ANTI-GRAVITY ATTRACTION SYSTEM WITH LEVER ASSEMBLY

BACKGROUND

[0001] This section is intended to introduce the reader to various aspects of art that may be related to various aspects of the present disclosure, which are described and/or claimed below. This discussion is believed to help provide the reader with background information to facilitate a better understanding of the various aspects of the present disclosure. Accordingly, it is understood that these statements are to be read in this light, and not as admissions of prior art.

[0002] Entertainment venues, such as theme parks or amusement parks, have been created to provide guests with various immersive experiences. Traditional systems and methods for providing such experiences may include various features that impart movement, for example, to a passenger vessel (e.g., operable to receive and transport at least one passenger). It is now recognized that, for various reasons, improved systems and methods for imparting movement are desired. For example, certain traditional ride features for imparting movement may be undesirably perceptible by the passenger(s), which can prevent desired immersion in the environment. Similarly, certain of these features may hinder desirable ride sensations provided to the passenger(s), which also may reduce or negatively affect an immersive experience of the passenger(s). Additionally or alternatively, certain of these features may be expensive, may require complicated and/or time-consuming installation, maintenance, or repair processes, and the like.

BRIEF DESCRIPTION

[0003] Certain embodiments commensurate in scope with the originally claimed subject matter are summarized below. These embodiments are not intended to limit the scope of the disclosure, but rather these embodiments are intended only to provide a brief summary

of certain disclosed embodiments. Indeed, the present disclosure may encompass a variety of forms that may be similar to or different from embodiments set forth below.

[0004] In an embodiment, an attraction system includes an arm having a first end and a second end with a passenger vessel coupled to the first end of the arm. The passenger vessel is configured to receive at least one passenger therein. A fulcrum is engaged with the arm and disposed between the first end of the arm and the second end of the arm. A counterweight is disposed on a segment of the arm between the second end of the arm and the fulcrum, where the counterweight is movable across the segment of the arm. A vehicle is coupled to and/or integrated with the fulcrum, where the vehicle is configured to be moved along a vehicle path.

[0005] In an embodiment, an attraction system includes an arm having a first end and a second end with a passenger vessel coupled to the first end of the arm. The passenger vessel is configured to receive at least one passenger therein. A fulcrum is engaged with the arm and disposed between the first end of the arm and the second end of the arm. An arm path is coupled to the second end of the arm and configured to enable the second end of the arm to move along the arm path. The movement of the second end of the arm along the arm path is configured to impart movement of the passenger vessel opposing the direction.

[0006] In an embodiment, a method of operating an attraction system includes receiving a passenger in a passenger vessel coupled to a first end of an arm. The arm includes a second end opposing the first end, and the arm is engaged with a fulcrum between the first end and the second end. The method also includes controlling a movement of the second end of the arm and, by way of the fulcrum, the first end of the arm. The method also includes controlling an additional movement of a vehicle (e.g., along a vehicle path), where the vehicle is coupled to and/or integrated with the fulcrum.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] These and other features, aspects, and advantages of the present disclosure will become better understood when the following detailed description is read with reference to the accompanying drawings in which like characters represent like parts throughout the drawings, wherein:

[0008] FIG. 1 is a block diagram of an attraction system (e.g., a ride system), the attraction system including, among other features, a lever assembly having an arm, a fulcrum engaged with the arm, a passenger vessel coupled to an end of the arm, and a movement mechanism for controlling a movement of the arm about the fulcrum, in accordance with an aspect of the present disclosure;

[0009] FIG. 2 is a schematic perspective view of the attraction system of FIG. 1, where the movement mechanism includes a counterweight coupled to the arm, and a vehicle of the attraction system is coupled to and/or integrated with the fulcrum and configured to move along a vehicle path, in accordance with an aspect of the present disclosure;

[0010] FIG. 3 is a schematic perspective view of the attraction system of FIG. 1, where the movement mechanism includes an arm path (e.g., arm track or guide) coupled to the arm, the fulcrum is positioned between the passenger vessel and the arm path, and a vehicle of the attraction system is coupled to and/or integrated with the fulcrum and configured to move along a vehicle path, in accordance with an aspect of the present disclosure;

