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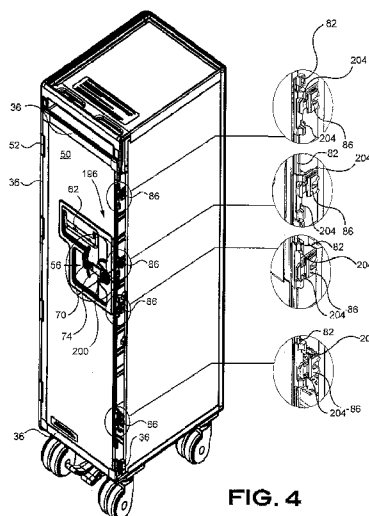


FIG. 4

(57) **Abstract:** A galley cart for moving along a passenger aisle of a vehicle is presented, the galley cart comprising a body comprising an upper portion, a lower portion, a right lateral portion, a left lateral portion and a door opening, the galley cart comprising wheels attached to the lower portion for supporting the body, a door pivotally attached to the body and adapted to mate with the door opening, and a locking mechanism operatively associated with the door, the locking mechanism comprising a first door-locking portion, and a second door-locking portion, each door-locking portion locking independently the door to the body when the door is closing the door opening. A securing mechanism and a method of use is also presented.



GALLEY CART LOCKING MECHANISM AND METHOD OF USE THEREOF

1. CROSS-REFERENCE

5 The present invention relates to and claims priority from United States Provisional Patent Application No.: 62/141,570, filed 04/01/2015, entitled TROLLEY DOOR LOCKING MECHANISM AND METHOD OF USE THEREOF, which is incorporated herein by reference.

2. FIELD OF THE INVENTION

10 This invention relates generally to a locking mechanism for a galley cart for moving objects. The present invention relates more precisely to a door locking mechanism for a galley cart for use in an airplane, or another vehicle, that can include a redundant door locking mechanism.

3. BACKGROUND OF THE INVENTION

Galley carts are generally used in the transportation industry for moving goods and other articles. Galley carts can be used in critical environments like in the aeronautical industry and are subject to safety requirements.

15 These requirements are intended to define the design and the use of galley carts to increase the safety of the people using them and also for the safety of the public. Galley carts used in aircrafts are subjected to many technical requirements that must be considered closely. Among others, mechanical resistance and fire resistance requirements are mandatory and have a direct effect on the design and the choice of material that can be used to manufacture the
20 galley cart.

The design and the construction of galley carts benefit from innovation in connection with various elements thereof. One of the elements that would benefit from innovative structure would be the door locking mechanism of the galley cart. The door locking mechanism might cause some safety issue if it becomes defective.

25 It is therefore desirable to provide an improved door locking mechanism over the existing art. It is also desirable to provide an improved locking mechanism that would not be jeopardized and unlocked by a shock in a direction over the existing art.

It is desirable to provide an improved door locking mechanism that would use a structure that not be jeopardized by the rupture of an element therein by using redundancy therein. It is therefore desirable to provide an improved door locking mechanism that would indicate to a user that the locking mechanism, or a redundant element therein, is not working properly.

- 5 Other deficiencies will become apparent to one skilled in the art to which the invention pertains in view of the following summary and detailed description with its appended figures.

4. SUMMARY OF THE INVENTION

10 The following presents a simplified summary of the invention in order to provide a basic understanding of some aspects of the invention. This summary is not an extensive overview of the invention. It is not intended to identify key/critical elements of the invention or to delineate the scope of the invention. Its sole purpose is to present some concepts of the invention in a simplified form as a prelude to the more detailed description of exemplary embodiments that is presented later.

15 Therefore, one aspect of the present invention improves at least some of the deficiencies associated with the drawbacks identified above.

It is one aspect of our work to provide, in accordance with at least one embodiment thereof, a galley cart with a redundant door locking mechanism.

It is one aspect of our work to provide, in accordance with at least one embodiment thereof, a galley cart with a door locking mechanism with self-locking capability when closing the door.

20 It is one aspect of our work to provide, in accordance with at least one embodiment thereof, a galley cart with a mechanism indicating to a user whether a galley cart door locking mechanism is correctly engaged or not.

25 It is an aspect of our work to provide, in accordance with at least one embodiment thereof, a galley cart with a mechanism indicating to a user whether a galley cart double door locking mechanism is correctly engaged or not.

It is an aspect of our work to provide, in accordance with at least one embodiment thereof, a galley cart with a mechanism indicating to a user whether a galley cart independent double door locking mechanism is correctly engaged or not correctly engaged.

It is an aspect of our work to provide, in accordance with at least one embodiment thereof, a galley cart with a warning mechanism indicating to a user whether a galley cart independent double door locking mechanism is correctly engaged or not, the warning mechanism being independent of the double door locking mechanism.

- 5 It is an object of our work to provide, in accordance with at least one embodiment thereof, a galley cart with a warning mechanism using the position of the door locking handle to indicate to a user whether a galley cart independent double door locking mechanism is correctly engaged or not.

- 10 It is an aspect of our work to provide, in accordance with at least one embodiment thereof, a galley cart with door locking mechanism secured to a galley cart door frame for mechanically securing the door locking mechanism secured to a galley cart door frame hence increasing the mechanical strength of the door assembly.

- 15 It is an aspect of our work to provide, in accordance with at least one embodiment thereof, a galley cart for moving along a passenger aisle of a vehicle is presented, the galley cart comprising a body comprising an upper portion, a lower portion, a right lateral portion, a left lateral portion and a door opening, the galley cart comprising wheels attached to the lower portion for supporting the body, a door pivotally attached to the body and adapted to mate with the door opening, and a locking mechanism operatively associated with the door, the locking mechanism comprising a first door-locking portion, and a second door-locking portion, each door-locking portion locking independently the door to the body when the door is closing the door opening.

- 25 It is an aspect of our work to provide, in accordance with at least one embodiment thereof, a door locking mechanism for selectively locking a door of a galley cart for moving along a passenger aisle of a vehicle, the galley cart comprising a body comprising an upper portion, a lower portion, a right lateral portion, a left lateral portion, and a door opening, the galley cart comprising wheels attached to the lower portion for supporting the body, and a door pivotally attached to the body and adapted to mate with the door opening, the locking mechanism comprising a first door-locking portion, and a second door-locking portion, each door-locking portion locking independently the door to the body when the door is closing the door opening.

- 30 These and other advantages and features of the present invention will become apparent from the following description and the attached drawings.

5. BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a perspective view of a full size galley cart in accordance with at least an embodiment of the present invention;

- 5 Figure 2 is a perspective view of a half size galley cart in accordance with at least an embodiment of the present invention;

Figure 3 is a semi exploded perspective view of a half size galley cart equipped with a tablet module in accordance with at least an embodiment of the present invention;

- 10 Figure 4 is a perspective view of a galley cart door with several illustrated operating configurations in accordance with at least an embodiment of the present invention;

Figure 5 is a front-right perspective exploded view of a portion of a locking mechanism in accordance with an embodiment of the present invention;

Figure 6 is a front-right side perspective view of a portion of a locking mechanism in accordance with an embodiment of the present invention;

- 15 Figure 7 is a front-right side perspective view of a portion of a locking mechanism in accordance with an embodiment of the present invention;

Figures 8 A), 8 B) and 8 C) are front elevation views of a portion of a locking mechanism of a galley cart in accordance with an embodiment of the present invention;

- 20 Figures 9 A) and 9 B) are front elevation views of a portion of a locking mechanism of a galley cart in accordance with an embodiment of the present invention;

Figure 10 is a front-right side perspective view of a portion of a locking mechanism in accordance with an embodiment of the present invention;

Figure 11 is a front-right side perspective view of internal components of a portion of a locking mechanism in accordance with an embodiment of the present invention;

Figure 12 is a front elevation view of internal components of a portion of a locking mechanism in accordance with an embodiment of the present invention;

Figure 13 is a front-right side perspective view of a portion of a locking mechanism in accordance with an embodiment of the present invention;

5 Figure 14 is a front-right side perspective view of internal components of a portion of a locking mechanism in accordance with an embodiment of the present invention;

Figure 15 is a front elevation view of internal components of a portion of a locking mechanism in accordance with an embodiment of the present invention;

10 Figure 16 is a front-right side perspective view of a portion of a locking mechanism in accordance with an embodiment of the present invention;

Figure 17 is a front-right side perspective view of internal components of a portion of a locking mechanism in accordance with an embodiment of the present invention;

Figure 18 is a front elevation view of internal components of a portion of a locking mechanism in accordance with an embodiment of the present invention;

15 Figure 19 is a front elevation view of internal components of a portion of a locking mechanism in accordance with an embodiment of the present invention;

Figure 20 is a front elevation view of internal components of a portion of a locking mechanism in accordance with an embodiment of the present invention;

20 Figure 21 is a front elevation view of internal components of a portion of a locking mechanism in accordance with an embodiment of the present invention;

Figure 22 is a rear-right side perspective view of internal components of a portion of a locking mechanism in accordance with an embodiment of the present invention;

Figure 23 is a front-right perspective exploded view of internal components of a portion of a locking mechanism in accordance with an embodiment of the present invention;

Figure 24 is a rear-right perspective exploded view of internal components of a portion of a locking mechanism in accordance with an embodiment of the present invention;

Figure 25 is a rear-right perspective semi exploded view of internal components of a portion of a locking mechanism in accordance with an embodiment of the present invention;

5 Figure 26 is a section view of internal components of a portion of a locking mechanism in accordance with an embodiment of the present invention;

Figure 27 is a front elevation view of internal components of a portion of a locking mechanism in accordance with an embodiment of the present invention;

10 Figure 28 is a front-right perspective view of a portion of a locking mechanism in accordance with an embodiment of the present invention;

Figure 29 is a front-right perspective view of a portion of a locking mechanism in accordance with an embodiment of the present invention;

15 Figure 30 is a flow chart representing behavior when the engaging member is engaged or not with respective engaging member receiver in accordance with an embodiment of the present invention; and

Figure 31 is a flow chart representing behavior when the engaging member is engaged or not with respective engaging member receiver in accordance with an embodiment of the present invention.

6. DESCRIPTION OF EMBODIMENT(S) OF THE INVENTION

20 The present invention is now described with reference to the drawings, wherein like reference numerals are used to refer to like elements throughout. In the following description, for purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of the present invention. It may be evident, however, that the present invention may be practiced without these specific details. In other instances, well-known
25 structures and devices are shown in schematic form in order to facilitate describing the present invention.

A galley cart 10 adapted to carry goods in accordance with an embodiment of the invention is illustrated in Figure 1. The galley cart 10 is adapted to be used in a passenger airplane but could alternatively be used in other environments like in a passenger train or, *inter alia*, in the medical field. The galley cart 10 illustrated in Figure 1 comprises a body 14 defining an upper
5 portion 18, a right lateral portion 22, a left lateral portion 26 and a bottom portion 30. The body 14 can be described as an assembled construction 32 using composite material panels 34 and junction members 36 therebetween simultaneously supplying the aesthetic envelope of the galley cart 10 and the structure providing its mechanical strength. In other words, the assembled construction 32 provides an envelope that is also the frame structure. As it will be described
10 below in respect with an embodiment, the assembled construction 32 uses a body 14 made of a plurality of parts.

The upper portion 18, the right lateral portion 22, the left lateral portion 26 and the bottom portion 30 of the body 14 are connected together to obtain a strong unified structure. Illustrative
15 embodiments described herein are using a variety of junction members 36 to interconnect adjacent portions 18, 22, 26, 30. The body 14 of the illustrated embodiment is forming a hollowed structure having four planar side portions 18, 22, 26, 30. It can be appreciated that the wall thickness of the different portions 18, 22, 26, 30 can have different thicknesses adapted to sustain the specific mechanical loads applied thereto. In other words, the assembled construction 32 of the galley cart 10 can be optimized to only use the required material at the
20 right place and therefore reduces the weight while providing the appropriate mechanical resistance. For example, the panel of the upper portion 18 can have a thinner wall section than the panel of the bottom portion 30 because the upper portion 18 does not bear the weight of the entire galley cart 10. Additional details about the construction of the body 14 will be provided below.

25 The galley cart 10 illustrated in Figure 1 is referred to as a full-size galley cart 10 having a predetermined longitudinal length 28 and provided with a door opening 38 on each longitudinal side 42, 46. Each door 50 is hingedly 52 connected to body 14 and is adapted to pivot between a closed position 54, when mating with its respective door opening 38, and an open position (not illustrated in the Figures). A locking mechanism 56 housing 60, that is also acting as a
30 reinforcement member 62 recessed into the door 50, provides support for a pulling handle 66 pivotally secured thereon and adapted to pull on the door 50. The pulling handle 66 can, in embodiments thereof, be spring loaded to bias the pulling handle 66 toward its collapsed position adjacent to the housing 60. A locking member 70 configured to align with an operatively pivotable locking handle 74 when the door 50 is locked in the closed position 54, to receive a
35 lock 58 (not shown in Figure 1, although, this element is illustrated in Figure 7) thereon to

prevent opening of the door 50 is also connected to the reinforcement member 62. The locking handle 74 is pivotally secured to the door 50 to selectively move a pair of pivotable lock members 78 that is operatively actuating a pair of opposed movable engaging member 82 to open the door 50. The handle 74 can be actuated in both vertical directions to engage and
5 disengage the pivotable lock members 78 from cooperating engaging member receivers 86 hereby embodies as hooks.

Still referring to Figure 1, the galley cart 10 is provided with a cover element 90 made of molded plastic to cover the upper portion 18 of the body 14. The cover element 90 is defining a planar work area 94 defined by a peripheral frame 98 configured to prevent objects to slide off
10 the upper portion 18 of the body 14.

The bottom portion 30 rests on a wheelbase 140 adapted to pivotally secure thereto a set of four (4) of caster wheels 144. Two pedals 148 are also pivotally secured to the wheelbase 140 to selectively lock or unlock the caster wheels 144 to immobilize the galley cart 10 when required.

15 A tablet module 110 is optionally secured inside the body 14, adjacent to the upper portion 18. The tablet module 110 comprises an extendable tablet/receptacle 114. The extendable tablet 114 is moveable between a closed position 122 and an opened position 126 as it can better be appreciated in Figure 3. A locking mechanism 130 prevents the extendable tablet 114 to extend when undesired. A handle 118 is affixed to, or built in the extendable tablet 114 and is
20 more accessible when the extendable tablet 114 is slightly extended.

The full size galley cart 10 illustrated in Figure 1 has a smaller counterpart. A reduced size galley cart 180, as illustrated in Figure 2 and Figure 3, has a smaller size due to its shorter longitudinal length 28. The reduced size galley cart 180 illustrated in Figure 1 and Figure 2 has a single door 50 located at one end of the body 14. The smaller volume of the reduced size
25 galley cart 180 can contain fewer goods therein but takes less space and allows nimbler movements.

As it is illustrated, the reduced size galley cart 180 of the present embodiment is about half the length of the full size galley cart 10. This is mainly obtained by reducing the length 28 of the body 14 and includes a single tablet module 110 on one longitudinal side of the body and a
30 single door 50. The longitudinal side of the body opposed to the door 50 is closed with a back portion 184, not illustrated in the Figures although a skilled reader will infer from the Figures there is a single door. The reduced size galley cart 180 is shown semi-exploded in Figure 3.

Beside the shorter longitudinal length 28, the components of the reduced size galley cart 180 are substantially similar as the components of the full size trolley illustrated in Figure 1. It can be appreciated that the door 50 has a recessed portion 188 sized and designed to receive therein the housing 60 such that the reinforcement member 62 and some components of the locking mechanism 56 located thereon do not extend above the external surface of the door 50.

Moving now to Figure 4 and Figure 5 depicting a door 50 of the galley cart 10 and further detailing the locking mechanism components 196 thereof. The locking handle 74 is pivotally secured to a pivot 200 and is configured to pivot toward the upward direction and the downward direction to unlock the locking mechanism and allows the door 50 to open. The locking handle 74 is in the locked position when it is in the horizontal position. When the locking mechanism 56 is not properly engaged to lock the door 50 in the closed position, the locking handle 74 is kept in the horizontal position. The non-horizontal position of the locking handle 74 is hence providing a visual indication to a user that the locking mechanism 56 is not engaged correctly in its locked position and the door 50 is not correctly secured. This ensures the user can appreciate when the door 50 is locked or not. The locking handle 74 actuates a pair of longitudinal engaging members 82 that selectively engages a plurality of corresponding engaging member receivers 86 (or any mechanism capable of providing a similar function). In the illustrated embodiment, the longitudinal engaging members 82 can be made of a polymer material or other suitable material. The embodied locking mechanism 56 is comprising two independent door-locking portions, a first door-locking portion 102 operational on the upper portion of the door 50 and a second door-locking portion 106 operational on the lower portion of the door 50. The pair of longitudinal engaging members 82 is assembled with the door 50 and the engaging member receivers 86 are secured to the body 14 of the galley cart 10. The door 50 is locked in the closed position when the pair of longitudinal engaging members 82, connected to the door 50, is engaged with the engaging member receivers 86 connected to the body 14. The first door-locking portion 102 is associated with the actuation of the upper longitudinal engaging members 82.1 while the second door-locking portion 106 is associated with the actuation of the lower longitudinal engaging members 82.2. Both door-locking portion 102, 106 are actuated independently to lock the door 50 as it is described below.

The pair of longitudinal engaging members 82 includes a plurality of engaging portions 204. The engaging portions 204 can be embodied in plastic or alternatively in metallic material such as aluminum or steel to ensure it is strong enough to sustain the loads generated by the engagement of the engaging portions 204 with corresponding engaging member receivers 86. Each hook-engaging portion 204 is embodied as a pair of opposed engaging portions 204 because the longitudinal engaging member 82 is used to engage the engaging member

receivers 86 on both sides when translated in each of the two opposed directions. This way, only one longitudinal engaging member 82 design is required for engaging the engaging member receivers 86 in both locations, above and below each engaging member receiver 86, to accommodate the opposite movements of the longitudinal engaging member 82.

5 As better seen in Figure 5, the locking handle 74 is illustratively connected to a pivotable actuating member 208 (embodied as an asymmetric eccentric member in the Figures) assembled inside the door 50. The actuating member 208, or any comparable actuation member, is designed to contact the two pivotable lock members 78. A vertical movement of the locking handle 74, to unlock the door 50, is pivoting the two pivotable lock members 78 about
10 their respective pivots 212 that actuate, via actuator arms 216, the vertical movements of the two longitudinal engaging members 82. One can appreciate the actuating member 208 has two opposed contacting portions 220 of different lengths to adapt to the different lever length of the actuator arms 216 between the pivots 212 and the contact point of the actuating member 208. Each pivotable lock members 78 is independently biased with a spring 224, respectively or
15 collectively, to bias the two pivotable lock members 78 in their locked position. Each spring 224 is retained in its operating position with spring locators 224 illustratively protruding from a rear panel 228 of the reinforcement member 62.

One can appreciate from Figure 5 the pivotal lock member 78 is embodied in an "L" like shape. A first branch 236 of the pivotal lock member 78 is extending from the pivot 212 to its
20 associated engaging member 82. A second branch 240 of the pivotal lock member 78 is extending from the pivot 212 to a signal portion 232. The signal portion 232 includes two distinct signal areas 232.1 and 232.2, respectively having, for example, distinctive colors. The signal areas 232.1 and 232.2 of the signal portion 232 are sized and designed to be visible from information windows 244 in the housing 60. In the present embodiment, each signal area 232
25 has a specific color, for instance red and green, adapted to be seen from the exterior of the cart 10 through the information windows 244. Each color is associated with a locking state of the engaging members 82. The color used in the present application are for illustrative purposes only and could vary without departing from the scope of the invention. When the color green of the signal portion 232 is visible through its respective information window 244, it informs a
30 viewer that its related engaging member 82 is in its locked state and the door 50 is locked in its closed position. Conversely, when the color red of the signal portion 232 is visible through its respective information window 244, it informs a viewer that its related engaging member 82 is in its unlocked state and the door 50 is not locked in its closed position and can be open.

