



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
01.09.2021 Bulletin 2021/35

(51) Int Cl.:
E04D 13/035 (2006.01) E05C 17/16 (2006.01)

(21) Application number: **21159593.9**

(22) Date of filing: **26.02.2021**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

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(30) Priority: **28.02.2020 DK PA202070130**

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(54) **A ROOF WINDOW WITH AN OPENING RESTRICTOR FOR LIMITING THE OPENING OF A ROOF WINDOW**

(57) The roof window (1) is configured to be installed in an inclined roof and comprises a frame (2) and a sash (3), each having a top member (8, 9) and a bottom member (4, 5) extending in a longitudinal direction, and two side members (6, 7) extending in a height direction substantially perpendicular to the longitudinal direction, the sash (3) being rotatably connected to the frame (2), such that a rotating opening movement of the sash (3) in relation to the frame (2) about a pre-defined hinge axis brings the sash (3) from a closed position to an open position, said rotating opening movement forming an opening angle (b) between the frame (2) and the sash (3) in the open position. At least one opening restrictor (10) comprising an arm (11) rotatably connected to a frame or sash member and having a gripping mechanism (12) configured to engage with a gripping element (23) connected to an opposing sash or frame member so as to limit the opening of the sash (3), the arm (11) with the gripping mechanism (12) being configured to assume at least a disengaged condition and an engaged condition in which the gripping mechanism (12) is in engagement with the gripping element (23) and in which the opening of the sash (3) is limited to a maximum limited angle (b2). The arm (11) of each opening restrictor (10) is connected to a bottom member (5, 4) of the sash (3) or the frame (2), and that gripping element (23) is connected to the opposing bottom member (4, 5) of the frame (2) or the sash (3), such that said arm (11) is hidden in a space (130) provided between the frame (2) and the sash (3), leaving said opening restrictor (10) invisible in the closed

position of said sash (3) and in the open position of said sash (3) within a pre-defined opening angle (b1).

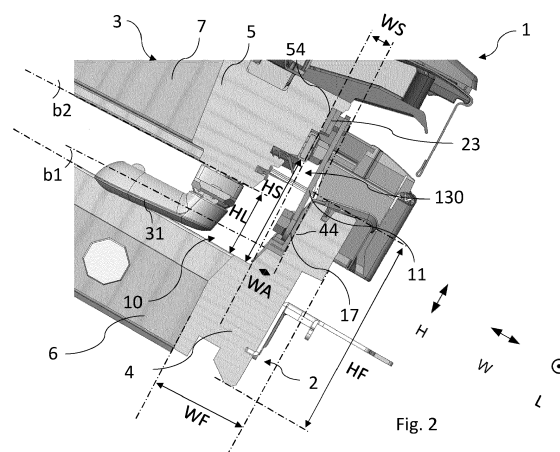


Fig. 2

Description

Technical Field

[0001] The present invention relates to a roof window configured to be installed in an inclined roof, said roof window comprising a frame and a sash, each having a top member and a bottom member extending in a longitudinal direction, and two side members extending in a height direction substantially perpendicular to the longitudinal direction, the sash being rotatably connected to the frame, such that a rotating opening movement of the sash in relation to the frame about a pre-defined hinge axis brings the sash from a closed position to an open position, said rotating opening movement forming an opening angle between the frame and the sash in the open position, and at least one opening restrictor comprising an arm rotatably connected to a frame or sash member and having a gripping mechanism configured to engage with a gripping element connected to an opposing sash or frame member so as to limit the opening of the sash, the arm with the gripping mechanism being configured to assume at least a disengaged condition and an engaged condition in which the gripping mechanism is in engagement with the gripping element and in which the opening of the sash is limited to a maximum limited angle.

Background Art

[0002] Opening restrictors are well known to be installed in windows, where a limitation of the opening of the sash in relation to the frame is achieved. Conventionally, such limitation by an opening restrictor provides the possibility of locking the sash in a ventilation position leaving a free airflow into a room. Furthermore, conventional opening restrictors also provide a child safety mechanism preventing unintended opening of the window.

[0003] As known per se, opening restrictors are installed on the frame part of a window, usually comprising two parts. They often comprise a gripping element having a gripping mechanism, where the gripping mechanism is configured to engage a stud provided on the sash part of the window. Thus, a rotating opening movement of the sash in relation to the frame causes the stud to be restricted by the gripping mechanism of the opening restrictor. In this way, the degree of opening of the sash in relation to the frame is limited by the gripping mechanism.

[0004] In order to provide a fully opened window, for example for cleaning of the window or for providing an increased airflow in the room, the opening restrictor is often manually disengaged from the engaged condition. This disengagement is achieved by a user actively acting on the gripping mechanism of the opening restrictor releasing the stud from the gripping mechanism, or vice versa, thereby allowing the sash to be freely moved away from the frame. The manual act by a user leading to dis-

engagement of the opening restrictor is not an obvious act for a child to comprehend, thereby preventing unintended opening by a child.

[0005] A window with an opening restrictor of this kind is disclosed in GB 2 414 513, where the opening restrictor is provided on a bottom part of the frame so that a slot provided in an arm of the opening restrictor engages a stud on the bottom part of the sash. The disengagement is achieved by a user acting on both the window sash and the arm of the opening restrictor at the same time. During a rotating opening movement of the sash in relation to frame, the slot automatically engages with the stud on the sash so that the opening restrictor is automatically activated. Thus, the disengagement of the opening restrictor is provided by a two-part act, where a user handles both the sash and the opening restrictor at the same time in order to release the opening restrictor from the sash to provide a fully opening thereof. In general, the sash often needs to be pulled towards or away from the frame in order to release the opening restrictor from the engaged condition, so that both the sash and the opening restrictor should be handled during disengagement of the opening restrictor. A closing movement of the sash in relation to the frame causes the stud to automatically engage the slot of the opening restrictor. Thus, the opening restrictor is as such always in an active position, and needs to be disengaged if a fully opening of the sash in relation to the frame is needed. The opening restrictor in general limits the airflow into the room due to the limited opening provided by the slot. In a room where children are not present, more airflow for ventilating the room may be preferable, while a need for opening restrictors providing the option of occasional child safety is needed.

[0006] Well-known opening restrictors are also often, as disclosed in for example GB 2 414 513, intended to restrict opening of windows installed in facades of buildings and may not be adapted in a proper manner to roof windows. Thus, there is a present need for opening restrictors suitable to be installed in an inclined roof window.

[0007] Examples of opening restrictors suitable for roof windows are shown in for instance Applicant's European patents Nos EP 3 124 732 B1 and EP 3 123 725 B1.

[0008] In light of the above, it is the object of the present invention to provide a roof window with an opening restrictor of the type mentioned in the introduction which overcomes the above mentioned disadvantages.

Summary of Invention

[0009] With this background, it is therefore an object of the invention to provide a roof window which is easy and safe to handle, allowing for natural ventilation, limiting the window opening and preventing unintended opening by the user.

[0010] This and further objects are achieved with a roof window of the kind mentioned in the introduction, which is furthermore characterised in that the arm of each opening restrictor is connected to a bottom member of the

sash or the frame, and that the gripping element is connected to the opposing bottom member of the frame or the sash, such that said arm is hidden in a space provided between the frame and the sash, leaving said opening restrictor invisible in the closed position of said sash and in the open position of said sash within a pre-defined opening angle.

[0011] This solution results in an effective and safe window, which is easy to handle. It is furthermore applicable to roof windows having a pre-defined hinge axis located arbitrarily, in that it is also possible to limit the opening movement of the sash in a top-hung roof window, and not only of a centre-hung or pivoting roof window.

[0012] The opening restrictor comprising an arm and a gripping mechanism allows for an effective, simple and easy to manufacture solution for limiting the opening of the roof window, which is furthermore easy to retrofit on an existing window.

