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(54) **INTERMEDIATE ARM ASSEMBLY FOR A DUAL-FUNCTION ROOF WINDOW**

(57) An intermediate arm is composed of at least two sections, including a channel section (1) having shelves (12, 13) of various widths, and a Z-bar (2). The lower shelves (12, 22) of these two sections face each other and the opposite upper shelves (13, 22) of the two sections are adjacent to one another and are inseparably connected, especially by clinch connection. The intermediate arm has an articulated connection to the trough (3) by means of two connectors (51, 52), which together with the trough (3) and the intermediate arm form an articulated quadrilateral. The intermediate arm assembly has also a sash lifting support mechanism, whose slider (61) moves in the trough (3) and is connected by a support bracket (62) to the Z-bar (2) of the intermediate arm.

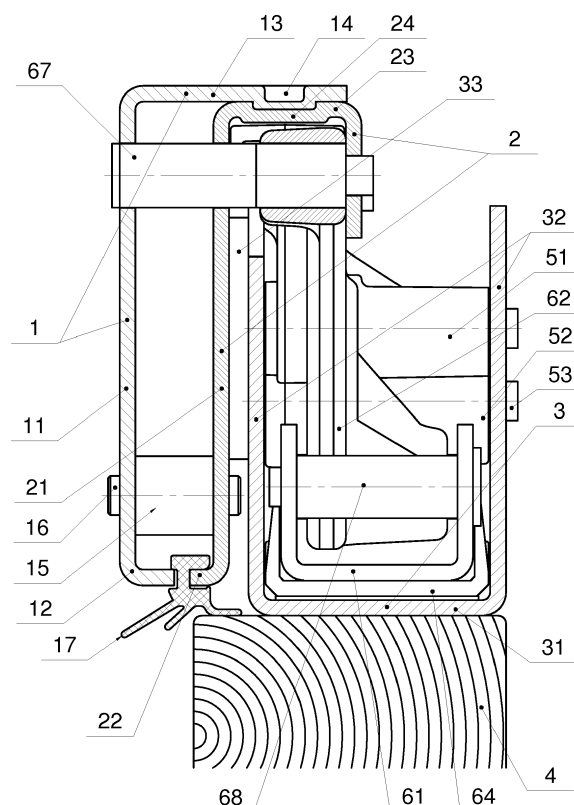


Fig. 2

Description

[0001] The invention relates to an intermediate arm assembly for a dual-function roof window that is arranged to connect the sash with the window frame and to allow one of two functions involved in the opening of the said window. Depending on the selection of the opening function, the two intermediate arms, located on both sides of the skylight window, either rest on the window frame or are lifted together with the window sash.

[0002] State of the art. For example from Polish patent PL 210344 B1 are known dual-function skylight windows, equipped with intermediate arms which allow opening and closing of the window in one of two functions, as selected by the window's user. The intermediate arms are made of open sections, especially made of bent sheet metal profiles. At their upper ends, the intermediate arms are attached by hinges to the window frame, and on their lower ends they have hinges to which the sash of the window is attached. The intermediate arms are fitted with mechanisms designed to alternatively lock both intermediate arms in a resting position on the window frame or lock the intermediate arms with the sash for joint movement.

[0003] Essence of the solution. The intermediate arm assembly for a dual-function roof window, opened in the pivoting function or in the tilting function, where said intermediate arm assembly comprises an intermediate arm composed of at least two sections, including a channel section comprising shelves of various widths. A lower shelves of these two sections, i.e. of the channel and of the other section, which may have a different cross-section, or may also be channel-shaped section, face each other. The upper shelves of said two sections, arranged opposite to the former, are adjacent to each other and inseparably connected. Both sections jointly form the box-type intermediate arm, with increased strength and stiffness.

[0004] The upper part of the intermediate arm is connected by a tilting hinge to a fixed fitting attached to the window frame. The tilting hinge executes opening of the window in the tilting function, that is by rotation of the sash around a horizontal axis located at the top of the window, near the upper member of the window frame.

[0005] At its lower part, the intermediate arm is connected by a pivoting hinge to the sash. The pivoting hinge executes the opening of the window in the pivoting function, that is by rotation of the sash around a horizontal axis located slightly above half the height of the window. When opening the window in the pivoting function, the lower part of the sash moves to the outside of the roof, while the upper part of the sash moves to the inside of the attic, whereas the intermediate arms rest on the side members of the window frame. When opening the window in the tilting fashion, the entire sash, together with the intermediate arms, moves to the outside of the roof. The complete skylight window features two symmetrical intermediate arm assemblies located on the right and left

side of the window.

[0006] The second section of the intermediate arm is a Z-bar, positioned so that the top shelves of the channel section and of the Z-bar are facing in the same direction. A webs of the channel section and of the Z-bar are located vertically, parallel to each other, forming the box-like structure of the intermediate arm. Preferably, the Z-bar has an additional wall, which is the bent end of its upper shelf, facing downwards. This makes it possible to insert various fasteners into the intermediate arm such as axles, pegs or pins, recessed in the web and in the additional wall of the Z-bar, connecting the intermediate arm to other components of the intermediate arm assembly. The additional wall of the Z-bar along with its web is also used to attach the pivoting hinge to the lower end of the intermediate arm.

