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(54) **Vent Assembly**

(57) A smoke vent assembly for the roof of a building has a panel 15 hinged to a frame 10, for movement between open and closed positions under the action of a powered actuator 60,61,63. The frame 10 is constructed at least in part from metallic inner and outer frame members 17,18 with thermal break elements 28,29,30,31 connecting together the inner and outer frame members 17,18 and with insulation 26,27 disposed therebetween. Each of the two opposed outer frame members 12,14 extending at right angles to the frame member 11 hinging the panel 15 defines a respective chamber 19 for accommodating a powered actuator 60,61,63.

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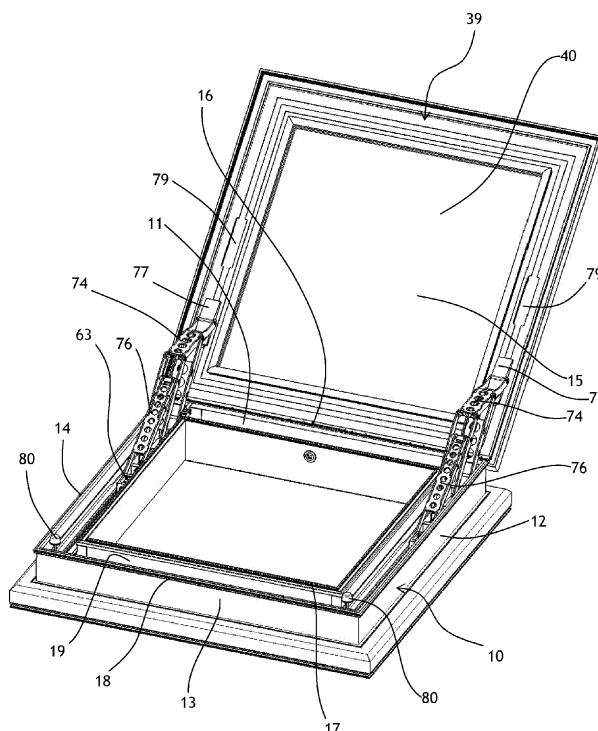


Figure 1

Description

[0001] This invention relates to a vent assembly for a building and in its preferred aspects to a smoke vent for fitting to the roof of a building. Though the invention could be used for other kinds of vent, it will in the following be described solely in relation to 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] In the case of a smoke vent, it is most important that the opening arrangement for the hinged panel is highly reliable and will not be adversely affected by the increased temperature in the region of the vent, should there be a fire within the building. Heat from the fire will rise to the smoke vent and thus steps must be taken to ensure the or each actuator is able to withstand the effects of that heat, such that reliable opening may be achieved when it is most needed, when there is a fire.

[0005] It is also 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. In the case of an aluminium frame, it is the conventional practice to construct that frame from a structural inner frame with an external weather resistant outer frame secured to the structural inner frame by thermal break elements, to reduce the conductivity of heat from the inner frame to the outer frame.

[0006] With a smoke vent having a frame and double-glazed panel as described above, the weight of the panel typically requires two actuators disposed one to each side of the structural inner frame, and possibly exposed within the opening defined by that frame. Though the actuators may be enclosed within a casing which may be provided with insulation, the actuators still will be ex-

posed to the heat of the air, smoke and perhaps flames reaching the smoke vent. In turn, this may reduce the reliability of operation of the smoke vent, when it is most required.

[0007] It is a principal aim of the present invention to provide a building vent assembly which is primarily intended to serve as a smoke vent and which is configured to increase the isolation of actuators for a hinged panel from the effects of hot air, smoke or flames in the vicinity of the vent assembly.

[0008] According to this invention, there is provided a vent assembly comprising a frame, a panel hinged to the frame for movement between closed and open positions, and a powered actuator arranged to effect hinging movement of the panel, wherein the frame is constructed at least in part from metallic inner and outer frame members with thermal break elements disposed between and connecting together the inner and outer frame members, at least one of the outer frame members defining a chamber for accommodating the actuator.

[0009] It will be appreciated that with the vent assembly of this invention, the frame is constructed from metallic inner and outer frame members with a thermal break therebetween, but the outer frame members are configured to accommodate the or each actuator for the hinged panel, in a chamber defined by the outer frame members. In this way, the actuators are disposed externally of the inner frame and so externally of the thermal break such that in the event the temperature of the inner frame increases, such as may occur when there is a fire within the building, the chamber in the outer frame is insulated from that temperature rise.

