

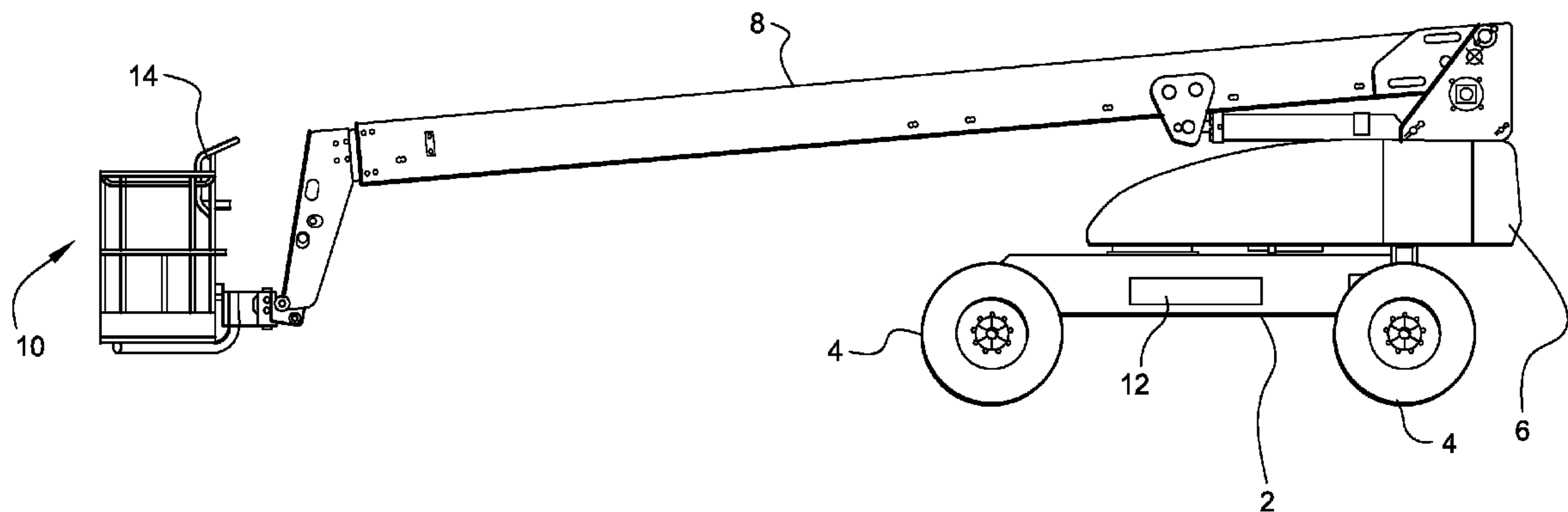


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(54) Title: WORK PLATFORM WITH PROTECTION AGAINST SUSTAINED INVOLUNTARY OPERATION



(57) **Abrégé/Abstract:**

A work platform for a personnel lift includes a floor structure, a safety rail coupled with the floor structure and defining a personnel work area, and a control panel area. A protection envelope surrounds the control panel area and enhances protection for an operator from an obstruction or structure that may constitute a crushing hazard. In one arrangement, the protection envelope includes protection bars on either side of the control panel area extending above the safety rail relative to the floor structure. In another arrangement, the protection envelope includes a platform switch that is configured to trip upon an application of a predetermined force.

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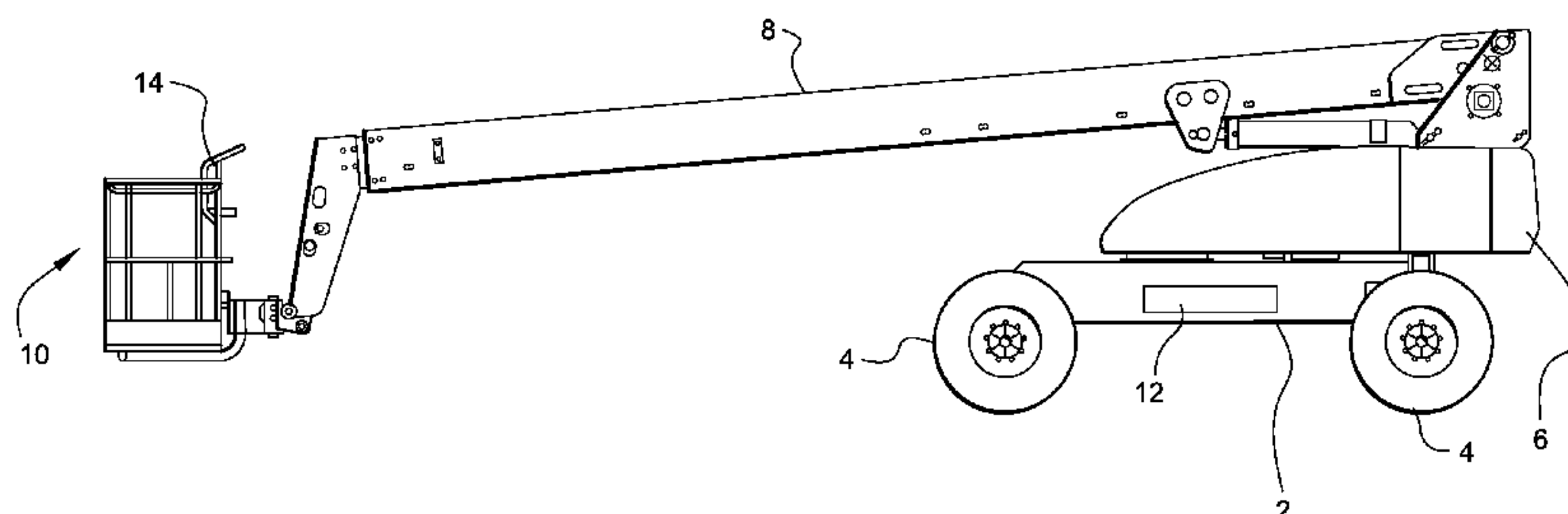


FIG. 1

(57) Abstract: A work platform for a personnel lift includes a floor structure, a safety rail coupled with the floor structure and defining a personnel work area, and a control panel area. A protection envelope surrounds the control panel area and enhances protection for an operator from an obstruction or structure that may constitute a crushing hazard. In one arrangement, the protection envelope includes protection bars on either side of the control panel area extending above the safety rail relative to the floor structure. In another arrangement, the protection envelope includes a platform switch that is configured to trip upon an application of a predetermined force.