[0007] The permanent connection of the upper shelf of the channel section's to the upper shelf of the Z-bar is a clinch connection, obtained by means of a set of joint embossings of these shelves in both sections. During embossing there occurs a radial flow of the two combined materials, which creates a shaped joint similar in nature to a rivet connection, but using only the original material of the two joined parts. The upper shelves of the two sections may be alternatively joined by their spot or linear welding, or else plug welding, or classical riveting.

[0008] Between the ends of the lower shelf of the channel section and the lower shelf of the other section, e.g. a Z-bar, there is a slot extending over the entire length of the intermediate arm, while the web of the channel section and the web of the other section are connected by spacer pegs located near the lower shelves of the two sections. The ends of these spacer pegs are smaller than the middle part of the pegs, and these pass through the holes in the webs of both sections, and from the outside are unriveted. Recessed in the slot between the lower shelves of the two sections there is a gasket, placed along the intermediate arm, which with the window closed, is adjacent to the side member of the window frame.

[0009] The second variant for the intermediate arm section assembly is an arm formed by two channel sections, with upper shelves longer than the lower shelves. One of the channel sections has a web shorter than the other channel section, and this difference is equal to the thickness of the upper shelf. In this set of sections, the bottom shelves are facing each other, with a slot between them, while the upper shelves, adjacent to each other, thanks to the resulting double thickness, stiffen the box structure of the intermediate arm. The webs of the two channel sections are connected by spacer pegs located near their lower shelves, as in the variant of the intermediate arm consisting of a channel section and a Z-bar.

[0010] The intermediate arm assembly also includes a fixed fitting attached to the window frame. One such fixed fitting is a trough with a channel cross-section, wherein the web of this channel section, i.e. the bottom of the trough, is arranged on the side member of the window frame and attached to that member by means of

fasteners selected depending on the material the members of the window frame are made of. When these members are wooden, the trough is attached to them with wood screws.

[0011] The tilting hinge, which connects the trough to the intermediate arm, is a set of two short connectors, namely: a lower connector and an upper connector, each of which is connected in a swiveling fashion, at one end to the side walls of the trough, and at the other end to the web and additional wall of the Z-bar. The distance to the axis on which the lower connector is mounted in the trough from the bottom of this trough is greater than the analogous distance to the axis on which the upper connector is mounted in the trough. The trough, both connectors and the intermediate arm form an articulated quadrilateral, whereby, when tilting the window open, the intermediate arms, together with the sash, slide out from beneath the stationary covers of the upper member of the window frame. From the nature of this articulated quadrilateral application also ensues the fact that the axis of rotation of the sash, when tilting the window open, does not have a fixed position but changes its position during movement.

[0012] The intermediate arm assembly is also equipped with a sash lifting support mechanism for opening of the window in its tilting function. In addition to this support, the mechanism, while balancing the weight of the sash, is also designed to maintain the sash in any open position selected by the window's user, and attenuates lowering of the sash during window closing. The sash lifting support mechanism consists of a slider that travels in and along the trough, and of a support bracket articulated by its ends with the slider and the intermediate arm, and has an assembly of springs driving the slider's movement, resulting in the intermediate arm being lifted by the support bracket, and, consequently, in rotation of the window's sash around its axis of tilting. The slider of the support mechanism is in the form of a channel section, whose web slides along the bottom of the trough, and mounted in the side walls of that channel section slider there is a spindle connecting the slider to the support bracket. The other end of the support bracket is connected to the intermediate arm by means of a spindle which is mounted in the web and in the additional wall of the intermediate arm Z-bar.

[0013] In the tilting hinge, spindles on which the lower connector and the upper connector are mounted in the trough are secured against rotation relative to the walls of that trough. Preferably, also spindles connecting both the upper and lower connector to the web and the additional wall of the intermediate arm Z-bar, are secured against rotation relative to the web and the additional wall of the Z-bar. Also, the spindle on which the support bracket is mounted in the side walls of the slider is secured against rotation relative to those walls. Preferably, also the spindle connecting the support bracket to the web and the additional wall of the intermediate arm Z-bar is secured against rotation relative to the web and the ad-

ditional wall of the Z-bar. Protection against rotation is achieved by recessing each spindle in a non-circular hole in at least one of the walls: of either the trough, the slider, the web or the additional wall of the Z-bar. The non-circular hole may be oval, circular with one or two chamfer cuts, or rectangular including square, and tailored to that shape is the cross-section of the stub of the spindle inserted in that hole.

[0014] The intermediate arm assembly has also an adjustment wedge for positioning of the intermediate arm relative to the side member of the window frame. The adjustment wedge is slide mounted in the intermediate arm, near the pivoting hinge, or directly in the pivoting hinge's guide. Preferably, on the sloping surface of the adjustment wedge, and on the cooperating surface of the seat in the intermediate arm for that wedge, there are teeth for positioning of the adjustment wedge. The function of the adjustment wedges in both intermediate arms is to provide equal support of the arms on both sides of the window and to correctly position the pivoting hinges for the purpose of opening the window in its pivoting function.