[0011] FIG. 4 is a schematic side view of the attraction system of FIG. 1, where the movement mechanism includes an arm path (e.g., arm track or guide) coupled to the arm, the arm path is spatially aligned with (e.g., extends over a top of) the fulcrum, and a vehicle of the attraction system is coupled to and/or integrated with the fulcrum and configured to move along a vehicle path, in accordance with an aspect of the present disclosure;

[0012] FIG. 5 is schematic perspective view of a portion of an arm path adjustment assembly corresponding to the movement mechanism of the attraction system of FIG. 1,

where the arm path adjustment assembly includes selectable arm paths coupled to a rotatable unit, in accordance with an aspect of the present disclosure;

[0013] FIG. 6 is a schematic top-down view of the attraction system of FIG. 1, where the attraction system includes a carousel configuration, in accordance with an aspect of the present disclosure;

[0014] FIG. 7 is a schematic top-down view of the attraction system of FIG. 1, where the attraction system includes a rotatable carousel configuration, in accordance with an aspect of the present disclosure;

[0015] FIG. 8 is a process flow diagram illustrating a method of operating an attraction system, such as the attraction system of FIG. 1, in accordance with an aspect of the present disclosure;

[0016] FIG. 9 is schematic side view of a portion of the attraction system of FIG. 1, including a lever engagement assembly configured to engage the arm of the lever assembly with the fulcrum of the lever assembly, in accordance with an aspect of the present disclosure; and

[0017] FIG. 10 is a schematic side view of a portion of the attraction system of FIG. 1, including a bogey engagement assembly configured to engage a bogey associated with the arm of the lever assembly with an arm track, in accordance with an aspect of the present disclosure.

DETAILED DESCRIPTION

[0018] One or more specific embodiments will be described below. In an effort to provide a concise description of these embodiments, not all features of an actual implementation are described in the specification. It should be appreciated that in the development of any such actual implementation, as in any engineering or design project, numerous implementation-specific decisions must be made to achieve the developers' specific goals,

such as compliance with system-related and business-related constraints, which may vary from one implementation to another. Moreover, it should be appreciated that such a development effort might be complex and time consuming, but would nevertheless be a routine undertaking of design, fabrication, and manufacture for those of ordinary skill having the benefit of this disclosure.

[0019] When introducing elements of various embodiments of the present disclosure, the articles "a," "an," and "the" are intended to mean that there are one or more of the elements. The terms "comprising," "including," and "having" are intended to be inclusive and mean that there may be additional elements other than the listed elements. Additionally, it should be understood that references to "one embodiment" or "an embodiment" of the present disclosure are not intended to be interpreted as excluding the existence of additional embodiments that also incorporate the recited features.

[0020] The present disclosure relates generally to attraction systems, such as ride systems employed in an amusement park, and more particularly to a lever assembly of the attraction system, where the lever assembly is employed to impart movement to a passenger vessel of the attraction system. Presently disclosed embodiments, which are described in detail below, may be employed in the attraction system to enhance an immersive experience of the passenger(s), for example, by providing a perception of anti-gravity or weightlessness to the passenger(s). Other technical benefits include improved interaction of the passenger(s) of the attraction system and/or other guests (e.g., of the amusement park) with each other, with the attraction system, or with both.

[0021] In accordance with the present disclosure, an attraction system includes a lever assembly having a fulcrum and an arm engaged with (e.g., coupled to or integrated with) the fulcrum. A passenger vessel (e.g., a cabin, a harness, a pod, a frame, a suit) configured to receive one or more passengers may be coupled to the arm. For example, the passenger vessel may be coupled to a first end of the arm. A movement mechanism may be employed at or adjacent to a second end of the arm opposing the first end of the arm. The movement mechanism may cause a movement of the second end of the arm (e.g., in a direction) and,

by way of the fulcrum, an opposing movement of the first end of the arm (e.g., in an opposing direction). The movement mechanism may include, for example, a counterweight disposed on a segment of the arm between the second end of the arm and the fulcrum, where the counterweight is movable along the segment to cause the above-described movement of the second end of the arm and opposing movement of the first end of the arm. For example, movement (e.g., translation) of the counterweight across the segment of the arm may change a weight distribution and/or a center of gravity or mass on the arm relative to a position of the fulcrum, thereby causing the movement of the second end of the arm and the opposing movement of the first end of the arm. In some embodiments, an actuator (e.g., hydraulic actuator, pneumatic actuator, electronic actuator, etc.) may be coupled to the counterweight or otherwise employed to move (e.g., translate) the counterweight along the segment of the arm.

