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(54) **ACTUATOR SYSTEM FOR A MOVABLE BUILDING ELEMENT**

(57) A building element actuator system (1), in particular a roof window actuator system (1), configured to allow a building element (2) to be moved between a closed position (P1) and at least one open position (P2). The actuator system (1) comprises an electric motor (3), a push-pull chain (4) fixedly connected to said electric motor (3) and releasably connected to said movable building element (2). An environmental unit (5) is configured to process environmental data and a control unit (6) is configured to determine, based on said environmental data, if said environmental data fulfills a predefined environmental condition (C) and generate an environmental condition alert (A) if said environmental data fulfills said predefined environmental condition (C). A user interface (7) is configured to receive said environmental condition alert (A) and issue a notification (N) to a user in response to said environmental condition alert (A).

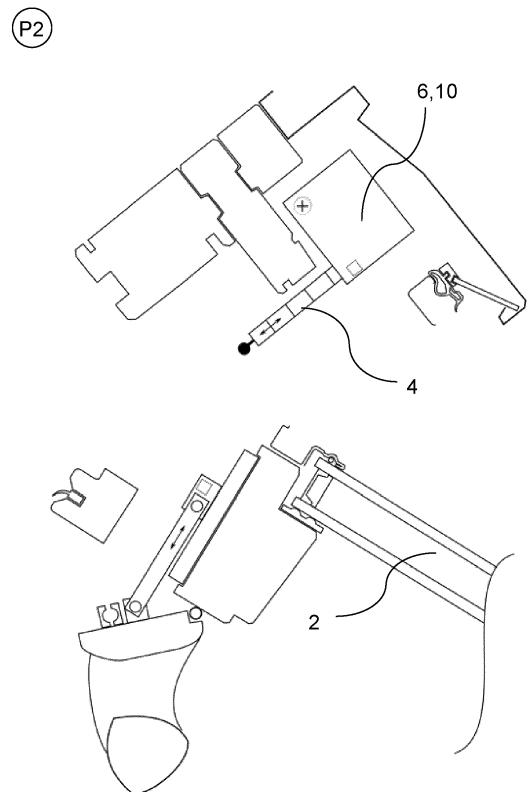


**Fig. 8**

## Description

### TECHNICAL FIELD

**[0001]** The disclosure relates to a building element actuator system configured to allow a building element to be moved between a closed position and at least one open position. The disclosure also relates to a building roof window arrangement comprising a building element in the form of a roof window and the actuator system.

### BACKGROUND

**[0002]** Building elements such as hatches, windows, or doors may be operated manually or automatically. When the opening and closing of the building element is operated automatically, the building element can be part of a larger building management system such as a ventilation system or a fire protection system. This is in particular applicable to roof windows.

**[0003]** Roof windows, also known as skylights, are usually installed in inclined or substantially horizontal roof surfaces of buildings. Roof windows are often provided with electrically operated drive arrangements, i.e. electric actuators, in order to be able to open and close the roof window semiautomatically or fully automatically. When precipitation such as rain, hail, or snow is detected, the actuator can be configured to automatically close the roof window, should the roof window be open, in order to protect the interior of the building from expensive water damage.

**[0004]** US2022316265 shows such a roof window with an electric drive arrangement and a rain sensor. The use of electrically operated drive arrangements allows not only automatic closing of open windows due to changing weather conditions, but also facilitates automated indoor temperature regulation.

**[0005]** US7114389 shows a roof window where two rain sensors are integrated into an electric drive unit in the form of a chain actuator.

**[0006]** WO 2008/103061, EP2947239, and EP0792991 show electric chain actuators that can be disconnected from the window sash such that the sash can be opened and closed manually, i.e. without actuator use. This may be useful for example when there is a power outage. Such disconnectable actuators have to be manually reconnected to the window sash in order for the automatic operation to function.

### SUMMARY

**[0007]** It is an object to provide an improved actuator system for movable building elements. The foregoing and other objects are achieved by the features of the independent claims. Further implementation forms are apparent from the dependent claims, the description, and the figures.

**[0008]** According to a first aspect, there is provided a

building element actuator system, in particular a roof window actuator system, the actuator system being configured to allow a building element to be moved between a closed position and at least one open position, the actuator system comprising an electric motor, a push-pull chain configured to be fixedly connected to the electric motor and releasably connected to the movable building element, an environmental unit configured to process environmental data, a control unit configured to, based on the environmental data, determine if the environmental data fulfills a predefined environmental condition, and generate an environmental condition alert if the environmental data fulfills the predefined environmental condition, and a user interface configured to receive the environmental condition alert and issue a notification to a user in response to the environmental condition alert.

**[0009]** This solution ensures a user is alerted that a building element, such as a window, is open in case of rain or any other environmental condition that might affect the integrity of the building. The building element may be automatically closable, however, in case the push-pull chain has been disconnected from the building element it may no longer be possible to close it automatically. By alerting a user, the user can ensure the building element is closed. The inventor has found that people often forget that they have disconnected the push-pull chain (for example by manually opening the window beyond the motor reach) but still rely on the window closing automatically when it rains. Automatic windows, in particular roof windows, have existed for more than 20 years but still, no one has realized and addressed this risk of user-induced rain damage.

**[0010]** In a possible implementation form of the first aspect, the user interface is configured to provide a user with current, and optionally stored, data relating to the building element, facilitating a versatile and highly useful user interface.

**[0011]** In a possible implementation form of the first aspect, the actuator system further comprises an arrangement for determining a push-pull chain status, the push-pull chain status being a chain connection status and/or a chain extension status, and/or a position sensor configured to detect a building element position, the building element position being one of the closed position and the open positions, the control unit furthermore being configured to receive the chain status and/or the building element position, determine if the building element position is one of the open positions, and determine if the chain connection status indicates the push-pull chain is disconnected from the building element and/or if the chain extension status indicates the push-pull chain is in a fully retracted position, the control unit furthermore being configured to generate the environmental condition alert if the environmental data fulfills the predefined environmental condition, if the building element position is one of the open positions, and if the chain connection status indicates the push-pull chain is dis-

connected from the building element and/or if the chain extension status indicates the push-pull chain is in the fully retracted position. This allows for maximum flexibility when setting up the system, using and adapting to existing components as far as possible.

**[0012]** In a further possible implementation form of the first aspect, the building element is a roof window and the predefined environmental condition is precipitation.

**[0013]** In further a possible implementation form of the first aspect, said user interface is an application for an electronic device. This allows a simple and user-friendly user interface that is available to the user at all times and independently of the user's location.

**[0014]** In a further possible implementation form of the first aspect, the arrangement for determining a chain status comprises a revolution counter operably connected to the motor, the revolution counter indicating if the chain is in the fully retracted position or in an extended position.

**[0015]** In a further possible implementation form of the first aspect, the fully retracted position corresponds to a motor revolution of 0% and a fully extended position corresponds to a motor revolution of 100%.

**[0016]** In a further possible implementation form of the first aspect, the arrangement for determining a chain status comprises a contact sensor configured to detect if the chain is connected to the building element or disconnected from the building element.

**[0017]** In a further possible implementation form of the first aspect, the environmental unit processes environmental data by detecting environmental data, predicting environmental data, and/or receiving environmental data from an external environmental data unit. This allows all kinds of historic, current, and future data to be taken into account.

**[0018]** In a further possible implementation form of the first aspect, environmental data, and optionally environmental data thresholds, is stored in at least one of the environmental unit, the control unit, and a memory unit.