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TITLE OF INVENTION**WORK PLATFORM WITH PROTECTION AGAINST SUSTAINED INVOLUNTARY
OPERATION**

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This application claims the benefit of U.S. Provisional Patent Application Serial No. 61/424,888, filed December 20, 2010, and U.S. Provisional Patent Application Serial No. 61/435,558, filed January 24, 2011.

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BACKGROUND OF THE INVENTION

The invention relates to work platforms and, more particularly, to a work platform including provisions to enhance protection for an operator from sustained involuntary operation resulting in an impact with an obstruction or structure.

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Lift vehicles including aerial work platforms, telehandlers such as rough terrain fork trucks with work platform attachments, and truck mounted aerial lifts are known and typically include an extendible boom, which may be positioned at different angles relative to the ground, and a work platform at an end of the extendible boom. On or adjacent the platform, there is typically provided a control console including various control elements that may be manipulated by the operator to control such functions as boom angle, boom extension, rotation of the boom and/or platform on a vertical axis, and where the lift vehicle is of the self-propelled type, there are also provided engine, steering and braking controls.

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A safety hazard can occur in a lift vehicle including a work platform when an operator is positioned between the platform and a structure that may be located overhead or behind the operator, among other places. The platform may be maneuvered into a position where the operator is crushed between that structure and the platform, resulting in serious injury or death.

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SUMMARY OF THE INVENTION

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It would be desirable for a platform to incorporate protective structure to enhance protection of the operator from continued involuntary operation of the machine in proximity to an obstruction or structure. The protecting structure can also serve as a physical barrier to enhance protection for the operator and/or cooperate with the drive/boom functions control system to cease or reverse movement of the platform. If cooperable with the operating components of the machine, it is also desirable to prevent inadvertent tripping of the protective structure.

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In an exemplary embodiment, a work platform for a personnel lift includes a floor structure, a safety rail coupled with the floor structure and defining a personnel work area, and a control panel area. A protection envelope surrounds the control panel area and enhances protection for an operator from an obstruction or structure that may constitute a crushing hazard.

In one embodiment, the protection envelope includes protection bars on either side of the control panel area extending above the safety rail relative to the floor structure. The protection bars may extend above the safety rail by an amount sufficient to accommodate an anteroposterior diameter of an adult human. The safety rail may include side sections and end sections, where the control panel area is positioned within one of the side sections. In this context, the protection bars are disposed intermediately within the one of the side sections adjacent the control panel area. Alternatively, the protection bars may be disposed in alignment with the end sections.

In another embodiment a work platform for a personnel lift, the work platform comprises a floor structure; a safety rail coupled with the floor structure and defining a personnel work area; a control panel area; a protection envelope surrounding the control panel area, the protection envelope enhancing protection for an operator from an obstruction or structure that may constitute a crushing hazard; and a switch bar secured to the control panel area, wherein the protection envelope comprises a platform switch attached to the switch bar that is configured to trip upon an application of a predetermined force to the switch bar, and wherein the switch bar is secured to the control panel area via a shear element at each end of the switch bar, the shear element including a reduced diameter section that is sized to fail upon an application of a predetermined force.

In one embodiment a personnel lift comprising a work platform including a floor structure, a safety rail coupled with the floor structure and defining a personnel work area, a control panel area, a protection envelope surrounding the control panel area, the protection envelope enhancing protection for an operator from an obstruction or structure that may constitute a crushing hazard, and a switch bar secured to the control panel area, wherein the protection envelope comprises a platform switch attached to the switch bar that is configured to trip upon an application of a predetermined force to the switch bar; a vehicle chassis; a lifting assembly secured to the vehicle chassis, wherein the work platform is attached to the lifting assembly; a control panel disposed in the control panel

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area, the control panel including an operator input implement; driving components cooperable with the lifting assembly for lifting and lowering the work platform; and a control system communicating with the driving components, the control panel, and the platform switch, the control system controlling operation of the driving components based on signals from the operator input implement and the platform switch, wherein the control system is programmed to initiate a reversal function and reverse a last operation when the platform switch is tripped.

In another embodiment, a work platform for a personnel lift, the work platform comprising a floor structure; a safety rail coupled with the floor structure and defining a personnel work area; a control panel area; a protection envelope disposed adjacent the control panel area, the protection envelope including a frame structure positioned above the control panel area relative to the floor structure, the protection envelope enhancing protection for an operator from an obstruction or structure that may constitute a crushing hazard; and a switch bar secured to the control panel area, the protection envelope comprising a platform switch attached to the switch bar that is configured to trip upon an application of a predetermined force to the switch bar, wherein the switch bar is secured to the control panel area via a shear element at each end of the switch bar, the shear element including a reduced diameter section that is sized to fail upon an application of a predetermined force.

The control system may be programmed to shut down the driving components or otherwise modify operating parameters of the driving components when the platform switch is tripped.

In another exemplary embodiment, a work platform for a personnel lift includes a floor structure, a safety rail coupled with the floor structure and defining a personnel work area, and a control panel area. A protection envelope is disposed adjacent the control panel area and includes a frame structure positioned above the control panel area relative to the floor structure, where the protection envelope enhances protection for an operator from an obstruction or structure that may constitute a crushing hazard.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other aspects and advantages of the present invention will be described in detail with reference to the accompanying drawings, in which:

FIG. 1 illustrates an exemplary lift vehicle;

FIGS. 2-3 show a work platform including a protection envelope of a first embodiment;

FIG. 4 shows a control panel area and a protective envelope including a platform switch;

FIG. 5 is a cross-sectional view of the platform switch;

FIGS. 6-7 show an alternative design of the protection envelope including the platform switch; and

FIG. 8 shows the platform switch connected with shear elements.

DETAILED DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates an exemplary typical aerial lift vehicle including a vehicle chassis 2 supported on vehicle wheels 4. A turntable and counterweight 6 are secured for rotation on the chassis 2, and an extendible boom assembly is pivotably attached at one end to the turntable 6.

An aerial work platform 10 is attached at an opposite end of the extendible boom 8. The illustrated lift vehicle is of the self-propelled type and thus also includes a driving/control system (illustrated schematically in FIG. 1 at 12) and a control console 14 on the platform 10 with various control elements that may be manipulated by the operator to control such functions as boom angle, boom extension, rotation of the boom and/or platform on a vertical axis, and engine, steering and braking controls, etc.

FIGS. 2 and 3 show an exemplary work platform 10 including a protection envelope according to a first embodiment of the invention. The platform 10 includes a floor structure 20, a safety rail 22 coupled with the floor structure 20 and defining a personnel work area, and a control panel area 24 in which the control panel 14 is mounted. The protection envelope surrounds the control panel area 24 and serves to enhance protection for the operator from an obstruction or structure that may constitute a crushing hazard.

