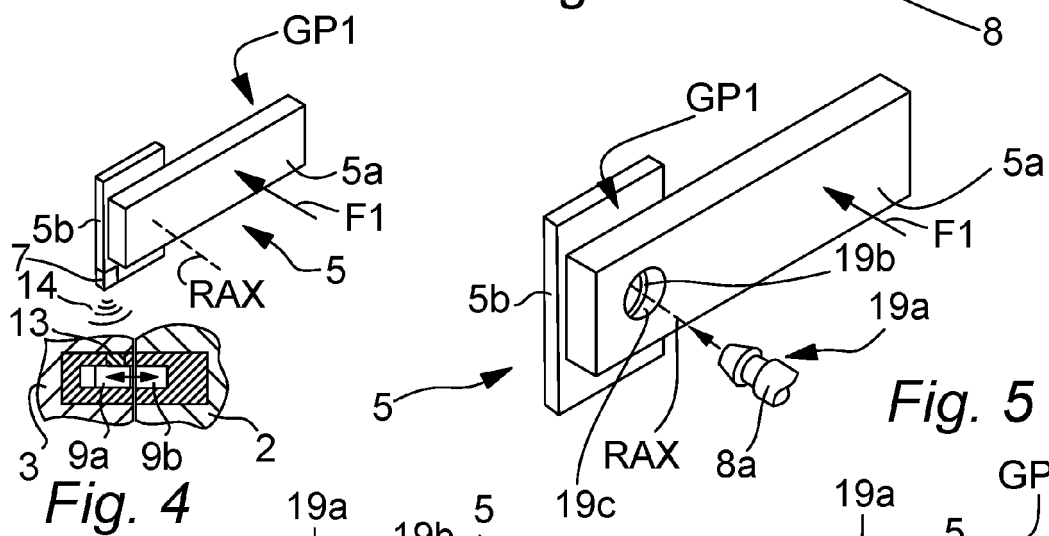
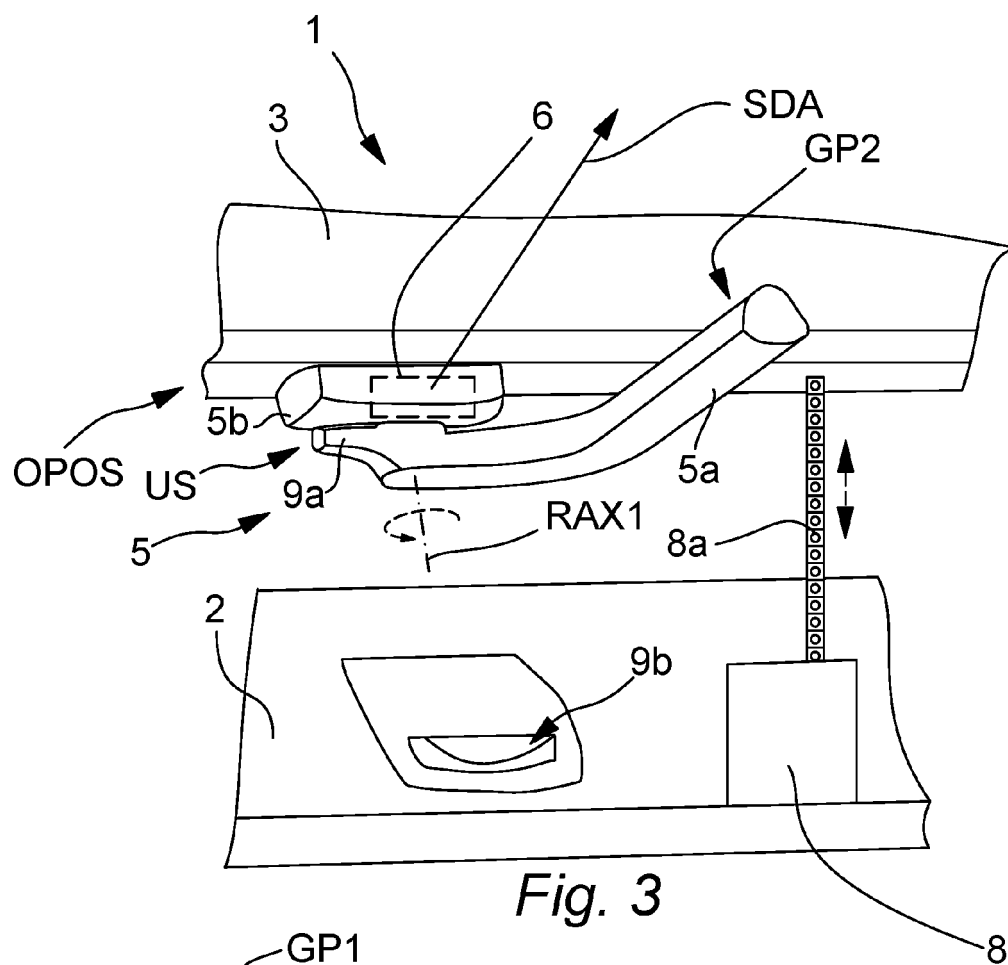
