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Yamich et al.

(54) **FLYING THEATER**

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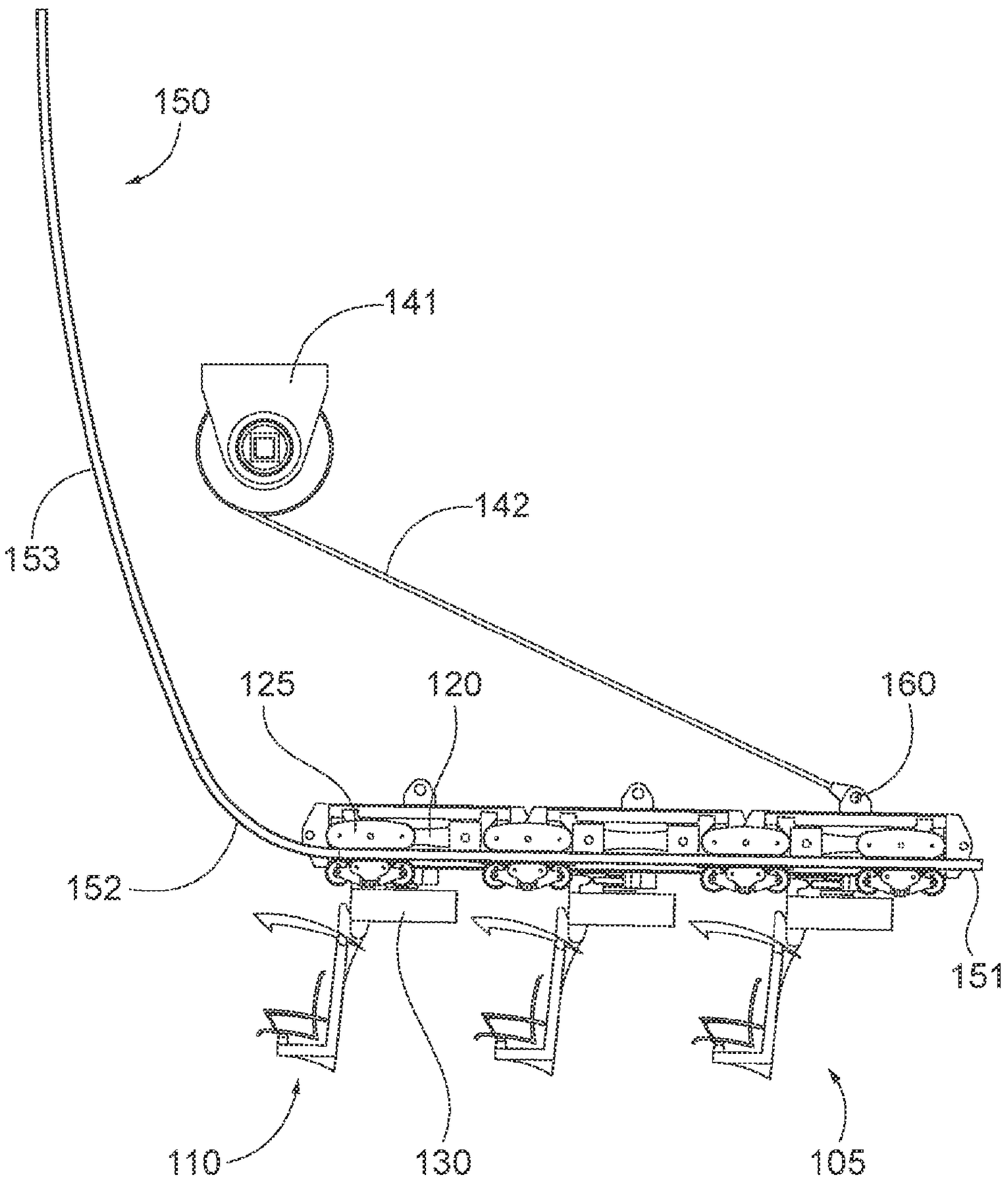
(57) **ABSTRACT**

The present invention relates to the field of amusement rides, and particularly the field of flying theatres. The present invention improves on previous flying theaters in that it provides guests greater motion, and additional types of motion accomplished in unique ways, while being more cost effective than existing flying theaters. The performance parameters of the theater give it the unique ability to not only smoothly replicate the motion of a light flying experience but also simulate motions that are more aggressive than in existing flying theater rides. Guests experience turbulence and more exciting experiences that would otherwise be sacrificed due to limitations in the range of motion or quality of experience of existing rides that would take the rider out of the experience.



