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(54) **Roof window, at least pivoting**

(57) A roof window, at least pivoting, has two sets of hinges situated at both side edges of the window sash, preferably above the middle of the height of the sash, making it possible to open the window pivotally, where the lower part of the sash moves outside the roof, while the upper part of the sash to the inside of the attic. Centres of mass of the elements of these hinges that mate with the sash are situated above the external surface of the glazing unit (2), when the window is closed. The window frame (3) is fixed to the roof structure through the support flashing (4). The window may also have a second set of hinges situated near the top edge of the window, making it possible to open the window either in the pivotal or tilting mode, i.e. by rotating the whole window sash towards the outside of the roof.

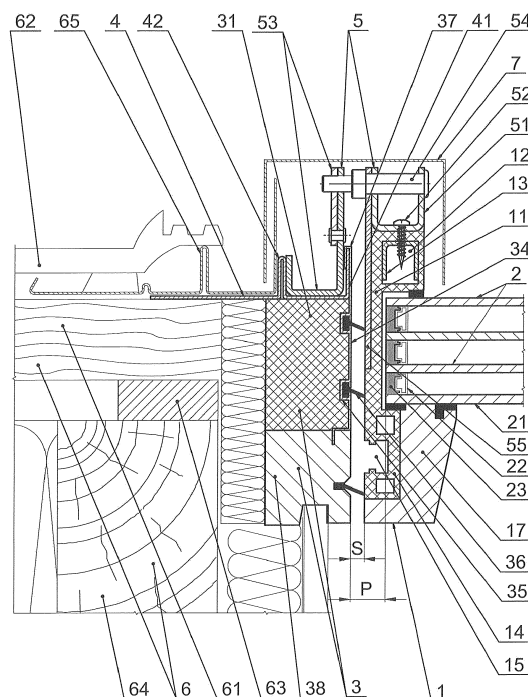


Fig. 2

EP 2 843 151 A2

Description

[0001] The invention relates to a roof window, at least pivoting, i.e. being opened by rotation of the sash around a horizontal axis located in the middle zone of the height of the window. The invention also relates to dual-action windows, or windows being opened as pivoting or as tilting, that is by rotation of the sash around a horizontal axis located near the top edge of the window.

[0002] State of the art. Patent description No. PL 214536 discloses a roof window, having a window frame fixed by runners penetrating the roof structure basically perpendicularly to its surface, the runners being covered on the side with a thin layer of thermal insulation. Significant part of the window frame protrudes above the roof's surface, causing escape of heat from the attic outwards through the window frame; moreover, the fixing runners form thermal bridges, also facilitating escape of heat from the attic. In known roof windows being opened at least as pivoting, called also pivot windows or reversible windows, the hinges, in which the sash is mounted, are immersed into the window between the side members of the window frame and the sash, forming thermal bridges with a high share of metal parts.

[0003] Essence of the solution. A roof window at least pivoting, has a window frame consisting of a top frame member, a bottom frame member and two side frame members. It has also a window sash with a glazing unit, opened at least in a pivoting way, or by rotation of the sash, by at least right angle, around a horizontal axis located between the top and bottom member of the window frame, so as to in every phase of the window opening process, part of the sash runs through the opening in the window frame. The window according to the invention has at least two sets of hinges, in which the window sash is installed, situated at both side edges of the window sash, preferably above the middle of the height of the sash, defined as "pivoting hinges". Centres of mass of the elements of these hinges that mate with the sash are situated above the external surface of the glazing unit, when the window is closed. The window is also equipped with shields for gaps between the sash and the window frame, including side gaps, and with sealing sets in these gaps. The pivoting hinges are placed under the covers of the side gaps, while the covers may be divided in the pivoting hinges zone. The window has also sets for bolting the sash in relation to the window frame, in the closed position of the window.

[0004] The sash of the roof window has walls made of a material with a low thermal conductivity, particularly of a plastic, adjacent at least to the side surfaces of the glazing unit, in at least part of the length of side edges of the sash. Preferably, the walls form the frame of the sash surrounding the glazing unit from all four sides. Elements of fittings of the window, such as hinges, handles, bolts, are situated, each of them in the whole, on the external and internal sides of the glazing unit. They have no construction elements running from one side of the

glazing unit to the other, or elements, which would be situated in the window partially on the external side of the roof, and partially on the attic side. In the sash of the roof window, its walls adjacent to the side surfaces of the glazing unit, may extend towards the internal side of the sash when the window is closed, i.e. towards the attic, and in these wall extensions, there are longitudinal fitting grooves, situated on the external side of these walls, in relation to the glazing. The fitting grooves in these walls of the sash are intended for elements sliding along the sash belonging to the set for side locking the sash in the window frame. Side locking of the sash, in order to close the window, replaces or supplements the locking sets situated on a horizontal frame member, usually the bottom one.

[0005] Walls made of a material with a low thermal conductivity, adjacent in the sash of the window to the side surfaces of the glazing unit, are thin, and in consequence the glazing unit occupies almost whole width of the sash. The distance between the edges of the glazing unit and the internal surfaces of the side members of the window frame is not longer than three times the width of the side gap between the window frame and the window sash. The distance is also not longer than 20 millimetres. When the window is closed, these walls are extended outside of the glazing unit, and thickened there; in the thickening, a longitudinal duct is situated, running in parallel to the side edge of the glazing unit. The side walls of the sash have reinforcing inserts, particularly metal, placed in the duct, at the external side of the glazing unit, at least in the middle section of the length of the sash. The reinforcing inserts are connected with moving subsets of the pivoting hinges, and they serve the purpose of - apart from reinforcing the walls - distribution of load transfer zone onto a larger section of the reinforced wall. In the aspect in which the walls made of a material with a low thermal conductivity surround the glazing unit from at least three sides, forming the frame of the sash, longitudinal ducts in the walls and reinforcing inserts placed in them, are in side members of the sash frame.