**[0019]** In a further possible implementation form of the first aspect, the control unit is configured to transmit the environmental condition alert, and optionally the environmental data, to the user interface.

**[0020]** In a further possible implementation form of the first aspect, the environmental data fulfills a predefined environmental condition if the environmental data exceeds an environmental data threshold.

**[0021]** In a further possible implementation form of the first aspect, the control unit determines if the environmental data exceeds the environmental data threshold by comparing the environmental data to stored environmental data or stored environmental data thresholds, and/or applying an algorithm on the environmental data and, optionally, stored environmental data or stored environmental data thresholds.

**[0022]** In a further possible implementation form of the first aspect, the control unit is configured to drive the motor, the motor generating automatic movement of

the building element between the closed position and the open positions by means of the push-pull chain when the push-pull chain is connected to the building element, and automatic movement is generated, from one of the open positions to the closed position, if the control unit determines that the environmental data fulfills the predefined environmental condition, if the building element position is one of the open positions, and if the chain extension status indicates the push-pull chain is in an extended position. This allows the building element to be opened and closed automatically as well as manually.

**[0023]** In a further possible implementation form of the first aspect, the actuator system is configured to allow the building element to be moved manually between the closed position and the open positions when the push-pull chain is disconnected from the building element. This allows building elements to be opened and closed also when there is a power outage or automatic actuation for some other reason doesn't work.

**[0024]** In a further possible implementation form of the first aspect, the building element actuator system further comprises a lock sensor configured to detect if the building element has been locked to a further building element when in the closed position.

**[0025]** According to a second aspect, there is provided a building roof window system comprising a building element in the form of a roof window sash that is movable, relative a roof window frame, between at least one open position and a closed position, and a building element actuator system according to the above.

**[0026]** According to a third aspect, there is provided a method of notifying a user of a non-weathertight building configuration under a predefined environmental condition, wherein a building element actuator system comprising an electric motor and a push-pull chain is configured to automatically move a building element between a closed position and at least one open position, and to allow manual movement between the closed position and the open position(s), the push-pull chain being releasably connected to the movable building element. The method comprises detecting a non-weathertight building configuration, processing environmental data, determining if the environmental data fulfills the predefined environmental condition, and if the environmental data fulfills the predefined environmental condition, generating an environmental condition alert, and issuing a notification to a user based on the environmental condition alert.

**[0027]** This method ensures a user is alerted that a building element, such as a window, is open in case of rain or any other environmental condition that might affect the integrity of the building. The building element may be automatically closable, however, in case the push-pull chain has been disconnected from the building element it may no longer be possible to close it automatically. By alerting a user, the user can ensure the building element is closed.

**[0028]** In a possible implementation form of the third aspect, the non-weathertight building configuration is

detected by determining a building element position, the building element position being the closed position or one of the open positions, and determining a push-pull chain status, the push-pull chain status being a chain connection status and/or a chain extension status, and the environmental condition alert is generated if the building element position is one of the open positions, if the chain connection status indicates the push-pull chain is disconnected from the building element and/or if the chain extension status indicates the push-pull chain is in a fully retracted position, and if the environmental data fulfills the predefined environmental condition.

**[0029]** These and other aspects will be apparent from the example(s) and embodiment(s) described below.

#### BRIEF DESCRIPTION OF THE DRAWINGS

**[0030]** In the following detailed portion of the present disclosure, the aspects, embodiments, and implementations will be explained in more detail with reference to the example embodiments shown in the drawings, in which:

Fig. 1 shows a perspective view of a building roof window arrangement in accordance with an example of the embodiments of the disclosure, wherein the roof window is viewed from what would be the exterior of the building;

Fig. 2 shows the example of Fig. 1 from what would be the interior of the building;

Fig. 3 shows a partial side view of a building element actuator system in accordance with an example of the embodiments of the disclosure, along with a part of the building element, wherein the push-pull chain of the building element actuator system is disconnected from the building element;

Fig. 4 shows the example of Fig. 3 with the push-pull chain of the building element actuator system connected to the building element;

Fig. 5 shows a partial cross-sectional view of a building element actuator system in accordance with an example of the embodiments of the disclosure, along with a part of the building element, wherein the chain is connected to the building element and the building element is in a closed position;

Fig. 6 shows the example of Fig. 5, with the chain connected to the building element and the building element in an open position;

Fig. 7 shows the embodiment of Figs. 5 and 6, with the chain disconnected from the building element and the building element in the closed position;

Fig. 8 shows the embodiment of Figs. 5 to 7, with the

chain disconnected from the building element and the building element in an open position;

Fig. 9 shows a flowchart of a method notifying a user of a non-weathertight building configuration under a predefined environmental condition;

Fig. 10 is a flowchart outlining different variables of the status of the push-pull chain of the building element actuator system connected to the building element.

#### DETAILED DESCRIPTION

**[0031]** Figs. 1 and 2 illustrate a building roof window system 10 comprising a building element 2 in the form of a pivotable window sash 2, i.e. the building element 2 is a part of a window, the window also comprising a window frame 11. The building roof window system 10 also comprises a building element actuator system 1 which is described in more detail below. The building element actuator system 1 is configured to be substantially attached to, or arranged within, a member of the window frame 11 or a member of the window sash 2. However, the building element actuator system 1 may be configured to move any suitable building element, such as a door or the sash of a vertical window, that is arranged in an opening in a building between an open position P2, such as the position shown in Figs. 1 and 2, and a closed position, illustrated in Figs. 5 and 7, by means of the building element actuator system 1.

**[0032]** The present invention relates to a building roof window system 10 comprising a building element in the form of a roof window sash 2 that is movable, relative a roof window frame 11, between at least one open position P2 and a closed position P1 and a building element actuator system 1 described in more detail below. The building element 2, or roof window sash, is in a closed position when the sash is able to interlock with the window frame 11. The building element 2 may be in one open position, such as an open end position, or several open positions, such as intermediate open positions between the closed position and the open end position.

**[0033]** The present invention also relates to a building element actuator system 1, in particular a roof window actuator system 1, configured to allow the building element 2 to be moved between the closed position P1 and at least one open position P2.

**[0034]** The actuator system 1 comprises an electric motor 3 and a push-pull chain 4 configured to be fixedly connected to the electric motor 3 and releasably connected to the movable building element 2. The releasable connection is illustrated in Figs. 7 and 8. By push-pull chain is meant a chain that is stable enough to push the building element 2 into an open position P2 and pull the building element 2 into the closed position P1, as shown in Fig. 6, but at the same time flexible enough to be bent or rolled together e.g. within in a spiral-shaped track within

an actuator housing when the building element 2 is in the closed position P1. The spiral-shaped track and an actuator housing, accommodating a bent and spiraled push-pull chain 4, is shown in Figs. 3 and 4.

**[0035]** The building element 2 may be locked to a further building element 11, such as a window frame, by means of a separate window lock, or the building element 2 may be self-locking such that a separate window lock is not needed.

**[0036]** For embodiments that comprise a window lock, the building element actuator system 1 may comprise a lock sensor 12 configured to detect if the building element 2 has been locked to the further building element 11 when in the closed position P1. The lock sensor may be a hall sensor arranged at the window lock 13 to establish if the window lock is open or locked.

**[0037]** The movement between the closed position P1 and at least one open position P2 may be executed automatically as well as manually for the very same building element 2 and building element actuator system 1, i.e. the actuator system 1 may be configured to allow the building element 2 to be moved manually between the closed position P1 and the open positions P2. This is possible when the push-pull chain 4 is disconnected S11 from the building element 2 and, optionally, the lock has been unlocked.