[0013] A rotating movement of the sash in relation to the frame will cause the gripping element to be restricted by the gripping mechanism of the opening restrictor. In this way, the degree of opening of the sash in relation to the frame is limited by the gripping mechanism. To provide a fully opened window, the opening restrictor may be manually disengaged from the engaged condition. This disengagement may be achieved by a user actively acting on the gripping mechanism of the opening restrictor releasing the gripping element from the gripping mechanism bringing it to the first and second disengagement positions.

[0014] The position of the opening restrictor with the arm being hidden in a space provided between the frame and the sash leaves the opening restrictor invisible in the closed position of the sash and in the open position of the sash within a pre-defined opening angle increases not only the aesthetic appearance, but in particular the safety performance, since the opening restrictor can only be handled so as to be moved between the first disengaged condition, and the further second disengaged condition, when the window is at least slightly open, but still not clearly visible. This renders the opening restrictor more inconspicuous and may provide the effect that children and/or adults cannot activate or inactivate the opening restrictor when the window is in the closed position.

[0015] It is preferred that the maximum limited angle, that is the angle in which the arm is in full engagement with the gripping element, is larger than the pre-defined opening angle by a factor in the range 1 to 4, preferably about 2.5. In this way, the operational safety is increased even further, since non-authorised opening of the window by de-activation of the opening restrictor is rendered more complicated by the arm moving out of sight while moving the sash in the closing direction from the maximum limited angle.

[0016] The pre-defined opening angle may be in the range of 1 to 10 degrees, preferably lower than 5 degrees, more preferably lower than 2 degrees. The opening angle is defined as the angle formed by the rotating opening

movement of the sash in relation to the frame, or vice versa. The opening angle, thus, for a window in the closed position is 0 degrees. The selection of a suitable pre-defined opening angle depends on the size of the window and of the position of the hinge axis. Thus, a large top-hung roof window requires a small pre-defined opening angle, whereas a small centre-hung roof window requires a relatively larger pre-defined opening angle. The size indications large and small may in principle relate to any range of dimensions. Reference is in particular made to commercially available size diagrams of roof windows of the type VELUX.

[0017] The distance of the bottom sash and bottom frame member in the open position where the opening restrictor is not visible, the distance being defined in the height direction, may be in the range of 5 to 100 mm, more preferably lower than 70 mm. An opening height at the maximum limited angle may lie in the range 30 to 85 mm. Depending on the size of the roof window and the position of the hinge axis, this distance may correspond to the pre-defined opening angle for a specified open position. The selection of a suitable opening height is typically made taking all dimensions and properties of the roof window into consideration; not only the overall height and type of hinge connection, but also the width of the roof window and the position of the opening restrictor relative to the corners of the roof window. Since the accessible opening space may be wider at the corners of the roof window, depending on the structure of the frame and the sash, and due to possible deformation in the form of deflection of the frame and/or sash members, a suitable opening height at the position of the opening restrictor should be chosen with a safety margin.

[0018] In one embodiment, one opening restrictor is provided substantially at or in close proximity with the centre of the bottom sash and frame members, which may enable a simpler configuration where only one opening restrictor may be needed to limit the window opening. Furthermore, this solution may be easier to handle since the user may need to disengage only one opening restrictor and not multiple restrictors. Due to simple configuration of the opening restrictor, the user may not have to exert large force to disengage the gripping element from the gripping mechanism of the opening restrictor.

[0019] The opening restrictor may also have the advantage of being suitable for inclined roof windows, accounting for the roof pitch and the opening angle of the window. However, the opening restrictor of the present invention may be suitable for installation in facade buildings.

[0020] In an embodiment, the space, where the arm of the opening restrictor is hidden, has a height and a width, the width extending in a width direction defined as being perpendicular to the longitudinal and height directions. The width of the space may be substantially 1/3 of a width of the bottom frame member and the height of the space may substantially be 2/3 of the height of the bottom frame member. Alternatively, the width of the space may be 1/2

or 1/4 of the width of the bottom frame member and/or the height of the space may be 1/2 or 3/4 of the height of the bottom frame member.

[0021] In an embodiment, the width of the space may be lower than 30mm, preferably lower than 20 mm, more preferably lower than 17 mm.

[0022] In one presently preferred embodiment, the opening restrictor is configured to assume three positions, the engaged condition, the first disengaged condition and the second disengaged condition. The second disengaged condition may enable the sash to be pivoted away from the frame without any restrictions as to the opening angle in relation to the frame. These positions may allow the opening restrictor to be fully inactivated. When the gripping mechanism of the opening restrictor has been brought into the second disengaged condition, i.e. the inactive position, a user may simply pivot the sash from the frame to provide a fully open position of the sash. In order to disengage the opening restrictor, the user may have to pull the bottom sash member towards the interior of the building exerting a smaller force and push the opening restrictor bringing it from the first disengaged condition to the second disengaged condition.

[0023] The arm of each opening restrictor may be connected to the bottom frame member and the gripping element to the bottom sash member, or inversely. This provides for optimum flexibility.

[0024] In an embodiment, the bottom sash member and/or bottom frame member comprise a recess configured for accommodating the opening restrictor, preferably accommodating it tightly. The opening restrictor further comprises an attachment portion, the attachment portion being rotatably connected with the arm. The recess on the bottom sash member may have dimensions corresponding to the dimensions of the gripping element and/or said recess of the bottom frame member having dimensions corresponding substantially to the dimensions of the attachment portion of the opening restrictor. The recess may have such dimensions that the opening restrictor does not protrude beyond the plane defined by the length of the bottom sash member and/or the bottom frame member. This may allow a tight and effective engagement between the gripping mechanism and the gripping element. The recess may be in the form of a groove or an indentation. It may be milled in the bottom frame member or the bottom sash member. The recess may include barbs or like elements designed to prevent the opening restrictors from coming loose unintentionally. The recess on the bottom sash and/or bottom frame member may have a stepped configuration.

[0025] The recess may have a width that is equal to 1/2 or 1/3 of the width of the space where the arm is hidden. The recess may have a height which is equal to 1/2, 1/3, 1/4, 1/5 or 1/6 of the height of the arm. The recess that is formed on the bottom frame member may have dimensions which are larger, possibly two times larger, than the dimensions of the recess that is formed on the bottom sash member. The recess on the bottom

sash and/or frame member may determine the space where the opening restrictor is hidden. The dimensions of the recess may be chosen in accordance with other parameters such as the overall dimensions of the roof window, but typically the dimension of the recess in the bottom and/or frame member in the width direction may be lower than 15 mm, more preferably lower than 10 mm. In an embodiment, where both the bottom frame member and the sash member comprise a recess to accommodate the opening restrictor, the distance between the two recesses in the open position of the window, where the opening restrictor is hidden, may be lower than 20 mm, more preferably lower than 17 mm.

[0026] The bottom sash or frame member may comprise weakened sections, which may be understood as sections containing less material, so that they can receive the opening restrictors. Alternatively, the sash and/or the frame may comprise pre-compressed sections or sections made of a thinner material adapted for receiving the opening restrictors.

[0027] The sash and/or the frame may comprise wood and/or metal such as aluminium and/or polymer materials, such as plastic, specifically PVC (polyvinyl chloride), chlorinated PVC, PUR (polyurethane), fibre reinforced PUR such as glass fibre reinforced PUR or composites or combinations thereof.

[0028] The choice of material for the opening restrictor may in principle be made in any suitable manner as long as the requirements to proper functioning and durability are fulfilled. It may be advantageous that the opening restrictor comprises stainless steel and/or bent spring sheet material.

[0029] The opening restrictor may further comprise other attachment means to the window, such as a cord, barrel bolt or wire.