A reader skilled in the art can appreciate the two engaging members 82 are actuated in opposite vertical directions by a pivotal of the locking handle 74. With reference to the illustrated embodiment, a vertical upward pivotal of the locking handle 74 is going to rotate the first branch of the upper engaging members 82 upward and the first branch of the lower engaging members 82 downward, unlocking the engaging members 82 from their respective corresponding engaging member receivers 86. In contrast, a vertical downward pivotal of the locking handle 74 is going to rotate the first branch of the upper engaging members 82 downward and the first branch of the lower engaging members 82 upward, unlocking the engaging members 82 from their respective corresponding engaging member receivers 86. In both configurations, the red color of the signal portions 232 is going to be visible from the information window 244 informing a viewer the locking mechanism of the door 50 is in the unlocked position. In both of the above configurations, when the engaging members 82 are in their unlocked position, the red portion 256 of the signal portion 232 is displayed through the information window 244. A viewer will understand the engaging members 82 are in their unlocked position.

Leaving the locking handle 74 in its horizontal position is not biasing the engaging members 82 against their respective spring 224 and keeps the engaging members 82 in a locked position engaging their respective engaging member receivers 86. In that state, when the engaging members 82 are in their respective locked position, the green portion 252 of the signal portion 232 is displayed through the information window 244. A viewer will understand the engaging members 82 are in their locked position.

The illustrated embodiment is constructed in a way the two engaging members 82 are moving in their respective unlocked position with opposed vertical movements thereof. For instance, the upper engaging member 82 is moving in its locked position with an upper movement thereof while the lower engaging member 82 is moving in its locked position with a downward movement thereof. In contrast, the upper engaging member 82 is moving in its locked position with a downward movement thereof while the lower engaging member 82 is moving in its locked position with an upward movement thereof. This brings a significant advantage in a situation where the galley cart 10 would be subjected to a flight load (hypothetically) strong enough to cause a vertical movement of the engaging members 82 in a direction adapted to unlock the engaging member 82, at least one of the engaging members 82, the other engaging member 82, is going to remain in its locked position because the two engaging members 82 are actuated to be unlocked in opposite vertical directions.

Independent engaging members 82 and associated pivotal lock members 78 is another particularity of the embodied locking mechanism 56. The independent engaging members 82

and associated pivotal lock members 78 ensure a malfunction of one of the engaging members 82 and associated pivotal lock members 78 is not going to cause a malfunction of the other engaging member 82 and associated pivotal lock member 78.

Figure 6 depicts the assembled reinforcement member 62 with the components described above operatively assembled therein. It is possible to appreciate that the ends of the first branch 236 are extending outside the housing 60 to cooperate with their respective engaging members 82 when the housing 60 is operatively assembled with the door 50. The assembled housing 60 is illustrated with the locking handle 74 locked with a lock 58 in its horizontal locked position in Figure 7. It is also possible to see the engaging members 82 operatively assembled with the ends of the actuator arms 216 of the first branches 236 extending outside the reinforcement member 62. The ends of the actuator arms 216 are inserted in arm receivers 248 formed on the engaging members 82. The mating of the actuator arms 216 inserted in arm receivers 248 allow pivotal movements of the actuator arms 216 in the arm receivers 248 to slide the engaging members 82 in the desired position.

It can also be appreciated in Figure 7 the engaging members 82 includes pairs of opposed hook-receiving portions 204. The configuration of opposed hook-receiving portions 204 allows to engage the engaging member receiver 86 in both vertical directions. Movements of the locking handle 74, in the upward direction and the downward direction, are going to disengage the engaging member receivers 86. Central position of the locking handle 74 is allowing self-positioning of the engaging member 82 biased by their respective spring 224 in a locked position.

Figure 8 shows the engagement member 82 (latch) engagement and disengagement through normal locking handle 74 operation. Figure 8 A) depicts the locking handle 74 in the horizontal position corresponding to the locked position of the engaging members 82 that is also locating the green portion 252 of the signal portion 232 to be visible through the information window 244. It can also be seen the springs 224 are not compressed. Figure 8 B) depicts the locking handle 74 tilted in the downward position corresponding to the unlocked position of the engaging members 82 that is also locating the red portions 256 of the signal portion 232 to be visible through the information window 244. It can also be seen the springs 224 are compressed and bias the pivotal lock member 78 toward the locked position. Figure 8 C) depicts the locking handle 74 tilted in the upward position corresponding to the unlocked position of the engaging members 82 that is also locating the red portions 256 of the signal portion 232 to be visible through the information window 244. It can also be seen the springs 224 are compressed and bias the pivotal lock member 78 toward the locked position.

Mechanism failure scenarios are illustrated in Figure 9. Figure 9 A) illustrates the locking handle 74 is in the horizontal locked position. However, the upper engaging member 82.1 is stuck in the unlocked position, indicating the red portion 256 through the information window 244. Conversely, the lower engaging member 82.2 is in the locked position, indicating the green portion 252 through the information window 244. Figure 9 B) still illustrates the locking handle 74 is in the horizontal locked position. However, this time, the upper engaging member 82.1 is in the locked position, indicating the green portion 252 through the information window 244. Conversely, the lower engaging member 82.2 is undesirably stuck in the unlocked position, indicating the red portion 256 through the information window 244. The configuration of the double independent engaging members 82 provides a secondary retaining mechanism for locking the door 50 in case one of the engaging members 82 fails to engage correctly the engaging member receivers 86.

Figure 11 and Figure 12 are further magnified illustrations of the locking mechanism components 196 in the configuration of Figure 8 A). It can be seen in Figure 12 that the pivotal lock member 78 includes a shaped contacting portion 260 adapted to improve the link between the first branch 236 and the engaging member 82 by reducing the effect of the pivotal movement of the first branch 236 on the movement of the engaging member 82. The shaped contacting portion 260 is embodied as a semi-circular 264 recessed portion optimizing the contact interaction between the parts. The shaped contacting portion 260 could alternatively have an elliptic shape or an arbitrary shape reflecting a desired equilibrium of strength between the parts to get a particular feeling when actuating the mechanism.

Figure 13 is a magnified illustration of the locking mechanism 56 components 196 in the configuration shown in Figure 8 B). Figure 14 and Figure 15 are further magnified versions of the components of the locking mechanism 56 components 196 in the configuration illustrated in Figure 8 B).

Figure 15 is a magnified illustration of the locking mechanism 56 components 196 in the configuration depicted in Figure 8 C). Figure 16 and Figure 17 are further magnified versions of the components of the locking mechanism 56 components 196 in the configuration drawn by Figure 8 C).

Two mechanism failure scenarios are respectively illustrated in Figure 19 and in Figure 20. Figure 19 is a magnified illustration of the locking mechanism 56 components 196 disposed in the configuration exemplified in Figure 9 A). Figure 20 is a magnified illustration of the locking mechanism 56 components 196 in the configuration as in Figure 9 B).

Another embodiment of the locking mechanism 56 is presented in Figure 21 throughout Figure 28. The signal portions 232 and corresponding information windows 244 are absent in this design. The locking mechanism 56 is embedded in the door 50 recessed into the composite material 300, as best seen in Figure 25, through the front external layer of fibers 304 and the core 308. The housing 60 of the locking mechanism 56 is containing locking mechanism elements 196 therein. The housing 60 of the locking mechanism 56 is secured in place with a series of fasteners 312 from the interior side of the door 50 hence providing a fasteners-free exterior design. The housing 60 of the locking mechanism 56 is also secured to the peripheral frame 98 with an engagement of an extending housing portion 316 designed to be located within the corresponding portion of the peripheral frame 98. The extending housing portion 316 is secured to the corresponding portion of the peripheral frame 98 with a fastener 320 through a corresponding fastener opening 324 located in the peripheral frame 98. This connection between the housing 60 and the peripheral frame 98 further reinforce the peripheral frame 98 with the panel 34 of the door 50. The peripheral frame 98 of the door 50 can sustain higher mechanical stresses.

It can be appreciated from Figure 23, Figure 24, Figure 25 and Figure 26 that the actuating member 208, springs 224, branches 236, 240 are assembled behind the reinforcement member 62 and secured with cover plate 328. The cover plate 328 is preferably made of strong material, like steel or aluminum, to increase the strength of the assembly. For achieving this, the cover plate 328 extends within the corresponding portion of the peripheral frame 98 and secured with fastener 320 through a corresponding fastener opening 324 located in the peripheral frame 98. The handle 74 is pivotally secured along pivot axis 332 from behind with fastener 336 through opening 340. The handle 74 includes hollowed portions 344 to lighten its weight and is cover with handle cover 348. The handle 74, in this embodiment, has a structure reducing the mechanical lever between the pivot axis 332 and the opposite end of the handle 74. The mechanical lever is reduced in the illustrated embodiment by a retaining element embodied as a hook portion 356 pivotally engaging corresponding slot 352 in the reinforcement member 62. The hook portion 356 significantly increases the strength of the handle 74 when pulled from the front of the door 50 by reducing the lever of about 50% in the current illustrated embodiment. An alternate embodiment, not illustrated, is equipped of a similar retaining element disposed at the complete end of the handle 74 that is opposed to the pivot axis 332. This latter embodiment cancels the lever effect and dramatically increases the strength of the handle 74. One can also appreciate from Figure 23 the handle 66 is biased toward the door with spring 360. The spring 360 and handle 66 assembly is covered with cover 364 that is securing the assembly in place. More clearly illustrated, in Figure 25, branch 240 of pivotable lock member 78 includes a pivot 212 that is embodied as a semi-circular external shape of an end of branches 240. A

counterpart pivot-receiver 272 built in the reinforcement member 62. A semi-circular ridge portion 276 is provided in the reinforcement member 62 material and embodied with the reinforcement ridges 280 therein.

Figure 27, Figure 28 and Figure 29 are illustrating the interaction of parts for the illustrated embodiment that is substantially similar to the operating principles discussed above in respect with the embodiments illustrated in the Figure 1 throughout Figure 20 of the specification. It is depicted the branches 236 and 240 are extending on respective sides of the extending housing portion 316. The distal end 368 of the handle 74 is arcuately moving in a recessed portion 372 in the reinforcement member 62 hence providing a tight assembly. The door 50 is adapted to close and engage the locking mechanism 56 by solely closing the door 50 on the body 14. No manual actuation of the handle 74 is required because the hook-receiving portions 204 of the engaging member 82 are adapted to slide over the forward portion 376 engaging member receivers 86. The forward portion 376 includes hook-contacting portion 380, that can be embodied with an angled plane or a curved portion, to move the engaging member 82 against its biasing spring 224 and smoothly engage the engaging member receiver 86 with the engaging portion 204. This feature can be referred to as a "slam latch" mechanism meaning closing the door 50 is going to engage the locking mechanism 56 without touching the handle 74.

A flow chart of a typical behavior of the locking mechanism 56 informing a user of the door locking status is depicted in Figure 30. The user is closing 400 the door 50 and the first engaging member 82.1 is moved 404 to engage corresponding engaging member receiver 86. Concurrently, the second engaging member 82.2 is moved 408 to engage corresponding engaging member receiver 86. A detection of the locking status of the first engaging member 82.1 is made 412 and a detection of the locking status of the second engaging member 82.2 is made 416. The user is informed of a determination 420 that the two engaging members 82 are engaged with corresponding engaging member receiver 86. Conversely, the user is informed of a determination 424 that the at least one of the two engaging members 82 is not engaged with corresponding engaging member receiver 86.

Another flow chart of a typical behavior of the locking mechanism 56 informing a user of the door locking status is depicted in Figure 31. The user is closing 430 the door 50 and the first engaging member 82.1 is moved 434 to engage corresponding engaging member receiver 86. Concurrently, the second engaging member 82.2 is moved 438 to engage corresponding engaging member receiver 86. A detection of the locking status of the first engaging member 82.1 and a detection of the locking status of the second engaging member 82.2 is made 442.

The user is informed of a determination 446 that the two engaging members 82 are engaged with corresponding engaging member receiver 86. Conversely, the user is informed of a determination 450 that the two engaging members 82 is not engaged with corresponding engaging member receiver 86.

- 5 The description and the drawings that are presented above are meant to be illustrative of the present invention. They are not meant to be limiting of the scope of the present invention. Modifications to the embodiments described may be made without departing from the present invention, the scope of which is defined by the following claims:

What is claimed is:

1. A galley cart for moving along a passenger aisle of a vehicle, the galley cart comprising:
a body comprising
an upper portion;
5 a lower portion;
a right lateral portion;
a left lateral portion; and
a door opening;
the galley cart comprising
10 wheels attached to the lower portion for supporting the body;
a door pivotally attached to the body and adapted to mate with the door opening; and
a locking mechanism operatively associated with the door, the locking mechanism
comprising
a first door-locking portion; and
15 a second door-locking portion, each door-locking portion locking independently
the door to the body when the door is closing the door opening.
2. The galley cart of claim 1, wherein the first door-locking portion is locking an upper
portion of the door to the body and the second door-locking portion is locking a lower portion of
the door to the body.
- 20 3. The galley cart of claim 1, wherein the first door-locking portion includes a first engaging
member for locking the door to the body, and the second door-locking portion includes a second
engaging member for locking the door to the body, the two engaging members being actuable
independently for locking the door to the body.
4. The galley cart of claim 3, wherein pivoting the door to close a door opening is engaging
25 an engaging portion of the engaging member with a corresponding engaging member receiver
secured to the body without manual actuation of a handle of the locking mechanism.
5. The galley cart of claim 3, wherein the engaging members are slidably housed in a
peripheral frame of the door.
6. The galley cart of claim 3, wherein an engaging portion of the first engaging member is
30 engaging with the corresponding engaging member receiver secured to the body, when moving

in a first direction, and the second engaging member is engaging with the corresponding engaging member secured to the body, when moving in a second direction opposed to the first direction.

7. The galley cart of claim 3, wherein an actuating member actuates a pair of lock
5 members pivotably secured on a first side and operatively connected to respective engaging members on a second side.

8. The galley cart of claim 1, wherein the locking mechanism includes a handle pivotably secured thereon, the handle pivoting the actuating member.

9. The galley cart of claim 1, wherein the locking mechanism handle includes a mechanism
10 adapted to warn a user when one of the first door-locking portion and the second door-locking portion is not securing the door with the body.

10. The galley cart of claim 1, wherein the first door-locking portion is biased toward a locked configuration and the second door-locking portion is biased toward a locked configuration.

15 11. A door locking mechanism for selectively locking a door of a galley cart for moving along a passenger aisle of a vehicle, the galley cart comprising:

a body comprising

an upper portion;

a lower portion;

20 a right lateral portion;

a left lateral portion; and

a door opening;

the galley cart comprising

wheels attached to the lower portion for supporting the body; and

25 a door pivotally attached to the body and adapted to mate with the door opening;

the locking mechanism comprising

a first door-locking portion; and

a second door-locking portion, each door-locking portion locking independently the door to the body when the door is closing the door opening.

12. The door locking mechanism of claim 11, wherein the first door-locking portion is locking an upper portion of the door to the body and the second door-locking portion is locking a lower portion of the door to the body.
13. The door locking mechanism of claim 11, wherein the first door-locking portion includes
5 a first engaging member for locking the door to the body, and the second door-locking portion includes a second engaging member for locking the door to the body, the two engaging members being actuatable independently for locking the door to the body.
14. The door locking mechanism of claim 13, wherein pivoting the door to close a door opening is engaging an engaging portion of the engaging member with a corresponding
10 engaging member receiver secured to the body without manual actuation of a handle of the locking mechanism.
15. The door locking mechanism of claim 13, wherein the engaging members are slidably housed in a peripheral frame of the door.
16. The door locking mechanism of claim 13, wherein an engaging portion of the first
15 engaging member is engaging with the corresponding engaging member receiver secured to the body, when moving in a first direction, and the second engaging member is engaging with the corresponding engaging member secured to the body, when moving in a second direction opposed to the first direction.
17. The door locking mechanism of claim 13, wherein an actuating member actuates a pair
20 of lock members pivotably secured on a first side and operatively connected to respective engaging members on a second side.
18. The door locking mechanism of claim 11, wherein the locking mechanism includes a handle pivotably secured thereon, the handle pivoting the actuating member.
19. The door locking mechanism of claim 11, wherein the locking mechanism handle
25 includes a mechanism adapted to warn a user when one of the first door-locking portion and the second door-locking portion is not securing the door with the body.
20. The door locking mechanism of claim 11, wherein the first door-locking portion is biased toward a locked configuration and the second door-locking portion is biased toward a locked configuration.

30

AMENDED CLAIMS
received by the International Bureau on
17 August 2016 (17.08.2016)

What is claimed is:

1. A galley cart for moving along a passenger aisle of a vehicle, the galley cart comprising:
 - a body comprising
 - an upper portion;
 - a lower portion;
 - a right lateral portion;
 - a left lateral portion; and
 - a door opening;
 - the galley cart comprising
 - wheels attached to the lower portion for supporting the body;
 - a door pivotally attached to the body and adapted to mate with the door opening; and
 - a locking mechanism operatively associated with the door, the locking mechanism comprising
 - a first door-locking portion;
 - a second door-locking portion, each door-locking portion locking independently the door to the body when the door is closing the door opening; and
 - a handle pivotally connected to the door in a plane parallel with the door and operatively interacting with the first door-locking portion and the second door-locking portion to unlock the first door-locking portion and the second door-locking portion.
2. The galley cart of claim 1, wherein the first door-locking portion is locking an upper portion of the door to the body and the second door-locking portion is locking a lower portion of the door to the body.
3. The galley cart of claim 1, wherein the first door-locking portion includes a first engaging member for locking the door to the body, and the second door-locking portion includes a second engaging member for locking the door to the body, the two engaging members being actuatable independently for locking the door to the body.

4. The galley cart of claim 3, wherein pivoting the door to close a door opening is engaging an engaging portion of the engaging member with a corresponding engaging member receiver secured to the body without manual actuation of a handle of the locking mechanism.

5. The galley cart of claim 3, wherein the engaging members are slidably housed in a vertical portion of a peripheral frame of the door.

6. The galley cart of claim 3, wherein an engaging portion of the first engaging member is engaging with the corresponding engaging member receiver secured to the body, when moving in a first vertical direction, and the second engaging member is engaging with the corresponding engaging member secured to the body, when moving in a second vertical direction opposed to the first vertical direction.

7. The galley cart of claim 3, wherein an actuating member actuates a pair of lock members pivotally secured on a first side and operatively connected to respective engaging members on a second side.

8. The galley cart of claim 1, wherein the handle is pivotally connected to an actuating member operatively assembled between a pair of pivotal lock members.

9. The galley cart of claim 1, wherein the locking mechanism handle includes a mechanism for warning a user when one of the first door-locking portion and the second door-locking portion is not securing the door with the body when the door is closing the door opening.

10. The galley cart of claim 1, wherein the first door-locking portion is biased in a first direction toward a locked configuration and the second door-locking portion is biased in a second direction toward a locked configuration.

11. A door locking mechanism for selectively locking a door of a galley cart for moving along a passenger aisle of a vehicle, the galley cart comprising:

a body comprising

an upper portion;

a lower portion;

a right lateral portion;

a left lateral portion; and

a door opening;

the galley cart comprising

wheels attached to the lower portion for supporting the body; and

a door pivotally attached to the body and adapted to mate with the door opening;

the locking mechanism comprising

a first door-locking portion;

a second door-locking portion, each door-locking portion locking independently the door to the body when the door is closing the door opening; and

a handle pivotally connected to the door in a plane parallel with the door and operatively interacting with the first door-locking portion and the second door-locking portion to unlock the first door-locking portion and the second door-locking portion.