**[0038]** The actuator system 1 furthermore comprises an environmental unit 5 configured to process environmental data D1. The environmental unit 5 may process environmental data D1 by detecting environmental data, such as by means of a rain sensor arranged at or adjacent to the building element, as illustrated in Fig. 5. Such a rain sensor may be capacitive i.e. sense drop electric conduction; acoustic i.e. detect drop impact; optical i.e. sense light reflected by drops). The environmental data D1 may also be data gathered from the internet.

**[0039]** The environmental unit 5 may process environmental data D1 by predicting environmental data, e.g. by using artificial intelligence to evaluate the likelihood of rain. Furthermore, the environmental unit 5 may process environmental data D1 by receiving environmental data from an external environmental data unit, e.g. by receiving and processing the weather forecast from an external weather forecast provider.

**[0040]** A control unit 6 is configured to, based on the environmental data D1, determine if the environmental data D1 fulfills a predefined environmental condition C. The predefined environmental condition C may be the occurrence, and/or amount of, precipitation such as rain, hail, or snow. The predefined environmental condition C may also be wind strength or direction and/or UV-radiation level.

**[0041]** Environmental data D2, such as historical data and or forecasted data, may be stored within one of the components of the actuator system 1 such as the environmental unit 5, the control unit 6, or a separate memory unit 10. Correspondingly, environmental data thresholds T, such as maximum limits for different types of precipita-

tion, may also be stored in the same way.

**[0042]** If the environmental data D1 fulfills the predefined environmental condition C, the control unit 6 is configured to generate an environmental condition alert A.

**[0043]** The environmental data D1 may be considered to fulfill the predefined environmental condition C if the environmental data D1 exceeds environmental data threshold T.

**[0044]** The control unit 6 determines if the environmental data D1 exceeds the environmental data threshold T by comparing the environmental data D1 to stored environmental data D2 or stored environmental data thresholds T. The control unit 6 may also determine if the environmental data D1 exceeds the environmental data threshold T by applying an algorithm on the environmental data D1 and, optionally, stored environmental data D2 or stored environmental data thresholds T.

**[0045]** The control unit 6 may be configured to transmit the environmental condition alert A, and optionally the environmental data D1, to a user interface 7.

**[0046]** The user interface 7 is configured to receive the environmental condition alert A, generated by the control unit 6, and to issue a notification N to a user in response to the environmental condition alert A. The user interface may be an app downloaded onto a tablet or smartphone, as illustrated in Fig. 1. The user interface may also be part of a building management system or a building safety system.

**[0047]** In addition to the notification N, the user interface 7 may be configured to provide a user with current, and optionally stored, data relating to the building element 2 such as temperature, humidity, indications on which building elements are open, ventilation status, and lightning status.

**[0048]** The building element actuator system 1 may further comprise an arrangement 8 for determining a push-pull chain status S, the push-pull chain status S being a chain connection status S1 and/or a chain extension status S2. The building element actuator system 1 may also, or instead, comprise a position sensor 9 configured to detect a building element position, the building element position being one of the closed position P1 and the open positions OP.

**[0049]** For such embodiments, the control unit 6 is configured to receive the chain status and/or the building element position. The control unit 6 may determine if the building element position is one of the open positions P2, i.e. if the window is open. The control unit 6 may also determine if the chain connection status S1 indicates the push-pull chain 4 is disconnected S11 from the building element 2. Additionally, or instead, the control unit 6 may determine if the chain extension status S2 indicates the push-pull chain 4 is in a fully retracted position S21. The fully retracted position S21 indicates the building element 2 is either in a closed position P1 or the push-pull chain 4 has been disconnected S11 from the building element 2. Usually, the push-pull chain 4 has been retracted when

disconnecting it from the building element 2, i.e. the building element 2 is usually in the closed position P1 when doing so.

**[0050]** These positions and statuses may be used to evaluate if the building element is open and if it needs to be closed manually in case of a change in weather conditions.

**[0051]** The control unit 6 may, in other words, be configured to generate the environmental condition alert A if the environmental data D1 fulfills the predefined environmental condition C, if the building element position is one of the open positions P2, and if the chain connection status S1 indicates the push-pull chain 4 is disconnected S11 from the building element 2 and/or if the chain extension status S2 indicates the push-pull chain 4 is in the fully retracted position S21.

**[0052]** The arrangement 8 for determining the chain status may comprise a revolution counter 8a operably connected to the motor 3, as suggested in Fig. 3. The revolution counter indicates if the chain 4 is in the fully retracted position S21 or in an extended position S22. The fully retracted position S21 may correspond to a motor revolution of 0% and a fully extended position S22 corresponds to a motor revolution of 100%.

**[0053]** The arrangement 8 for determining a chain status may instead comprise a contact sensor 8b, also indicated in Fig. 3. The contact sensor 8b is configured to detect if the chain 4 is connected S12 to the building element 2 or disconnected S11 from the building element 2.

**[0054]** The control unit 6 may be configured to drive the motor 3, the motor 3 generating automatic movement of the building element 2 between the closed position P1 and the open positions P2 by means of the push-pull chain 4 when the push-pull chain 4 is connected S12 to the building element 2.

**[0055]** Automatic movement may be generated, from one of the open positions P2 to the closed position P1, if the control unit 6 determines that the environmental data D1 fulfills the predefined environmental condition C, if the building element position is one of the open positions P2, and if the chain extension status S2 indicates the push-pull chain 4 is in an extended position S22.

**[0056]** The different variables of the push-pull chain status S is outlined in Fig. 10. The push-pull chain status S may be a chain connection status S11 indicating the push-pull chain 4 is disconnected from the building element 2 and S12 indicating the pull chain 4 is connected to the building element 2. The push-pull chain status S may also be a chain extension status S2 indicating the push-pull chain 4 being in the fully retracted position S21 and indicating the push-pull chain 4 being in the extended position S22.

**[0057]** The present invention also relates to a method of notifying a user of a non-weathertight building configuration, such as an open window, under a predefined environmental condition C, such as rain.

**[0058]** As described above, a building element actua-

tor system 1 comprising an electric motor 3 and a push-pull chain 4 is configured to automatically move a building element 2 between a closed position P1 and at least one open position P2, and to allow manual movement between the closed position P1 and the open positions P2. The push-pull chain 4 is releasably connected to the movable building element 2.

**[0059]** The method comprises detecting a non-weathertight building configuration, for example detecting a window being open. The non-weathertight building configuration may be detected by determining the building element position, the building element position being the closed position P1 or one of the open positions P2. By determining the push-pull chain status S, the push-pull chain status S being the chain connection status S1 and/or the chain extension status S2, it is determined whether the building element 2 has to be operated manually or can be operated automatically.

**[0060]** The method also comprises processing environmental data D1 and determining if the environmental data D1 fulfills the predefined environmental condition C. Processing of environmental data may be executed, e.g., only after a non-weathertight building configuration has been detected. This may be the case when using a rain sensor which is powered only when the building element is open (in order to save power).

**[0061]** If the environmental data D1 fulfills the predefined environmental condition C, the method comprises generating an environmental condition alert A and issuing a notification N to a user based on the environmental condition alert A.

**[0062]** The method is illustrated schematically in Fig. 9 by showing the main data points to be considered.

**[0063]** The environmental condition alert A may be generated if the building element position is one of the open positions P2, if the chain connection status S1 indicates the push-pull chain 4 is disconnected S11 from the building element 2 and/or if the chain extension status S2 indicates the push-pull chain 4 is in a fully retracted position S21, and if the environmental data D1 fulfills the predefined environmental condition C.