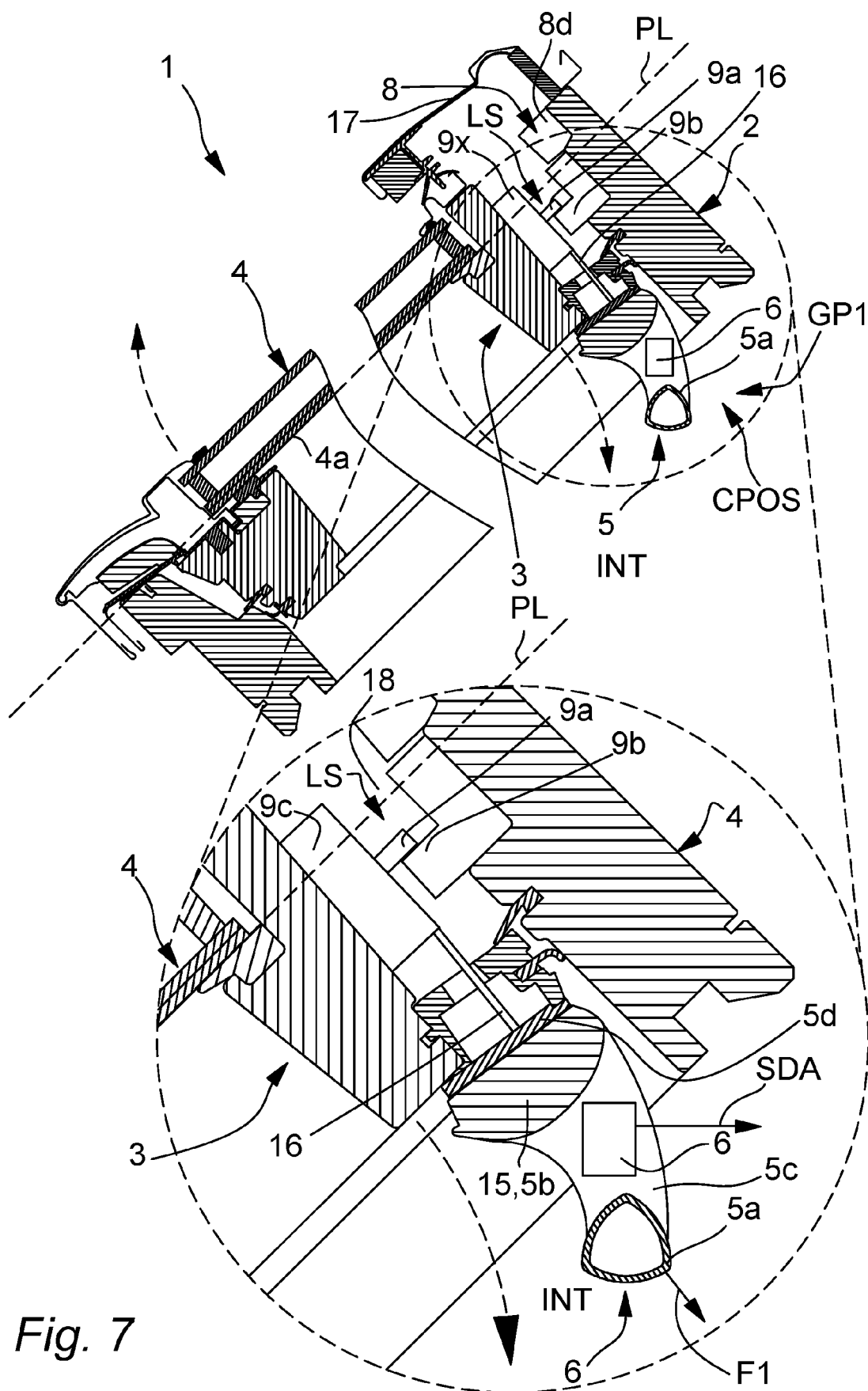