[0010] In a preferred embodiment of vent assembly of this invention, the frame is constructed from four inner and four outer frame members, arranged in a rectangular configuration. Conveniently, all four outer frame members are of the same cross-sectional profile and all four inner frame members are also of the same cross-sectional profile but which is different from that of the outer frame members. Each outer frame member may be of a channel-shaped cross-section whereby the chamber for accommodating an actuator is provided by the base and side walls of the channel-shaped cross-section. In this case, each inner frame member may be of L-shaped cross-section and the two limbs of the L-shaped cross-section are opposed to and spaced from corresponding walls of the outer frame member - that is, a side wall of the channel shape and the base thereof.

[0011] Thermal insulating material may be disposed between the confronting limbs and walls of the inner and outer frame members respectively, to assist thermal isolation of the chamber and so of an actuator disposed therein. In addition, spacers of a low thermal conductivity material may be disposed between the inner and outer frame members. For example, each spacer may comprise a strip of plastics material extending along the length of the inner and outer frame members and bridging the gap therebetween. Each long edge of each strip may

be received in a respective groove formed in the confronting limbs and walls of the inner and outer frame members.

[0012] Preferably, the hinged panel comprises a panel frame supporting a double-glazed unit. The panel frame may also have a resilient seal, and advantageously a seal able to withstand high temperatures, arranged to effect the seal to the adjacent upper ends of the inner and outer frame members, when the panel is in a closed setting. The panel frame may have a further resilient seal arranged to effect a seal to the upper end of the side wall of the channel-shaped cross-section outer member remote from the inner frame member.

[0013] Advantageously, the outer frame member supports a skirt which depends downwardly therefrom and which is arranged to overlie and be secured to a component of a roof to which the vent assembly is to be attached.

[0014] In a preferred embodiment, the vent assembly has a pair of actuators disposed in the chambers of two opposed side frame members which extend normally to the frame member to which the panel is hinged.

[0015] This invention extends to a vent assembly of this invention as described above in combination with a control system for the or each actuator and which effects the operation thereof, 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.

[0016] By way of example only, one specific embodiment of a roof vent incorporating an operating mechanism and having a thermal break frame arranged in accordance with this invention 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 while 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 actuators, 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 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 vent assembly comprising a frame (10), a panel (15) hinged to the frame for movement between closed and open positions, and a powered actuator (60, 61, 63) arranged to effect hinging movement of the panel, **characterised in that** the frame (10) is constructed at least in part from metallic inner and outer frame members (17, 18) with thermal break elements (28, 29, 30, 31) disposed between and connecting together the inner and outer frame members,

at least one of the outer frame members (18) defining a chamber (19) for accommodating the actuator (60,61,63).

2. A vent assembly as claimed in claim 1, wherein the frame (10) is constructed from four inner and four outer frame members (17,18), arranged in a rectangular configuration. 5
3. A vent assembly as claimed in claim 2, wherein the four outer frame members (18) are all of the same cross-sectional profile. 10
4. A vent assembly as claimed in claim 3, wherein each outer frame member (18) is of a channel-shaped cross-section, whereby said chamber (19) for accommodating the actuator (60,61,63) is provided by the base wall (23) and side walls (24,25) of the channel-shaped cross-section. 15
5. A vent assembly as claimed in claim 4, wherein the base wall (23) of the channel-shaped cross-section is provided with a T-slot (58) in which a foot (57) of the actuator is received. 20
6. A vent assembly as claimed in any of claims 2 to 5, wherein each inner frame member (17) is of L-shaped cross-section, and each limb (21,22) of the L-shaped cross-section is opposed to and spaced from a corresponding wall (23,24) of the adjacent outer frame member. 25
7. A vent assembly as claimed in claim 6, wherein thermal-insulating material (26,27) is located between the opposed limbs (21,22) and walls (23,24) of the inner and outer frame members (17,18). 30
8. A vent assembly as claimed in any of the preceding claims, wherein each thermal break element comprises a strip (28,29,30,31) of a plastics material extending along the length of the inner and outer frame members (17,18), each long edge of each strip being received in a respective groove (32) formed in a confronting part of the associated inner or outer frame member. 35
9. A vent assembly as claimed in claim 8, wherein each long edge of each strip (28,29,30,31) is formed with an enlarged head and the enlarged heads of the strips are received in respective re-entrant grooves (32) in the confronting limbs and walls of the inner and outer frame members, respectively, and preferably at least some of the grooves (32) are crimped so as to hold the head of the received strip against movement. 40
10. A vent assembly as claimed in any of the preceding claims, wherein the panel (15) comprises a panel 45

frame (39) supporting a double-glazed unit (40,41).