**[0064]** The various aspects and implementations have been described in conjunction with various embodiments herein. However, other variations to the disclosed embodiments can be understood and effected by those skilled in the art in practicing the claimed subject-matter, from a study of the drawings, the disclosure, and the appended claims. In the claims, the word "comprising" does not exclude other elements or steps, and the indefinite article "a" or "an" does not exclude a plurality. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage.

**[0065]** The reference signs used in the claims shall not be construed as limiting the scope. Unless otherwise indicated, the drawings are intended to be read (e.g., cross-hatching, arrangement of parts, proportion, degree, etc.) together with the specification, and are to

be considered a portion of the entire written description of this disclosure. As used in the description, the terms "horizontal", "vertical", "left", "right", "up" and "down", as well as adjectival and adverbial derivatives thereof (e.g., "horizontally", "rightwardly", "upwardly", etc.), simply refer to the orientation of the illustrated structure as the particular drawing figure faces the reader. Similarly, the terms "inwardly" and "outwardly" generally refer to the orientation of a surface relative to its axis of elongation, or axis of rotation, as appropriate.

## Claims

1. A building element actuator system (1), in particular a roof window actuator system (1), said actuator system (1) being configured to allow a building element (2) to be moved between a closed position (P1) and at least one open position (P2), said actuator system (1) comprising:
  - an electric motor (3);
  - a push-pull chain (4) configured to be fixedly connected to said electric motor (3) and releasably connected to said movable building element (2);
  - an environmental unit (5) configured to process environmental data (D1);
  - a control unit (6) configured to, based on said environmental data (D1),
    - determine if said environmental data (D1) fulfills a predefined environmental condition (C), and
    - generate an environmental condition alert (A) if said environmental data (D1) fulfills said predefined environmental condition (C); and
  - a user interface (7) configured to receive said environmental condition alert (A) and issue a notification (N) to a user in response to said environmental condition alert (A).
2. The building element actuator system (1) according to claim 1, wherein said actuator system (1) further comprises:
  - an arrangement (8) for determining a push-pull chain status (S), said push-pull chain status (S) being a chain connection status (S1) and/or a chain extension status (S2); and/or
  - a position sensor (9) configured to detect a building element position, said building element position being one of said closed position (P1) and said open positions (P2); said control unit (6) furthermore being configured to
    - receive said chain status and/or said building element position,
    - determine if said building element position is one of said open positions (P2), and
    - determine if said chain connection status (S1) indicates said push-pull chain (4) is disconnected (S11) from said building element (2) and/or if said chain extension status (S2) indicates said push-pull chain (4) is in a fully retracted position (S21); said control unit (6) furthermore being configured to generate said environmental condition alert (A)
    - if said environmental data (D1) fulfills said predefined environmental condition (C),
    - if said building element position is one of said open positions (P2), and
    - if said chain connection status (S1) indicates said push-pull chain (4) is disconnected (S11) from said building element (2) and/or if said chain extension status (S2) indicates said push-pull chain (4) is in said fully retracted position (S21).
3. The building element actuator system (1) according to claim 1 or 2, wherein said building element is a roof window and said predefined environmental condition (C) is precipitation.
4. The building element actuator system (1) according to any one of the previous claims, wherein said arrangement (8) for determining a chain status comprises a revolution counter (8a) operably connected to said motor (3), said revolution counter indicating if said chain (4) is in said fully retracted position (S21) or in an extended position (S22).
5. The building element actuator system (1) according to any one of the previous claims, wherein said arrangement (8) for determining a chain status comprises a contact sensor (8b) configured to detect if said chain (4) is connected (S12) to said building element (2) or disconnected (S11) from said building element (2).
6. The building element actuator system (1) according to any one of the previous claims, wherein said environmental unit (5) processes environmental data (D1) by
  - detecting environmental data;
  - predicting environmental data; and/or
  - receiving environmental data from an external environmental data unit.
7. The building element actuator system (1) according to any one of the previous claims, wherein environmental data (D2), and optionally environmental data

thresholds (T), is stored in at least one of said environmental unit (5), said control unit (6), and a memory unit (10).

8. The building element actuator system (1) according to any one of the previous claims, wherein said control unit (6) is configured to transmit said environmental condition alert (A), and optionally said environmental data (D1), to said user interface (7). 5
9. The building element actuator system (1) according to any one of the previous claims, wherein said environmental data (D1) fulfills said predefined environmental condition (C) if said environmental data (D1) exceeds an environmental data threshold (T). 15
10. The building element actuator system (1) according to claim 9, wherein said control unit (6) determines if said environmental data (D1) exceeds said environmental data threshold (T) by 20
  - comparing said environmental data (D1) to stored environmental data (D2) or stored environmental data thresholds (T); and/or
  - applying an algorithm on said environmental data (D1) and, optionally, stored environmental data (D2) or stored environmental data thresholds (T). 25
11. The building element actuator system (1) according to any one of the previous claims, wherein said control unit (6) is configured to drive said motor (3), said motor (3) generating automatic movement of said building element (2) between said closed position (P1) and said open positions (P2) by means of said push-pull chain (4) when said push-pull chain (4) is connected (S12) to said building element (2), and 30
  - wherein automatic movement is generated, from one of said open positions (P2) to said closed position (P1), 35
  - if said control unit (6) determines that said environmental data (D1) fulfills said predefined environmental condition (C); 45
  - if said building element position is one of said open positions (P2); and
  - if said chain extension status (S2) indicates said push-pull chain (4) is in an extended position (S22). 50
12. The building element actuator system (1) according to any one of the previous claims, wherein said actuator system (1) is configured to allow said building element (2) to be moved manually between said closed position (P1) and said open positions (P2) when said push-pull chain (4) is disconnected (S11) from said building element (2). 55

13. A building roof window arrangement (10) comprising

- a building element in the form of a roof window sash (2) that is movable, relative a roof window frame (11), between at least one open position (P2) and a closed position (P1); and
- a building element actuator system (1) according to any one of claims 1 to 12.

14. A method of notifying a user of a non-weathertight building configuration under a predefined environmental condition (C), 10

wherein a building element actuator system (1) comprising an electric motor (3) and a push-pull chain (4) is configured to automatically move a building element (2) between a closed position (P1) and at least one open position (P2), and to allow manual movement between said closed position (P1) and said open position(s) (P2), said push-pull chain (4) being releasably connected to said movable building element (2), said method comprising:

- detecting a non-weathertight building configuration;
- processing environmental data (D1);
- determining if said environmental data (D1) fulfills said predefined environmental condition (C), and
- if said environmental data (D1) fulfills said predefined environmental condition (C),

--generating an environmental condition alert (A); and  
 --issuing a notification (N) to a user based on said environmental condition alert (A).

15. The method according to claim 14, wherein said non-weathertight building configuration is detected by: 40

- determining a building element position, said building element position being said closed position (P1) or one of said open positions (P2), and
- determining a push-pull chain status (S), said push-pull chain status (S) being a chain connection status (S1) and/or a chain extension status (S2); 50

and wherein said environmental condition alert (A) is generated

- if said building element position is one of said open positions (P2),
- if said chain connection status (S1) indicates

said push-pull chain (4) is disconnected (S11)  
from said building element (2) and/or if said chain  
extension status (S2) indicates said push-pull  
chain (4) is in a fully retracted position (S21), and  
- if said environmental data (D1) fulfills said 5  
predefined environmental condition (C).