[0022] Additionally or alternatively, the movement mechanism may include, for example, an arm path (e.g., an arm track or guide) coupled to (e.g., slidably engaging, abutting, translationally coupled to) the second end of the arm and along which the second end of the arm travels. In some embodiments, a bogey may be employed to interface the second end of the arm with the arm path. Curvature of the arm path may cause the movement of the second end of the arm and, by way of the fulcrum, the opposing movement of the first end of the arm. In general, the movement mechanism (e.g., counterweight, arm path) may enable the lever assembly to impart an anti-gravity or weightlessness sensation experienced by the passenger(s) in the passenger vessel coupled to the first end of the arm, as described in greater detail with reference to the drawings.

[0023] In some embodiments, a control system including one or more controllers is employed to control movement of the passenger vessel, for example, by controlling the movement mechanism(s) described above. The control system may include a manually operable controller that is used to control, for example, the movement mechanism in real-time during a cycle of the attraction system. In some embodiments, a guest (e.g., of an amusement park employing the attraction system) may handle and operate the manually

operable controller. The guest, for example, may handle and operate the manually operable controller while observing the attraction system in operation. In some embodiments, the passenger(s) disposed in or on the passenger vessel may handle and operate the manually operable controller. Additionally or alternatively, pre-programmed movement mechanism instructions (e.g., pre-programmed counterweight movement instructions) may be entered to the control system, such as to an automation controller, prior to operation (e.g. a cycle) of the attraction system. In some embodiments, movement of the movement mechanism, such as the counterweight or the arm path, may be based on one or more characteristics associated with the attraction system and detected by sensors of the control system. Such characteristic(s) may include a speed or velocity characteristic of the passenger vessel and/or other aspect(s) of the attraction system, an acceleration or deceleration characteristic of the passenger vessel and/or other aspect(s) of the attraction system, a weight characteristic of the passenger vessel, the passenger(s), and/or other aspect(s) of the attraction system, a position characteristic of the passenger vessel, the movement mechanism (e.g., counterweight), and/or other aspect(s) of the attraction system, a position of a center of gravity or mass on the arm (e.g., relative to a position of the fulcrum), or any combination thereof.

[0024] In some embodiments, an aspect of the lever assembly, such as the fulcrum, is coupled to and/or integrated with a vehicle of the attraction system. The vehicle may be movable along a vehicle path (e.g., a vehicle track) such that the lever assembly is moved along the vehicle path (e.g., together with the vehicle) by way of the coupling between (or integration of) the fulcrum and the vehicle. A configuration (e.g., curvature) of the vehicle path may be employed to move the vehicle in various directions, such as a height (e.g., elevation) direction. Additionally or alternatively, the attraction system may include a carousel configuration configured to move the lever assembly (including the passenger vessel coupled to the arm thereof) in a circular direction. In some embodiments, the movement of the vehicle and/or the movement corresponding to the carousel configuration may be coordinated with the movement imparted to the passenger vessel by way of the movement mechanism (e.g., counterweight, arm path). Such movement coordination may

enhance the anti-gravity, weightlessness, and/or other perception(s) or sensation(s) experienced by the passenger(s) in the passenger vessel. These and other aspects of the present disclosure are described in detail below with reference to the drawings.

[0025] Turning now to the drawings, FIG. 1 is a block diagram of an embodiment of an attraction system 10 (e.g., a ride system employed in an amusement park) including a lever assembly 12. The lever assembly 12 in the illustrated embodiment includes an arm 14, a fulcrum 16 engaged with the arm 14, a passenger vessel 18 coupled to an end of the arm 14, and a movement mechanism 20 for controlling a movement of the arm 14 about the fulcrum 16. The movement mechanism 20 may be coupled to the arm 14 at or adjacent to an end of the arm 14 opposite to the passenger vessel 18. That is, the passenger vessel 18 may be coupled to a first end 22 of the arm 14 and the movement mechanism 20 may be coupled to the arm 14 at or adjacent to a second end 24 of the arm 14 (e.g., between the second end 24 of the arm 14 and the fulcrum 16) opposing the first end 22 of the arm 14. As shown, the fulcrum 16 engages the arm 14 between the first end 22 and the second end 24.

