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(54) **DOOR SEALING AND TIMING MECHANISM FOR USE IN COACH DOOR CONFIGURATION FOR A VEHICLE**

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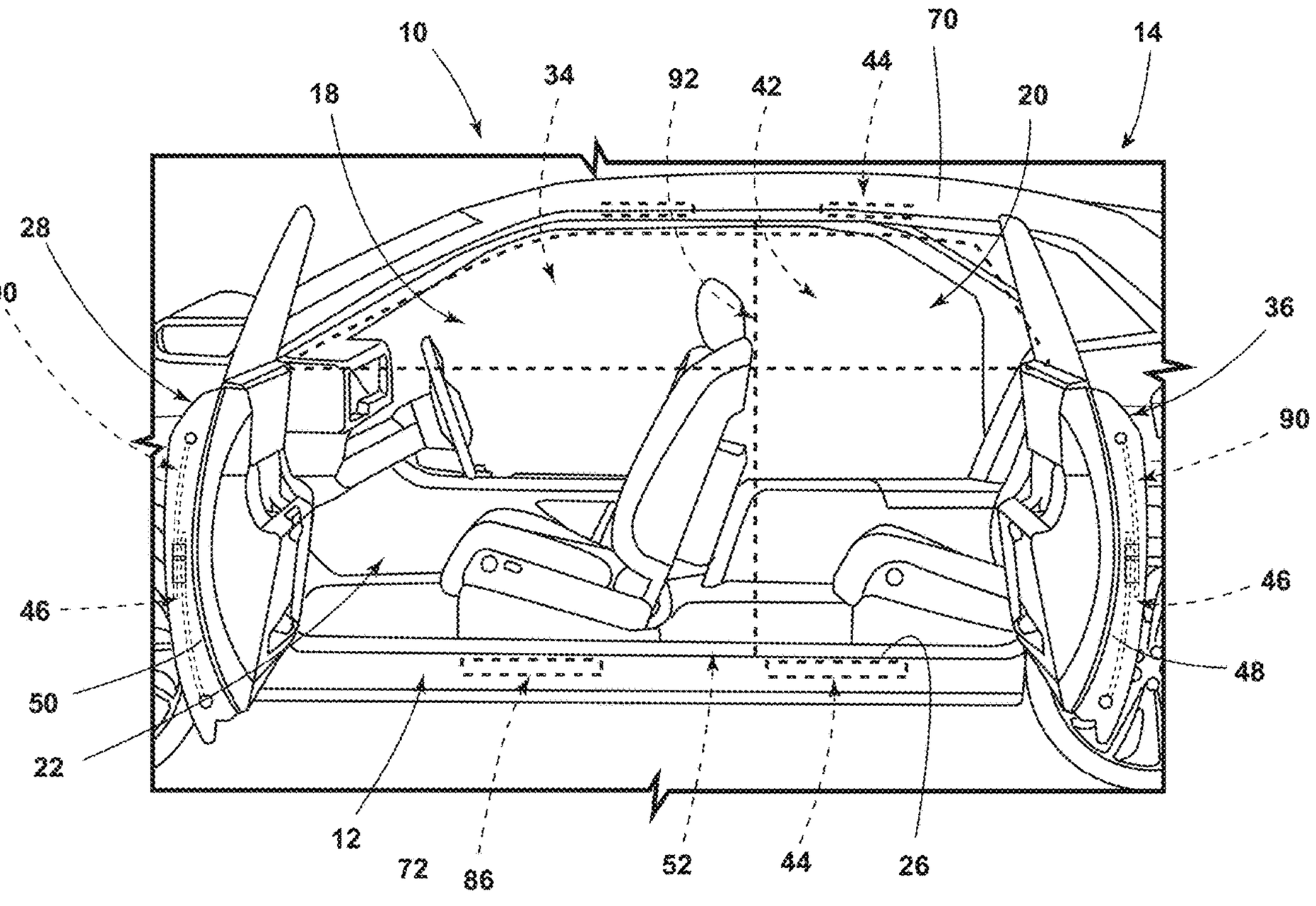
CPC ***E05B 83/38*** (2013.01); ***B60J 10/87*** (2016.02); ***B60J 5/0479*** (2013.01); *E05Y 2900/531* (2013.01)

(57) **ABSTRACT**

A vehicle includes a body having an uninterrupted side aperture that provides access to an interior passenger cabin. A front door is hingedly attached at a forward edge of the uninterrupted side aperture. The front door is selectively operable between front open and front closed positions. A rear door is hingedly attached at a rearward edge of the uninterrupted side aperture. The rear door is selectively operable between rear open and rear closed positions. A latching assembly is at least partially positioned within the body and configured to receive the front door in the front closed position and the rear door in the rear closed position. A sealing assembly is defined between a forward seal of the rear door and a rearward seal of the front door. The forward and rearward seals engage one another in a fully-closed position.



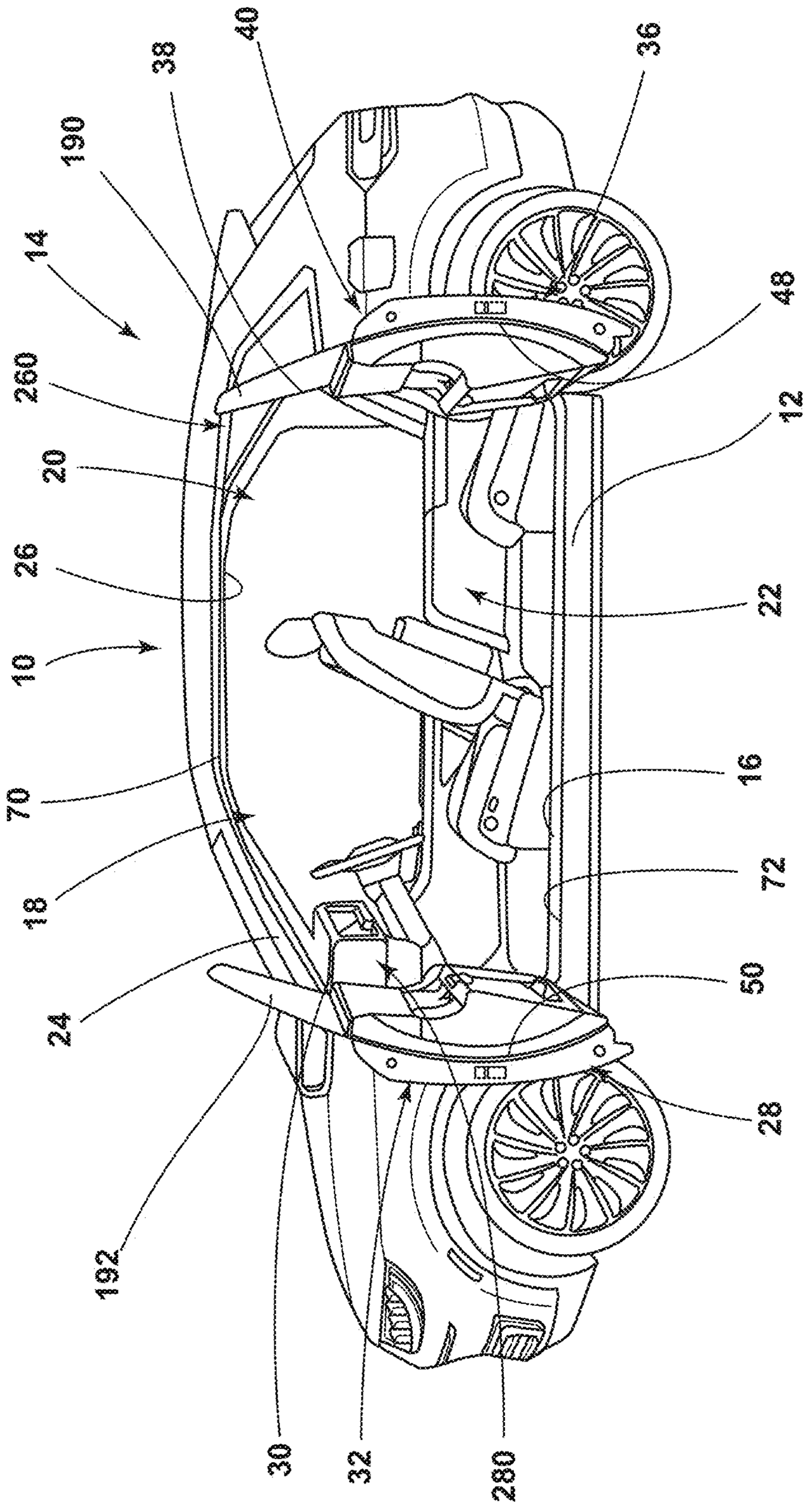

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FIG. 1

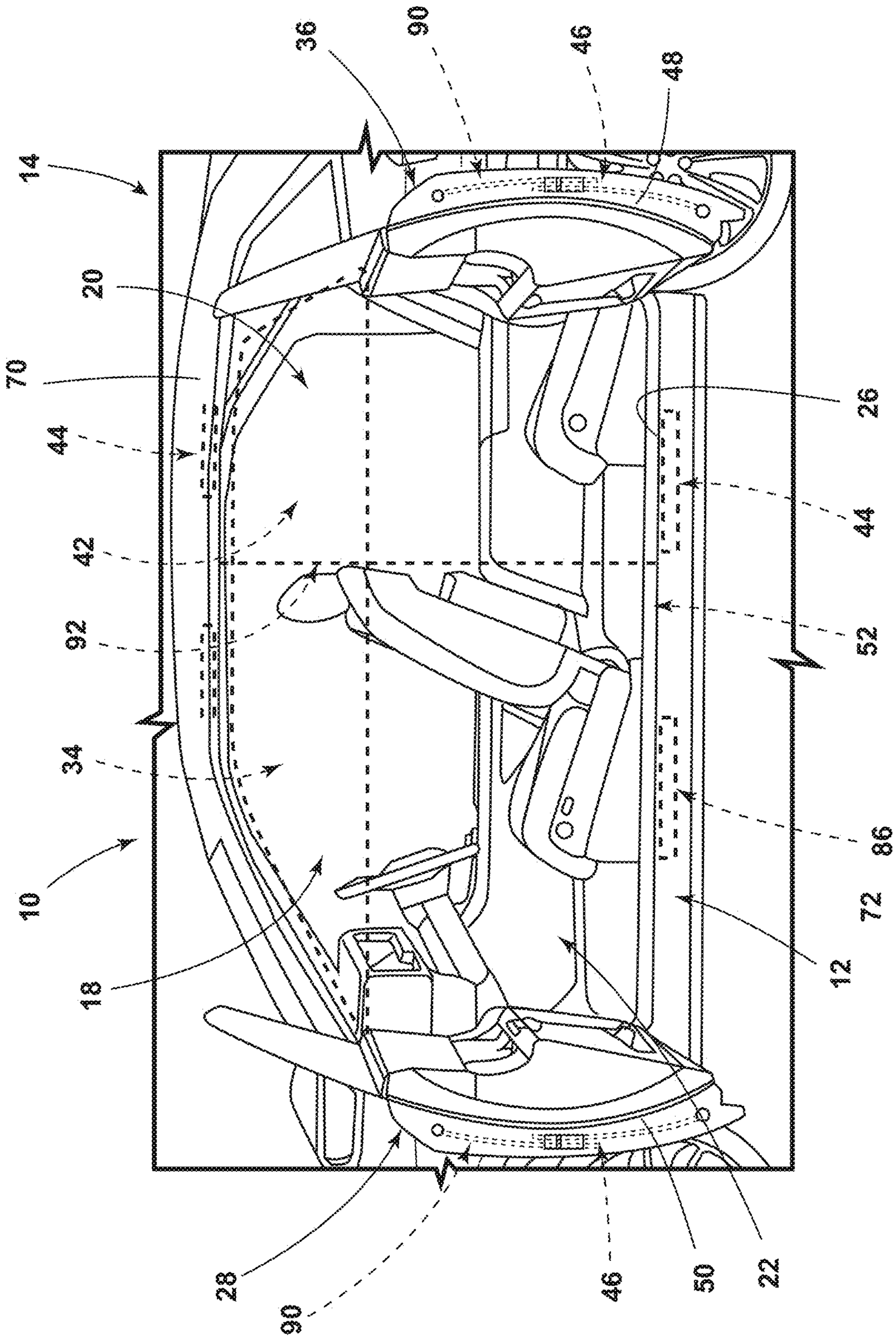

FIG. 2

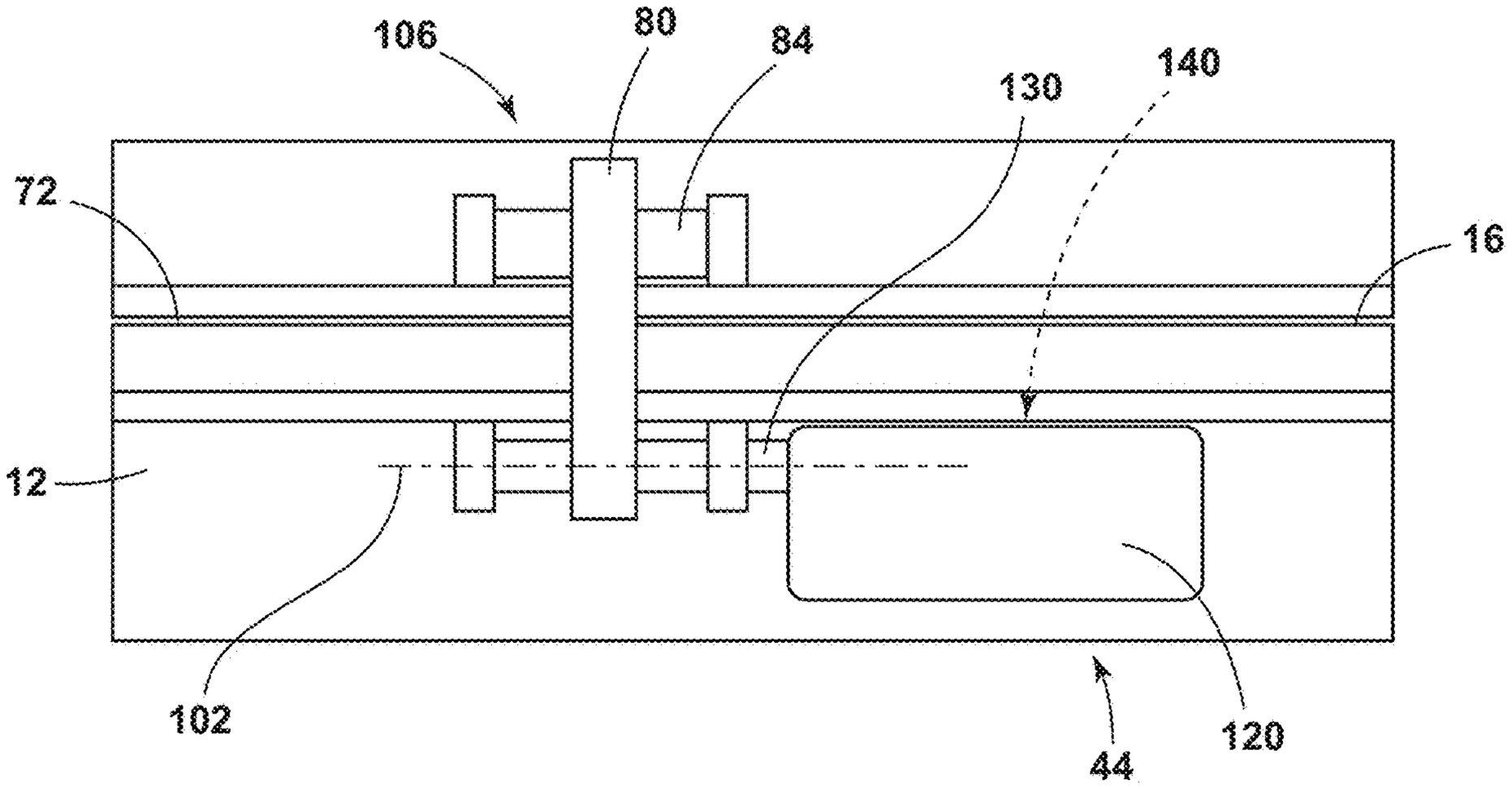
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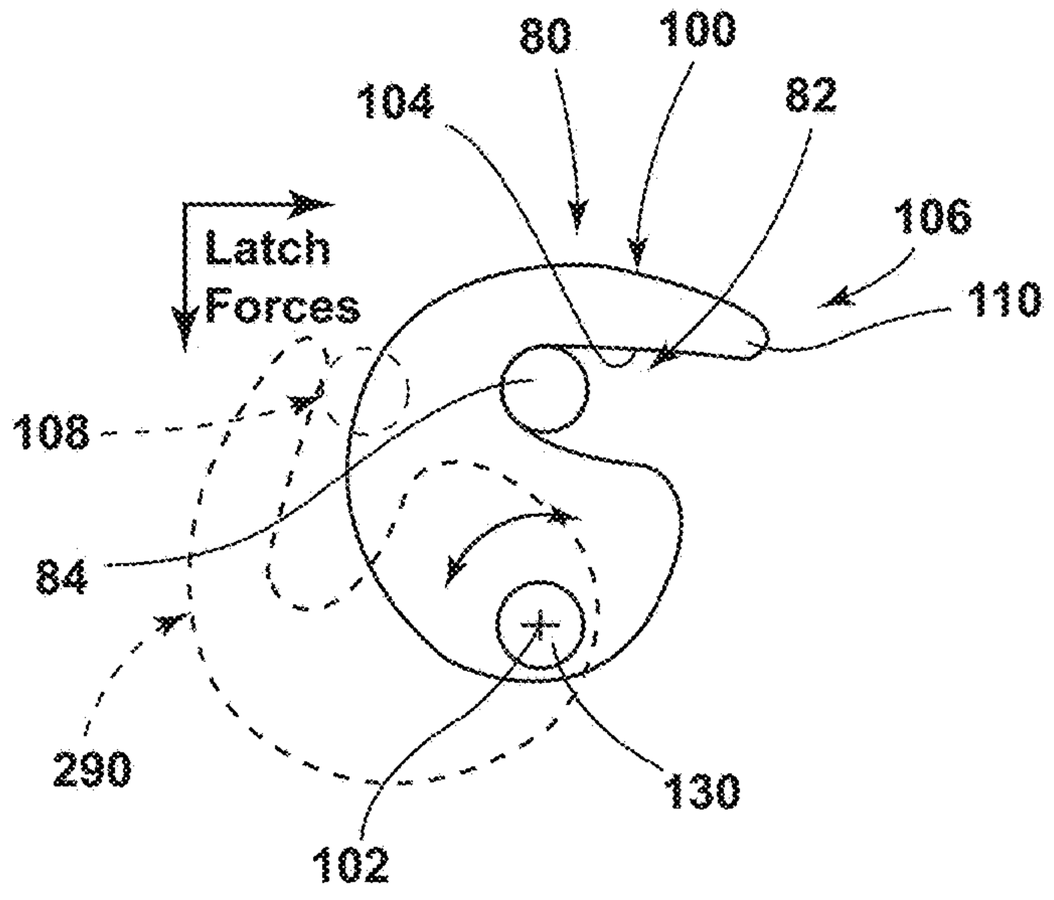
FIG. 3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Latch
Forces
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FIG. 4