[0015] Advantages of the invention. The intermediate arm being a set of two sections makes it possible for this arm to be of a box structure, which has the beneficial effect of increasing the stiffness and strength of the arm, while the clinch connections of both sections ensure the required durability of the joints. Use of Z-bar sections with an additional wall makes it easy to connect the intermediate arm with the tilting and pivoting hinges and with the support bracket of the sash lifting support mechanism. The longitudinal slot between the lower shelves of both sections facilitates attachment of a gasket, and the articulated quadrilateral tilting hinge allows for an increase in the opening angle of the window without collision with the covers of the upper member of the window frame.

[0016] The invention's embodiment. The intermediate arm assembly, which is the subject of the invention, is illustrated by the embodiment in the drawing, wherein individual figures represent the following:

Fig. 1 - Main components of the intermediate arm assembly, such as: intermediate arm (in its raised position), trough and slider with support bracket - in axonometric view.

Fig. 2 - The intermediate arm assembly with the arm resting on the window frame - in cross-section.

Fig. 3 - The intermediate arm assembly with the arm resting on the window frame and with springs to support sash lifting - as seen in a profile view of the skylight window.

Fig. 4 - The ending of the intermediate arm with a pivoting hinge and adjustment wedge - in axonometric view.

[0017] The intermediate arm assembly in a dual-function skylight window features an intermediate arm composed of two sections, i.e., a channel section **1**, whose web **11** is located and moves in the skylight window vertically, and a Z-bar **2** whose web **21** is also vertical, parallel to the web **11** of the channel section. The lower shelf **12** of the channel section and the bottom shelf **22** of the Z-bar face each other, whereas the upper shelf **13** of the channel section and the upper shelf **23** of the Z-bar, both longer than the lower shelves **12**, **22** of those sections, face the same way and are adjacent to each other. On the section of the upper shelves **13**, **23** of both sections, on the outer side of the web **21** of the Z-bar **2**, in the upper shelves **13** of the channel section there are embossings **14**, and in the upper shelves **23** of the Z-bar there are embossings **24** - formed jointly in both shelves **13**, **23**, forming a clinch connection. During embossing there occurs a radial flow of the material of both joined shelves, the effect being that the outer diameter of the embossing **14** is slightly larger than its outer diameter at the lower surface of the upper shelf **23**, and the outer surface of the embossing **14** is a cone that is slightly, by several degrees tapered upwards. This creates a shape joint, similar in its nature to a rivet connection, but using only the original material of both joined parts, without the additional material that a rivet would be. Clinch connections are spot joints, so that there are several joints of this type on the length of the channel section **1** and Z-bar **2**, with an appropriate number of these being used depending on the length of the intermediate arm, which depends on the size of the skylight window.

[0018] The Z-bar **2** has an additional wall **25**, which is an extension of its upper shelf **23**, bent downwards vertically and parallel to the web **21**. The additional wall **25** is designed to attach the components of the intermediate arm assembly to the intermediate arm, mainly to its Z-bar **2**, as described further herein.

[0019] Between the lower shelf **12** of the channel section **1** and the lower shelf **22** of the Z-bar **2** there is a slot extending along the entire intermediate arm. Due to the existence of this slot, the web **11** of the channel section **1** is connected to the web **21** of the Z-bar **2** by spacer pegs **15** spaced along the entire length of the intermediate arm. The stubs **16** of these spacer pegs **15**, with a diameter smaller than the middle section of these pegs, pass through openings in the webs **11**, **21** of the channel section and of the Z-bar, and are unriveted in the tapered drill holes. Fig. 2 shows the stubs **16** of the spacer pegs **15**, projecting from the webs **11**, **21** of the two sections, i.e. before unriveting of these stubs. A gasket **17** is mounted in the slot formed between the lower shelf **12** of the channel section and the lower shelf **22** of the Z-bar.

[0020] In the interior of the box structure of the intermediate arm, which is limited on the sides by the web **11** of the channel section **1** and the web **21** of the Z-bar **2**, are fitted mechanisms for controlling the opening of the window in its one or other function and controlling the correct operation of the window, for example, one of the

mechanisms disclosed in patents PL 210344 B1, PL 210917 B1, or PL 219336 B1. These mechanisms are not covered by the present invention, and therefore they are not presented in detail in the embodiment or in the drawing.