As shown in FIGS. 2 and 3, the protection envelope may include protection bars 26 on either side of the control panel area 24 extending above the safety rail 22. The safety rail 22 includes side sections (the longer sections in Figs. 2 and 3) and end sections (the shorter sections in Figs. 2 and 3). The control panel area 24 may be positioned within one of the side sections. In one construction, the protection bars 26 are disposed intermediately within the one of the side sections adjacent the control panel area 24. In an alternative construction, the protection bars 26 may be disposed in alignment with the end sections of the safety rail 22 (as shown in dashed line in FIG. 3). Preferably, the protection bars 26 extend above the safety rail 22 by an amount sufficient to accommodate an anteroposterior diameter of an adult human (i.e., a distance between a person's front and back). In this manner, if an obstacle is encountered that could result in crushing the operator between the structure and the control panel 14, the operator will be protected from injury by the protection bars 26 with sufficient space between the control panel 14 and a top of the protection bars 26 to accommodate the operator's torso. FIG. 3 shows the user in a "safe" position where an encountered structure is prevented from crushing the operator by the protection bars 26.

An alternative protection envelope is shown in FIG. 4. In this embodiment, the protection envelope includes a switch bar 28 secured in the control panel area 24. A platform switch 30 is attached to the switch bar 28 and includes sensors for detecting the application of a force, such as by an operator being pressed into the platform switch by an obstruction or structure. The platform switch 30 is configured to trip upon an application of a predetermined force. It has been discovered that inadvertent tripping can be avoided if the predetermined force is about 40-50 lbs over a 6" sensor (i.e., about 6.5-8.5 lbs/in). As shown, the switch bar 28 and the platform switch 30 are positioned between the personnel work area and the safety rail 22. Relative to the floor structure, the switch bar 28 and the platform switch 30 are positioned above and in front of the control panel area 24. Based on an ergonomic study, it was discovered that the switch bar 28 and platform switch 30 should be positioned about 50" above the platform floor.

Although any suitable construction of the platform switch 30 could be used, a cross section of an exemplary switch 30 is shown in FIG. 5. The switch 30 includes a switch housing 32 with internal ribs 34 connected between the switch housing and a pressure switch 36. Sensitivity can be adjusted by selecting a different rating pressure switch 36 and/or by adjusting the number, shape and stiffness of the ribs 34. The switch bar 28 and platform switch 30 also serve as a handle bar that an operator can grab in an emergency.

An alternative platform switch assembly 301 is shown in Figs. 6 and 7. The switch assembly 301 includes a platform switch 302 with injection molded end caps 303 and die cast mounting brackets 304. The platform switch 302 operates in a similar manner to the switch 30 shown in FIGS. 4 and 5. An exemplary suitable switch for the platform switch is available from Tapeswitch Corporation of Farmingdale, NY.

With reference to FIG. 8, the platform switch 30, 302 and switch bar 28 may be secured to the control panel area 24 via a shear element 38. The shear element 38 includes a reduced diameter section as shown that is sized to fail upon an application of a predetermined force.

With this construction, in the event that the machine momentum or the like carries the platform beyond a stop position after the platform switch is tripped, the shear elements 38 will fail/break to give the operator additional room to avoid entrapment. The predetermined force at which the shear element 38 would fail is higher than the force required to trip the platform switch 30, 301. In one construction, nylon may be used as the material for the shear element 38, since nylon has low relative elongation to plastic. Of course, other materials may be suitable.

In use, the driving components of the vehicle that are cooperable with the lifting assembly for lifting and lowering the work platform are controlled by an operator input implement on the control panel 14 and by the driving/control system 12 communicating with the driving components and the control panel 14. The control system 12 also receives a signal from the platform switch 30, 302 and controls operation of the driving components based on signals from the operator input implement and the platform switch 30, 302. At a minimum, the control system 12 is programmed to shut down driving components when the platform switch 30, 302 is tripped. Alternatively, the control system 12 may reverse the last operation when the platform switch 30, 302 is tripped.

If function cutout is selected, when the platform switch is tripped, the active function will be stopped immediately, and all non-active functions shall not be activated. If a reversal function is selected, when the platform sensor is tripped during operation, the operation required RPM target is maintained, and the active function only when the trip occurred is

reversed until the reversal function is stopped. A ground horn and a platform horn can be activated when the reversal function is active. After the reversal function is completed, engine RPM is set to low, and all functions are disabled until the functions are re-engaged with the foot switch and operator controls. The system may include a platform switch override button
5 that is used to override the function cut out initiated by the platform switch. If the override button is pressed and held, it enables the hydraulic functions if the foot switch and controls are re-engaged sequentially. In this event, function speed is set in creep mode speed automatically. The controller is programmed to avoid the cut out feature being disabled before the platform switch is tripped regardless of whether the override button is pressed or released.
10 This assures that the cut out feature will still be available if the override button is stuck or manipulated into an always-closed position.

The reversal function is implemented for various operating parameters of the machine. For vehicle drive, if drive orientation shows that the boom is between the two rear wheels, reversal is allowed only when the drive backward is active and the platform switch is tripped.
15 If a drive forward request is received when the platform switch is tripped, it is treated as a bump or obstacle in the road and will not trigger the reversal function. If the drive orientation shows that the boom is not in line with the rear wheels, then both drive forward and drive backward may trigger the reversal function. Additional operating parameters that are implemented with the reversal function include main lift, tower lift, main telescope (e.g.,
20 telescope out only), and swing.

Reversal function terminates based on the platform switch signal, footswitch signal and time parameters that are set for different functions, respectively. If the platform switch changes from trip status to non-trip status before the maximum reversal time is elapsed, then the reversal function will be stopped; otherwise, the reversal function is active until the
25 maximum reversal time is elapsed.

Disengaging the footswitch also terminates the reversal function at any time.

If an operator is trapped on the platform, ground control can be accessed from the ground via a switch. In the ground control mode, if the platform switch is engaged, boom operation is allowed to operate in creep speed. If the platform switch changes status from
30 engaged to disengaged, then operation is maintained in creep speed unless the ground enable and function control switch is re-engaged.

The protection envelope provided by the described embodiments serves to enhance protection for operators from an obstruction and continued involuntary operation. The

protection envelope can include physical/structural protection in the form of protection bars or the like and/or a platform switch that is tripped upon the application of a predetermined force (such as by an operator being driven into the control panel by an obstruction or structure).

5 While the invention has been described in connection with what is presently considered to be the most practical and preferred embodiments, it is to be understood that the invention is not to be limited to the disclosed embodiments, but on the contrary, is intended to cover various modifications and equivalent arrangements included within the scope of the appended claims, as purposively construed.