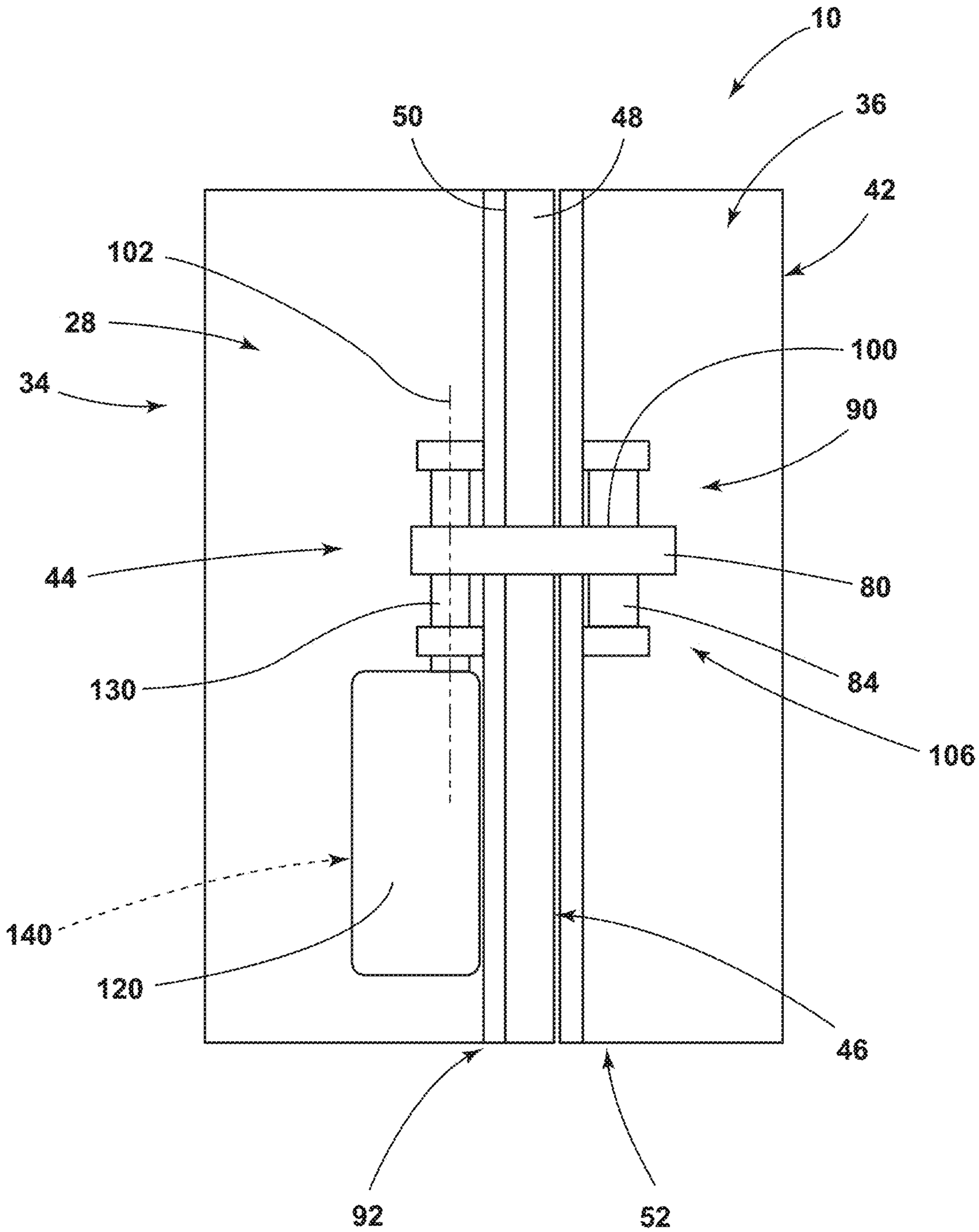

FIG. 5

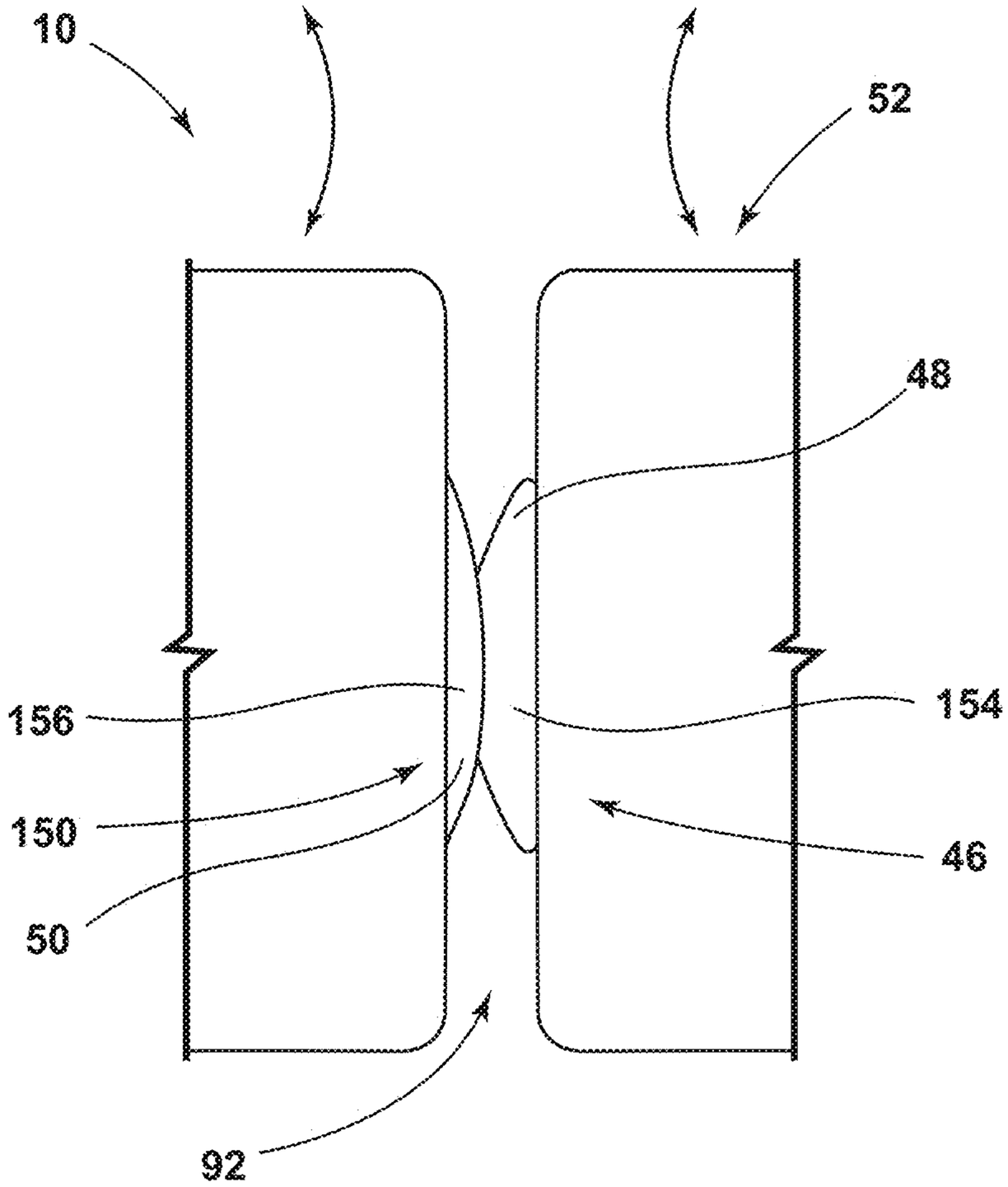

FIG. 6

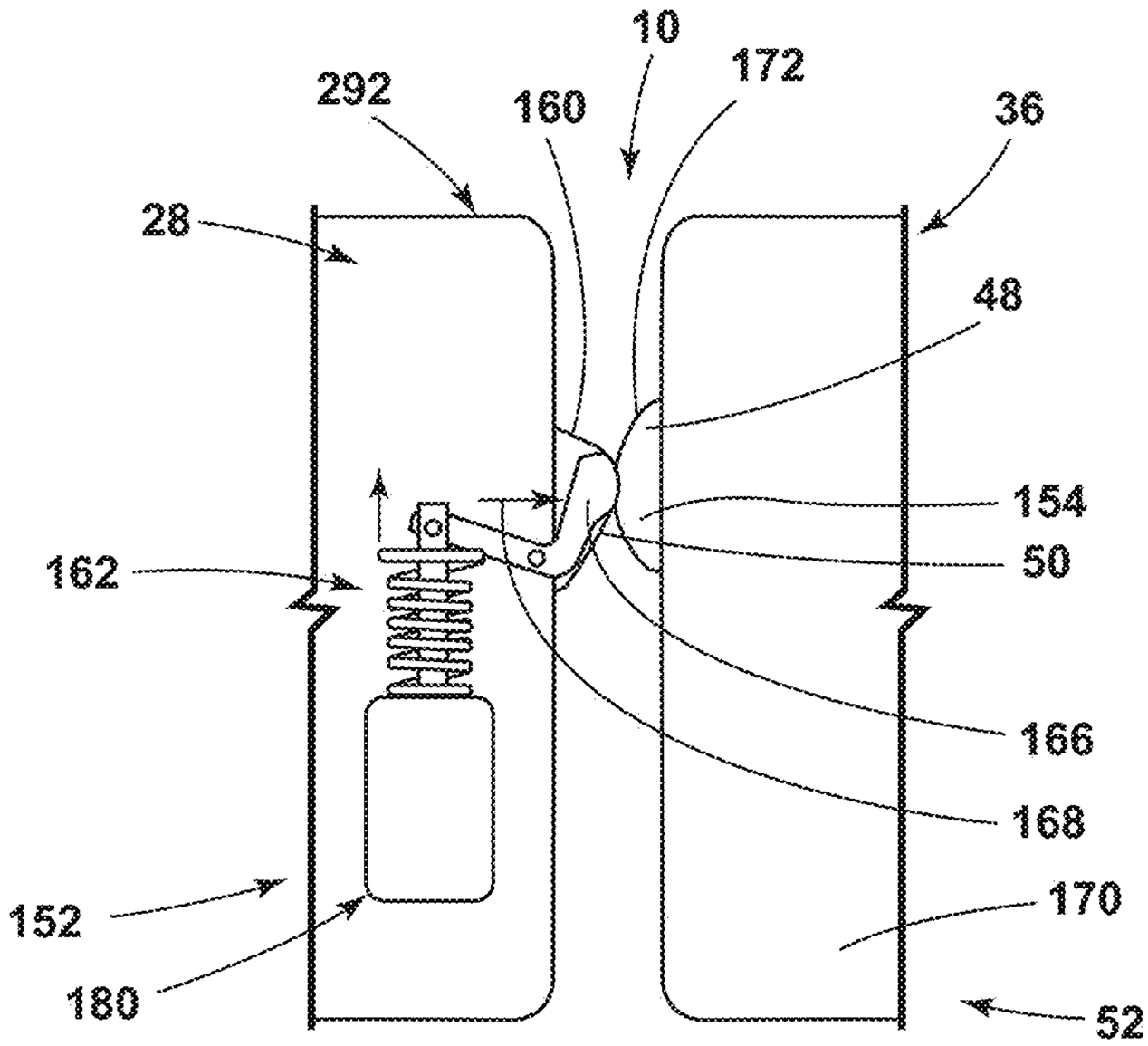
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FIG. 7

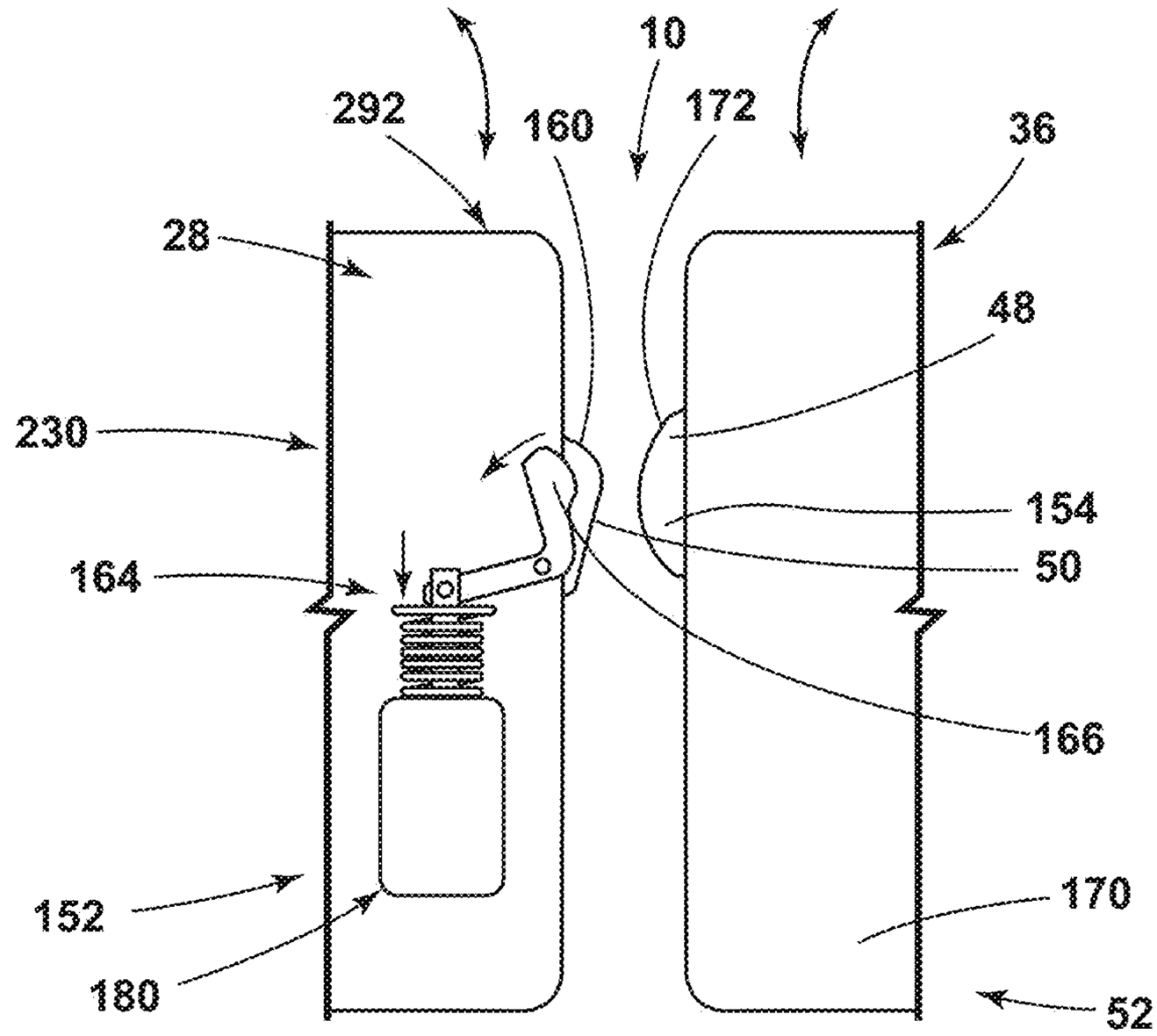
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FIG. 8

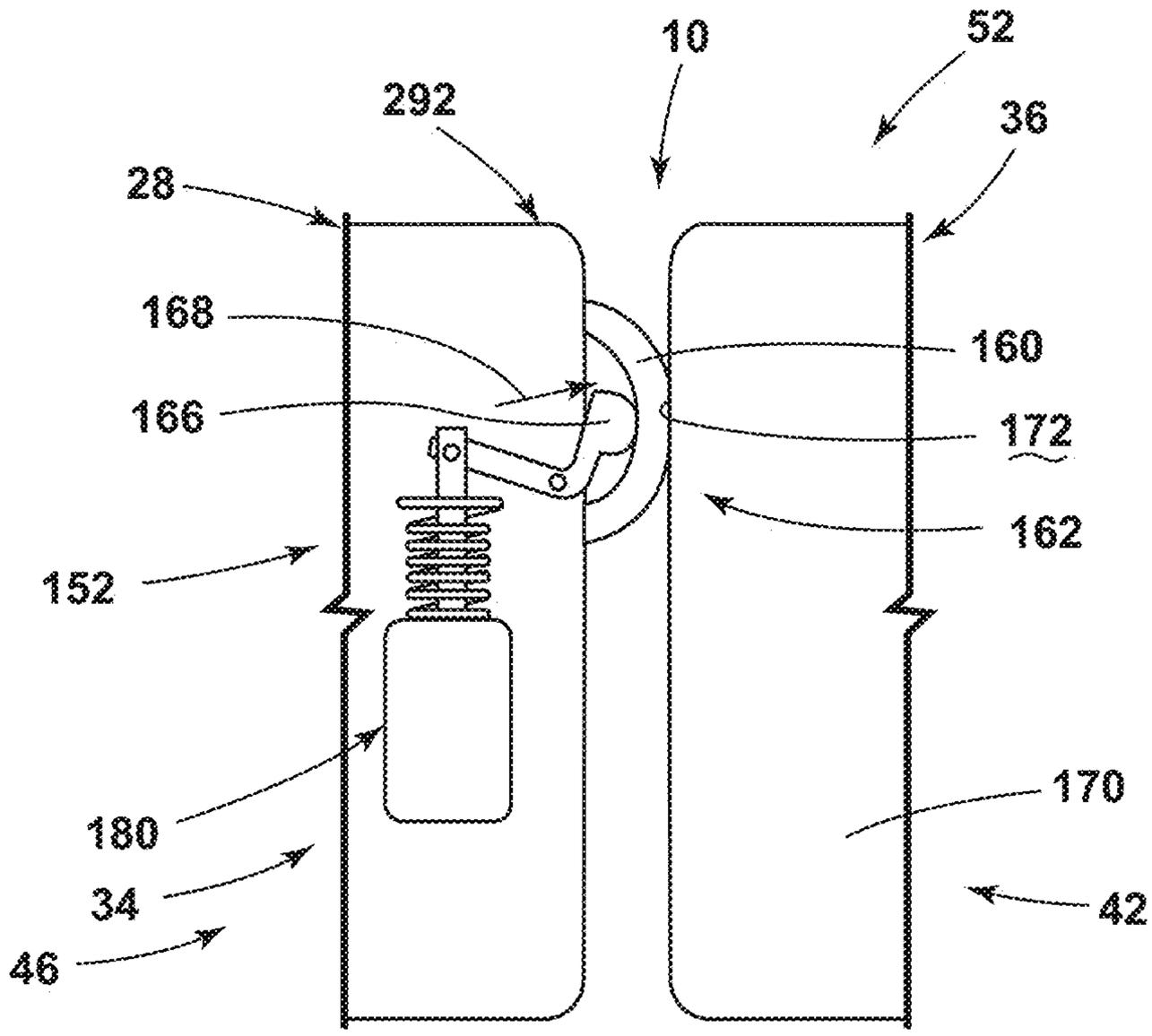
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FIG. 9

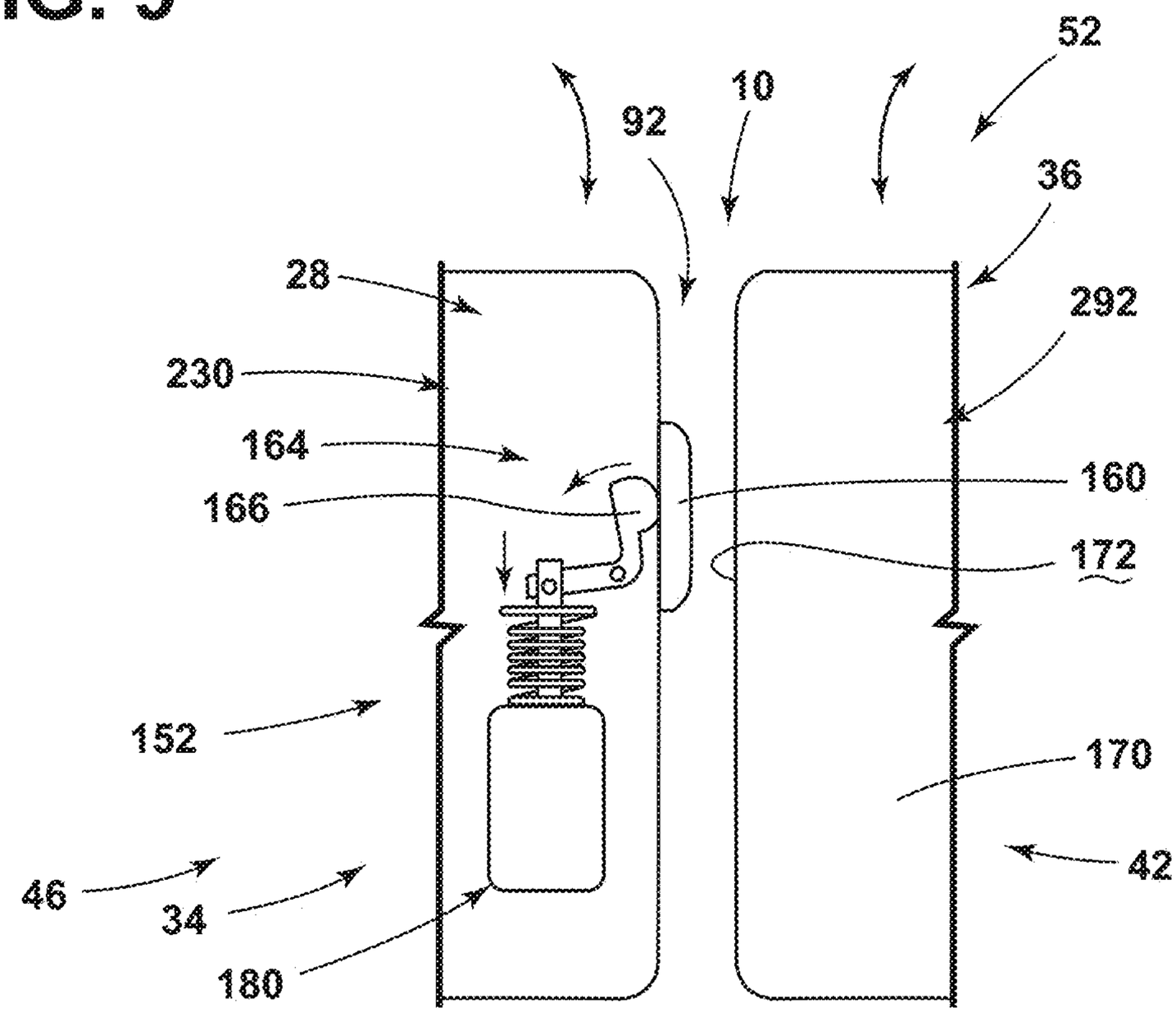
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FIG. 10

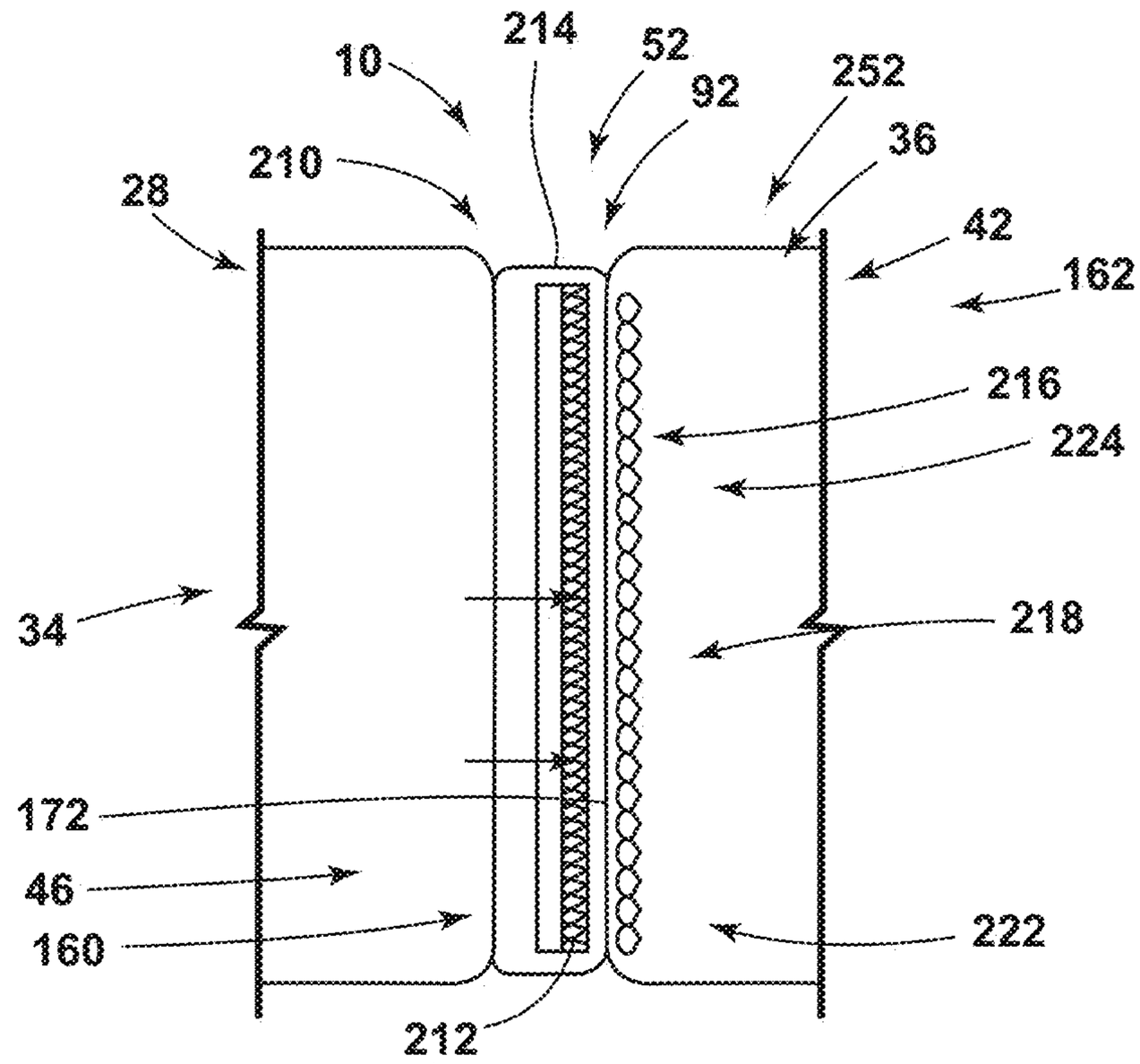
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FIG. 11