[0006] The window frame of the roof window according to the invention has at least one structural element connecting it with the roof. This element of the window frame rests on the surface of its members, at the external side of the window, and protrudes beyond the outline of the window frame members, at least in two opposite directions, particularly to the sides. The structural element of the window frame connecting it with the roof, is particularly a support flashing, adjacent to at least three of the window frame members, including both side members. Preferably, the window frame has walls made of a material with a low thermal conductivity, particularly of a plastic, situated in its frame members, along the support flashing, transversely to its surface resting on the roof. The walls are situated in the window frame members at least from the side of the window sash. They may be also two walls in every window frame member, or in some of them, one from the side of the sash, and the other one -

from the side of the roof opening, in which the window frame is seated. Outside the walls situated from the side of the window sash, or between the walls, if there are two wall in the window frame member, the window frame has a filling made of an insulating material, which is not a support element, but only insulates thermally.

[0007] In a first aspect of the invention, the roof window is being opened only in the pivoting mode. The pivoting hinges are fixed to the structural element of the window frame, connecting the frame with the roof, particularly to the support flashing, more precisely, to those sections of the flashing, which rest on the side members of the window frame. With such a mounting, components of these hinges mating with the window frame flashing are immobile. However, the subsets and parts mating with the window sash move together with the sash. Preferably, the pivoting hinges are situated as a whole at the external side of the window.

[0008] In a second aspect of the invention, the roof window is a dual action window, that is, apart from the opening in the pivoting mode described above, the window may be also opened in a tilting mode, *i.e.* by rotation of the sash around an axis located near the top edges of the window. In this aspect, the roof window has a second pair of hinges apart from the pivoting hinges, the second hinges being situated near the top edge of the window and defined hereinafter as "tilting hinges", while the pivoting hinges are fixed at the ends of arms connecting them with the tilting hinges. The arm connecting the tilting hinges with the pivoting hinges, are situated at the external side of the window, under the covers of the side gaps.

[0009] In both aspects of the invention, the glazing unit in the sash of the roof window preferably contains more than two panes, separated at their perimeter with internal frames, supplemented by sealing laid around them. The purpose of the internal frames is to maintain the distance between the individual panes of the glazing unit and to form cavities filled with gas, which constitute thermal insulation. At least one pane of the glazing unit, situated at the external side of the window when it is closed, is extended in relation to other panes of the glazing unit, overlapping, in a closed window, the bottom sash member of the window frame. It provides a drainage for rainwater, flowing on the pane beyond the window frame, onto the roof plane below the window. The bottom window sash member is lowered in relation to the side members of the window frame, correspondingly to the thickness of the extended pane.

[0010] Apart from the walls adjacent to the side surfaces of the glazing unit or the sash frame, made of a material with a low thermal conductivity, particularly of a plastic, the roof window has also an additional frame of the sash, particularly wooden, situated at the internal side of the glazing unit, when the window is closed. On the additional frame of the sash, elements locking the window sash in a closed position are installed, such as a handle, a bolt latch, or other known locking elements. Optionally, internal accessories of the window sash may

be installed on the additional frame of the sash, for instance textile roller shutters, together with their system for unrolling and storage in the rolled-up state.

[0011] Also the window frame of the roof window may have an additional frame of the window frame, particularly wooden, situated at the internal side of the window. On the additional frame of the window frame, elements locking the window are installed, mating with locking elements corresponding to them, seated on the frame of the sash. For example, it is a bolt socket, mating with the bolt of the handle seated in the additional frame of the sash.

[0012] Embodiments. Embodiments of a roof window at least pivoting, being the subject of the invention, are presented in the drawing, with the individual Figures showing:

Fig. 1 - The window being opened only in the pivoting mode, in a partially opened state - in an axonometric view.

Fig. 2 - A cross-sectional view through the side members of the sash and the window frame, and through a pivoting hinge of the window from Fig. 1.

Fig. 3 - A cross-section through the bottom members of the sash and window frame of the window from Fig. 1.

Fig. 4 - The window frame of the window from Fig. 1 with the pivoting hinges - in an axonometric view.

Fig. 5 - The window frame of a dual-action window, being opened as pivoting or tilting, with the hinges set - in an axonometric view.

Fig. 6 - Distribution of isotherms on a cross-section of a window from state of art.

Fig. 7 - Distribution of isotherms on a cross-section of the window according to the invention, installed within the roof structure.

[0013] Example 1. A roof window, opened in a single-action mode, as a pivoting window, has a window sash **1**, with a glazing unit **2**, connected, in order to open the window pivotally, with a window frame **3**, which is fixed to the roof structure through its support flashing **4**. The window sash **1** has thin side walls **11** at least on its sides, made of a plastic, serving the purpose of side sash frame members, and adjacent to the side edges of the glazing unit **2** at their whole length. Preferably, the plastic walls are situated also at the top and bottom edges of the glazing unit, while the cross-section of walls in these sections may be different than on the sides of the sash. The glazing unit **2** is composed of four single panes **21**, separated with internal frames **22**, located at the perimeter of these panes and supplemented by a sealing **23**, laid around

these frames. The purpose of the internal frames **22** is to maintain the distance between the individual panes **21** of the glazing unit **2**, and together with the sealing **23**, these frames form gas cavities between the panes **21**, the cavities constituting thermal insulation of the window sash.

[0014] The window sash **1** of the window opened in the pivoting mode, is connected with the window frame **3** via the pivoting hinges **5**, fixed onto the window frame in the middle zone of the height of the window, usually slightly below the middle of the window. In the window opened in the pivoting mode, the window sash **1**, in its every position is located inside the window frame **3**, at least with its middle part connected by pivoting hinges **5** with the window frame. In the open state of the pivoting window, irrespective of its angle of opening, the lower part of the sash is outside the building, while the upper part of the sash is inside, in the attic. In a closed window, the whole window sash **1** is situated in the opening of the window frame **3**, in parallel to the frame. The pivoting hinges **5** are situated at the external side of the window, so as to centres of mass of moving elements **51** of these hinges mating with the sash, are situated above the glazing unit **2**, when the window is closed.