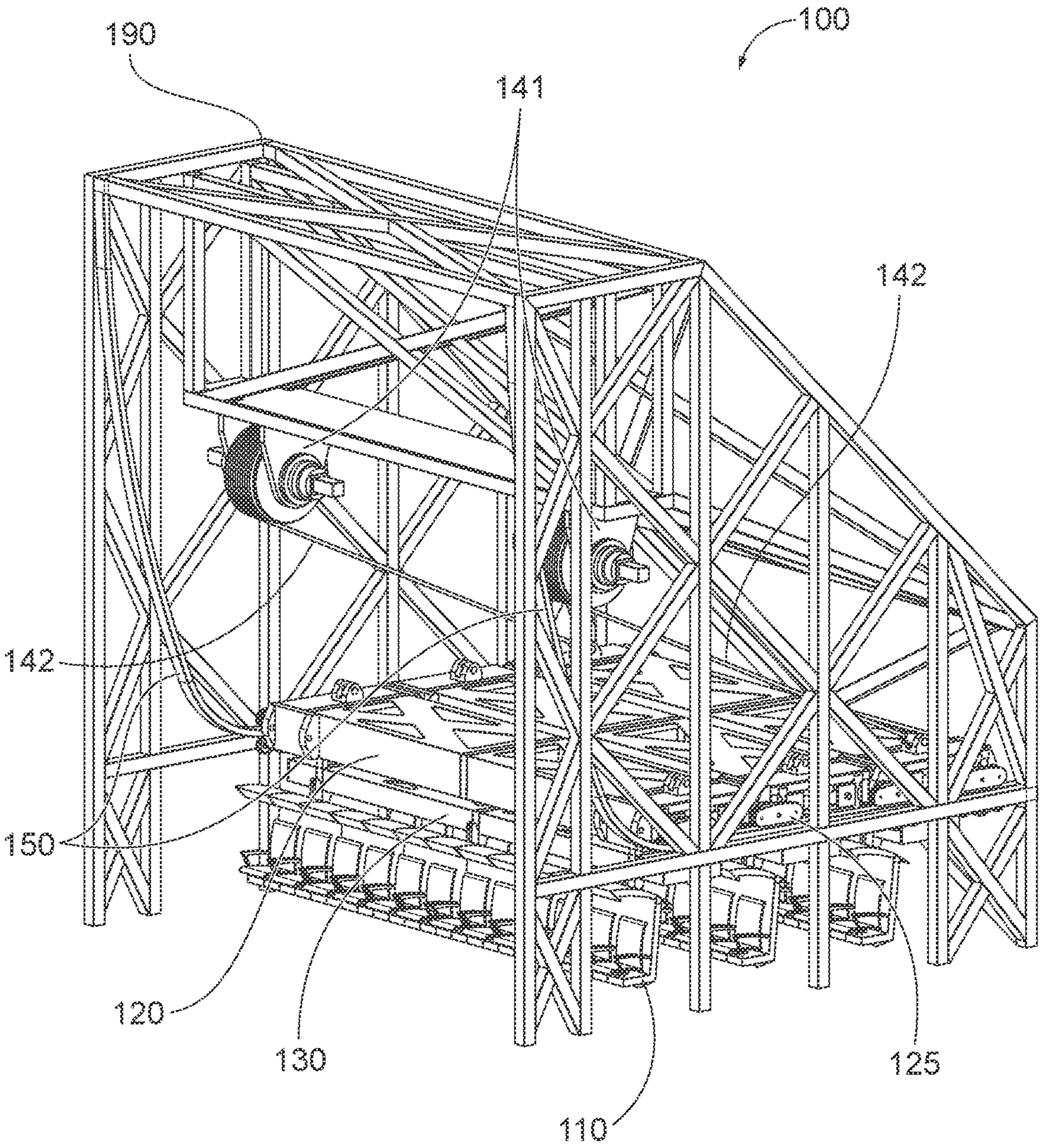


FIG. 1

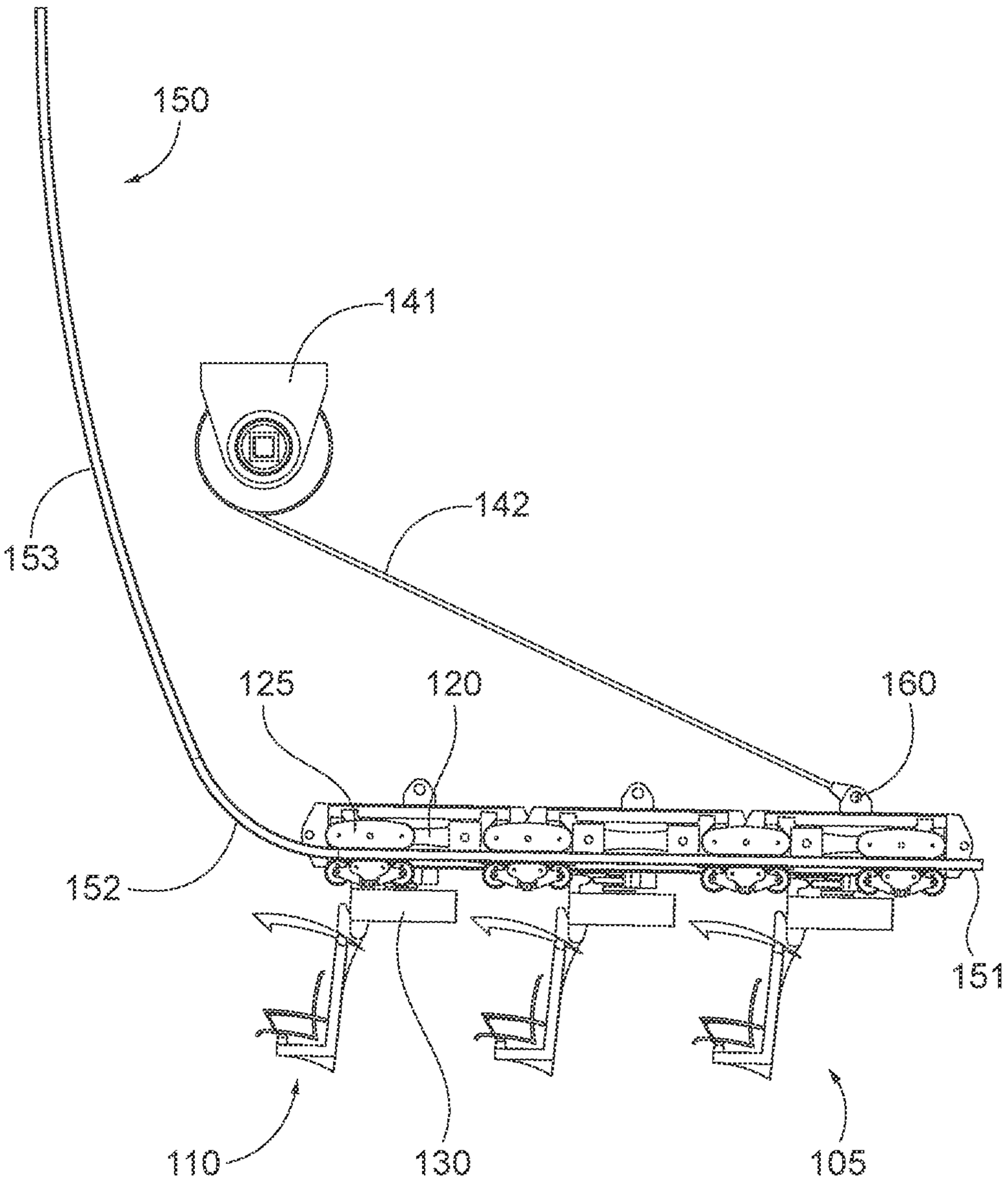


FIG. 2

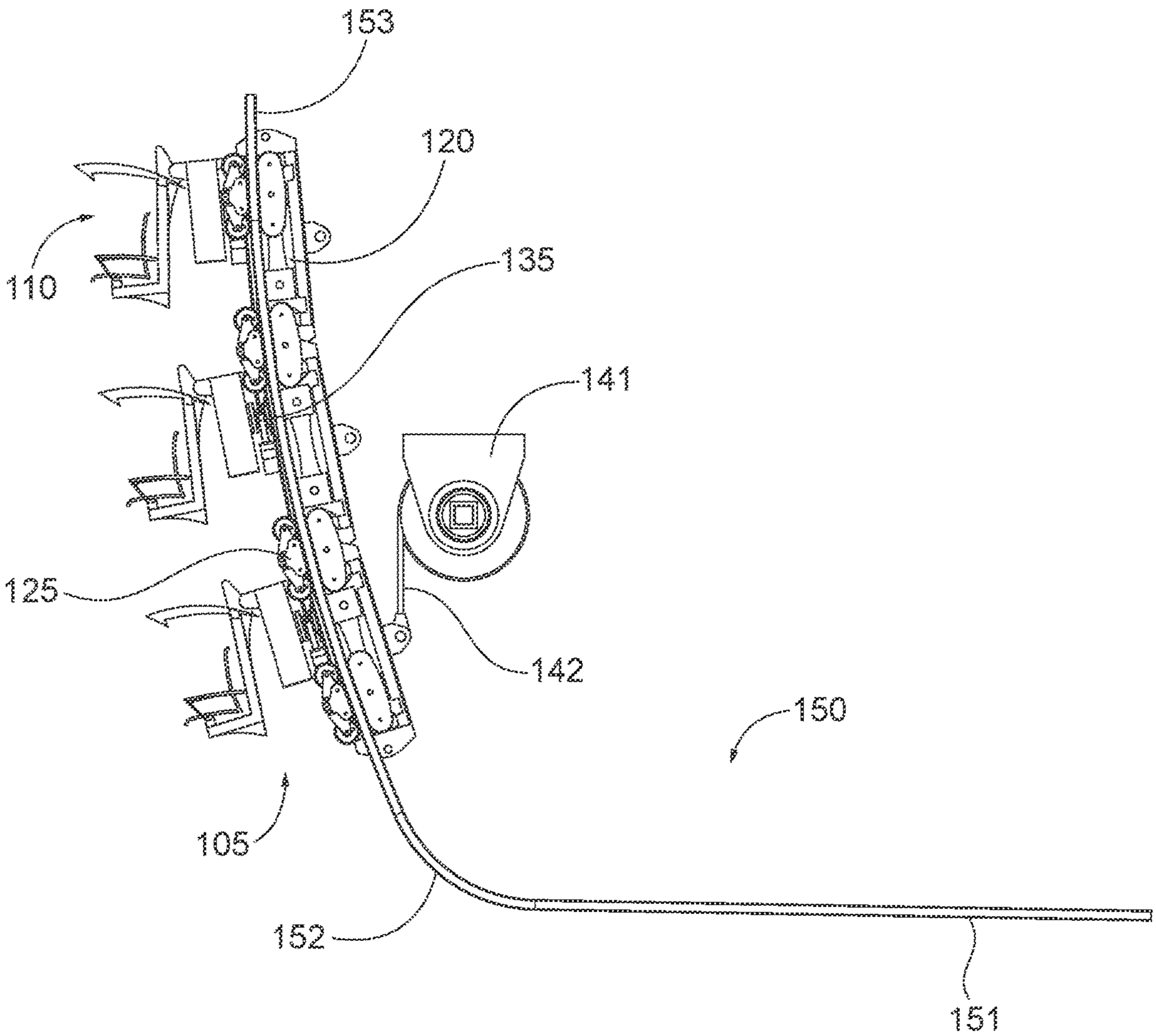


FIG. 3

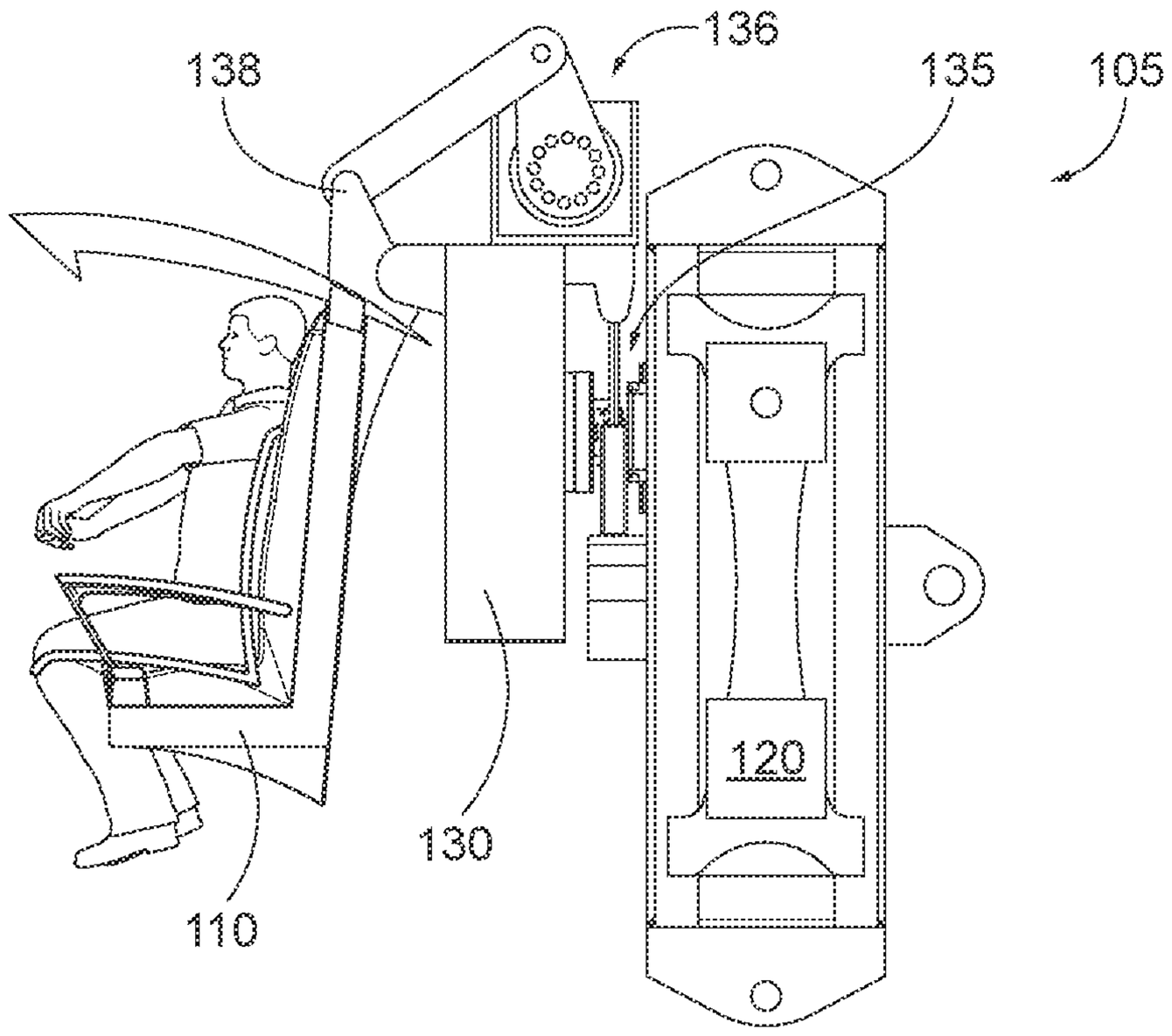


FIG. 4A

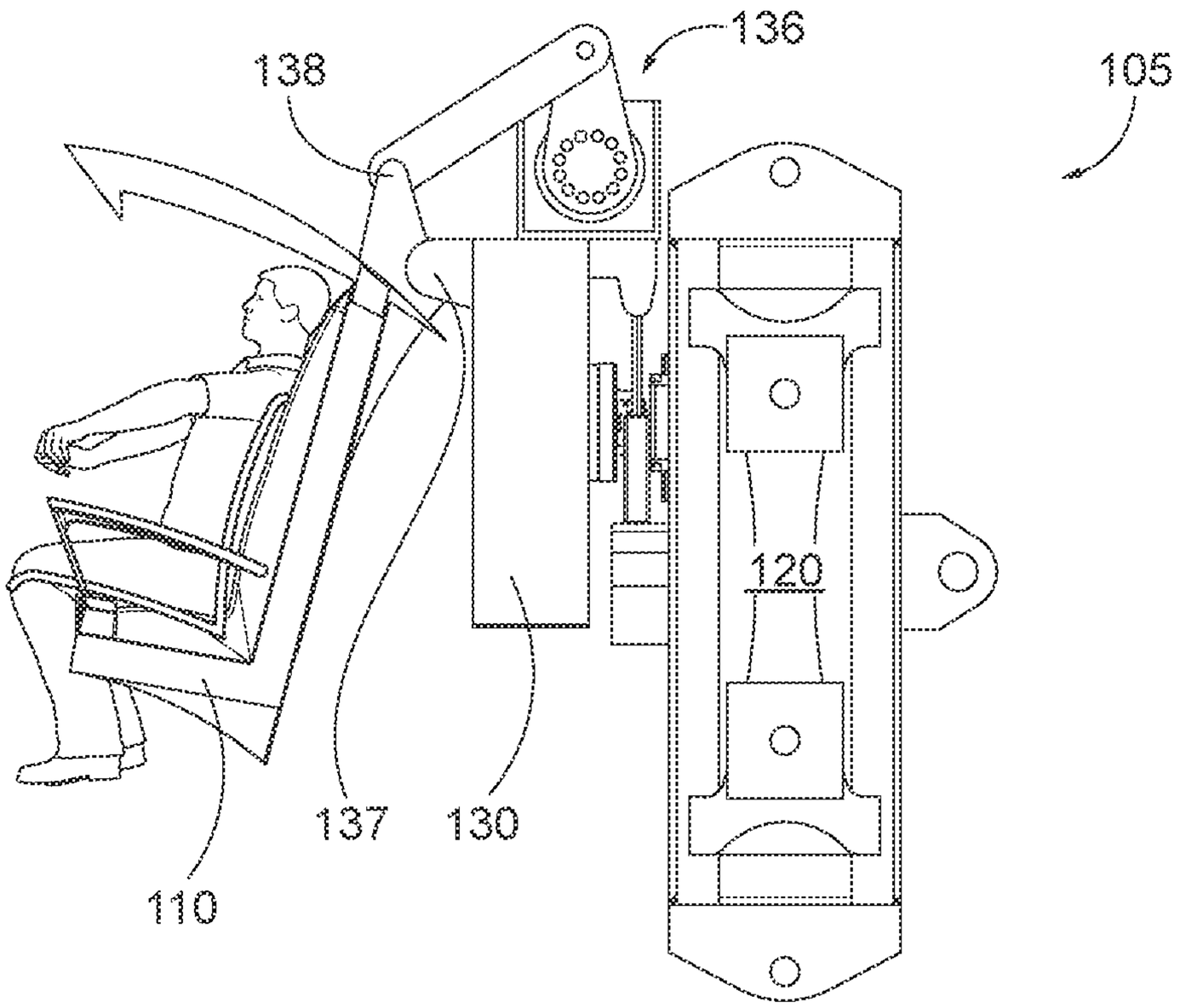


FIG. 4B

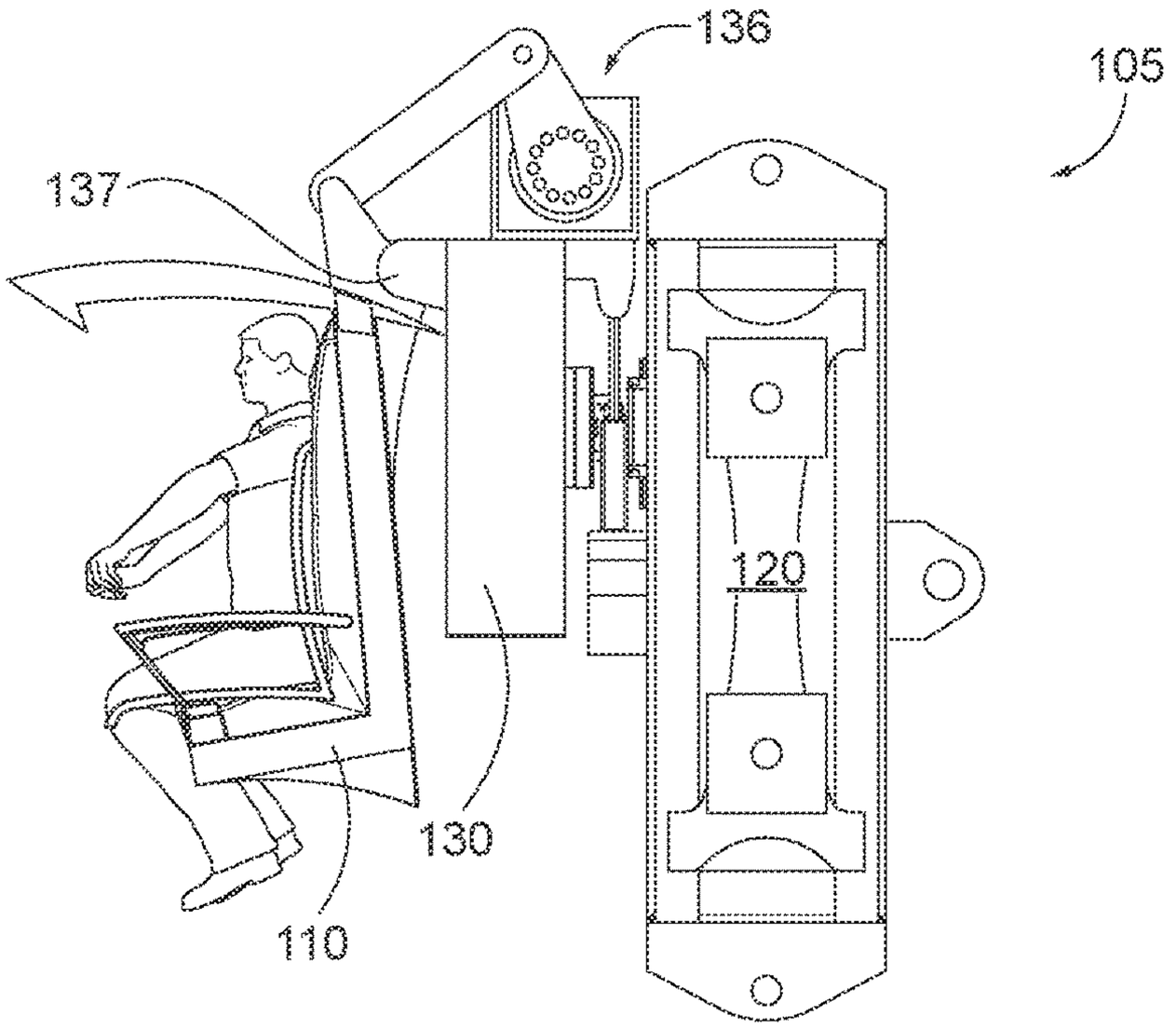


FIG. 4C

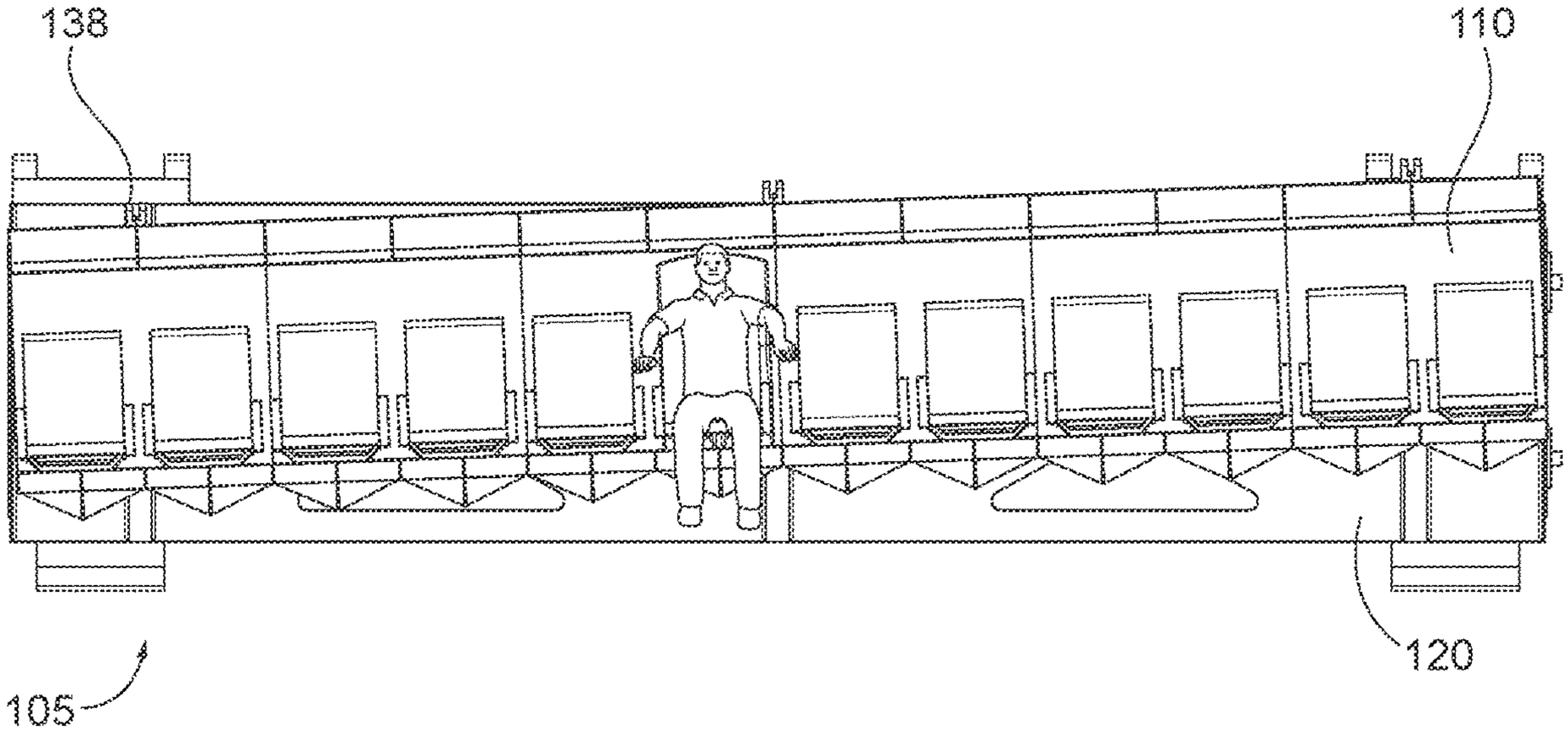


FIG. 5

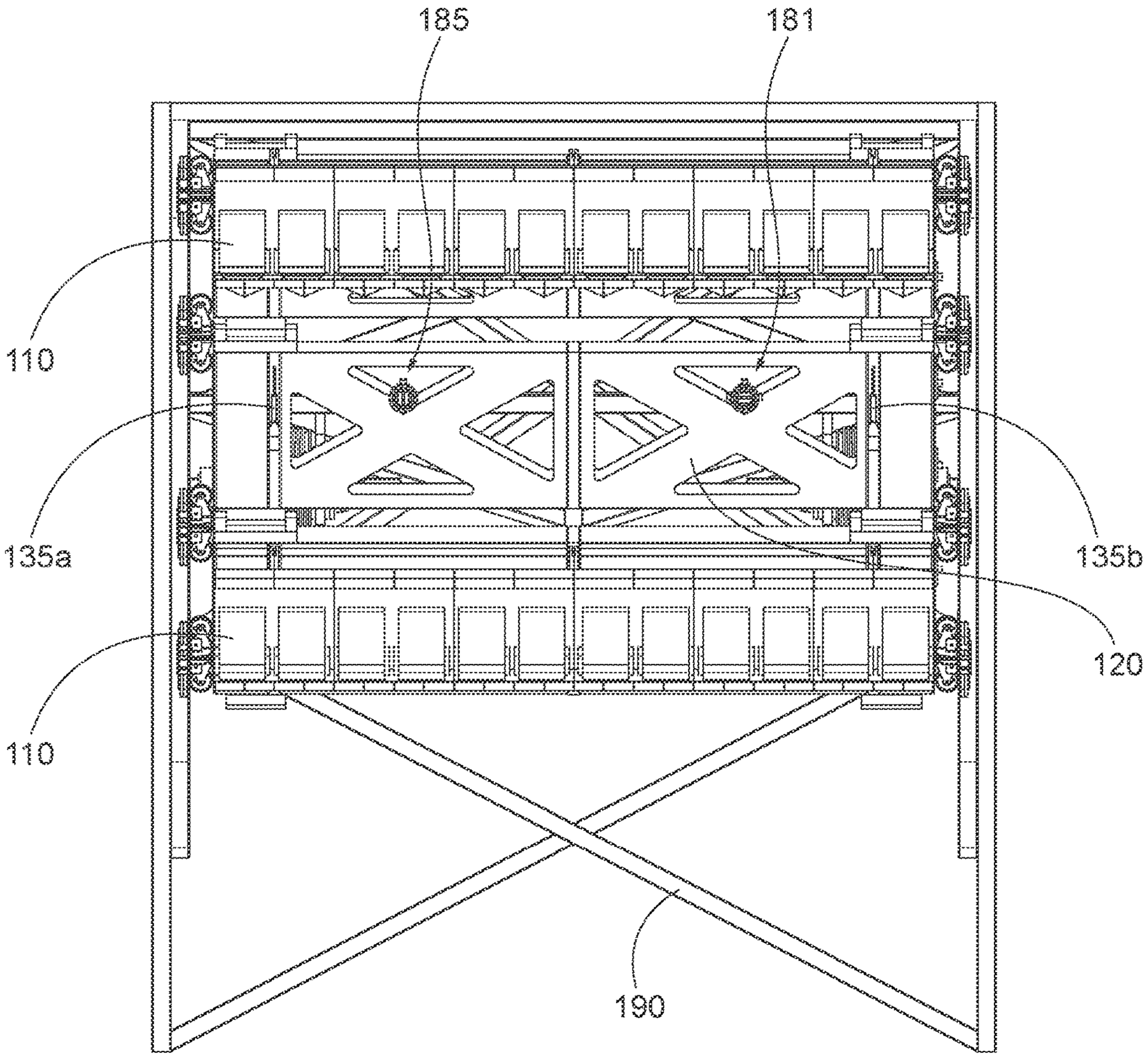