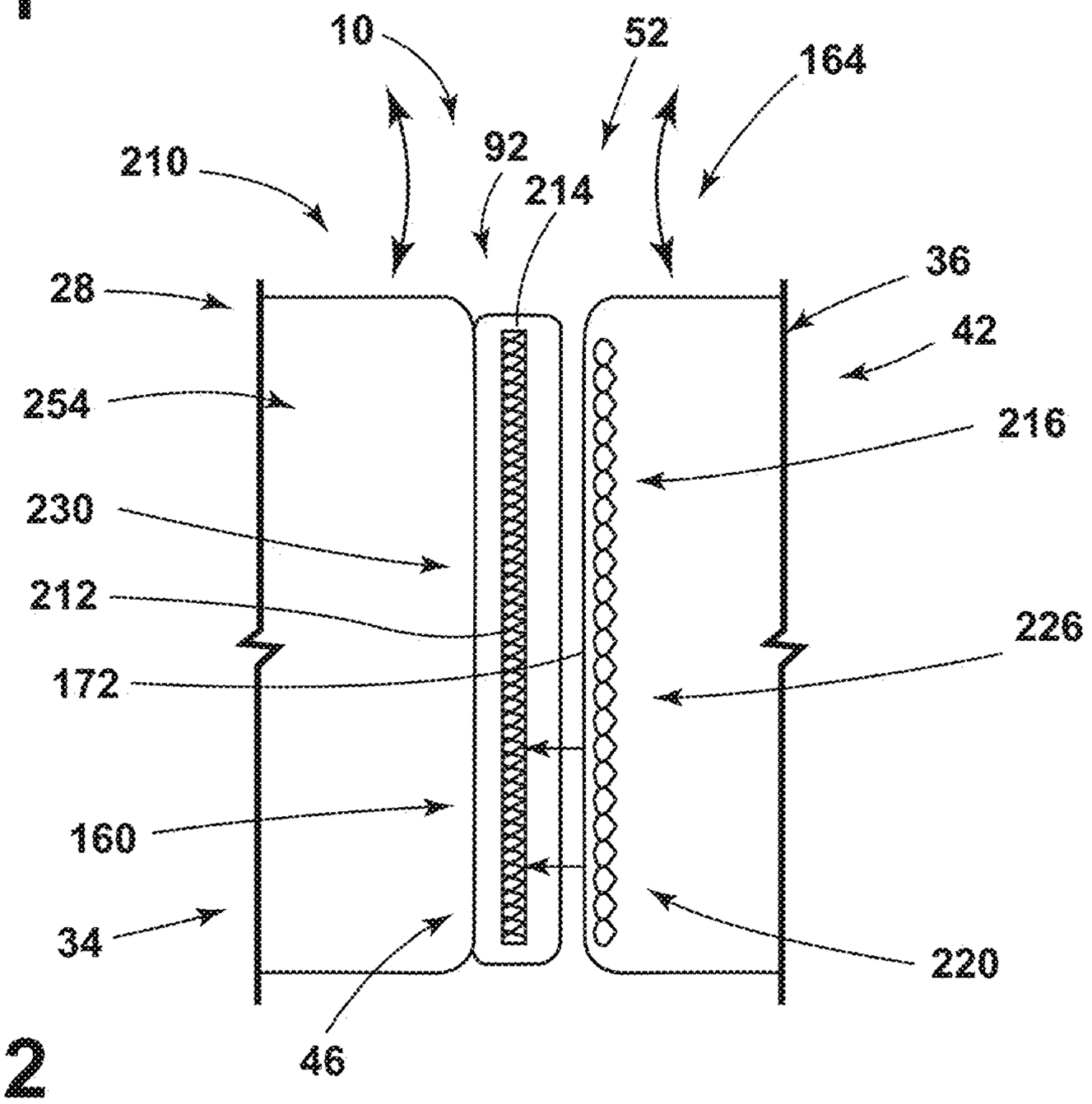
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FIG. 12

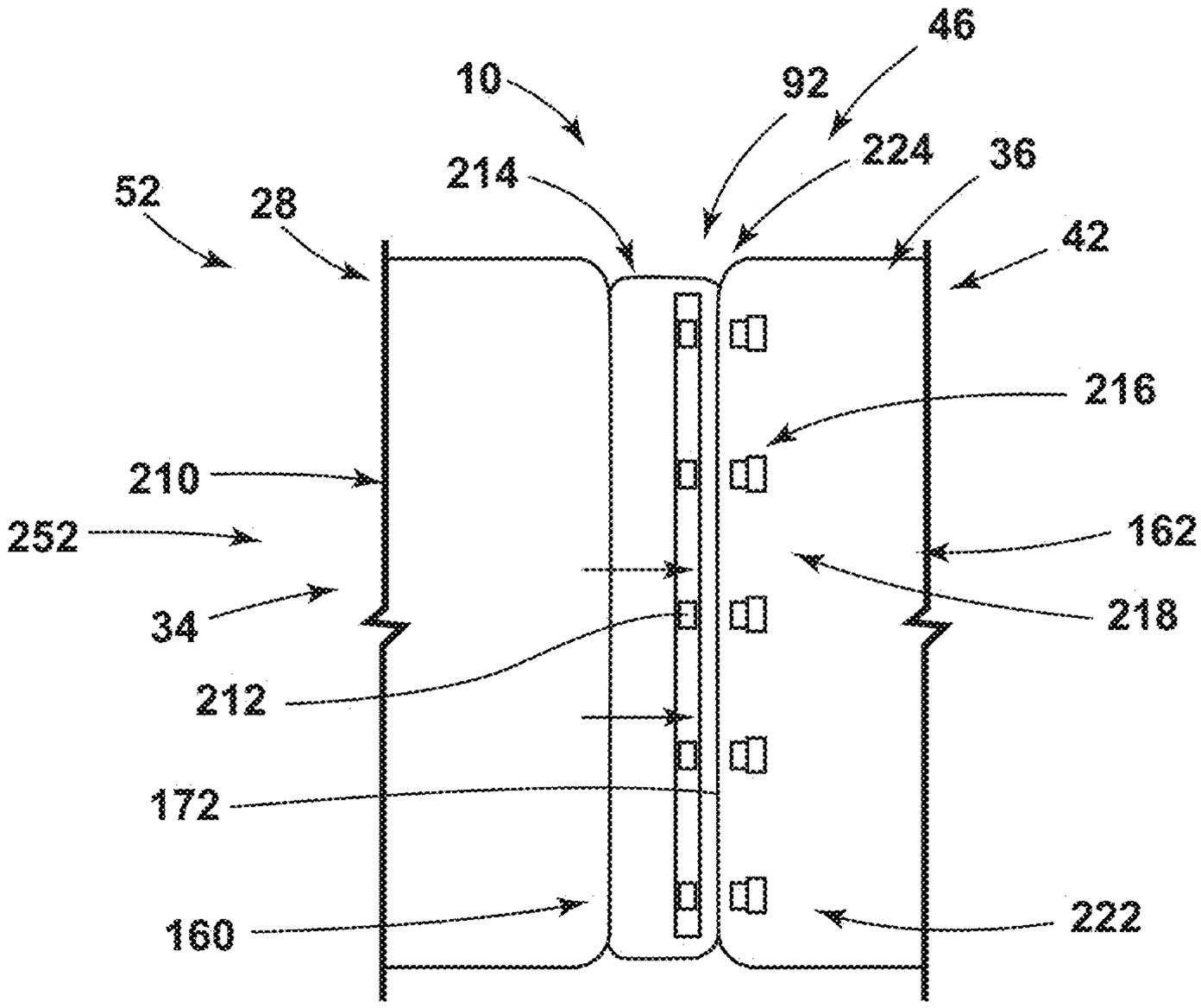
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FIG. 13

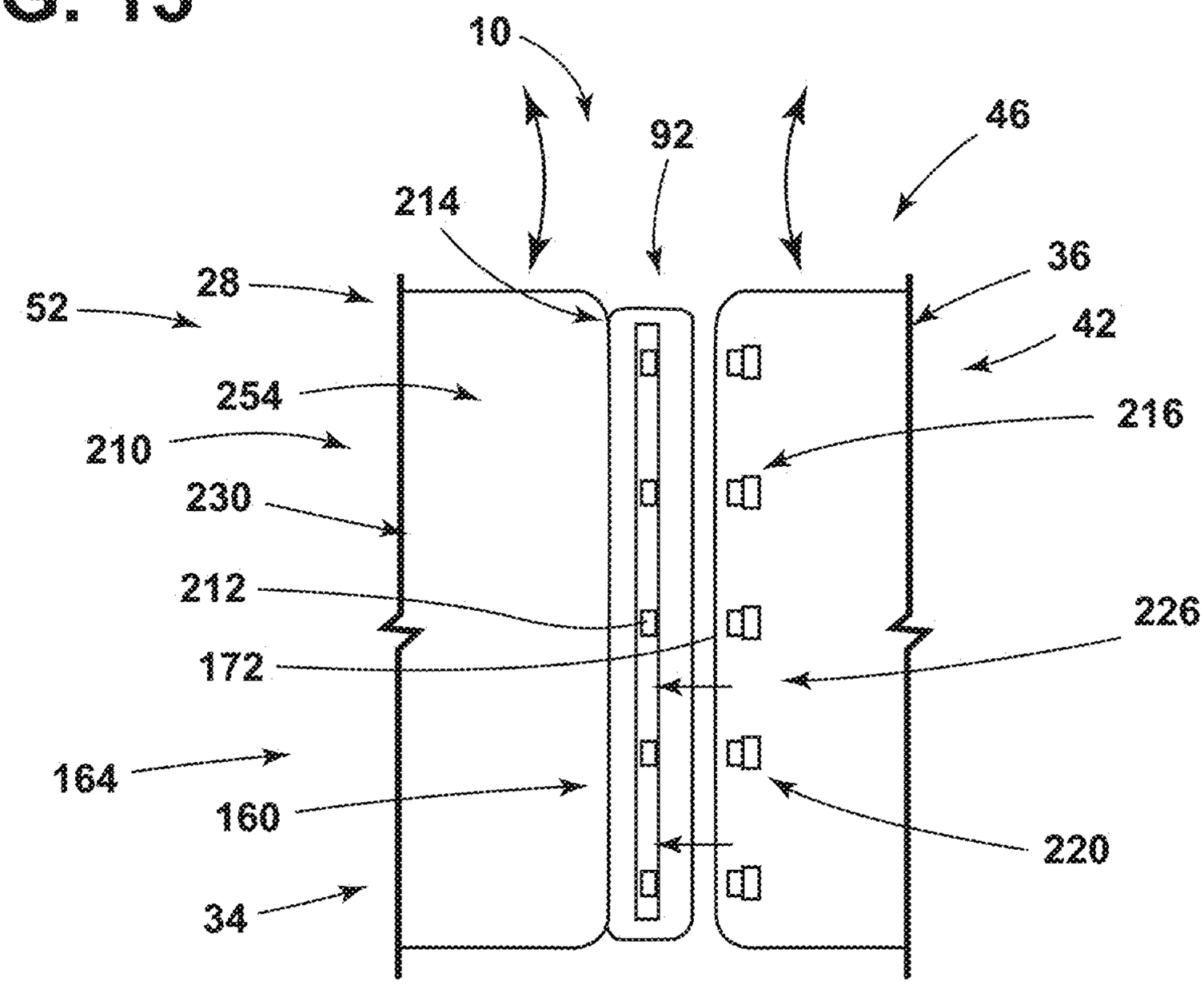
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FIG. 14

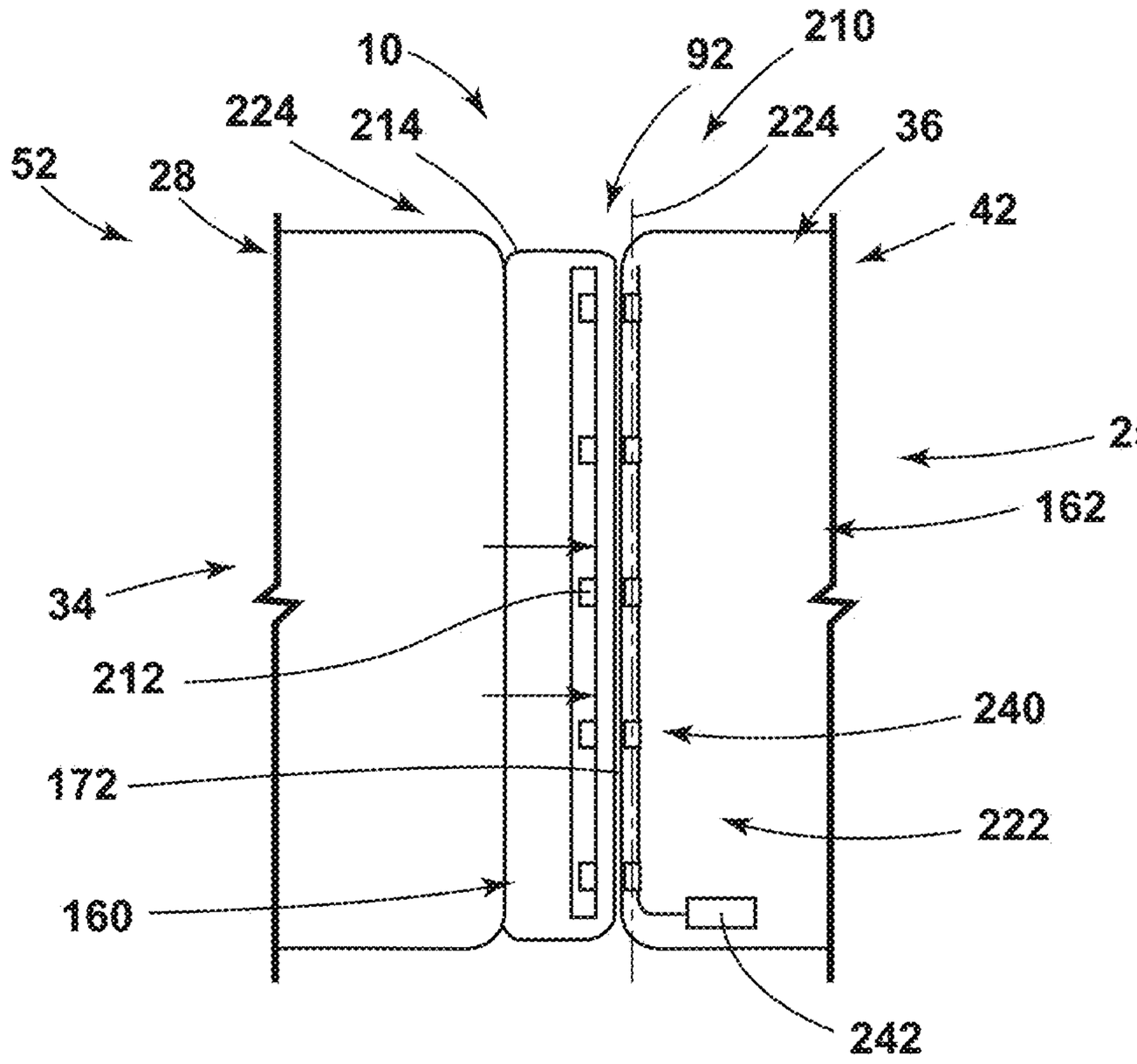
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FIG. 15

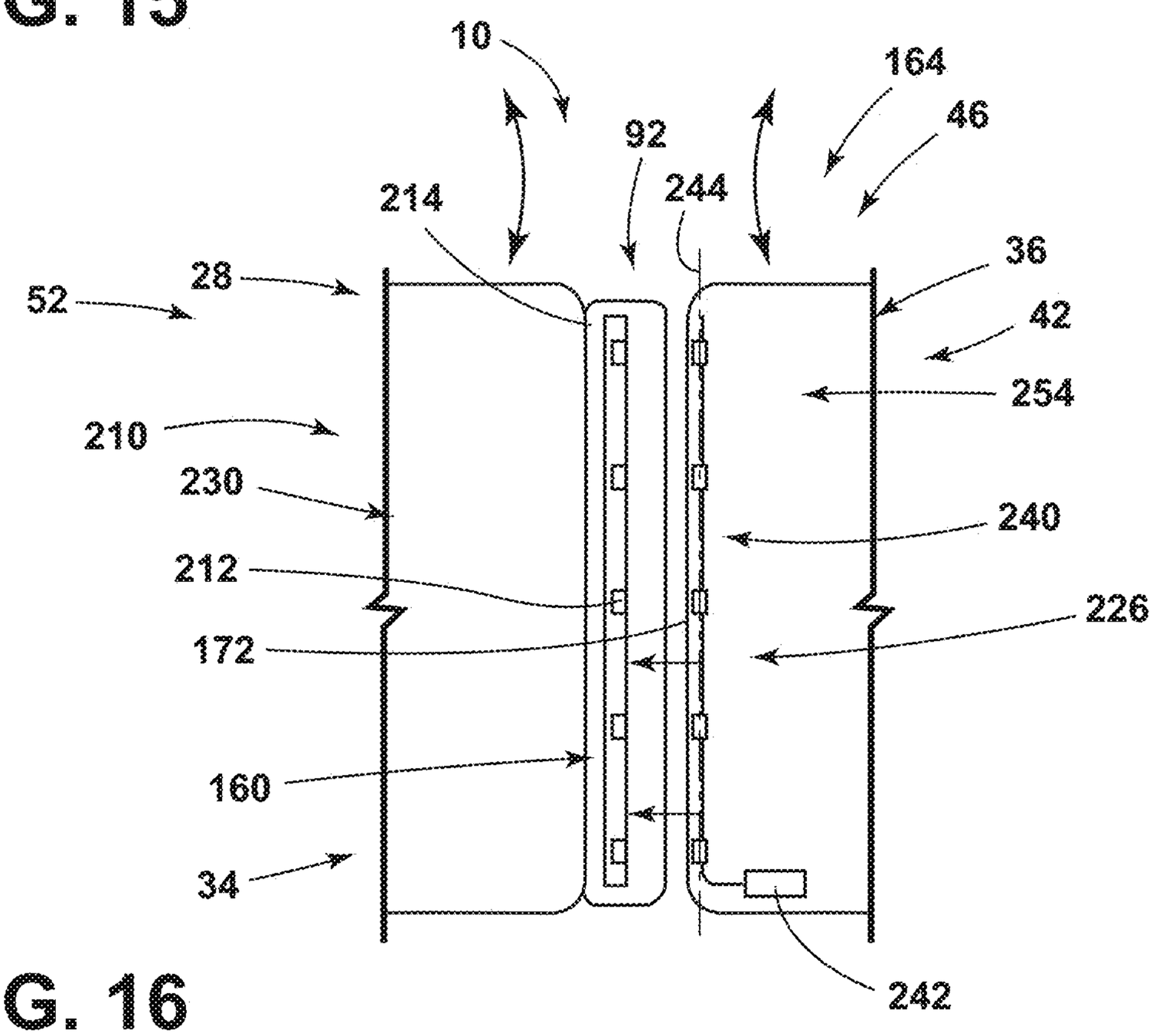
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FIG. 16

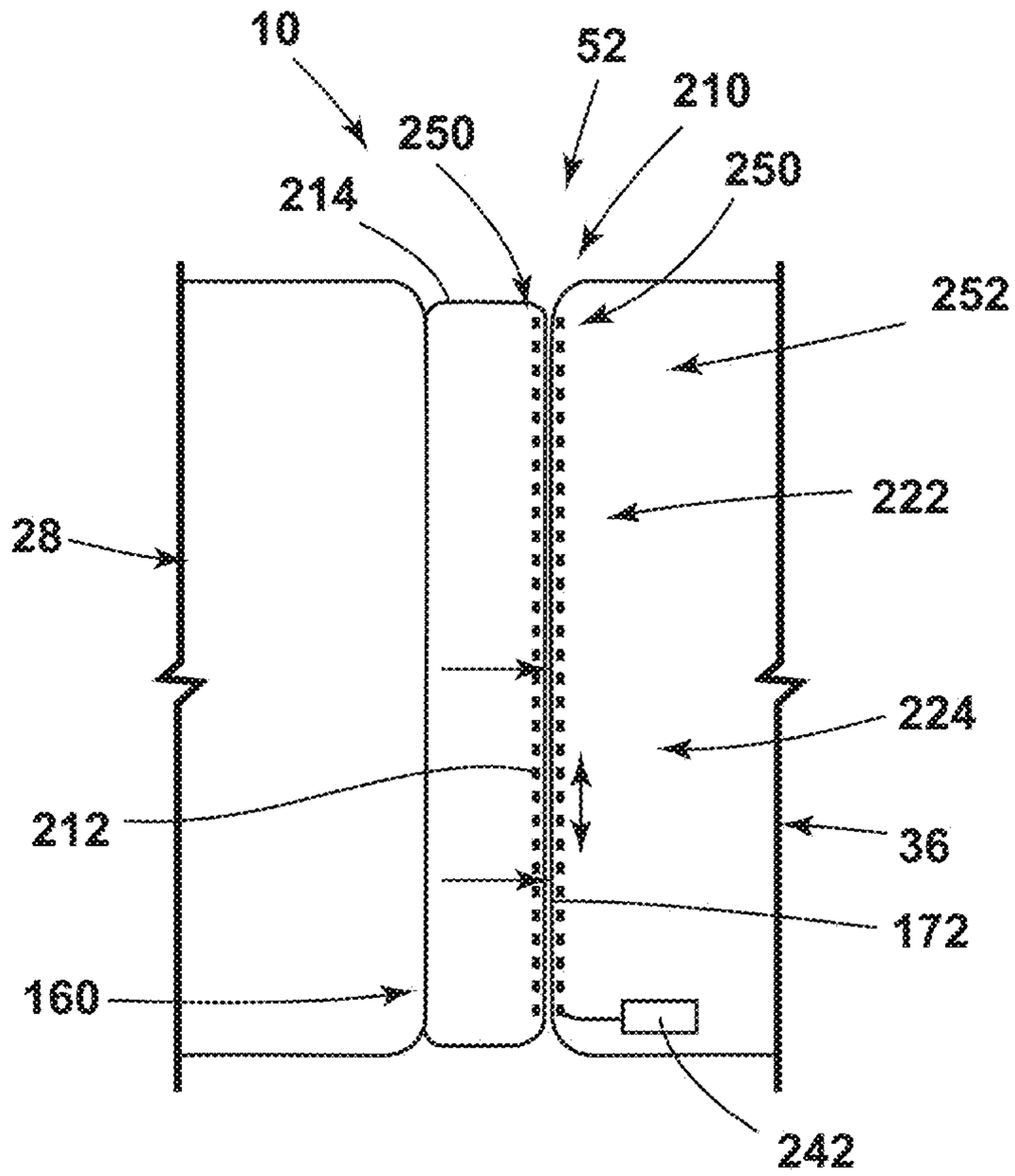
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FIG. 17