12. The door locking mechanism of claim 11, wherein the first door-locking portion is locking an upper portion of the door to the body and the second door-locking portion is locking a lower portion of the door to the body.

13. The door locking mechanism of claim 11, wherein the first door-locking portion includes a first engaging member for locking the door to the body, and the second door-locking portion includes a second engaging member for locking the door to the body, the two engaging members being actuable independently for locking the door to the body.

14. The door locking mechanism of claim 13, wherein pivoting the door to close a door opening is engaging an engaging portion of the engaging member with a corresponding engaging member receiver secured to the body without manual actuation of a handle of the locking mechanism.

15. The door locking mechanism of claim 13, wherein the engaging members are slidably housed in a vertical portion of a peripheral frame of the door.

16. The door locking mechanism of claim 13, wherein an engaging portion of the first engaging member is engaging with the corresponding engaging member receiver secured to the body, when moving in a first vertical direction, and the second engaging member is engaging with the corresponding engaging member secured to the body, when moving in a second vertical direction opposed to the first vertical direction.

17. The door locking mechanism of claim 13, wherein an actuating member actuates a pair of lock members pivotally secured on a first side and operatively connected to respective engaging members on a second side.

18. The door locking mechanism of claim 11, wherein, the handle is pivotally connected to an actuating member operatively assembled between a pair of pivotal lock members.

19. The door locking mechanism of claim 11, wherein the locking mechanism handle includes a mechanism for warning a user when one of the first door-locking portion and the second door-locking portion is not securing the door with the body when the door is closing the door opening.

20. The door locking mechanism of claim 11, wherein the first door-locking portion is biased in a first direction toward a locked configuration and the second door-locking portion is biased in a second direction toward a locked configuration.