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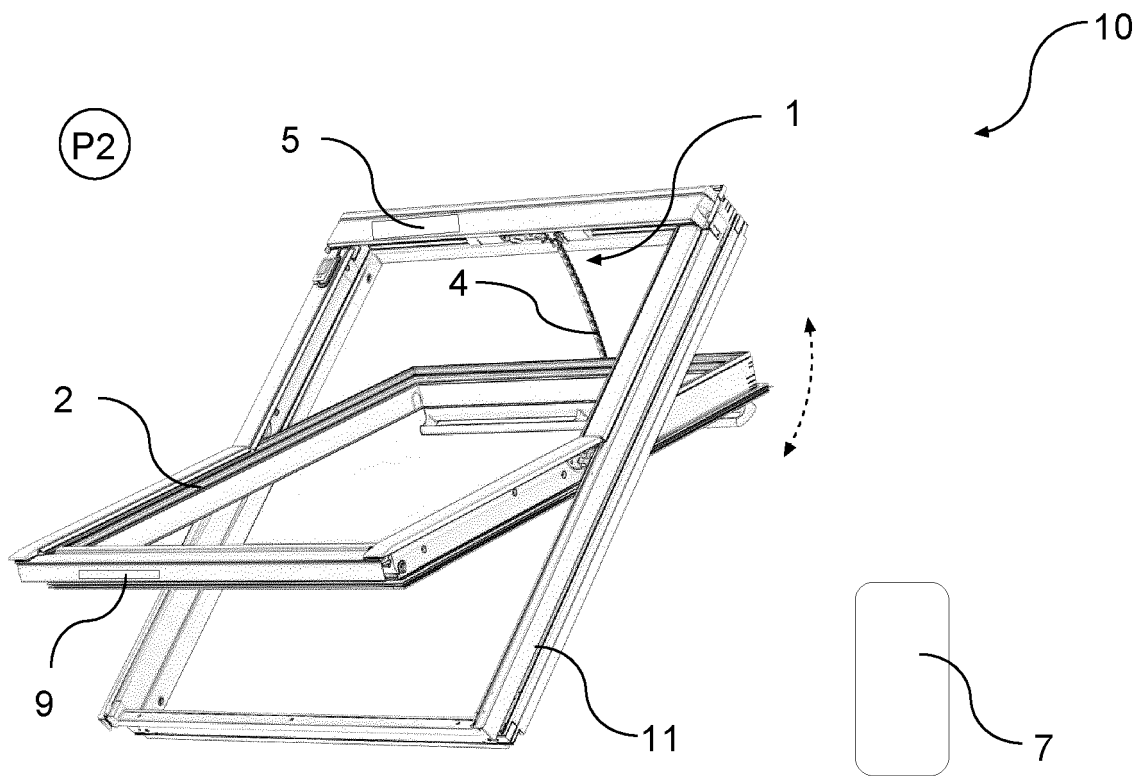