Fig. 2A



2 *Fig. 2B*





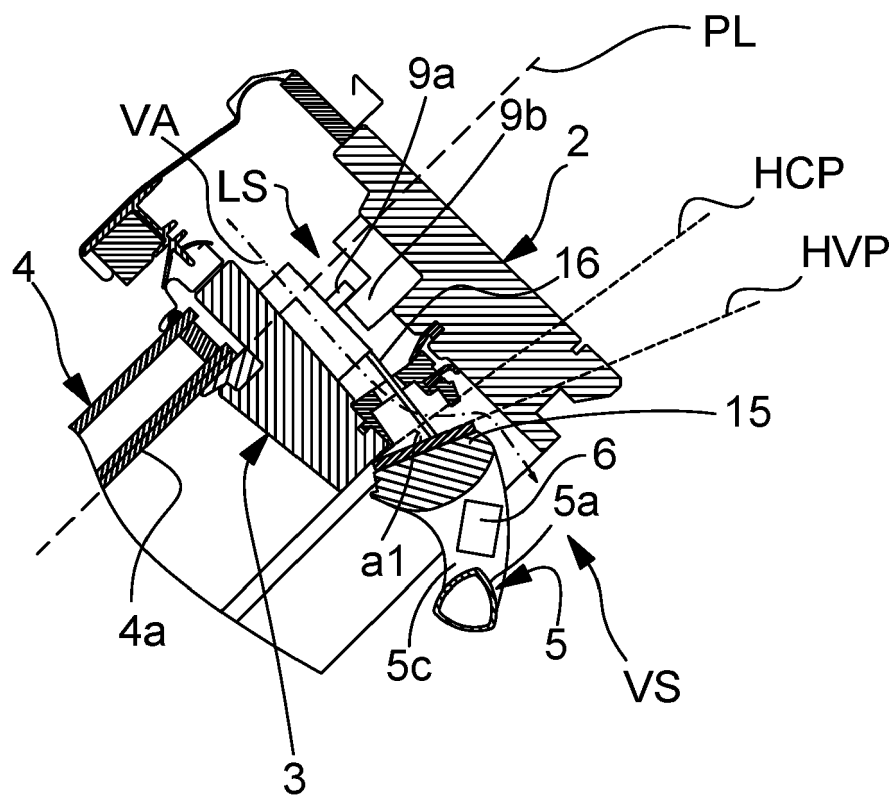


Fig. 8

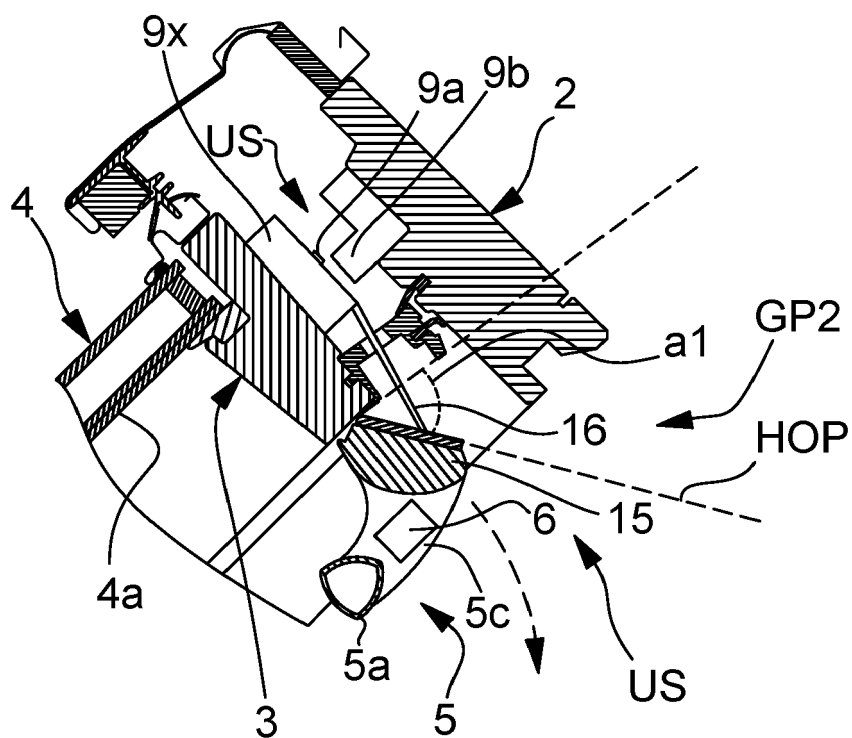


Fig. 9

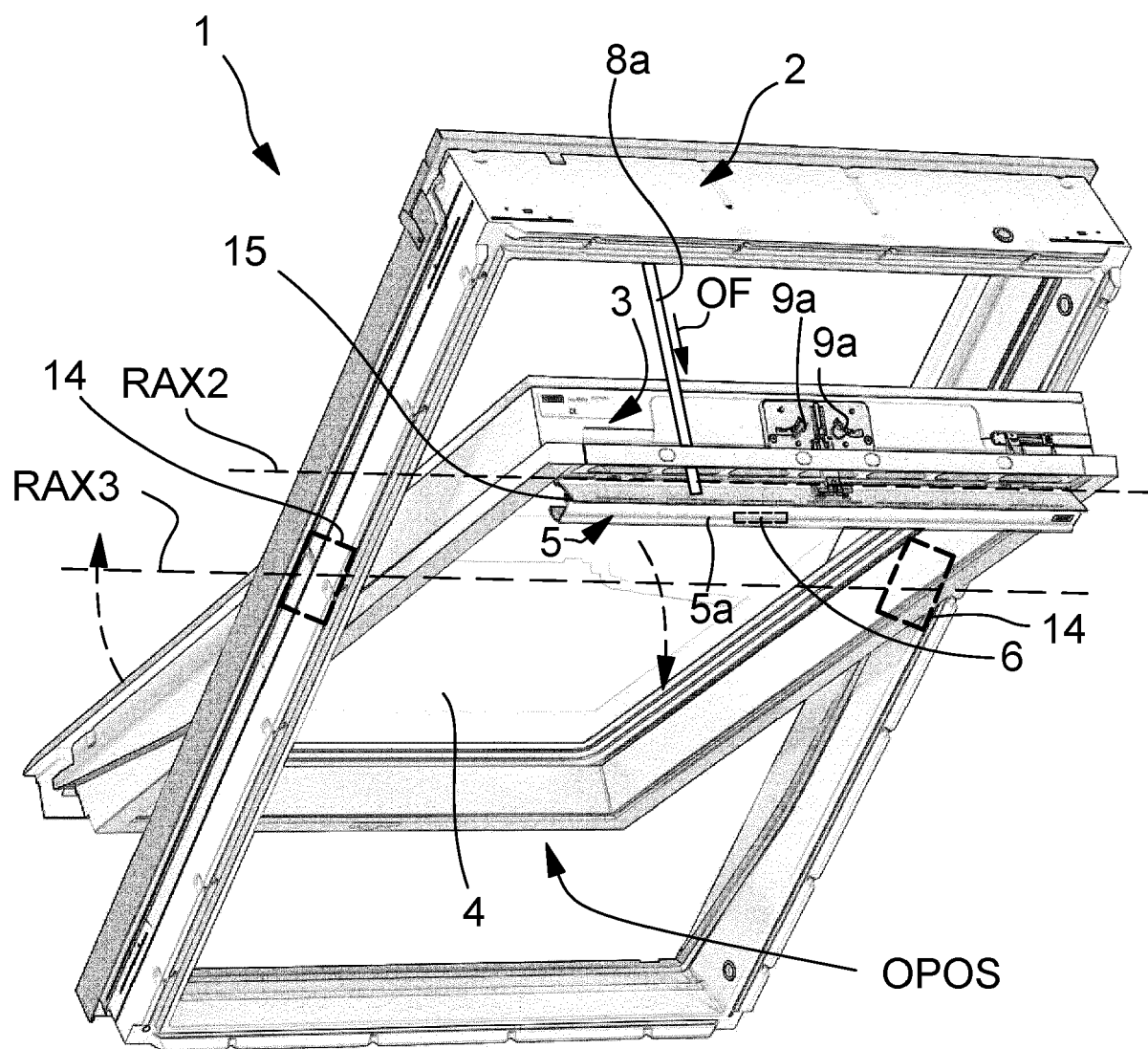


Fig. 10

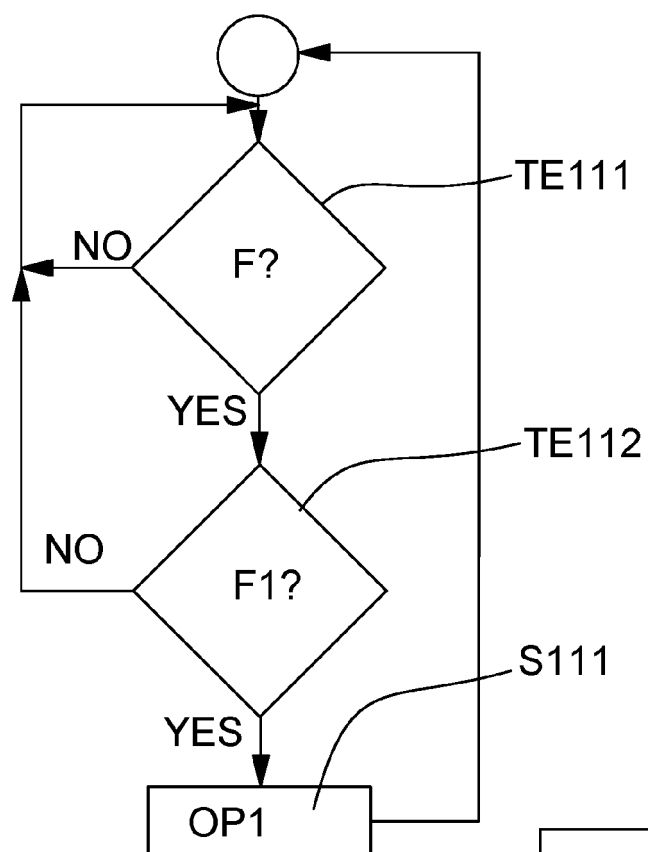


