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(54) **Vent operating mechanism**

(57) A mechanism for effecting opening and closing movement of a vent panel 15 for a roof-mounted smoke vent has an elongate channel-shaped base member 56 for attachment to, or forming a part of, a frame 10 for the vent panel 15. A parallelogram linkage 69,70 connects a support 73 to the base member 56 and a power drive assembly including a motor 60 and a lead screw 61 ef-

fects movement of a slider 63 along the length of the base member, the slider being connected by an operating arm 75 to the support 73 or to the parallelogram linkage 69, 70. The support 73 carries a connector 77 for the panel 15, the support being slidable along that panel as the mechanism is operated to cause a connected panel to effect hinging movement by varying the geometry of the parallelogram linkage.

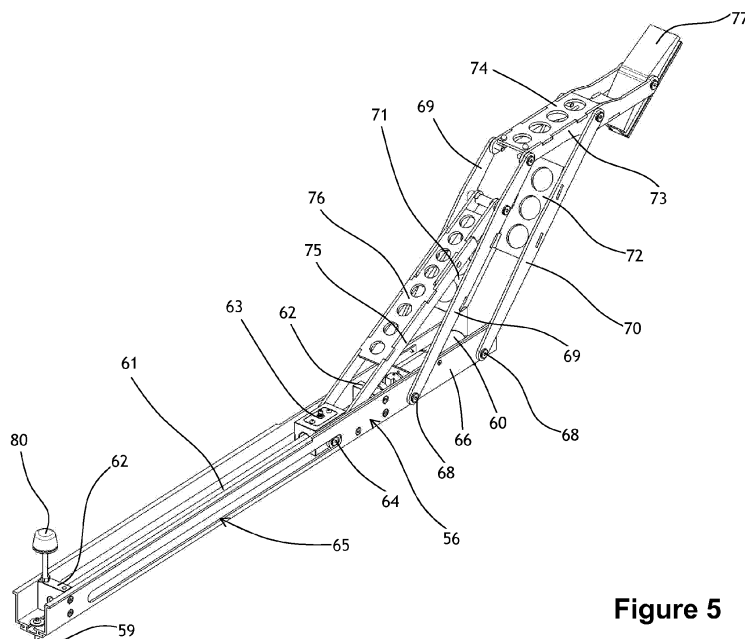


Figure 5

Description

[0001] This invention relates to an operating mechanism for a vent assembly for a building and in its preferred aspects to an operating mechanism for a smoke vent for the roof of a building. Though the operating mechanism of this invention could be used in other applications, it will in the following be described solely in relation to a mechanism for opening and closing a smoke vent.

[0002] Smoke vents are frequently fitted to commercial, public and industrial building in order to allow smoke to escape in the event of a fire, thereby enhancing the ability of people to evacuate the building before being overcome by the smoke and fumes of the fire. Such a smoke vent is fitted with an automatic mechanism to effect opening of the vent should there be a fire in the building. A control unit may receive signals from fire or smoke detectors and drives an actuator associated with the smoke vent, to effect opening of that vent. A smoke vent of this kind may equally be fitted to a residential dwelling and it is expected that this will increasingly be adopted.

[0003] A typical smoke vent has a frame secured to the roof of the building and a panel hinged along one edge to a side of the frame, the panel normally closing the opening defined by the frame. An actuator to perform hinging movement of the panel may be disposed centrally of the panel to act between the panel and the frame, or a pair of actuators may be disposed one to each side of the frame. Various designs of smoke vents are described for example in JP07217306A, US3728956 and US4473979.

[0004] It is important that a roof mounted smoke vent has good thermal insulating properties in order to minimise heat loss through the vent at times when the interior of the building is heated for environmental comfort for the occupants, and there is no fire. To that end, the hinged panel may be double-glazed and secured to a thermally insulating frame. A double-glazed panel is relatively heavy especially for a large smoke vent and if the panel is hinged along one edge and the operating mechanism is connected to the panel part way along a side thereof the load on the operating mechanism and which the operating mechanism must move can be very large.

[0005] Though in the past a smoke vents may have been used which opened through only an acute angle, modern building regulations require a hinged panel of a smoke vent to be moved through more than 90°, to ensure that there is adequate venting of smoke no matter what the direction of the wind or whether the vent is mounted on one side face of a pitch roof. Typically, the regulations require the panel of a smoke vent to be movable through at least 135° from its fully closed setting. In the case of a double-glazed panel, this presents particular engineering problems to ensure that once the panel has moved over centre (i.e. more than 90° from the fully closed setting in the case of a vent on a substantially flat roof) the operating mechanism is able to hold the panel at the required setting and moreover to pull the panel

back to the 90° setting, before resisting self-closing of the panel under gravity.

[0006] The above problems dictate that a relatively strong and so massive and powerful operating mechanism must be employed and yet the space and weight capacity available in the vicinity of a roof vent may be very restricted. This invention aims at providing an operating mechanism for a building vent assembly which is primarily intended to serve as a smoke vent and so which is configured to open through more than 90° from the fully closed setting.

[0007] According to this invention, there is provided a mechanism for effecting opening and closing movement of a panel hinged to a frame therefor, which mechanism comprises:

- an elongate base member for attachment directly or indirectly to the frame or forming a part thereof;
- a support;
- a parallelogram linkage connecting the support to the base member;
- a slider arranged for movement along the base member;
- a power drive assembly to effect said movement of the slider;
- an operating arm connecting the slider to the support or the parallelogram linkage, such that movement of the slider effects hinging movement of the linkage; and
- a connector mounted on the support and arranged for connection to a panel;

whereby operation of the power drive assembly moves the slider along the base member so changing the relationship between the base member and the support by varying the geometry of the parallelogram linkage, and the movement of the support relative to the base member causes a connected panel to effect hinging movement.