Fig. 1

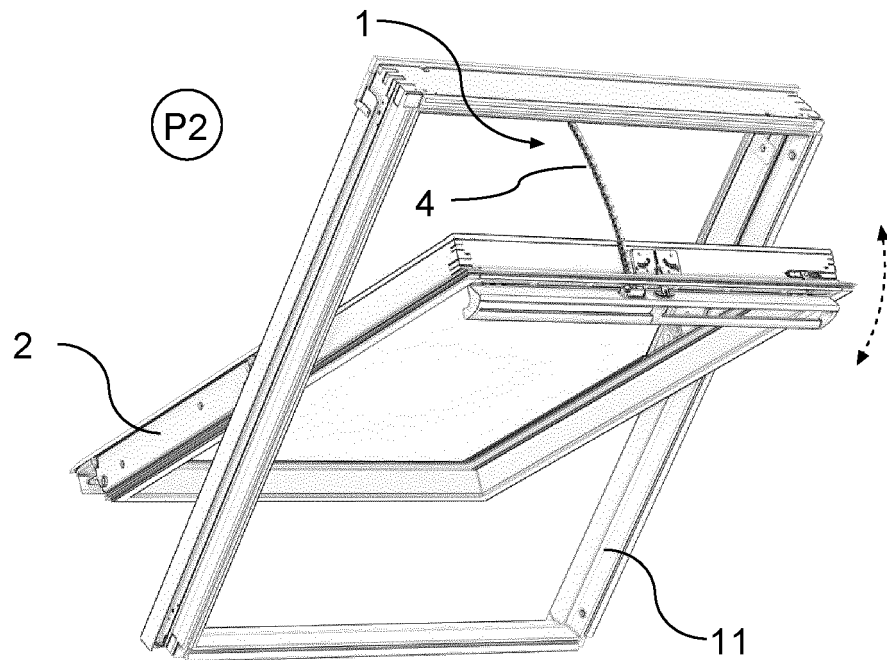
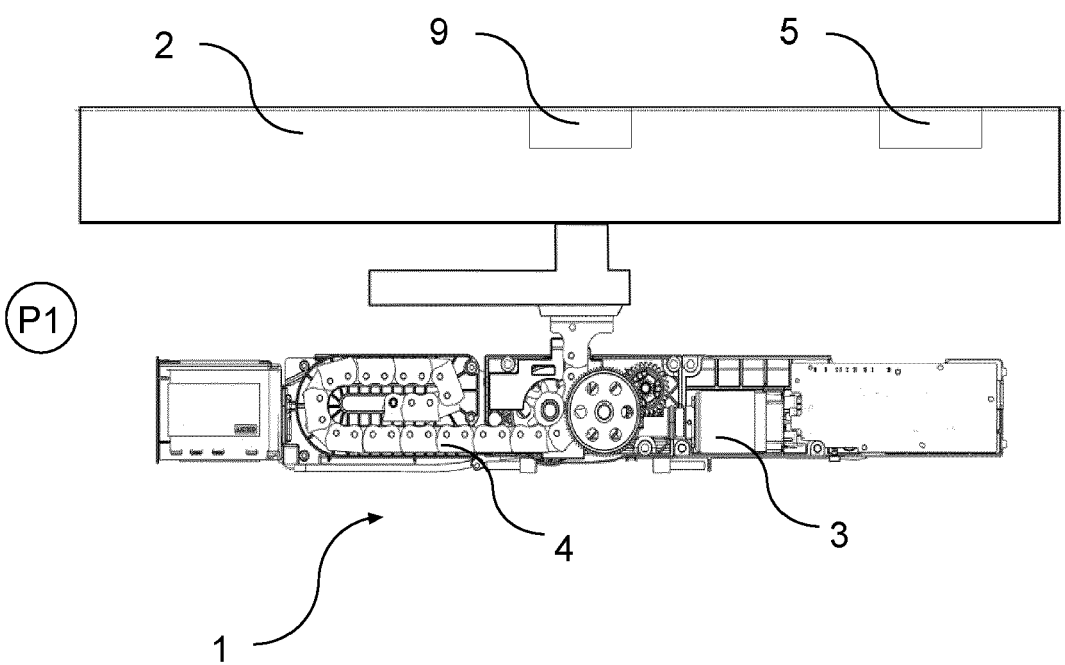
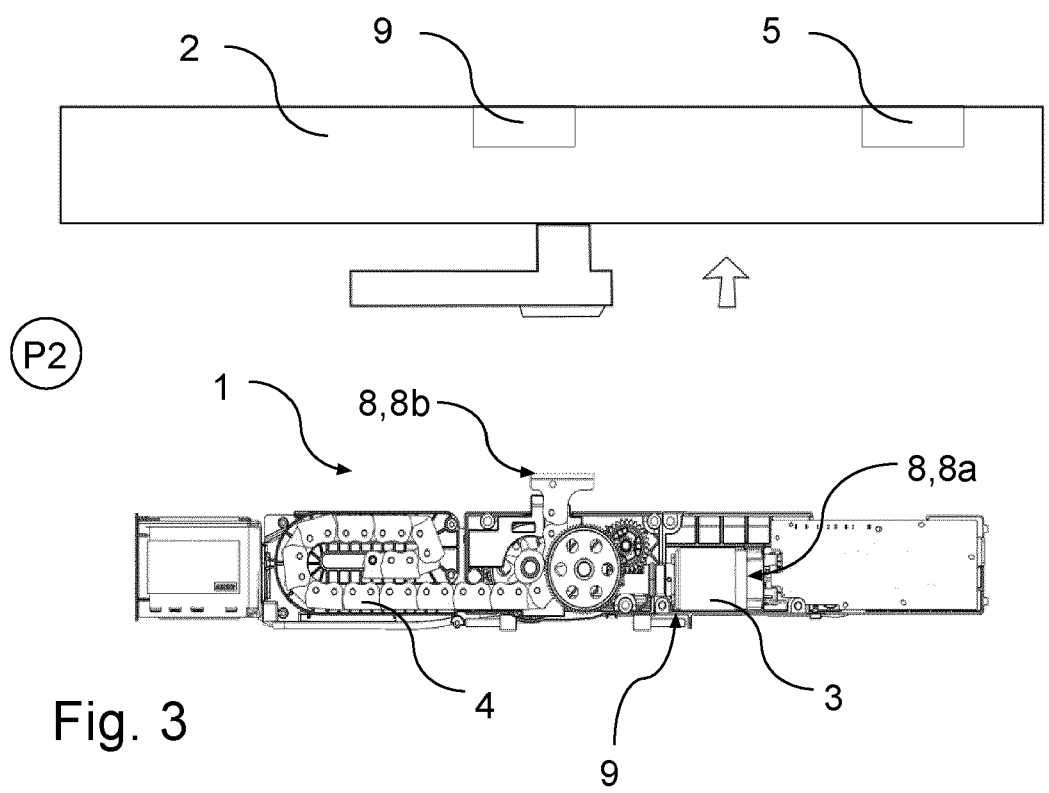
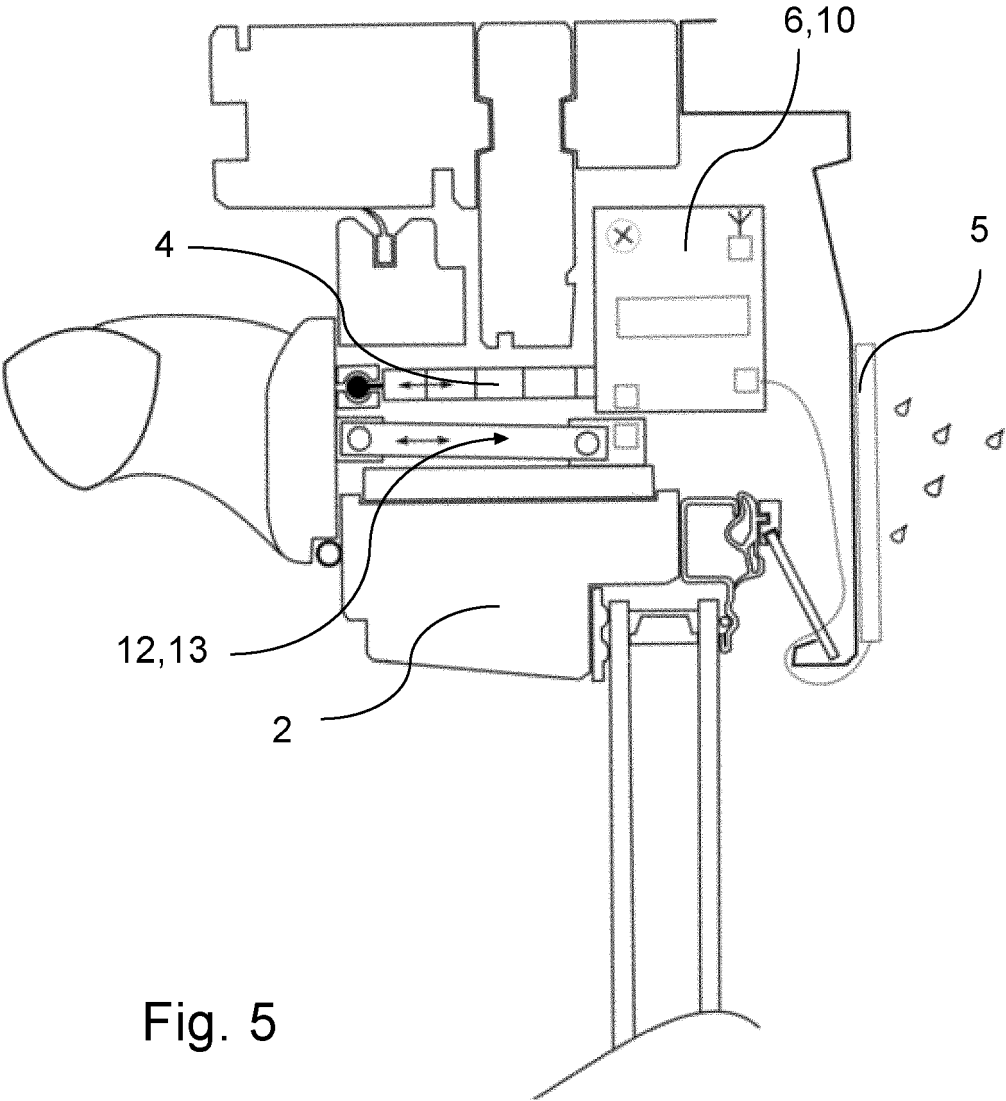