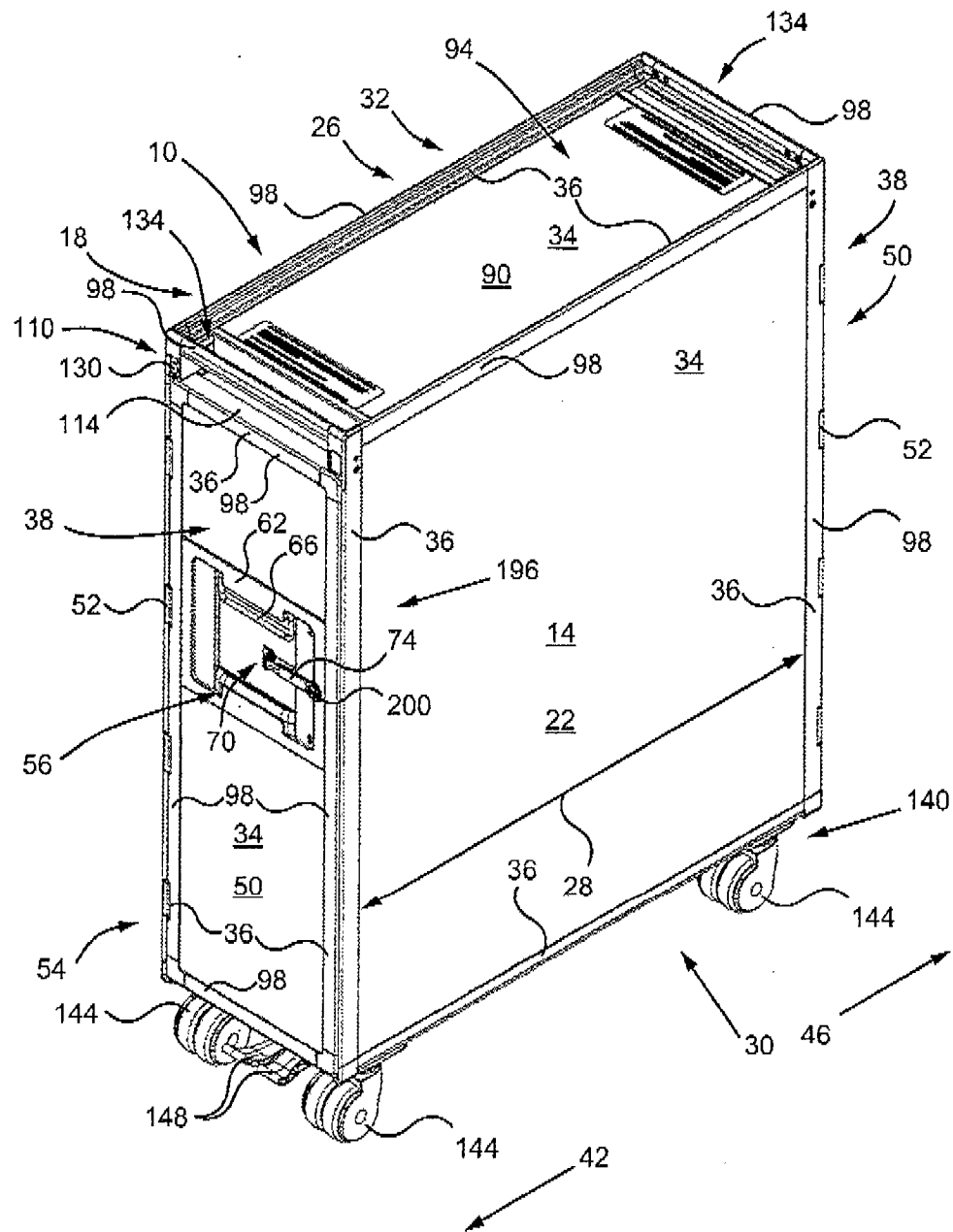


FIG. 1

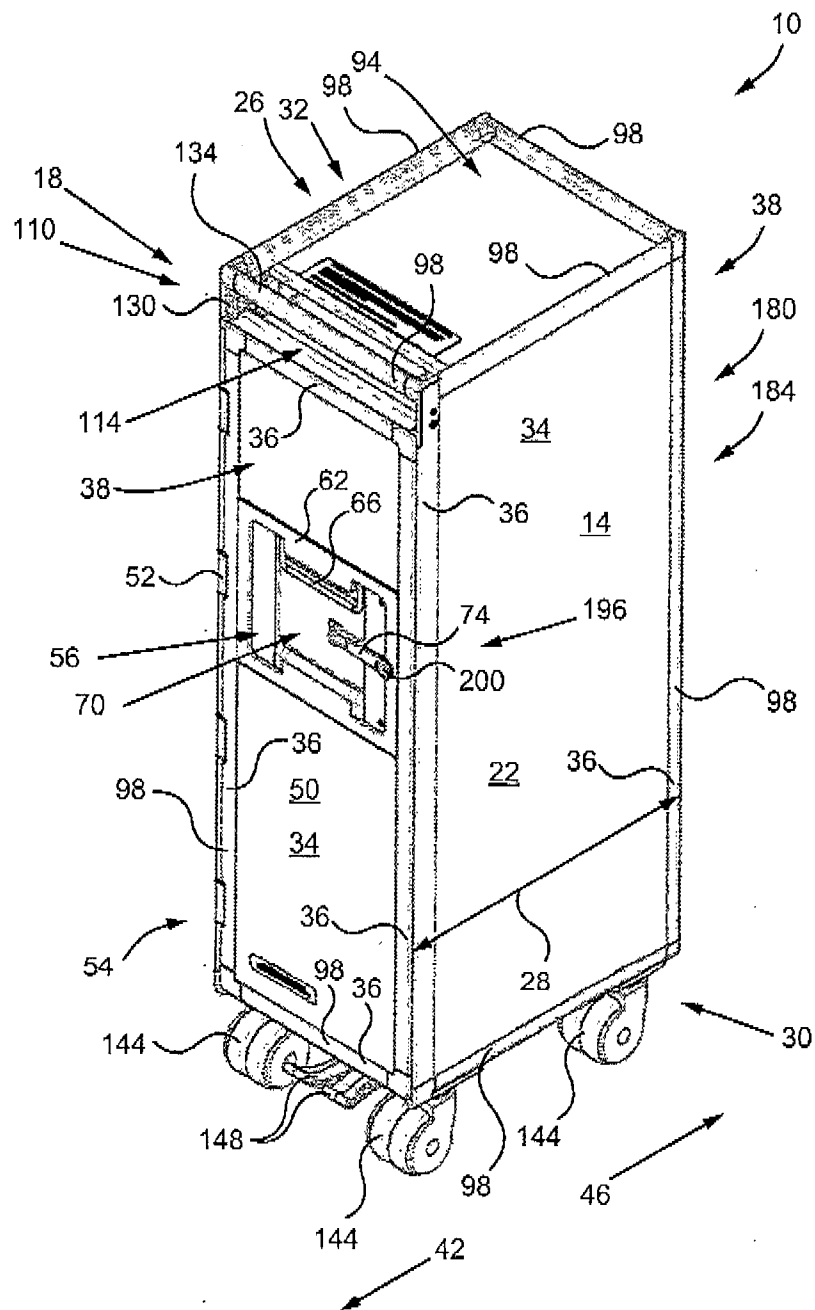


FIG. 2

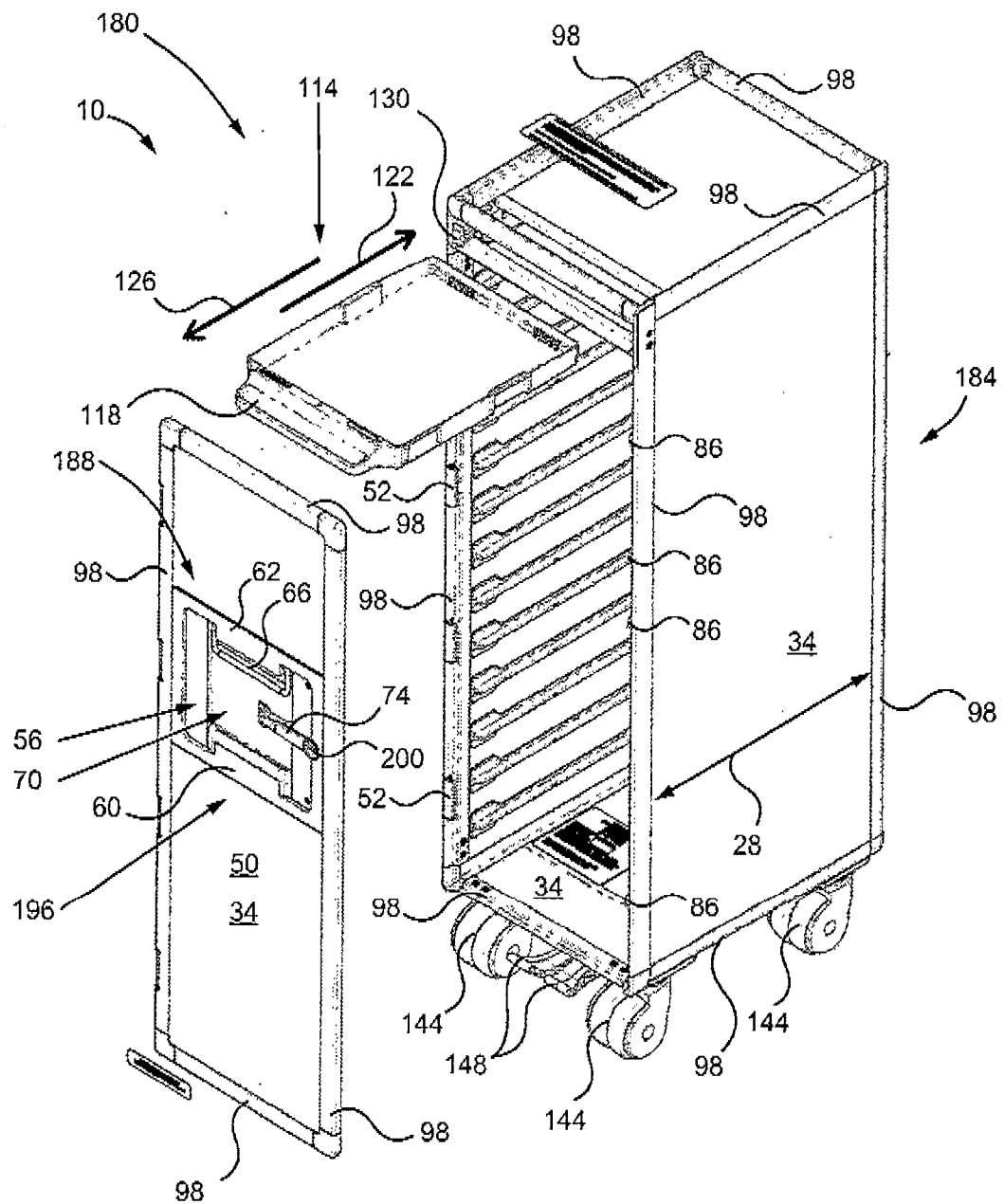


FIG. 3

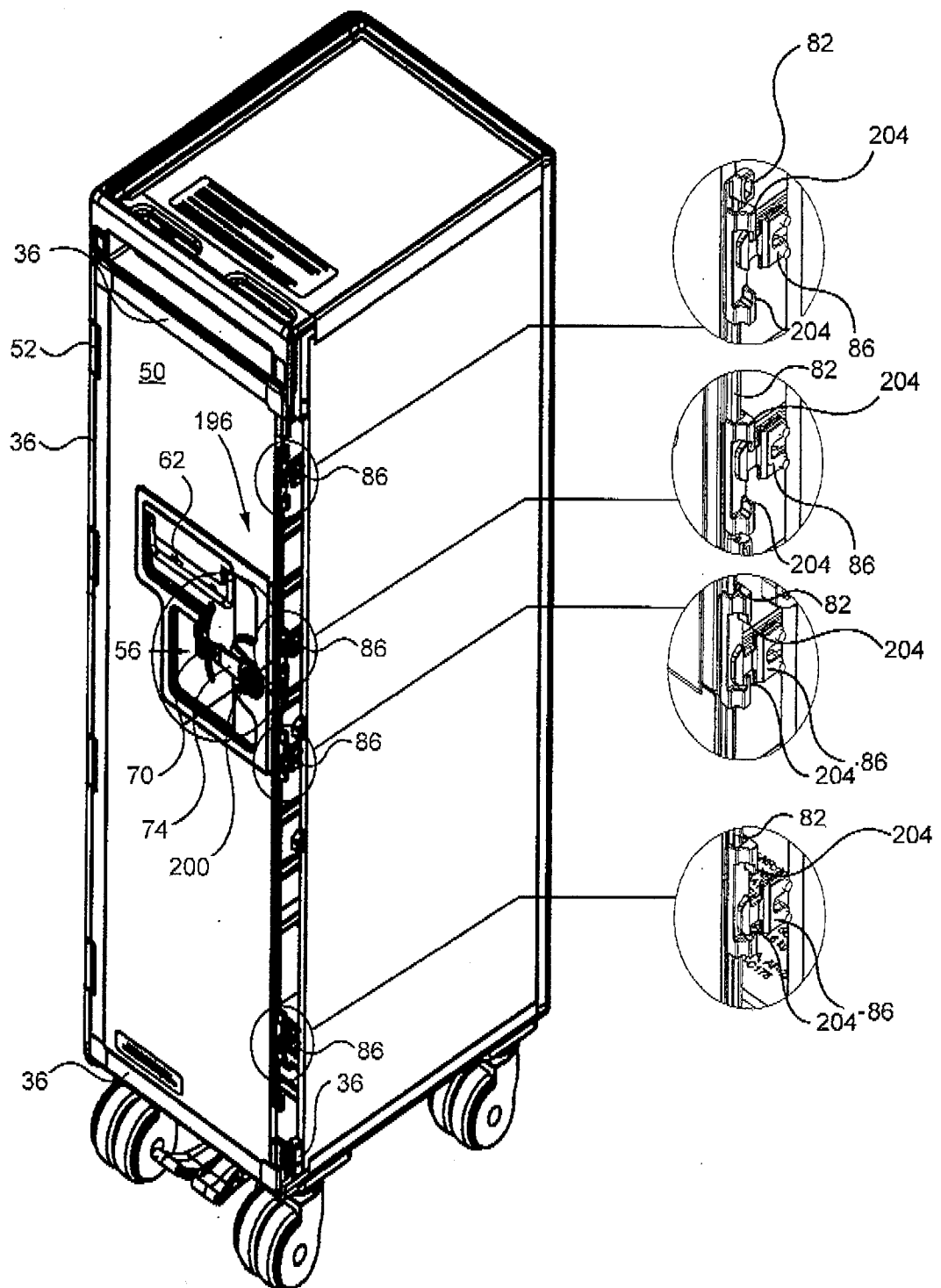


FIG. 4

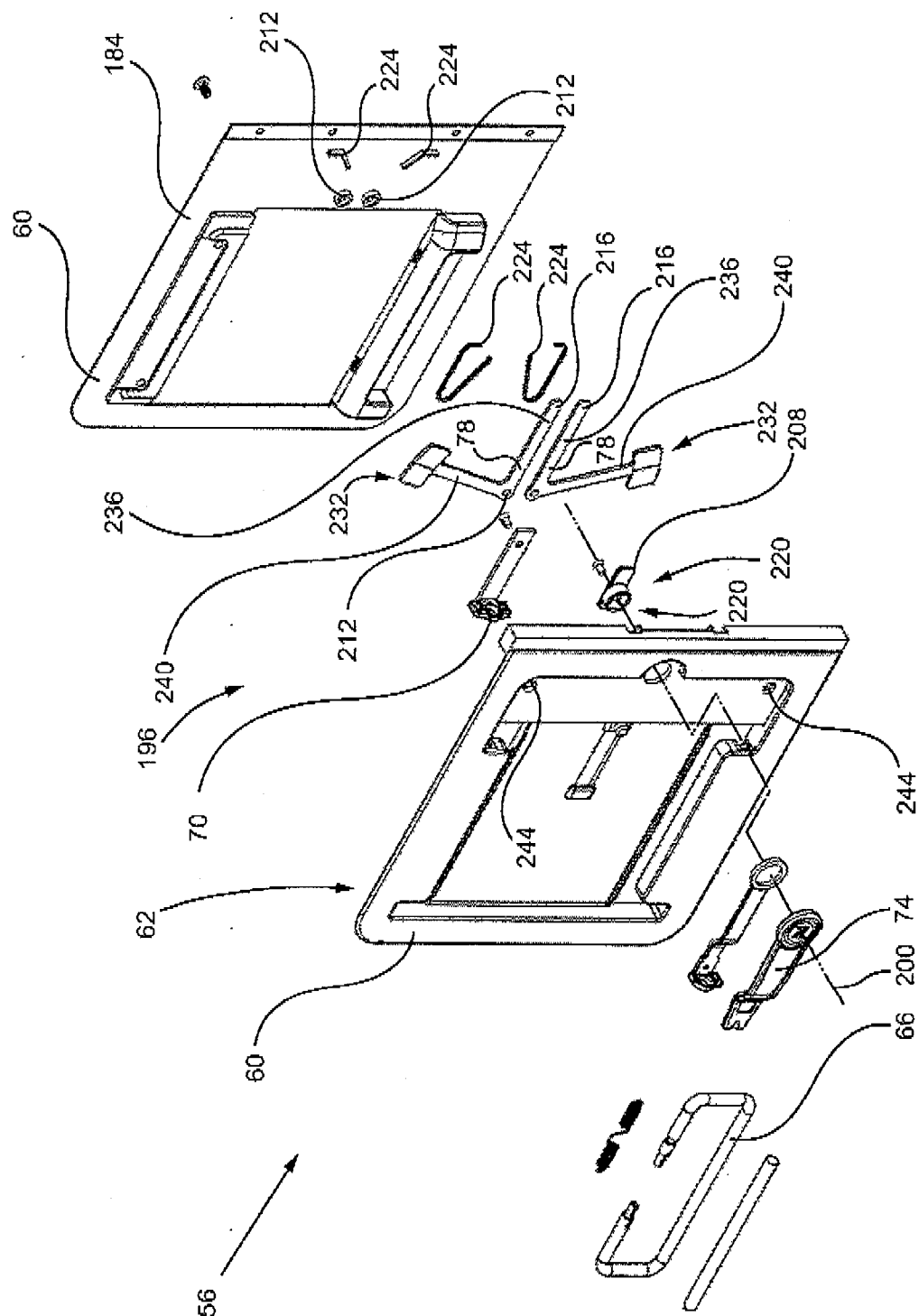


FIG. 5

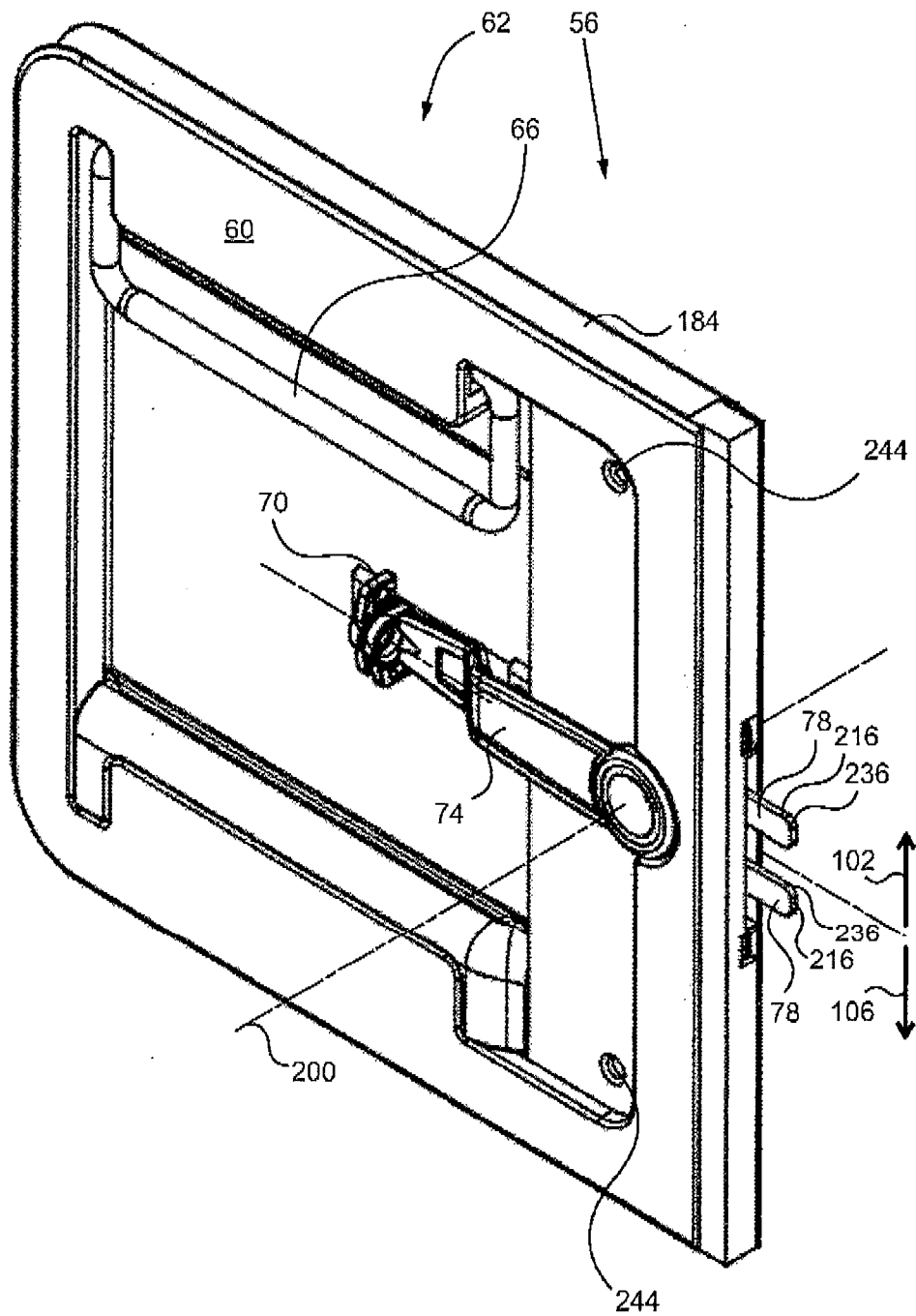


FIG. 6

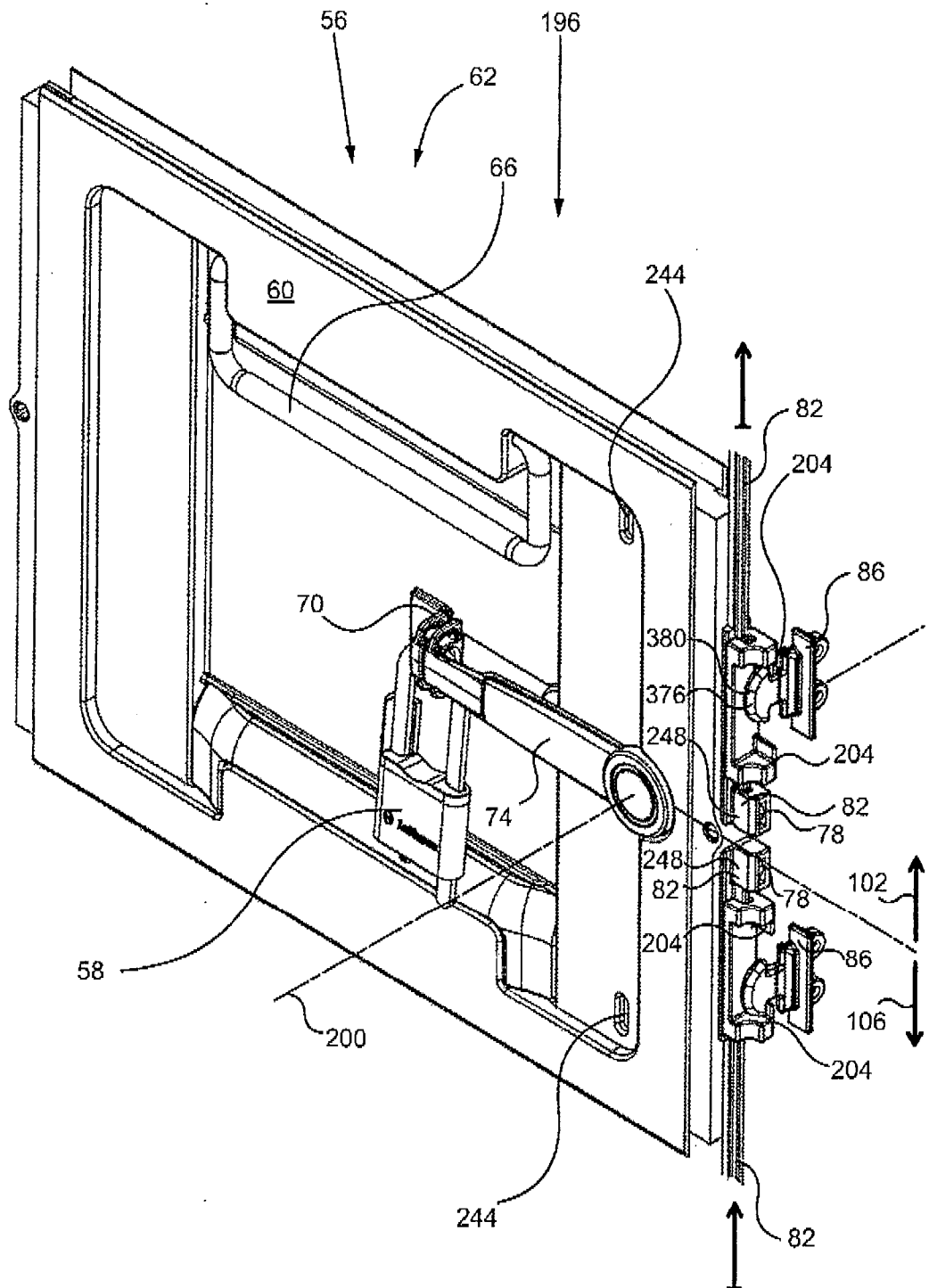


FIG. 7

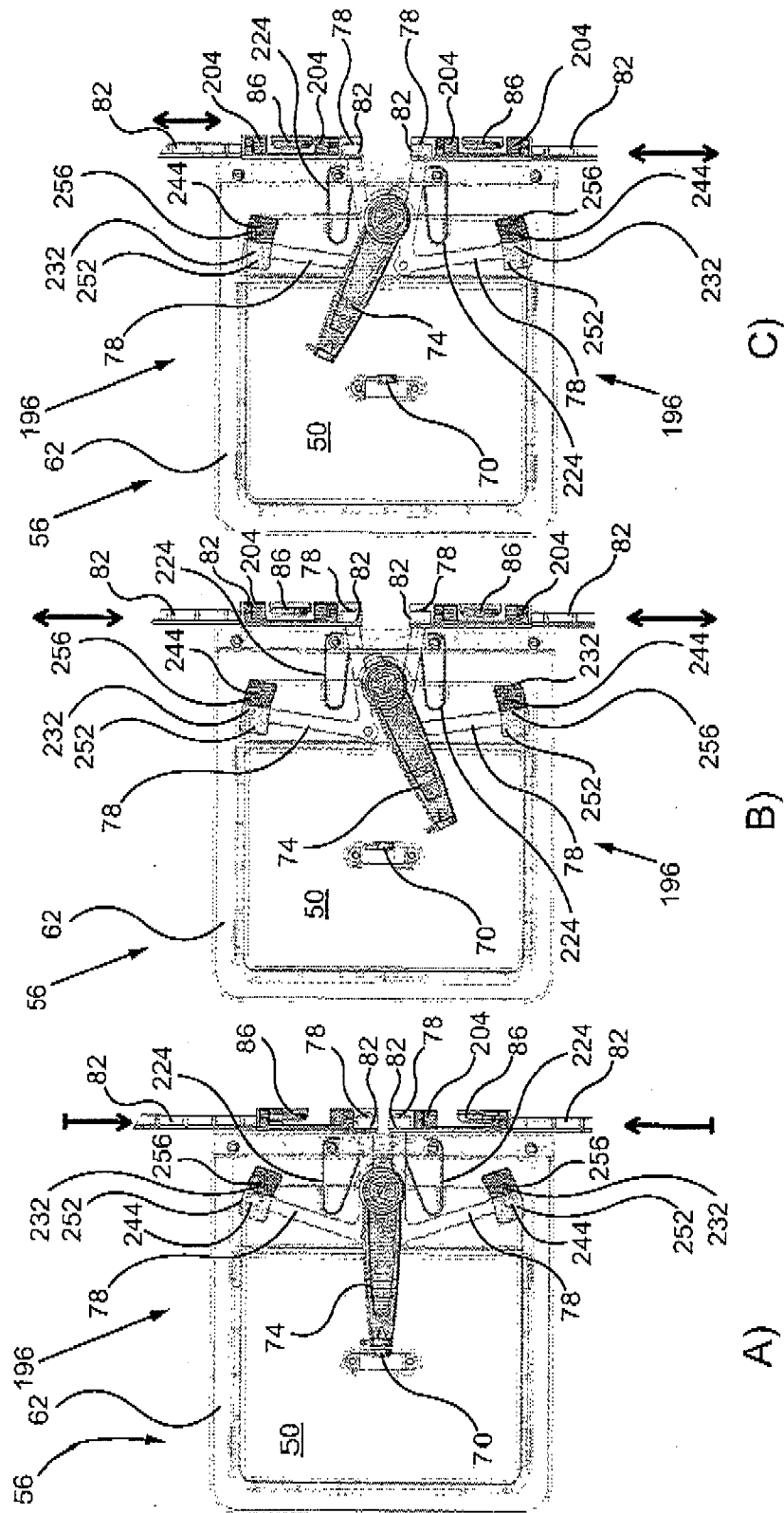
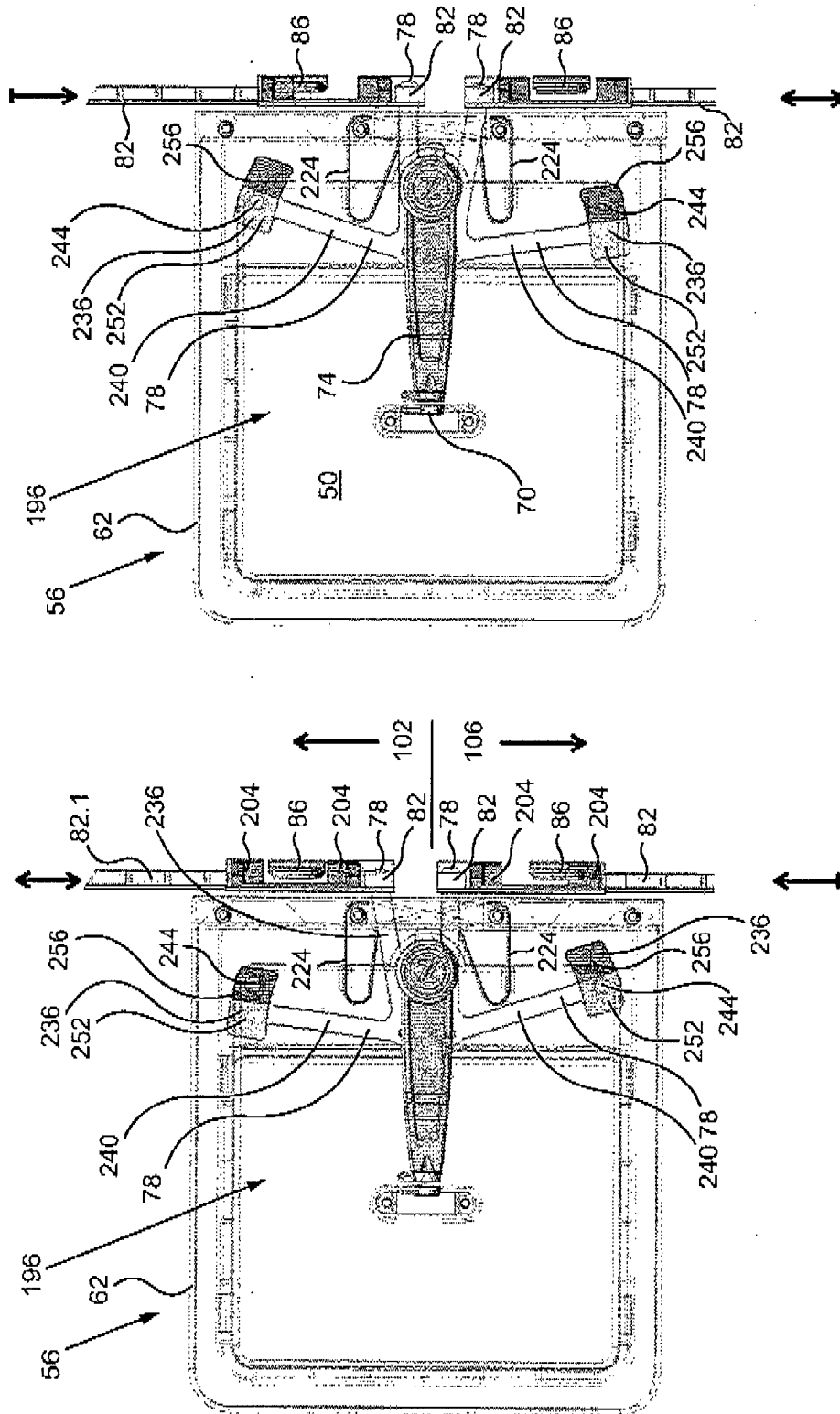


FIG. 8



B)

FIG. 9

A)