[0030] In an embodiment, the gripping element comprises a protrusion such as a stud, such that it engages firmly with the gripping mechanism in the engaged condition. This may allow the roof window to be retained in the engaged condition by means of the opening restrictor. The gripping element may be resiliently engageable with and disengageable from the gripping mechanism or vice versa.

[0031] The gripping element may further comprise a base, on which the protrusion may be attached to. Alternatively, the protrusion may be moulded in one piece with the base of the gripping element. The base may be a plate portion adapted to be attached to the sash. The protrusion may alternatively be a barb, hook or a bulge. The protrusion may have dimensions corresponding to the dimensions of the gripping mechanism. It may be advantageous that the protrusion has a height, measured as from the base of the gripping element to the free end of the protrusion that is larger than the thickness of the gripping mechanism, such that it engages firmly with the gripping mechanism in the engaged condition.

[0032] In an embodiment, the arm has a width extending in the width direction, and a height extending in the

height direction, said width to height ratio of said arm is 16:1. The width to height ratio may alternatively be 15:1, 14:1, 13:1, 12:1, 11:1, 10:1, 9:1, 8:1, 7:1, 6:1, 5:1, 4:1 or 3:1.

[0033] In an embodiment, the stud of the gripping element has a width extending in the width direction, the width being substantially larger than the width of the arm, such that the stud engages firmly with the arm in the engaged condition. The width of the stud may be two or three times larger than the width of the arm. This may lead to a resilient grip of the stud by the gripping mechanism of the arm, such that a tight and stable connection is formed. The stud may further comprise a headed projection at the top of it so that a more resilient connection with the gripping mechanism, which may be in the form of a recess, opening or slot, is created. The stud may have a circular cross-section. The diameter of the stud may be larger at the top of the stud and smaller at the bottom of the stud which is connected to the base of the gripping element. The headed projection having a larger diameter may protrude from the gripping mechanism in the engaged condition.

[0034] In an embodiment, the base of the gripping element comprises a set of holes provided for receiving an attachment element, such as nail, screw or clip, to the bottom sash member or bottom frame member. The base of the gripping element may comprise two holes, each hole placed aside of the stud.

[0035] The gripping mechanism may comprise an opening, recess or slot, the height of the opening, recess or slot being at least half the height of the arm and the length of the opening, recess or slot extending in a length direction perpendicular to the longitudinal and height direction, being at least 1/3 of the length of the arm. The opening, recess or slot may be formed such that the gripping mechanism is exposed and easily accessible. The arm may have different lengths at different points of the arm, so the length of the arm is considered at the point where the length is the largest.

[0036] In an embodiment, the arm may be provided as one single leg portion, wherein the leg portion is adjacent to the opening, recess or slot, and a tip end of the leg portion has a curvature such that it forms a hook and acts as the gripping mechanism. The arm formed as a single leg portion adjacent to the opening, recess or slot may further allow for accessibility of the gripping mechanism and easier engagement of it.

[0037] In an embodiment, the gripping mechanism comprises one single slot. The slot may be formed as an open recess or opening along a side of the arm. The slot may result in a smaller length of the arm in the position where the slot is formed. The arm is adjacent to the slot such that the gripping mechanism is fully exposed and easily accessible. The main portion of the arm that is adjacent to the slot may comprise two straight sides extending in the height direction parallel to each other. This may also facilitate the operation of the opening restrictor, without requiring large forces to operate it or complex

movements to bring it into engagement.

[0038] In an embodiment, the attachment portion comprises a rotary joint connected with the arm, allowing rotation of the arm around the attachment portion, the rotation being preferably limited by a shoulder portion of the arm abutting a pin on the attachment portion. The shoulder portion may have the largest length of the arm.

[0039] In an embodiment, the opening restrictor is configured to assume three positions: the engaged condition, a first disengaged condition, and a second disengaged condition, the gripping mechanism being in an inactive position in said second disengaged condition and in which the opening restrictor is adapted to be manually handled for bringing the gripping mechanism into the inactive position of the second disengaged condition.

[0040] In an embodiment, the attachment portion comprises a spring for allowing movement of said arm around said attachment portion biasing said gripping mechanism into the active position of the first disengaged condition.

[0041] In another embodiment, the gripping mechanism is brought from the first disengaged condition into the engaged condition by a rotation of said arm by at least 30 degrees. The rotation of the arm may be achieved by the shoulder portion being rotated around the pin on the attachment portion. The arm may alternatively be rotated 10 degrees, 20 degrees or more than 30 degrees to occupy an engaged condition.

[0042] In an embodiment, two opening restrictors are provided, one of the opening restrictors being positioned near an end of the bottom frame member and bottom sash member in the longitudinal direction, the other opening restrictor being positioned at the opposite end of the bottom frame member and the bottom sash member. Alternatively, the two opening restrictors may be placed at any other point along the length of the frame and/or sash.

[0043] Further presently preferred embodiments and advantages will appear from the following description and subsequent claims.

Brief Description of Drawings

[0044] In the following description embodiments of the invention will be described with reference to the schematic drawings, in which

Fig. 1 is a perspective view of a roof window;

Fig. 2 is a cross-sectional view of an embodiment of a roof window according to the invention, with the opening restrictor in the engaged condition;

Fig. 3 is a part-sectional perspective view of another embodiment of a roof window, as seen from the exterior of the building;

Fig. 4 is view of the roof window of Fig. 3, as seen from the interior of the building;

Fig. 5 is a partial top view of the bottom of the roof window, as seen from the interior, in a further embodiment;

Fig. 6 is a partial bottom perspective view of the bot-

tom of the roof window, as seen from the exterior, of an embodiment of a roof window;

Fig. 7 is a perspective view of an embodiment of the gripping element of the opening restrictor; and

Fig. 8 is a perspective view of an embodiment of the gripping mechanism and the arm of the opening restrictor.

Description of Embodiments

[0045] Referring initially to Fig. 1, a roof window 1 is shown for easier indication of components of the roof window, however without the inventive opening restrictor.

[0046] Fig. 2 illustrates an embodiment of the roof window 1 according to the invention, with an opening restrictor generally designated 10 being in the engaged condition.

[0047] Generally, the opening restrictor 10 is configured to be installed in the roof window 1 having a frame 2 and a sash 3 each comprising a respective top member 8, 9, a bottom member 4, 5 and two side members 6, 7. The top and bottom members 4, 8, 5, 9 of the frame and of the sash are extending in a longitudinal direction. The side members of the frame 6, and of the sash 7 are extending in a height direction, which is substantially perpendicular to the longitudinal direction. The top, bottom and side members 8, 4, 6 of the frame 2 define a frame plane. The top, bottom and side members 9, 5, 7 of the sash 3 together define a sash plane in which a pane 30 is installed. The roof window 1 is configured to be built into a roof surface, which is inclined with respect to horizontal plane. The sash 3 is openable relative to the frame 2 about a pre-defined hinge axis to one or more open positions, in which the sash plane forms an angle with the frame plane as will be described in further detail below.

[0048] The roof window 1 shown in Fig. 1 is configured as a top-hung roof window, which pivots for cleaning, meaning that during normal operation, the sash 3 is opened by rotating the sash 3 about a top hinge axis $\alpha 1$ at the top of the roof window 1. However, it is also possible to open the sash 3 by rotating about a pivot hinge axis $\alpha 2$ located at a position at the centre. In other configurations of such a roof window, the hinge axis may be provided as a single pre-defined hinge axis located substantially centrally in the roof window. The opening restrictor 10 according to the invention is applicable to several configurations of a roof window in which the pre-defined hinge axis may be positioned at the top, the centre, or between the top and centre, or bottom and centre by means of suitable hinge connections between the frame 2 and sash 3 (not shown). In all configurations of such roof windows, the sash 3 is thus rotatably connected to the frame 2 such that opening of the sash 3 in relation to the frame 2 brings the sash 3 from a closed position in which the sash plane is substantially parallel to the frame plane to an arbitrary open position, and vice versa. Op-

erating members include a handle 31 at the bottom sash member 5 to cooperate with striking plates 41 on the bottom frame member 4 (cf. Fig. 5).