FIG. 6A

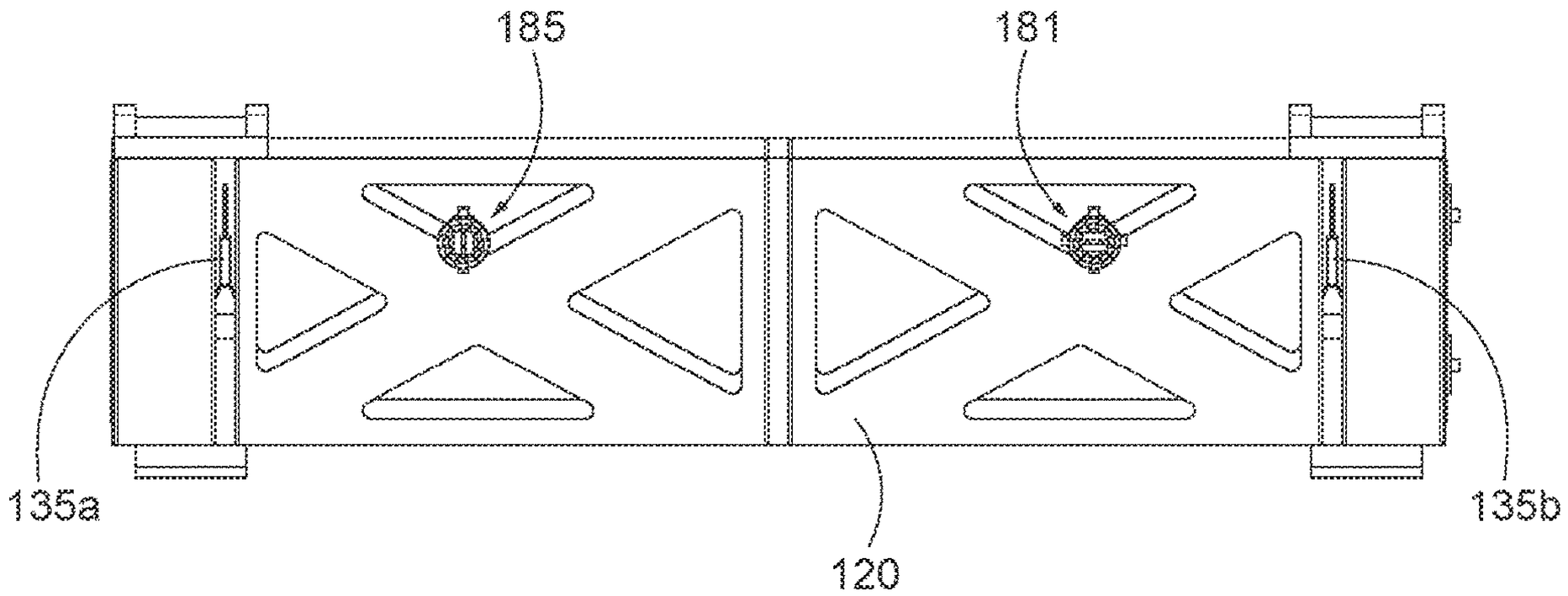


FIG. 6B

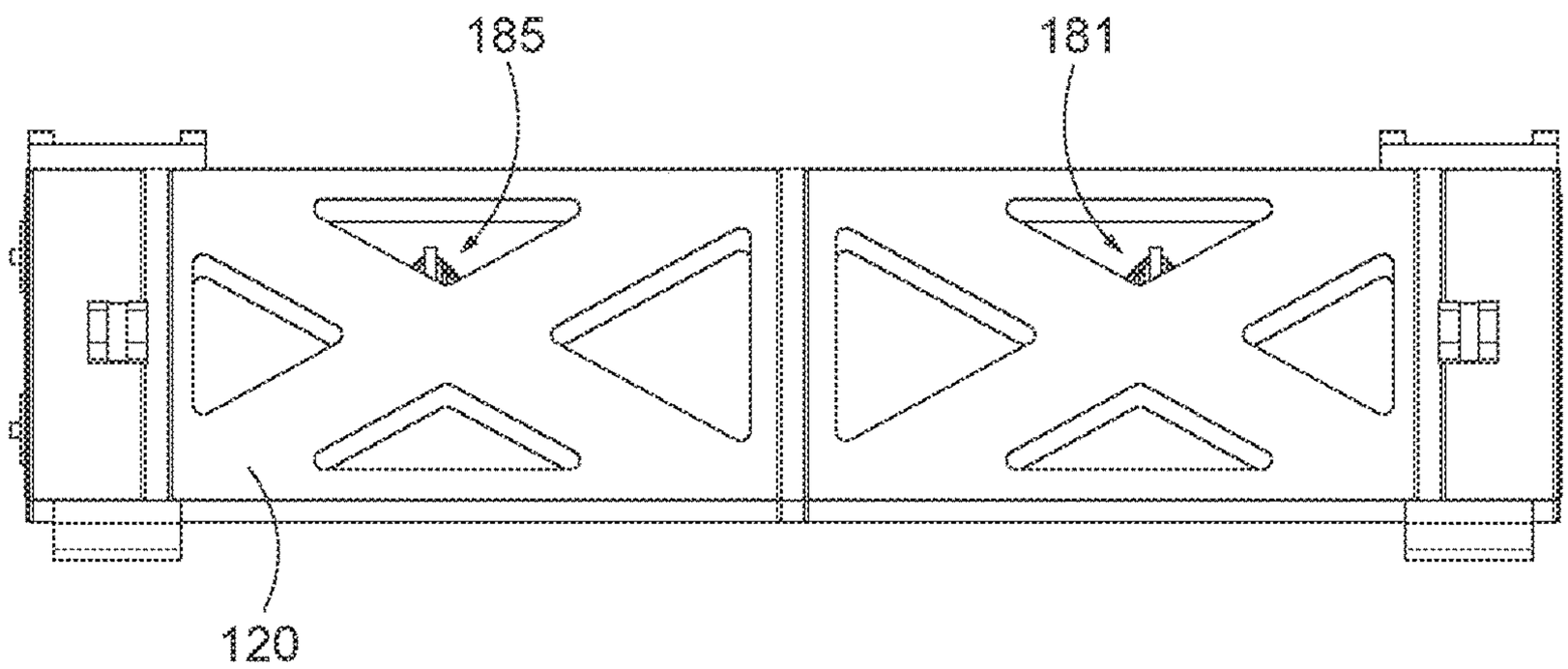


FIG. 6C

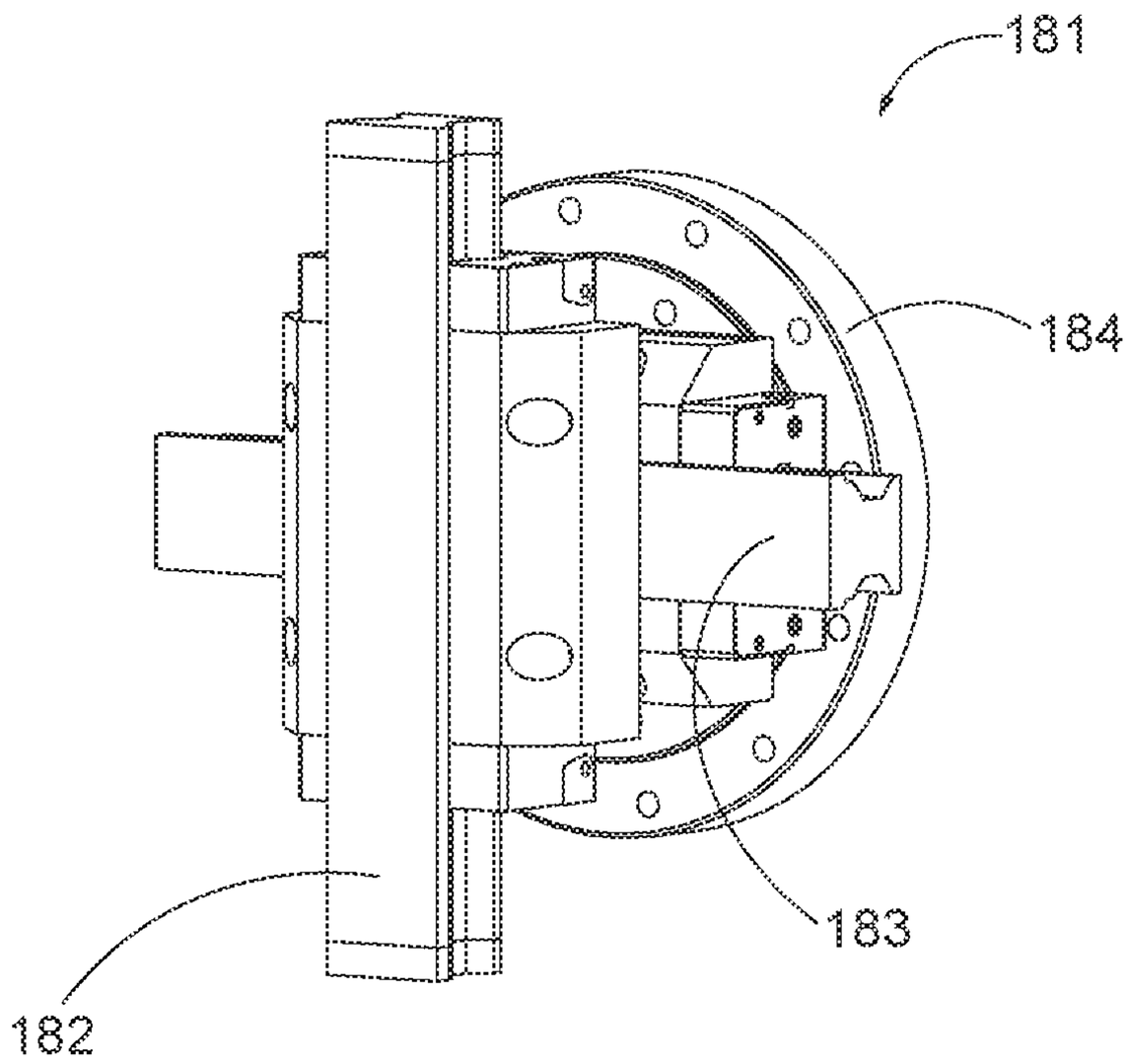


FIG. 6D

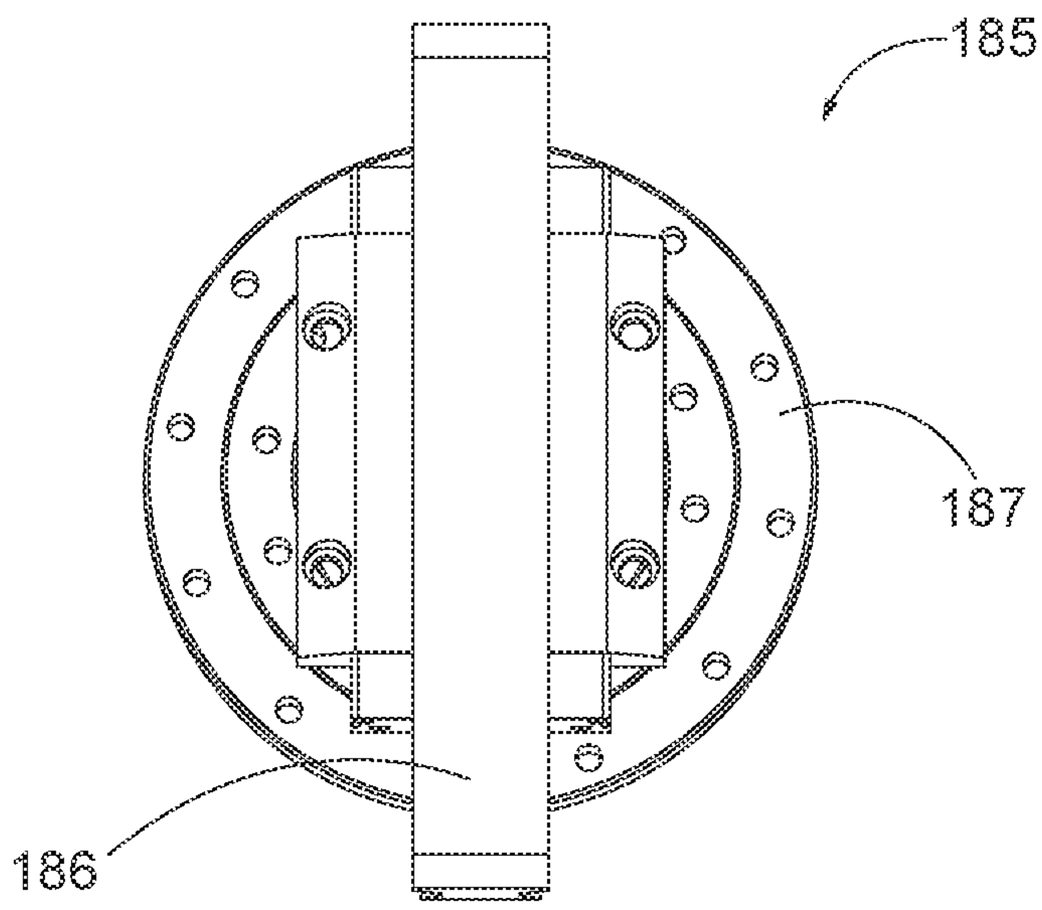


FIG. 6E

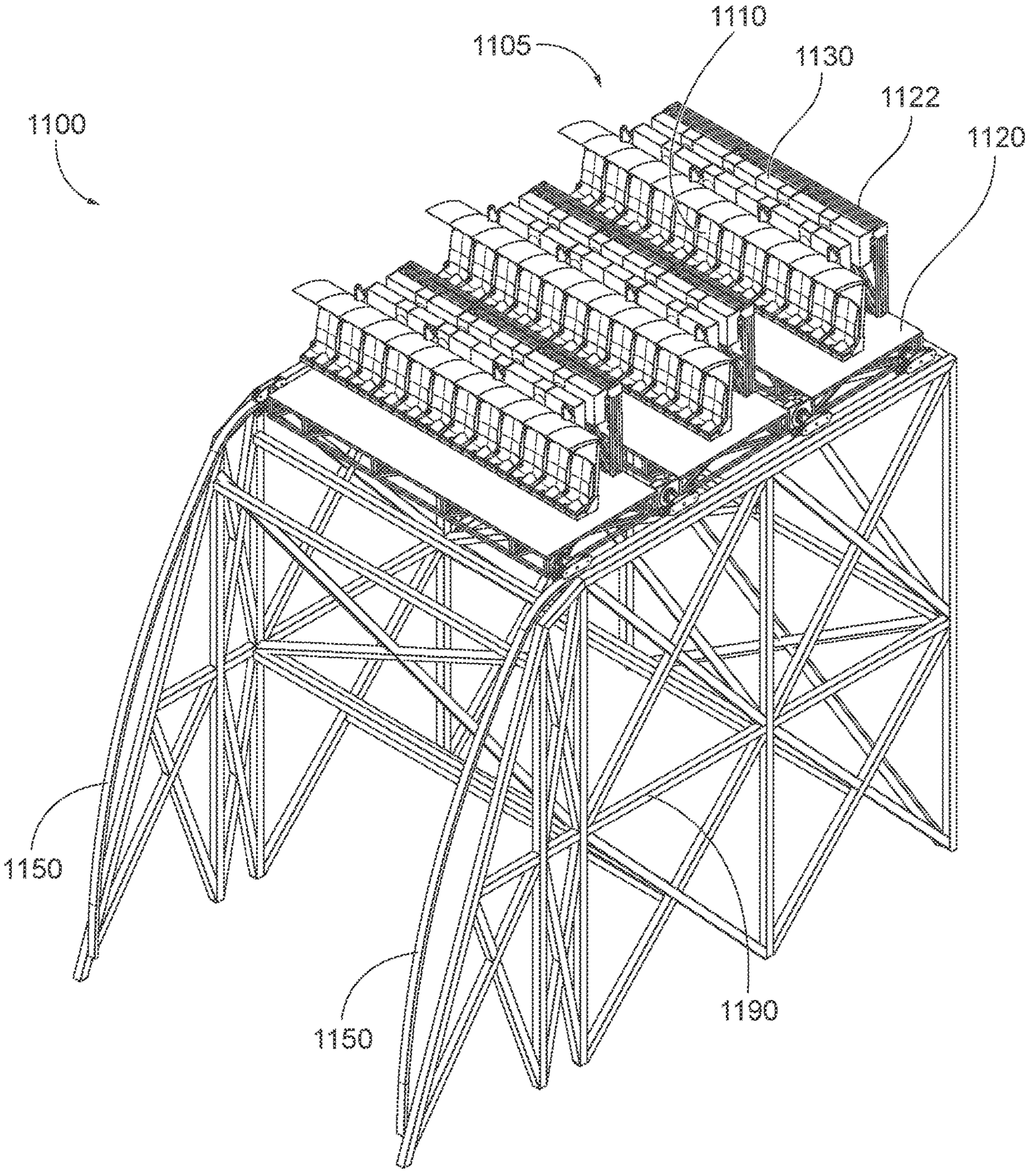


FIG. 7

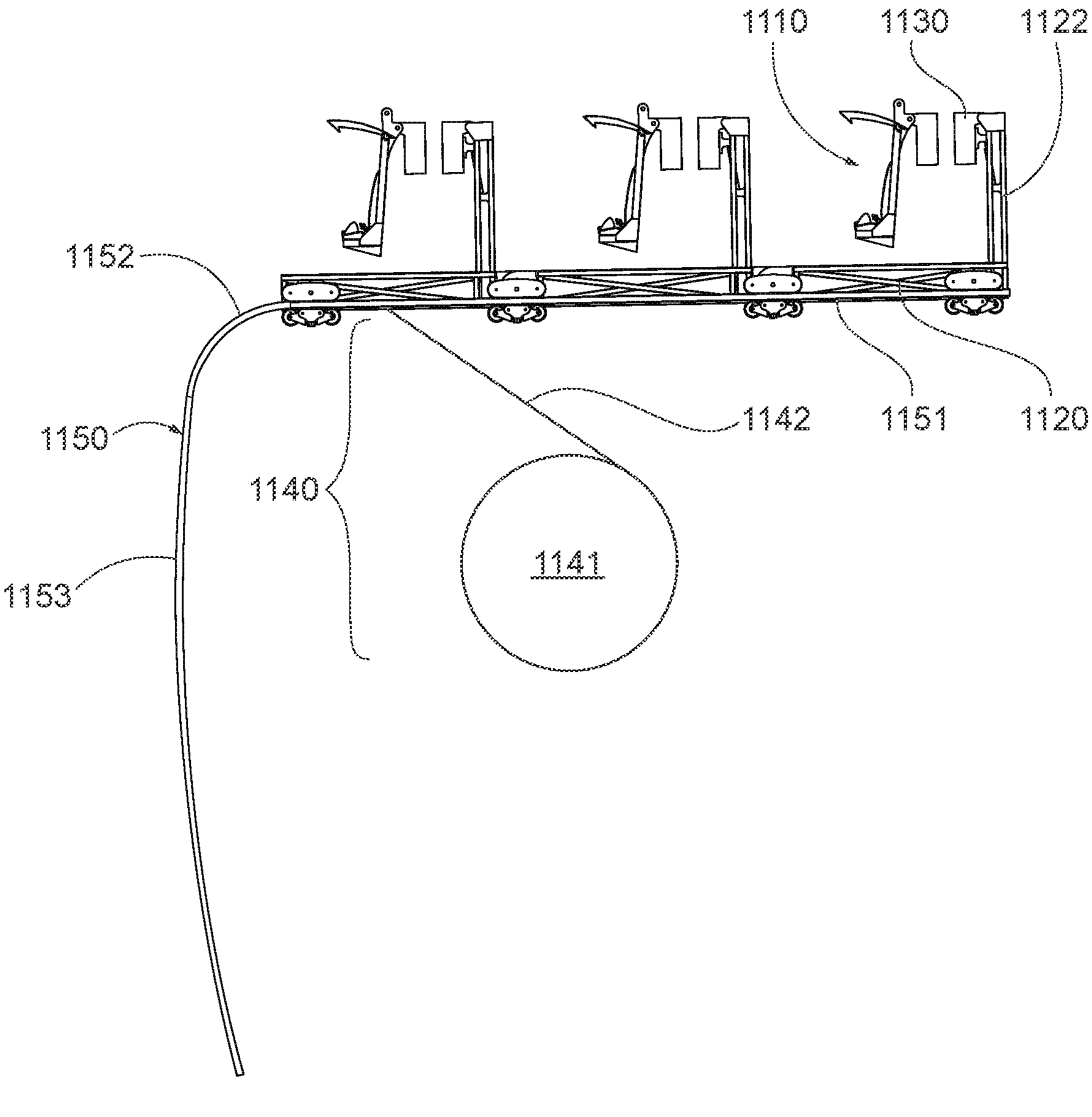


FIG. 8

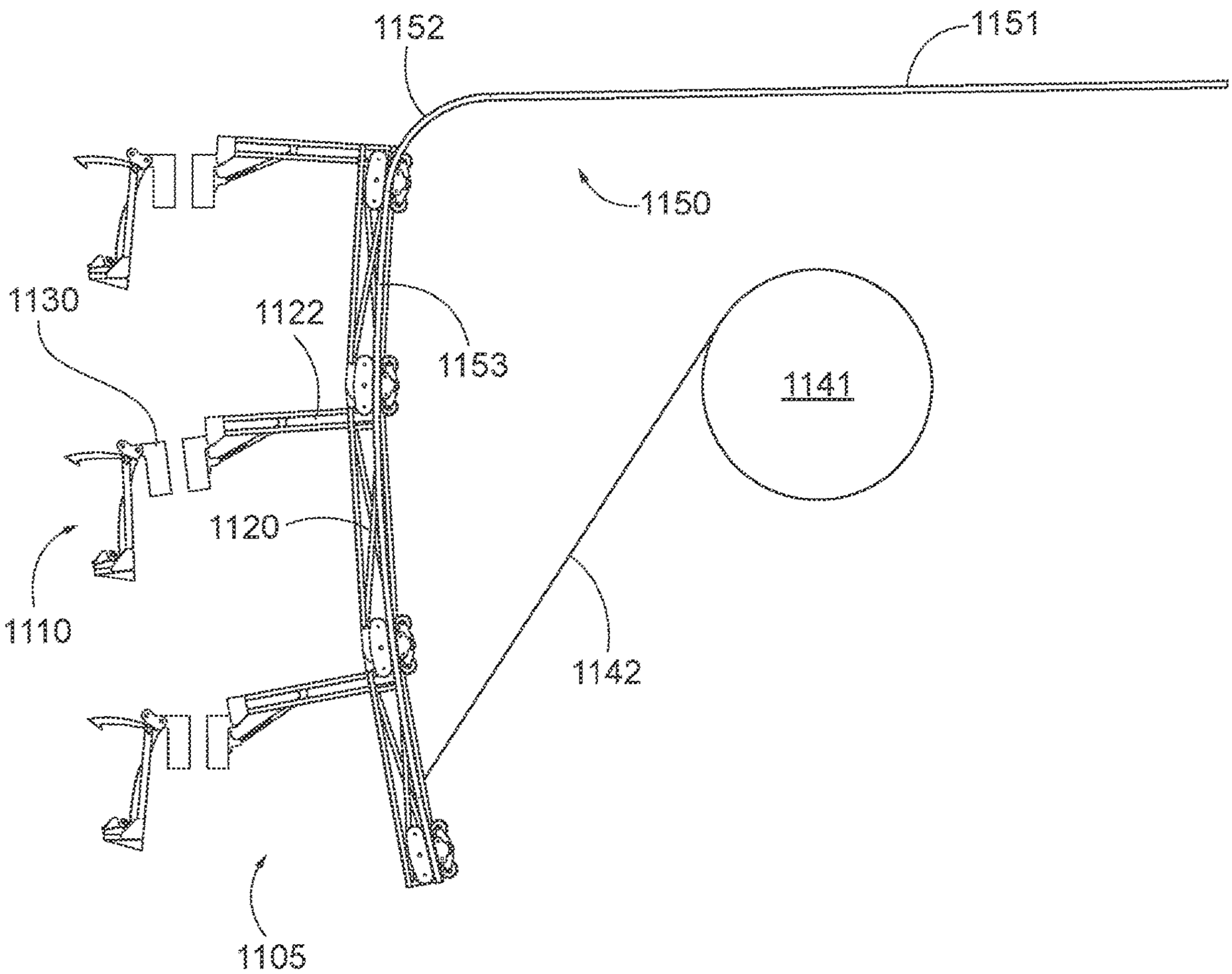