[0021] The intermediate arm assembly also includes a fixed fitting attached to the window frame, this being a trough **3** with a channel type cross-section. The bottom **31** of this trough is mounted on the side member **4** of the wooden window frame and is attached to it by wood screws (not shown in the drawing). In the trough **3**, near its upper end, a tilting hinge **5** is mounted, this being a set of two connectors, i.e. a lower connector **51** and an upper connector **52**. Each of these two connectors has at one end a hub with a width slightly smaller than the distance between the side walls **32** of the trough **3**, and each hub is rotationally mounted on a longer spindle **53** passing through the openings in the side walls **32** of the trough **3**. The opposing ends of the lower connector **51** and the upper connector **52**, i.e. the heads of these connectors, fit into the cavity formed by the upper section of the web **21**, the upper shelf **23**, and the additional wall **25** of the Z-bar **2**, and are connected to the Z-bar **2** and thus to the entire intermediate arm by means of shorter spindles **54** passing through the openings in the web **21** and the additional wall **25** of the Z-bar. The trough **3**, the lower connector **51**, the upper connector **52** and the intermediate arm together form an articulated quadrilateral, whose support is the trough **3**. The openings for the longer spindles **53** in the side walls **32** of the trough **3** and the holes for the shorter spindles **54** in the web **21** and in the additional wall **25** of the Z-bar **2** are not round, but have chamfer cuts on both sides. Thanks to this the spindles **53**, **54** are secured against rotation in these openings, which prevents wear on the surface of the holes, which, being narrower than the hubs and the heads of the connectors **51**, **52**, are exposed to higher loads.

[0022] The intermediate arm assembly has also a support mechanism **6** for lifting the sash when opening the window in the tilting function, and for balancing the weight of the sash in the open position or when the window is being closed. The main parts of the support mechanism **6** are: a slider **61** moving along the inside of the trough **3** and a support bracket **62** disposed between the slider **61** and the Z-bar **2** of the intermediate arm. The slider **61** is in the shape of a channel section, whose web **63** slides along the bottom **31** of the trough **3**, and in order to reduce friction, the slider **61** has plastic sliding caps **64** arranged between the web **63** of the slider **61** and the bottom **31** of the trough **3**; these caps overlap the side walls **65** of the slider **61**. On the outer side of the side wall **32** of the trough **3** an outer sliding cap **33** is attached to this wall, located between the side wall **32** of the trough and the web **21** of the Z-bar in the intermediate arm.

[0023] The support bracket **62** has at one end a hub having a width slightly smaller than the distance between the side walls **65** of the slider **61**, which is rotationally mounted on the slider spindle **66** passing through the

openings in the side walls **65** of the slider **61**. The opposite end of the support bracket **62**, i.e. its head, fits into the cavity formed by the upper section of the web **21**, the upper shelf **23** and the additional wall **25** of the Z-bar **2**, and is connected to the intermediate arm by a spindle **67** passing through the openings in the web **21** and in the additional wall **25** of the Z-bar **2** and in the web **11** of the channel section **1**. The openings for the slider spindle **66** in the side walls **65** of the slider **6**, and the openings for the spindle **67** in the web **11** of the channel section **1** and in the additional wall **25** of the Z-bar **2** are not round, but have chamfer cuts on both sides. Thanks to this, the slider spindle **66** is secured against rotation in the openings provided for it in the side walls **65** of the slider, and the spindle **67** is secured against rotation in the holes provided for it in the intermediate arm. This prevents wear on the surfaces of those openings, which, being narrower than the hub and the head of the support bracket **62**, are exposed to higher loads.

[0024] Cooperating with the sash lifting support mechanism **6** is a spring assembly **7** arranged along the member **4** of the window frame. These springs **7**, through their ends **71** terminating in a common hook **72** engaging the pin **68** exert a force on the slider **61** directed along the side member **4** of the window frame, and this force is transferred by the support bracket **62** to the intermediate arm as a force balancing the weight of the sash. The number and characteristics of the springs are chosen according to the size of the sash and its weight.

[0025] The intermediate arm is terminated by a pivoting hinge sub-assembly **8**, which is formed by the arch-shaped guide for that hinge. This cooperates with the arch-shaped slider, which forms part of the second pivoting hinge assembly **8** attached to the sash frame. The pivoting hinge's guide is comprised of a body **81** having a channel for the arch-shaped slider of the pivoting hinge, and a cap **82** which abuts the body **81** and closes the channel from the side. The guide's body **81** is partially inserted in the cavity formed by: the upper section of the web **21**, the upper shelf **23** and the additional wall **25** of the Z-bar **2**. The cap **82** has stubs **83** that pass through the holes in the body **81** and, after unriveting, the ends of these stubs form a connection of the cap **82** with the body **81** of the arch-shaped guide. Some of the stubs **83** of the cap **82** also pass through the web **21** of the Z-bar in the intermediate arm, attaching both the body **81**, and the cap **82** of the pivoting hinge's **8** guide to the Z-bar **2** in the intermediate arm.

[0026] In the bottom part of the body **81** of the pivoting hinge's **8** guide a sliding adjustment wedge **84** is inserted to adjust the position of the intermediate arm relative to the side member **4** of the window frame.

[0027] The sloping surface of the adjustment wedge **84** and the cooperating surface of the seat **85** accommodating this wedge are equipped with teeth **86** for positioning the adjustment wedge. Attachment of the adjustment wedge **84** in the seat **85** is executed by means of a screw **87** mounted in the body **81** of the pivoting hinge's

guide, passing through a longitudinal opening in the adjustment wedge **84**.