[0049] As illustrated, the roof window 1 comprises an opening restrictor 10. The opening restrictor 10 comprises an arm 11 rotatably connected to the bottom member 4 of the frame 2 or the bottom member 5 of the sash 3 and has a gripping mechanism 12. The opening restrictor 10 is configured to assume an engaged condition, in which the gripping mechanism 12 is engaging with a gripping element 23 provided on the opposing bottom member 5 of the sash 3 or the bottom member 4 of frame 2, so as to limit the opening of the sash 3 when the roof window 1 is opened.

[0050] The opening restrictor 10 is also configured to assume a first disengaged condition, where the gripping mechanism 12 is in an active position and the gripping mechanism 12 is in engagement with the gripping element 23. Although not shown in detail, the gripping element 23 may be configured to automatically engage with the gripping mechanism 12, for instance by biasing means such that a spring acting to bring the arm 11 towards the second disengaged condition.

[0051] The opening restrictor 10 is further configured to assume a second disengaged condition, where the gripping mechanism 12 is in an inactive position. The opening restrictor 10 is adapted to be manually handled for bringing the gripping mechanism 12 into the inactive position of the second disengaged condition.

[0052] In the embodiment shown in Fig. 2, the arm 11 of the opening restrictor 10 is connected to the bottom frame member 4, such that said arm 11 in the first disengaged condition is hidden in a space 130 provided between the frame 2 and the sash 3, leaving the opening restrictor 10 virtually invisible in the closed position of the sash 3. The gripping element 23 is provided on substantially or in close proximity with the centre of the bottom sash member 5 in the engaged condition. The bottom sash member 5 has a length in the longitudinal direction, and the centre of the sash 3 is defined as the middle point of the length of the sash 3.

[0053] The longitudinal L, height H and width W directions are denoted and shown in Fig. 2.

[0054] A pre-defined opening angle $b1$ within which, the arm is invisible is here approximately 1.1 degrees. The space 130 has a height HS and a width WS. The width WS extends in a width direction W defined as being perpendicular to the longitudinal L and height H directions. The width WS of the space 130 is substantially 1/3 of a width WF of the bottom frame member 4 and the height HS of the space 130 is 2/3 of the height HF of the bottom frame member 4 in the engaged condition shown in Fig. 2. A maximum limited angle $b2$ is defined as the opening angle in which the arm 11 is engaged with the gripping element 23. In the embodiment, the maximum limited angle is about 2.5 degrees.

[0055] The arm 11 of the opening restrictor 10 has a width WA extending in the width direction W, and a height

HA extending in the height direction H. The width to height ratio of the arm 11 is here 16:1.

[0056] The width WS typically lies in the range 10 to 20 mm, in the embodiment shown about 16 mm. The height HS is about 70 mm. It is noted that the height HS is larger than an opening height HL at the maximum limited angle b2 measured from the side frame member 6, corresponding to a stepped portion of the bottom frame member 4, to the interior side of the bottom sash member 5. In order to access the space 130, a user thus needs to insert their fingers through the narrow passage defining the opening height HL, following which the arm 11 may be reached.

[0057] In the embodiment shown in Fig. 3, the arm 11 of the opening restrictor 10 is instead connected to the bottom sash member 54 and the gripping element 23 on the bottom frame member 4. Other elements of the roof window 1 correspond in substance to the embodiment shown in Fig. 2.

[0058] Referring now also to Fig. 4, the bottom sash member 5 and bottom frame member 4 each comprises a respective recess 54, 44 configured for accommodating the opening restrictor 10. Preferably, the operating restrictor 10 is accommodated tightly in the respective recess 54, 44. The recess 54 on the bottom sash member has a stepped configuration. The width of the recess 54 defined in the width direction is here approximately 7 mm, while the width of the recess 44 on the bottom frame member 4 is here 9 mm.

[0059] The opening restrictor 10 comprises an attachment portion 17 that is rotatably connected with the arm 11. The recess 54 on the bottom sash member 5 has dimensions corresponding to the dimensions of the gripping element 23. The recess 44 of the bottom frame member 4 has dimensions corresponding to the attachment portion 17 of the opening restrictor 10.

[0060] Fig. 5 illustrates a roof window with an opening restrictor 10 located near the centre of the bottom part of the roof window 1, namely to the side of handle 31. The opening restrictor 10 is in the engaged condition, limiting the opening of the roof window. The base 29 of the gripping element 13 is formed as a plate, being attached to the bottom frame member 4.

[0061] In the embodiments shown, the recess or recesses 44, 54 is/are milled in the bottom frame member 4 and in the bottom sash member 5 (Fig. 4).

[0062] An embodiment of the roof window is shown in Fig. 6, illustrating a bottom view of the opening restrictor 10, where the arm 11 and the attachment portion 17 are attached in close proximity with the centre of the bottom sash member 5. A recess 54 is milled in the bottom sash member 5. The dimensions of the recess 54 correspond substantially to the dimensions of the attachment portion 17, such that the attachment portion 17 is accommodated tightly on the bottom sash member 5 and, in turn the entire opening restrictor 10 in the space 130.

[0063] Referring now to Figs 7 and 8, the gripping mechanism 12 is, in the embodiment shown, provided

as an opening, recess or a slot and the gripping element 23 comprises a protrusion or a stud 27 on the bottom sash member 5, such that the stud 27 engages firmly with the gripping mechanism 12 in the engaged condition.

5 The opening restrictor 10 is in the engaged condition when the gripping mechanism 12 in the arm 11 of the opening restrictor 10 engages the stud 27 illustrated in Fig. 3 on the bottom sash member 3. This is done by the stud 27 sliding in the slot of the gripping mechanism 12.
10 The degree of opening of the sash 3 is thereby limited to the maximum limited angle b2 by the height HO of the slot 12 in the arm 11 of the opening restrictor 10. The height HO of the slot 12 is here approximately 1/2 of the height HA of the arm 11, and the length LO of the slot 12 extending in the length direction perpendicular to the width and height direction is here approximately 1/3 of the length LA of the arm 11, the length of the arm LA being considered at its highest value, which is at a shoulder portion 110.

20 **[0064]** The stud 27 has a width WT extending in the width direction W. The width WT is 3 times larger than the width WA of the arm 11 shown in Fig. 2, The stud 27 thus engages firmly with the arm 11 in the engaged condition.

25 **[0065]** The gripping element 23 further comprises a pre-defined hole 28 provided for receiving an attachment element, such as nail, screw or clip, to the bottom sash member 5.

[0066] The attachment portion 17 comprises a rotary joint 18 adapted to receive a fastening element. The rotary joint 18 is connected with the arm 11 allowing rotation of the arm 11 around the attachment portion 17. The attachment portion comprises pre-defined holes 28 for receiving an attachment element to the bottom frame member 4, or the bottom sash member 5, depending on the location.
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35 **[0067]** The gripping mechanism 12 is brought from the first disengaged condition into the engaged condition by a rotation of the arm 11 by at least 30 degrees. The gripping mechanism 12 is also brought into the second disengaged condition by a rotation of the arm 11.
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[0068] Fig. 7 illustrates an embodiment of the gripping element 23, having a base 29 and a stud 27 in the centre of the base 29 and two pre-defined holes 28 opposite the stud. The pre-defined holes are formed to receive attachment elements to the bottom sash member 5, or the bottom frame member 4 as the case may be.