FIG. 9

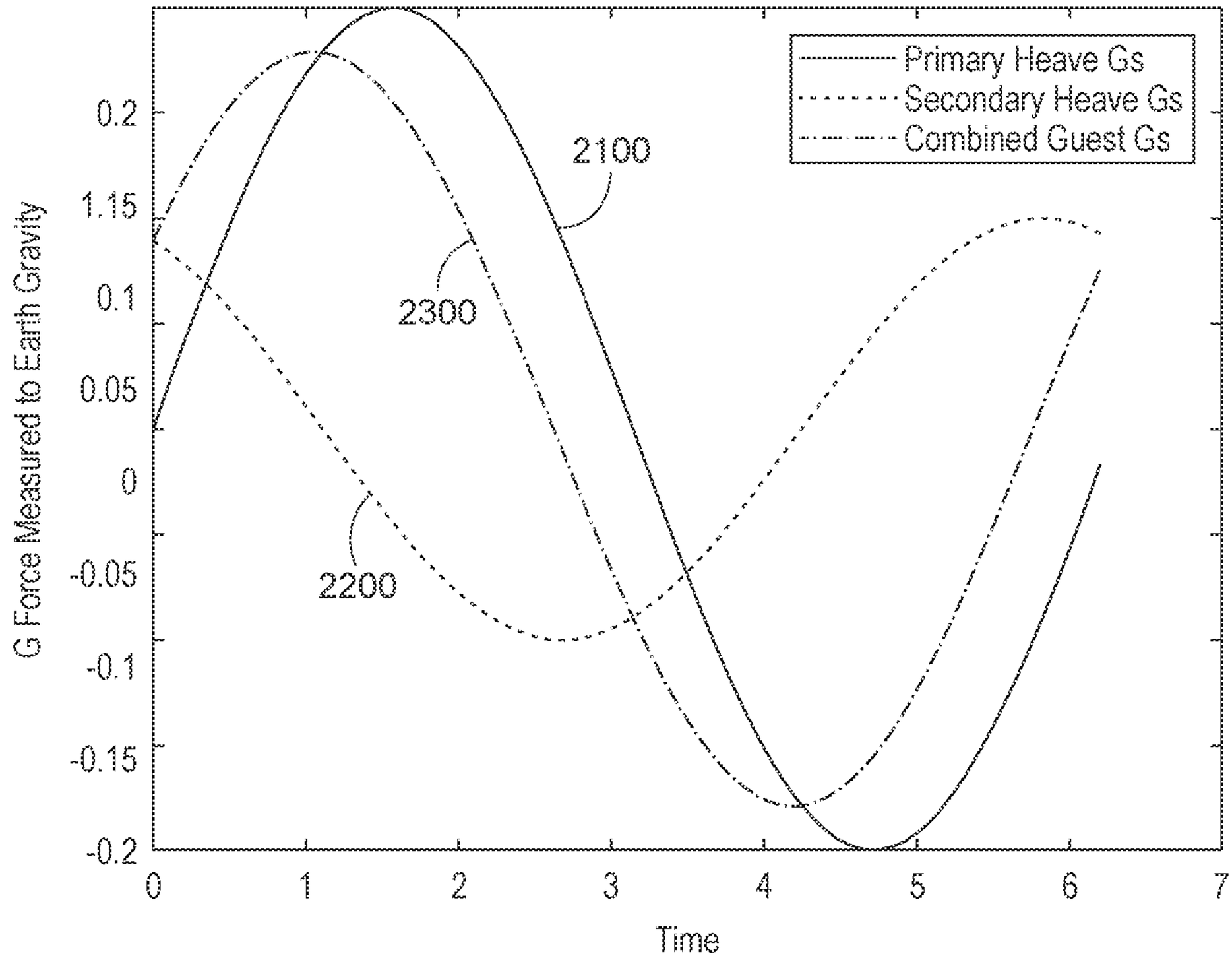

Primary Heave Gs
Secondary Heave Gs
Combined Guest Gs
2100
2300
2200
G Force Measured to Earth Gravity
Time
0.2
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
-0.2
0
1
2
3
4
5
6
7

FIG. 10

FLYING THEATER

BACKGROUND

1. Field of the Invention

[0001] The present invention relates to the field of amusement rides, and particularly the field of flying theatres. Flying theaters are typically comprised of multiple rows of passengers seat, with the rows stacked vertically during the show portion of the ride. The passenger seat rows typically are capable of some degree of vertical movement during the show, to simulate a sensation of flying that coordinates with a video presentation shown to the riders.