[0026] In general, the movement mechanism 20 is configured to cause a movement of the second end 24 of the arm 14 (e.g., in a direction) and, by way of the fulcrum 16, an opposing movement of the first end 22 of the arm 14 and the passenger vessel 18 coupled thereto (e.g., in an opposing direction). As described in detail below, such movement of the arm 14 may impart a feeling of anti-gravity or weightlessness to one or more passengers received by the passenger vessel 18 in certain embodiments and/or operating conditions. As described below and with reference to later drawings, this feeling of anti-gravity or weightlessness (or other perceptions) experienced by the passenger(s) may be enhanced by other aspects (e.g., movement of other parts) of the attraction system 10.

[0027] The passenger vessel 18 may include, for example, one or more ride cabins, harnesses, seats, or the like. In general, the passenger vessel 18 is configured to receive and/or restrain one or more passengers of the attraction system 10. Thus, it should be understood that the passenger vessel 18 is not limited to an enclosed or open-air cabin, but

may include any suitable assembly for restraining and/or containing the passenger(s) during operation (e.g., a cycle) of the attraction system 10. The movement mechanism 20 may include, for example, a counterweight movable (e.g., translatable) along a segment of the arm 14 (or portion thereof) extending from the second end 24 of the arm 14 to the fulcrum 16. In such embodiments, the movement mechanism 20 may include an actuator (e.g., hydraulic actuator, pneumatic actuator, electronic actuator, etc.) configured to move the counterweight along the above-described segment of the arm 14. Other types and/or componentry of the movement mechanism 20 (e.g., an arm track coupled to the second end 24 of the arm 14), which are described in detail below and with reference to later drawings, are also possible in accordance with the present disclosure.

[0028] A control system 26 of the attraction system 10 may be employed to control the movement mechanism 20, such as the counterweight and/or the actuator corresponding to the counterweight, the arm path, etc. As shown, the control system 26 may include one or more controllers 28 having processing circuitry 30, memory circuitry 32, and communication circuitry 34. The memory circuitry 32 is configured to store instructions thereon that, when executed by the processing circuitry 30, cause the processing circuitry 30 to perform various functions. As an example, the processing circuitry 30 may execute instructions stored in the memory circuitry 32 to communicate with (e.g., control) various aspects of the attraction system 10 by way of the communication circuitry 34. The control system 26 may also include one or more sensors 36 configured to detect one or more characteristics associated with the attraction system 10. The characteristic(s) detected by the sensor(s) 36 may include, for example, a speed or velocity characteristic (e.g., of the passenger vessel 18, the movement mechanism 20, a vehicle 38 (e.g., wheeled vehicle) of the attraction system 10 configured to be moved along a vehicle path 44 via a vehicle propulsion and/or braking assembly 42, etc.), an acceleration or deceleration characteristic (e.g., of the passenger vessel 18, the movement mechanism 20, the vehicle 38, etc.), a weight characteristic (e.g., of the passenger vessel 18, the passenger(s) within the passenger vessel 18, etc.), a position characteristic (e.g., of the passenger vessel 18, the movement mechanism 20, the vehicle 38, a center of gravity or mass on the arm 14 relative to, for

example, the fulcrum 16, etc.), a status of the vehicle propulsion and/or braking assembly 42 configured to control movement of the vehicle 38 along the vehicle path 44 (e.g., a track), or some other characteristic(s) associated with the attraction system 10 or an environment 40 in which the attraction system 10 is disposed.

[0029] In certain embodiments, the controller(s) 28 may be configured to control aspects of the attraction system 10 based on sensor feedback from the sensor(s) 36, where the sensor feedback is indicative of any one or any combination of two or more of the characteristics referenced above. As an example, the controller(s) 28 may be configured to control the movement mechanism 20 based on the sensor feedback, the vehicle 38 based on the sensor feedback, or both. In some embodiments, the controller(s) 28 include pre-programmed instructions (e.g., entered thereto prior to a cycle of the attraction system 10) for controlling certain aspects of the attraction system 10, either with or without consideration of the sensor feedback.