[0069] Fig. 8 illustrates an embodiment of the arm 11 and the gripping mechanism 12 of an opening restrictor 10, wherein the gripping mechanism 12 is here also provided as an opening or slot 13. The attachment portion 17 also comprises pre-defined holes 19 for receiving an attachment element to the bottom frame member 4. As shown, it is possible to limit the rotation of the arm 11 by the shoulder portion 110 of the arm 11 abutting a pin 170 on the attachment portion 17.
45

[0070] The arm 11 is here provided as one single leg portion 111, the leg portion 111 being adjacent to the

opening or slot 13, such that the gripping mechanism 12 is exposed and easily accessible. A tip end of the leg portion has a curvature such that it forms a hook and acts as the gripping mechanism 12.

[0071] The main portion of the arm that is adjacent to the slot, that is, here the single leg portion 111, may comprise two straight sides extending in the height direction parallel to each other.

[0072] The height of the slot 13 is at least half the height of the arm and the length of the slot 13 is approximately 1/3 of the length of the arm 11 such that it extends over a major part of the leg portion 111. This combination provides for a base of the arm 11 including the shoulder portion 110 and connection to the rotary joint 18, which does not protrude significantly in the height direction, but is sufficiently long in the length direction to accommodate the connection with the attachment portion on one hand, and a single leg portion 111, which is relatively taller in the height direction, but provides for a sufficient slot length to ensure ease of handling. In turn, this facilitates the operation of the opening restrictor, without requiring large forces to operate it or complex movements to bring it into or out of engagement.

[0073] The invention is not limited to the embodiments shown and described in the above, but several modifications and combinations are conceivable.

List of reference numerals

[0074]

- | | |
|-----|-----------------------------|
| 1 | Roof window |
| 2 | Frame |
| 3 | Sash |
| 30 | Pane |
| 31 | Handle |
| 32 | Ventilation flap |
| 4 | Bottom frame member |
| 41 | Striking plates |
| 44 | Recess |
| 5 | Bottom sash member |
| 54 | Recess |
| 6 | Side frame member |
| 7 | Side sash member |
| 8 | Top frame member |
| 9 | Top sash member |
| 10 | Opening restrictor |
| 11 | Arm |
| 110 | Shoulder portion on arm |
| 111 | Leg portion of arm |
| 12 | Gripping mechanism |
| 13 | Slot |
| 17 | Attachment portion |
| 170 | Pin |
| 18 | Rotary joint |
| 19 | Holes in attachment portion |
| 23 | Gripping element |

- | | |
|----|-------------------------------------|
| 27 | Protrusion of gripping element/Stud |
| 28 | Holes in base of gripping element |
| 29 | Base of gripping element |

5 130 space

- | | |
|------------|------------------|
| $\alpha 1$ | top hinge axis |
| $\alpha 2$ | pivot hinge axis |

10 b1 Pre-defined opening angle

b2 Maximum limited angle

HA Height of arm

WA Width of arm

LA Length of arm

15 HS Height of space

WS Width of space

HL Opening height at maximum limited angle

WT Width of stud

HF Height of bottom frame member

20 WF Width of bottom frame member

HO Height of slot

LO Length of slot

25 Claims

1. A roof window (1) configured to be installed in an inclined roof, said roof window (1) comprising a frame (2) and a sash (3), each having a top member (8, 9) and a bottom member (4, 5) extending in a longitudinal direction, and two side members (6, 7) extending in a height direction substantially perpendicular to the longitudinal direction, the sash (3) being rotatably connected to the frame (2), such that a rotating opening movement of the sash (3) in relation to the frame (2) about a pre-defined hinge axis brings the sash (3) from a closed position to an open position, said rotating opening movement forming an opening angle (b) between the frame (2) and the sash (3) in the open position, and
- at least one opening restrictor (10) comprising an arm (11) rotatably connected to a frame or sash member and having a gripping mechanism (12) configured to engage with a gripping element (23) connected to an opposing sash or frame member so as to limit the opening of the sash (3), the arm (11) with the gripping mechanism (12) being configured to assume at least a disengaged condition and an engaged condition in which the gripping mechanism (12) is in engagement with the gripping element (23) and in which the opening of the sash (3) is limited to a maximum limited angle (b2),
- characterised in that** the arm (11) of each opening restrictor (10) is connected to a bottom member (5, 4) of the sash (3) or the frame (2), and that the gripping element (23) is connected to the opposing bottom member (4, 5) of the frame (2) or the sash (3), such that said arm (11) is hidden in a space (130)

- provided between the frame (2) and the sash (3), leaving said opening restrictor (10) invisible in the closed position of said sash (3) and in the open position of said sash (3) within a pre-defined opening angle (b1).
2. A roof window according to claim 1, wherein the maximum limited angle (b2) is larger than the pre-defined opening angle (b1) by a factor in the range 1 to 4, preferably about 2.5.
 3. A roof window according to claim 1 or 2, wherein the pre-defined opening angle (b1) is preferably less than 10 degrees, more preferably less than 5 degrees, more preferably less than 2 degrees.
 4. A roof window according to any one of the preceding claims, wherein an opening height (HL) at the maximum limited angle (b2) lies in the range 30 to 85 mm.
 5. A roof window according to any one of the preceding claims, wherein one opening restrictor (10) is provided substantially at or in close proximity of the centre of the bottom sash and frame members (5, 4), said bottom sash and frame members (5, 4) each having a length in the longitudinal direction, said centre of the sash (3) being defined as the middle point of the length of the sash and frame bottom members (5, 4).
 6. A roof window according to any one of the preceding claims, wherein said space (130) has a height (HS) and a width (WS), said width (WS) extends in a width direction (W) defined as being perpendicular to the longitudinal (L) and height (H) directions, said width (WS) of said space (130) is substantially 1/3 of a width (WF) of the bottom frame member (4) and said height (HS) of said space (130) is substantially 2/3 of the height (HF) of the bottom frame member (4).
 7. A roof window according to claim 6, wherein the arm (11) has a width (WA) extending in the width direction (W), and a height (HA) extending in the height direction (H), said width to height ratio of said arm (11) is 16:1.
 8. A roof window according to any one of the preceding claims, wherein the arm (11) of each opening restrictor (10) is connected to the bottom frame member (4) and the gripping element (23) is connected to the bottom sash member (5).
 9. A roof window according to any one of the preceding claims, wherein the bottom sash member (5) and/or bottom frame member (4) comprise/s a recess (54, 44) configured for accommodating the opening restrictor (10), preferably accommodating it tightly.
 10. A roof window according to any one of the preceding claims, wherein said opening restrictor (10) comprises an attachment portion (17) rotatably connected with the arm (11), and wherein the gripping element (23) comprises a base (29), the attachment portion (17) and the base (29) being preferably provided with a set of holes (19, 28).
 11. A roof window according to claims 9 and 10, wherein the recess (54) in the bottom sash member (5) and/or the recess (44) of the bottom frame member (4) has dimensions corresponding to the dimensions of the base (29) of the gripping element (23) or the attachment portion (17) of the opening restrictor (10), respectively.
 12. A roof window according to any one of the preceding claims, wherein the gripping element (23) comprises a protrusion such as a stud (27), said stud (27) having a width (WT) extending in the width direction (W), said width (WT) being substantially larger than the width (WA) of the arm (11), such that said stud (27) engages firmly with said arm (11) in the engaged condition, the stud (27) being preferably provided with headed projection at its top.
 13. A roof window according to any one of the preceding claims, wherein the gripping mechanism (12) comprises an opening, a recess or a slot (13), the height of the opening, recess or slot being at least half the height of the arm and the length of the opening, recess or slot is at least 1/3 of the length of the arm (11).
 14. A roof window according to claim 13, wherein the arm is provided as a single leg portion (111) adjacent to the opening, recess or slot (13), and a tip end of the leg portion has a curvature such that it forms a hook and acts as the gripping mechanism (12).
 15. A roof window according to claim 14, wherein the gripping mechanism (12) comprises one single slot (13) formed as an open recess or opening along a side of the arm, the slot (13) extending over a major part of the leg portion (111).