[0002] The present invention in particular represents an improvement in flying theatre rides as it provides for additional degrees of movement, lighter weight, and a greater sensation of movement imparted to passengers.

2. Description of the Related Art

[0003] Related art exists in the form of the Soarin' rides operated at Disney theme parks. U.S. Pat. No. 6,354,954 to Sumner, is assigned to Disney Enterprises, Inc., and describes a ride similar to the Soarin' rides. As seen in that patent, the passenger seat rows are attached to a rigid members connected by hinges that move the passenger seat rows in a generally circular path from the loading configuration to show configuration. U.S. Pat. No. 9,254,040 to Foster, et al., describes another flying theater in which the passenger seat rows are suspended from overhead arms or platforms. U.S. Pat. No. 9,463,391 describes yet another flying theater configuration, in which multiple passenger seat rows are mounted on a platform, which serves as a floor during loading; the platform is then pivoted into a vertical position for the show portion of the ride. These and other related inventions all suffer drawbacks, such as limited motion, excess weight, or limited passenger capacity.

BRIEF SUMMARY OF THE INVENTION

[0004] The present invention relates to the field of amusement rides, and particularly the field of flying theatres. Flying theaters are typically comprised of multiple rows of passengers seat, with the rows stacked vertically during the show portion of the ride. The passenger seat rows typically are capable of some degree of vertical movement during the show, to simulate a sensation of flying that coordinates with a video presentation shown to the riders. The present invention in particular represents an improvement in flying theatre rides as it provides for additional degrees of movement, lighter weight, and a greater sensation of movement imparted to passengers.

[0005] Flying theaters often are relegated to a more casual experience, having to increase range of motion to offset low acceleration or vice versa. The present invention aims to provide an experience that can cover all ranges of flying theater needs allowing ride operators to get the most out of the ride.

[0006] The present invention improves on previous flying theaters because it provides guests greater motion, and additional types of motion accomplished in unique ways. The performance parameters of the theater give it the unique ability to not only smoothly replicate the motion of a light flying experience but also simulate motions that are more aggressive than in existing flying theater rides. Guests experience turbulence and more exciting experiences that would otherwise be sacrificed due to limitations in the range of motion or quality of experience of existing rides that would take the rider out of the experience.

[0007] The present invention is intended to replicate the motion of a non-specific flying machine, having the ability to replicate motions that are more aggressive than the traditional floating or gliding experience. The degrees of motion can be broken down into five types: the takeoff and media reveal, primary heave, secondary heave, roll, and finally pitch.

[0008] In one embodiment, the invention comprises one or more rows of passenger seats or cabins, each cabin associated with a carriage and a transport, supported by a superstructure. Each transport has one or more sets of wheel assemblies or bogies adapted to guide the transport (and by extension the carriage, and cabin) along a set of rails. Each rail exhibits a compound curvature along its length and comprises three sections: a loading section, a transition section, and a show section. During loading, the cabins are disposed generally below the superstructure, transport, and carriage in a hanging arrangement. After loading, the transports are moved into the show position through the operation of a set of drums and cables attached to one or more of the transports. As the cables are retracted by the drums, the riders first move forward, then forward and up along a second curvature in the rail, and then finally in a predominantly upward direction along the final portion of the rails. In the vertical or show position, each cabin is capable of being moved up and down (secondary heave), pitching up or down, and rolling.

[0009] In another embodiment, the invention comprises one or more rows of passenger seats or cabins, each cabin associated with a carriage and a transport, supported by a superstructure. Each transport has one or more sets of wheel assemblies or bogies adapted to guide the transport (and by extension the carriage, and cabin) along a set of rails. Each rail exhibits a compound curvature along its length and comprises three sections: a loading section, a transition section, and a show section. During loading, the cabins are disposed generally above the superstructure, transport, and carriage, with the transport and carriage acting as a floor during loading. After loading, the transports are moved into the show position through the operation of a set of drums and cables attached to one or more of the transports. As the cables are released by the drums, the riders first move forward, then forward and down along a second curvature in the rail, and then finally in a predominantly downward direction along the final portion of the rails. In the vertical or show position, each cabin is capable of being moved up and down (secondary heave), pitching up or down, and rolling.

[0010] A person of ordinary skill in the art will understand that the invention is not intended to be limited to the particular embodiments, or components thereof, described herein. These and other embodiments of the present invention will become apparent to those skilled in the art from a consideration of the following detailed description taken in combination with the accompanying drawings and by the elements, features, and combinations particularly pointed out in the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] Example embodiments will be described and explained with additional specify and detail through the use of the accompanying drawings.

[0012] FIG. **1** illustrates a perspective view of a bottom-loading embodiment of the invention, showing the ride during the load and unload stage.

[0013] FIG. **2** illustrates a side view of a bottom-loading embodiment of the invention, with the superstructure removed, showing the ride during the load and unload stage.

[0014] FIG. **3** illustrates a side view of a bottom-loading embodiment of the invention, with the superstructure removed, showing the ride during the show stage.

[0015] FIGS. **4**A through **4**C are side views of the ride vehicle. FIG. **4**A shows the ride vehicle during a secondary heave maneuver; FIG. **4**B shows the ride vehicle during an upward pitch maneuver; FIG. **4**C shows the ride vehicle during a downward pitch maneuver.

[0016] FIG. **5** is a front view of the ride vehicle showing the ride vehicle during a roll maneuver.

[0017] FIGS. **6**A through **6**E illustrate an embodiment of the transport and gimbal system of the invention.

[0018] FIG. **7** shows a perspective view of a top-loading embodiment of the invention.

[0019] FIG. **8** illustrates a side view of a top-loading embodiment of the invention, with the superstructure removed, showing the ride during the load and unload stage.

[0020] FIG. **9** shows a side view of a top-loading embodiment of the invention, with the superstructure removed, showing the ride during the show stage.

[0021] FIG. **10** is a graph showing the G-forces that may be encountered by a rider during the ride.

DETAILED DESCRIPTION OF THE INVENTION

[0022] While certain embodiments have been provided and described herein, it will be readily apparent to those skilled in the art that such embodiments are provided by way of example only. It should be understood that various alternatives to the embodiments described herein may be employed, and are part of the invention described herein.

[0023] The present invention relates to the field of amusement rides, and particularly the field of flying theatres. Flying theaters are typically comprised of multiple rows of passengers seat, with the rows stacked vertically during the show portion of the ride. The passenger seat rows typically are capable of some degree of vertical movement during the show, to simulate a sensation of flying that coordinates with a video presentation shown to the riders. The present invention in particular represents an improvement in flying theatre rides as it provides for additional degrees of movement, lighter weight, and a greater sensation of movement imparted to passengers.

[0024] Flying theaters often are relegated to a more casual experience, having to increase range of motion to offset low acceleration or vice versa. The present invention aims to provide an experience that can cover all ranges of flying theater needs allowing ride operators to get the most out of the ride.

[0025] The present invention improves on previous flying theaters because it provides guests greater motion, and additional types of motion accomplished in unique ways. The performance parameters of the theater give it the unique ability to not only smoothly replicate the motion of a light flying experience but also simulate motions that are more aggressive than in existing flying theater rides. Guests experience turbulence and more exciting experiences that would otherwise be sacrificed due to limitations in the range of motion or quality of experience of existing rides that would take the rider out of the experience.

[0026] The present invention is intended to replicate the motion of a non-specific flying machine, having the ability to replicate motions that are more aggressive than the traditional floating or gliding experience. The degrees of motion can be broken down into five types: the takeoff and media reveal, primary heave, secondary heave, roll, and finally pitch.

[0027] FIG. **1** shows a perspective view of one embodiment of the invention. This embodiment shows the flying theater ride **100** in the bottom-loading configuration. In this embodiment, the flying theater comprises three cabins **110**, with each cabin comprised of multiple seats arranged in a row. When in the loading stage shown in FIG. **1**, each cabin is suspended underneath a corresponding transport **120**, and adjacent to a corresponding carriage **130**. For ease of viewing the features, numbering has been omitted for like items in the Figures. For example, although three cabins **110** are shown in FIGS. **1** and **2**, only one cabin has been called out with a number (**110**) in the drawing. The transport can be considered analogous to a roller coaster car in that the transport that engages with the rails **150** via wheel cartridges or bogies **125** similar to a roller coaster.

[0028] The carriage **130** contains the mechanism that allows the cabin **110** to experience additional types of movement described below. The carriage **130** is movably attached to the transport **120** via two or more support gimbal assemblies that allow the carriage to rotate and slide up, down, and side to side relative to the transport when in the show stage of the ride. The support gimbal assemblies utilize linear slides for guiding of motion, and a turntable style bearing to allow for rotation. In a preferred embodiment, two gimbal assemblies are used. Where two or more gimbal assemblies are used, it is preferred that one of the assemblies does not allow side to side lateral motion in order to constrain the carriage **130** and cabin **110**. The gimbal assembly aspect of the invention is described in more detail with respect to FIG. **6**A through **6**E, below. The carriage is also connected to the cabin **110** such that during roll and secondary heave maneuvers, the carriage **130** and the cabin **110** move in unison. The carriage **130** and cabin **110** are also connected via a pivot in one dimension in order to allow pitch maneuvers, as described below.

[0029] Together, the passenger cabin **110**, transport **120**, and carriage **130** are referred to as the "ride vehicle" **105**.

[0030] A viewing screen (not pictured) is located to the left side of the superstructure **190** in the view shown in FIG. **1**. The viewing screen may be LCD, LED, projection, or any other technology suitable to present images to the riders. Alternatively, the rider may be given a VR headset or similar personal viewing screen on which the visual portion of the ride is presented.

[0031] During the loading stage, the carriage **130** is disposed below each transport **120**. As described below, the carriages **130** include mechanisms that allow the cabin to roll and pitch while in operation. The cabin **110** is attached in a pivotable manner to the carriage **130**. As shown in FIGS.

1 and 2, the pivot allows the cabin 110 to hang down below the carriage 130 and transport 120 during loading.

[0032] In this embodiment, the flying theater 100 has two rails 150 along which the transport 120 moves during operation. The flying theater 100 of this embodiment uses a drum 141 and cable 142 to accomplish movement of the ride vehicle 105. This embodiment in particular uses two drum 141 and cable 142 sets, one located on each side of the flying theater 100. Together, the drum 141 and cable 142 are sometimes referred to as a "heave system" 140. Movement of the ride vehicle 105 along the rails is referred to as "heave." A primary heave is used for major flight motion ranges (e.g., from loading to show positions), while secondary heave can be used in combination with primary heave for additional motion at the ends of the primary heave range or to add smoothness and/or additional accelerations in directional changes for the primary heave. Secondary heave is explained in more detail below. In a preferred embodiment, more than one heave system is used, both for redundancy and for load sharing that will ensure repeatability.

[0033] In an alternative embodiment, the heave system may be comprised of a rack and pinion assembly, a pivoting screw drive system, a linear actuator system, or an actuated linkage system could also be utilized. For example, a motor attached to the wheels of the bogies could work as well as a "pinch drive" where gas springs, coil springs, or compressed rubber pads would be compressed to provide the friction force for the drive wheels to not slip along the path.

[0034] FIG. 2 illustrates a side view of the current embodiment, but with the superstructure removed for ease of understanding the invention. A length of cable 142 is let out or taken in to the drum 141 to move the ride vehicle 105 along the rail 150. The side view more clearly shows the compound curvature of the rail 150. During loading, the transport 120 is located along a substantially horizontal portion 151 of the rail. The cable 142 is attached to an attachment point 160 located on the transport 120. In this embodiment, the cable is attached to the attachment point 160 on the hindmost transport 120.

[0035] When the cable 142 is taken in or wound around the drum 141, the ride vehicle 105 will begin to move with a forward surge along the first rail segment 151, or to the left in the side view of FIG. 2. In a preferred embodiment, the first rail segment 151 is not exactly horizontal, but has a shallow upward angle. This portion of travel is referred to as "takeoff" as it often simulates the rider taking off in an aircraft.

[0036] As the ride vehicle 105 reaches the end of the first segment of the rail 151, it moves into a composite curve, comprising at least a first and second rail segment. As the ride vehicle 105 moves to the second rail segment 152, the ride vehicle 105 will accelerate more rapidly upward. The second rail segment 152 in this embodiment has a greater radius of curvature than the first segment 151, thus simulating an abrupt launch into the air. The portion of travel that takes place along the second rail segment 153 is often referred to as "media reveal" as it is typically during this portion of the ride that the riders are first able to see the images being displayed on the view screen. Movement along the tight radius has the added benefit of providing additional G forces in the cabin seat pan such that when the guest enters the third rail section 153, the guest experiences a sensation of weightlessness.

[0037] As the drum 141 continues to take in the cable 142, the ride vehicle 105 will move to the third rail section 153 that is substantially vertical and has a lesser radius of curvature than the second rail segment 152, as shown in FIG. 3.