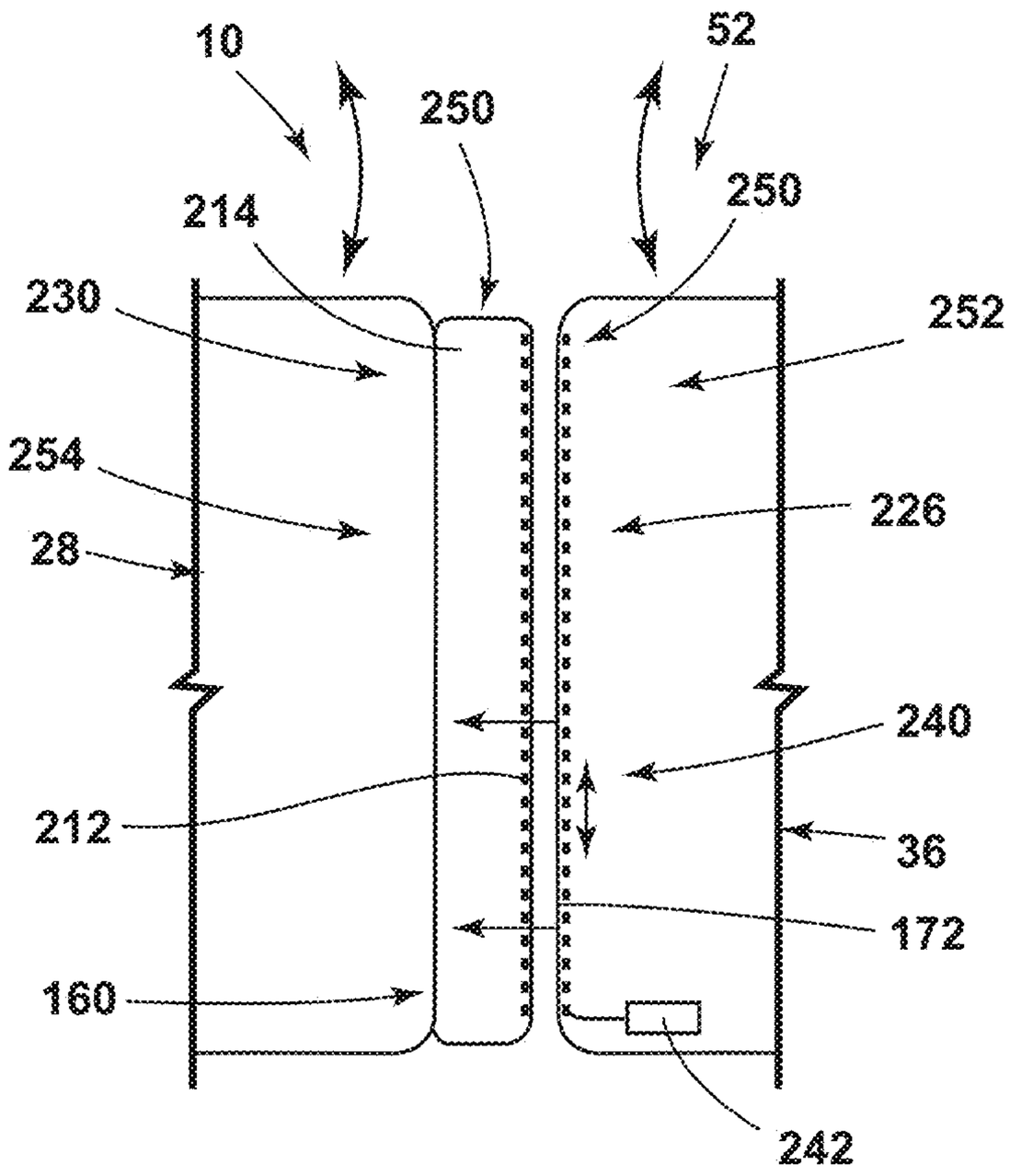
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FIG. 18

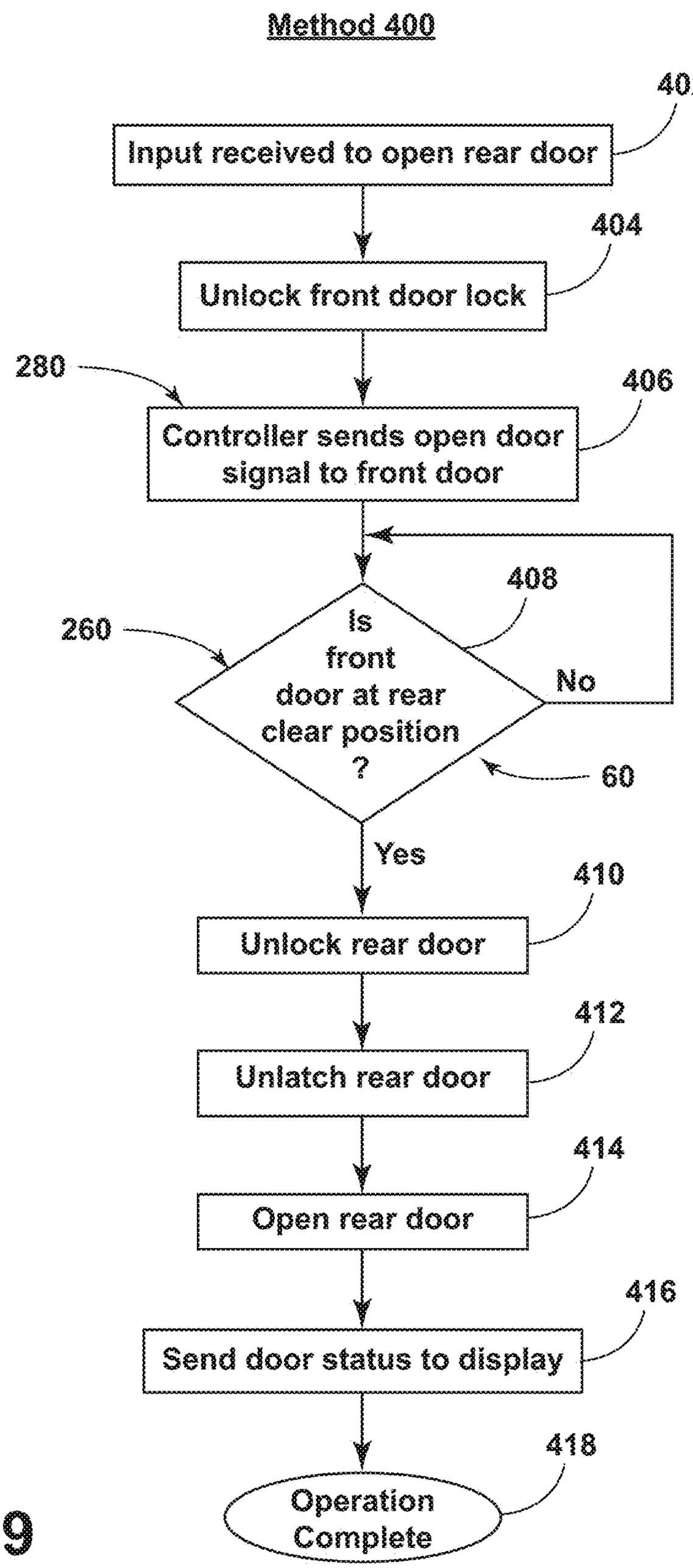
Method 400
402
Input received to open rear door
404
Unlock front door lock
280
406
Controller sends open door signal to front door
408
260
Is front door at rear clear position ?
No
60
Yes
410
Unlock rear door
412
Unlatch rear door
414
Open rear door
416
Send door status to display
418
Operation Complete

FIG. 19

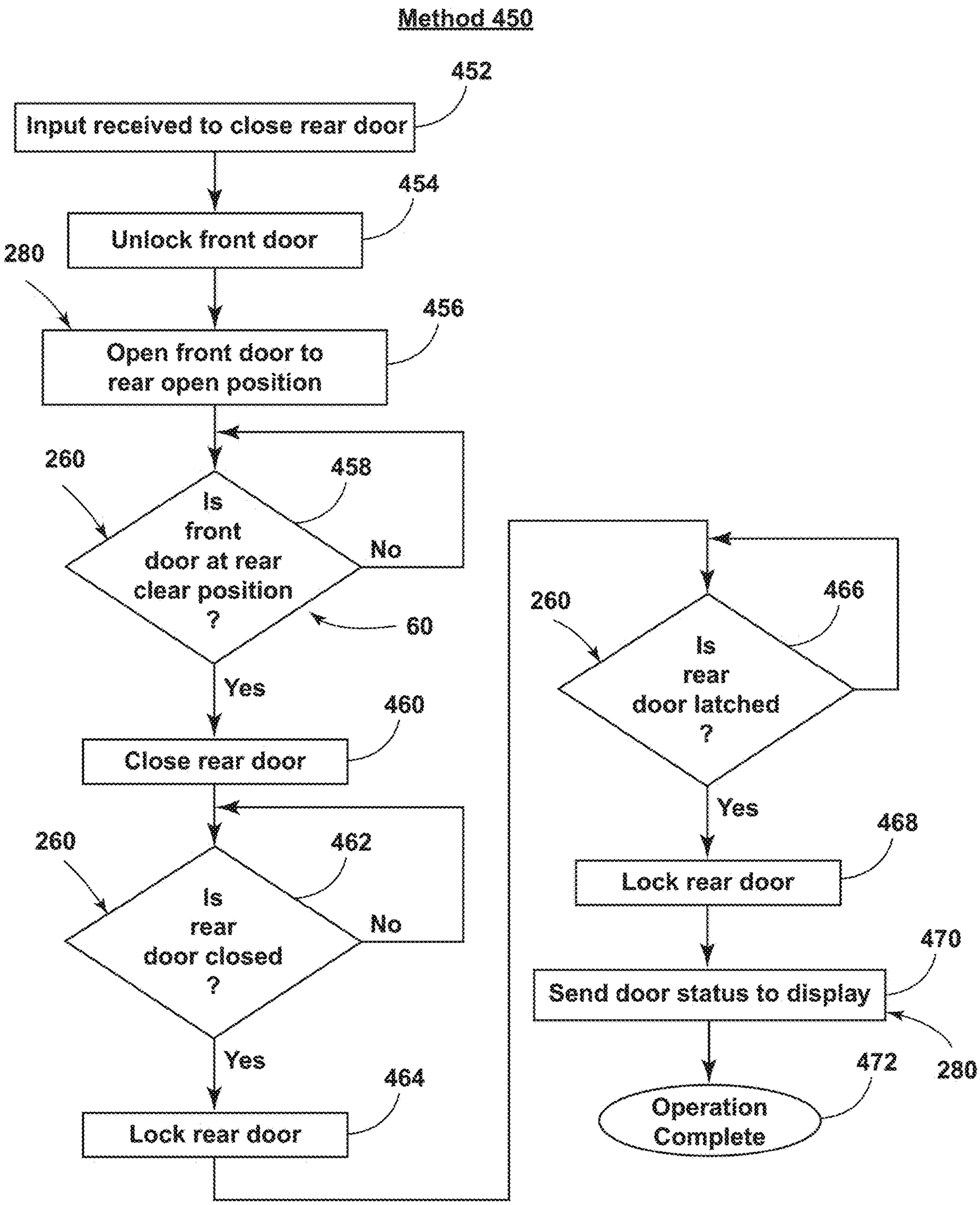
Method 450
452
Input received to close rear door
454
Unlock front door
280
456
Open front door to rear open position
260
458
Is front door at rear clear position ?
No
60
Yes
460
Close rear door
260
462
Is rear door closed ?
No
Yes
464
Lock rear door
260
466
Is rear door latched ?
Yes
468
Lock rear door
470
Send door status to display
280
472
Operation Complete

FIG. 20

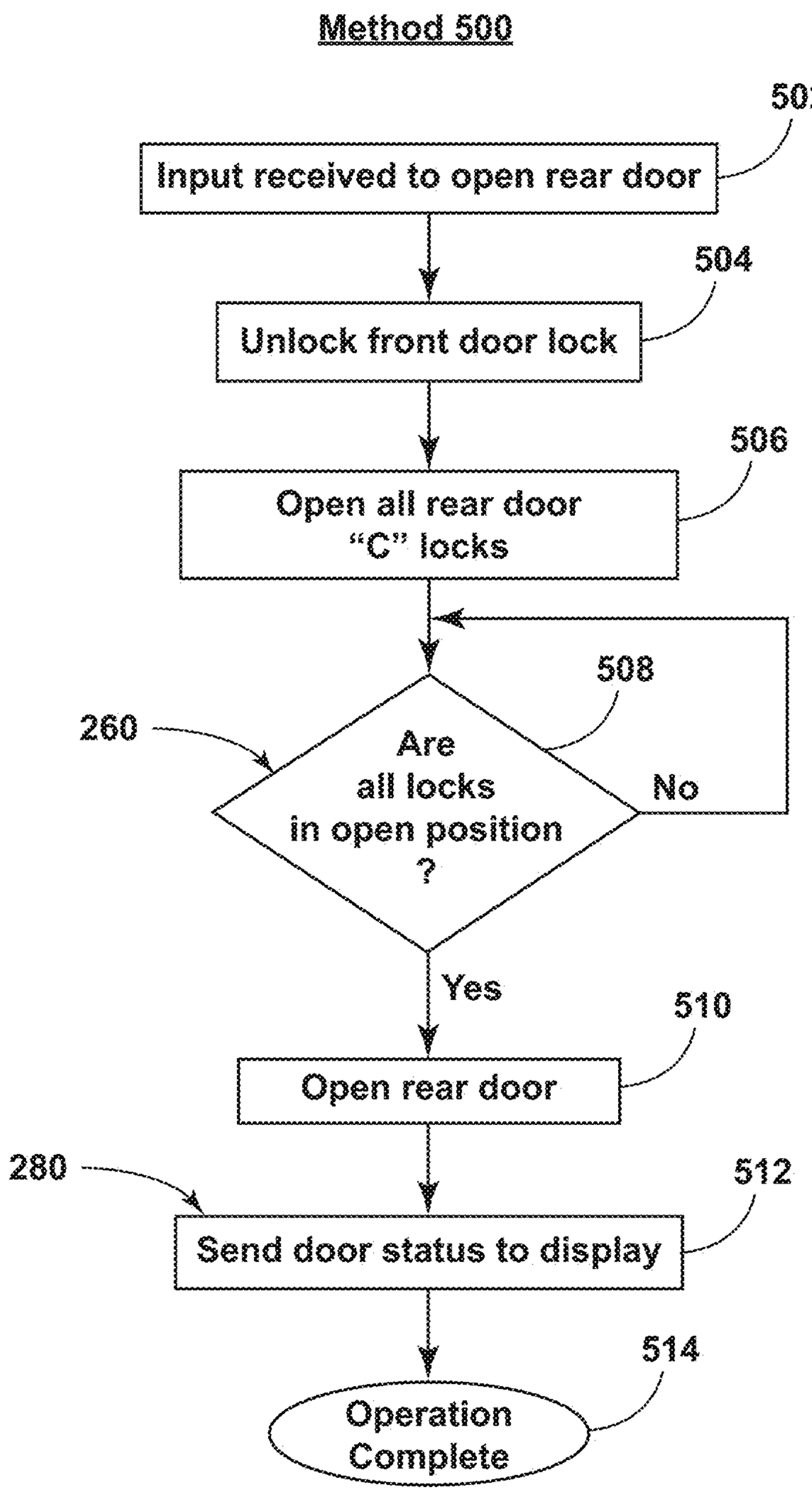
Method 500
502
Input received to open rear door
504
Unlock front door lock
506
Open all rear door "C" locks
508
260
Are all locks in open position ?
No
Yes
510
Open rear door
280
512
Send door status to display
514
Operation Complete

FIG. 21

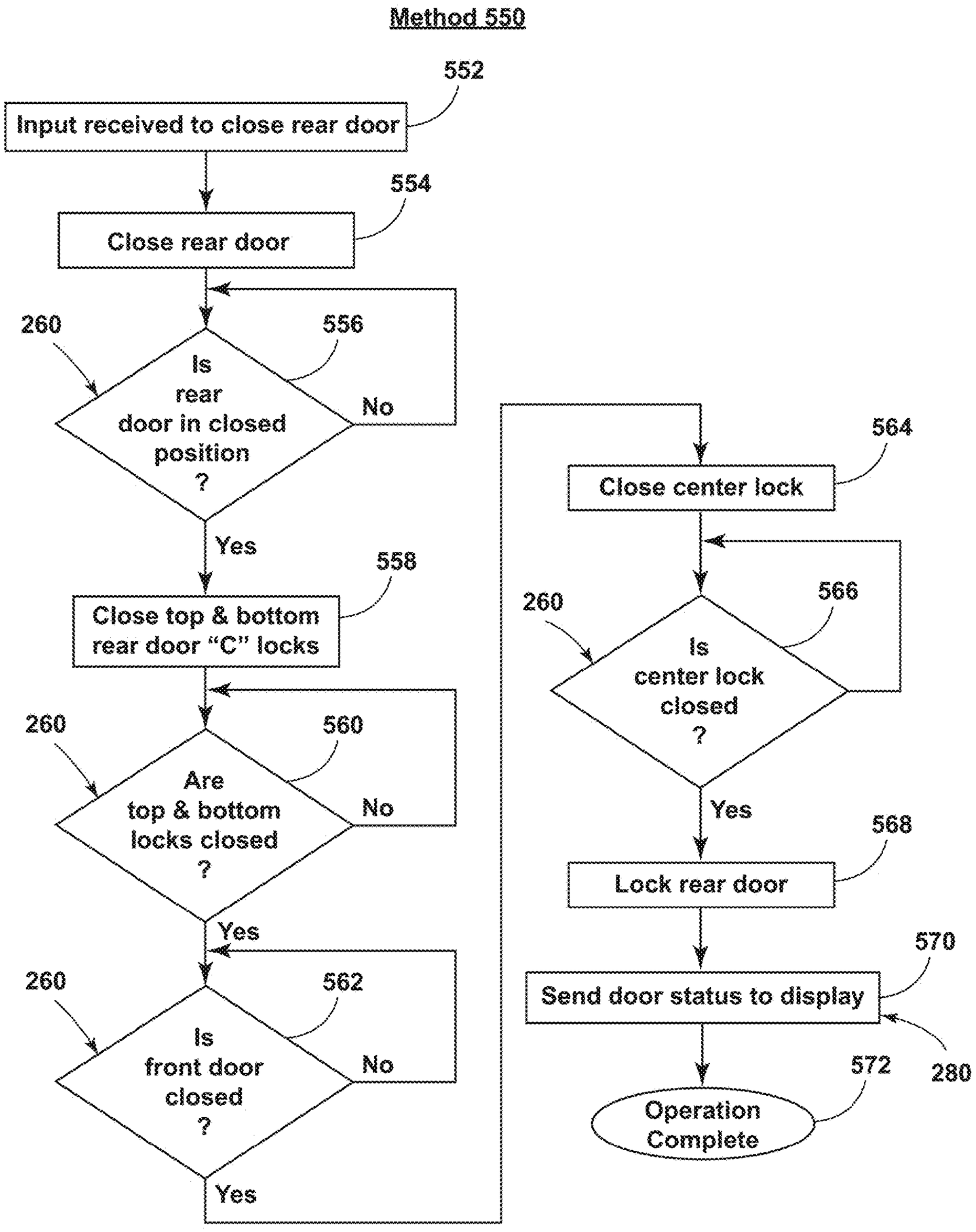
Method 550
552
Input received to close rear door
554
Close rear door
260
556
Is rear door in closed position ?
No
Yes
558
Close top & bottom rear door "C" locks
260
560
Are top & bottom locks closed ?
No
Yes
260
562
Is front door closed ?
No
Yes
564
Close center lock
260
566
Is center lock closed ?
Yes
568
Lock rear door
570
Send door status to display
280
572
Operation Complete