[0008] The configuration of the mechanism of this invention allows a connected vent panel to be moved through a relatively large obtuse angle (and typically in the region of 120° to 145°) from the fully closed setting where the panel closes the frame of the vent. The mechanism can be constructed to be relatively compact so that the mechanism may be accommodated within the frame of a roof vent. Moreover, the mechanism may withstand relatively large loads particularly at the extremes of movement, such that the mechanism may support a relatively heavy roof vent panel moved from its closed setting through an obtuse angle and then pull the opened panel back over centre and control movement of the panel to its closed setting. The load on the mechanism will be increased if snow is lying on the panel, or in freezing conditions, when ice may be holding the panel in its closed position. Also, the mechanism must be able to open the panel and hold it open even in strong windy conditions.

[0009] In order to allow proper operation of the mech-

anism, the coupling of the mechanism connector to a vent panel may allow the connector to slide with respect to the panel in a direction normal to the axis of hinging movement of the panel, while retaining the connector in engagement with the panel. In a preferred embodiment, a connected panel defines a slot extending in a direction normal to the axis of hinging movement of the panel and the connector is received in that slot while being restrained against movement out of the slot in a direction normal to the plane of the panel. Conveniently, the panel has a T-shaped slot and the connector has a slide element located in that slot.

[0010] Again, to allow proper operation of the mechanism, the connector may be pivoted to the support, which may have an extension beyond the connection thereto of the parallelogram linkage, the connector being mounted on that extension of the support.

[0011] The elongate base member of the mechanism preferably is of channel-shaped cross-section having a base wall with upstanding side walls and the parallelogram linkage comprises two pairs of links arranged with the links of each pair on opposed side walls of the base member. The links of each pair are pivoted about common axes both to the side wall of the base member and to the support.

[0012] The power drive assembly may comprise an electric motor drivingly connected to a lead screw rotatably mounted to the side walls of the base member, so as to extend therealong. With such a power drive assembly, the slider may comprise a nut threadingly engaged with the lead screw and guided to slide along the length of the base member. For example, the side walls of the channel-section base member may have opposed slots extending therealong, the nut having a pair of laterally-projecting guide pins received in the slots.

[0013] The vent operating mechanism may have a control system therefor and which controls the operation of the power drive assembly, either under manual or automatic control on the basis of an input from at least one environmental sensor. That sensor may sense at least one of air temperature, concentration of smoke particles in the air and air contamination. In the case of a panel having a pair of operating mechanisms, one to each side of the frame supporting a hinged panel, the control system should serve to keep the two mechanisms operating in synchronism, so as to avoid any twisting of the hinged panel, during operation.

[0014] This invention extends to an operating mechanism as described above in combination with a frame assembled from a plurality of frame members and a panel hinged to one of the frame members, wherein the elongate base member is attached to or forms a part of a frame member extending normally to that frame member to which the panel is hinged.

[0015] Further, this invention extends to a combination of an operating mechanism and a frame as just-described, together with a panel hinged to one side of the frame and the connector of the mechanism connected

to the panel, for sliding movement with respect thereto in a direction normal to the hinging axis of the panel. The panel may comprise a frame supporting a double-glazed unit in which case the connector of the mechanism connects to the frame of the panel. In a typical application for a smoke vent, two operating mechanisms may be provided, one to each side of the panel and respectively connected to the sides of the panel frame.

[0016] By way of example only, one specific embodiment of a roof vent incorporating an operating mechanism of this invention and having a thermal break frame will now be described in detail, reference being made to the accompanying drawings in which:-

Figure 1 is an isometric view of the complete roof vent, when the panel thereof is in its fully opened setting;

Figure 2 is a side view of the roof vent of Figure 1 and showing the movable panel in a partly opened and a fully opened setting;

Figure 3 is a detail view on an enlarged scale of a cross-section through the roof vent frame together with part of the double-glazed panel;

Figures 4 and 5 are isometric views of the operating mechanism when set to have the panel fully closed and fully opened, respectively; and

Figures 6 and 7 are side views of the operating mechanism when set to have the panel fully closed and fully opened, respectively.

[0017] The roof vent comprises a generally rectangular frame 10 having four sides 11,12,13,14, a double-glazed panel 15 being hinged along one edge 16 to side 11 of the frame. The panel 15 is of the same shape as the frame 10 and of an appropriate size to co-operate therewith. The panel is movable between a fully closed setting (not shown) where the underside of the panel engages the upper surface of the frame and a fully opened setting where the panel has been hinged through approximately 140°, as shown in Figure 2. The frame 10 is constructed from inner and outer metallic frame members 17,18 a thermal break being provided between those frame members. The outer frame member defines a chamber 19 along each side of the frame 11 and a pair of operating mechanisms for the panel are located in the chambers 19 of the two opposed frame sides 12,14 adjoining the hinge side 11. These various components will now be described in more detail.

[0018] Referring initially to Figure 3, the configuration of the frame 10 and the panel 15 is shown in more detail. The inner frame member 17 is an L-shaped aluminium extrusion having limbs 21,22. The outer frame member 18 is generally of channel-shaped cross-section having a base wall 23 and upstanding flanks 24,25, the base wall 23 being opposed to limb 21 of the inner frame member and flank 24 being opposed to limb 22. Elongate blocks 26,27 of high performance insulating material are located between the opposed parts of the inner and outer

frame members, for the full length thereof. Further, the inner and outer frame members are maintained at the required separation by thermal break elongate strips 28,29,30,31 of a plastics material such as a polyamide. Each long edge of strips 28 and 31 is formed with an enlarged head which is received in a corresponding groove 32 in the associated frame member. The grooves are then crimped on to the heads of the strips so as to grip the strips and maintain the inner and outer frame members in the required relative disposition. Though the long edges of strips 29 and 30 are also enlarged, those heads are received in simple grooves to facilitate assembly whilst still providing support.