[0038] FIG. 3 shows the present embodiment with the ride vehicle 105 in show position on the third rail segment 153. The superstructure is again omitted in this view for ease of understanding. Because the majority of the ride takes place with the cabin in this position on the rail, this is also referred to as "show" position. As the ride vehicle 105 moves along the rail 150 into the show position, the cabin 110 pivots from the previous orientation of being perpendicular to the carriage 130 to being at an angle closer to parallel to the carriage 130.

[0039] With the ride vehicle 105 in show position, the rider can experience three types of movement. One type of movement is "secondary heave," which is vertical movement of the cabin due to the activation of actuators in the carriage and/or from activation of the heave system 140. FIG. 4A shows a side view of the ride vehicle 105 in the position depicted in FIG. 3. The carriage 130 includes a heave actuator 135 that is used to push the carriage 130 vertically, either up or down, and in so doing pushes the attached cabin 110 up and down. In other words, the carriage 130 and the cabin 110 move up and down together during a secondary heave maneuver. The carriage 130 moves up and down in relation to the transport 110 during a secondary heave maneuver.

[0040] Preferably, the carriage will include at least two heave actuators 135 distributed along the length of the carriage 130 to facilitate secondary heave during the ride. The heave system 140 can optionally be engaged in tandem with the heave actuator 135 to increase the travel distance and/or speed of the cabin during the secondary heave motion.

[0041] The secondary heave utilizes two actuators 135 to support the guest compartment as well as provide additional heave with a travel of around 10.13 inches. The maximum speed preferably would not exceed 1 ft/s with a maximum acceleration of 0.1 G. The relatively low G forces experienced by the secondary heave is because the secondary heave is intended to act as a support for providing the sensation of additional range of motion, or smaller bumps for turbulence or similar types of motion encountered.

[0042] Another type of movement capable with the present invention is pitch, illustrated in FIGS. 4B and 4C. Pitch is a cabin movement that points the riders body at an angle from vertical, as shown in the figures. Pitch is a key motion as when combined with heave it allows for diving swooping motions that are commonly thought of when flying. In this embodiment, the carriage 130 includes pitch actuators 136 that are connected to the carriage 130 and to the cabin 110 at a pitch actuator attachment point 138. The cabin 110 is pivotably connected to the carriage 130 at a pivot point 137. The pivot point may extend along the entire width of the cabin, or there may be several pivot points of attachment at various points along the width of the cabin. In FIG. 4B, the pivot actuator is activated, pulling the top of the cabin 110 back toward the transport 120, thereby pitching the cabin 110 and the rider up. In FIG. 4B, the cabin 110 is pitched up by approximately 10 degrees, as compared to the neutral position shown in FIG. 4A. FIG. 4C shows the pitch actuator 136 being activated and pushing the top of the cabin 110

forward, thereby pitching the cabin **110** and the rider down. In FIG. **4**C, the cabin **110** is pitched down by approximately 10 degrees, as compared to the neutral position shown in FIG. **4**A.

[0043] A third type of movement made possible by the invention is roll. FIG. **5** shows a front view of the ride vehicle **105**, showing the roll capability of the invention. The secondary heave doubles as a means of providing roll to the guests where it can be varied along the length of the cabin such that a central point of rotation does not result in one seat having less of an experience than another.

[0044] In FIG. **5**, the cabin **110** is rolling to the right, as experienced from the rider's point of view. Rolling is accomplished by activating the at least two heave actuators **135** in different degrees and/or in different directions. In the roll maneuver shown in FIG. **5**, heave actuator **135***a* (visible in FIG. **6**A) is activated to drop the rider's right side down, while heave actuator **135***b* (visible in FIG. **6**A) is activated to lift the rider's left side up. The cabin **110** is thereby tipped to one side, simulating a roll maneuver.

[0045] In the embodiment shown in FIG. **5**, one heave actuator **135** is lifting one end of the cabin **110**, while another heave actuator **135** is dropping the other end of the cabin **110**. In another aspect of the invention, the roll maneuver may be performed by both heave actuators lifting their respective ends of the cabin **110**, but to different degrees. In this manner, the roll maneuver would be accompanied by a simulated gain in altitude, providing an additional variation for the guest to experience. Likewise, both heave actuators could be activated downward to drop the cabin **110**, but to different degrees, thus simulating a roll and decrease in altitude.

[0046] In alternative embodiments, the ride vehicle **105** may comprise more than two heave actuators. For example, a third actuator may be situated at approximately the lateral midpoint of the ride vehicle **105**, etc. Similar methods could be employed to perform a roll maneuver in this variation. For example, a roll could be effected by having all three actuators lift, but to different degrees. Alternatively, the left side actuator could lift the left end of the cabin, the middle actuator could remain in a neutral position, and the right side actuator could drop the right end of the cabin to simulate a roll toward the right side. A person of skill in the art will understand that various combinations of activation may be effected according to this invention.

[0047] In a preferred embodiment, the range of motion for the roll is slight as the roll is meant to accentuate any rolling camera work in the media being presented to the guests. In a preferred embodiment, the carriage can roll a maximum of +/−2 degrees (roll left and roll right) for a full range of 4 degrees, at a maximum speed of 2 deg/s and a maximum acceleration of 6 deg/sˆ2.

[0048] Having the two free pivot points allows the center of rotation to be moved such that the cabin bench can rotate about a variable location rather than a fixed central pivot point.

[0049] This freedom of motion is important as it enables the ride to simulate an airplane banking maneuvers in which the plane rolls left or right while turning. True banking in an airplane (and in animal movement) involves roll and yaw (rotation about the vertical axis) to accomplish a turn. However, yaw is not an practical form of motion in flying theaters, as it adds to the cost with little additional enjoyment added to the guest experience. Thus, the flying theater makes use of the movements described herein to simulate more motion than is actually occurring.

[0050] In a preferred embodiment the invention makes use of one or more gimbal assemblies to facilitate movement of the cabin. FIG. **6**A is a front view of one embodiment of the invention while in the show position, with the cabin **110** and carriage **130** removed from the illustration of the middle ride vehicle, exposing the transport, gimbal assemblies **181**, **185**, and heave actuators **135***a*, **135***b*.

[0051] FIG. **6**B shows a close-up isolated front view of the exposed transport of FIG. **6**A. Gimbal assemblies **181**, **185** are attached to the transport **120** and to the carriage **130** (not pictured) in this embodiment. Although two gimbal assemblies are shown here, a person of skill in the art will understand that more than two gimbal assemblies may be employed consistent with the object of this invention. In a preferred embodiment, gimbal assemblies will be equally spaced along the length of the transport. As shown in FIG. **6**B, the two gimbal assemblies are not identical; in particular, gimbal assembly **181** has more degrees of motion (up, down, left, right, and rotational) than gimbal assembly **185** (up and down, and rotational only). When more than two gimbal assemblies are used, it is preferred that the gimbal assembly in one of the end-most positions (i.e., farthest to the right or to the left) will be capable of two types of motion (up and down, rotational), while the remaining gimbals will be capable of more types of motion (up and down, left and right, and rotational). The difference in degrees of motion helps to alleviate cabin stress, while also providing for stability, as described below.

[0052] FIG. **6**C shows the back view of the close-up isolated illustration of the transport depicted in FIG. **6**B. In this view, the view of the heave actuators is blocked by the transport **120**, but a portion of the gimbal assemblies **181**, **185** can be seen through the gaps in the transport **120** assembly. The design of the transport **120** body assembly in the figures accompanying this description are meant to be illustrative only, and not limited. That is, the depiction of the transport body assembly as being two side-by-side x-shaped structures is a preferred embodiment only. A person of skill in the art will recognize that alternative designs may be employed within the scope of the invention, such as a grid, mesh, hexagonal, or other structurally sound configuration that provides the requisite strength and weight characteristics.

[0053] FIG. **6**D is a perspective view of the gimbal assembly **181**, as seen from the back side. Gimbal assembly **181** comprises a vertical guide rail **182**, a horizontal guide rail **183**, and a slewing ring **184**. In this embodiment, the carriage would be attached to the gimbal on the slewing ring side, and the transport would be attached to the gimbal on the vertical guide rail side.

[0054] FIG. **6**E is a back view of the gimbal assembly **185**. Gimbal assembly **185** comprises a vertical guide rail **186**, and a slewing ring **187**. In this embodiment, the carriage would be attached to the gimbal on the slewing ring side, and the transport would be attached to the gimbal on the vertical guide rail side.

[0055] Referring again to FIG. **5**, during the roll maneuver, the cabin **110** is rolling to the right, as experienced from the rider's point of view. Rolling is accomplished by activating the at least two heave actuators **135***a*, **135***b* (shown in FIGS. **6**A, **6**B) in different degrees and/or in different directions. In the roll maneuver shown in FIG. **5**, heave

actuator **135***a* (visible in FIG. **6**A) is activated to drop the rider's right side down, while heave actuator **135***b* (visible in FIG. **6**A) is activated to lift the rider's left side up. The cabin **110** is thereby tipped to one side, simulating a roll maneuver. The gimbal assemblies **181**, **185** help to alleviate stress on the ride vehicle during this maneuver.

[0056] As the rider's right side of the cabin **110** dips down during the roll maneuver, the rider's left side rises. A rigid cabin is subjected to stress during this maneuver. By employing the shown gimbal assemblies, the cabin is allowed to slide up and down, assisted by the vertical guide rails **123**, **186**. In order to relieve stress on the cabin during the maneuver, it is necessary to also cause one end of the cabin to move side to side to some degree. That is, at least one end of the cabin is allowed to travel in an arcuate path to relieve stress. This is accomplished by having the cabin attached to the slewing rings **184**, **187** on each gimbal assembly **181**, **185**, and by having a horizontal guide rail on the gimbal assembly **181** on one end. In this embodiment, gimbal assembly **181** with the horizontal guide rail **183** is located on the rider's left side. The terms "vertical guide rail" and "horizontal guide rails" are used because the motion along these rails is predominantly vertical and horizontal, respectively, and because when in the neutral position, the guide rails will be aligned vertically and horizontally, respectively. As described below, during the ride maneuver, the rotation of the gimbal assembly means that travel along the vertical guide rail will also include a small horizontal component and travel along the horizontal guide rail will also include a small vertical component.

[0057] As the rider's left side rises (as shown in FIG. **5**), the slewing rings **184**, **187** rotate, the vertical guide rails **182**, **186** allow the cabin to slide up and down, and the horizontal guide **183** rail allows the rider's left side to slide to the rider's right. In this manner, the roll maneuver can be effectuated without placing undue stress on the ride vehicle **105**,

[0058] The amount of horizontal travel along the horizontal guide rail **183** during a roll maneuver is typically so short that it would be imperceptible to the rider. Because of this it is not necessary to have a horizontal guide rail on the gimbal assembly on each end of the ride vehicle. In a preferred embodiment, the gimbal assembly on one end will not have a horizontal guide rail. By omitting the horizontal guide rail on the gimbal assembly on one end of the ride vehicle, there is an added benefit of security, as it will prevent excess horizontal sliding during the roll maneuver.

[0059] The embodiment described above and shown in FIGS. **1-6** is a preferred embodiment of the present invention. It should be understood that variations on this embodiment are also contemplated. For example, instead of three cabins, the ride may have more or fewer passenger row cabins consistent with this invention. Instead of using wheel cartridges, the invention may make use of a rack and pinion mechanism, railroad-style tracks, or other suitable rails or tracks. The invention may include multiple sets of drum and cable mechanisms, including one set attached to each transport, or the invention may make use of a powered onboard drive system to move the transports. Likewise, the rail itself may take a different shape with different curvatures than that disclosed in the drawings. Additional variations not explicitly set forth herein may be employed without departing from the scope of this invention.

[0060] Another embodiment of the invention is depicted in FIG. **7**. In this embodiment, the ride vehicle **1105** is positioned above the superstructure **1190** during the loading stage. In this top-loading embodiment, the flying theater comprises three cabins **1110**, with each cabin **1110** comprised of multiple seats arranged in a row. When in the loading stage shown in FIG. **7**, each cabin is placed above a corresponding transport **1120**, and adjacent to a corresponding carriage **1130**. Together, the passenger cabin **1110**, transport **1120**, and carriage **1130** are referred to as the "ride vehicle" **1105**. The transport can be considered analogous to a roller coaster car in that the transport that engages with the rails **1150** via wheel cartridges or bogies **1125**. In this top-loading embodiment, the transport **1120** also comprises an upright **1122** extending upward (during loading) from the main body of the transport **1120**.

[0061] A viewing screen (not pictured) is located to the left side of the superstructure **1190** in the view shown in FIG. **7**. The viewing screen may be LCD, LED, projection, or any other technology suitable to present images to the riders. Alternatively, the rider may be given a VR headset or similar personal viewing screen on which the visual portion of the ride is presented.