FIG. 22

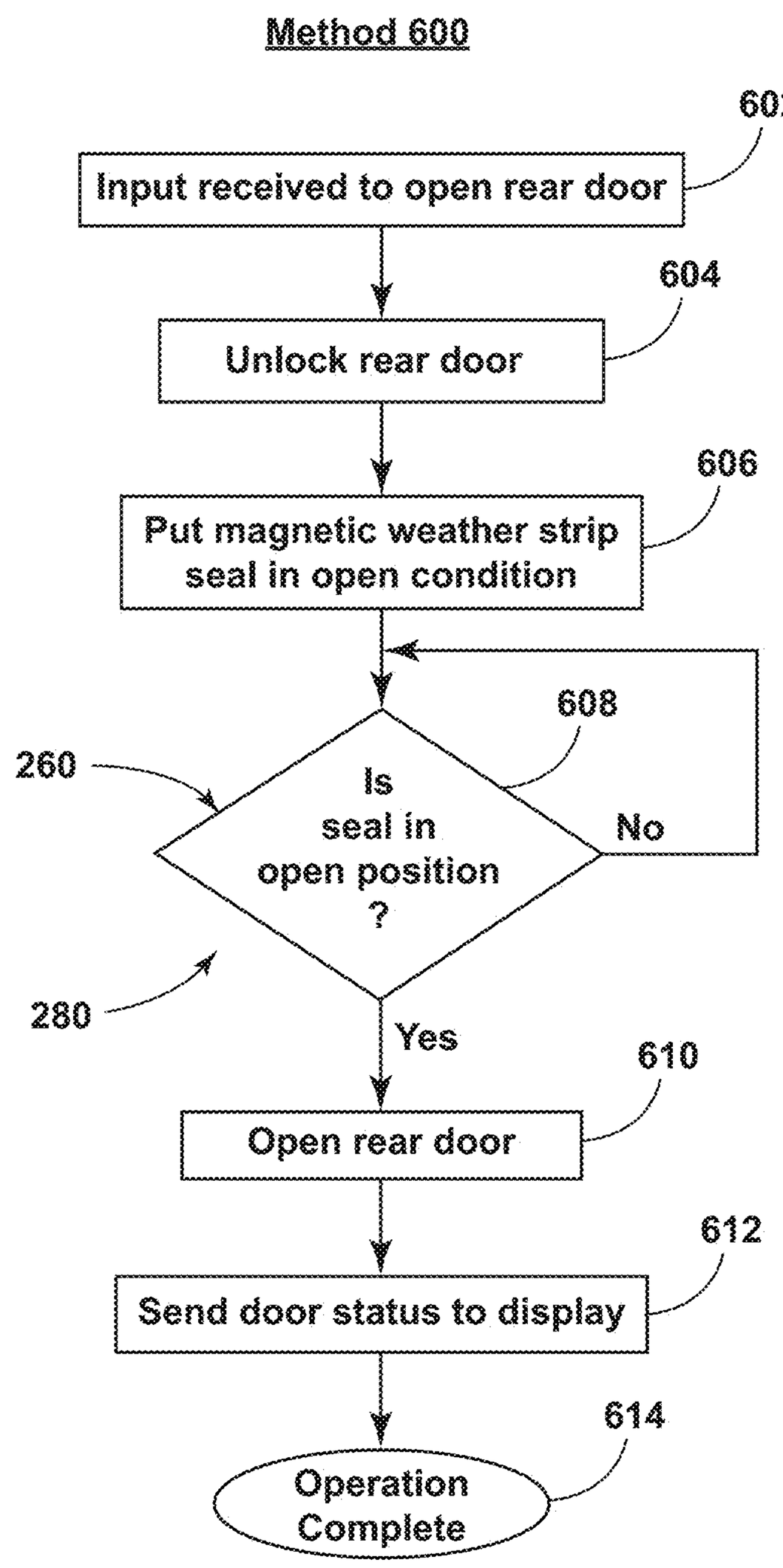
Method 600
602
Input received to open rear door
604
Unlock rear door
606
Put magnetic weather strip seal in open condition
608
260
Is seal in open position ?
No
280
Yes
610
Open rear door
612
Send door status to display
614
Operation Complete

FIG. 23

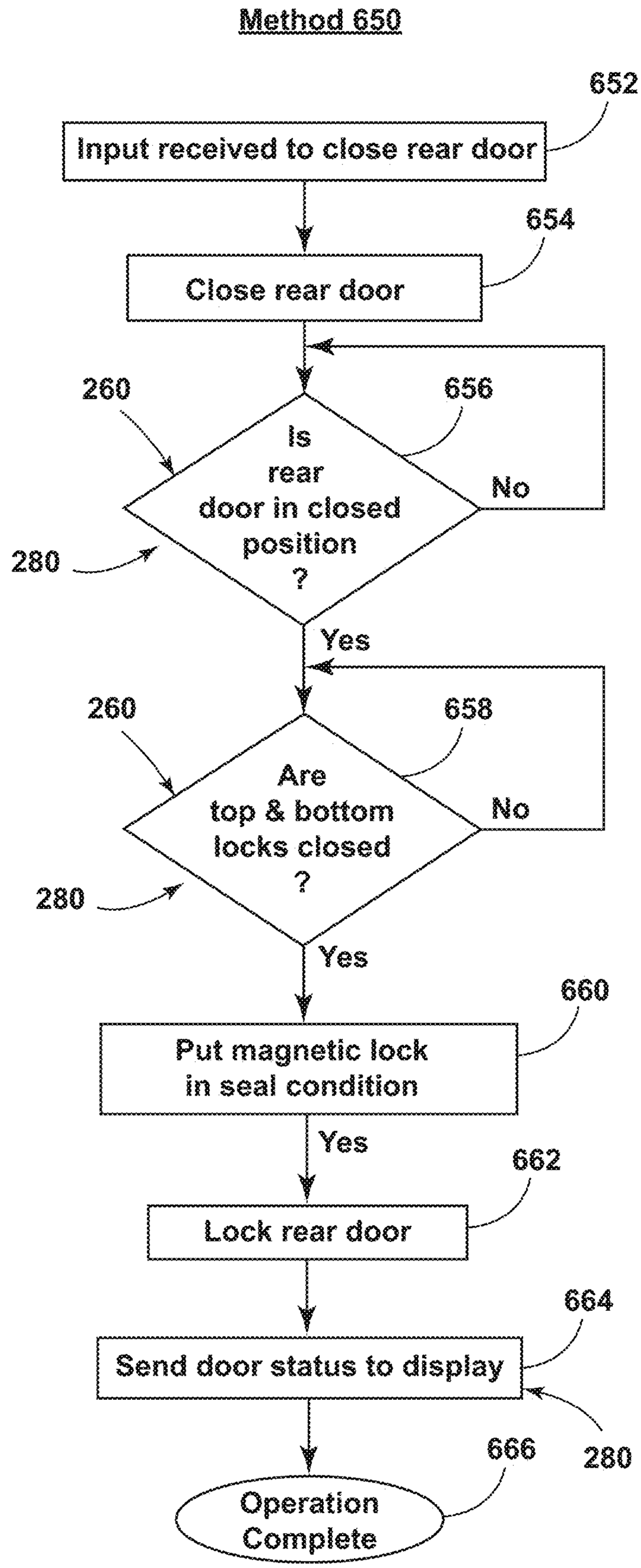
Method 650
652
Input received to close rear door
654
Close rear door
260
656
Is rear door in closed position ?
No
280
Yes
260
658
Are top & bottom locks closed ?
No
280
Yes
660
Put magnetic lock in seal condition
Yes
662
Lock rear door
664
Send door status to display
280
666
Operation Complete

FIG. 24

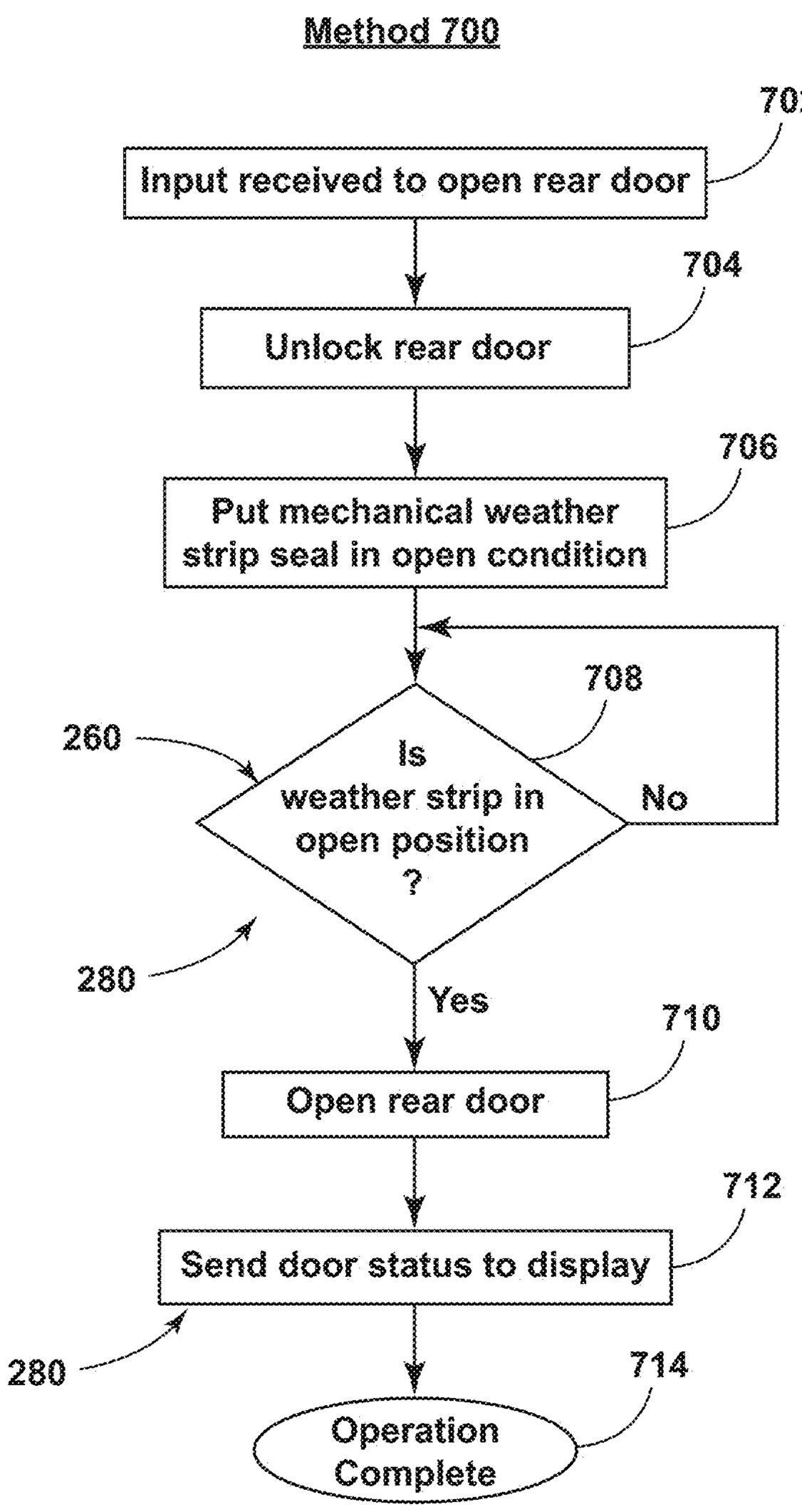
Method 700
702
Input received to open rear door
704
Unlock rear door
706
Put mechanical weather strip seal in open condition
708
260
Is weather strip in open position ?
No
280
Yes
710
Open rear door
712
Send door status to display
280
714
Operation Complete

FIG. 25

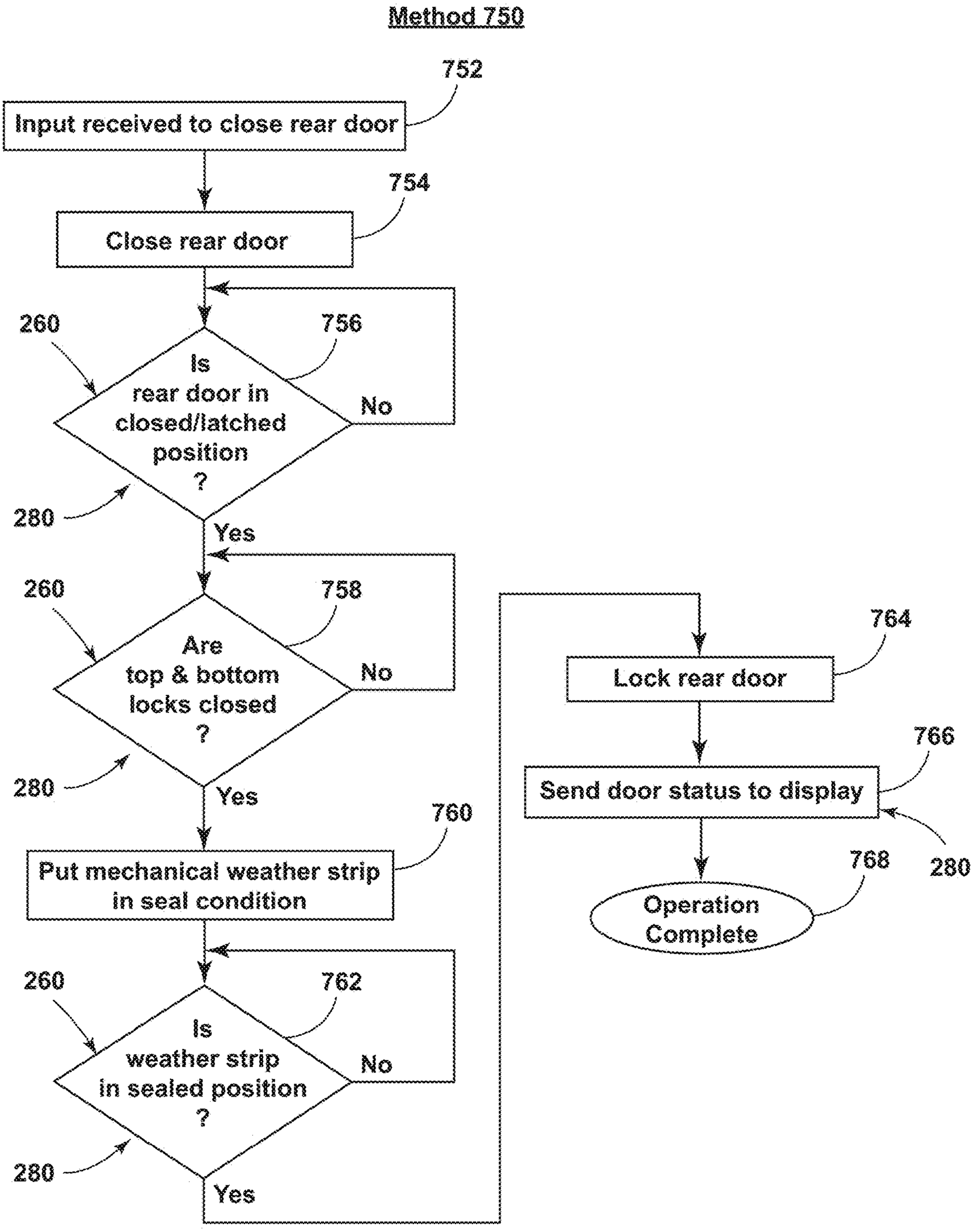
Method 750
752
Input received to close rear door
754
Close rear door
260
756
Is rear door in closed/latched position ?
No
280
Yes
260
758
Are top & bottom locks closed ?
No
280
Yes
760
Put mechanical weather strip in seal condition
260
762
Is weather strip in sealed position ?
No
280
Yes
764
Lock rear door
766
Send door status to display
280
768
Operation Complete

FIG. 26

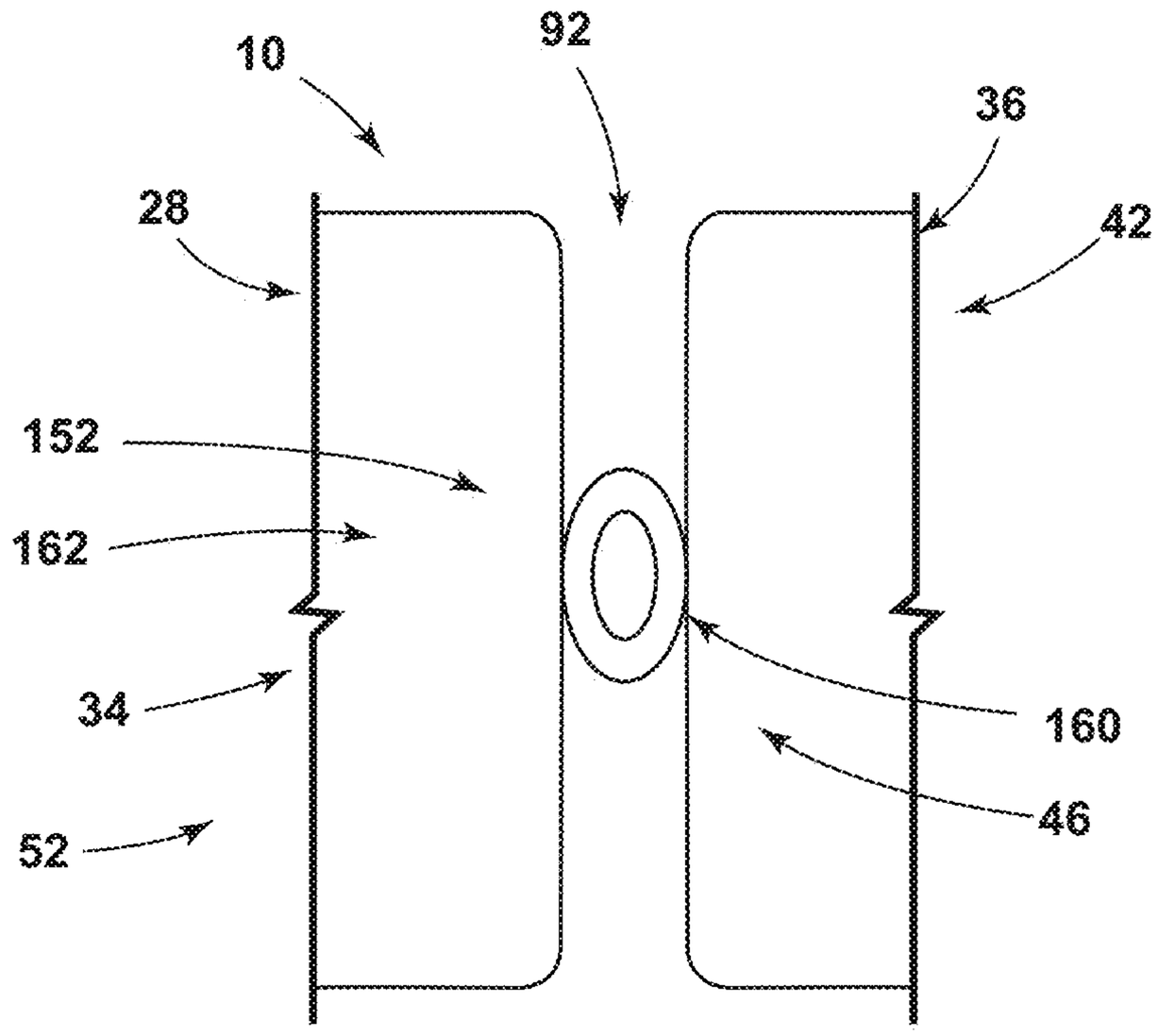
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FIG. 27

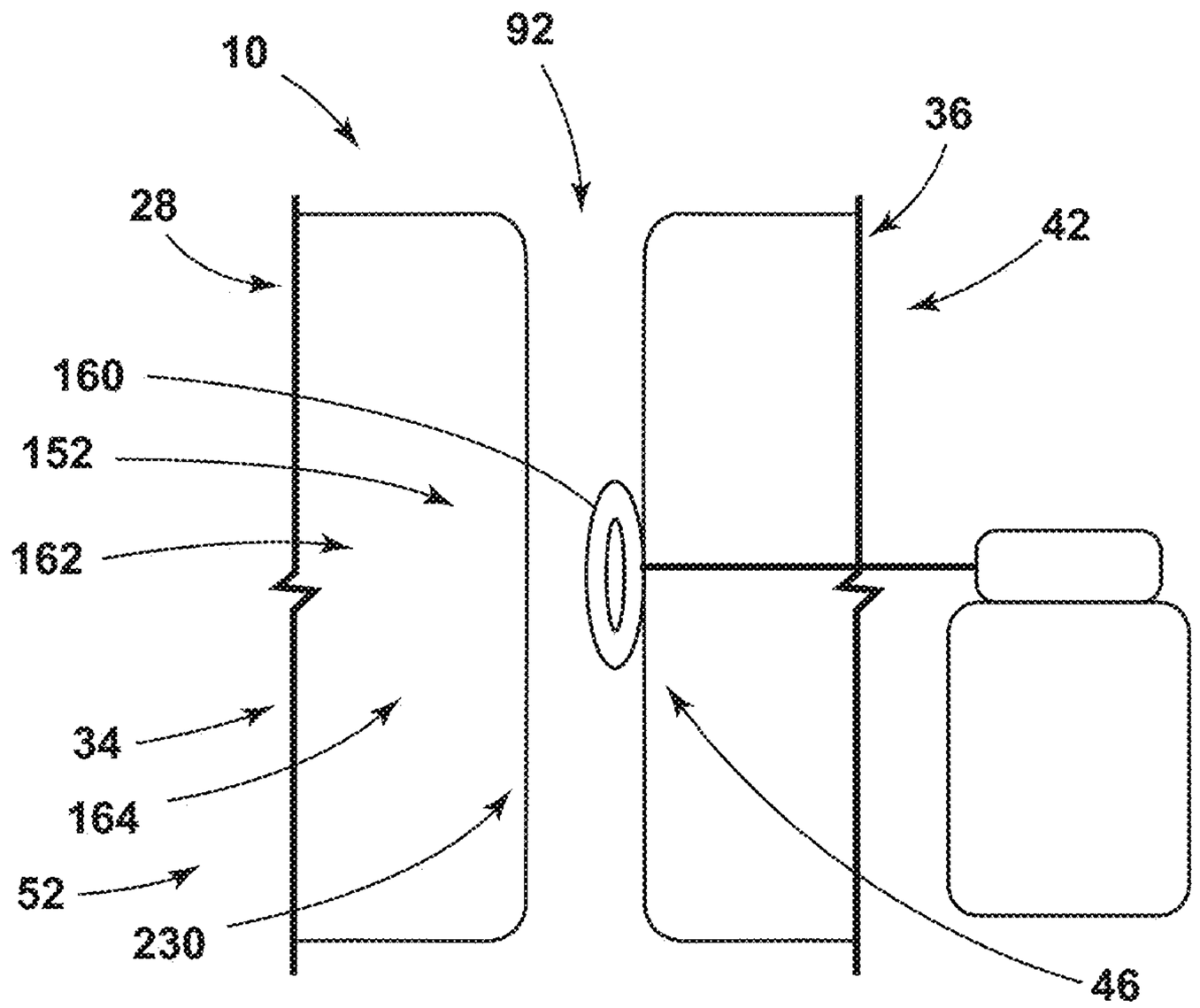
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FIG. 28