What is claimed is:

1. A work platform for a personnel lift, the work platform comprising:
 - a floor structure;
 - a safety rail coupled with the floor structure and defining a personnel work area;
 - a control panel area;
 - a protection envelope surrounding the control panel area, the protection envelope enhancing protection for an operator from an obstruction or structure that may constitute a crushing hazard; and
 - a switch bar secured to the control panel area,wherein the protection envelope comprises a platform switch attached to the switch bar that is configured to trip upon an application of a predetermined force to the switch bar, and wherein the switch bar is secured to the control panel area via a shear element at each end of the switch bar, the shear element including a reduced diameter section that is sized to fail upon an application of a predetermined force.
2. A work platform according to claim 1, wherein the switch bar and the platform switch are positioned between the personnel work area and the safety rail.
3. A work platform according to claim 1, wherein relative to the floor structure, the switch bar and the platform switch are positioned above and in front of the control panel area.
4. A work platform according to claim 1, wherein the switch bar comprises a pressure switch disposed in a switch housing, the switch housing including internal ribs connected between an exterior surface and the pressure switch.
5. A personnel lift comprising:
 - a work platform including:
 - a floor structure,
 - a safety rail coupled with the floor structure and defining a personnel work area,
 - a control panel area,
 - a protection envelope surrounding the control panel area, the

protection envelope enhancing protection for an operator from an obstruction or structure that may constitute a crushing hazard, and

a switch bar secured to the control panel area,

wherein the protection envelope comprises a platform switch attached to the switch bar that is configured to trip upon an application of a predetermined force to the switch bar;

a vehicle chassis;

a lifting assembly secured to the vehicle chassis, wherein the work platform is attached to the lifting assembly;

a control panel disposed in the control panel area, the control panel including an operator input implement;

driving components cooperable with the lifting assembly for lifting and lowering the work platform; and

a control system communicating with the driving components, the control panel, and the platform switch, the control system controlling operation of the driving components based on signals from the operator input implement and the platform switch, wherein the control system is programmed to initiate a reversal function and reverse a last operation when the platform switch is tripped.

6. A personnel lift according to claim 5, wherein the control system is programmed to shut down the driving components when the platform switch is tripped.

7. A personnel lift according to claim 5, wherein the control system is programmed to modify operating parameters of the driving components associated with the reversal function when the platform switch is tripped.

8. A work platform according to claim 5, wherein the control system is programmed to continue the reversal function until the reversal function is stopped when the platform switch is tripped.

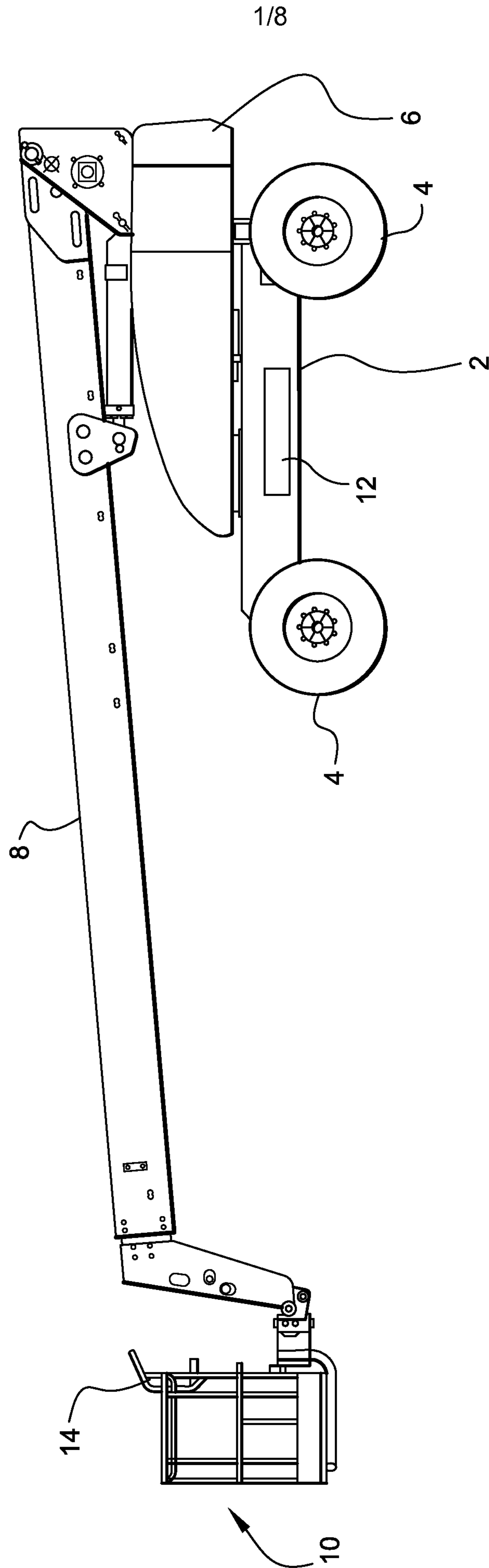
9. A work platform for a personnel lift, the work platform comprising:
a floor structure;
a safety rail coupled with the floor structure and defining a personnel work area;

a control panel area;

a protection envelope disposed adjacent the control panel area, the protection

envelope including a frame structure positioned above the control panel area relative to the floor structure, the protection envelope enhancing protection for an operator from an obstruction or structure that may constitute a crushing hazard; and

a switch bar secured to the control panel area, the protection envelope comprising a platform switch attached to the switch bar that is configured to trip upon an application of a predetermined force to the switch bar, wherein the switch bar is secured to the control panel area via a shear element at each end of the switch bar, the shear element including a reduced diameter section that is sized to fail upon an application of a predetermined force.