[0019] A skirt 34 for the outer frame member 18 is bonded to a flange 35 projecting from the base wall 23 of the outer frame member and depends downwardly from that frame member. The frame rests on roof members (not shown) defining an opening through the roof and is secured to those members by fastenings received in a channel 36 formed in the lower edge of the skirt. Once secured in this way, the channel 36 may be closed by a cap strip (not shown). A further channel 37 is formed in leg 21 of the inner frame member, to receive an elastomeric sealant for effecting a seal to the roof members.

[0020] The double-glazed panel 15 has a rectangular frame 39 of extruded aluminium sections joined together at the corners and supporting a double-glazing unit having inner and outer glass panes 40,41 held at the required separation by a spacer bar 42. Each frame section defines an inwardly-projecting flange 43 to which the inner glass pane 40 is adhered by a bead 44 of adhesive. A foam tape strip 45 extends along the flange 43, further from the pane edge than the bead 44, and serves to support the pane during setting of the adhesive. A high-temperature silicon rubber gasket 46 is attached to the free edge of the flange 43, that gasket having a lip 47 to effect a seal against the inner surface of the inner pane 40, the gasket also having a cylindrical resiliently deformable portion 48 for effecting a seal to the upper edges of limb 22 and flank 24 of the inner and outer frame members, respectively, when the panel is in its closed setting.

[0021] Each panel frame section also defines an upper surface 50 to which the outer glass pane 41 is adhered by a bead 51 of adhesive. The periphery of the outer pane 41 is sealed to the frame section by a silicon weather-seal strip 52. A further resiliently deformable gasket 53 is fitted to a lower surface 54 of the frame section to co-operate with the upper edge of flank 25 of the outer frame member 18. Figure 3 shows the panel 15 in its fully closed setting where the gaskets 46 and 53 partially compressed against the corresponding upper edges of the inner and outer frame members 17,18, thereby effecting a seal thereto.

[0022] Accommodated in the chambers 19 of the sides 12 and 14 of the frame 10 are respective opening mechanisms, to perform hinging movement of the panel 15 from its fully closed setting to its fully opened setting. Each mechanism has a channel section 56 provided with

tabs 57 projecting laterally from below the base of that channel section, which tabs are adapted to be received in a T-groove 58 formed in the base wall 23 of the outer frame member 18. Two pins 59 are arranged one at each end of the channel section 56 and serve to hold the section at the required location with respect to the length of the receiving frame member.

[0023] An electric motor 60 is arranged within the channel section 56 adjacent one end and drives a lead screw 61 rotatably carried in bearings 62 mounted in the channel section. A nut 63 is threaded on to the lead screw and is slidably disposed within the channel section, the nut having laterally projecting pivot pins 64 received in elongate slots 65 in the side walls 66 of the channel section.

[0024] Pivoted to each side wall 66 of the channel section 56 and at spaced locations are first and second links 69,70, there being a pair of first links 69 and a pair of second links 70 with the links of each pair pivoted about a common axis on the opposed side walls of the base member. Links 69 are connected together by cross-members 71 and links 70 by cross-members 72. The other ends of the links 69,70 are pivoted to a support 73 at the same spacing, such that the links, support 73 and the channel section 56 together form a parallelogram linkage in which the support remains parallel to the channel section, irrespective of the pivoting of the links. The support 73 is also constructed from a pair of arms connected together by a cross-member 74. An operating arm 75, again in the form of a pair of parallel links connected together by a cross-member 76, is pivoted at one end to the pivot pins 64 of the nut 63 and at its other end to each of the two links 69, adjacent the support 73. A connector 77 is pivoted to an extension of the support 73 and is adapted for connection to the panel 15, that connector being received in a T-slot 78 (Figure 3) formed in the lower surface 54 of the panel frame. The T-slot 78 is relieved at 79 (Figure 1) to allow the connector to be engaged in the T-slot 78 during assembly of the roof vent, whereafter the connector may slide along that part of the T-slot between the relieved part and the hinged edge of the panel, as dictated by the geometry of the mechanism when operated.

[0025] Also shown in Figures 1, 2 and 4 to 7 are bump-stops 80 disposed adjacent the side 13 of the frame, remote from the hinged side 11. The panel 15 engages those bump-stops 80 when closed and so the compression of the gaskets 46 and 53 is limited thereby. The bump-stops are adjustable, in order to allow optimum sealing of the panel when closed.

[0026] Though not shown, a control unit is provided for the operating mechanisms, to control the supply of power to the electric motors 60. Environmental sensors are connected to the control unit, monitoring for example smoke particles in the air at various places within the building in which the vent is installed. Sensors may also be provided for air temperature and also contaminants that may be present in the air, such as hydrocarbons. The control unit

serves to cause operation of the motors 60 to open the vent by hinging the panel from its closed position, in the event that a sensed parameter exceeds a pre-set value.

[0027] The control system should drive in synchronism the electric motors 60 of the two mechanisms so as to avoid any twisting of the hinged panel 15 during operation. Thus may be achieved by fitting hall effect sensors to the motors and which provide outputs to the control system, so that the speeds of operation of the two motors may be controlled to be the same.

[0028] The mechanism described above is configured to perform hinging movement of the double-glazed panel 15, between a fully closed setting (Figure 3) and a fully opened setting (Figure 2), or to a chosen setting between those extremes, also shown in Figure 2. Operation of the motor rotates the lead screw 61 which drives the nut 63 along the length of the channel section 56 in a direction depending on the sense of rotation of the lead screw. This changes the geometry of the operating arm 75 with respect to the lead screw and the pair of links 69, so operating the parallelogram linkage. The exact configuration of the links 69,70, operating arm 75 and the support 73 is determined so that the full required range of movement of the panel 15 may be achieved, corresponding to the full movement of the nut 63 along the slots 65 of the channel section 56. Moreover, the configuration of the mechanism allows a relatively high force to be achieved for moving the panel between its fully closed and fully opened settings, both when opening the vent and when closing the vent.