Fig. 11

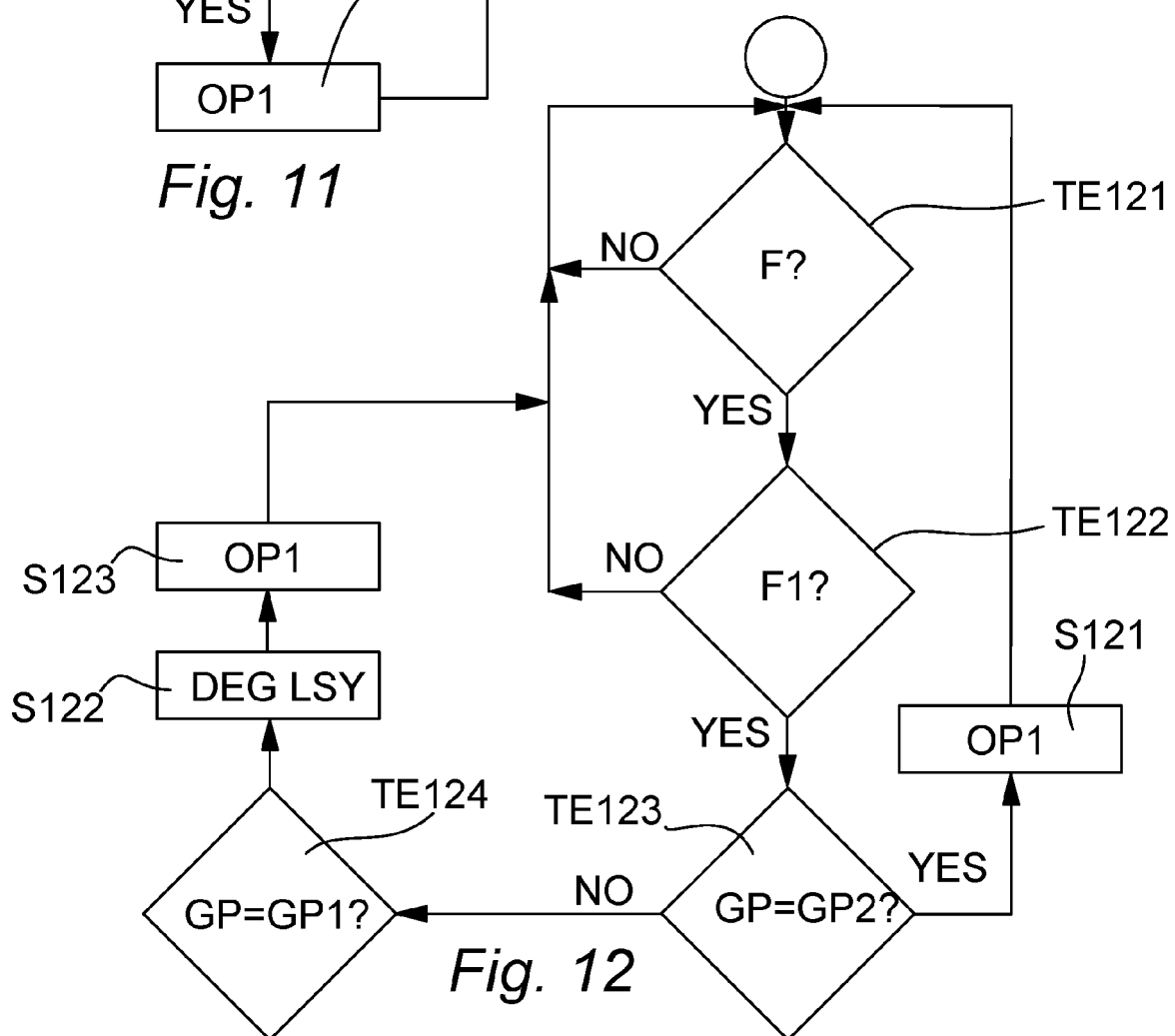


Fig. 12

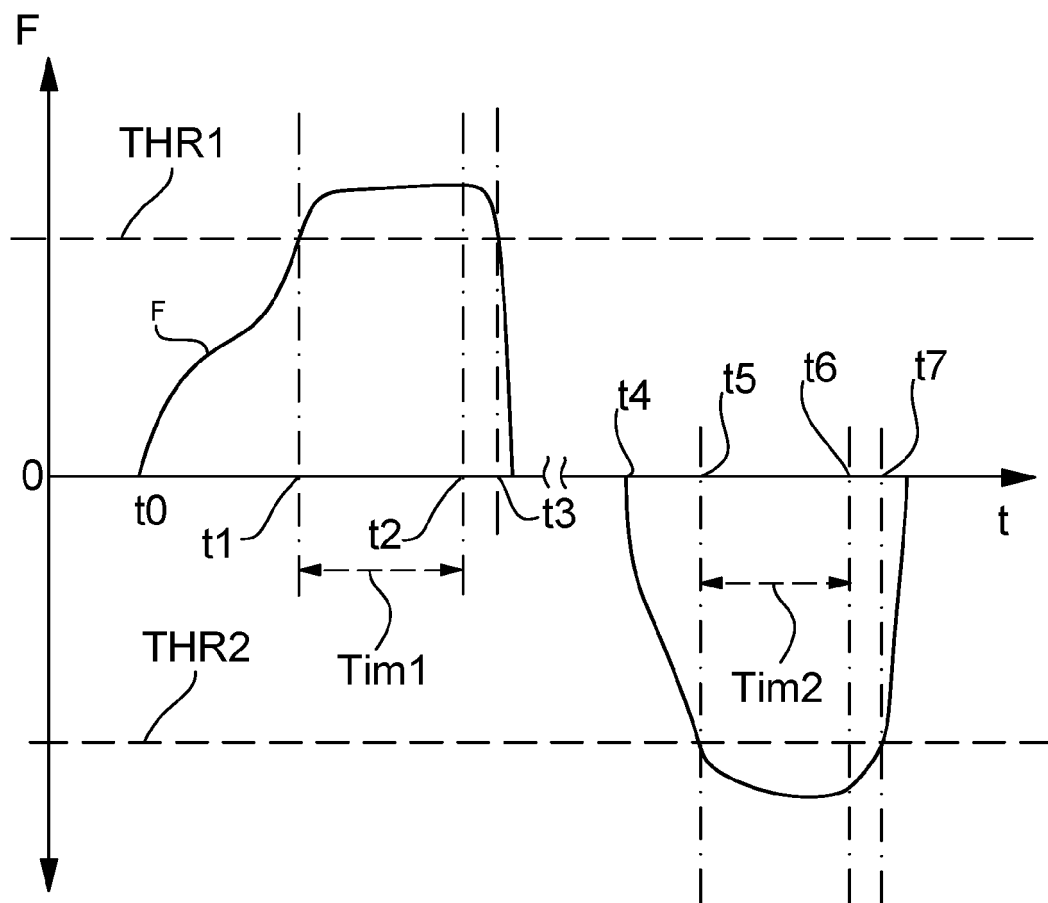


Fig. 13

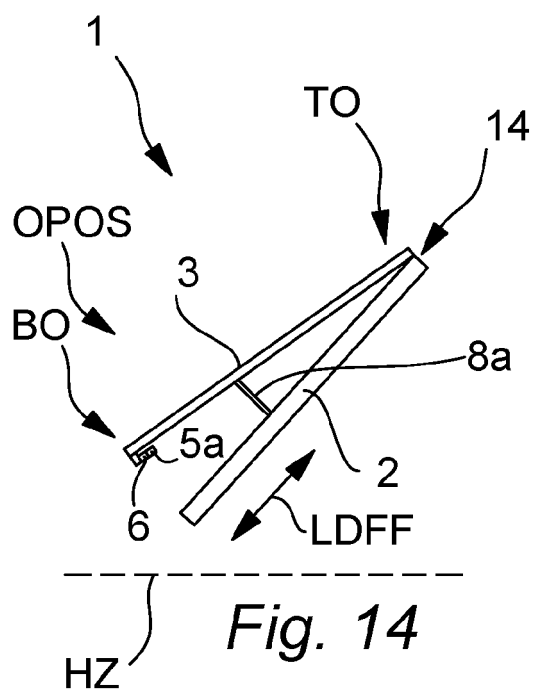


Fig. 14

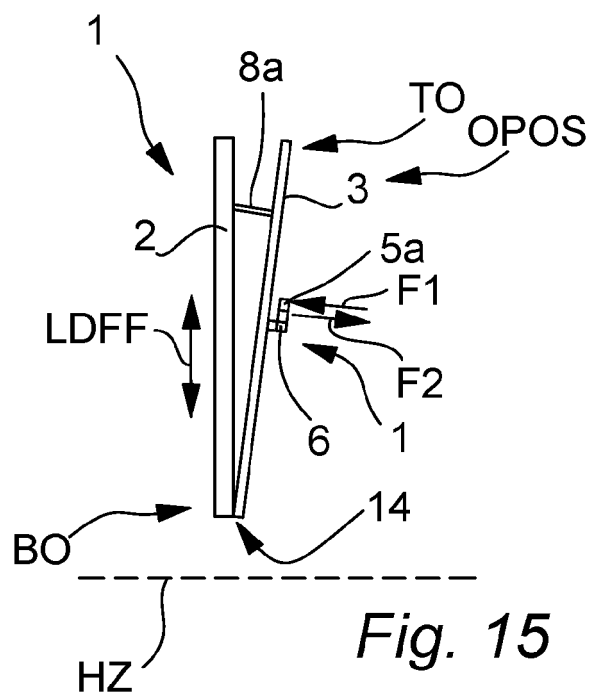


Fig. 15