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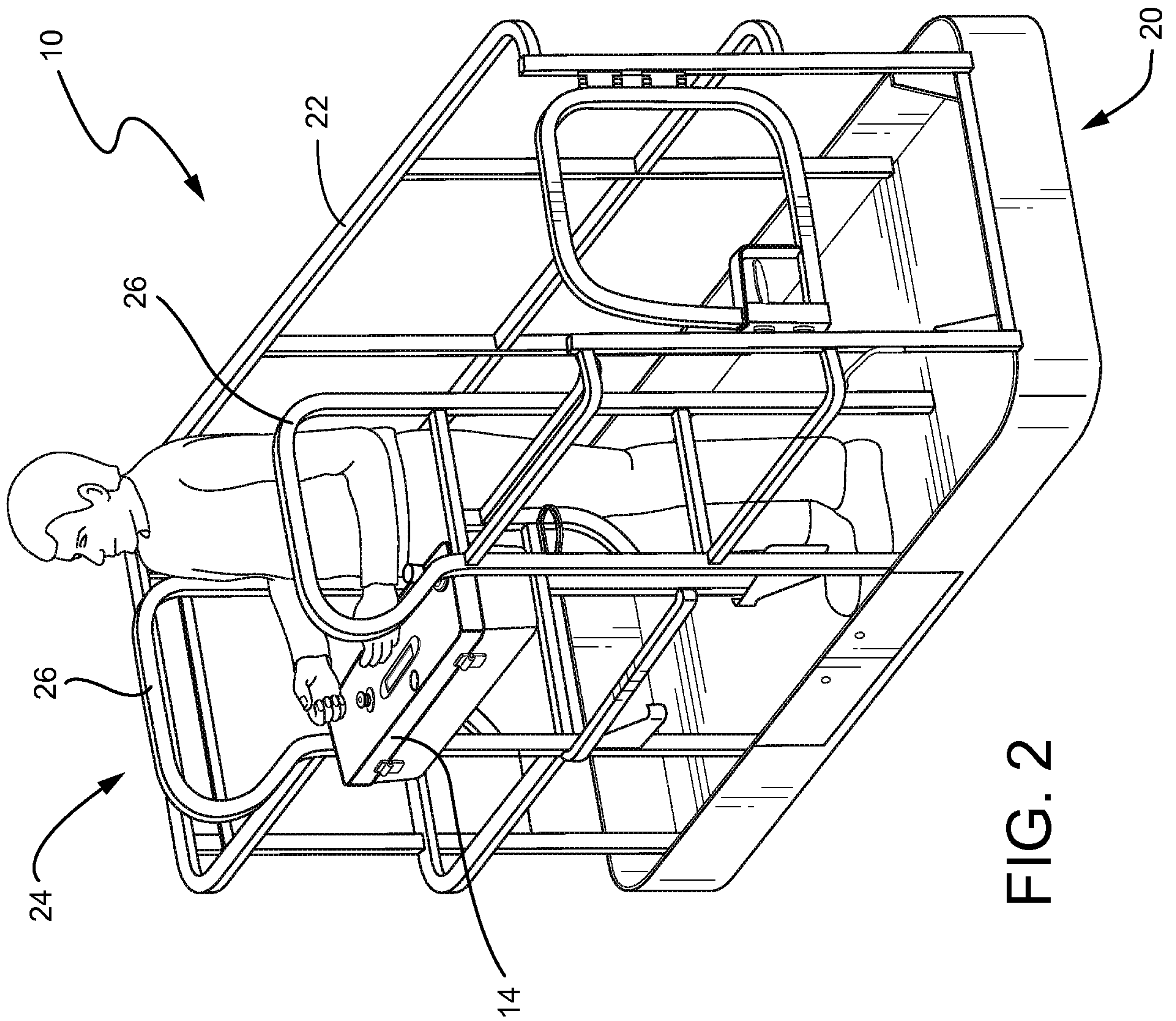


FIG. 2

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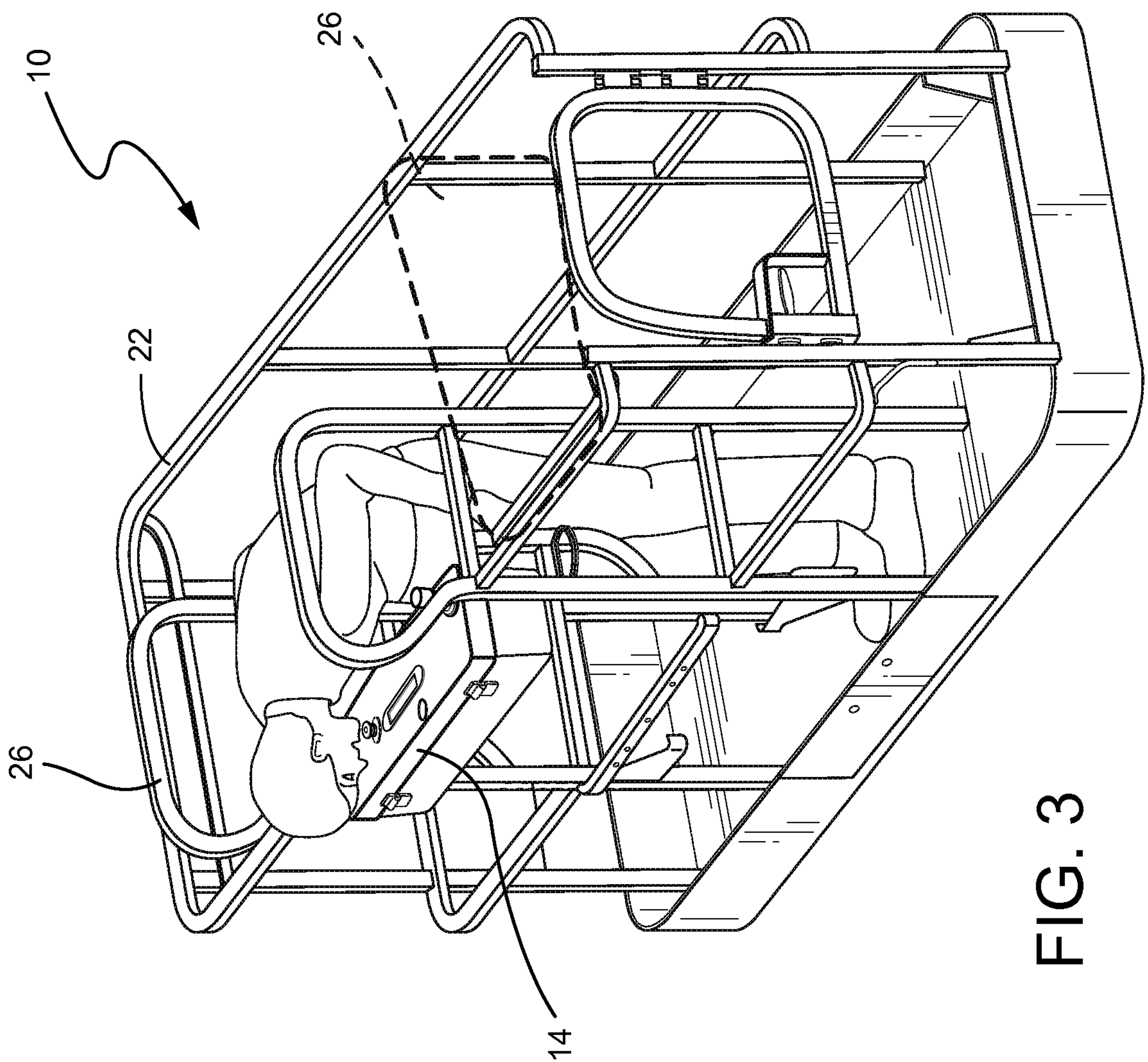