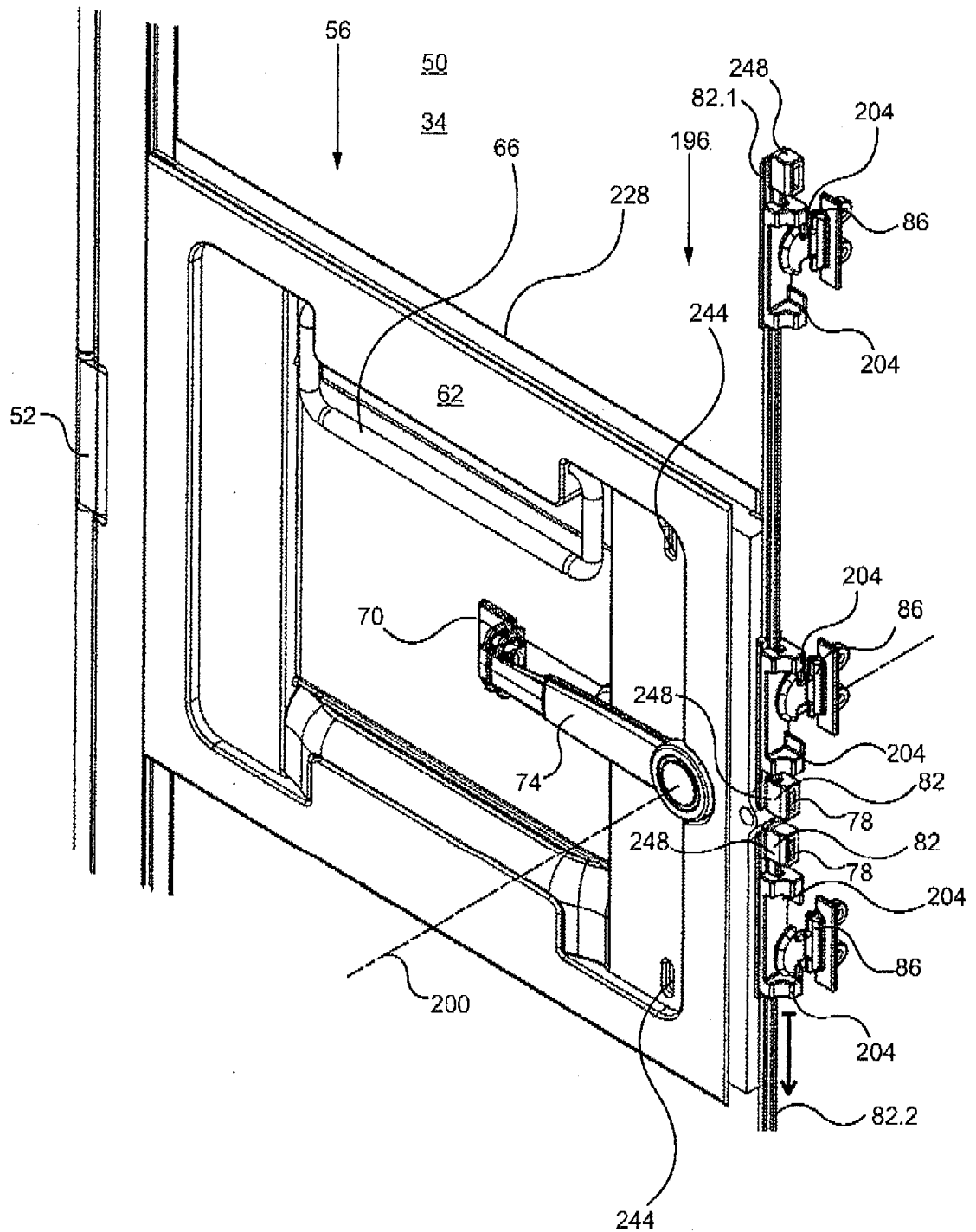


FIG. 10

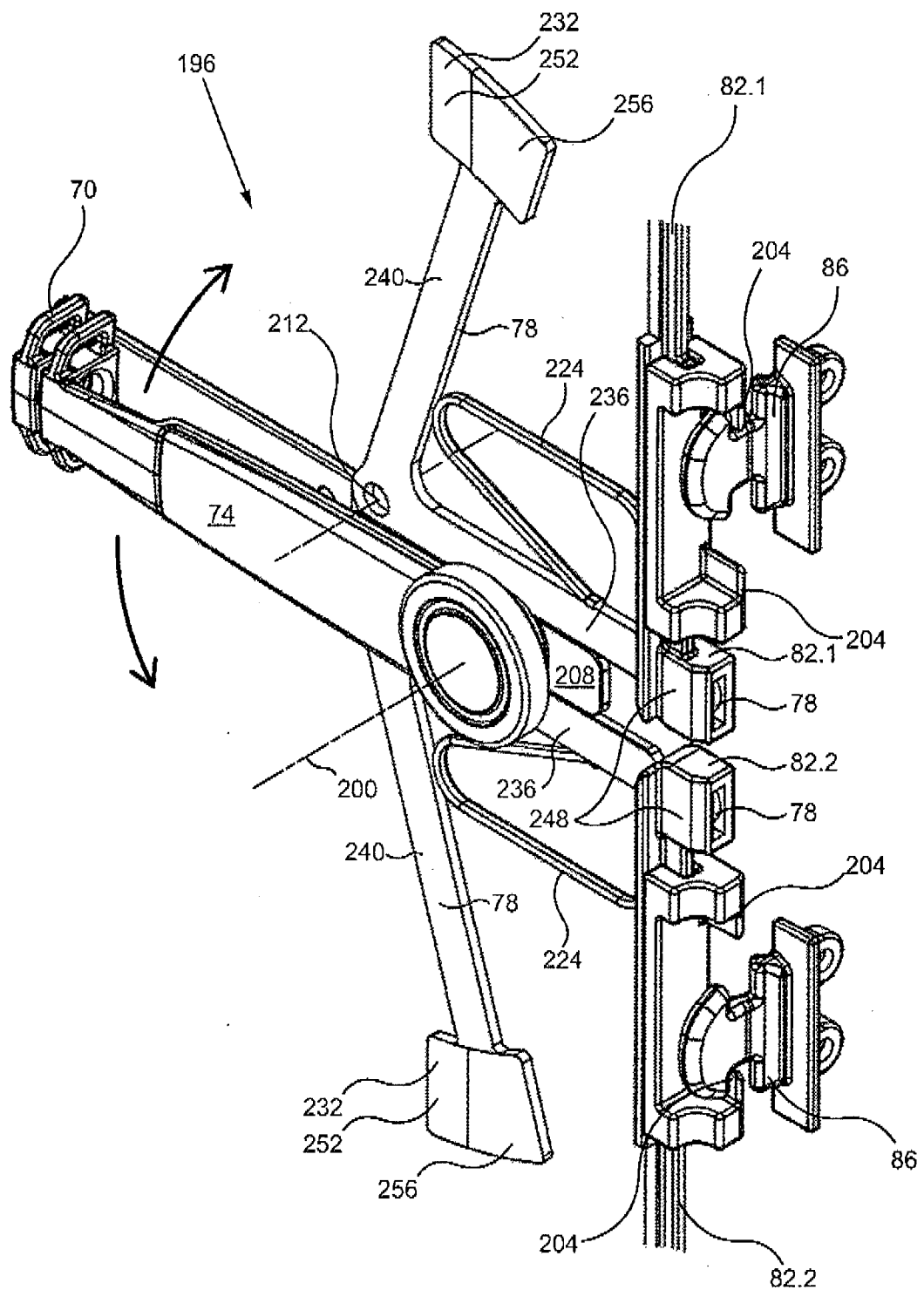


FIG. 11

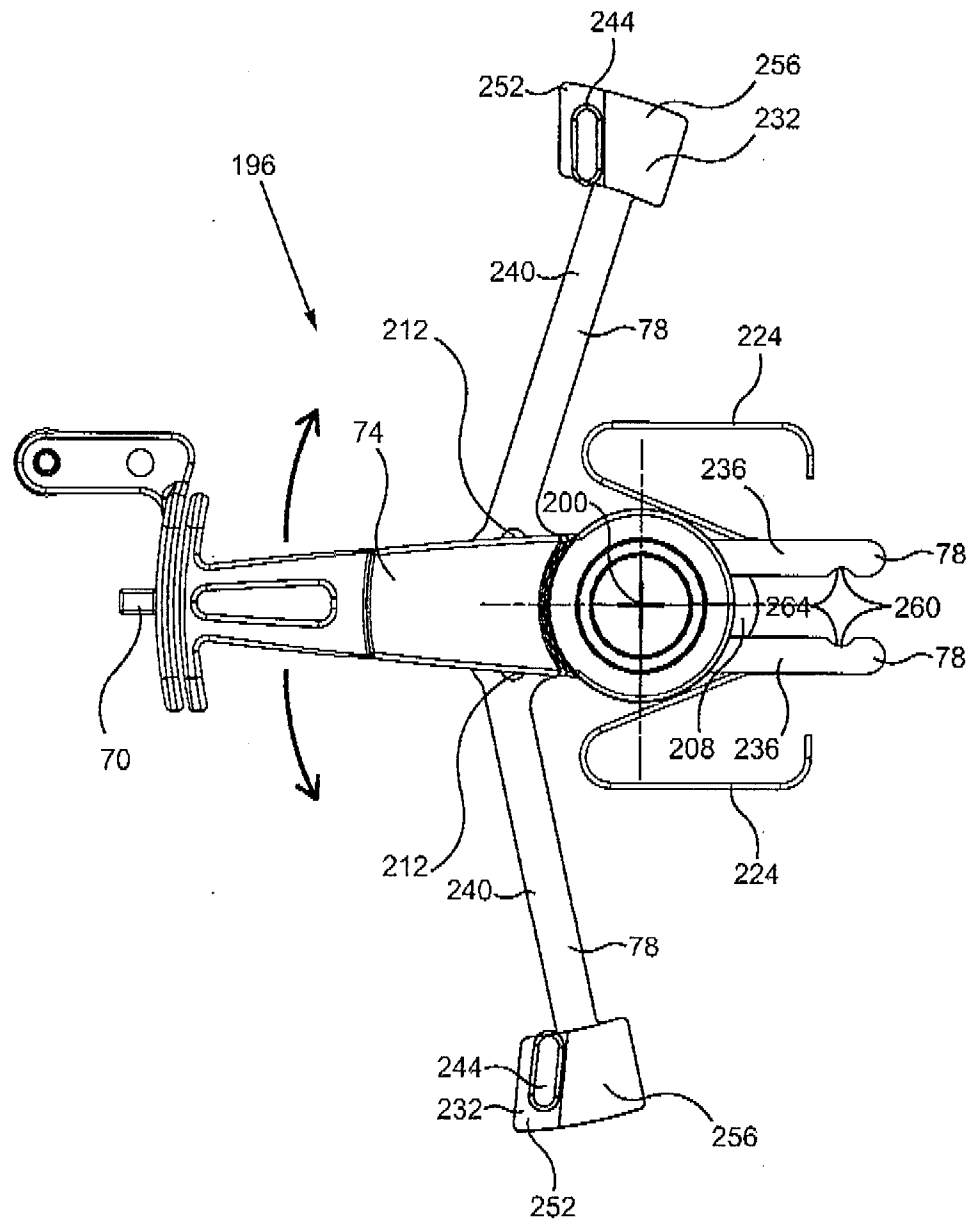


FIG. 12

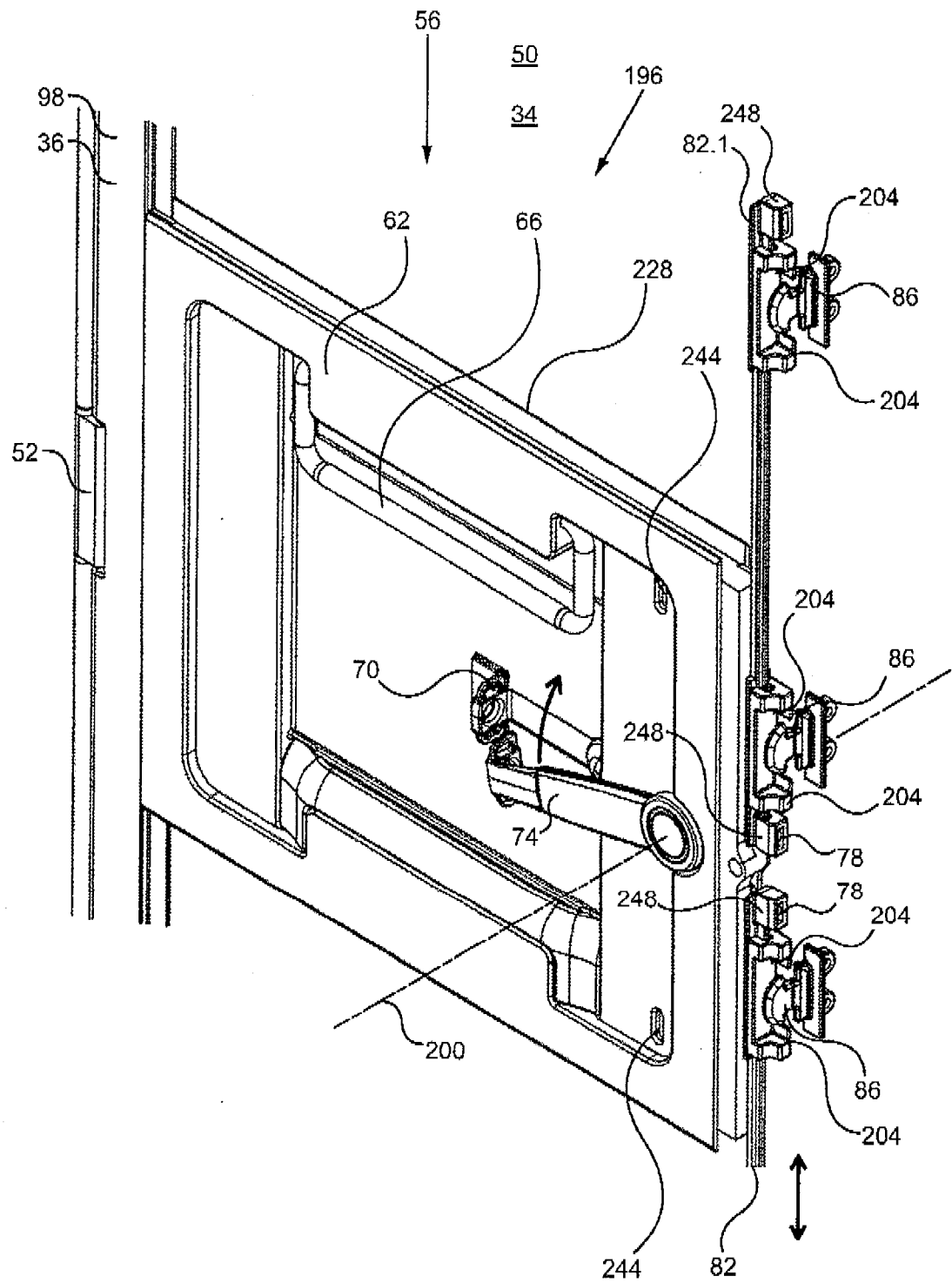


FIG. 13

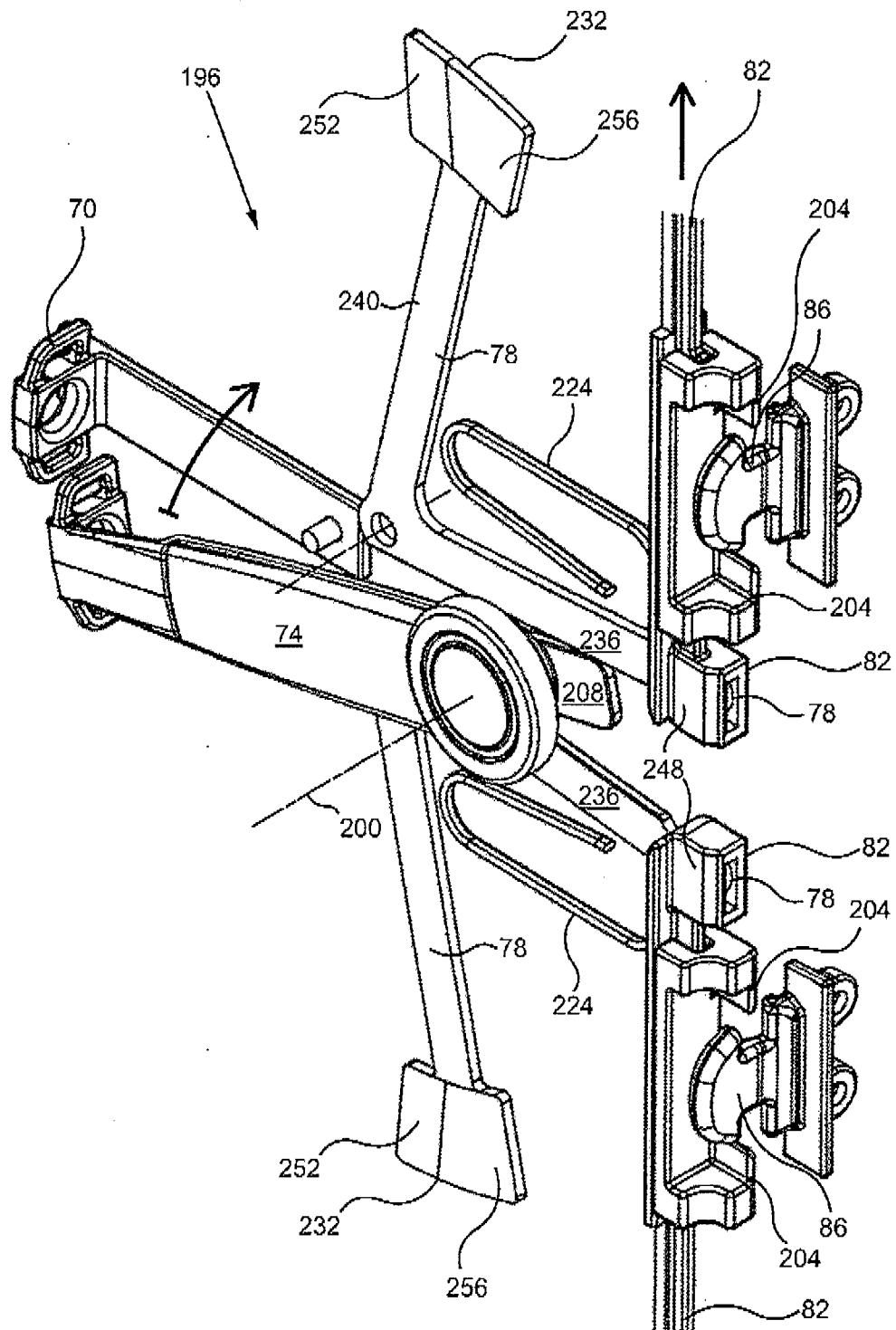
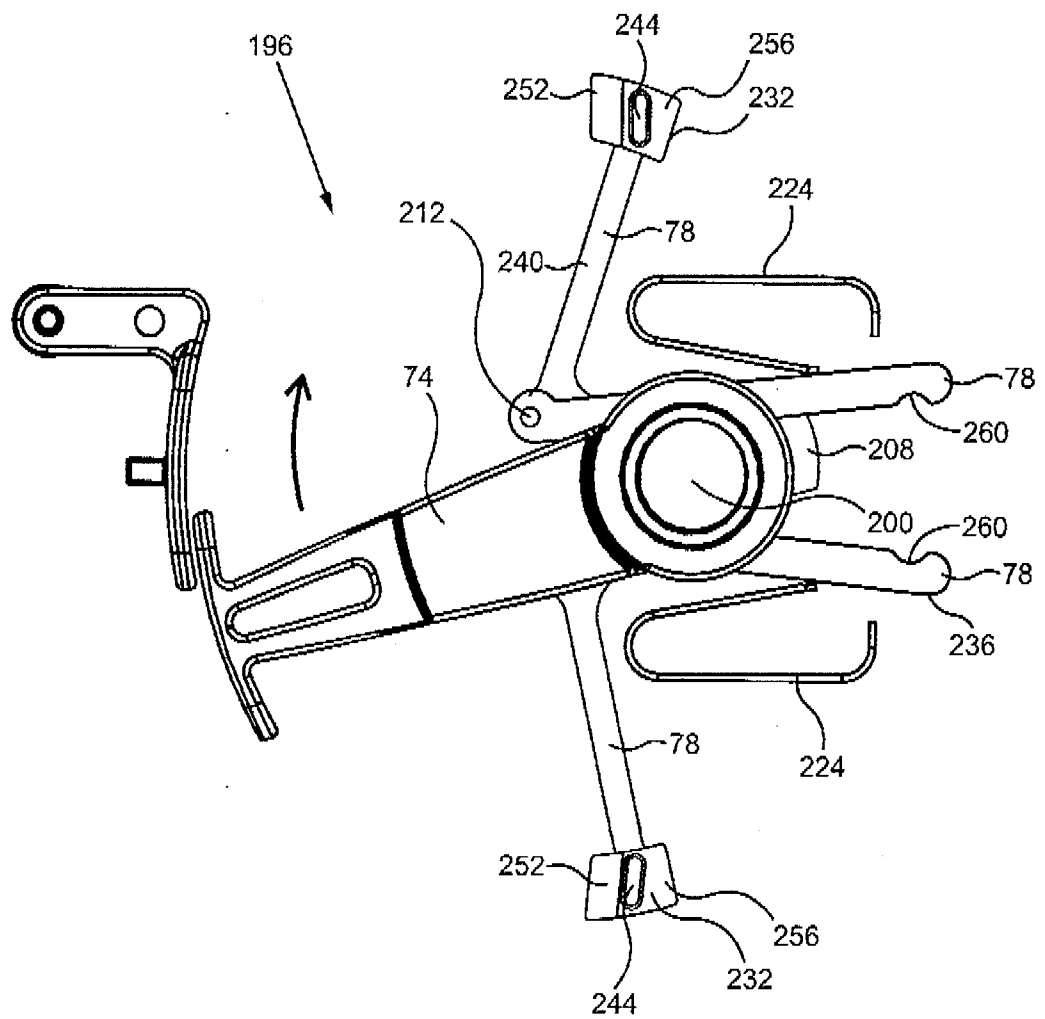