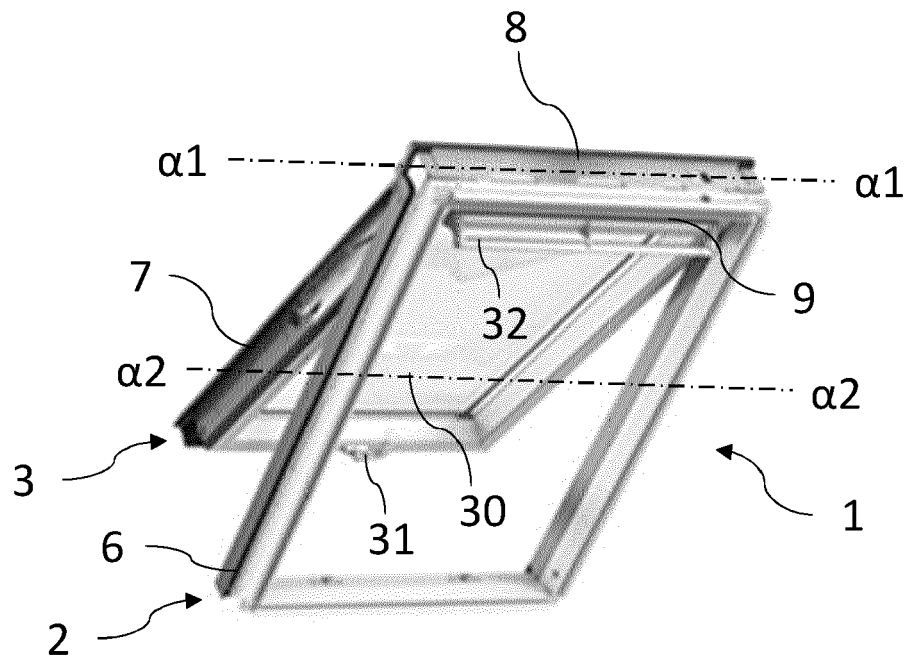


Fig. 1

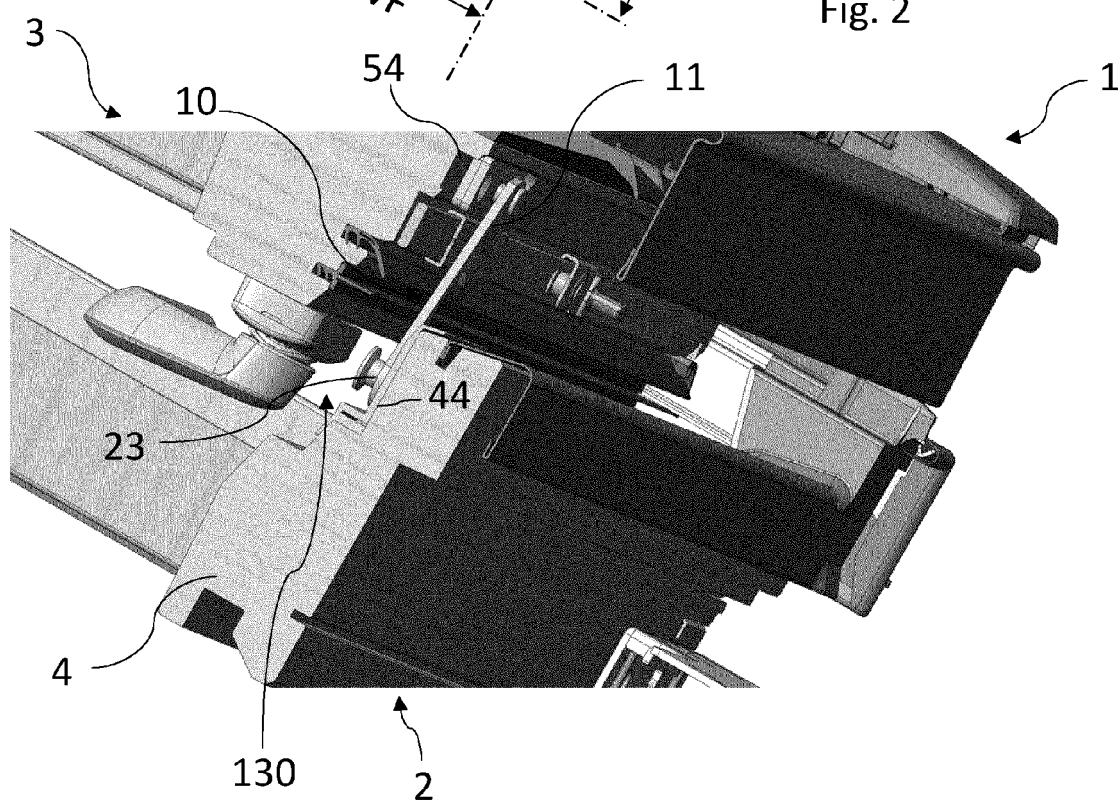