Fig. 2



P1



P2

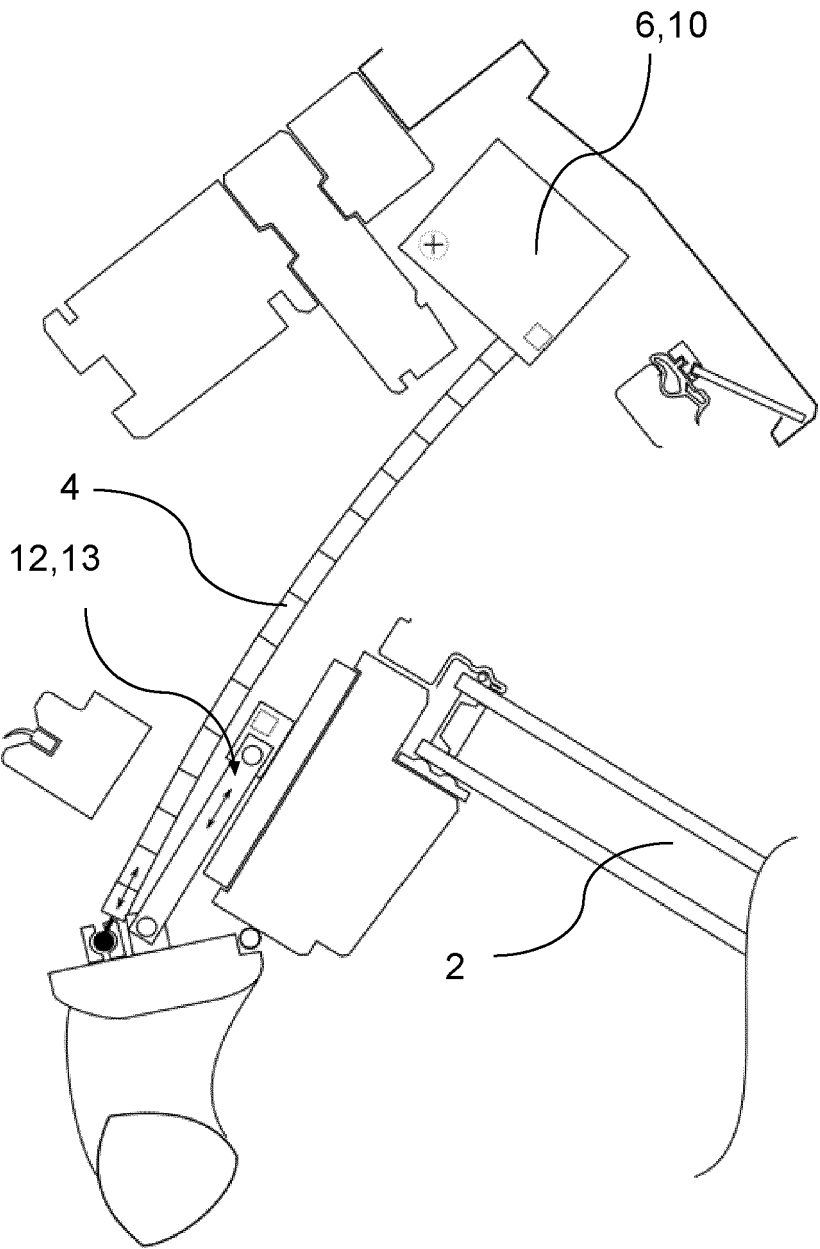


Fig. 6

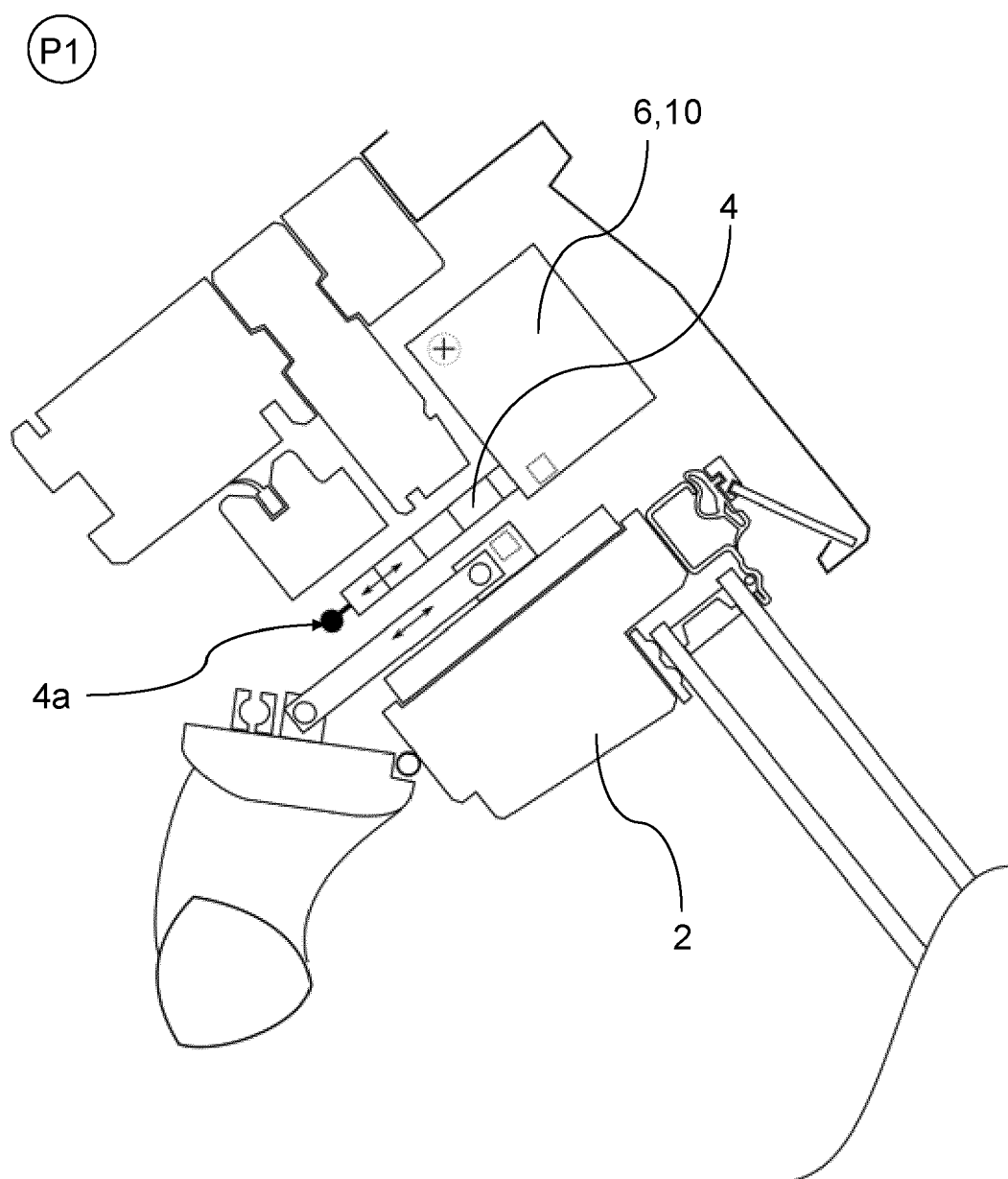


Fig. 7

P2

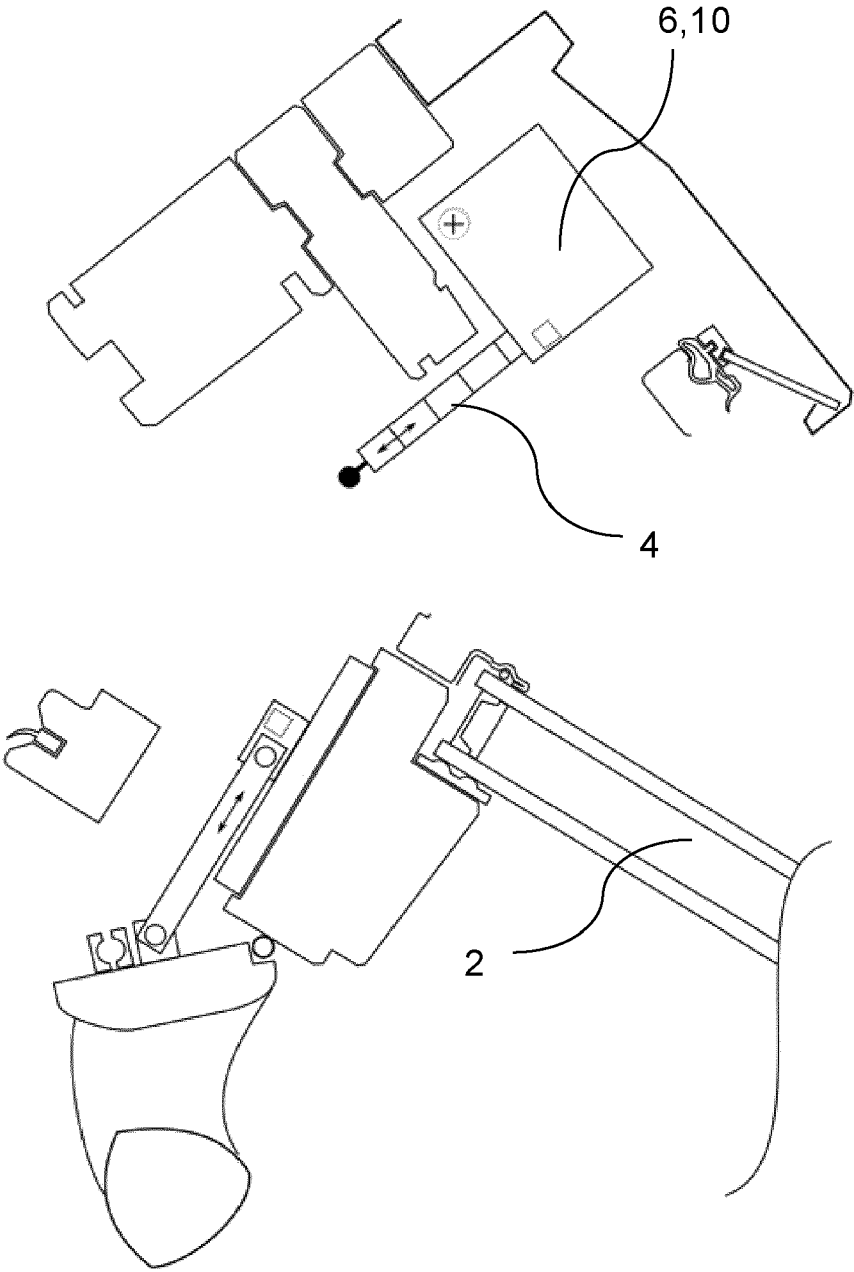


Fig.8

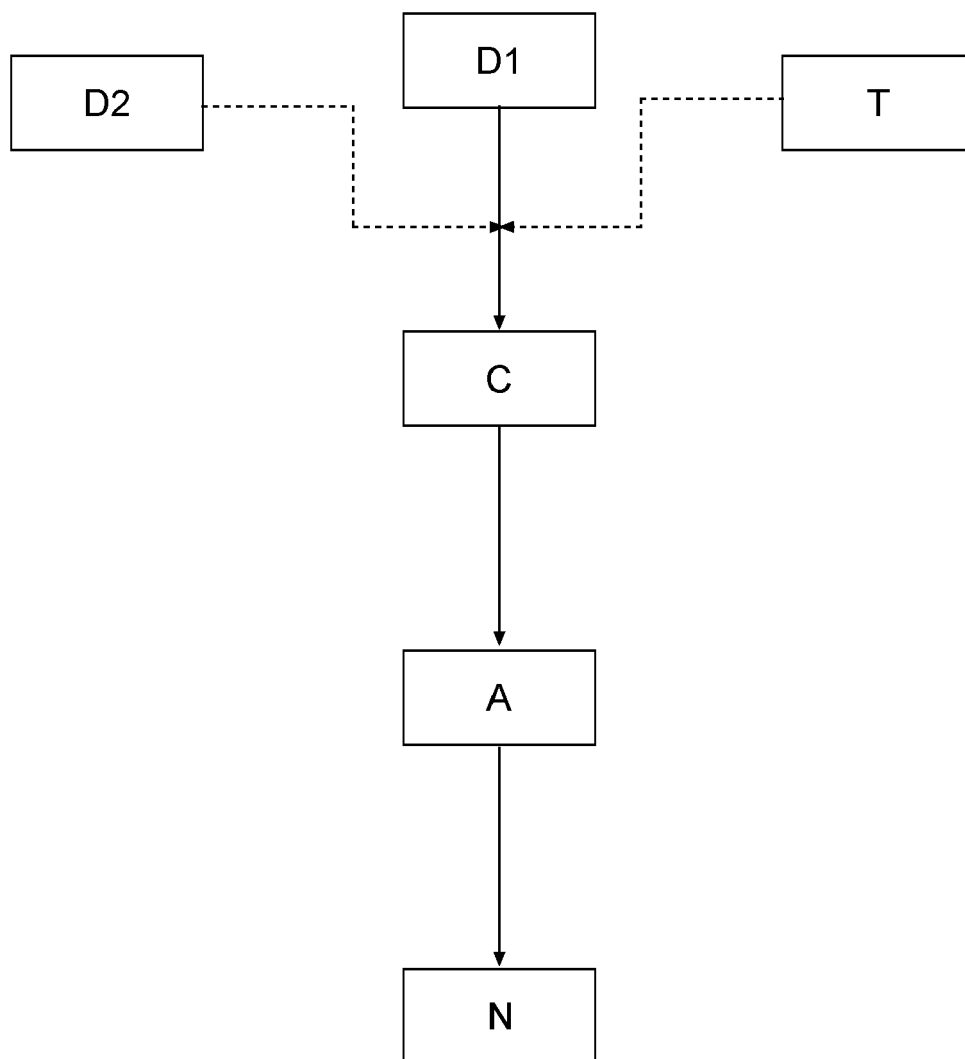


Fig. 9

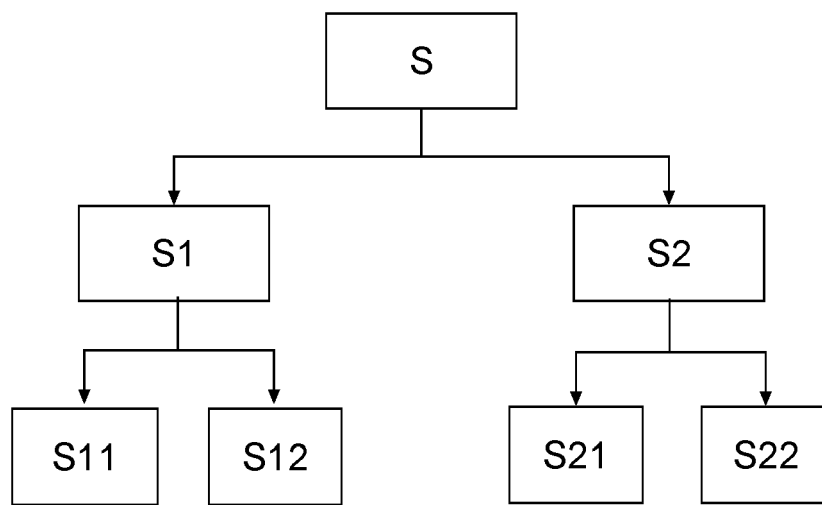


Fig. 10



## EUROPEAN SEARCH REPORT

Application Number

EP 23 19 0633

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| A                                                                                                                                                                                                                                                                            | * paragraph [0008] *<br>* paragraph [0010] *<br>* paragraph [0014] - paragraph [0015] *<br>* figures 1-2 *                                      | 2, 4, 5, 11, 15                  |                                         |
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| The present search report has been drawn up for all claims                                                                                                                                                                                                                   |                                                                                                                                                 |                                  |                                         |
| Place of search                                                                                                                                                                                                                                                              |                                                                                                                                                 | Date of completion of the search | Examiner                                |
| The Hague                                                                                                                                                                                                                                                                    |                                                                                                                                                 | 17 January 2024                  | Prieto, Daniel                          |
| CATEGORY OF CITED DOCUMENTS                                                                                                                                                                                                                                                  |                                                                                                                                                 |                                  |                                         |
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| T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>& : member of the same patent family, corresponding document |                                                                                                                                                 |                                  |                                         |

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ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.

EP 23 19 0633

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17-01-2024

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