FIG. 3

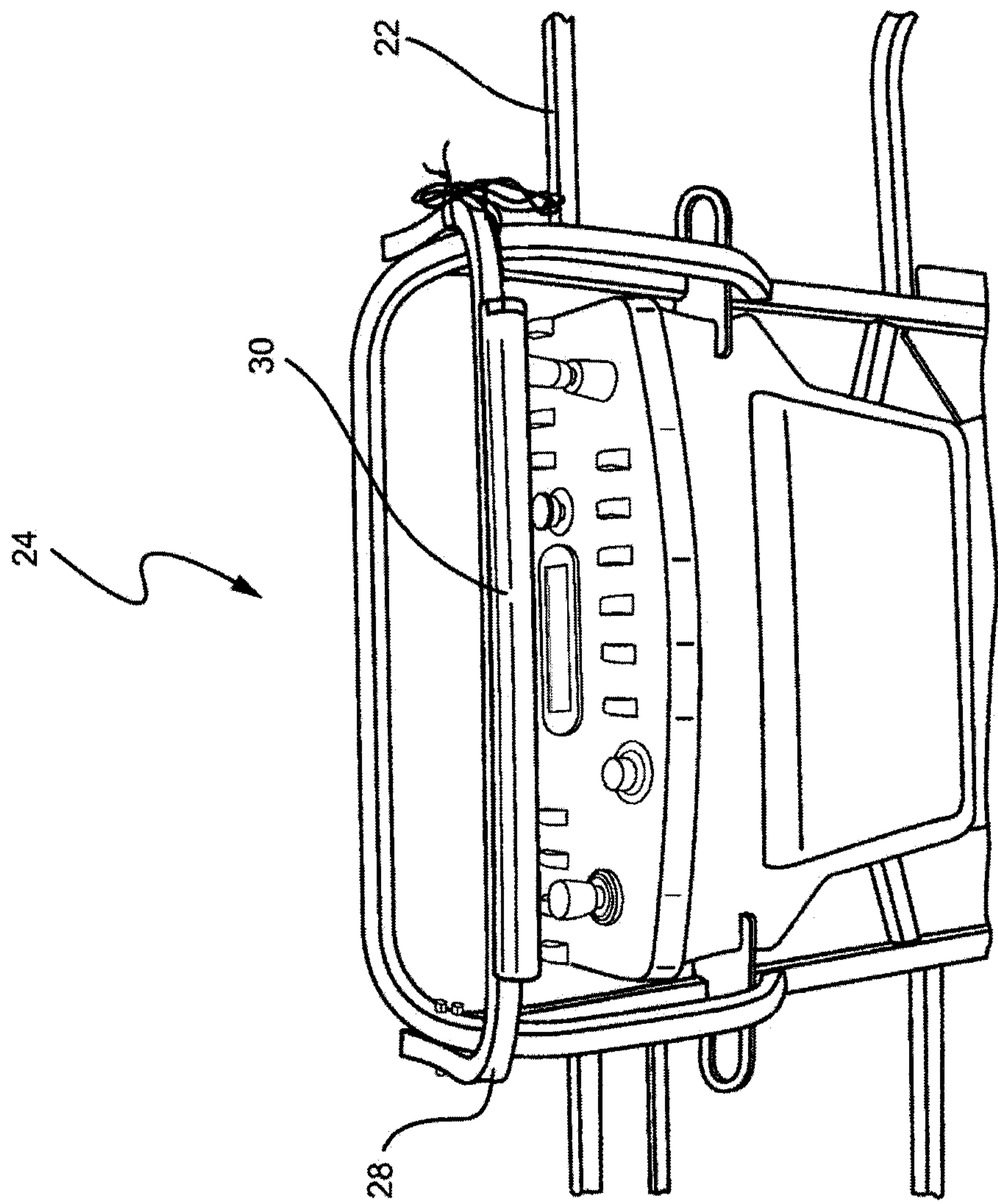


FIG. 4

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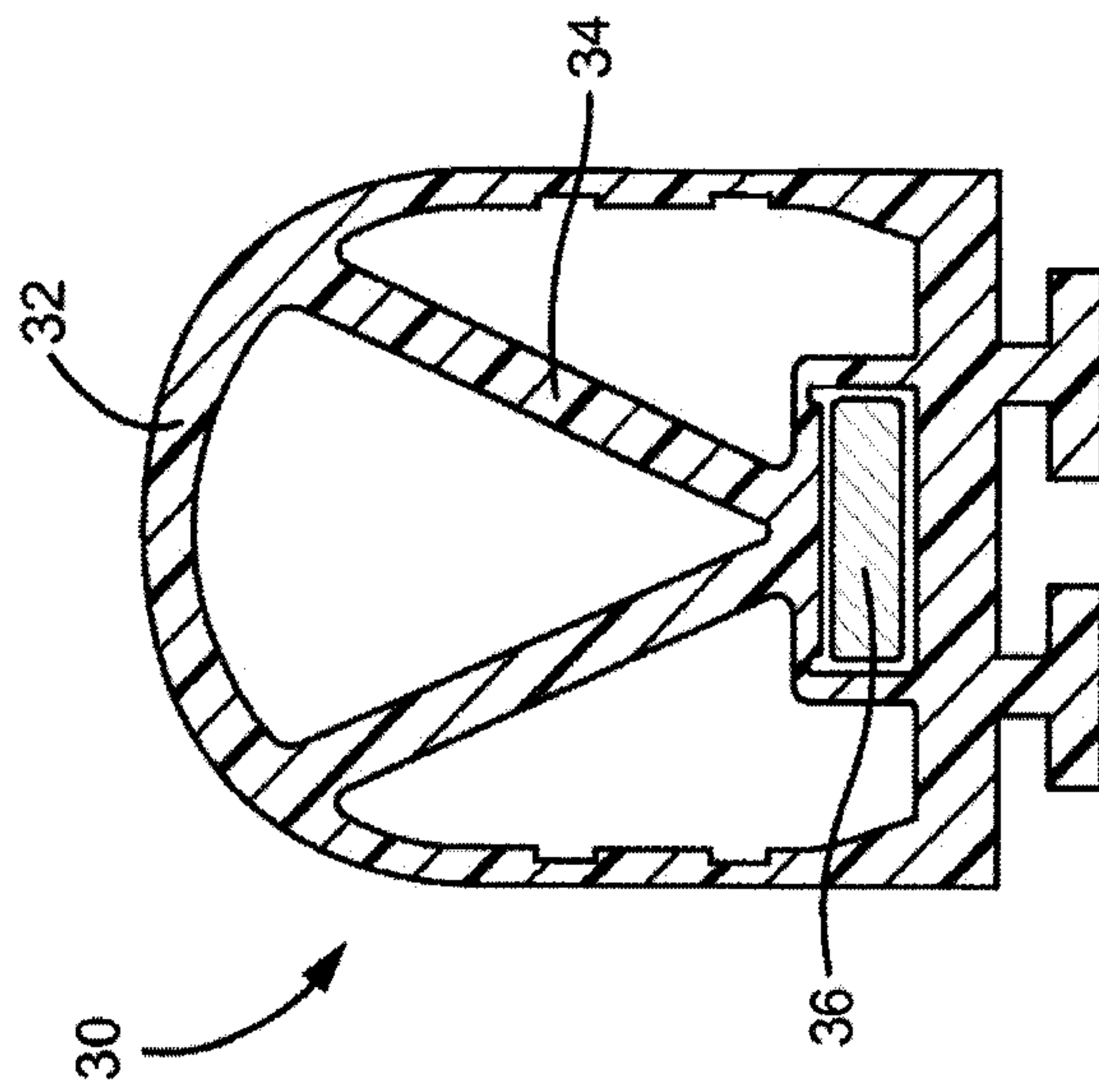