FIG. 14

**FIG. 15**

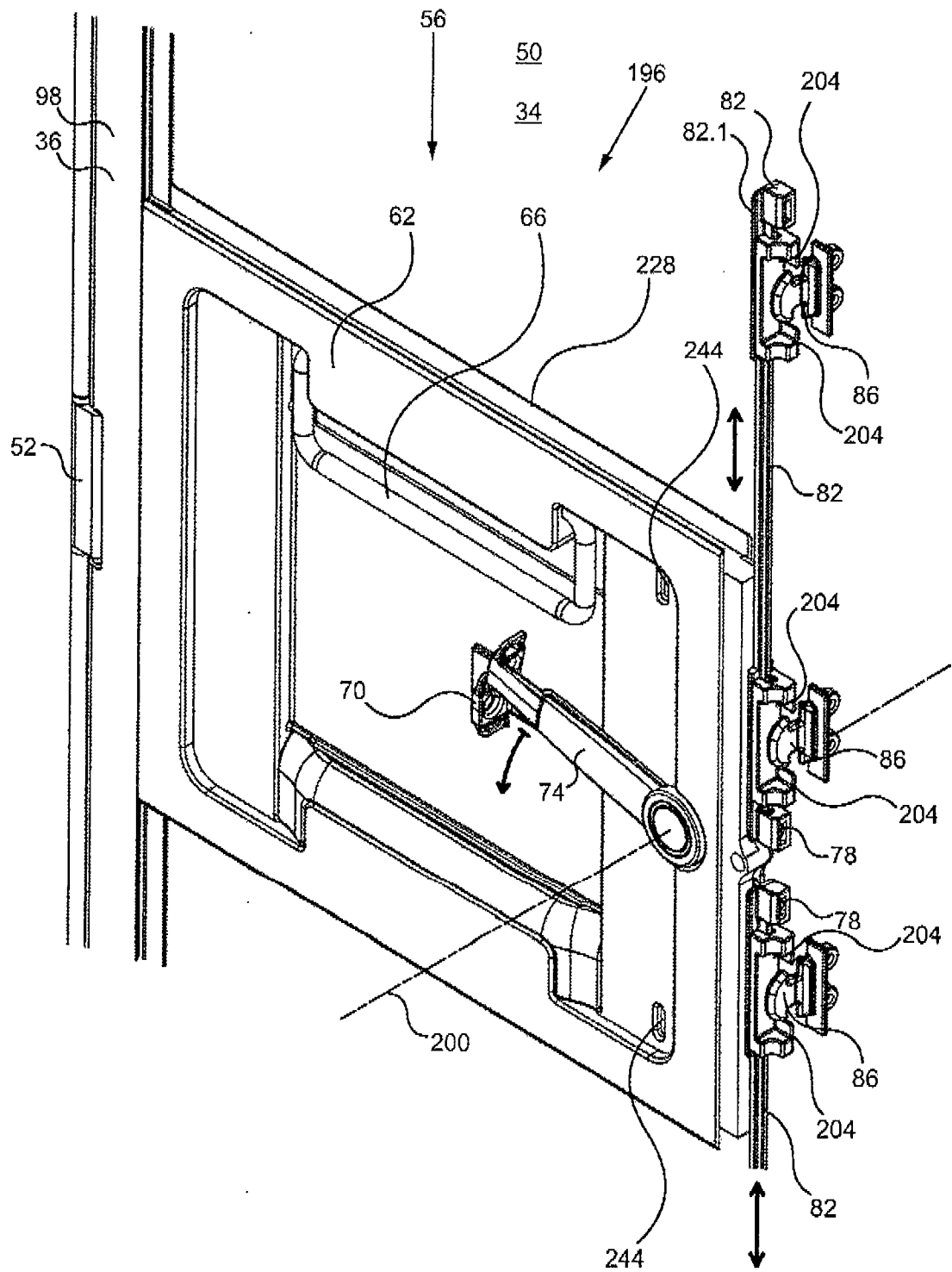


FIG. 16

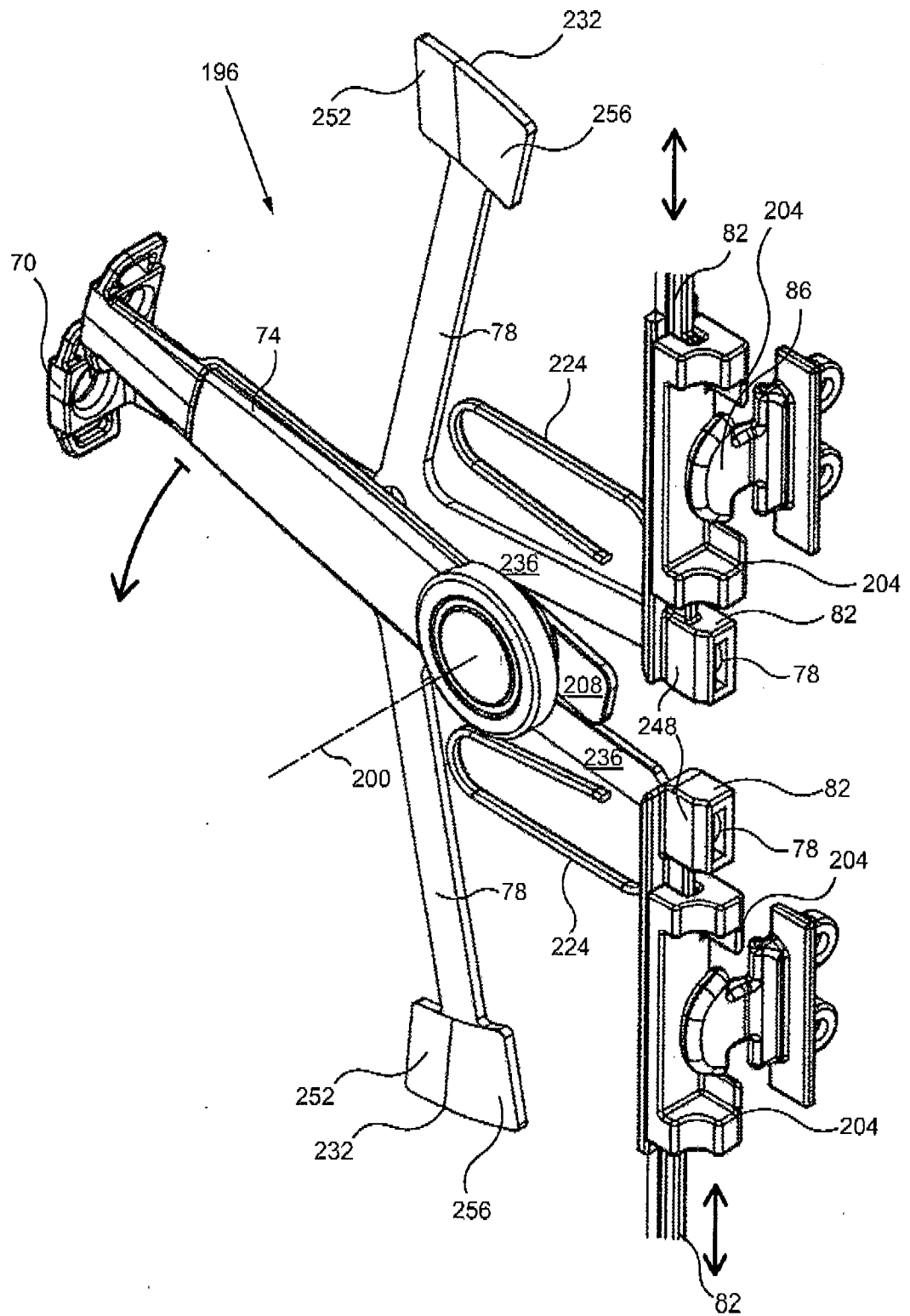


FIG. 17

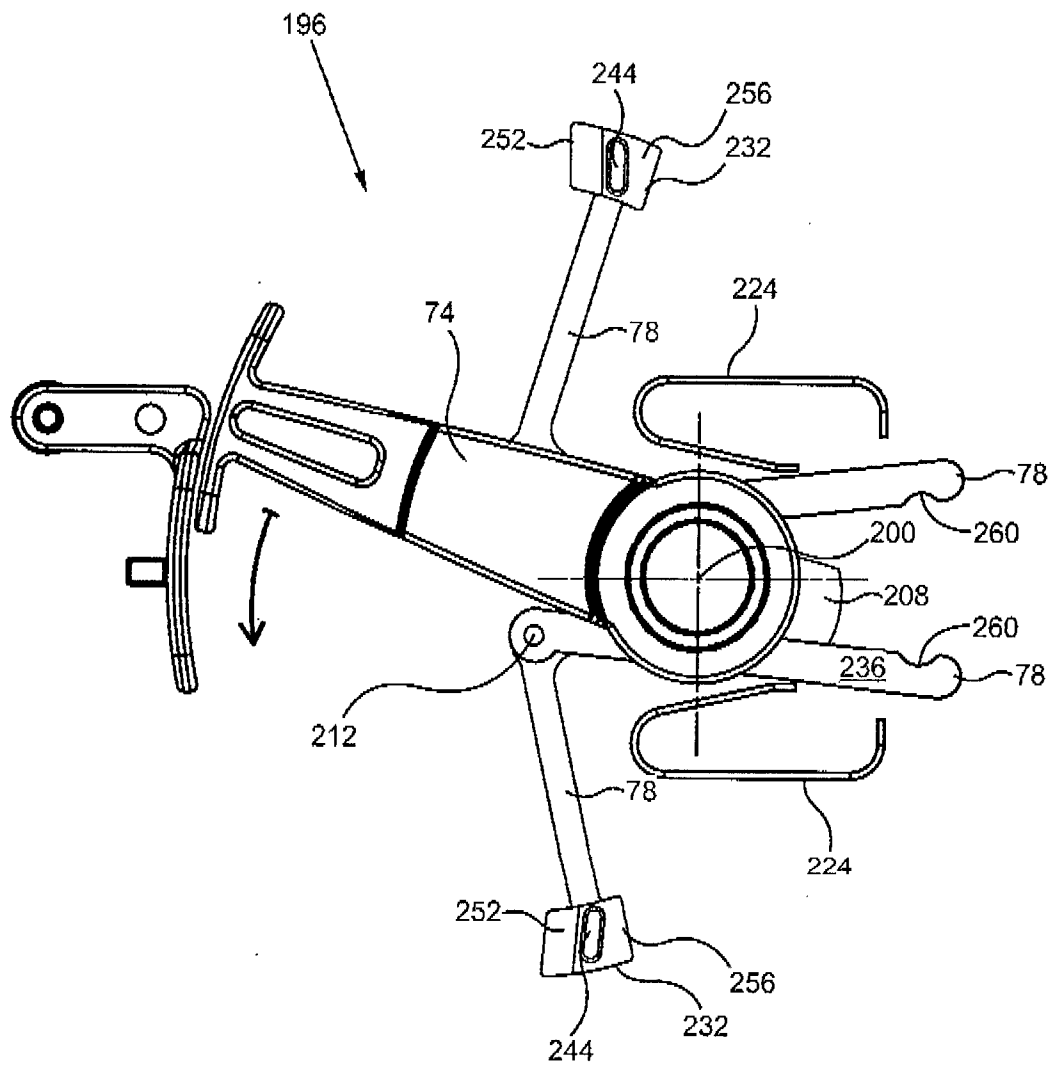


FIG. 18

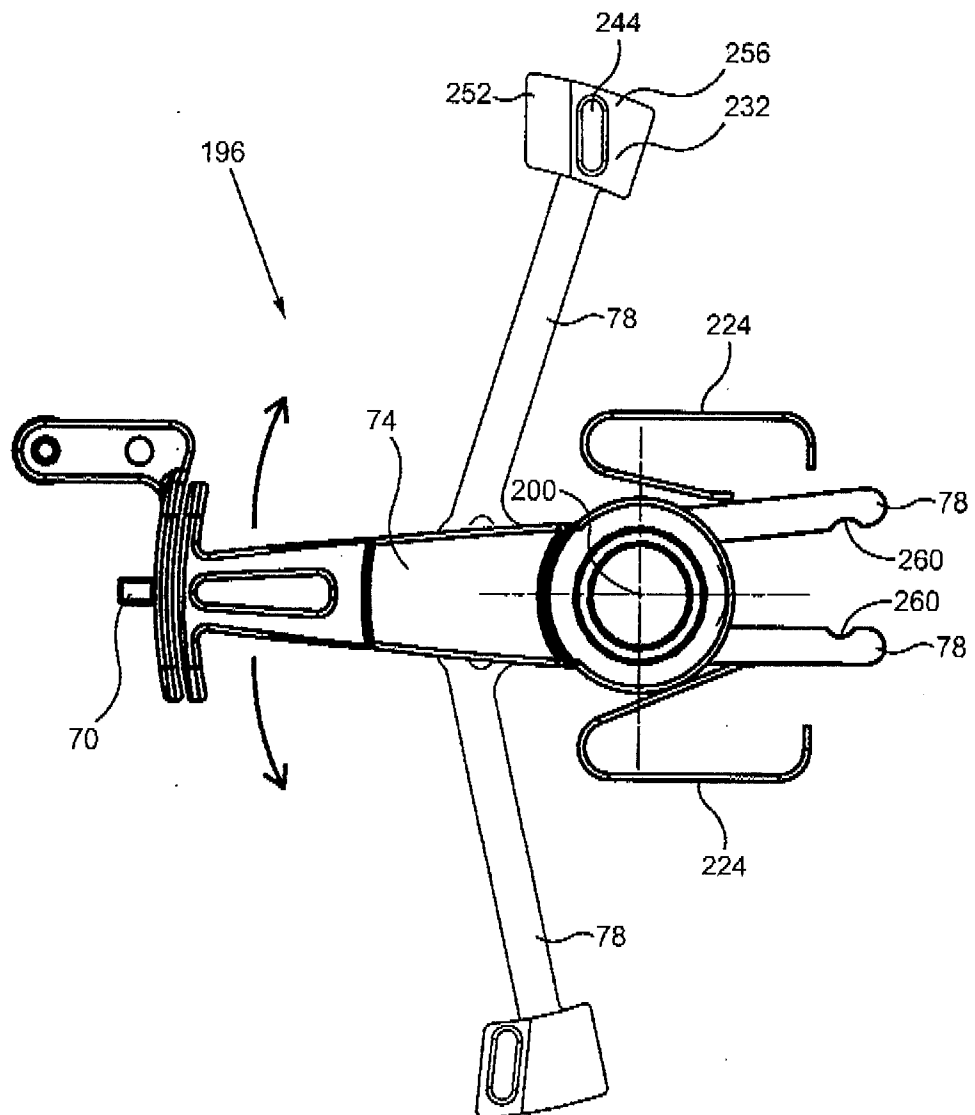


FIG. 19

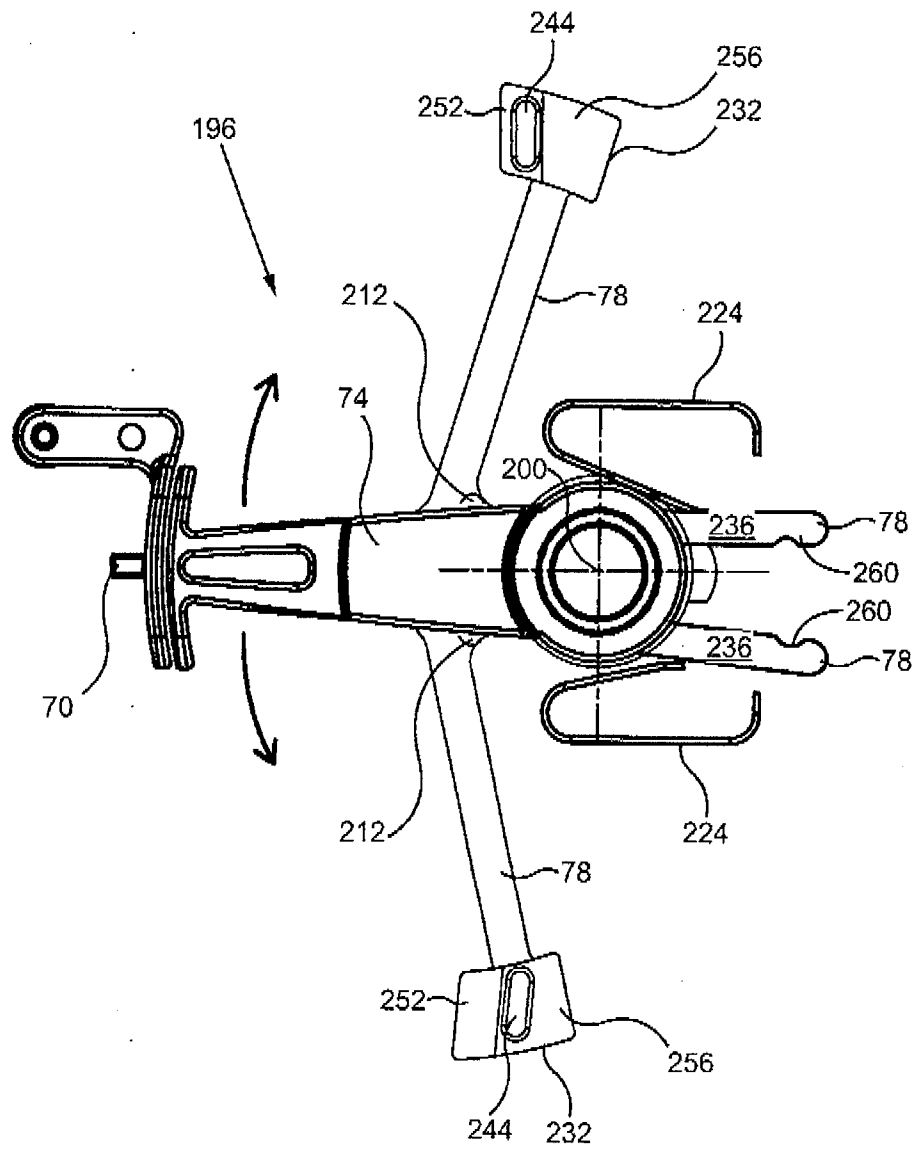


FIG. 20

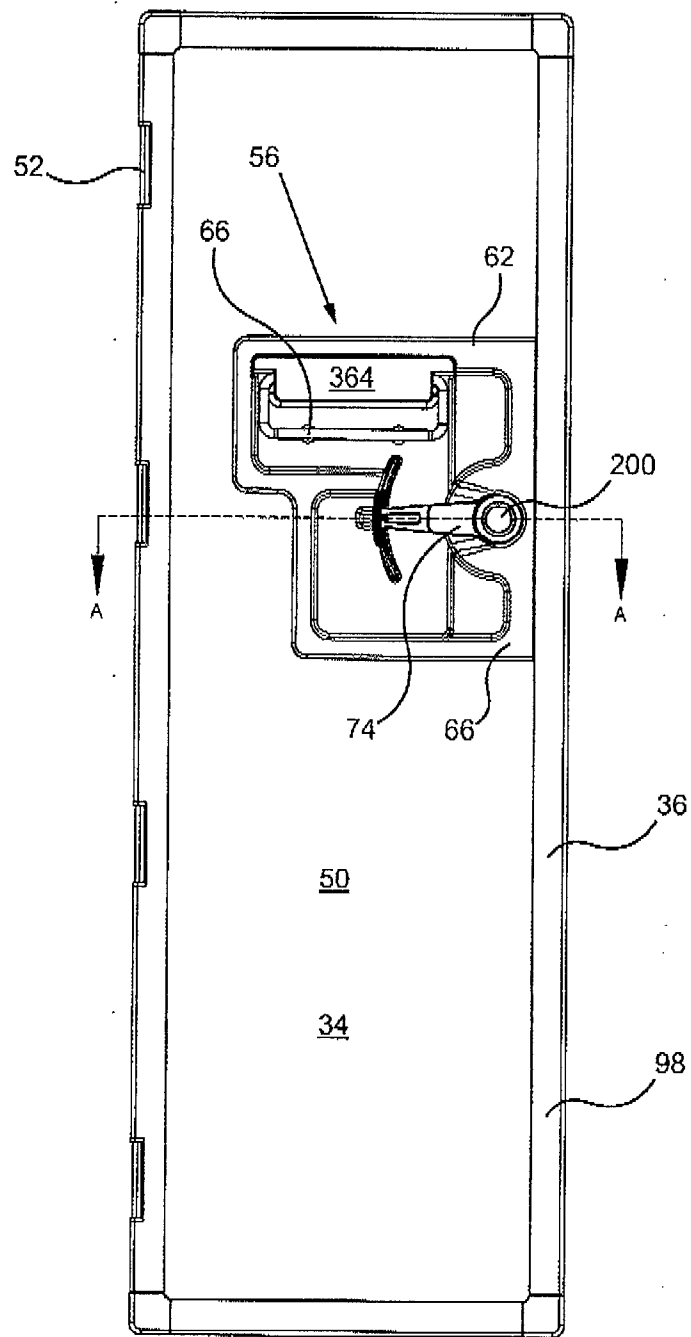


FIG. 21

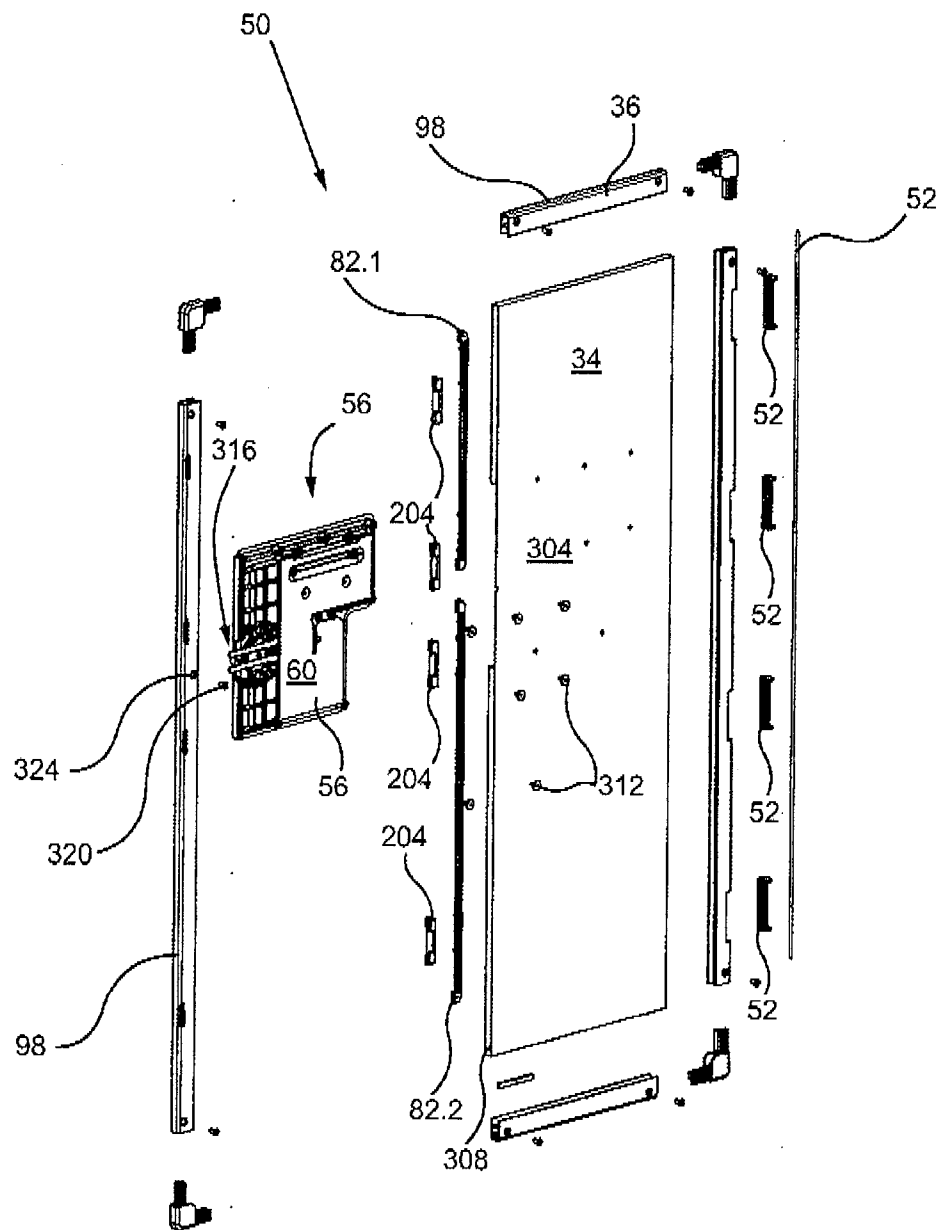


FIG. 22

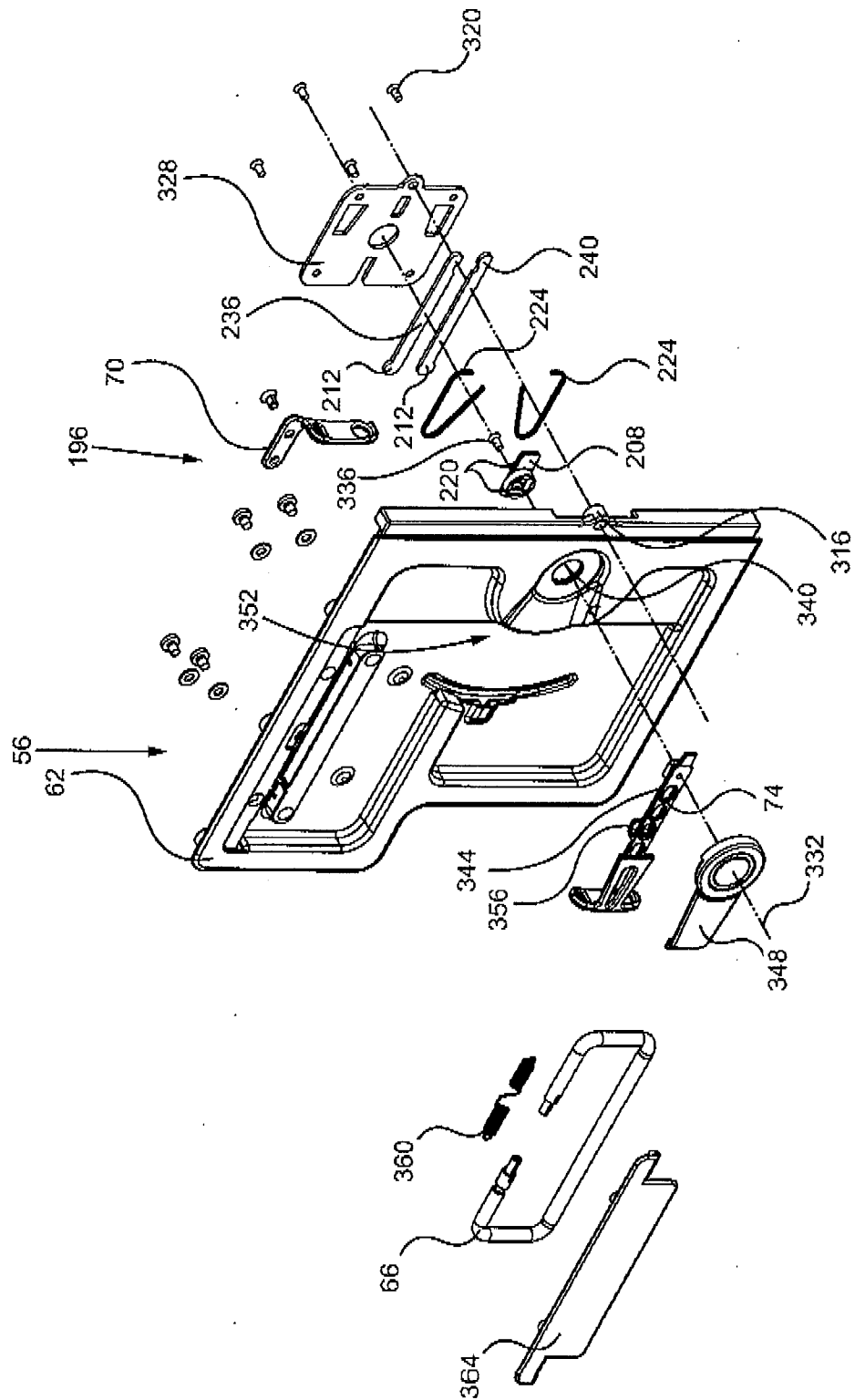


FIG. 23

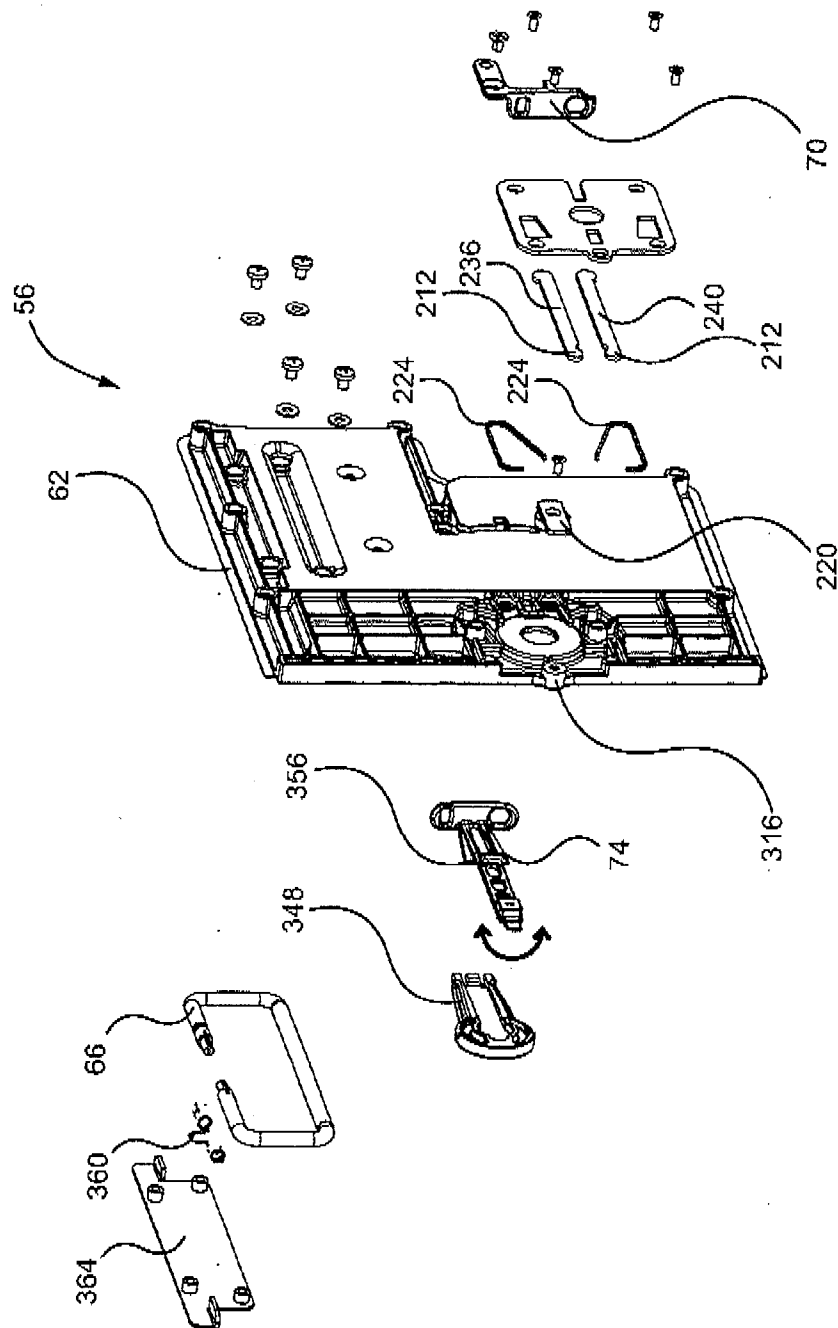


FIG. 24

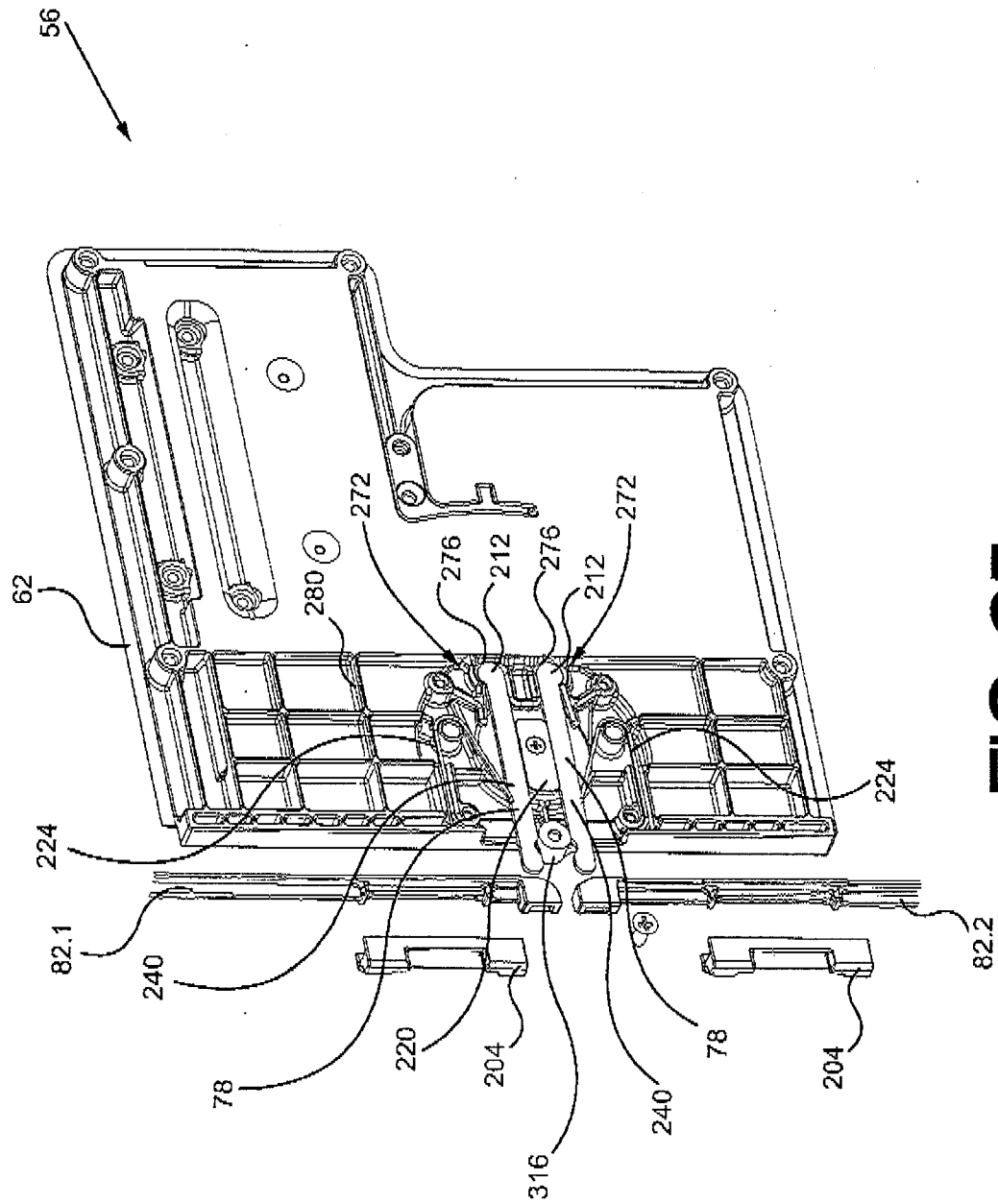


FIG. 25

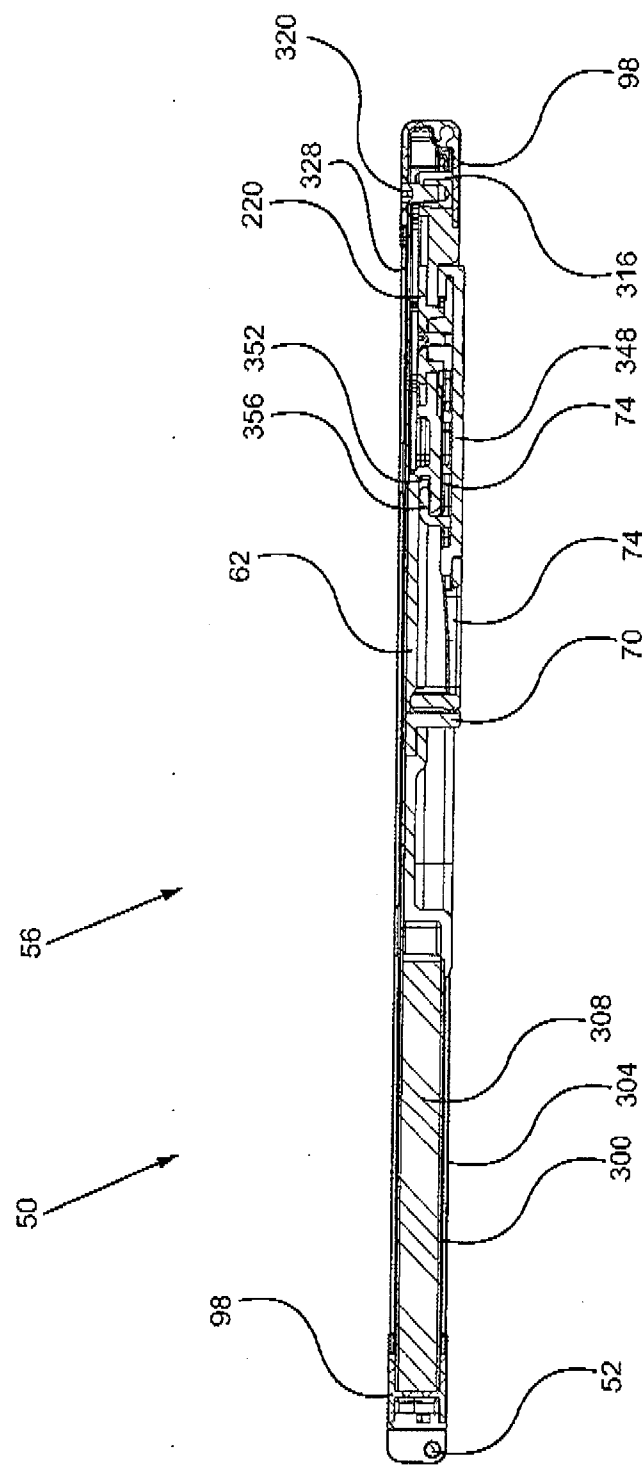


FIG. 26

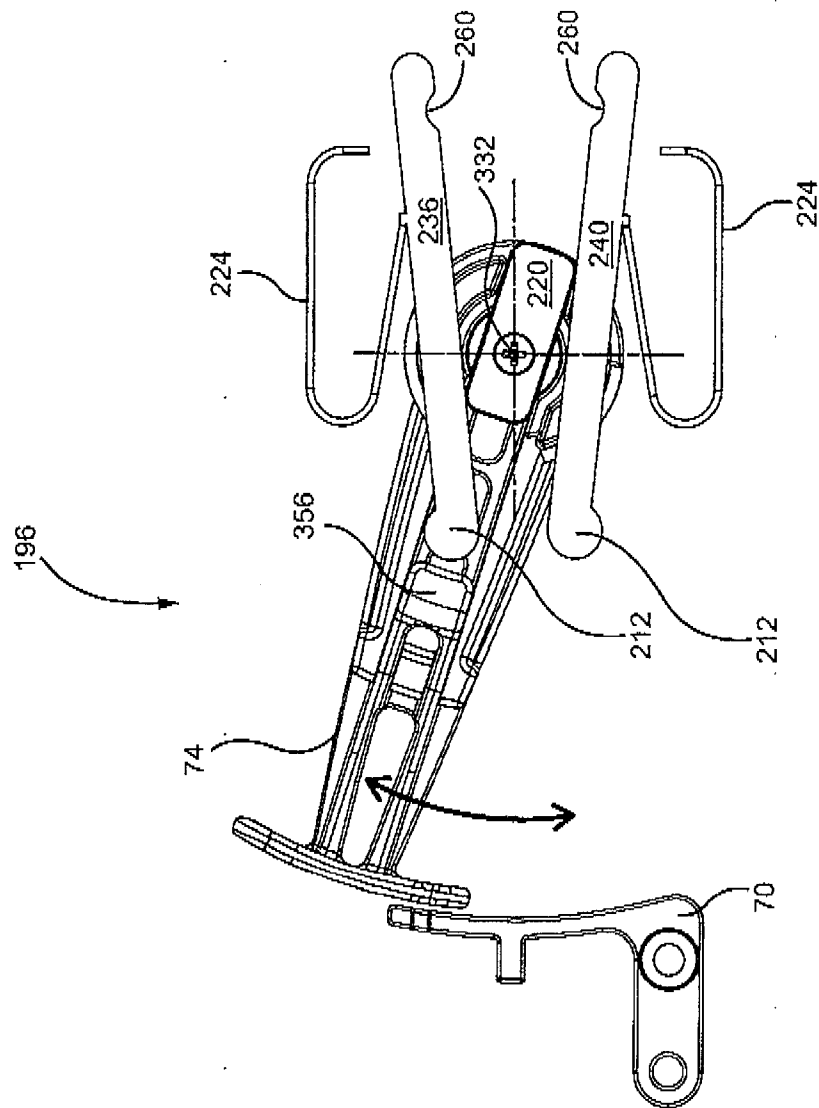


FIG. 27

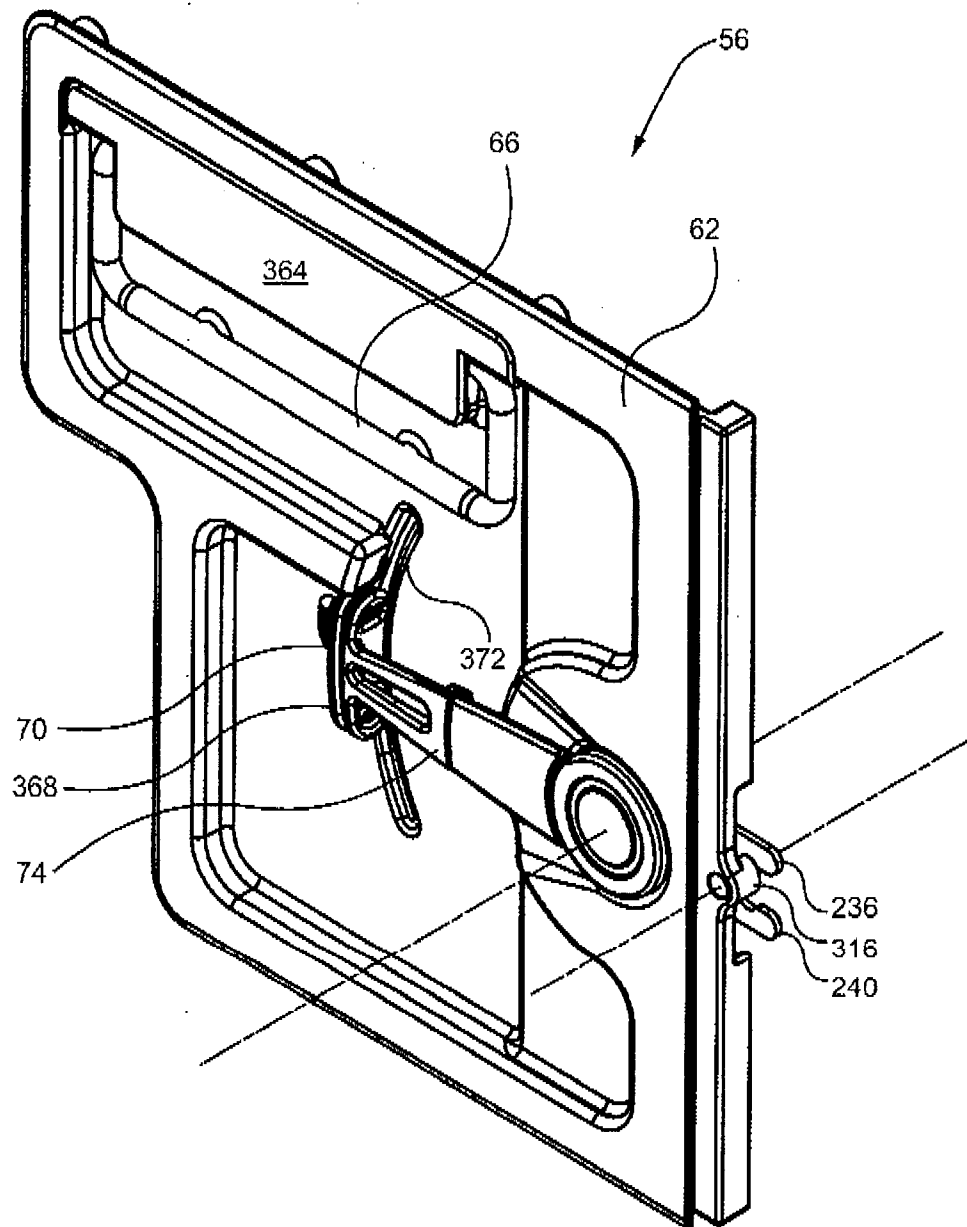


FIG. 28

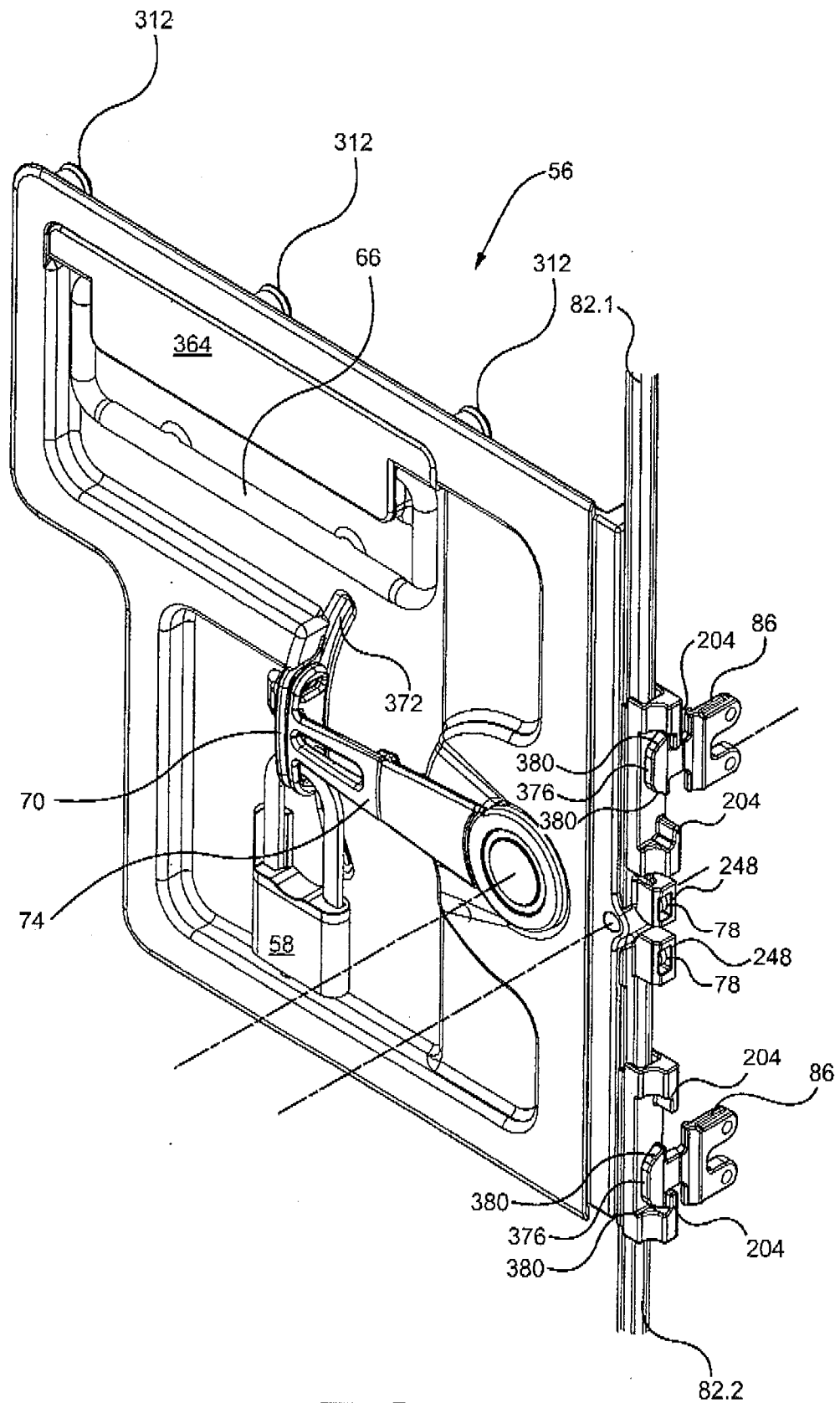
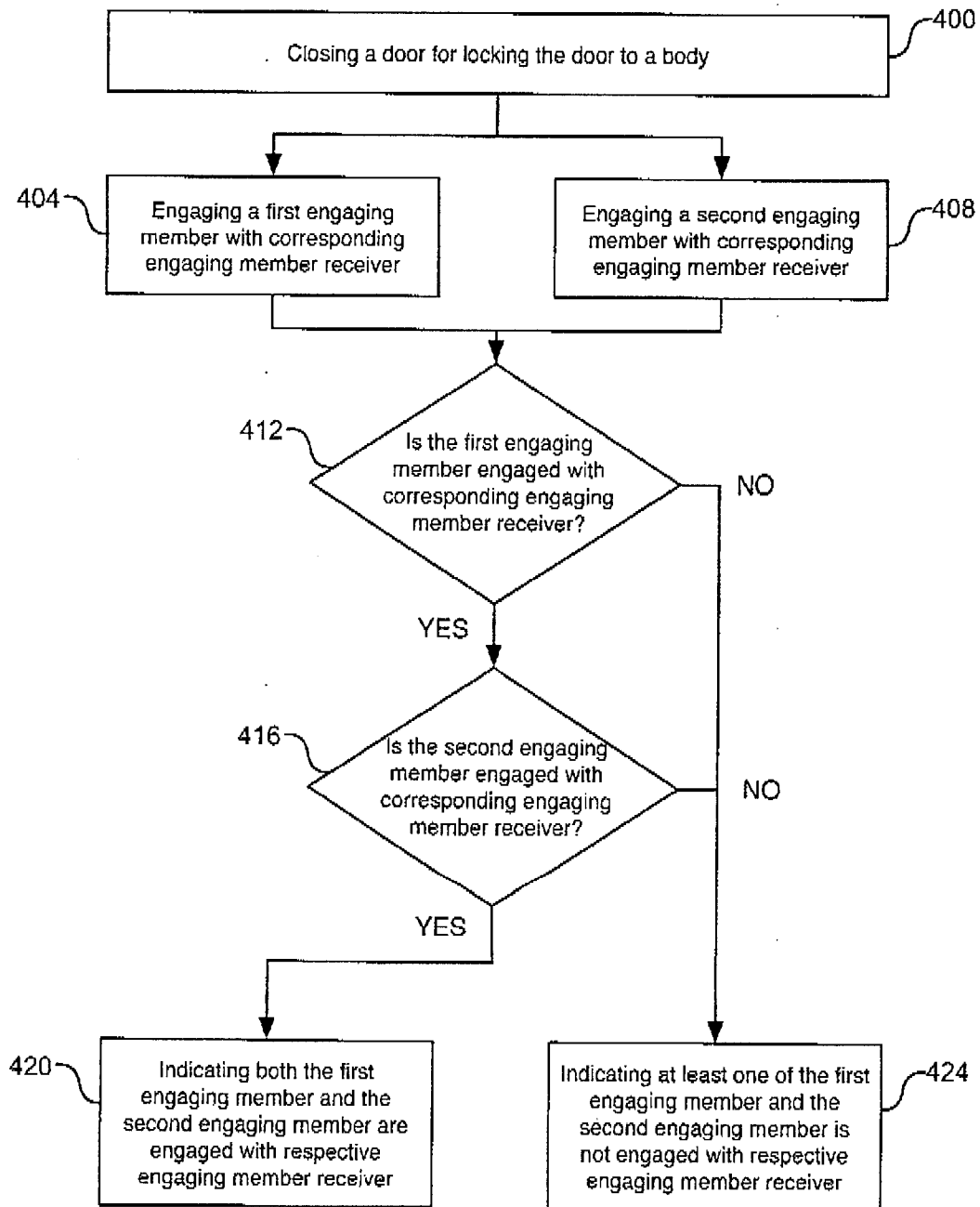
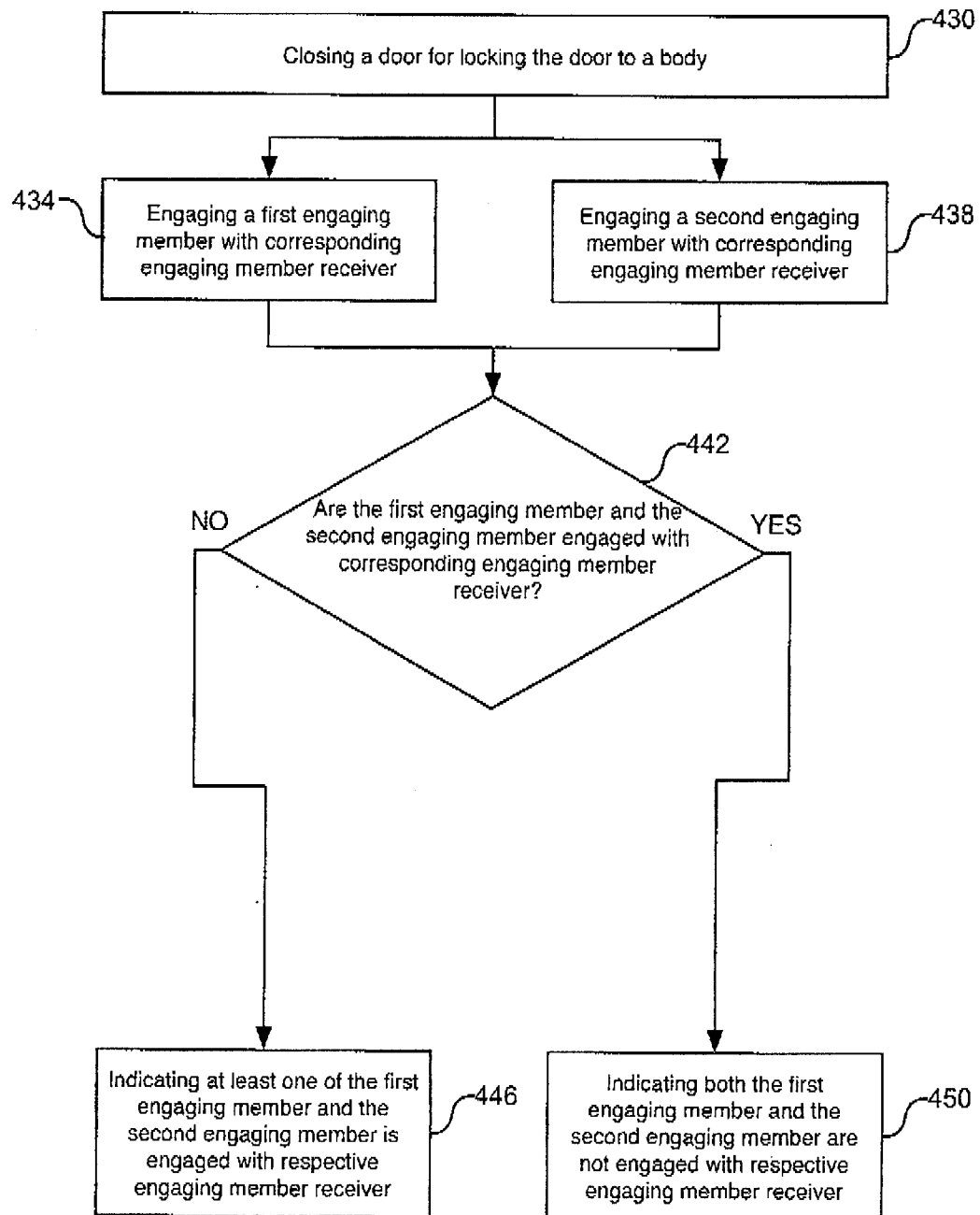


FIG. 29

**FIG. 30**

**FIG. 31**

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CA2016/000098

A. CLASSIFICATION OF SUBJECT MATTER
 IPC: **B64D 11/04** (2006.01), **A47B 31/06** (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: B64D 11/04 (2006.01), A47B 31/06 (2006.01)

CPC: B64D 11/0007

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

None