11. A vent assembly as claimed in claim 10, wherein the panel frame (39) is provided with a resilient seal (46) arranged to effect a seal to the adjacent upper ends of the inner and outer frame members (17,18). 50
12. A vent assembly as claimed in claim 11 and in which each outer frame member (18) is of a channel-shaped cross-section, wherein the panel frame (39) is provided with a further resilient seal (53) arranged to effect a seal to the upper end of the side wall (25) of the outer frame member (18) defining the channel-shaped cross-section remote from the inner frame member (17). 55
13. A vent assembly as claimed in any of the preceding claims, wherein the outer frame member (18) supports a skirt (34) which depends downwardly therefrom, the skirt (34) being arranged to overlie and be secured to a building component of a roof to which the vent assembly is to be attached.
14. A vent assembly as claimed in any of the preceding claims, wherein there is a pair of actuators (60,61,63) disposed respectively one in each of two chambers (19) of opposed sides of the frame (10) extending normally to the frame member to which the panel (15) is hinged.
15. A vent assembly as claimed in any of the preceding claims in combination with a control system for the actuator (60,61,63) and arranged to effect the operation thereof, either under manual or automatic control depending on an input from at least one environmental sensor arranged to sense at least one of air temperature, concentration of smoke particles in air and air contamination.

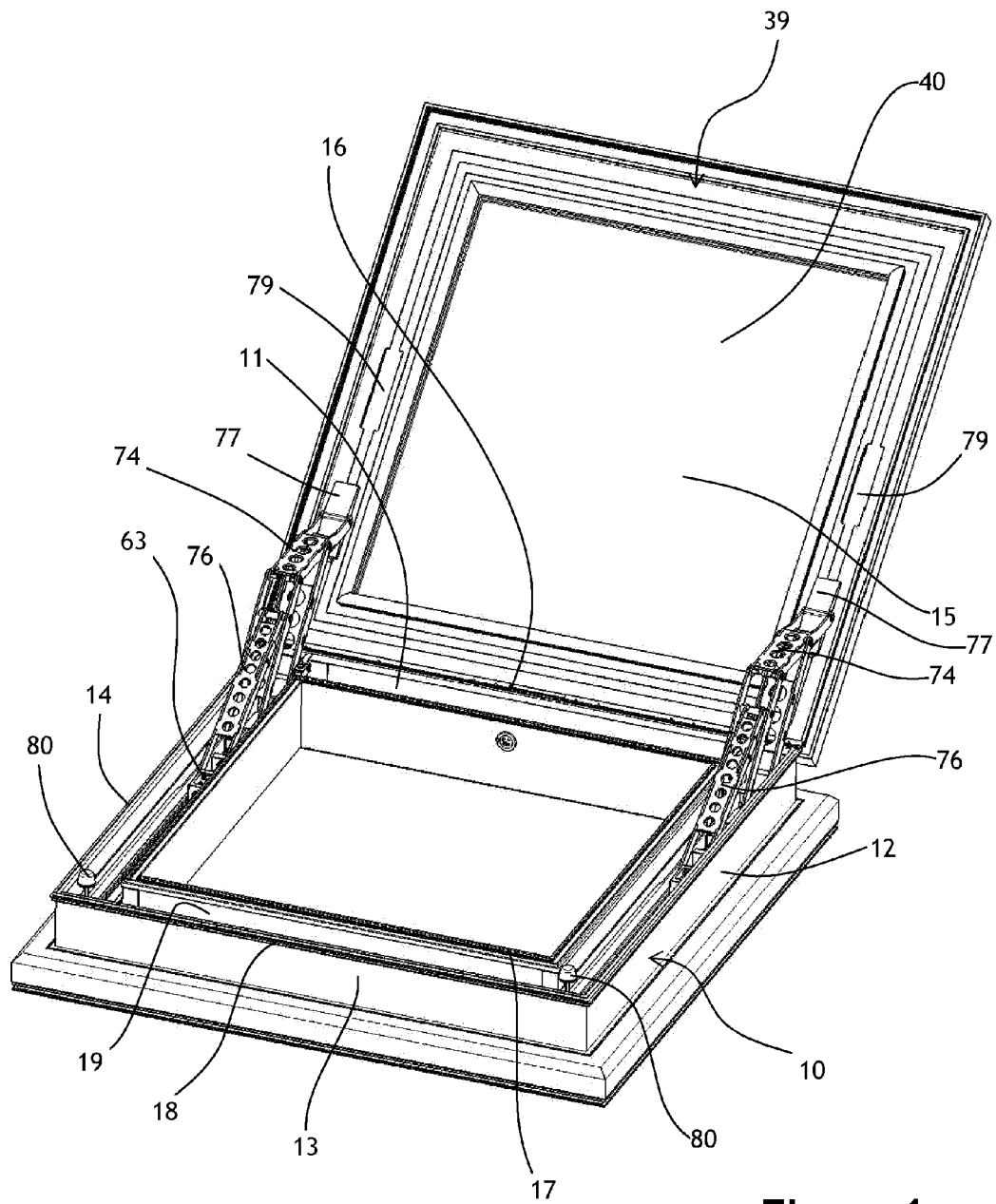


Figure 1

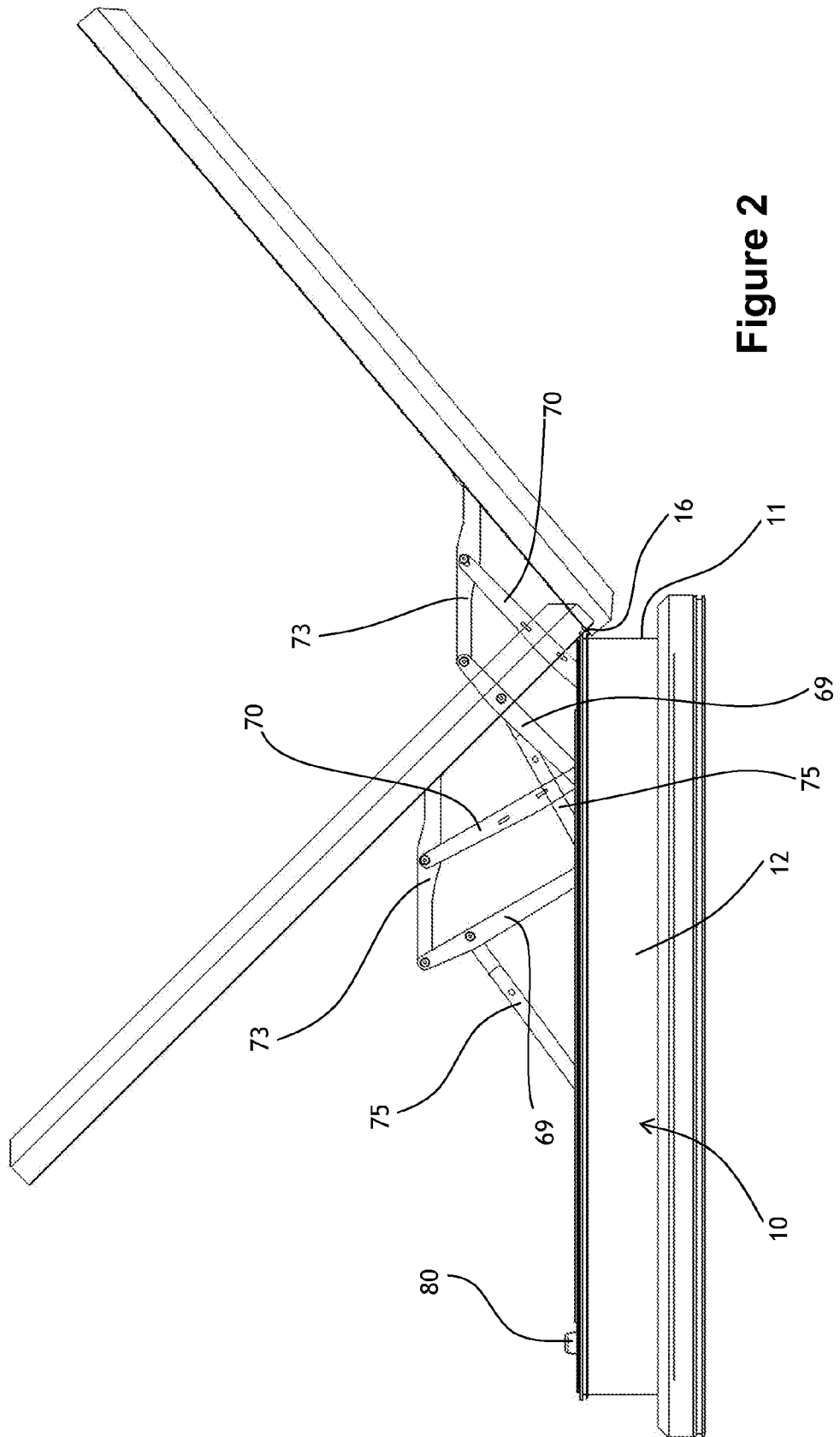


Figure 2