[0015] As thin side plastic walls **11** are used as the side members of the sash, the glazing unit **2** has a very large share in the whole width of the sash **1**, the width of the glazing unit **2** being almost equal to the width of the opening in the window frame. The distance **P** between the edges of the glazing unit **2** and the inside surfaces of the side members of the window frame is not longer than three times the width **S** of the gap between the window frame and the window sash, and it is not longer than 20 millimetres. Above the glazing unit **2**, or outside the window, the side wall **11** is thickened, and a duct **12** running along the whole side wall is located in the thickening. In the duct **12**, a reinforcing insert **13** is placed, particularly a metal insert, of bended plate, situated in the middle section of length of the side wall **11** of the sash. The reinforcing insert **13** is connected with a moving part **51** of the pivoting hinges **5**, using threaded fasteners **52**, being self-tapping screws, penetrating the top wall of the duct **12** in the side wall **11** of the sash. The reinforcing insert **13** reinforces and stiffens the side wall **11** of the sash, particularly in its connection point with the moving part **51** of the pivoting hinges **5**. Length of the reinforcing insert **13** and proportion of its length to the length of the side wall **11** of the sash, is selected depending on dimensions and mass of the whole sash **1**.

[0016] The window frame **3** has a form of a rectangular frame with the following main elements: two side window frame members **31**, a top window frame member **32** and a bottom window frame member **33**. Both side window frame members **31** have thin walls **34** with a low thermal conductivity, made of a plastic, situated in the window frame from the side of the sash **1** of the window, while the main bulk of side window frame members **31** is formed by a filling made of an insulating material, partic-

ularly a porous material. In the walls **34**, T-shaped grooves **35** are situated along the window frame members, and in these grooves, weather strips **36** are mounted, with freely moving flaps adjacent, in a closed window, to the side surfaces of the sash **1**.

[0017] In parallel to the walls **34** of the side window frame members **31**, the side walls **11** of the sash **1** have an extension **14** towards the external side of the window when it is closed, i.e. towards the inside of the attic. In the extensions **14** of the side walls **11**, longitudinal fitting grooves **15**, are located, situated at the external side of these walls, in relation to the glazing unit **2**. The fitting grooves **15** in the side walls **11** of the sash are intended for elements sliding along the sash belonging to the set for side locking (not shown in the Figure) of the sash **1** in the window frame **3**.

[0018] The window frame **3** has a support flashing **4** in the form of an open frame, placed at the external side of the window on the side window frame members **31** and the top window frame member, connecting the window frame with the roof structure. A wall **34** is connected with the support flashing **4**, the wall being adjacent to the side window frame member **31** and having a connecting lip **37** situated above the frame member **31**, laid on the internal lip **41** of the support flashing. The filling of the side window frame members **31** is glued both to the plastic walls **34**, and to the support flashing **4** of the window frame. The top member of the window frame (not shown in the cross-section) is built in the same way, and the wall of the frame member situated from the side of the window sash, is connected with the walls **34** of the side members at its ends, forming, together with them, a frame surrounding the opening in the window frame for a sash **1** from at least three sides.

[0019] The support flashing **4**, while being adjacent from the external side of the window to the side members **31** and the top member **32** of the window frame, protrudes beyond the outline of these members sideways and towards the upper section of the roof plane, and it is founded on the roof supporting structure **6** with this protruding part, on horizontal tile battens **61**, being a support for roofing-tiles **62**, while the tile battens rest on counter battens **63** laid on rafters **64**, being the base supporting elements of the roof structure. The support flashing **4** has a lip on its sections laid on the side members **31** and on the top member **32** of the window frame, the lip forming an open installation frame **42** on these three sections of the flashing. The open installation frame serves the purpose of connection of the detailing **65** of the window with the support flashing **4**, the detailing being installed in the roof structure, while the purpose of the detailing is to seal the mounting of the window in the roof structure.

[0020] To the support flashing **4**, on its side sections, which rest on the side members **31** of the window frame, at the external side of the window, stationary parts **53** of the pivoting hinges **5** are fixed, situated slightly above the middle of the length of the side members **31** of the window frame (the drawing - Fig. 4). In the pivoting hinges

5, both their stationary parts **53** and moving parts **51**, mating with the sash **1** of the window, as well as axes **54** of the hinge, are situated above the support flashing **2**, as well as above the glazing unit **41** in the sash **4** of the window, the unit consisting of four panes separated with internal frames. Only a small strip **55** belonging to the moving part **51** of the pivoting hinge, enters partially the space between the side member **31** of the window frame and the side wall **11** of the sash **1**, in order to stabilise this part of the hinge on the sash **1**.

[0021] The window has also a set of shields **7** for the gaps between the window frame **3** and the sash **1**, and each of these shields covers the side member **31** or the top member **32** of the window frame, together with that elements of the sash which corresponds to this frame member. Every of the shields covering the side window frame members **31** consists of two sections, i.e. a bottom section **71** situated between the pivoting hinges **5** and the bottom window frame member **33**, and a top section **72** situated between the pivoting hinges **5** and the top window frame member **32**. The bottom sections **71** of the shields are fixed on the lower part of the sash **1**, and during opening of the window, they move together with the sash towards the exterior of the roof. The top sections **72** of the shields are fixed immovably to the window frame **3**. In a closed window, the top and bottom sections of the shields are positioned along the side members of the window frame, and the bottom ends of the top sections **72** overlap the top ends of the bottom sections **71** of the shields, ensuring the downflow of water from precipitations. The pivoting hinges **5**, both in stationary parts **53** and movable parts **51**, are situated as a whole under the shields **7**. On the top member **32** of the window frame, there is a top shield **73** fixed to this frame member. In the glazing unit **2** mounted in the sash **1**, one pane **21** situated at the external side of the window when it is closed, has an extension **24**, protruding beyond the other panes **21** of the glazing unit, the extension overlapping the bottom member **33** of the window frame in a closed window, providing a drainage for rainwater, flowing down on the pane, beyond the window frame.