Electronic database(s) consulted during the international search (name of database(s) and, where practicable, search terms used)

Intellect (CPD), Questel Orbit (FAMPAT), Internet

Keywords: lock+, latch+

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2014/167593 A2 (IACOBUCCI, L.) 16 October 2014 (16-10-2014)	1-8, 10-18, and 20
Y	* Entire document	9, 19
X	US 2011/0278879 A1 (BELANGER, M. et al.) 17 November 2011 (17-11-2011)	1-4 and 11-14
Y	* Entire document	
Y	WO 2014/017903 A1 (PORTEGIES, C.) 30 January 2014 (30-01-2014)	9, 19
	* Paragraph [0027]	
Y	CA 2 835 647 A1 (GRANT, R. et al.) 15 November 2012 (15-11-2012)	9, 19
	* Paragraph [0065]	

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier application or patent but published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search
 15 June 2016 (15-06-2016)

Date of mailing of the international search report
 20 June 2016 (20-06-2016)

Name and mailing address of the ISA/CA
 Canadian Intellectual Property Office
 Place du Portage I, C114 - 1st Floor, Box PCT
 50 Victoria Street
 Gatineau, Quebec K1A 0C9
 Facsimile No.: 819-953-2476

Authorized officer

Daniel Rempel (819) 639-7893

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CA2016/000098