Claims

1. A mechanism for effecting opening and closing movement of a panel (15) hinged to a frame (10) therefor, which mechanism comprises:

- an elongate base member (56) for attachment directly or indirectly to the frame (10) or forming a part thereof;
- a support (73);
- a parallelogram linkage (69, 70) connecting the support (73) to the base member (56);
- a slider (63) arranged for movement along the base member (56);
- a power drive assembly (60,61) to effect said movement of the slider (63) ;
- an operating arm (75) connecting the slider (63) to the support (73) or the parallelogram linkage (69, 70), such that movement of the slider effects hinging movement of the linkage; and
- a connector (77) mounted on the support (73) and arranged for connection to a panel ;

whereby operation of the power drive assembly (60,61) moves the slider (63) along the base member (56) so changing the relationship between the base

member and the support by varying the geometry of the parallelogram linkage, and the movement of the support (73) relative to the base member (56) causes a connected panel to effect hinging movement.

2. A mechanism as claimed in claim 1, wherein the connection of the connector (77) to a panel (15) allows the connector to slide with respect to the panel in a direction normal to the axis of hinging movement of the panel.
3. A mechanism as claimed in claim 2, wherein a connected panel (15) defines a slot (74) extending in a direction normal to the axis of hinging movement of the panel and the connector (77) is received in said slot and is restrained against movement out of the slot in a direction normal to the plane of the panel.
4. A mechanism as claimed in claim 3, wherein the slot (74) of a connected panel (15) is of T-shaped cross-section.
5. A mechanism as claimed in any of the preceding claims, wherein the connector (77) is pivoted to the support (73).
6. A mechanism as claimed in any of the preceding claims, wherein the support (73) has an extension beyond the connection thereto of the parallelogram linkage (70) and the connector (77) is mounted on the extension of the support.
7. A mechanism as claimed in any of the preceding claim, wherein the base member (56) is of channel-shaped cross-section having a base wall with up-standing side walls (66) and the parallelogram linkage (69,70) comprises two pairs of links arranged with the links of each pair on opposed side walls (66) of the base member.
8. A mechanism as claimed in claim 7, wherein the power drive assembly (60,61) is mounted between the side walls (66) of the base member (56).
9. A mechanism as claimed in claim 8, wherein the power drive assembly comprises an electric motor (60) drivingly connected to a lead screw (61) rotatably mounted between the side walls (66) of the base member (56) to extend therealong.
10. A mechanism as claimed in claim 9, wherein the slider comprises a nut (63) threadingly engaged with the lead screw (61) and guided to slide along the base member (56).
11. A mechanism as claimed in claim 10, wherein the side walls (66) of the channel-section base member (56) have opposed slots (65) extending therealong

and the nut (63) has a pair of laterally-projecting guide pins (64) received in the slots.

12. A mechanism as claimed in any of the preceding claims in combination with a frame assembled from a plurality of frame members (17,18) and a panel (15) hinged to one of the frame members, wherein the elongate base member (56) is attached to a frame member (18) extending normally to said frame member to which the panel is hinged. 5 10
13. A mechanism as claimed in any of the preceding claims in combination with a control system for the power drive assembly (60,61) and arranged to effect the operation thereof, either under manual or automatic control depending on an input from at least one environmental sensor. 15
14. A mechanism as claimed in claim 13, wherein the environmental sensor senses at least one of air temperature, concentration of smoke particles in air and air contamination. 20

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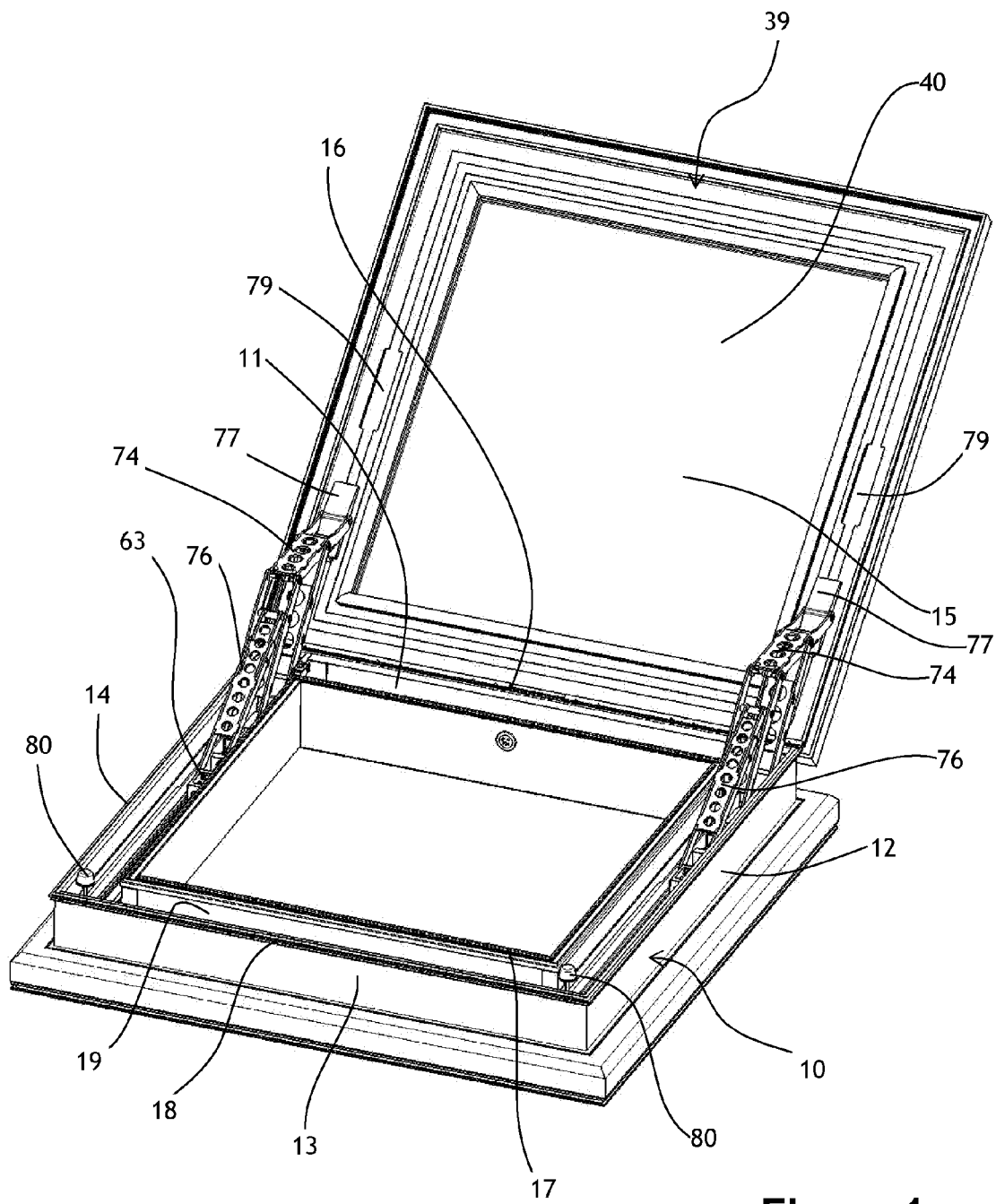