5 Claims

1. An intermediate arm assembly for a dual-function roof window, arranged to be opened by a pivoting function, that is by rotation of the sash around a horizontal axis located slightly above half the height of the window, and/or arranged to be opened by a tilting function by rotating the sash around a horizontal axis located at the top of the window, comprising:

- an intermediate arm connected in its upper part by a tilting hinge to a fixed fitting attached to the window frame and in its lower part connected by a pivoting hinge to the window sash,
- where window comprises two symmetrically arranged said intermediate arm assemblies located on the right and left side of the window,

characterized in that

the intermediate arm comprising at least two sections (**1**, **2**), from which a channel section (**1**) comprises a shelves (**12,13**) of various widths, wherein a bottom shelves (**12**, **22**) of said two sections are arranged to face each other and an opposing upper shelves (**13**, **23**) of said two sections are adjacent to each other and are inseparably connected.

2. The arm assembly according to claim 1, **characterized in that** the other intermediate arm section is a Z-bar (**2**) and the upper shelves (**13**, **23**) of the channel section and of the Z-bar are oriented in the same direction.
3. The arm assembly according to claim 2, **characterized in that** the Z-bar (**2**) comprises an additional wall (**25**), which is a bent end of its upper shelf (**23**), facing downwards.
4. The arm assembly according to claim 1, or 2, or 3, **characterized in that** a web (**11**) of the channel section (**1**) and a web (**21**) of the other section are connected by spacer pegs (**15**) located near the lower shelves (**12**, **22**) of the two sections, and between the ends of the lower shelf (**12**) of the channel section (**1**) and the bottom shelf (**22**) of the other section there is a slot in which a gasket (**17**) is mounted.
5. The arm assembly according to claim 1, or 2, or 3, or 4, **characterized in that** the connection of the upper shelf (**13**) of the channel section (**1**) to the upper shelf (**23**) of the other section is a clinch joint obtained by a set of common embossings (**14**, **24**) of the shelves of both sections.

6. The arm assembly according to claim 1, or 2, or 3, or 4, or 5, **characterized in that** the fixed fitting attached to the window frame is a trough (3) with a channel type cross-section, attached to the side member (4) of the window frame, and a tilting hinge (5) is an assembly of two connectors, i.e. a lower connector (51) and an upper connector (52), each of which is connected in a swiveling fashion at one end with the side walls (32) of the trough (3), and at the other end with the web (21) and the additional wall (25) of the Z-bar (2), so that the trough (5), both connectors (51, 52) and the intermediate arm form an articulated quadrilateral.
7. The arm assembly according to claim 6, **characterized in that** the distance from the bottom (31) of the trough to the spindle on which the lower connector (51) is mounted in the trough (3) is greater than the distance to the spindle on which the upper connector (52) is mounted.
8. The arm assembly according to claim 6, or 7, **characterized in that** the spindles (53), on which the lower (51) and the upper (52) connector are mounted in the trough (3), and preferably also the spindles (54) joining these two connectors (51, 52) with the web (21) and the additional wall (25) of the Z-bar (2) of the intermediate arm, are secured against rotating relative to the walls of the trough and the Z-bar respectively in which the spindles are mounted.
9. The arm assembly according to one of the claims from 1 to 8, **characterized in that** it has a support mechanism (6) for lifting the sash when opening the window in the tilting function, comprising a slider (61) which moves in the trough (3) and a support bracket (62) articulated and connected by its ends with the slider (61) and the intermediate arm, and furthermore, the support mechanism has a spring assembly (7) driving the slider's movement, resulting in the window being lifted by means of the intermediate arm's support bracket, and consequently rotation of the sash around its axis of tilting.
10. The arm assembly according to claim 8, **characterized in that** the slider (61) is in the form of a channel section, whose web (63) slides along the bottom of the trough (31), and in the side walls (65) of the said channel section slider (61) is mounted a spindle (66) connecting the slider (61) with the support bracket (62) whose other end is connected to the intermediate arm by means of the spindle (67) mounted in the web (21) and in the additional wall (25) of the Z-bar (2) of the intermediate arm.
11. The arm assembly according to claim 10, **characterized in that** the spindle (66) on which the support bracket is mounted in the side walls (65) of the slider (61), and preferably also the spindle (67) connecting the support bracket (62) to the web (21) and the additional wall (25) of the Z-bar (2) of the intermediate arm, is secured against rotation relative to the walls of the trough (3) and the Z-bar (2) respectively in which the spindles are mounted.
12. The arm assembly according to claim 8, or 11, **characterized in that** the spindle (53, 54, 66, 67) is mounted in at least one of the walls in a non-circular hole.
13. The arm assembly according to one of the claims from 1 to 12, **characterized in that** it has an adjustment wedge (84) for positioning the intermediate arm relative to the side member (4) of the window frame, which is slide mounted in the intermediate arm near the pivoting hinge (8).
14. The arm assembly according to claim 13, **characterized in that** in the adjustment wedge (84) on its sloping surface and also on the cooperating surface of the seat (85) in the intermediate arm, there are teeth (86) for positioning the adjustment wedge.