Patent Document Cited in Search Report	Publication Date	Patent Family Member(s)	Publication Date
WO2014167593A2	16 October 2014 (16-10-2014)	WO2014167593A2 WO2014167593A3 EP2983551A2 ITRM20130211A1 US2016052231A1	16 October 2014 (16-10-2014) 24 September 2015 (24-09-2015) 17 February 2016 (17-02-2016) 10 October 2014 (10-10-2014) 25 February 2016 (25-02-2016)
US2011278879A1	17 November 2011 (17-11-2011)	US2011278879A1 US8690170B2 CA2740081A1 CN102267483A GB201107666D0 GB2480370A	17 November 2011 (17-11-2011) 08 April 2014 (08-04-2014) 14 November 2011 (14-11-2011) 07 December 2011 (07-12-2011) 22 June 2011 (22-06-2011) 16 November 2011 (16-11-2011)
WO2014017903A1	30 January 2014 (30-01-2014)	WO2014017903A1 CN104718335A EP2875200A1 NL2009218C SG11201500490UA US2015159403A1	30 January 2014 (30-01-2014) 17 June 2015 (17-06-2015) 27 May 2015 (27-05-2015) 27 January 2014 (27-01-2014) 27 February 2015 (27-02-2015) 11 June 2015 (11-06-2015)
CA2835647A1	15 November 2012 (15-11-2012)	CA2835647A1 CN103534427A CN103534427B EP2707563A2 US2014062102A1 WO2012155020A2 WO2012155020A3	15 November 2012 (15-11-2012) 22 January 2014 (22-01-2014) 13 April 2016 (13-04-2016) 19 March 2014 (19-03-2014) 06 March 2014 (06-03-2014) 15 November 2012 (15-11-2012) 07 November 2013 (07-11-2013)