Figure 1

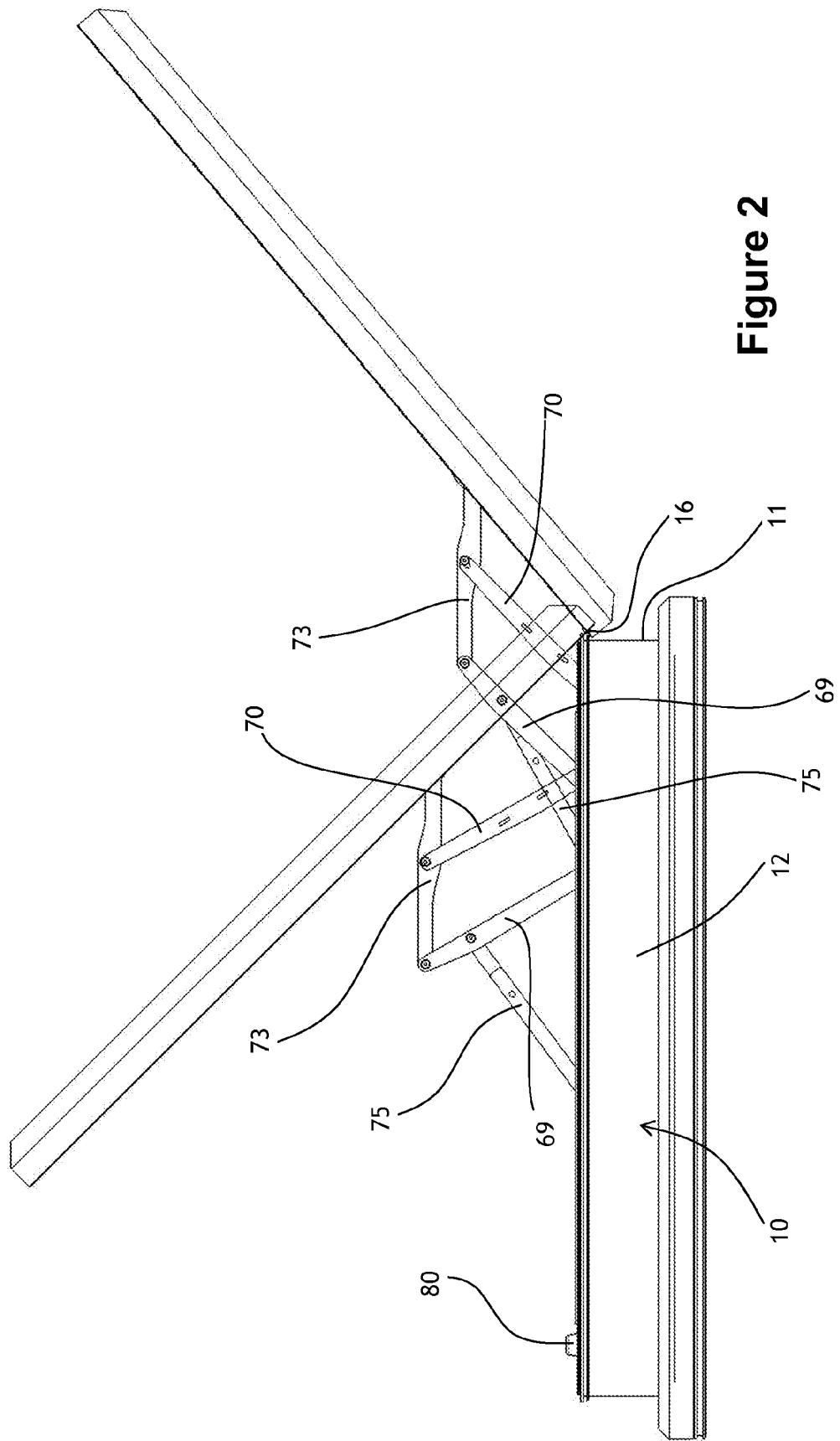


Figure 2

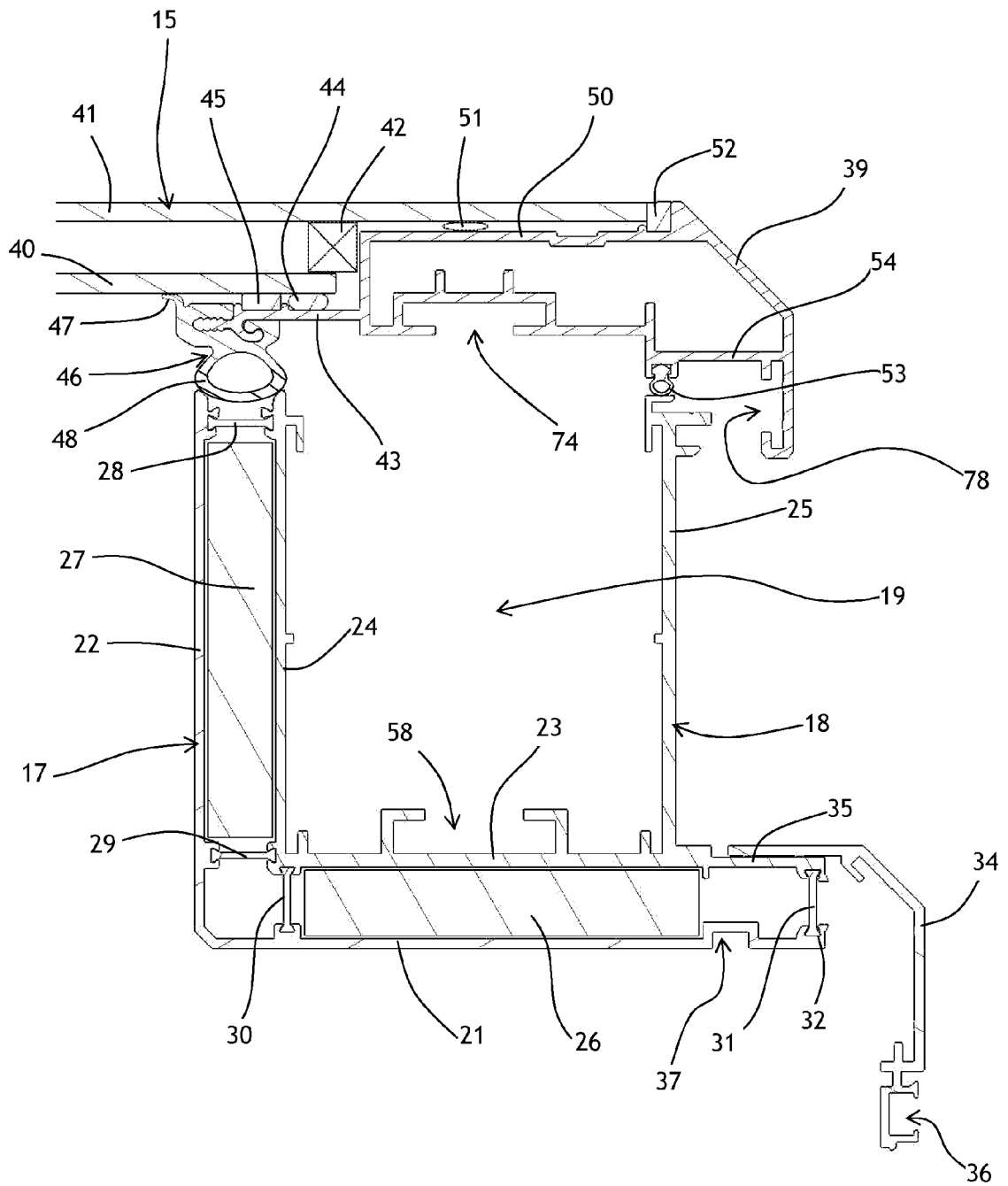