[0030] Additionally or alternatively, the controller(s) 28 may include a manually operable controller for controlling certain aspects of the attraction system 10. As an example, a guest (e.g., of an amusement park in which the attraction system 10 is employed) may handle and operate the manually operable controller to control the movement mechanism 20 coupled to the arm 14 and, by extension, movement of the passenger vessel 18 coupled to the arm 14 during operation (e.g., a cycle) of the attraction system 10. That is, the manually operable controller may enable the guest to control movement of the passenger vessel 18 in real-time (e.g., as the guest observes the attraction system 10 and the passenger vessel 18 thereof). Additionally or alternatively, in some embodiments, the manually operable controller may be handled and operated by the passenger(s) of the attraction system 10 (e.g., positioned in the passenger vessel 18), thereby enabling them to control movement of the passenger vessel 18. In this way, the attraction system 10 may enable improved interaction with the attraction system 10 by the passenger(s) participating in the attraction system 10 and/or other guests observing the attraction system 10. In other embodiments, the manually operable controller may be handled and employed by a

different entity (e.g., an operator or attendant of the attraction system 10) to control movement of the movement mechanism 20 coupled to the arm 14 and, thus, the passenger vessel 18 coupled to the arm 14.

[0031] As mentioned above, the attraction system 10 may also include the vehicle 38 configured to be moved along the vehicle path 44, for example, via the vehicle propulsion and/or braking assembly 42. In some embodiments, the vehicle 38 may be coupled to the fulcrum 16 of the lever assembly 12. In this way, as the vehicle 38 is moved along the vehicle path 44, the lever assembly 12 (including the passenger vessel 18) is also moved along the vehicle path 44 together with the vehicle 38. In some embodiments, the controller(s) 28 and corresponding features described above are configured to control movement (e.g., acceleration, deceleration, speed or velocity, directionality, etc.) of the vehicle 38 along the vehicle path 44, for example, by controlling the vehicle propulsion and/or braking assembly 42. In some embodiments, movement of the vehicle 38 along the vehicle path 44 may be coordinated with the movement of the movement mechanism 20 (and, thus, movement imparted to the passenger vessel 18 by way of the lever assembly 12) to provide and/or enhance the anti-gravity, weightlessness, or other sensations or perceptions experienced by the passenger(s) in the passenger vessel 18.

[0032] While much of the discussion above relates to a counterweight corresponding to the movement mechanism 20 (e.g., where the counterweight is movable across a segment of the arm 14 extending between the second end 24 of the arm 14 and the fulcrum 16), in certain embodiments, an arm path (e.g., arm track) may be used as the movement mechanism 20. The counterweight and the arm path are illustrated (and described in greater detail with respect to) later drawings. In embodiments employing the arm path, the second end 24 of the arm 14 may be coupled to (e.g., engaged with, abutting, etc.) the arm path corresponding to the movement mechanism 20. The arm path may include various curvatures followed by the second end 24 of the arm 14 (e.g., as the lever assembly 12 moves along the vehicle path 44 by way of the coupling between the fulcrum 16 and the vehicle 38). As the arm 14 follows the arm path, a movement of the second end 24 and an

opposing movement of the first end 22 enabled by the fulcrum 16 imparts a movement to the passenger vessel 18. Detailed aspects of embodiments including the counterweight corresponding to the movement mechanism 20 and the arm path corresponding to the movement mechanism 20 are illustrated in later drawings and described in detail below. In general, the attraction system 10 of the present disclosure is configured to improve ride sensations (e.g., a feeling of anti-gravity and/or weightlessness) experienced by the passenger(s) situated at or in the passenger vessel 18, among other technical benefits over traditional configurations (e.g., improved interaction with the attraction system 10, reduced ride complexity and cost associated with the attraction system 10, etc.).

[0033] FIG. 2 is a schematic perspective view of an embodiment the attraction system 10 of FIG. 1, where the movement mechanism 20 for controlling the movement of the arm 14 about the fulcrum 16 includes a counterweight 60, and the vehicle 38 of the attraction system 10 is coupled to (and/or forms a part of) the fulcrum 16 of the lever assembly 12 and configured to move along the vehicle path 44. For example, the vehicle 38 may move along the vehicle path 44 in a direction 62. As shown, the vehicle path 44 may include a substantially flat portion 63 (e.g., a portion having substantially constant elevation) and/or one or more variable portions 65 (e.g., one or more portions having variable elevation). Thus, the direction 62 the vehicle 38 travels may be variable through certain portions of the vehicle path 44, as shown. In some embodiments, the vehicle 38 may be capable of traveling in the direction 62 and opposite to the direction 62 (e.g., forwards and backwards).