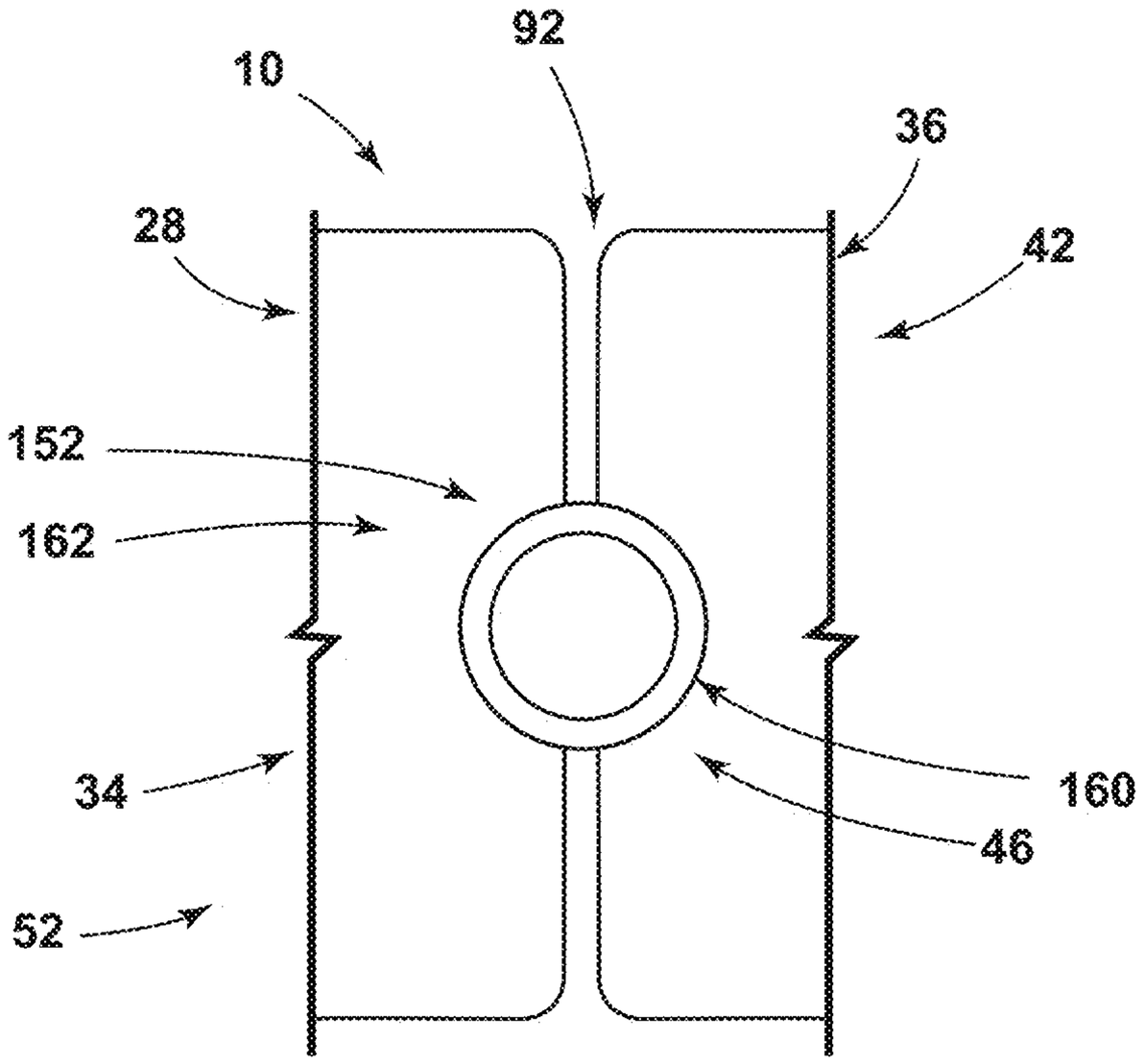
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FIG. 29

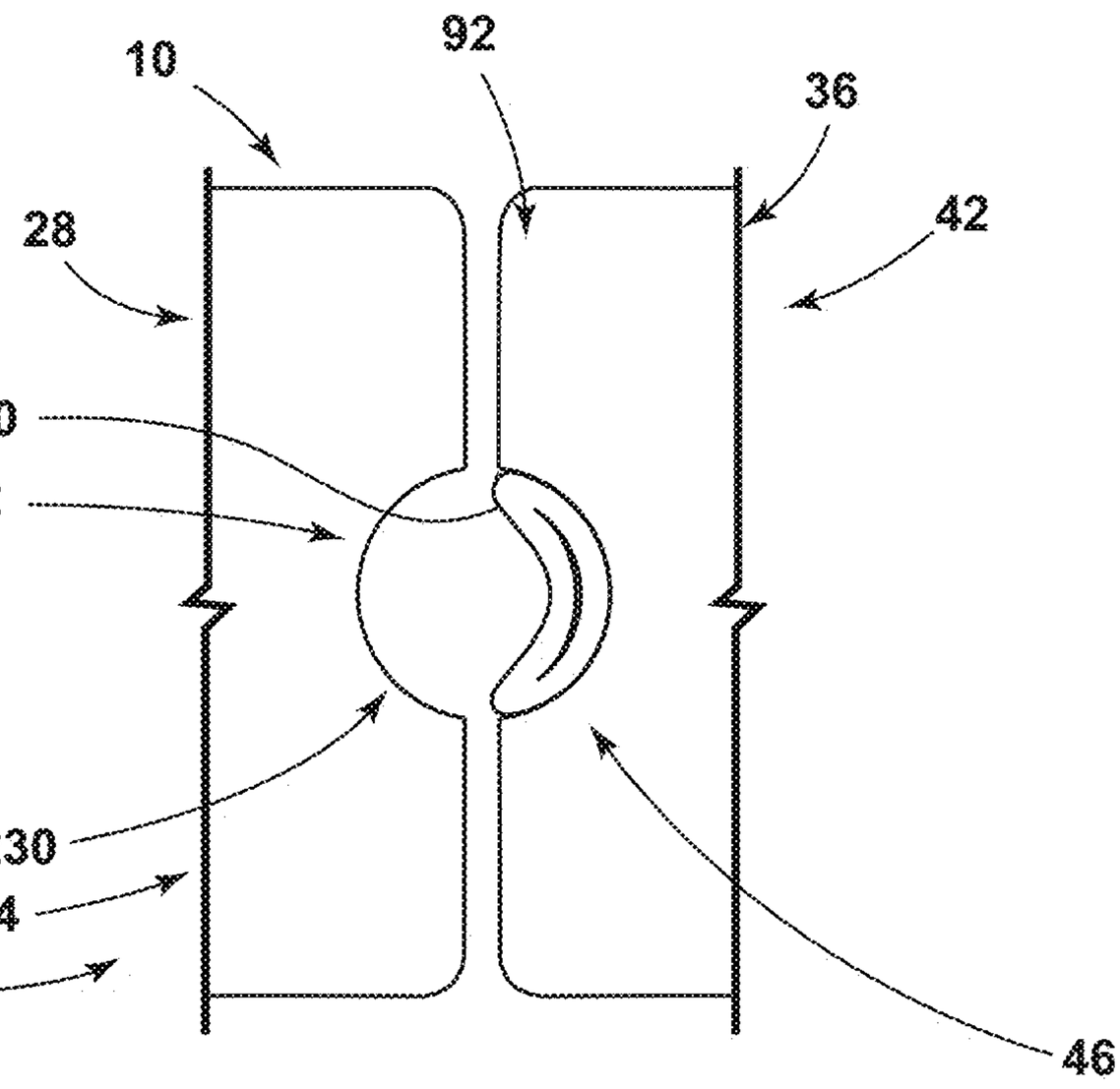
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FIG. 30

DOOR SEALING AND TIMING MECHANISM FOR USE IN COACH DOOR CONFIGURATION FOR A VEHICLE

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application is a continuation of and claims priority to U.S. patent application Ser. No. 16,775,879, filed on Jan. 29, 2020, entitled "DOOR SEALING AND TIMING MECHANISM FOR USE IN COACH DOOR CONFIGURATION FOR A VEHICLE," which claims the benefit under 35 U.S.C. § 119(e) of U.S. Provisional Patent Application No. 62/824,356, filed on Mar. 27, 2019, entitled "DOOR SEALING AND TIMING MECHANISM FOR USE IN COACH DOOR CONFIGURATION FOR A VEHICLE," the entire disclosures of which are hereby incorporated herein by reference.

FIELD OF THE INVENTION

[0002] The present invention generally relates to vehicle doors, and more specifically, coach-style vehicle doors that include a door sealing mechanism and a timing mechanism that provides for a vehicle body configuration having no pillar between the coach-style doors.

BACKGROUND OF THE INVENTION

[0003] Within certain vehicles, vehicle doors are disposed on each side of the vehicle body.

[0004] Typically, with sedan-type vehicles, the body includes a front door and a rear door on each side of the vehicle. These front and rear doors can be configured in a coach-style configuration, where the front door has a front hinge and the rear door has a rear hinge. This configuration of doors allows for the front and rear doors to open opposite from one another, so that a large opening is provided for at the side of the vehicle. These coach-style doors are currently used within pick-up trucks and certain luxury vehicles. Typically, the B-pillar is positioned between the front and rear doors and each of the front and rear doors latch to an area within the B-pillar.

SUMMARY OF THE INVENTION

[0005] According to one aspect of the present invention, a vehicle includes a body having an uninterrupted side aperture that provides access to an interior passenger cabin. A front door is hingedly attached at a forward edge of the uninterrupted side aperture. The front door is selectively operable between front open and front closed positions. A rear door is hingedly attached at a rearward edge of the uninterrupted side aperture. The rear door is selectively operable between rear open and rear closed positions. A latching assembly is at least partially positioned within the body and configured to receive the front door in the front closed position and the rear door in the rear closed position. A sealing assembly is defined between a forward seal of the rear door and a rearward seal of the front door. The forward and rearward seals engage one another in a fully-closed position.

[0006] Embodiments of this aspect of the invention can include any one or combination of the following features:

[0007] the front door is operable between the front open and front closed positions when the rear door is in the rear closed position

[0008] the rear door is operable between the rear open and rear closed positions when the front door is in the front closed position

[0009] the latching assembly is further defined within the forward edge of the rear door and the rearward edge of the front door

[0010] the sealing assembly includes an operable member that articulates toward a receiving seal to define the fully-closed position

[0011] the operable member is operated by a mechanical assembly

[0012] the operable member is operated by a magnetic assembly

[0013] the sealing assembly includes opposing elastomeric seals that are attached to the front and rear doors, respectively

[0014] the front and rear doors are operated by a door operating mechanism that operates the front door, the rear door and the latching assembly between an ajar position and the fully-closed position

[0015] the ajar position is approximately 5 degrees rotationally distal from the fully-closed position

[0016] the mechanical door operating mechanism includes the latching assembly

[0017] According to another aspect of the present invention, a vehicle includes a body having an uninterrupted side aperture that provides access to an interior passenger cabin. A front door is operably attached at a forward portion of the uninterrupted side aperture. The front door is selectively operable between front open and front closed positions. A rear door is operably attached at a rearward portion of the uninterrupted side aperture. The rear door is selectively operable between rear open and rear closed positions. A latching assembly is at least partially positioned within the body and configured to receive the front door in the front closed position and the rear door in the rear closed position. A sealing assembly is defined between a forward seal of the rear door and a rearward seal of the front door. Forward and rearward seals engage one another in a fully-closed position.

[0018] Embodiments of this aspect of the invention can include any one or combination of the following features:

[0019] the front door is rotationally coupled with a forward edge of the uninterrupted side aperture

[0020] each of the front and rear doors are independently and selectively operable between the front open and front closed positions and the rear open and rear closed positions, respectively

[0021] the sealing assembly includes an operable member that articulates toward a receiving seal to define the fully-closed position

[0022] the operable member is at least partially operated by a mechanical assembly disposed within one of the front and rear doors

[0023] the operable member is at least partially operated by a magnetic assembly disposed within one of the front and rear doors

[0024] According to another aspect of the present invention, a vehicle includes a body having an uninterrupted side aperture that provides access to an interior passenger cabin. A front door is hingedly attached at a forward edge of the uninterrupted side aperture. The front door selectively operable between front open and front closed positions. A rear door is operably attached at a rearward portion of the uninterrupted side aperture. The rear door is selectively

operable between rear open and rear closed positions. A latching assembly is positioned within the body and the front and rear doors. The latching assembly is operable to receive the front door in the front closed position and the rear door in the rear closed position. A sealing assembly is defined between a forward seal of the rear door and a rearward seal of the front door. The forward and rearward seals engage one another in a fully-closed position. The latching assembly selectively operates the front and rear doors between respective ajar positions and the fully-closed position.

[0025] Embodiments of this aspect of the invention can include any one or combination of the following features:

[0026] each of the front and rear doors are independently and selectively operable between the front open and front closed positions and the rear open and rear closed positions, respectively

[0027] the sealing assembly includes an operable member that articulates toward a receiving seal to define the fully-closed position, and wherein the operable member is operated by at least one of a mechanical assembly and a magnetic assembly, and wherein the operable member is disposed within one of the front and rear doors

[0028] These and other aspects, objects, and features of the present invention will be understood and appreciated by those skilled in the art upon studying the following specification, claims, and appended drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029] In the drawings:

[0030] FIG. **1** is a side perspective view of a vehicle including coach-style doors shown in an open position;

[0031] FIG. **2** is an enlarged side perspective view of the vehicle of FIG. **1**;

[0032] FIG. **3** is a schematic plan view of a latching assembly for the coach-style doors that can be attached to a portion of the vehicle frame;

[0033] FIG. **4** is a schematic cross-sectional view of an exemplary latch for securing the coach-style doors in a closed position;

[0034] FIG. **5** is a schematic elevational view of a vertically positioned latch assembly that can be engaged between the front and rear doors;

[0035] FIG. **6** is a schematic cross-sectional view of a sealing assembly for the coach-style doors that are shown in the closed position;

[0036] FIG. **7** is a schematic cross-sectional view of an operable sealing assembly for the coach-style doors shown in a rest position;

[0037] FIG. **8** is a schematic cross-sectional view of the operable sealing assembly of FIG. **7** shown in an actuated position for moving at least one of the front and rear doors to an open position;

[0038] FIG. **9** is a schematic cross-sectional view of an operable sealing assembly for the coach-style doors shown in a rest position;

[0039] FIG. **10** is a schematic cross-sectional view of the operable sealing assembly of FIG. **9** shown in an actuated position for moving at least one of the front and rear doors to an open position;

[0040] FIG. **11** is a schematic cross-sectional view of an operable magnetic seal shown in a sealed position when the doors are in a closed position;

[0041] FIG. **12** is a schematic cross-sectional view of the operable magnetic sealing assembly of

[0042] FIG. **11** shown in an actuated position for moving one of the front and rear doors to an open position;

[0043] FIG. **13** is a schematic cross-sectional view of an operable magnetic seal shown in a sealed position when the doors are in a closed position;

[0044] FIG. **14** is a schematic cross-sectional view of the operable magnetic sealing assembly of

[0045] FIG. **13** shown in an actuated position for moving one of the front and rear doors to an open position;

[0046] FIG. **15** is a schematic cross-sectional view of an operable magnetic seal shown in a sealed position when the doors are in a closed position;

[0047] FIG. **16** is a schematic cross-sectional view of the operable magnetic sealing assembly of

[0048] FIG. **15** shown in an actuated position for moving one of the front and rear doors to an open position;

[0049] FIG. **17** is a schematic cross-sectional view of an operable magnetic seal shown in a sealed position when the doors are in a closed position;

[0050] FIG. **18** is a schematic cross-sectional view of the operable magnetic sealing assembly of

[0051] FIG. **17** shown in an actuated position for moving one of the front and rear doors to an open position;

[0052] FIG. **19** is a linear flow diagram illustrating a method for opening a rear door in a coach-style configuration when the rear door is partially overlapped by the front door;

[0053] FIG. **20** is a linear flow diagram illustrating a method for closing a coach-style door when the front door partially overlaps the rear door;

[0054] FIG. **21** is a linear flow diagram illustrating a method for opening a coach-style door using the operable latch assembly;

[0055] FIG. **22** is a linear flow diagram illustrating a method for closing a coach-style door using the operable latch assembly;

[0056] FIG. **23** is a linear flow diagram illustrating a method for opening a coach-style door using a magnetic seal to seal the coach-style doors;

[0057] FIG. **24** is a linear flow diagram illustrating a method for closing and sealing coach-style doors using an operable magnetic seal;

[0058] FIG. **25** is a linear flow diagram illustrating a method for unsealing and opening a coach-style door utilizing a mechanical sealing mechanism;

[0059] FIG. **26** is a linear flow diagram illustrating a method for closing and sealing coach-style doors using an operable mechanical sealing mechanism;

[0060] FIG. **27** is a schematic cross-sectional view of an operable weather seal shown in a rest position;

[0061] FIG. **28** is a schematic cross-sectional view of the inflatable seal of FIG. **27** shown in a retracted position;

[0062] FIG. **29** is a schematic cross-sectional view of an inflatable sealing member shown in a rest position; and

[0063] FIG. **30** is a cross-sectional schematic view of the inflatable sealing member in retracted position.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0064] For purposes of description herein, the terms "upper," "lower," "right," "left," "rear," "front," "vertical," "horizontal," and derivatives thereof shall relate to the

invention as oriented in FIG. **1**. However, it is to be understood that the invention may assume various alternative orientations, except where expressly specified to the contrary. It is also to be understood that the specific devices and processes illustrated in the attached drawings, and described in the following specification are simply exemplary embodiments of the inventive concepts defined in the appended claims. Hence, specific dimensions and other physical characteristics relating to the embodiments disclosed herein are not to be considered as limiting, unless the claims expressly state otherwise.

[0065] As exemplified in FIGS. **1-18**, reference numeral **10** generally refers to a pair of coach-style doors that are operably coupled to a frame **12** for a vehicle **14** for any one or more of rotational, translational, sliding or other operable movement. The coach-style doors **10** rotate opposite to one another to provide a single access aperture **16** through which front and rear portions **18**, **20** of the passenger cabin **22** can be accessed. According to various aspects of the device, the vehicle **14** can include a body **24** and frame **12** having an uninterrupted side aperture **26** that provides access to the interior passenger cabin **22**. A front door **28** of the coach-style doors **10** is hingedly attached at a forward edge **30** or forward portion of the uninterrupted side aperture **26**. The front door **28** is selectively operable between front open and front closed positions **32**, **34**. A rear door **36** of the pair of coach-style doors **10** is hingedly attached at a rearward edge **38** or rearward portion of the uninterrupted side aperture **26**. The rear door **36** is selectively operable between rear open and rear closed positions **40**, **42**. For operating the coach-style doors **10**, a latching assembly **44** is at least partially positioned in engagement with the body **24** and is configured to receive the front door **28** in the front closed position **34** and the rear door **36** in the rear closed position **42**. A sealing assembly **46** is defined between a forward seal **48** of the rear door **36** and a rearward seal **50** of the front door **28**. In this manner, the forward and rearward seals **48**, **50** engage one another in a fully-closed position **52** of the coach-style doors **10**. One or both of the front and rear doors **28**, **36** can also be slidably attached to the frame **12** at the uninterrupted side aperture **26**.

[0066] According to various aspects of the device, the coach-style doors **10** can be independently operable with respect to one another, such that each of the front and rear doors **28**, **36** can be opened, while the other of the front and rear doors **28**, **36** remains in the front closed or rear closed positions **34**, **42**, respectively. It is also contemplated that the front door **28** may overlap the rear door **36**. In this configuration, the rear door **36** can only be opened when the front door **28** is moved into the front open position **32** or a rear door clear position **60**, which will be described more fully below.

[0067] As exemplified in FIGS. **1** and **2**, the body **24** of the vehicle **14** includes the uninterrupted side aperture **26** that does not include a central pillar, commonly referred to as a B-pillar, that divides the side aperture **26**. Accordingly, when the front and rear doors **28**, **36** are in the front open and rear open positions **32**, **40**, each of the front and rear portions **18**, **20** of the passenger cabin **22** can be accessed via the uninterrupted side aperture **26** defined within the body **24** of the vehicle **14**. Accordingly, no central B-pillar is included within the vehicle **14**. Accordingly, for securing the front and rear doors **28**, **36** in the front closed and rear closed positions **34**, **42**, respectively, the front and rear doors **28**, **36** are required to couple to the top and/or bottom edges **70**, **72** of the side aperture **26**. Additionally, the front and rear doors **28**, **36** may couple with one another to define the fully-closed position **52**. Using the latching assembly **44**, the selective coupling of the front and rear doors **28**, **36** with the top and/or bottom edges **70**, **72** of the side aperture **26** and with one another can be described as cinching, latching, securing, holding, locking or otherwise attaching the front and rear doors **28**, **36** relative to the frame **12** of the vehicle **14**.

[0068] Referring now to FIGS. **3-5**, the latching assembly **44** for the vehicle **14** can include a motorized assembly that rotationally operates a locking cam **80** that includes a locking recess **82**. When the front door **28** or the rear door **36**, or both, are moved into the respective closed positions, the locking cam **80** can rotate about a rotational axis **102** to connect with a catch pin **84** that is defined within the front and rear doors **28**, **36**. It is contemplated that each of the front and rear doors **28**, **36** can include a corresponding locking cam **80** that attaches with a respective catch pin **84** positioned within each of the front and rear doors **28**, **36**. Through this configuration, each of the front and rear doors **28**, **36** can be moved into the respective front closed and rear closed positions **34**, **42**, independently of one another. Where a driver **242** or front passenger requires access to the front portion **18** of the passenger cabin **22**, a front section **86** of the latching assembly **44** can disengage from the catch pin **84** of the front door **28**. Once disengaged, the front door **28** can be moved to the front open position **32** to provide for access to the front portion **18** of the passenger cabin **22**. The opposite is true of the rear door **36**, for accessing the rear portion **20** of the passenger cabin **22**. Again, each of the front and rear doors **28**, **36** are typically configured to be independently operable with respect to one another.