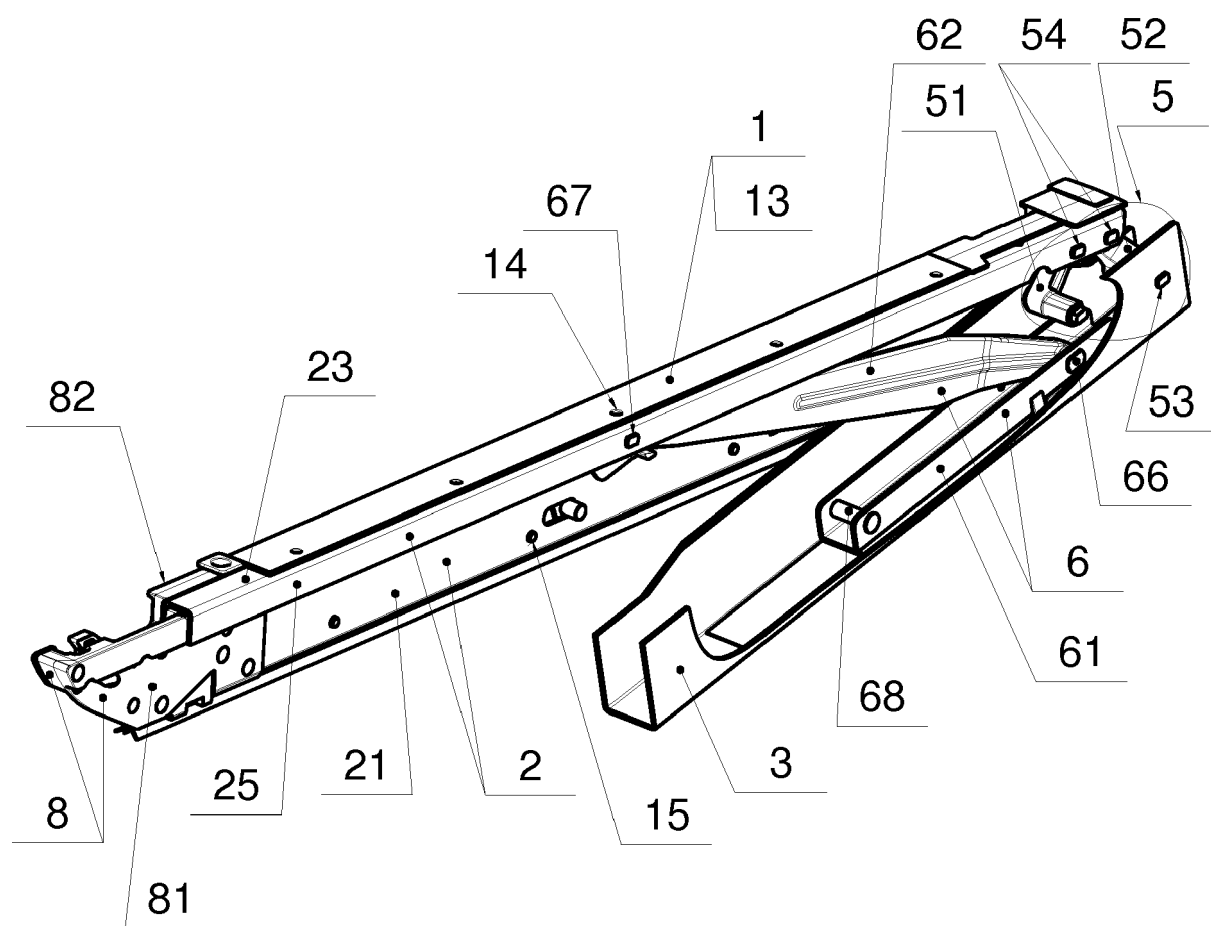


Fig. 1

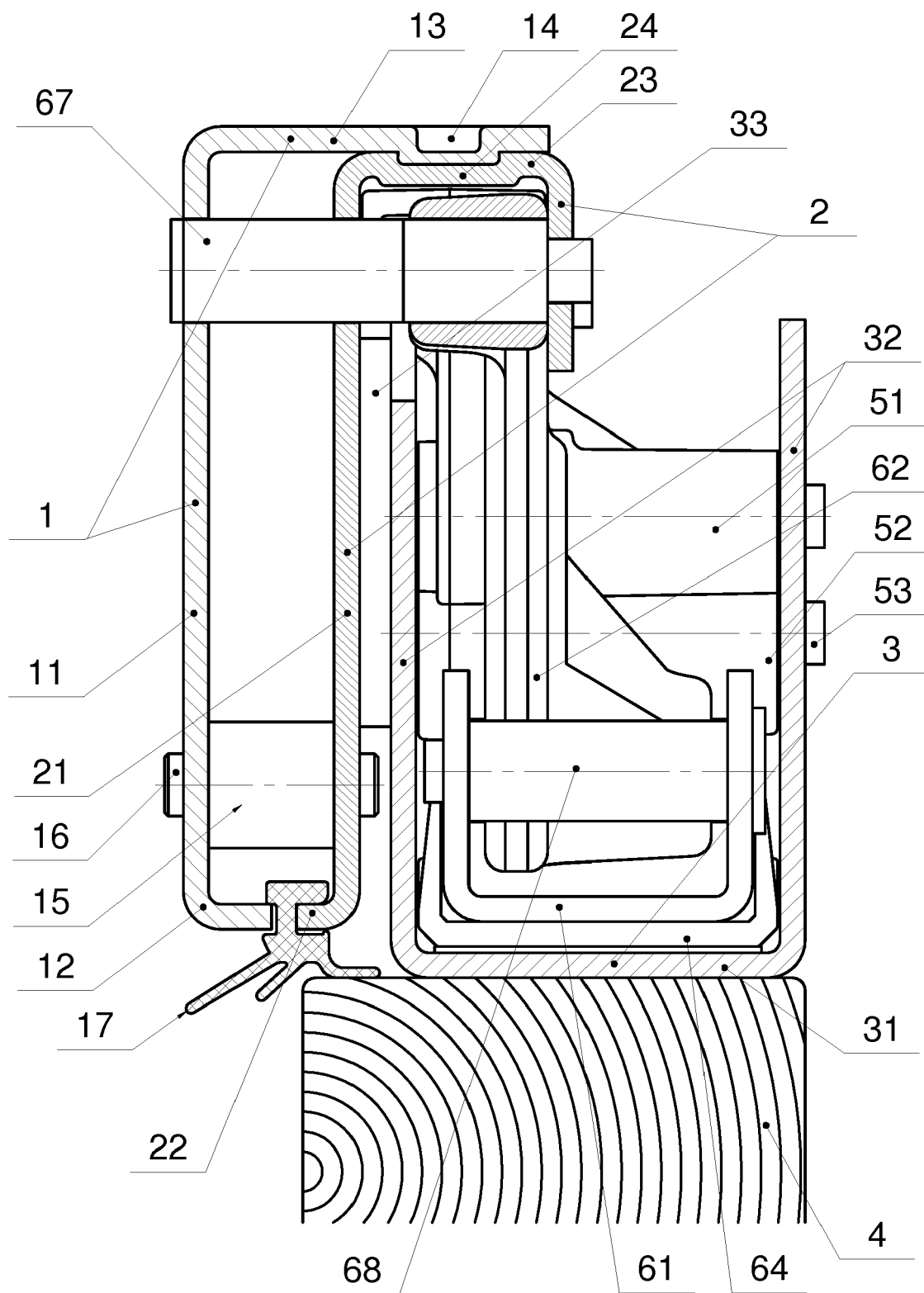


Fig. 2

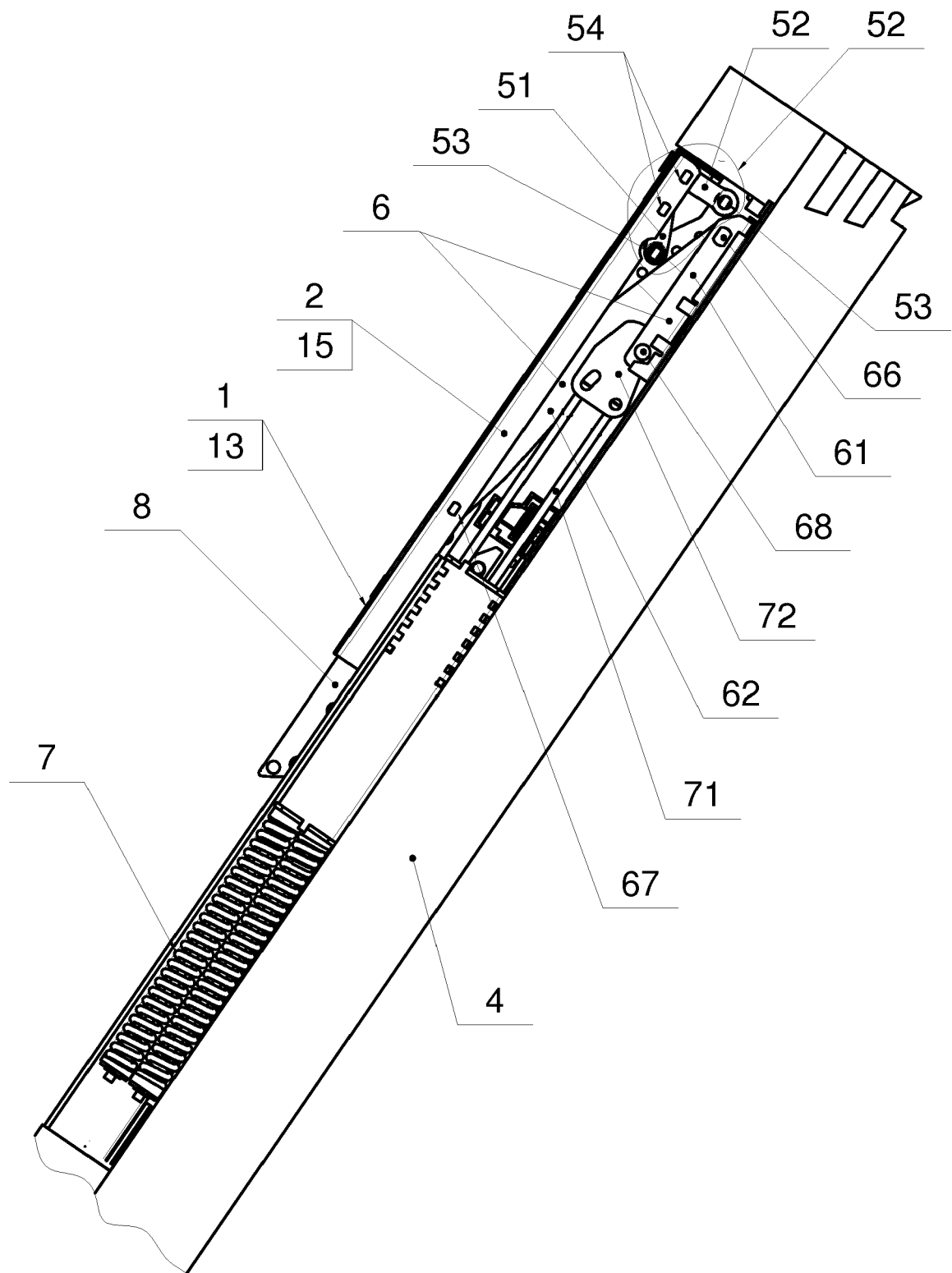


Fig. 3

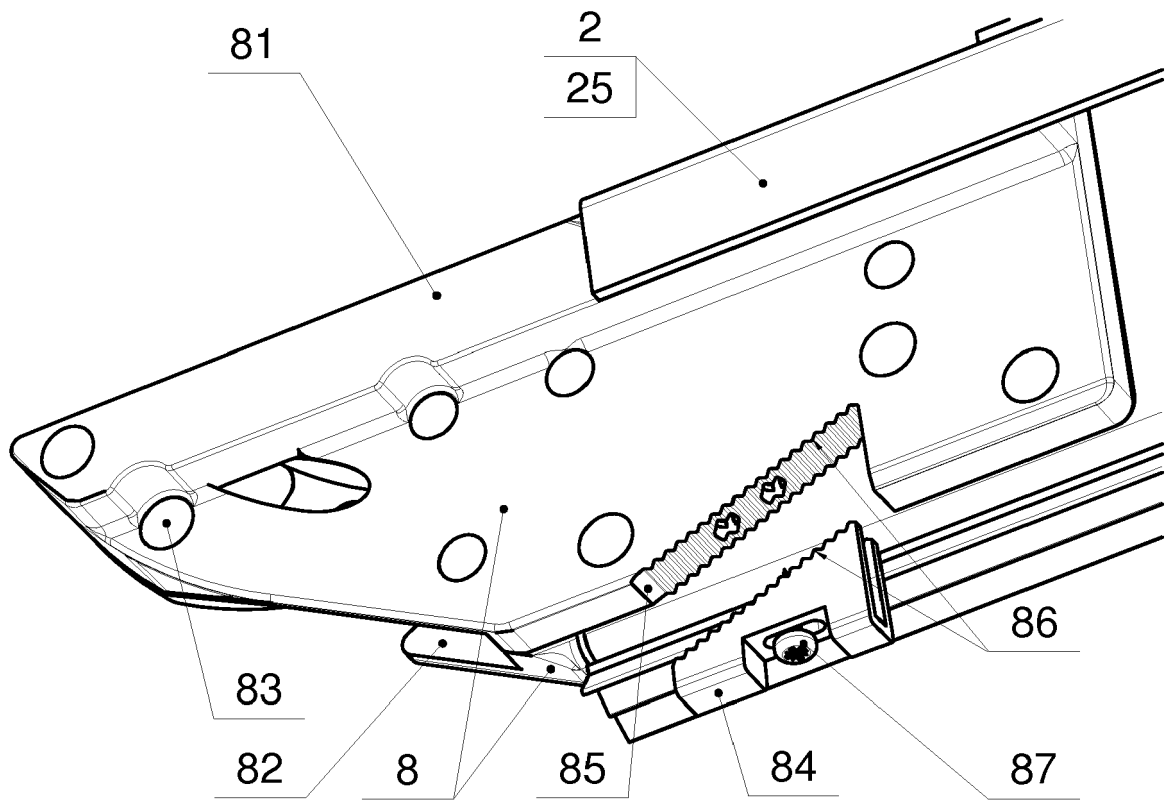


Fig. 4



EUROPEAN SEARCH REPORT

 Application Number
 EP 18 15 0276

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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 30 May 2018	Examiner Klemke, Beate
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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 EPO FORM 1503 03.02 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 18 15 0276

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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