FIG. 5

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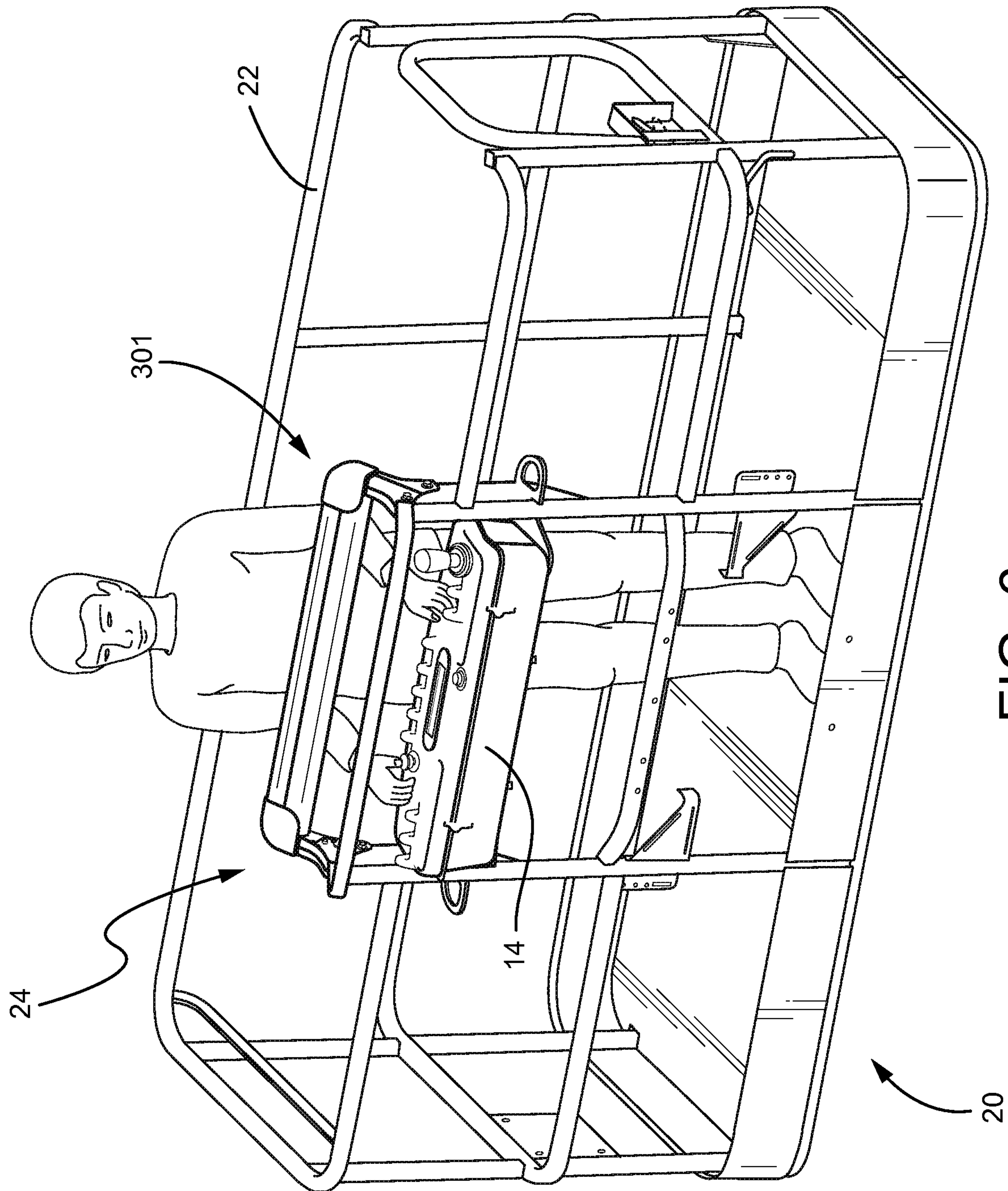