[0034] By way of a coupling between (or integration of) the vehicle 38 and the fulcrum 16 of the lever assembly 12, the lever assembly 12 (including the arm 14 and the passenger vessel 18 coupled to the first end 22 of the arm 14) also moves along the vehicle path 44 together with the vehicle 38. Movement imparted to the passenger vessel 18 by way of the lever assembly 12, described in detail below, may be coordinated in certain embodiments with movement of the vehicle 38 along the vehicle path 44. Such movement coordination may, in certain embodiments, provide and/or enhance sensations (e.g., anti-gravity

sensations, weightlessness sensations, etc.) experienced by the passenger(s) at the passenger vessel 18.

[0035] As previously described, the counterweight 60 corresponding to the movement mechanism 20 may be moved (e.g., translated) across a segment 64 of the arm 14, where the segment 64 extends between the fulcrum 16 and the second end 24 of the arm 14. As shown, the counterweight 60 may be moved in a first direction 66 and a second direction 68 opposing the first direction 66. An actuator 69 (e.g., hydraulic actuator, pneumatic actuator, electronic actuator, etc.) may be employed to cause the movement of the counterweight 60 in the first direction 66 and the second direction 68. In some embodiments, multiple actuators may be employed (e.g., one for movement of the counterweight 60 in the first direction 66, and another for movement of the counterweight 60 in the second direction 68).

[0036] Movement of the counterweight 60 in the first direction 66 (i.e., toward the second end 24 of the arm 14 and away from the fulcrum 16) may move a center of gravity or mass on the arm 14 toward the second end 24 of the arm 14 and away from the fulcrum 16, which causes the second end 24 of the arm 14 to move in a direction 70 (e.g., downward direction) and, by way of the fulcrum 16, the first end 22 of the arm 14 (along with the passenger vessel 18 coupled thereto) to move in an opposing direction 72 (e.g., upward direction). Further, movement of the counterweight 60 in the second direction 68 (i.e., away the second end 24 of the arm 14 and toward the fulcrum 16) may move a center of gravity or mass on the arm 14 away the second end 24 of the arm 14 and toward the fulcrum 16, which causes the second end 24 of the arm 14 to move in an additional direction 74 (e.g., additional upward direction) and, by way of the fulcrum 16, the first end 22 of the arm 14 (along with the passenger vessel 18 coupled thereto) to move in an additional opposing direction 76 (e.g., additional downward direction). The above-described movement enables a variance of an angle 71 between the arm 14 and the fulcrum 16 (e.g., an axis 73 of the fulcrum 16). For example, in certain embodiments, the angle 71 may be

varied between 1 degree (or greater than 1 degree) and 89 degrees (or less than 89 degrees) during a cycle of the attraction system 10.

[0037] In some embodiments, the passenger vessel 18 includes an interior 77 in which a view within the passenger vessel 18 is partly obstructed. For example, the passenger vessel 18 may include a solid frame 78 with windows 79 formed in a portion thereof, such that the view (e.g., of the external environment 40) from the interior 77 is only unobstructed through the windows 79. As shown, the windows 79 may face away from, for example, the arm 14, the fulcrum 16, and the movement mechanism 20 (e.g., the counterweight 60). In this way, much of the componentry employed for movement of the passenger vessel 18 is hidden from view to the passenger(s) within the interior 77 of the passenger vessel 18. These features may enhance an immersive experience of the passenger(s). Other features described in detail with reference to later drawings may be additionally or alternatively employed to block certain componentry from view.