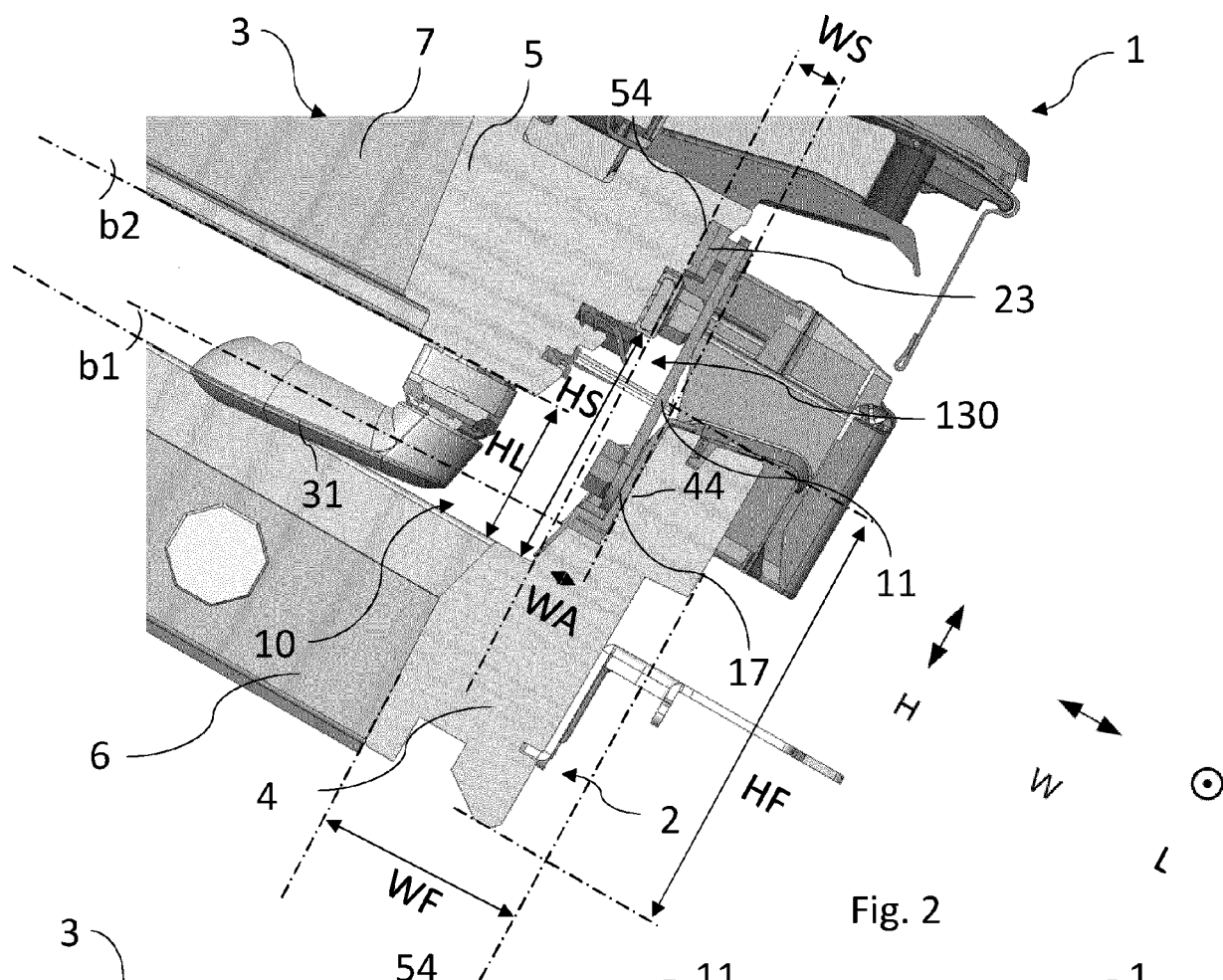
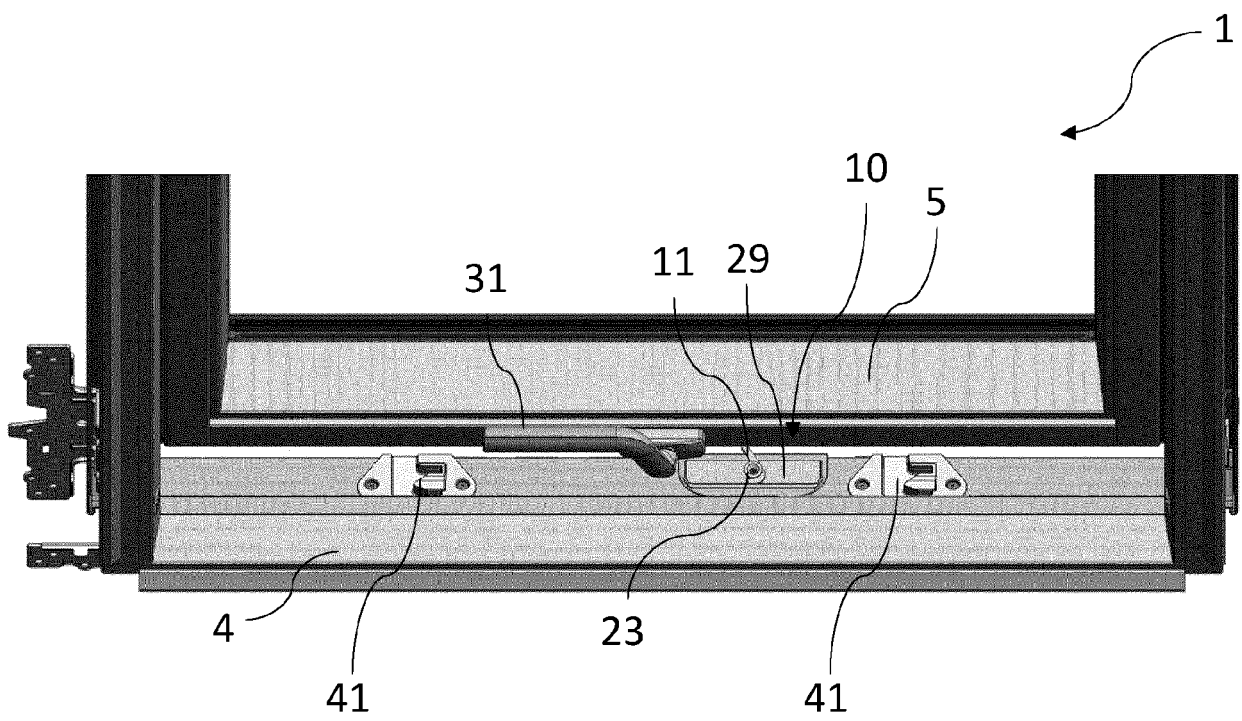
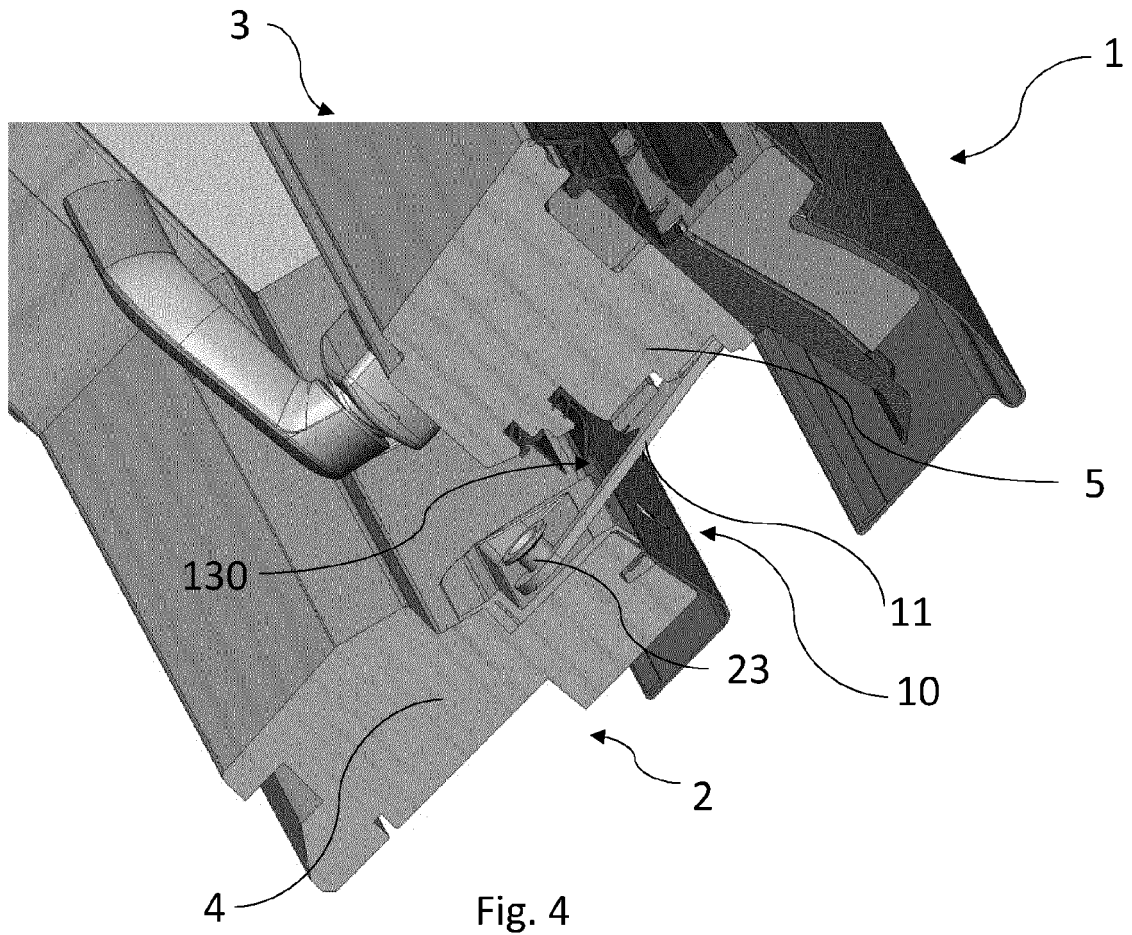