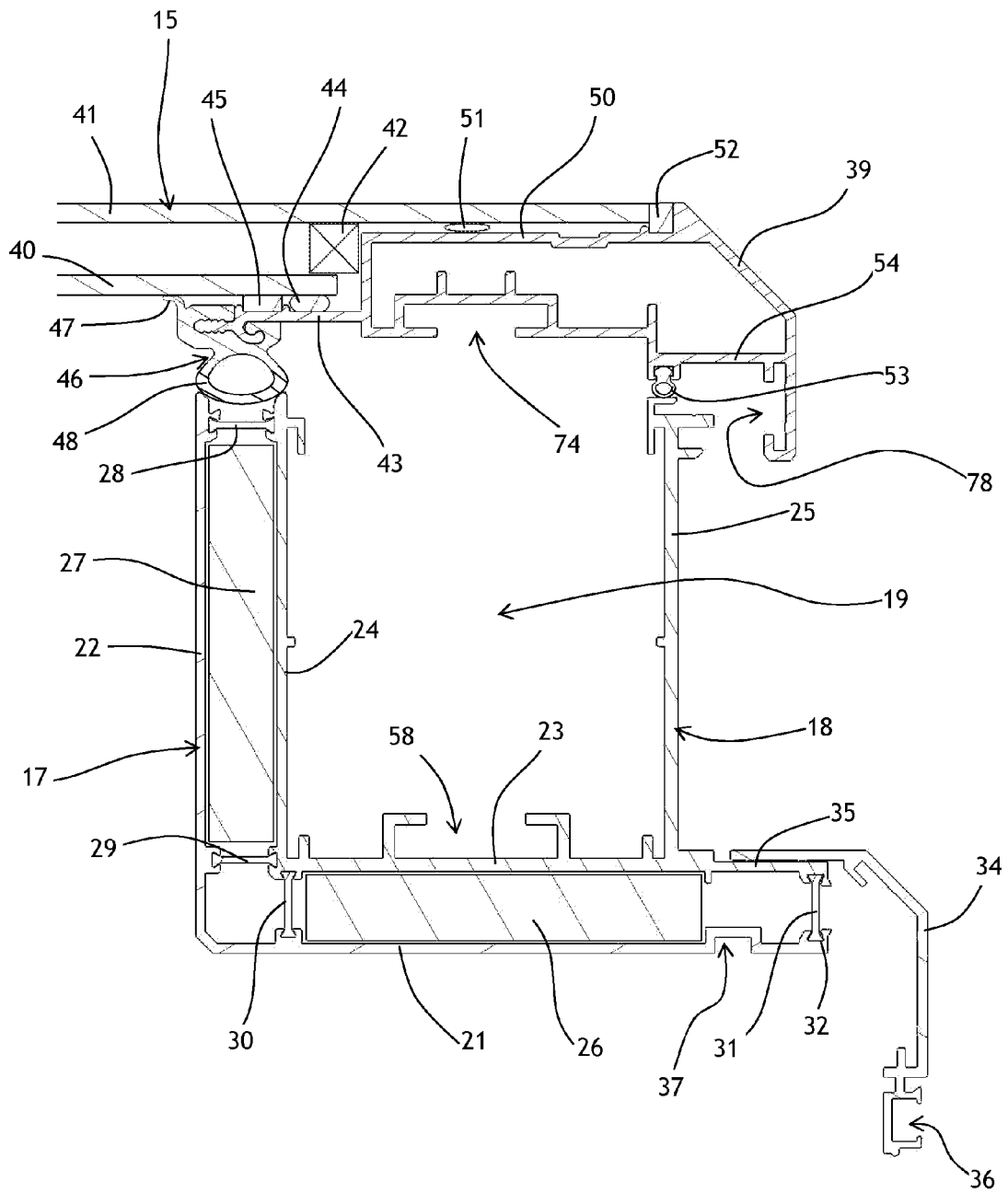


Figure 3

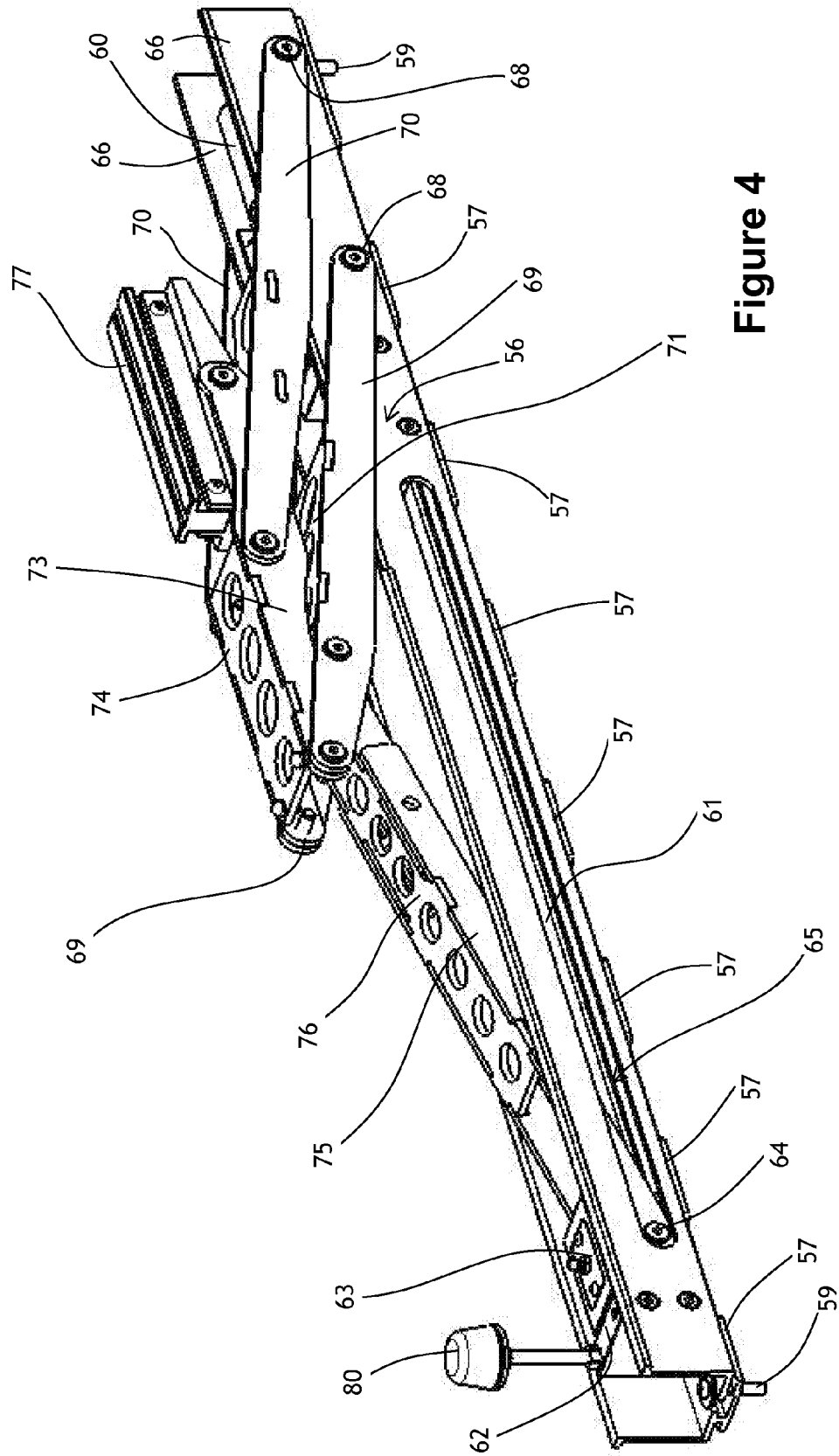


Figure 4

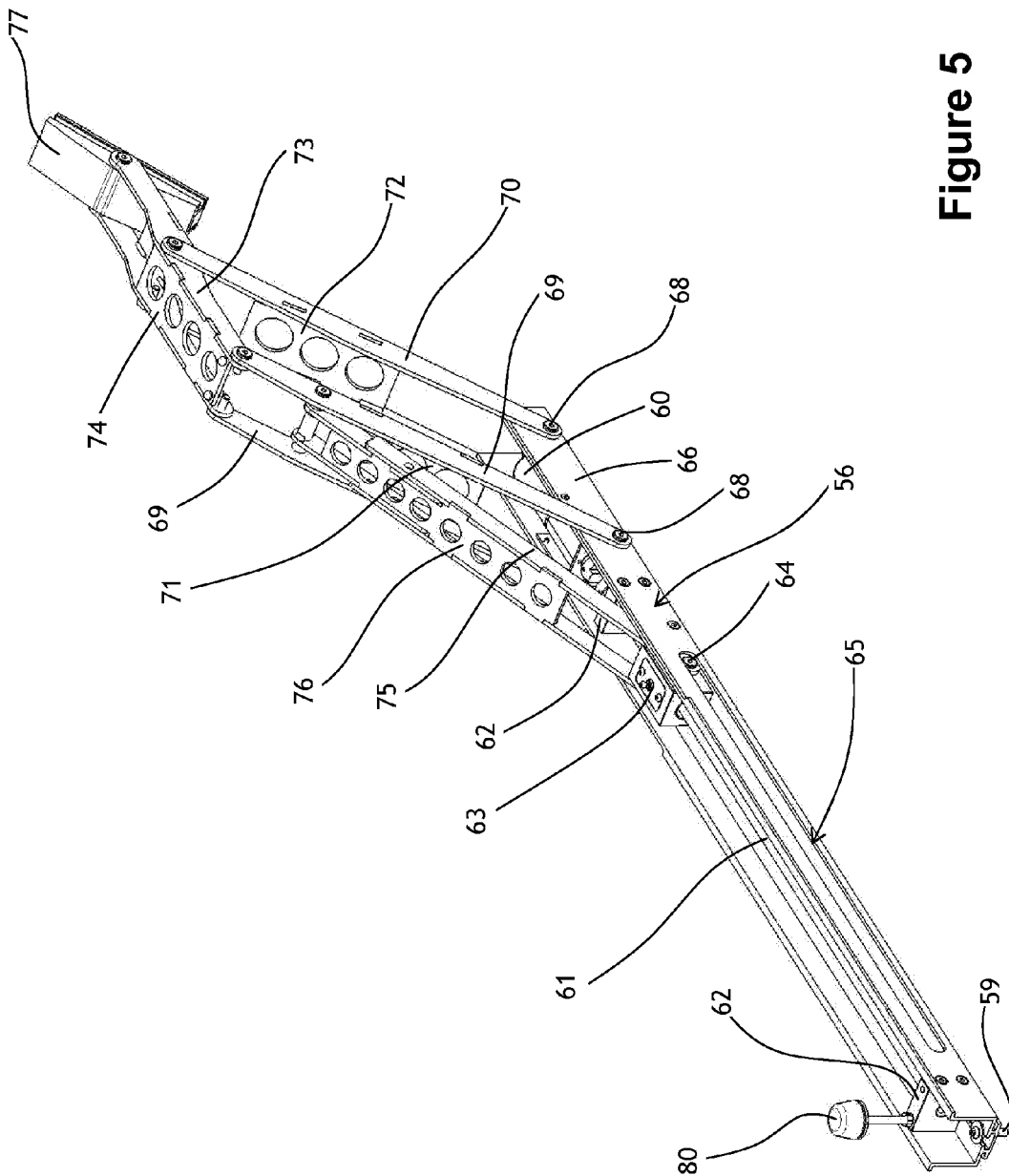


Figure 5

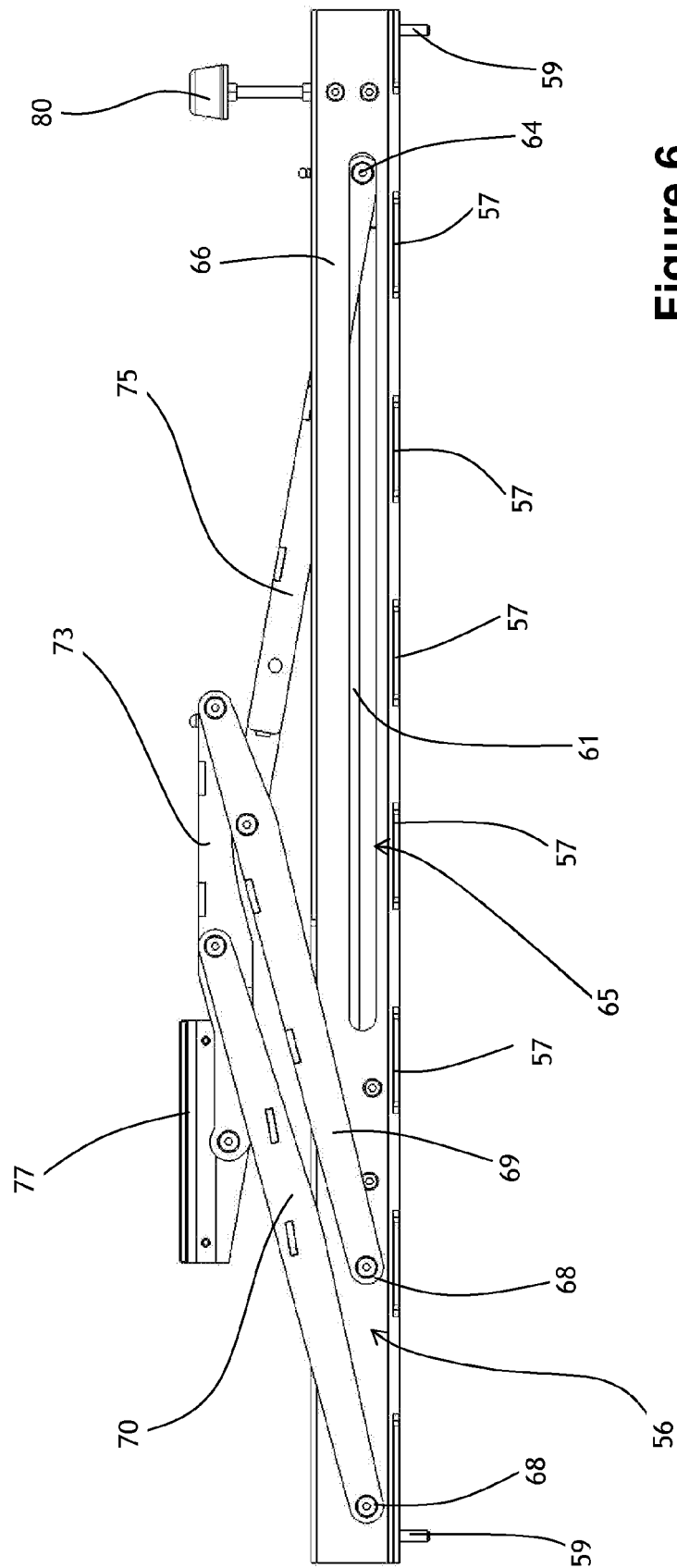


Figure 6

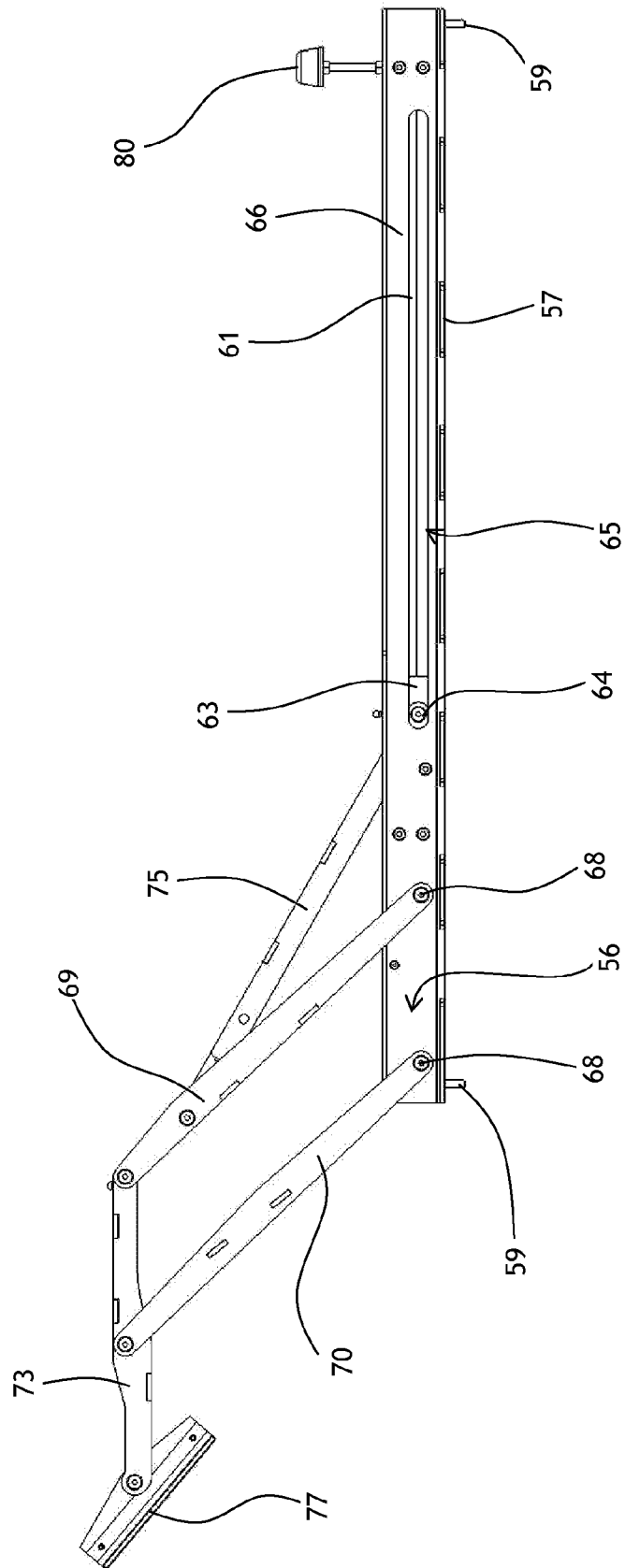


Figure 7

REFERENCES CITED IN THE DESCRIPTION

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