[0069] Referring again to FIGS. **3** and **4**, according to various aspects of the device, the latching assembly **44** that is coupled with the body **24** of the vehicle **14** at the side aperture **26** can be positioned at each of the top and bottom edges **70**, **72** of the side aperture **26**. Accordingly, when the front door **28** is moved to the front closed position **34** or the rear door **36** is moved to the rear closed position **42**, the latching assembly **44** couples with each of the front and rear doors **28**, **36** at top and bottom edges **70**, **72** of each of the side apertures **26**. It should be understood that in various aspects of the device, the latching assembly **44** may include only a latching assembly **44** at the top or bottom edges **70**, **72** of the side aperture **26**.

[0070] As exemplified in FIG. **5**, the latching assembly **44** can include a door securing latch **90** that is positioned to extend between the central seam **92** defined between the front and rear doors **28**, **36**. In various aspects of the device, the door securing latch **90** can be positioned proximate the forward seal **48** of the rear door **36**. In this configuration, the locking cam **80** of the operable door securing latch **90** can attach with a catch pin **84** that is defined near the rearward seal **50** of the front door **28**. It should be understood that the operable door securing latch **90** can be coupled near the rearward seal **50** of the front door **28** and the catch pin **84** can be defined near the forward seal **48** of the rear door **36**. The operable door securing latch **90** can operate in combination with the other portions of the latching assembly **44** that are positioned within the top and bottom edges **70**, **72** of the side aperture **26** for the body **24** of the vehicle **14**. Accordingly, each door may be secured in the fully-closed position **52** at

four points around the perimeter of the front and rear doors **28**, **36**. These connection points can be the respective hinges, the latching assemblies **44** positioned at the top and bottom edges **70**, **72** of the side aperture **26** and the door securing latch **90** positioned at the seam **92** where the front and rear doors **28**, **36** meet in the fully-closed position **52**.

[0071] Referring again to FIGS. **3-5**, the locking cam **80** can include a latching portion **100** that rotates about the rotational axis **102** of the locking cam **80**. This latching portion **100** can include a biasing surface **104** that serves to pull, cinch or otherwise draw the catch pin **84** toward the rotational axis **102** as the locking cam **80** moves toward a latched position **106**. Through this operation, the locking cam **80** can be utilized for moving each of the front and rear doors **28**, **36** from an ajar position **108** (typically approximately 5 degrees rotationally distal from the fully-closed position **52**) to the respective front closed and rear closed positions **34**, **42** of the front and rear doors **28**, **36**, respectively. Accordingly, by placing the front and rear doors **28**, **36** near the respective front closed and rear closed positions **34**, **42**, the latching assembly **44** can provide a function for fully closing the coach-style doors **10**. The biasing surface **104** of the locking cam **80** can include a generally curved configuration that is able to receive the catch pin **84** when the front or rear door **28**, **36** is positioned near the respective front closed and rear closed positions **34**, **42**, typically the ajar position **108**. An extending member **110** can be used to engage the catch pin **84**. This extending member **110** defines a portion of the curved biasing surface **104** that is adapted to bias the catch pin **84** and the remainder of the front or rear door **28**, **36** to the front closed and rear closed positions **34**, **42**, respectively.

[0072] In certain aspects of the device, as exemplified in FIGS. **3-5**, each of the front and rear doors **28**, **36** can be manually operable to any one of the front open and rear open positions **32**, **40** and the ajar position **108**. The front and rear doors **28**, **36** can then be automatically operable between the ajar position **108** and the front closed and rear closed positions **34**, **42**. In such an embodiment, the user of the vehicle **14** can manually close the front and/or rear doors **28**, **36** to the ajar position **108**, at which point the latching assembly **44** and the sealing assembly **46** can manipulate the front and rear doors **28**, **36** from the ajar position **108** to the front closed and rear closed positions **34**, **42**. Conversely, when it is desired for one or both of the front and rear doors **28**, **36** to be opened, the latching assembly **44** and the sealing assembly **46** can manipulate the front and rear doors **28**, **36** from the front closed and rear closed positions **34**, **42** to the ajar position **108**. Once in the ajar position **108**, the user can manually operate one or both of the front and rear doors **28**, **36**. It is also contemplated that the front and rear doors **28**, **36** can be operated by a door operating mechanism that can operate the front and rear doors **28**, **36** door at least between the front open and rear open positions **32**, **40** and the ajar position **108**.

[0073] In order to place the front door **28** and/or the rear door **36** into the ajar position **108**, it can be important to ascertain whether the opposing door of the front and rear doors **28**, **36** are opened or closed. Studies have shown that, for example, where the rear door **36** is closed, it can require more rotational force or velocity to move the front door **28** into the ajar position **108** so that the latching assembly **44** can move the front door **28** into a fully-closed position **52**. If insufficient force or velocity is applied to the front door **28**, the front door **28** may not achieve the ajar position **108** and the latching assembly **44** may be unable to manipulate the front door **28**. With this information in mind, where the front and rear doors **28**, **36** are operated by a door operating mechanism, the door operating mechanism can be configured to apply different rotational force and/or rotational velocity for the front and rear doors **28**, **36** depending on the position of the opposing door of the front and rear doors **28** **36**.

[0074] In addition, the door operating mechanism may be coupled with various sensors that can adjust the operation of the door operating mechanism to account for various environmental factors. Such factors may include, but are not limited to, the slope on which the vehicle is located, wind speed, temperature, and other factors. In addition, it is contemplated that the door operating mechanism can operate as a supplemental system for assisting a manual operation of the front and rear doors **28**, **36**. In such an embodiment, the door operating mechanism may detect a rotational force and/or velocity of the front and rear doors **28**, **36** applied by a manual operation. The door operating mechanism may detect an insufficient force or velocity. In this instance, the door operating mechanism may provide a supplemental force so that the front and rear doors **28**, **36** can achieve the ajar position **108**. Alternatively, if manual operation of the front and rear doors **28**, **36** results in an excessive force or velocity, typically indicative of a "slam" of the door, the door operating mechanism can apply an opposing rotational force to slow rotation of the front and rear doors **28**, **36** to the ajar position **108**. This opposing force applied to the front and rear doors **28**, **36** may also be implemented where an obstruction is present between one of the front and rear doors **28**, **36** and the body **24** of the vehicle **14**.

[0075] According to various aspects of the device, the door operating mechanism for the front and rear doors **28**, **36** can include one or more sensors that are used to detect a complete or incomplete closure of at least one of the front and rear doors **28**, **36**. Where the rear door **36** is not properly closed, the front door **28** can be configured to prevent a full closure until the rear door **36** is placed in the ajar position **108** or the rear closed position **42**, or vice versa with respect to the front door **28**.

[0076] As exemplified in FIGS. **3-5**, a motor **120** can be used to rotationally operate the locking cam **80** to engage and disengage the catch pin **84** to secure the front and rear doors **28**, **36** in the respective closed positions, and also release the front and rear doors **28**, **36** to allow the front and rear doors **28**, **36** to move to the front open and rear open positions **32**, **40**, respectively. It is contemplated that the locking cam **80** is configured to be substantially hidden within the front and rear doors **28**, **36**, or within the body **24** of the vehicle **14** in an area near the front and rear doors **28**, **36**. The only visible portion of the latching assembly **44** is typically the extending member **110** of the locking cam **80** that is adapted to engage the catch pin **84**. Again, the catch pin **84** can be positioned on one of the body **24** of the vehicle **14** or each of the coach-style doors **10**. The motorized assembly for the latching assembly **44** that includes the locking cam **80** can be positioned on the other of the coach-style doors **10** or the body **24** of the vehicle **14**.

[0077] By using the latching assembly **44** having the locking cam **80**, the front and rear doors **28**, **36** can be secured to the body **24** of the vehicle **14** in the fully-closed

position **52**. This fully-closed position **52** is configured to promote sufficient structural integrity for the vehicle **14**.

[0078] According to various aspects of the device, the latching assembly **44** can include a single locking cam **80** that rotates about a rotational axis **102**. In various aspects of the device, the motor **120** for the latching assembly **44** can operate a drive shaft **130** that is connected with multiple locking cams **80**. These multiple locking cams **80** can be configured to engage a single elongated catch pin **84** or multiple corresponding catch pins **84** for moving the front and rear doors **28**, **36** into the respective closed position. The particular design of the number of the locking cams **80** and catch pins **84** can vary depending upon the configuration of the vehicle **14** and the structural needs for the particular vehicle **14**.

[0079] It should be understood that the latching assembly **44** can incorporate various alternative latching mechanisms. These latching mechanisms can include various hook-type members and other alternatively shaped cam locks that can be used to secure the front and rear doors **28**, **36** to one another and also secure the front and rear doors **28**, **36** to the body **24** of the vehicle **14**. It is also contemplated that the motor **120** for operating the cam locks can include various motor types. These motor types can include, but are not limited to, geared motors, servo motors, stepper motors, screw-drive motors, and other similar drive mechanisms. It is also contemplated that in certain aspects of the device, the locking cam **80** may be operated manually through interior and exterior latches that are coupled with the front and rear doors **28**, **36** for the vehicle **14**.

[0080] According to various aspects of the device, it is contemplated that when the latching assembly **44** is moved to the latched position **106** for securing at least one of the front and rear doors **28**, **36**, a separate locking mechanism can be engaged to define a locked position **140** of the front door **28**, rear door **36**, or both. In this manner, the latching assembly **44** may be utilized for moving the front and rear doors **28**, **36** into the latched position **106**. This position may or may not be indicative of a locked position **140**. A locking mechanism may be coupled with the latching assembly **44** such that a separate mechanical lock may be utilized for securing the locking cam **80** in the latched position **106**. Accordingly, the motor **120** for the latching assembly **44** may be disengaged and the mechanical lock can be utilized for defining a locked position **140** of the front door **28**, rear door **36** or both. Additionally, a separate lock, separate from the latching assembly **44** can be utilized for defining a locked position **140** of the front and rear doors **28**, **36**. This locking mechanism may be in the form of an electrical lock, mechanical lock, magnetic lock, or other similar locking mechanism that can be used to secure the front and rear doors **28**, **36** in the front closed and rear closed positions **34**, **42**, respectively.

[0081] In certain aspects of the device, activation of the locking mechanism can automatically disengage the latching assembly **44**. In such an embodiment, engagement of the locking mechanism can prevent operation of the latching assembly **44** via an electrical and/or mechanical disengagement of the motor **120**. When the locking mechanism is disengaged, the latching assembly **44** can be activated so that at least one of the front and rear doors **28**, **36** can be operated toward the ajar position **108**. Operation of the locking mechanism and the latching assembly **44** can be accomplished via various user interfaces that may be located on an inside of the vehicle **14**, on the outside of the vehicle **14** or on a separate location, such as on a portable computing device.

[0082] Referring now to the various aspects of the device exemplified in FIGS. **6-18**, various sealing assemblies **46** can be included within the coach-style doors **10** for sealing the seam **92** defined between the front and rear doors **28**, **36** in the fully-closed position **52**. This seam **92** can take the form of a stagnant or static seal **150** that can be engaged when the doors are moved into the fully-closed position **52**. Various operable sealing mechanisms **152** having operable members can also be utilized for engaging or disengaging the sealing mechanism **152** at the seam **92** between the front and rear doors **28**, **36**.

[0083] As exemplified in FIG. **6**, a static seal **150** can include a forward seal **48** of the rear door **36** and a rearward seal **50** of the front door **28**. In the static seal **150**, one or both of the seal members can include an elastomeric seal member, such as a weatherstrip **154**. In certain aspects of the device, the static seal **150** can include an elastomeric seal or weatherstrip **154**, and the other sealing member can include a robust or sturdy substrate **156** that can engage the weatherstrip **154**. By way of example, and not limitation, the static seal **150** can include the robust contact substrate **156** that engages the weatherstrip **154** when the front and rear doors **28**, **36** are in the fully-closed position **52**. This configuration allows for a slidable engagement between the weatherstrip **154** and the robust contact substrate **156**. The substrate **156** can include any material that provides a hard, smooth and substantially non-corrosive surface for the resilient weatherstrip **154** to engage and slide over. The substrate **156** is configured to reduce friction against the weatherstrip **154** and limit visual indications of wear over time as the weatherstrip **154** slides against the substrate **156**. Accordingly, operation of the front and rear doors **28**, **36** between the fully-closed position **52** and one of the front open and rear open positions **32**, **40** will provide for a slidable engagement between the weatherstrip **154** and the robust contact substrate **156**, which can be a stainless steel material. This slidable engagement can minimize wear and tear on the weatherstrip **154** during use. In various aspects of the device, the static seal **150** can include opposing weatherstrips **154** that are each attached to the front and rear doors **28**, **36**. It is contemplated that the static seal **150** can be similar to that used in conventional doors where a seal or gasket **214** that extends around the perimeter of a door for a vehicle **14** engages a metallic frame **12** that surrounds the front and rear doors **28**, **36** in a fully-closed position **52**. Where the opposing weatherstrips **154**, or opposing elastomeric seals, are used, the various operating mechanisms of the front and rear doors **28**, **36** can include variations in the rotational force or velocity depending on the rotational position of the opposing door **170**, as discussed herein.

[0084] Referring now to FIGS. **7-10**, the sealing assembly **46** can include a mechanical assembly in the form of an operable sealing mechanism **152** that can manipulate a flexible seal **160** between a rest position **162** and an actuated position **164**. In the rest position **162**, an actuator **166** biases a flexible seal **160** in an outward direction **168** to engage a weatherstrip **154** that is attached to the opposing door **170** of the coach-style doors **10**. Accordingly, the rest position **162** is typically indicative of the fully-closed position **52** of the coach-style doors **10**. When one or both of the front and rear doors **28**, **36** are going to be operated to the front open and

rear open positions **32**, **40**, the actuator **166** can be operated to an actuated position **164**. In this actuated position **164**, the flexible seal **160** is moved away from the weatherstrip **154** of the opposing door **170**. By actuating the flexible seal **160** away from the weatherstrip **154**, no slidable engagement is contemplated between the flexible seal **160** and the weatherstrip **154** as the front and rear doors **28**, **36** are operated toward the respective front open and rear open positions **32**, **40**.

[0085] In various aspects of the device, the flexible seal **160** can be manipulated by the actuator **166** to engage the weatherstrip **154** or, as exemplified in FIGS. **9** and **10**, can be actuated to engage a receiving surface **172** of the opposing door **170** of the coach-style doors **10**. In each of these configurations, the rest position **162** of the actuator **166** is defined by the flexible seal **160** engaging a portion of the opposing door **170**. Again, this portion of the opposing door **170** can be a weatherstrip **154** or the receiving surface **172** of the opposing door **170** itself. Additionally, movement of the actuator **166** to the actuated position **164** serves to separate the flexible seal **160** from a portion of the opposing door **170**.

[0086] As exemplified in FIGS. **7-10**, the actuator **166** for manipulating the flexible seal **160** can be in the form of a piston member **180** that typically rotates the actuator **166**. Accordingly, the actuator **166** is utilized for biasing the flexible seal **160** toward or away from the opposing door **170** of the coach-style doors **10**. It is contemplated that various alternative actuating mechanisms can be utilized within the mechanically operable sealing mechanism **152**. Such operating mechanisms can include, but are not limited to, geared-type mechanisms, servo motors, geared motors, other motorized configurations, inflatable and deflatable seals (as exemplified in FIGS. **27-30**) and other similar configurations.

[0087] As exemplified in FIGS. **7-10**, the mechanically operable sealing mechanism **152** can include an actuator **166** that extends along the length of the seam **92** between the front and rear doors **28**, **36**. Additionally, the actuator **166** can be in the form of multiple individual actuators **166** that can move portions of the flexible seal **160** toward and away from the opposing door **170**. In each of these embodiments, the flexible seal **160** is operated along the entire seam **92** between the front and rear doors **28**, **36**. Accordingly, through the use of the actuator **166** and the flexible seal **160**, the seam **92** between the front and rear doors **28**, **36** can be substantially entirely sealed when in the fully-enclosed position.

[0088] As exemplified in FIGS. **7-10**, the use of the flexible seal **160**, while providing for an engagement surface that extends toward and away from the opposing door **170** of the coach-style doors **10**, also provides a covering that conceals the operable mechanism for moving the actuator **166** between the rest position **162** and the actuated position **164**. The flexible seal **160** also encloses and substantially seals the locking mechanism and the interior cavity of the coach-style doors **10** from water and dirt ingress. In this manner, the flexible seal **160** can be in the form of a continuous gasket **214** that extends substantially the entire height of the front door **28** or the rear door **36**, depending upon the placement of the actuator **166**.

[0089] For providing a sealing engagement **224** at the seam **92** between the front and rear doors **28**, **36**, the mechanical sealing assembly **292** can include an elongated actuator **166** that can be manipulated between the rest and actuated positions **162**, **164**. This elongated actuator **166** can be relatively small in size to provide for the operable engagement of the flexible seal **160** within upper portions **190** of the door, such as near the window **192** of the front and rear doors **28**, **36** (shown in FIG. **2**). In this configuration, a single actuator **166** or multiple actuators **166** can be activated to move the elongated actuator **166** between the rest and the actuated positions **162**, **164**. This elongated actuator **166**, in turn, can engage the flexible seal **160** to move the flexible seal **160** toward and away from the opposing door **170** of the coach-style doors **10**.

[0090] Referring now to FIGS. **11-18**, the sealing assembly **46** can also include a magnetic sealing assembly **210** that can be actuated by one or more magnetic members **212** that operate to move a gasket **214** or the flexible seal **160** between the rest position **162** and the actuated position **164**. As exemplified in FIGS. **11** and **12**, a flexible seal **160** can be attached to one of the front and rear doors **28**, **36**. This flexible seal **160** can include a magnet member having a particular orientation of magnetic polarity. The opposing door **170** of the coach-style doors **10** can include a magnetic member **212** or an electromagnetic member **216** that can be operated between opposing north and south polarities **218**, **220**. When in the rest position **162**, the electromagnetic member **216** can be operated to define an opposing polarity **222** with respect to the magnetic member **212** within the flexible seal **160**. Through this configuration, when the front and rear doors **28**, **36** are in the fully-closed position **52**, the electromagnetic member **216** can be operated to define the opposing polarity **222** that magnetically draws the magnetic member **212** of the flexible seal **160** toward the opposing door **170**. Through this electromagnetic connection, the flexible seal **160** is extended toward the opposing door **170** to define a sealing engagement **224** at the seam **92** defined between the front and rear doors **28**, **36**. When one or both of the front and rear doors **28**, **36** are to be moved to the front open and rear open positions **32**, **40**, the electromagnetic member **216** can be operated to the reverse polarity to be a common polarity **226** of the magnetic member **212** within the flexible seal **160**. Utilizing the common polarity **226**, the electromagnetic member **216** repels the magnetic member **212** of the flexible seal **160** and disengages a flexible seal **160** from the opposing door **170** of the coach-style doors **10**. In this configuration, the electromagnetic member **216** can be activated and deactivated to define the alternating opposing and common polarities **222**, **226** to attract and repel the magnetic member **212** as necessary to define the rest and actuated positions **162**, **164** of the flexible seal **160**.

[0091] Typically, the electromagnetic member **216** and the magnetic member **212** will each extend the full height of the opposing front and rear doors **28**, **36**. Through this configuration, the flexible seal **160** can also extend the full height of each of the front and rear doors **28**, **36** to seal the seam **92** defined between the front and rear doors **28**, **36** in the fully-enclosed position. Typically, the electromagnetic member **216** that is positioned within the front and rear doors **28**, **36** opposite the flexible seal **160** can be positioned behind a non-magnetic surface. This surface can be in the form of aluminum, fiberglass, carbon fiber, non-magnetic stainless steel, and other similar non-magnetic materials. Through this configuration, the electromagnetic member **216** can be positioned within the structure of the front and rear doors **28**, **36** and the electromagnetic communication

between the magnetic member **212** of the flexible seal **160** and the electromagnetic member **216** of the opposing door **170** can be placed in communication with one another when the front and rear doors **28**, **36** are in the fully-closed position **52**.

[0092] According to various aspects of the device, the flexible seal **160** can include a ferromagnetic member that may be attracted to a magnetic member **212** or electromagnetic member **216**. In such an embodiment, the flexible seal **160** may be biased toward a retracted position **230**. This retracted position **230** can be defined by the flexible seal **160** being offset from the receiving surface **172** of the opposing door **170** of the coach-style doors **10**. When the front and rear doors **28**, **36** are in the fully-closed position **52**, the electromagnetic member **216** can be activated to attract the ferromagnetic material of the flexible seal **160**. When the electromagnetic member **216** is activated, the ferromagnetic member is drawn toward the opposing door **170** of the coach-style doors **10**. Through this movement of the ferromagnetic member, the flexible seal **160** is also extended toward the opposing door **170** to engage a receiving surface **172** of the opposing door **170** through the attraction of the electromagnetic member **216**. When the electromagnetic member **216** is deactivated, the flexible seal **160** is returned to the retracted position **230**.

[0093] According to various aspects of the device, the flexible seal **160** can be in the form of an accordion-style seal, an elastomeric flap, an elastomeric flange, or other similar elastomeric member that includes the magnetic member **212** or a ferromagnetic member therein. As discussed above, the magnetic member **212** or the ferromagnetic member can be drawn toward the electromagnetic member **216** in the opposing door **170** of the coach-style doors **10** to define a sealed seam **92** of the front and rear doors **28**, **36** in the fully-closed position **52**.

[0094] Referring now to FIGS. **13** and **14**, the flexible seal **160** can include a multiple individual magnetic members **212**. Similarly, these magnetic members **212** can be positioned to correspond to multiple electromagnetic members **216** that are positioned within the opposing door **170** of the coach-style doors **10**. Similar to the embodiment exemplified in FIGS. **11** and **12**, the multiple individual electromagnetic members **216** can be operated to switch polarity between the common polarity **226** and the opposing polarity **222** with respect to the magnetic members **212** of the flexible seal **160**. This switching of polarity can be accomplished by changing the direction of the electrical current that is delivered to the electromagnetic members **216**. By switching polarity, the magnetic members **212** within the flexible seal **160** can be attracted or repelled, depending upon the need for the flexible seal **160** to engage the opposing door **170** or be repelled from the opposing door **170**. As discussed above, when the front and rear doors **28**, **36** are in the fully-closed position **52**, the electromagnetic members **216** can be activated to define an opposing polarity **222** to the polarity of the magnetic members **212**. Through this opposing polarity **222**, the magnetic members **212** are attracted to the electromagnetic members **216**. As the magnetic members **212** are attracted, the flexible seal **160** is also moved toward the surface of the opposing door **170** to define a sealing engagement **224** between the front and rear doors **28**, **36** at the seam **92**. When the polarity of the electromagnetic members **216** is switched, the flexible seal **160** is repelled to the retracted position **230**.