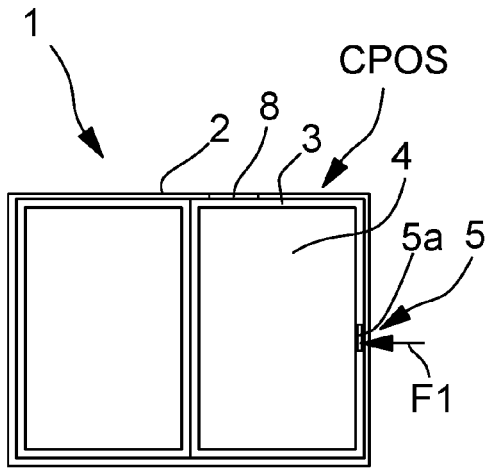


Fig. 16A

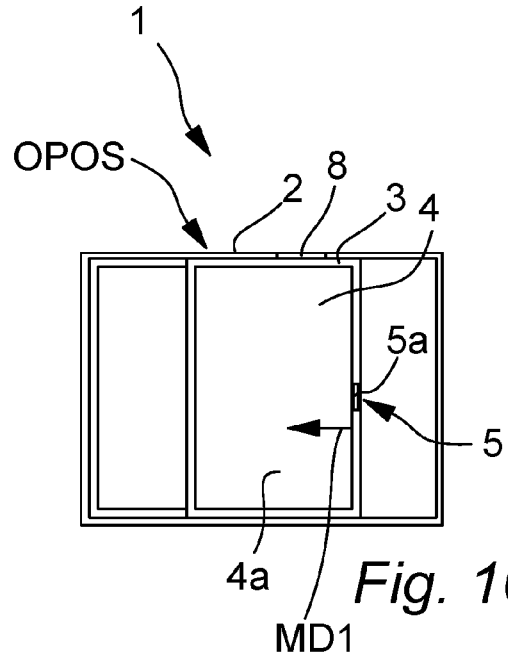


Fig. 16B

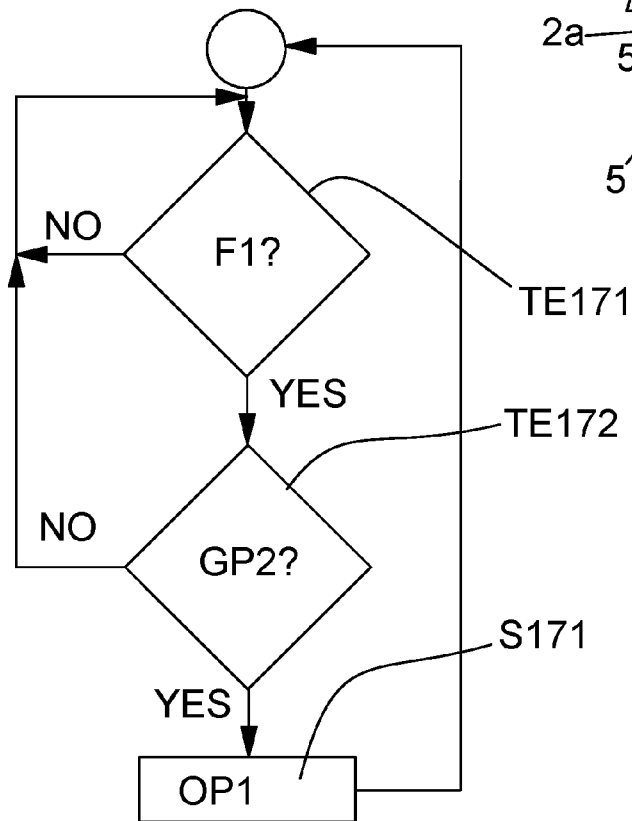


Fig. 17

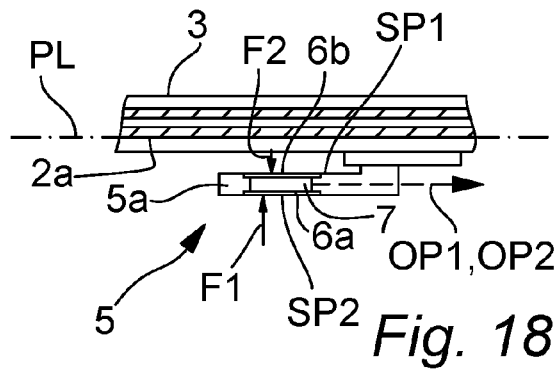


Fig. 18

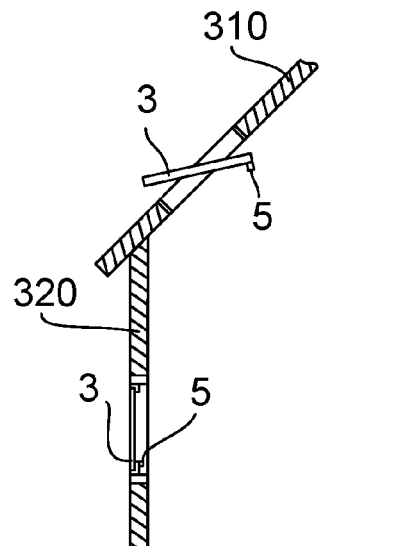