Figure 3

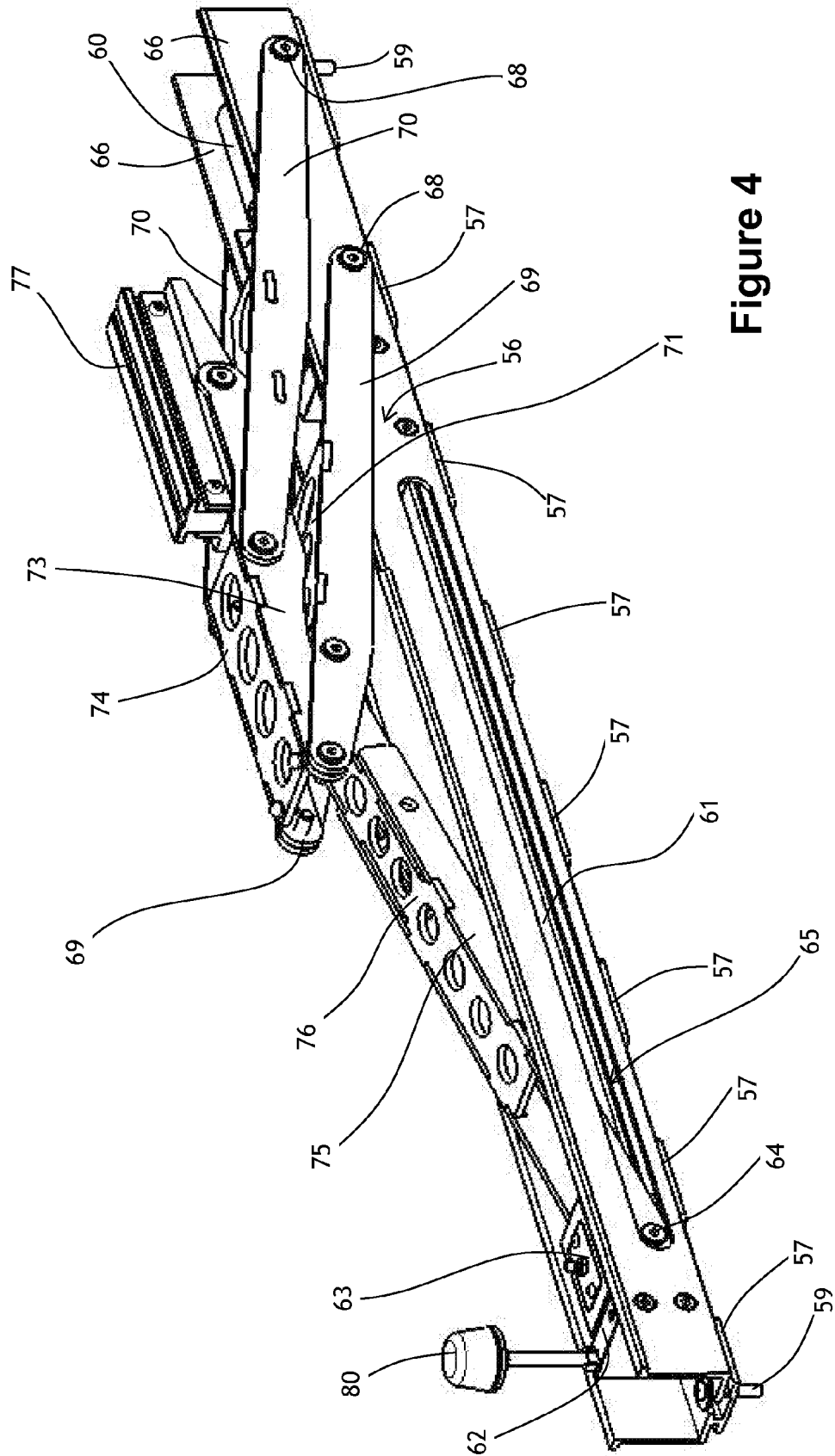


Figure 4

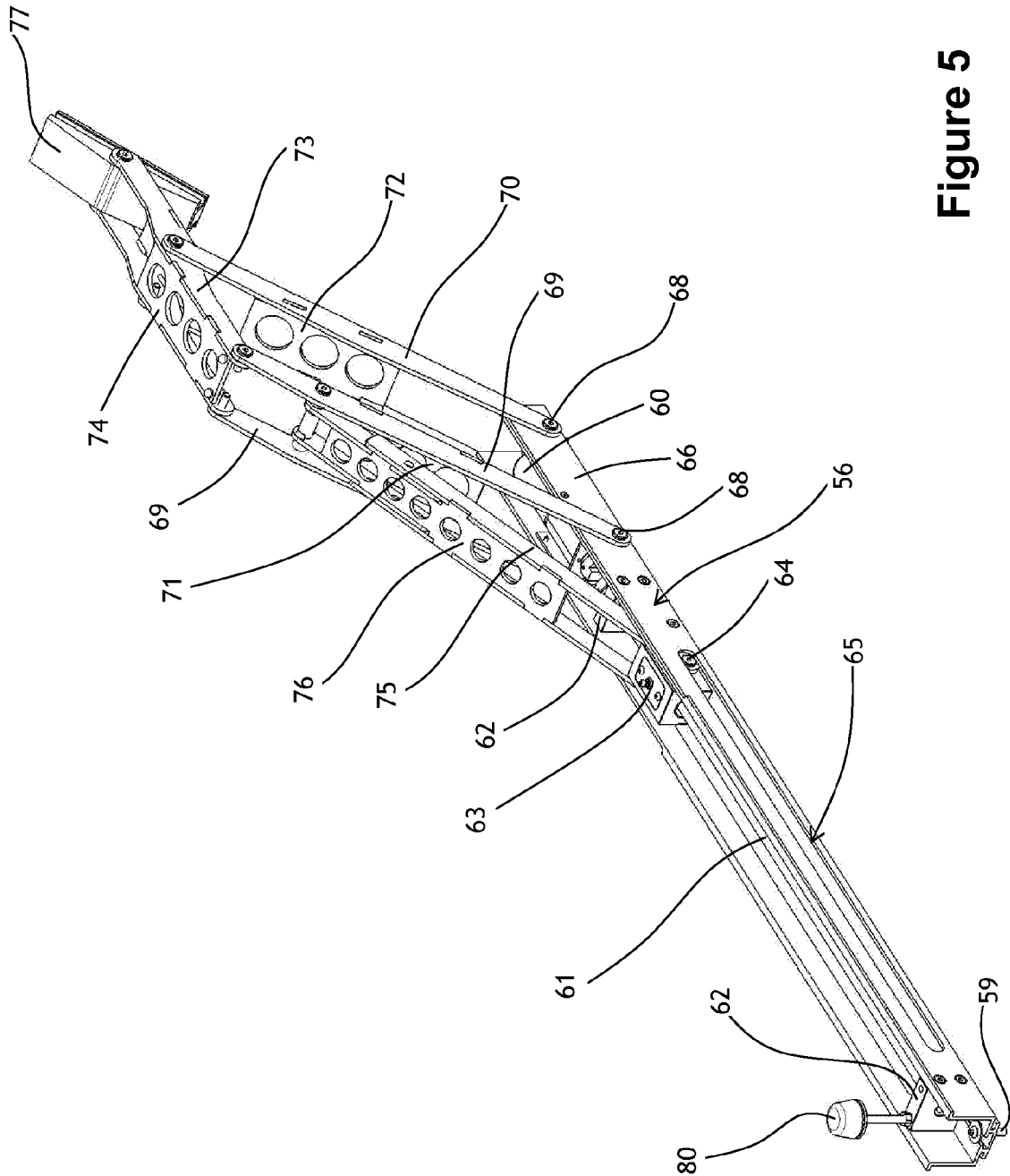


Figure 5