FIG. 6

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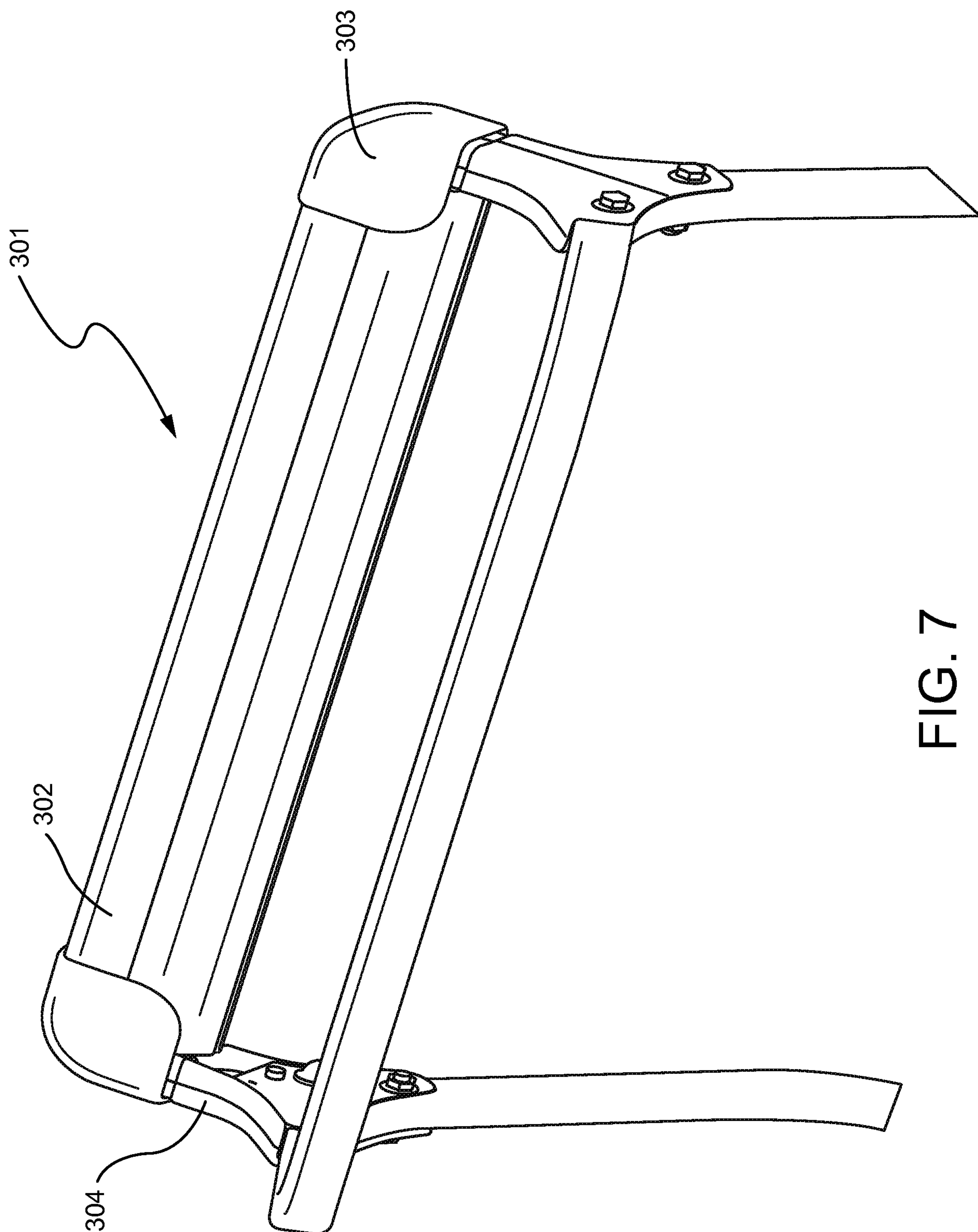


FIG. 7

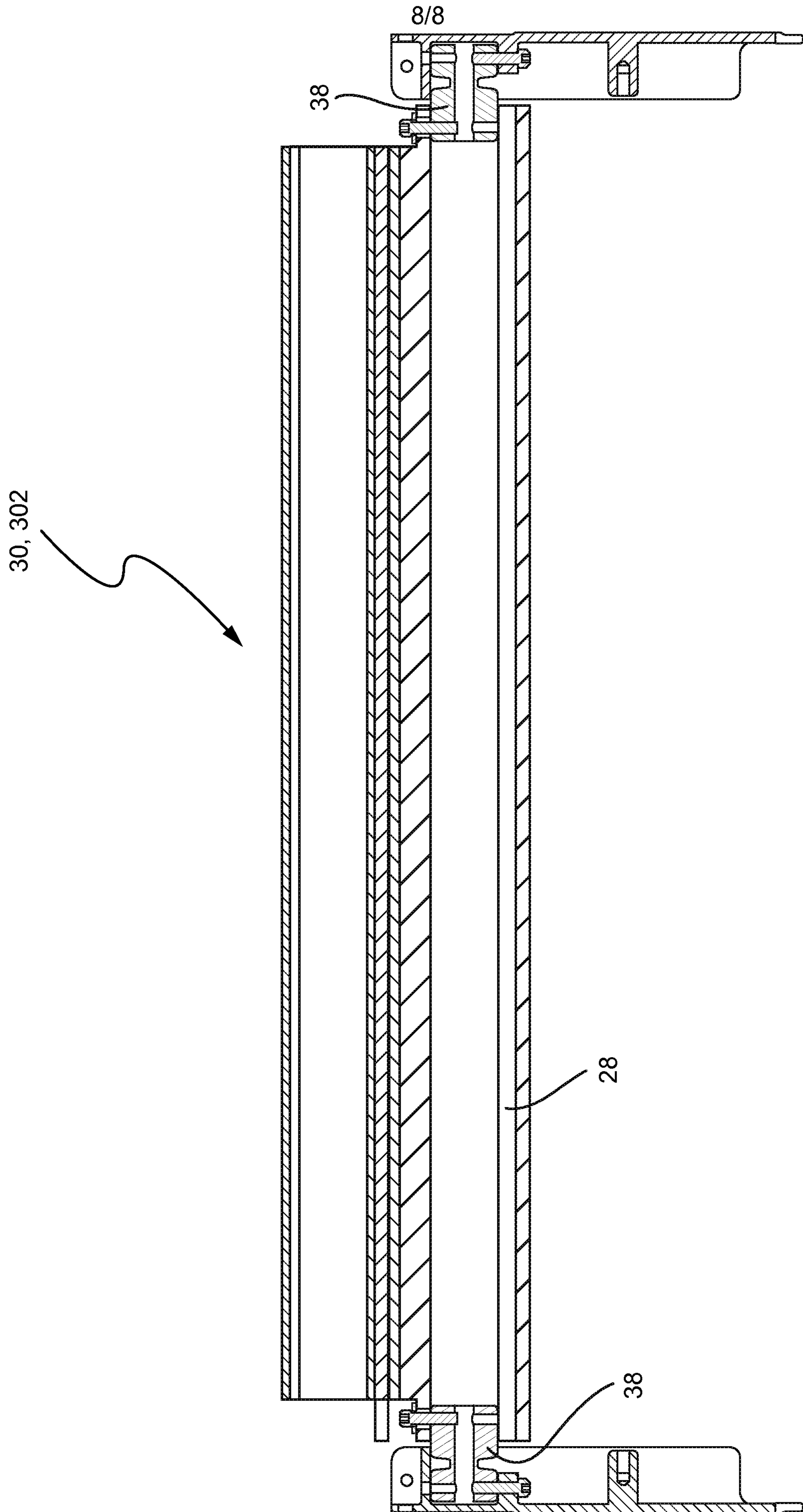


FIG. 8