Fig. 19

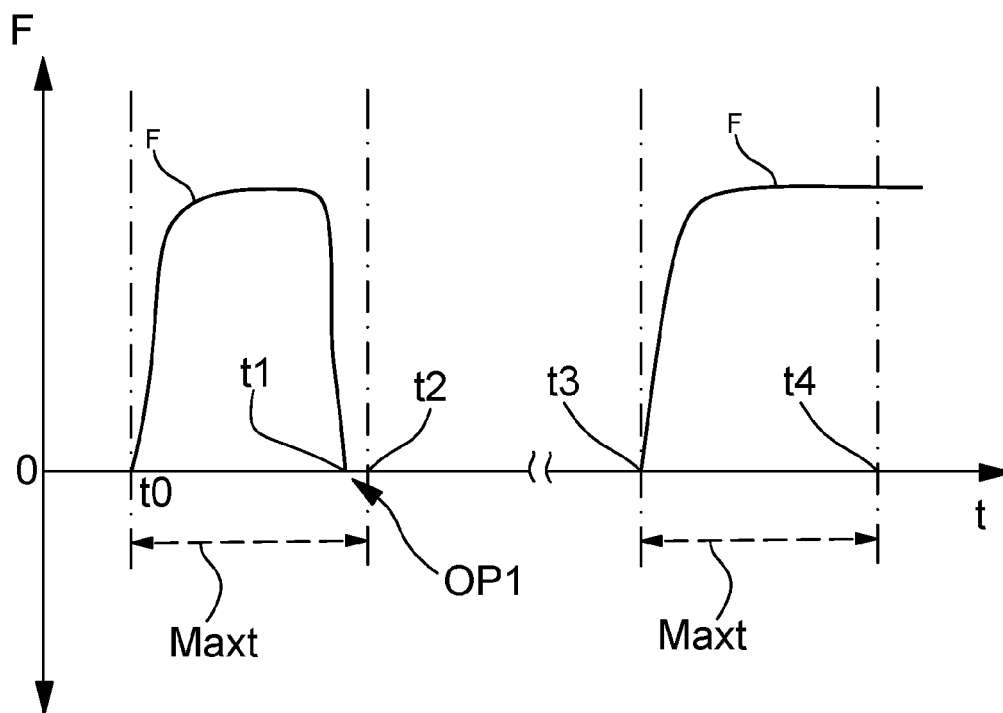


Fig. 20

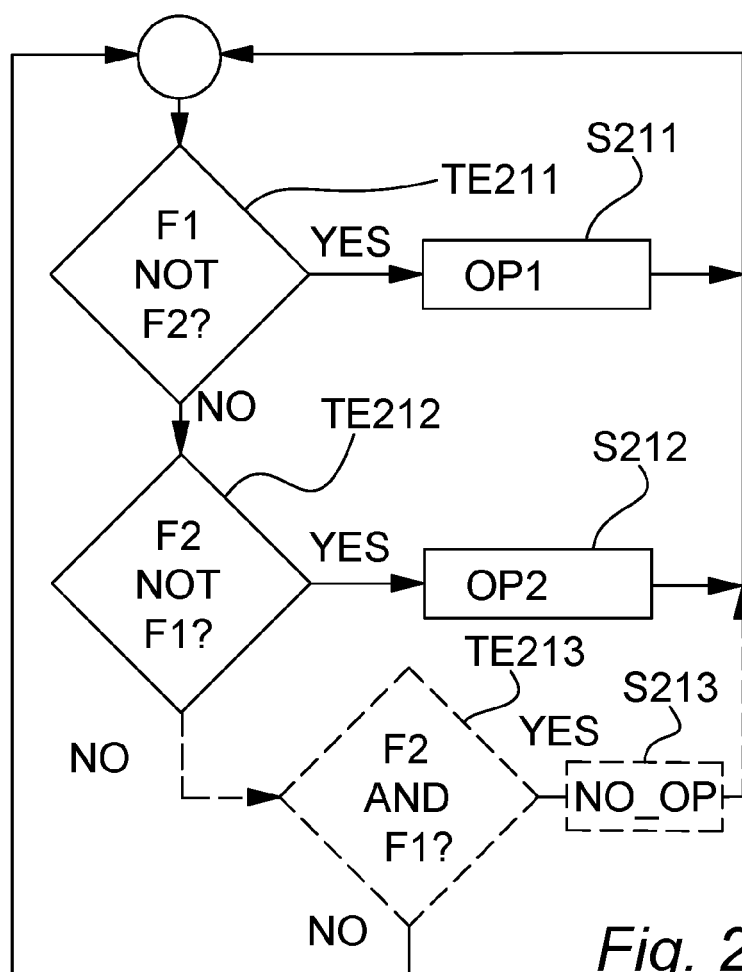


Fig. 21



EUROPEAN SEARCH REPORT

Application Number

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X	CN 109 339 619 A (ZHANG JIAN) 15 February 2019 (2019-02-15) * figures 1-6 * -----	1, 9, 13, 15	
			TECHNICAL FIELDS SEARCHED (IPC)
			E05F
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 26 July 2023	Examiner Prieto, Daniel
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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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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