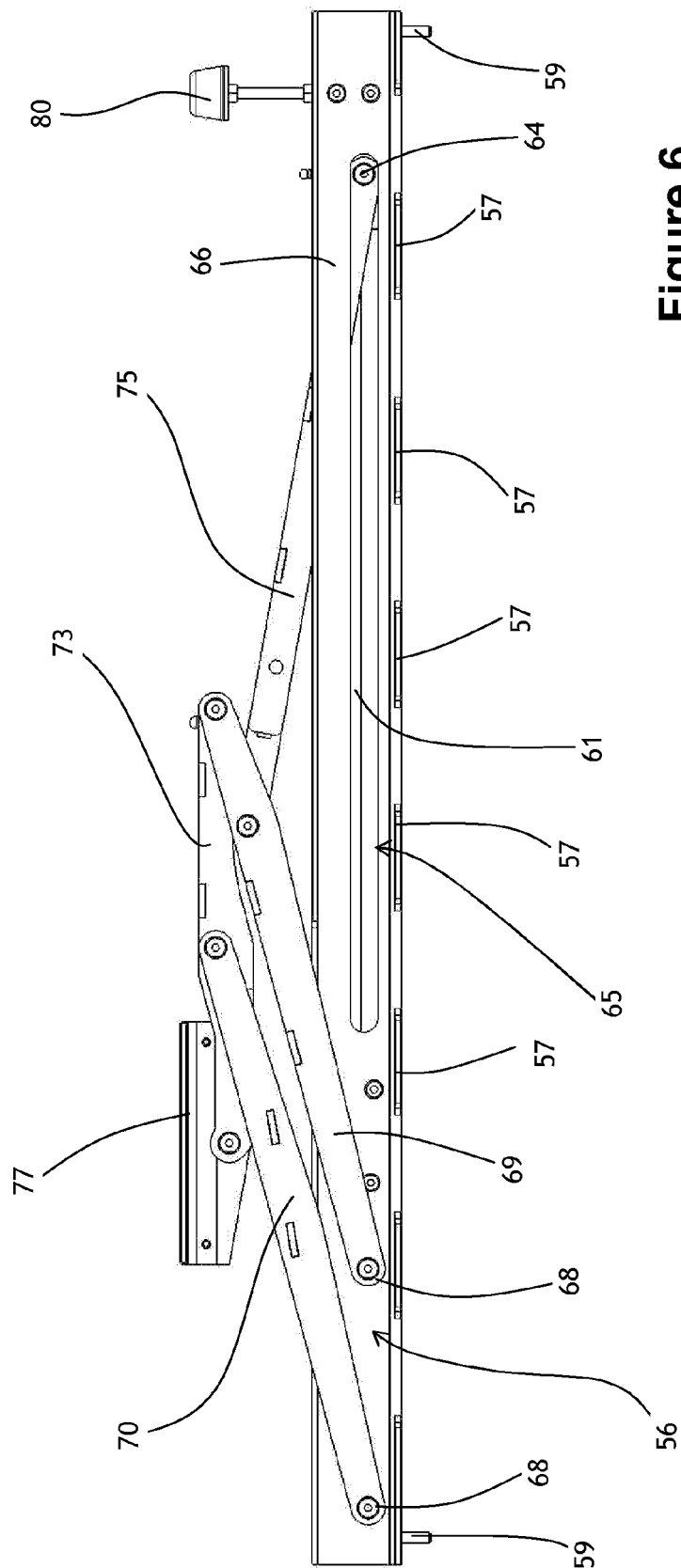


Figure 6

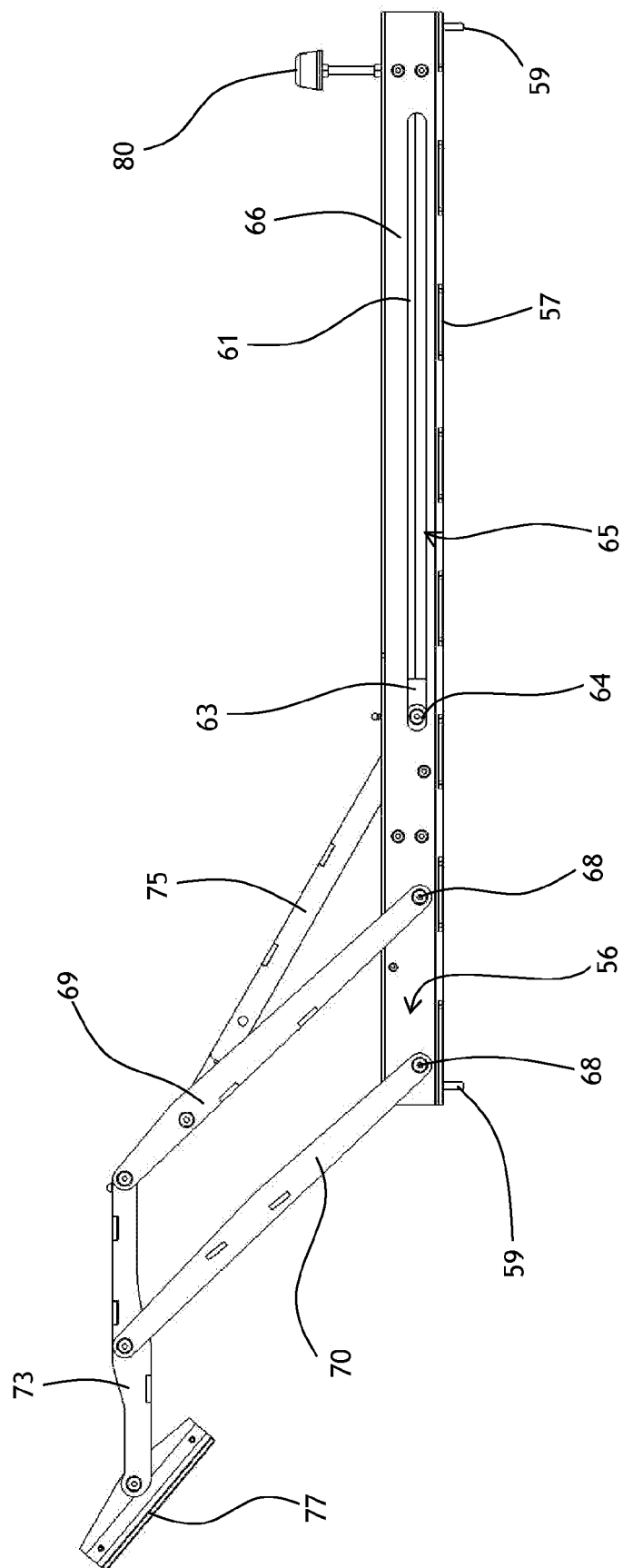


Figure 7

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 07217306 A [0003]
- US 3728956 A [0003]
- US 4473979 A [0003]