Fig. 3



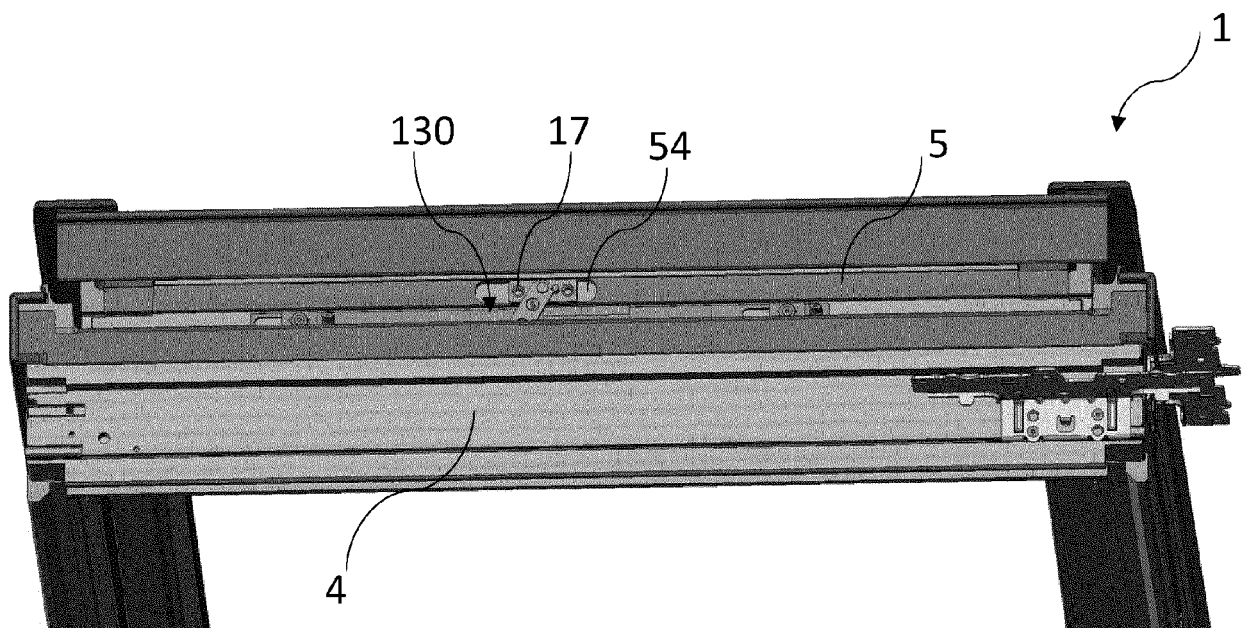


Fig. 6

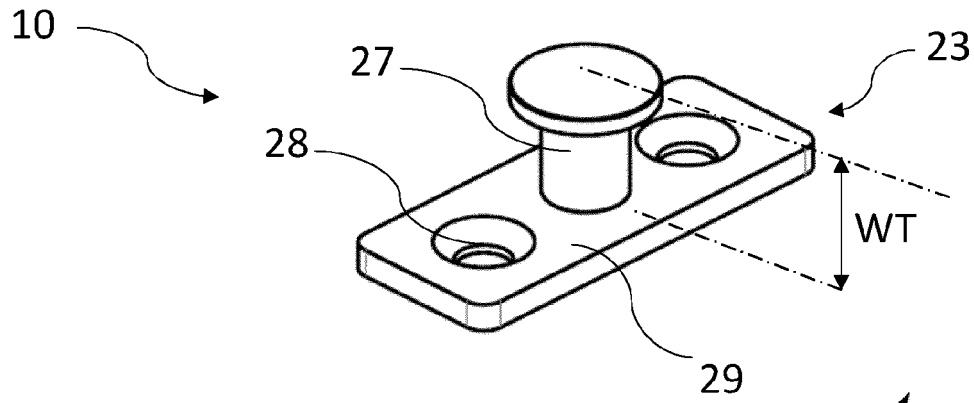


Fig. 7

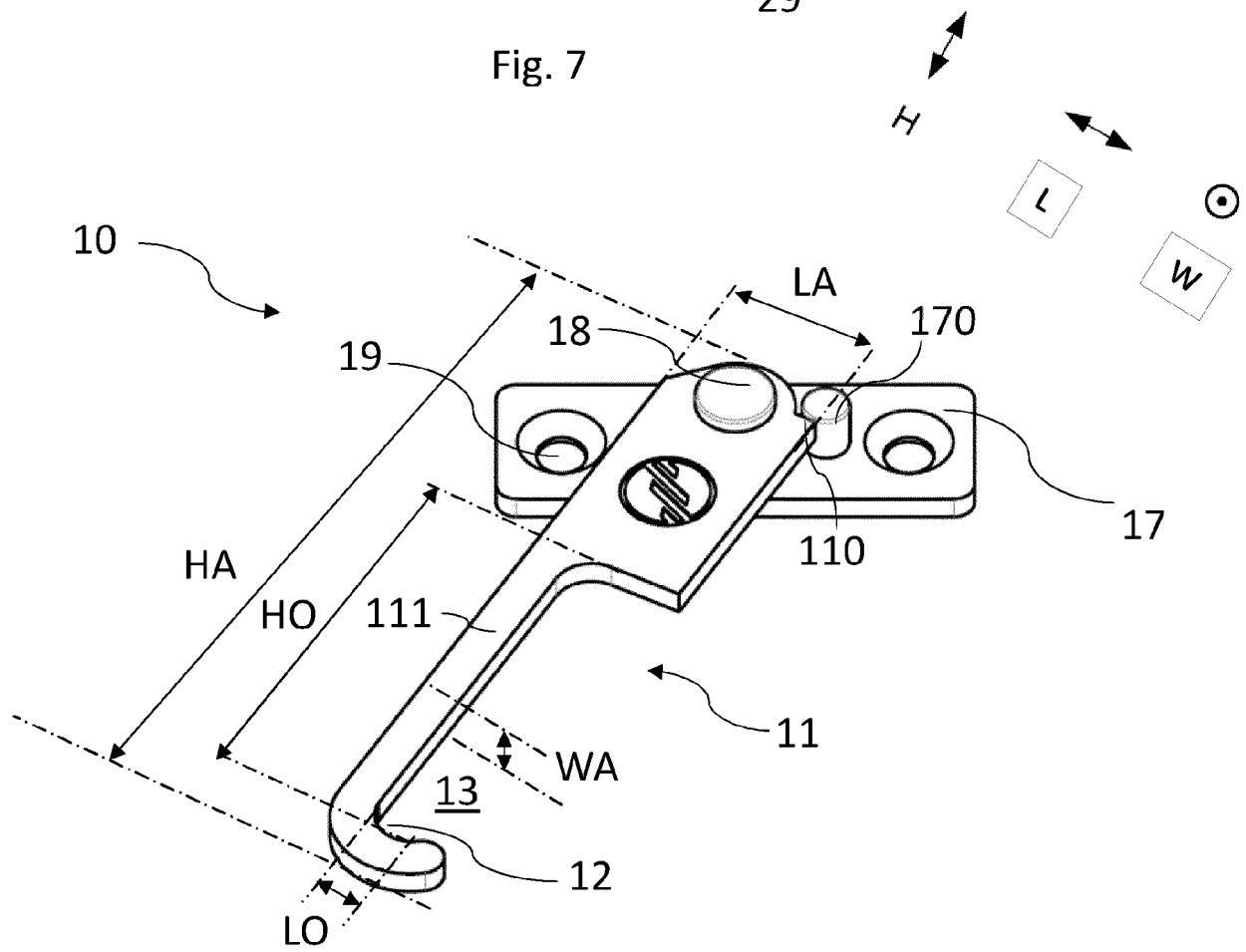


Fig. 8



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Application Number
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