[0095] As exemplified in FIGS. **15** and **16**, the elongated magnet member or individual magnet members that are disposed within the flexible seal **160** can be attracted or repelled from the opposing door **170** through operable magnets **240** that can be rotated within the opposing door **170** of the coach-style doors **10**. In such an embodiment, rather than an electromagnetic member **216**, the opposing door **170** of the coach-style doors **10** includes operable magnets **240** that can be rotated. This rotation can be used to present an opposing polarity **222** toward the magnetic members **212**, for attracting the magnetic members **212**. The operable magnets **240** can also be rotated to present a common polarity **226** toward the magnetic members **212** for repelling the magnetic members **212** away from the opposing door **170** of the coach-style doors **10**. These operable magnets **240** can be coupled with a driver **242** for rotating the magnetic members **212** about a rotating axis **244**. In such an embodiment, the operable magnets **240** can be in the form of permanent magnets, or other similar magnetic material that can include a predictable north polarity **218** and south polarity **220**. Accordingly, the north polarity **218** and south polarity **220** of the operable magnets **240** can be utilized for attracting and repelling the magnetic members **212** of the flexible seal **160**.

[0096] Referring now to FIGS. **17** and **18**, the operable magnets **240** can be placed in an alternating configuration, where each alternating operable magnet is positioned to have alternating polarities **250** presented toward the magnetic members **212** of the flexible seal **160**. Similarly, the magnetic members **212** of the flexible seal **160** are similarly oriented to provide alternating polarities **250** along the length of the flexible seal **160**. In this configuration, the operable magnets **240** may be linearly operable within the opposing door **170** of the coach-style doors **10**. By linearly operating the operable magnets **240**, the alternating polarities **250** can be moved between a rest position **162**, where the alternating polarities **250** are positioned to present opposing polarities **222** in an attracting state **252**, to common polarities **226**, where the operable magnets **240** are positioned in a repelling state **254**.

[0097] As exemplified in FIG. **17**, the operable magnets **240** include the alternating north and south polarities **218**, **220** along the opposing door **170** of the coach-style doors **10**. These alternating north and south polarities **218**, **220** are positioned to align with the magnetic members **212** so that each of the magnetic members **212** are attracted to each of the operable magnets **240** in the attracting state **252**. When moved to the actuated position **164**, the operable magnets **240** are operated linearly, as exemplified in FIG. **18**. In this actuated position **164**, the polarities of the operable magnets **240** are oriented in common polarities **226** with each of the magnetic members **212**. By matching the north and south polarities **218**, **220**, the operable magnets **240** repel the magnetic members **212** of the flexible seal **160** to define the repelling state **254**. In turn, the flexible seal **160** is repelled from the opposing door **170** to define the actuated position **164**. Again, the actuated position **164** allows for movement of each of the front and rear doors **28**, **36** from the fully-closed position **52** to the front open and rear open positions **32**, **40**, respectively.

[0098] According to various aspects of the device, the rest position **162** is indicative of an unpowered state of the various actuators **166**. The rest position **162** is also indicative of a natural polarity of the various magnetic members

212 and electromagnetic members **216**. The actuated position **164** is achieved when some force or power is applied to the actuator **166**.

[0099] According to various aspects of the device, the flexible seal **160** that includes the magnetic members **212** can be attracted to the opposing door **170** in the rest position **162**, and the opposing door **170** of the coach-style doors **10** can include an outer metallic frame **12** that receives the flexible seal **160**. It is also contemplated that the opposing door **170** can include a more rigid sealing member that can be adapted to receive the flexible seal **160** in the rest position **162**. The exact material of the receiving surface **172** of the opposing door **170** at the location where the flexible seal **160** is received may vary depending upon exact configuration of the vehicle **14** and the type of seal utilized at the seam **92** between the front and rear doors **28**, **36**.

[0100] As exemplified in FIGS. **27-30**, inflatable and deflatable seals are exemplified. It is contemplated that the operation of the magnetic members **212** and the electromagnetic members **216** or operable magnets **240** can be similar in operation to the inflatable and deflatable seals. Accordingly, in the rest position **162**, the flexible seal **160** is expanded to engage the opposing door **170** of the coach-style doors **10**. In the actuated position **164**, the flexible seal **160** is repelled from the opposing door **170** and/or retracted into a portion of the door having the flexible seal **160**.

[0101] Referring now to FIGS. **19-26**, various controls can be utilized for operating the latching assembly **44** and sealing assemblies **46** for the coach-style doors **10**. It is contemplated that these methods can incorporate various sensors **260** for determining a position of the front and rear doors **28**, **36** and the configuration of the latching assembly **44** and sealing assemblies **46** to determine whether the front and rear doors **28**, **36** are open, latched, locked or in some other configuration or state with respect to the body **24** of the vehicle **14**. In the various aspects of the device, a locking or unlocking step typically includes separate locking and unlocking operations that are distinct from latching and unlatching operations. In this manner, the locking and unlocking steps can be indicative of placing the door operating mechanism or door operating hardware in an operable or inoperable state. In this inoperable or locked state, the door is not capable of being opened through use of the door operating mechanism or door operating hardware. This is similar to the door hardware of a conventional vehicle door. The latching and unlatching operations may only take place when the door operating mechanism or door operating hardware are in an unlocked state or position. The latching and unlatching operations are implemented to place the front and rear doors **28**, **36** in, or release the front and rear doors **28**, **36** from, the respective closed positions. Accordingly, in the various methods that are disclosed, a locking or unlocking step will typically also include a latching and unlatching operation. Again, the latching and unlatching operations of the locking steps are for placing the front and rear doors **28**, **36** in or releasing the front and rear doors **28**, **36** from the respective closed positions. The locking and unlocking operations of the locking steps are for activating and deactivating the door operating mechanism or door operating hardware of one or more of the doors of the front and rear doors **28**, **36**.

[0102] As exemplified in FIGS. **19** and **20**, operation of the front and rear doors **28**, **36** can include an overlapping configuration where a front door **28** extends in front of a portion of a rear door **36** when the doors are in the fully-closed position **52**. In this configuration, as discussed above, the front door **28** must be manipulated to allow for the rear door **36** to move to the rear open position **40**. According to a method **400**, step **402** includes receiving an input related to moving the rear door **36** to a rear open position **40**. In the method **400**, the front door **28** is moved to an unlocked state (step **404**). In the method **400**, a controller **280** is configured to send a rear door open signal to an operating mechanism of the front door **28** (step **406**). The front door **28** is then moved to a rear door clear position **60**. The controller **280** determines whether the front door **28** is in the rear door clear position **60** (step **408**). Once the front door **28** is in the rear door clear position **60**, the rear door **36** can be unlocked (step **410**) and can also be unlatched (step **412**). The rear door **36** is then opened toward the rear open position **40** (step **414**). This status of the rear door **36** moving toward the rear open position **40** is then sent to a display or user interface indicating that the rear door **36** is not closed or is within the rear open position **40** (step **416**). Once displayed, this is indicative of the operation of opening the rear door **36** in a door overlap design is complete (step **418**).

[0103] As exemplified in FIG. **20**, where the front door **28** is designed to overlap at least a portion of the rear door **36**, closing the rear door **36** includes a method **450**. According to this method **450**, an input is received related to the rear door **36** moving to the rear closed position **42** (step **452**). Typically, where the rear door **36** is independently operated, the front door **28** may be in the front closed position **34**. Because the front door **28** is configured to overlap the rear door **36**, the rear door **36** cannot be closed in the rear closed position **42** until such time as the front door **28** is moved to allow for such closure. According to the method **450**, the front door **28** is moved to an unlocked state (step **454**). The front door **28** is then moved to the rear door clear position **60** (step **456**). A controller **280** determines whether the front door **28** is within the rear door clear position **60** (step **458**). Once in this position, the rear door **36** can be moved to the rear closed position **42** (step **460**). When in the rear closed position **42**, a controller **280** determines that the rear door clear position **60** has been achieved (step **462**). The front door **28** can then be moved back to the front closed position **34** and the front door **28** locked (step **464**). The rear door **36**, when in the rear closed position **42**, can be latched (step **466**) and can also be locked (step **468**). The latched and locked status of the rear door **36** can then be sent to a display or user interface (step **470**) and the operation can be indicated as completed when the rear door **36** is in the rear closed position **42** (step **472**).

[0104] According to various aspects of the device, as exemplified in FIGS. **20-26**, the various signals that are sent to the controller **280** for determining the position of the front and rear doors **28**, **36** can be operated by sensors **260** that are coupled with a hinge or other rotational component of the front and rear doors **28**, **36**. Additionally, a latch, electrical signal, or other similar indicator can be provided to a controller **280** that is indicative of the door being moved from the closed position to an open position. By way of example, and not limitation, when the door is to be moved from the closed position to an open position, unlocking the door, operating a handle, operating a key fob or other wireless operating mechanism, or other similar signal-providing device can be used to provide a communication to the controller **280** that the front door **28** or rear door **36** are

intended to be moved to the front open or rear open position **32**, **40**, respectively. Conversely, when the front or rear doors **28**, **36** are to be moved from the open position to the ajar position **108** or a closed position, an automatic operating mechanism coupled with the front and rear doors **28**, **36** can be used to communicate with a controller **280** for indicating that the doors are being moved to a closed position. Typically, when the front and rear doors **28**, **36** are in a respective open position, an initial movement of the front door **28** or rear door **36** toward the respective closed position may activate a sensor **260** that indicates a rotational operation of the front and/or rear doors **28**, **36**. This indication of rotational movement may communicate to the controller **280** that the doors are being moved toward the front closed and/or rear closed positions **34**, **42**, or the ajar position **108**. By receiving this indication, the controller **280** can then activate the appropriate assembly for achieving the front closed and rear closed positions **34**, **42** of the doors, or the fully-closed position **52** of the front and rear doors **28**, **36**, or the ajar position **108** so that the latching assembly **44** can be activated..

[0105] As exemplified in FIGS. **1-26**, the various sensors **260** that are utilized in operating the front and rear doors **28**, **36** of the coach-style doors **10** can include various operators and sensors **260**. These operating mechanisms and sensors **260** can include, but are not limited to:

[0106] Interior open and closed request buttons for operating the doors from an interior of the vehicle **14** (exterior door open/closed request buttons so that the front and rear doors **28**, **36** can be operated from an exterior of the vehicle **14**);

[0107] Driver door open/closed request buttons so that the front and rear doors **28**, **36** can be operated by a driver **242** or operator of the vehicle **14**;

[0108] Remote door input device such as a cell phone, key fob, or other similar wireless or portable communications device;

[0109] Door cleared position sensor **260** for the overlapping door configuration to indicate that the front door **28** is in the rear door clear position **60**;

[0110] Door closed sensors **260** to indicate that the front door **28** or rear door **36** are in the front closed or rear closed position **34**, **42** or whether both doors are in the fully-closed position **52**;

[0111] Door latched sensor **260** determined if the front and rear doors **28**, **36** are properly latched; door locked sensor **260** to indicate whether the front and rear doors **28**, **36** are locked;

[0112] Electronic control system that includes the controller **280** for operating and/or communicating the status of the front and rear doors **28**, **36**;

[0113] Door seal pressure sensor **260** to determine whether the front and rear doors **28**, **36** are properly sealed; door latch position to determine the status of the latching assembly **44**;

[0114] Front door interim closed latch that prevents the front door **28** from closing past a safety position for allowing the rear door **36** to close first in an overlapping door configuration;

[0115] Mechanical door seal actuators **166** to provide a force to move a mechanical seal mechanism between the rest position **162** and the actuating position of the magnetic seal assembly;

[0116] Other similar sensors **260** for operating the front and rear doors **28**, **36** as well as communicating the status of the front and rear doors **28**, **36**.

[0117] Referring now to FIGS. **21** and **22**, a method **500** is disclosed for operating the front and rear doors **28**, **36** of the coach-style doors **10** in a non-overlapping condition where each of the front and rear doors **28**, **36** can be operated independently of one another. According to the method **500**, an input is received indicative of the rear door **36** being moved to the rear open position **40** (step **502**).

[0118] According to the method **500**, the rear door **36** is then unlocked (step **504**) and the various latching assemblies **44** of the rear door **36** are moved to a disengaged position **290** (step **506**). As discussed above, the latching assembly **44** can be in the form of a C-shaped locking cam **80** that rotationally operates relative to a catch pin **84**. A controller **280** then determines whether the one or more latching assemblies **44** are all in the disengaged position **290** (step **508**). The rear door **36** can then be opened (step **510**). The controller **280** then sends a status to a display or user interface within the vehicle **14** indicating that the rear door **36** is either not in the rear closed position **42** or the rear door **36** is in the rear open position **40** (step **512**). This operation is then indicated as being complete (step **514**).

[0119] As exemplified in FIG. **22**, a method **550** illustrates closing the rear door **36** after the method **500** has been completed. According to the method **550**, an input is received with respect to the rear door **36** being moved to the rear closed position **42** (step **552**). The rear door **36** is then moved to the rear closed position **42** (step **554**). A controller **280** determines that the rear door **36** is in the rear closed position **42** (step **556**). The latching assembly **44** at the top and bottom edges **70**, **72** of the side aperture **26** are then activated to a latching position (step **558**) and the controller **280** determines that the latching assembly **44** are in a latching position (step **560**). The controller **280** can then determine whether the front door **28** is also in the front closed position **34** (step **562**). If each of the front and rear doors **28**, **36** are in the fully-closed position **52**, the center latching assembly **44**, typically the door securing latch **90**, can then be moved to a latching position (step **564**) and a control unit determines that a latching position of the center latching assembly **44** is achieved (step **566**). The rear door **36** can then be locked (step **568**) and the controller **280** sends a status of the rear door **36** to a display or user interface indicating that the rear door **36** is in the closed, latched and locked position **140** (step **570**). This operation is then indicated as being complete (step **572**).

[0120] Referring now to FIG. **23**, a method **600** is disclosed for operating a sealing assembly **46** as one of the front or rear doors **28**, **36** is being moved to a respective open position. According to the method **600**, an input is received relative to the rear door **36** being moved to the rear open position **40** (step **602**). The rear door **36** is then unlocked (step **604**) and the magnetic sealing mechanism is moved to the actuated position **164** (step **606**). As discussed above, the actuated position **164** of the magnetic sealing assembly **210** is indicative of the flexible seal **160** being repelled from the opposing door **170** of the coach-style doors **10**. A controller **280** then determines whether the flexible seal **160** is in the actuated position **164** and separated from the opposing door **170** (step **608**). The rear door **36** can then be moved to the rear open position **40** (step **610**) and the controller **280** sends a status of the rear door **36** to a display or user interface

indicative of the rear door **36** being in the rear open position **40** (step **612**). This operation is then indicated as being complete (step **614**).

[0121] As exemplified in FIG. **24**, a method **650** is illustrated for operating a magnetic sealing assembly **210** when the rear door **36** is being moved to a rear closed position **42**. According to the method **650**, an input is received relative to the rear door **36** being moved into the rear closed position **42** (step **652**). The rear door **36** is then moved into the rear closed position **42** (step **654**) and the controller **280** indicates whether the rear door **36** is in fact in this rear closed position **42** (step **656**). The controller **280** then determines whether the front door **28** is in the closed and latched position **106** (step **658**). If each of the front and rear doors **28**, **36** are in the fully-closed position **52**, the magnetic sealing assembly **210** is operated to the rest position **162** (step **660**). As discussed above, the rest position **162** of the magnetic sealing assembly **210** is indicative of the seal being attracted to the receiving surface **172** of the opposing door **170** through the application of electromagnetic members **216** or operable magnets **240** disposed within the opposing door **170**. The rear door **36** can then be locked (step **662**) and the status of the rear door **36** in the rear closed position **42** is sent to a display or user interface (step **664**). The operation is then indicated as being complete (step **666**).

[0122] Referring now to FIG. **25**, a method **700** is disclosed for operating a mechanical sealing assembly **292** when the rear door **36** is moved into a rear open position **40**. According to the method **700**, an input is received with respect to the rear door **36** being moved to the rear open position **40** (step **702**). The rear door **36** is then unlocked (step **704**) and the mechanical sealing assembly **292** is moved to the actuated position **164** (step **706**). The controller **280** determines whether the mechanical sealing assembly **292** is in the actuated position **164** (step **708**). The rear door **36** can then be opened (step **710**) and the controller **280** sends a status to a display or user interface that indicates whether the rear door **36** is in the rear open position **40** (step **712**). This operation is then indicated as being complete (step **714**).

[0123] As exemplified in FIG. **26**, a method **750** is disclosed for operating a rear door **36** to a rear closed position **42** and utilizing a mechanical sealing assembly **292**. According to the method **750**, an input is received related to the rear door **36** being moved to the rear closed position **42** (step **752**). The rear door **36** can then be moved to the rear closed position (step **754**) and a controller **280** determines whether the rear door **36** is in the rear closed position **42** and the latched position **106** (step **756**). The controller **280** then determines whether the front door **28** is also in the latched position **106** (step **758**). The mechanical sealing assembly **292** is then activated to a rest position **162** so that the flexible seal **160** is engaged with the opposing door **170** (step **760**). The controller **280** then determines whether the mechanical sealing assembly **292** has been moved to the rest position **162** (step **762**). The rear door **36** can then be locked (step **764**) and the controller **280** sends a status of the rear door **36** to a display or user interface of the vehicle **14** indicating that the rear door **36** is in the rear closed position **42** (step **766**). This operation can then be indicated as completed (step **768**).

[0124] It should be understood that the methods **400-750** can be modified based upon the exact configuration of the front and rear doors **28**, **36**, the configuration of the sealing assembly **46** and the configuration of the latching assembly **44**. Again, the operation of these methods **400-750** is typically accomplished through various manual operating mechanisms (such as handles) and various automated processes and sensors **260**, as described above.

[0125] According to various aspects of the device, the apparatus and methods described herein can be used within various vehicles. Such vehicles can include, but are not limited to, luxury sedans, pick-up trucks, cargo vehicles, or other similar vehicle configurations having opposite hinged doors that close at a single continuous opening within the frame of the vehicle.

[0126] It is to be understood that variations and modifications can be made on the aforementioned structure without departing from the concepts of the present invention, and further it is to be understood that such concepts are intended to be covered by the following claims unless these claims by their language expressly state otherwise.

What is claimed is:

1. A method for operating coach-style doors for a vehicle, the method comprising steps of:

unlocking, via a controller, a front door that overlaps a rear door in a closed position, wherein the front and rear doors are disposed within a single access aperture of a frame for the vehicle in the closed position;

moving, via the controller, the front door to a rear door clear position wherein the rear door is unobstructed by the front door;

unlocking the rear door via the controller; and

moving the rear door to a rear door open position to provide access to a passenger cabin for the vehicle via the single access aperture.

2. The method of claim **1**, wherein the step of unlocking the front door also includes unlatching the front door from the frame.

3. The method of claim **1**, wherein the step of unlocking the rear door also includes unlatching the front door from the rear door.

4. The method of claim **1**, wherein the front door in the rear door clear position remains within the single access aperture.

5. The method of claim **1**, wherein the step of moving the rear door to the rear door open position includes operating the rear door via the controller.

6. The method of claim **1**, wherein after the rear door is moved to the rear door open position, the front door is moved from the rear door clear position to a front door closed position.

7. The method of claim **6**, wherein when the rear door is moved toward a rear door closed position, the front door is moved from the front door closed position to the rear door clear position.

8. The method of claim **1**, further comprising:

moving the rear door to a rear door closed position within the single access aperture;

locking the rear door via the controller;

moving the front door, via the controller, from the rear door clear position to a front door closed position; and

locking the front door via the controller.

9. The method of claim **8**, wherein the step of locking the front door via the controller includes latching the front door to the frame.

10. The method of claim **9**, wherein the step of locking the front door via the controller also includes latching the front door to the rear door.

11. A method for operating a rear door of coach-style doors for a vehicle, the method comprising steps of:

unlocking, via a controller, the rear door, wherein a front door and the rear door of the coach-style doors are in a non-overlapping configuration within a single access aperture of a frame for the vehicle in a closed position;

unlatching the rear door relative to the frame;

unlatching the rear door relative to the front door when the front door is in a front door closed position; and

moving the rear door to a rear door open position to provide access to a passenger cabin for the vehicle via the single access aperture.

12. The method of claim **11**, wherein the step of unlatching the rear door includes disengaging a latching assembly that extends between the front door and the rear door.

13. The method of claim **11**, wherein the step of moving the rear door to the rear door open position includes moving the rear door via the controller.

14. The method of claim **11**, further comprising steps of:

moving the rear door to a rear door closed position;

latching the rear door, via the controller, relative to the frame;

determining whether the front door is in the front door closed position;

latching the rear door, via the controller, relative to the front door when the front door is in the front door closed position; and

locking the rear door via the controller.

15. The method of claim **14**, wherein the step of latching the rear door relative to the front door includes engaging a latching assembly that extends between the front door and the rear door.

16. The method of claim **12**, wherein the step of disengaging the latching assembly includes disengaging a sealing assembly that is disposed between the front door and the rear door.

17. A method for operating a front door of coach-style doors for a vehicle, the method comprising steps of:

unlocking, via a controller, the front door, wherein the front door and a rear door of the coach-style doors are in a non-overlapping configuration within a single access aperture of a frame for the vehicle in a closed position;

unlatching the front door relative to the frame;

unlatching the front door relative to the rear door when the rear door is in a rear door closed position;

unsealing the front door relative to the rear door when the rear door is in the rear door closed position; and

moving the front door to a front door open position to provide access to a passenger cabin for the vehicle via the single access aperture.

18. The method of claim **17**, wherein the step of unsealing the front door relative to the rear door includes operating a magnetic sealing assembly to an actuated position that is repelled from a gap defined between the front door and the rear door.

19. The method of claim **17**, wherein the step of unsealing the front door relative to the rear door includes operating a mechanical sealing assembly to an actuated position that is moved away from a gap defined between the front door and the rear door.

20. The method of claim **17**, wherein the step of unlatching the front door relative to the rear door and the step of unsealing the front door relative to the rear door are performed as sequential steps.

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