[0022] Apart from thin plastic walls **11** adjacent to the side surfaces of the glazing unit **2**, the window sash **1** of the roof window has also an additional wooden frame of the sash **17**, situated on the internal side of the glazing unit **2** when the window is closed. Also the window frame **3** has an additional wooden frame **38** of the window frame, situated on the internal side of the window. The bottom member of this additional frame is the bottom member **13** of the whole window frame. In the bottom member **18** of the additional frame of the sash **17**, a handle **8** is installed, and in the duct hollowed in this member, there are horizontal pushers **81** terminated with bolts, shifted out sideways, in both directions, from the additional frame of the sash. In a bolted state of the window, these bolts are inserted into their respective bolt sockets, situated in side members of the additional frame **38** of the window frame. On the additional frame of the sash

17, internal accessories of the window sash may be installed, for instance textile roller shutters, with their system for unrolling and storage in the rolled-up state.

[0023] Example 2. A dual-action roof window, opened as a pivot window or as a tilt window, has a window sash **1** with a glazing unit **2**, and window frame **3** with a support flashing **4**, identical as in the first embodiment - therefore the following Figures of the drawing remain valid for this example: 1, 2 and 3, in the scope showing these subsets of the window. The hinges connecting the window frame with the sash are realised in a different way, because of two functions of opening the window.

[0024] In the pivoting hinges, their movable elements **51** mating with the sash **1** are identical as in the first embodiment, and they are also identically connected with the sash through a reinforcing insert **13**. However, there are no stationary elements of the hinges fixed to the window frame in this embodiment - they are replaced by intermediate hinge elements **56**, installed at the ends of intermediate arms **57**, which are connected with the support flashing **4** of the window frame **3** through tilting hinges **58**, situated near the top member **32** of the window frame. Centres of mass of every element of the dual-action hinge set, i.e. the movable element **51**, the intermediate hinge element **56**, both in a pivoting hinge, the intermediate arm **57** and the tilting hinge **58**, are located above the support flashing, and at the same time, these elements are situated under the shields **7**.

[0025] The intermediate arms **57** of the hinge set in a dual-action window either rest on the window frame member, or are raised above the window frame **3**, depending on the opening function of the window. They are shown in Fig. 5, and for the sake of demonstration, the left-hand arm is shown as raised, and the right-hand arm - as resting on the window frame. Actually, both intermediate arms have the same position, on both sides of the window. During pivoting opening, the intermediate arms **57** rest on the window frame along the side members **31**, and the window sash rotates in the pivoting hinges, that is the movable elements **51** of these hinges rotate in relation to the intermediate hinge elements **56**, as in the first embodiment. During tilting opening, the window sash rotates in the tilting hinges **58**, and the intermediate arms **57** raise together with the sash.

[0026] The shields on both side members of the window frame have bottom **71** and top **72** sections, identical as in the first embodiment, while the bottom sections **71** are fixed on the lower part of the sash **1**, and the top sections **71** - on the intermediate arms **57**. During opening of the window in the pivoting mode, the bottom sections **71** of the shields move together with the lower part of the sash **1** towards the exterior of the roof, and the top sections **72** of these shields rest immovably, together with the intermediate arms, on the window frame **3**, as shown in Fig. 1. During opening of the window in the tilting mode, both the bottom sections **71** and the top sections **72** of the shields move together with the whole sash **1** towards the exterior of the roof, and the respective

position of the bottoms shields **71** in relation to the top shields **72** is the same as in a closed window.

[0027] Advantages of the invention. A window according to the invention has an improved thermal performance, resulting from the introduction of important changes. The first change is placement of the hinges outside the window, above the glazing unit and the window frame, eliminating thermal bridges present in the hitherto used solution of the hinges. The second change is fixing the window in the roof using a support flashing, resting on the window frame members, also on the external side of the window, enabling to immerse the window frame and the window sash into the layered structure of the roof.

[0028] It is illustrated by isotherm plots in Figs. 6 and 7 of the drawing, where Fig. 6 shows distribution of isotherms on a cross-section of the window from state of art, and Fig. 7 - distribution of isotherms on a cross-section of the window according to the invention. In a known window, a concentration of isotherms occurs, particularly nearly the confluence of the side surface of the window frame with the surface resting on the batten of the roof structure (Fig. 7), proving an intense and fast heat flow via this way from the attic to the outside, and therefore, heat losses. In a window according to the invention, distribution of isotherms is uniform, and distances between them are longer, indicating that the heat flow rate is lower, or heat losses are smaller, and thermal performance of the window is better.

Claims

1. A roof window, at least pivoting, equipped with a window frame consisting of a top window frame member, a bottom window frame member and two side window frame members, and having a window sash with a glazing unit, being opened at least in a pivoting way, i.e. by rotation of the sash around a horizontal axis located between the top and the bottom member of the window frame, so as to in every phase of the window opening, part of the sash runs through the opening in the window frame; the window having two sets of hinges in which the window sash is installed, situated at both side edges of the window, preferably above the middle of the height of the sash, defined as "pivoting hinges", as well as having sash locking sets in a closed position, while the window is also equipped with shields for gaps between the sash and the window frame, including side gaps, and with sealing sets in these gaps, and the pivoting hinges are placed under the shields of the side gaps, **characterised in that** in the pivoting hinges (**5**), centres of mass of elements of these hinges mating with the sash (**1**), are situated above the external surface of the glazing unit (**2**) when the window is closed.
2. A roof window, according to claim 1, **characterised in that** the window sash (**1**) has walls (**11**) made of a material with a low thermal conductivity, adjacent to the side surfaces of the glazing unit (**2**) at least in part of length of the side edges of the sash (**1**), while preferably these walls form a frame of the sash surrounding glazing unit (**2**), and the elements of fitting of the window, such as hinges (**5**), handles (**8**), bolts, are situated, each of them in the whole, by the external and internal sides of the glazing unit.
3. A roof window, according to claim 3, **characterised in that** the walls (**11**) adjacent to the side surfaces of the glazing unit have extensions (**14**) towards the external side of the sash when the window is closed, and these extensions have fitting grooves (**15**) for sliding elements belonging to the set for side locking of the sash in the window frame.
4. A roof window, according to claim 1, or 2, or 3, **characterised in that** the distance (**P**) between the edges of the glazing unit (**2**), and the inside surfaces of the side members (**31**) of the window frame (**3**) is not longer than three times the width (**S**) of the gap between the window frame (**3**) and the window sash (**1**), and is not longer than 20 millimetres.
5. A roof window, according to claim 2, or 3, or 4, **characterised in that** the side walls (**11**) of the sash (**1**), particularly the side members of the sash frame, have reinforcing inserts (**13**), situated on the external side of the window, connected with the movable elements (**51**) of the pivoting hinges (**5**).
6. A roof window, according to claim 1, or 2, or 3, or 4, or 5, **characterised in that** the window frame (**3**) has at least one structural element connecting it with the roof, the element resting on the surface of the window frame members (**3**), at the external side of the window, and protruding beyond the outline of the window frame members.
7. A roof window, according to claim 6, **characterised in that** the structural element of the window frame (**3**) connecting it with the roof is a support flashing (**4**), and the window frame preferably has walls (**34**) made of a material with a low thermal conductivity, particularly of a plastic, situated in the window frame members (**5**), at least from the side of the sash (**1**), along the support flashing (**4**), transversely to its surface resting on the roof.
8. A roof window, according to claim 7, **characterised in that** the pivoting hinges (**5**) are fixed to the structural element of the window frame connecting the frame with the roof.
9. A roof window, according to claim 1, or 2, or 3, or 4, or 5, or 6, or 7, **characterised in that** it has hinges