[0062] During the loading stage, the carriage **1130** is disposed above each transport **1120**. The carriages **1130** include mechanisms that allow the cabin to roll and pitch while in operation. The cabin **1110** is attached in a pivotable manner to the carriage **1130**. FIG. **8** shows the same embodiment during the loading stage from a side view, with the superstructure removed for ease of viewing.

[0063] The pivot allows the cabin **1110** to pivot from a position above the carriage **1130** during loading to a hanging position substantially parallel to the carriage **1130** during the show portion of the ride (see FIG. **9**, below).

[0064] In this embodiment, the flying theater **1100** has two rails **1150** along which the transport **1120** moves during operation. The flying theater **1100** of this embodiment uses a drum **1141** and cable **1142** to accomplish movement of the ride vehicle **1105**, in a similar manner as in FIGS. **1** through **4**. This embodiment in particular uses two drum **1141** and cable **1142** sets, one located on each side of the flying theater **100**. Together, the drum **1141** and cable **1142** are sometimes referred to as a "heave system" **1140**. Movement of the ride vehicle **1105** along the rails is referred to as "heave."

[0065] A length of cable **1142** is let out or taken in to the drum **1141** to move the ride vehicle **1105** along the rail **1150**. The side view more clearly shows the compound curvature of the rail **1150**. During loading, the transport **1120** is located along a substantially horizontal portion **1151** of the rail. The cable **1142** is attached to an attachment point (not shown) located on the transport **1120**. In this embodiment, the cable is attached to an attachment point **1160** on the front transport **1120**.

[0066] When the cable **1142** is let out or unwound around the drum **1141**, the ride vehicle **1105** will begin to move with a forward surge along the first rail segment **1151**, or to the left in the side view of FIG. **8**. In a preferred embodiment, the first rail segment **1151** is not exactly horizontal, but has a shallow downward angle. This portion of travel is referred to as "dive" as it may simulate diving in an aircraft, submarine, etc.

[0067] As the ride vehicle **1105** reaches the end of the first segment of the rail **1151**, it moves into a composite curve, comprising at least a first and second rail segment. As the

ride vehicle **1105** moves to the second rail segment **1152**, the ride vehicle **1105** will accelerate more rapidly downward. The second rail segment **1152** in this embodiment has a greater radius of curvature than the first segment **1151**, thus simulating an abrupt dive. The portion of travel that takes place along the second rail segment **1152** is often referred to as "media reveal" as it is typically during this portion of the ride that the riders are first able to see the images being displayed on the view screen. Movement along the tight radius has the added benefit of simulating a free fall with lessened G forces in the cabin seat pan such that when the guest enters the third rail section **1153** and comes to a stop, the guest experiences increased G forces.

[0068] As the drum **1141** continues to let out the cable **1142**, the ride vehicle **1105** will move to the third rail section **1153** that is substantially vertical and has a lesser radius of curvature than the second rail segment **1152**, as shown in FIG. **9**.

[0069] FIG. **9** shows the present embodiment with the ride vehicle **1105** in show position on the third rail segment **1153**. The superstructure is again omitted in this view for ease of understanding. Because the majority of the ride takes place with the cabin in this position on the rail, this is also referred to as "show" position. As the ride vehicle **1105** moves along the rail **1150** into the show position, the cabin **1110** pivots from the previous (loading) orientation of being perpendicular to the carriage **1120** to being at an angle closer to parallel to the carriage **1120**.

[0070] With the ride vehicle **1105** in show position, the rider can experience three types of movement. One type of movement is "secondary heave," which is vertical movement of the cabin due to the activation of actuators in the carriage and/or from activation of the heave system **1140**. The description of secondary heave and pitch shown in FIGS. **4**A through **4**C and described above also applies to the top-loading embodiment described here. However, in the top-loading embodiment, there would also be the upright **1122** piece (shown in FIGS. **7-9**) that would create separation between the transport **120** (or **1120**) and the carriage **130** (or **1130**). The inclusion of the upright **1122** does not alter in any meaningful way the secondary heave and pitch behavior previously described.

[0071] As with the bottom-loading embodiment shown in FIGS. **1-4**, the top-loading embodiment can also simulate roll movement. The depiction of the roll movement shown in FIG. **5** and the accompanying description are equally applicable to the top-loading embodiment of FIGS. **7-9**.

[0072] In another aspect of the invention, a primary heave is used for major flight motion ranges (e.g., from loading to show positions), while secondary heave can be used in combination with primary heave for additional motion at the ends of the primary heave range or to add smoothness and/or additional accelerations in directional changes for the primary heave. FIG. **10** is a graph showing how the primary heave and secondary heave may act together to add smoothness to the ride. In the scenario plotted in FIG. **10**, the primary heave moves the ride vehicle upward, while the secondary heave moves the ride vehicle downward. Line **2100** shows the G forces of the primary heave, while line **2200** shows the G forces of the secondary heave. Line **2300** shows the combined G forces felt by the guest during the ride.

[0073] In another aspect of the invention, when the ride comes to an end, the ride vehicle **105** is lowered along the guide rails **150** into a series of permanent magnetic brakes (not pictured) such that in the event of a fully catastrophic failure of the heave system **140**, the ride would come to a safe stop.

[0074] Unless the context clearly requires otherwise, throughout the description and the claims, the words "comprise," "comprising," and the like are to be construed in an inclusive sense as opposed to an exclusive or exhaustive sense; that is to say, in a sense of "including, but not limited to." Words using the singular or plural number also include the plural or singular number respectively. Additionally, the words "herein," "hereunder," "above," "below," and words of similar import refer to this application as a whole and not to any particular portions of this application. When the word "or" is used in reference to a list of two or more items, that word covers all of the following interpretations of the word: any of the items in the list, all of the items in the list and any combination of the items in the list.

[0075] The above descriptions of illustrated embodiments of the system, methods, or devices are not intended to be exhaustive or to be limited to the precise form disclosed. While specific embodiments of, and examples for, the system, methods, or devices are described herein for illustrative purposes, various equivalent modifications are possible within the scope of the system, methods, or devices, as those skilled in the relevant art will recognize. The teachings of the system, methods, or devices provided herein can be applied to other processing systems, methods, or devices, not only for the systems, methods, or devices described.

[0076] The elements and acts of the various embodiments described can be combined to provide further embodiments. These and other changes can be made to the system in light of the above detailed description.

[0077] In general, in the following claims, the terms used should not be construed to limit the system, methods, or devices to the specific embodiments disclosed in the specification and the claims, but should be construed to include all processing systems that operate under the claims. Accordingly, the system, methods, and devices are not limited by the disclosure, but instead the scope of the system, methods, or devices are to be determined entirely by the claims.

[0078] While certain aspects of the system, methods, or devices are presented below in certain claim forms, the inventors contemplate the various aspects of the system, methods, or devices in any number of claim forms. Accordingly, the inventors reserve the right to add additional claims after filing the application to pursue such additional claim forms for other aspects of the system, methods, or devices.

[0079] While preferred embodiments of the present invention have been shown and described herein, it will be obvious to those skilled in the art that such embodiments are provided by way of example only. Numerous variations, changes, and substitutions will now occur to those skilled in the art without departing from the invention. It should be understood that various alternatives to the embodiments of the invention described herein may be employed in practicing the invention. It is intended that the following claims define the scope of the invention and that methods and structures within the scope of these claims and their equivalents be covered thereby.

1. (canceled)
2. (canceled)
3. (canceled)

4. (canceled)
5. (canceled)
6. (canceled)
7. (canceled)
8. (canceled)
9. An amusement ride comprising:
a passenger cabin comprising one or more passenger seats;
a carriage comprising one or more secondary heave actuators;
a transport connected to the carriage, wherein the transport comprises one or more wheel assemblies;
wherein the one or more secondary heave actuators are configured to translate the passenger cabin in a vertical direction relative to the transport.

10. The amusement ride of claim **9**, wherein a first secondary heave actuator is offset from a midpoint of the carriage in a first direction, and a second secondary heave actuator is offset from the midpoint of the carriage in a second direction, and wherein the one or more secondary heave actuators are configured to be actuated independently of one another, such that the first secondary heave actuator is capable of translating a first portion of the passenger cabin up and a second secondary heave actuator is configured to translate a second portion of the passenger cabin down.

11. The amusement ride of claim **9**, wherein a first secondary heave actuator is offset from a midpoint of the carriage in a first direction, and a second secondary heave actuator is offset from the midpoint of the carriage in a second direction, and wherein the one or more secondary heave actuators are configured to be actuated independently of one another, such that the first secondary heave actuator is capable of translating a first portion of the passenger cabin up or down and a second secondary heave actuator is configured to translate a second portion of the passenger cabin up or down to a lesser degree than the first secondary heave actuator.

12. The amusement ride of claim **9**, wherein the transport further comprises a plurality of gimbal assemblies spaced along the length of the transport and connected to the carriage.

13. The amusement ride of claim **12**, wherein the plurality of gimbal assemblies consists of a first gimbal assembly capable of allowing the carriage to move vertically, horizontally, and rotationally with respect to the transport, and a second gimbal assembly capable of allowing the carriage to move only vertically and rotationally with respect to the transport.

14. The amusement ride of claim **12**, wherein the plurality of gimbal assemblies comprises two or more first gimbal assemblies capable of allowing the carriage to move vertically, horizontally, and rotationally with respect to the transport, and a second gimbal assembly capable of allowing the carriage to move only vertically and rotationally with respect to the transport, wherein the second gimbal assembly is positioned at an end-most position of the plurality of gimbal assemblies.

15. The amusement ride of claim **9**, wherein the carriage further comprises one or more pitch actuators connected to the passenger cabin and configured to pitch the passenger cabin up or down.

16. An amusement ride comprising:
a passenger cabin comprising one or more passenger seats;
a carriage comprising one or more secondary heave actuators configured to translate the passenger cabin up or down; and
one or more pitch actuators connected to the carriage and passenger cabin and configured to pitch the passenger cabin up or down.

17. The amusement ride of claim **16**, wherein a first secondary heave actuator is offset from a midpoint of the carriage in a first direction, and a second secondary heave actuator is offset from the midpoint of the carriage in a second direction, and wherein the one or more secondary heave actuators are configured to be actuated independently of one another, such that the first secondary heave actuator is capable of translating a first portion of the passenger cabin up and a second secondary heave actuator is configured to translate a second portion of the passenger cabin down.

18. The amusement ride of claim **16**, wherein a first secondary heave actuator is offset from a midpoint of the carriage in a first direction, and a second secondary heave actuator is offset from the midpoint of the carriage in a second direction, and wherein the one or more secondary heave actuators are configured to be actuated independently of one another, such that the first secondary heave actuator is capable of translating a first portion of the passenger cabin up or down and a second secondary heave actuator is configured to translate a second portion of the passenger cabin up or down to a lesser degree than the first secondary heave actuator.

19. An amusement ride comprising:
a superstructure;
one or more rails;
a ride vehicle comprising:
a guest cabin comprising one or more seats;
a carriage connected to the guest cabin;
a transport connected to the carriage, wherein the transport comprises one or more wheel assemblies and wherein the transport is capable of moving along the one or more rails;
a primary heave system capable of moving the ride vehicle along the one or more rails;
wherein, the ride vehicle travels along a substantially horizontal path during a the first portion of the ride, and along a substantially vertical path during a second portion of the ride.

20. The amusement ride of claim **19**, wherein the primary heave system comprises at least one cable having a first and second end attached to the ride vehicle at the first end and to a drum at the second end, whereby when the cable is retracted, the ride vehicle moves upward along the second portion of the ride, and whereby when the cable is let out, the ride vehicle moves downward along the second portion of the ride.

21. The amusement ride of claim **19**, wherein when the ride vehicle is positioned along the second portion of the ride, the primary heave system is capable of causing the ride vehicle to translate vertically along the one or more rails.

22. The amusement ride of claim **19**, wherein the carriage comprises one or more secondary heave actuators configured to translate the carriage in a vertical direction relative to the transport.

23. The amusement ride of claim **22**, wherein a first secondary heave actuator is capable of translating a first

portion of the passenger cabin up and a second secondary heave actuator is configured to translate a second portion of the passenger cabin down.

24. The amusement ride of claim **19**, wherein the transport further comprises a plurality of gimbal assemblies spaced along the length of the transport and connected to the carriage.

25. The amusement ride of claim **24**, wherein the plurality of gimbal assemblies consists of a first gimbal assembly capable of allowing the carriage to move vertically, horizontally, and rotationally with respect to the transport, and a second gimbal assembly capable of allowing the carriage to move only vertically and rotationally with respect to the transport.

26. The amusement ride of claim **24**, wherein the plurality of gimbal assemblies are configured to guide the guest cabin in an arcuate path.

27. The amusement ride of claim **19**, wherein during the first portion of the ride, the guest cabin is suspended beneath the one or more rails.

28. The amusement ride of claim **19**, wherein during the first portion of the ride, the guest cabin is positioned above the one or more rails.

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