situated near the top edge of the window, for opening the window in the tilting mode, hereinafter referred to as "tilting hinges" (58), and the arms connecting the tilting hinges (58) with the pivoting hinges (56, 51) are situated under the shields (7, 72) of the side gaps. 5

10. A roof window, according to claim 1, or 2, or 3, or 4, or 5, or 6, or 7, or 8, or 9, **characterised in that** one pane (21) of the glazing unit (2), situated at the external side of the window when it is closed, has an extension (24), protruding beyond the other panes of the glazing unit (2), the extension overlapping the bottom member (33) of the window frame in a closed window. 10 15

11. A roof window, according to claim 1, or 2, or 3, or 4, or 5, or 6, or 7, or 8, or 9, or 10, **characterised in that** has an additional frame of the sash (17), particularly wooden, situated at the internal side of the glazing unit (2), when the window is closed, on which elements locking the window sash in a closed position, as well as optional internal accessories of the window sash are installed. 20 25

12. A roof window, according to claim 11, **characterised in that** has an additional frame of the window frame (38), particularly wooden, situated at the internal side of the window, on which elements locking the window are installed, mating with locking elements corresponding to them, seated on the frame of the sash. 30 35 40 45 50 55

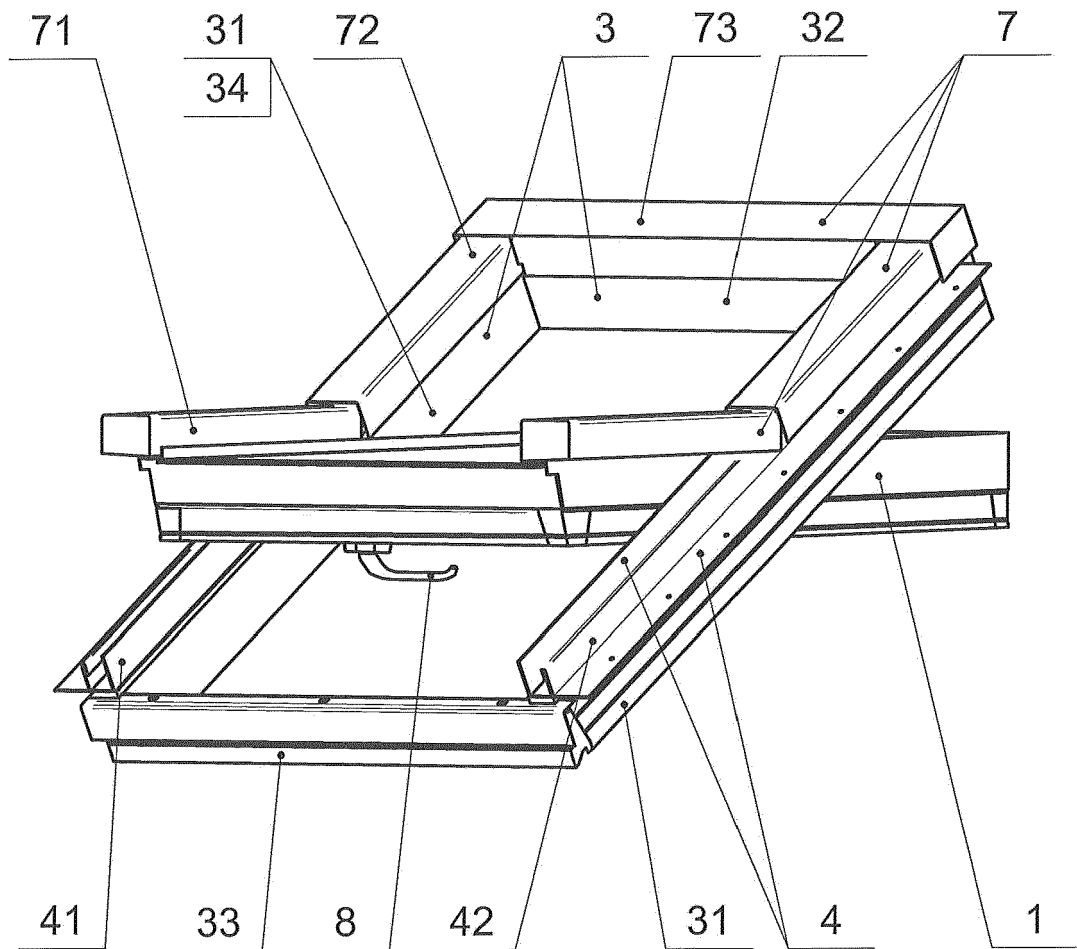


Fig. 1

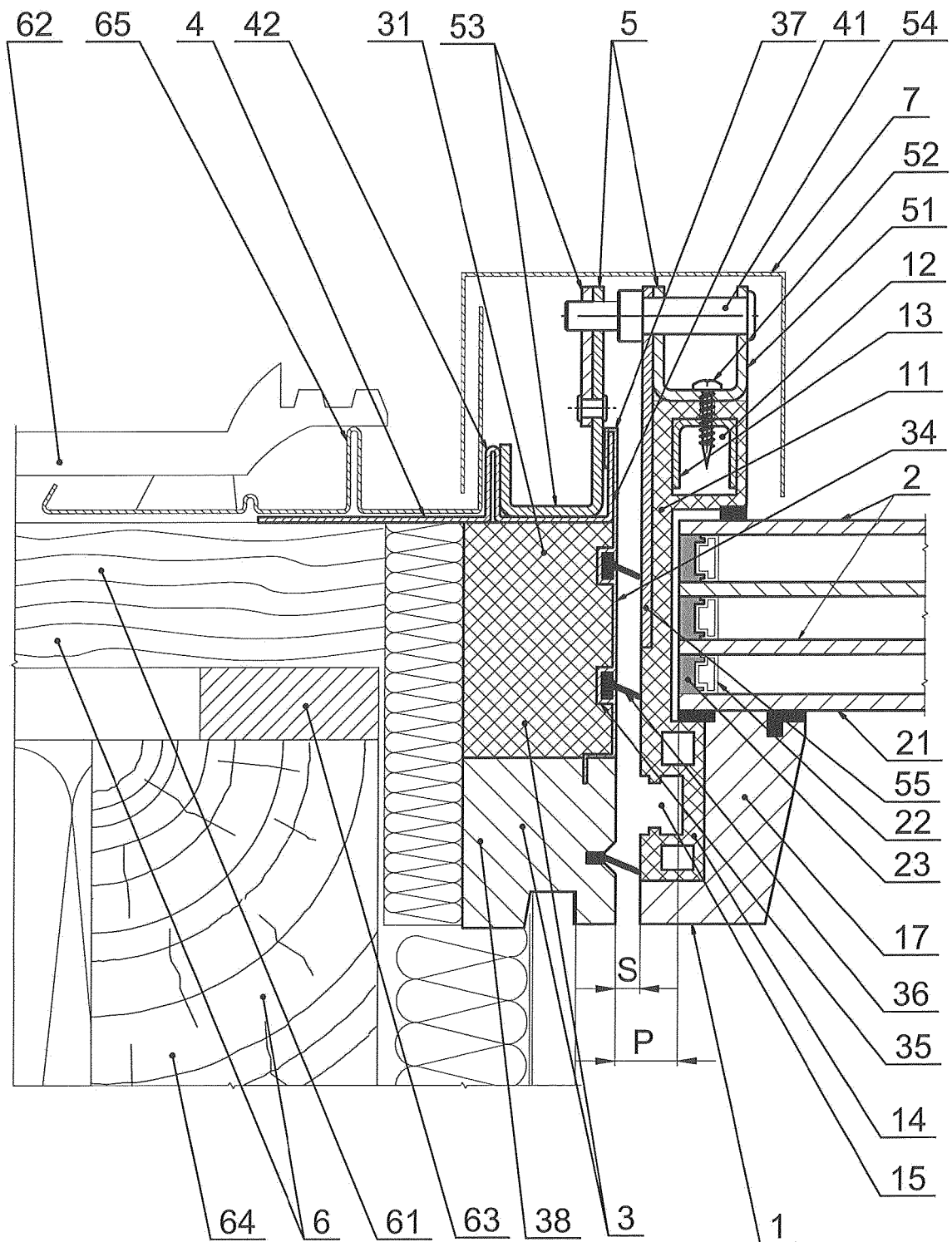


Fig. 2

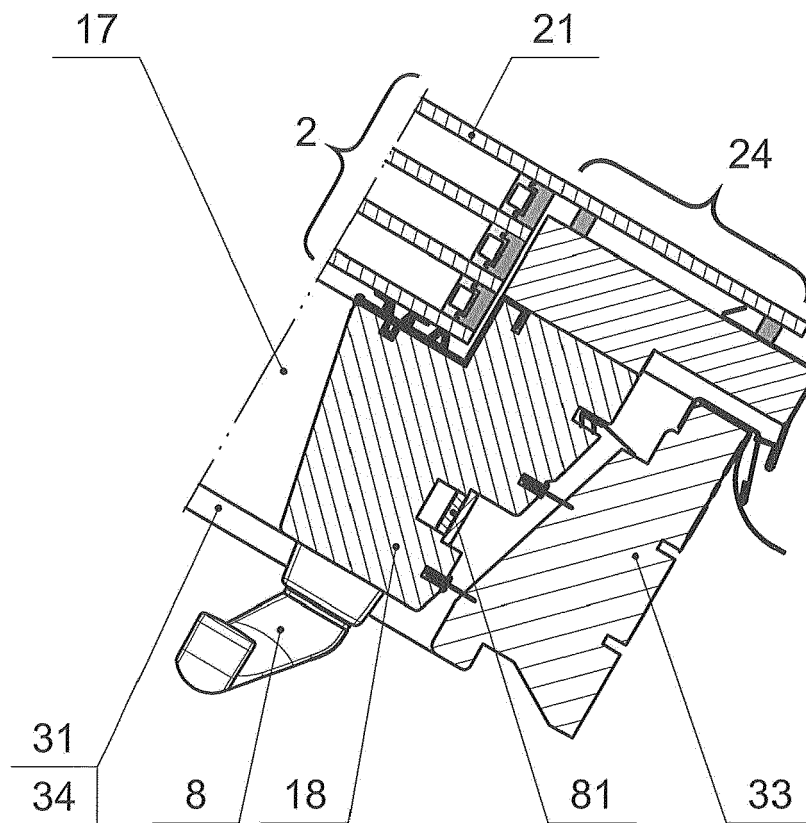


Fig. 3

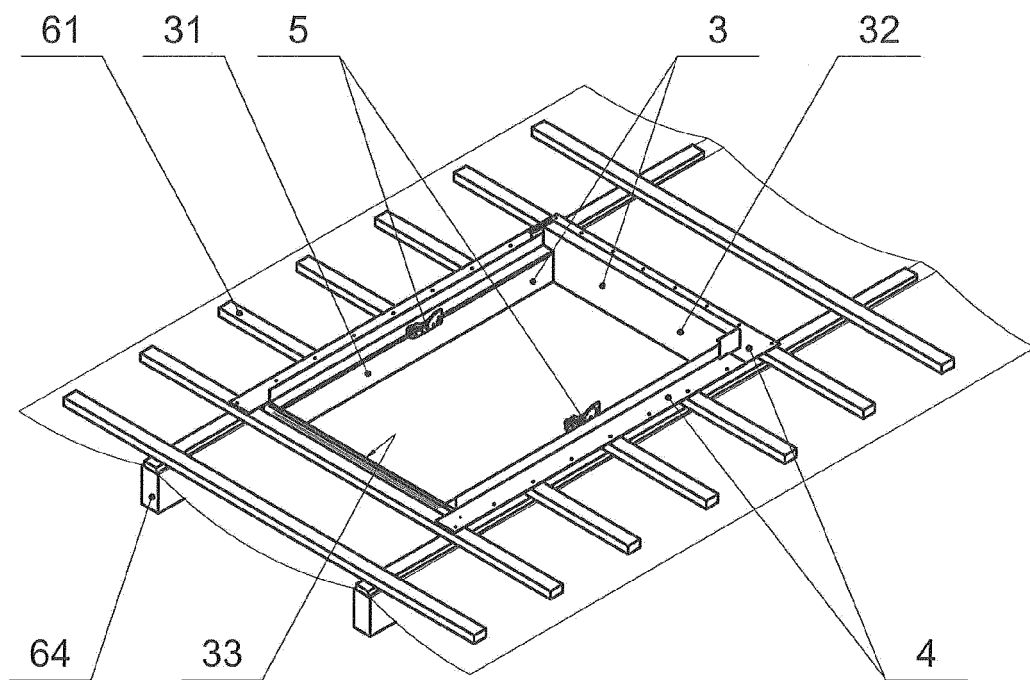


Fig. 4

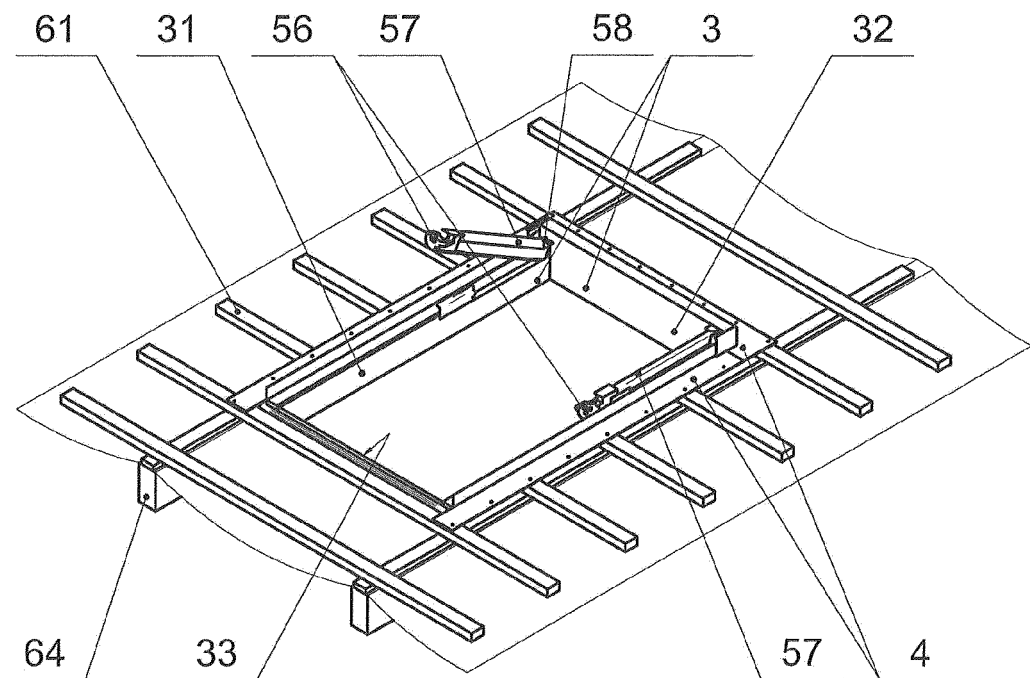


Fig. 5

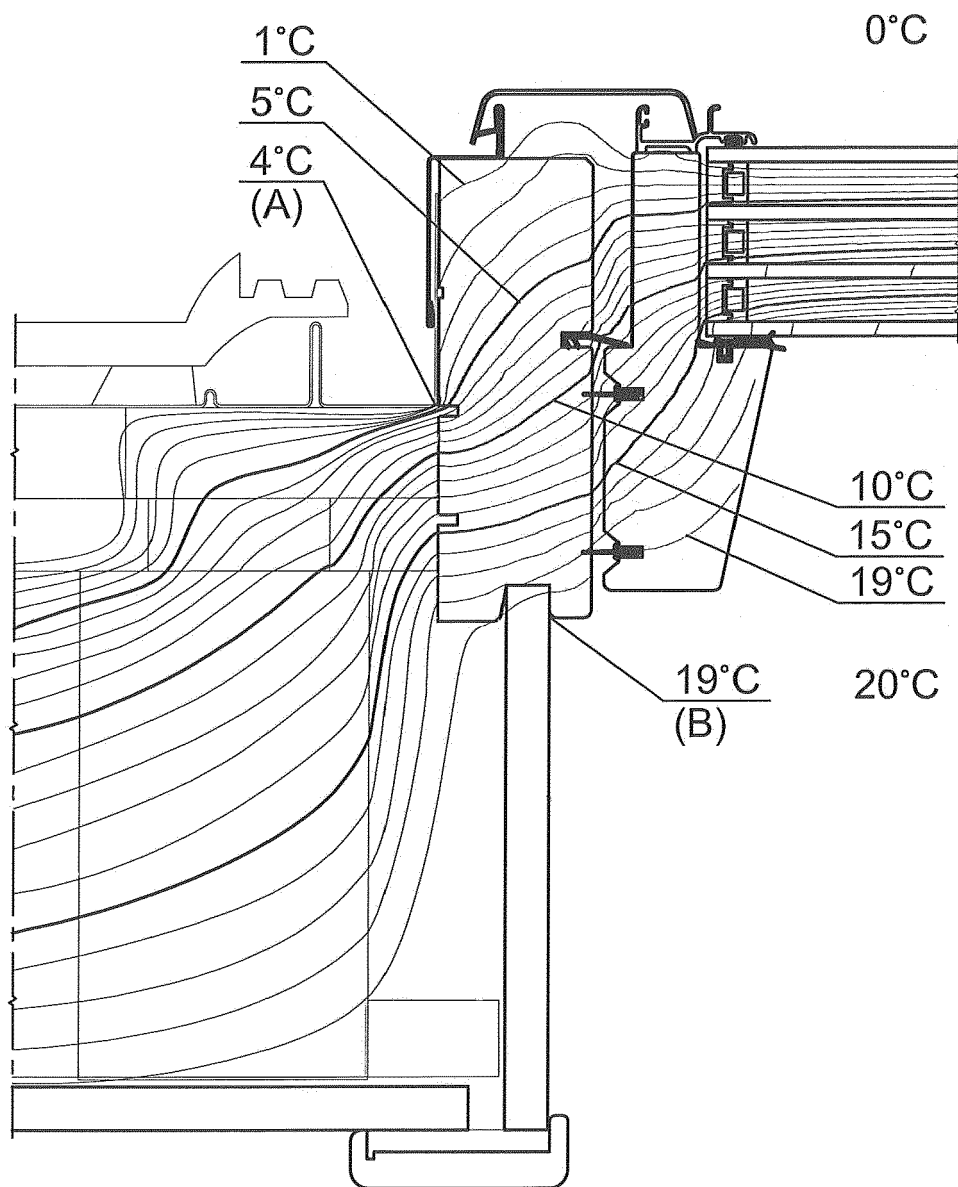


Fig. 6

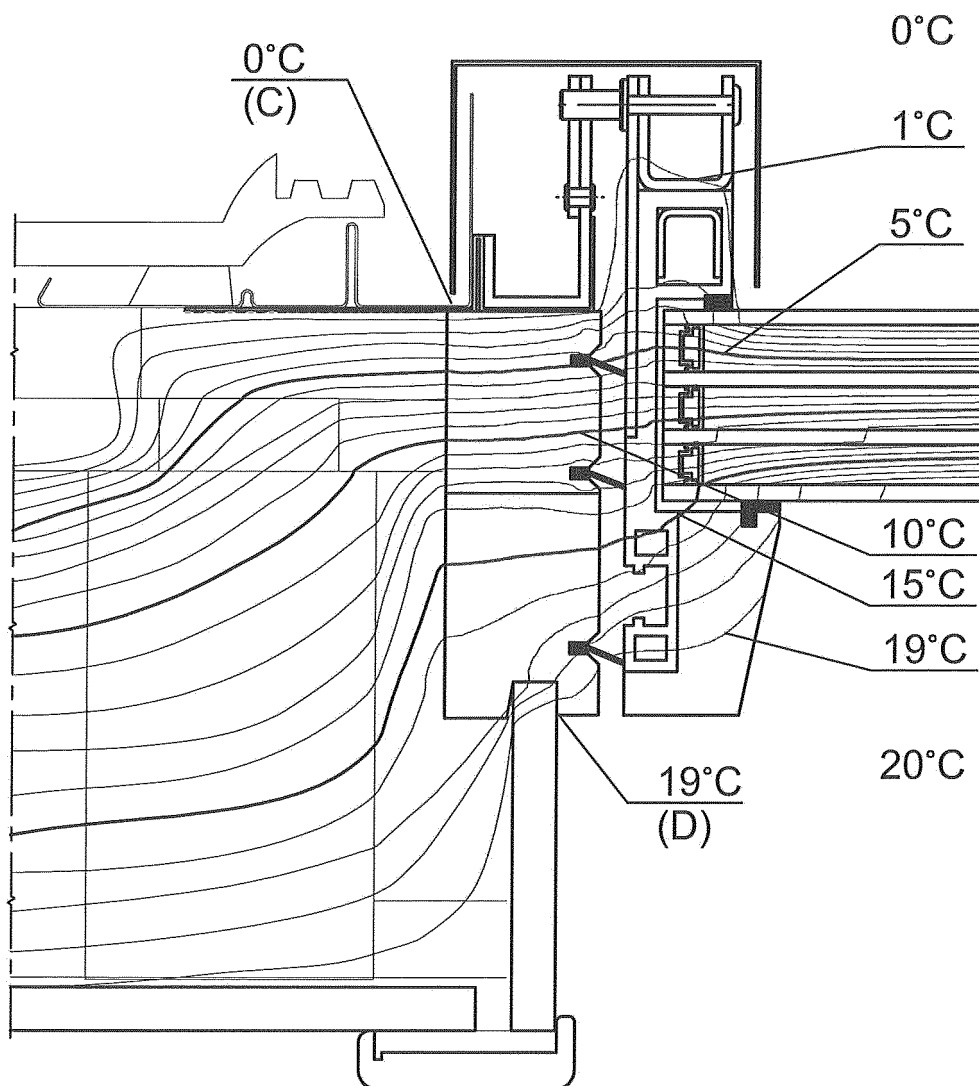


Fig. 7

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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