[0038] FIG. 3 is a schematic perspective view of an embodiment of the attraction system 10 of FIG. 1, where the movement mechanism 20 includes an arm path 80 (e.g., arm track) coupled to (e.g., engaged with) the arm 14. In the illustrated embodiment, the fulcrum 16 extends between the passenger vessel 18 and the arm path 80. Further, the vehicle 38 of the attraction system 10 is coupled to (or is integrated with) the fulcrum 16 of the lever assembly 12 and is configured to move along the vehicle path 44. As previously described, the vehicle path 44 may include the substantially flat portion 63, the variable portion 65, or both. In FIG. 3, the second end 24 of the arm 14 is coupled to (e.g., engaged with) the arm path 80 via a bogey 81 (e.g., wheeled bogey). Other mechanisms for coupling (e.g., engaging) the second end 24 of the arm 14 and the arm path 80 are also possible in accordance with the present disclosure. As the bogey 81 at the second end 24 of the arm 14 moves along (e.g., through) the arm path 80 (e.g., based on movement of the vehicle 38 along the vehicle path 44), the second end 24 of the arm 14 is moved in the direction(s) 70, 74, which imparts movement to the first end 22 of the arm 14 in the opposing direction(s) 72, 76, respectively, by way of the fulcrum 16.

[0039] In some embodiments, the arm 14 is slidably engaged with the fulcrum 16. Accordingly, even if a distance 83 between the arm path 80 and the axis 73 of the fulcrum 16 is substantially constant through a duration of the attraction system 10, the bogey 81 may remain engaged with the arm path 80. Additionally or alternatively, the arm path 80 may include various curvatures that vary the distance 83 between the arm path 80 and the axis 73 of the fulcrum 16 through a duration of the attraction system 10. In this or other ways, as the second end 24 of the arm 14 moves in the direction(s) 70, 74, the bogey 81 may remain engaged with the arm path 80.

[0040] While a configuration of the arm path 80 may be pre-defined, in certain embodiments, the arm path 80 may be controllably moved to a changed position. For example, as shown, the arm path 80 may be coupled to a frame structure 82 (e.g., truss structure), such as to vertical beams 84 of the frame structure 82, via bolts 86 or other coupling mechanisms (e.g., adhesive, welds, etc.). One or more actuators 85 (e.g., motors) may be employed to move the bolts 86 via, for example, belts 88 engaged with the actuators 85 and the bolts 86. In this way, the arm path 80 may be moved to various positions to change the arm path configuration. The above-described features of the arm path 80 and/or movement thereof may be employed to maintain contact between the second end 24 of the arm 14 (e.g., the bogey 81) and the arm path 80 during a cycle of the attraction system 10, to facilitate customizable ride configurations improving an immersive experience of the passenger(s) at the passenger vessel 18, or both.

[0041] FIG. 4 is a schematic side view of an embodiment of the attraction system 10 of FIG. 1, where the movement mechanism 20 includes the arm path 80 (e.g., arm track or guide) coupled to the arm 14. In FIG. 3, the fulcrum 16 is positioned between the arm path 80 and the passenger vessel 18. In FIG. 4, the arm path 80 is spatially aligned with (e.g., extends over a top 89 of) the fulcrum 16. Otherwise, certain aspects of FIG. 3 described above are substantially similar to certain aspects illustrated in FIG. 4. For example, in FIG. 4, the frame structure 82 also included in FIG. 3 may be employed for changing a position

of the arm path 80. Other mechanisms for changing an arm path configuration are also possible and described in greater detail below.

[0042] FIG. 5 is schematic perspective view of a portion of an embodiment of an arm path adjustment assembly 90 corresponding to the movement mechanism 20 of the attraction system 10 of FIG. 1, where the arm path adjustment assembly 90 includes various selectable arm paths 80a, 80b, 80c coupled to a rotatable unit 91, each of the arm paths 80a, 80b, 80c including a different configuration (e.g., different curvatures). As shown, the rotatable unit 91 includes an axis 92 and is configured to rotate (e.g., in a circumferential direction 93) about the axis 92. An actuator 94 (e.g., a motor) may be employed to rotate the rotatable unit 91 about the axis 92. In this way, the first arm path 80a, the second arm path 80b, and the third arm path 80c may be selected for engagement with the second end 24 of the arm 14 (e.g., the bogey 81). By enabling changeable arm path configurations as described above, an immersive experience of passengers may be improved over traditional configurations.

[0043] FIG. 6 is a schematic top-down view of an embodiment of the attraction system 10 of FIG. 1, where the attraction system 10 includes a carousel configuration. In the illustrated embodiment, the carousel configuration includes a curvilinear (e.g., circular) vehicle path 44 along which the vehicle 38 of the attraction system 10 is configured to travel. The lever assembly 12 may operate in the same or similar manner as described above with respect to earlier drawings. Other implementations of the carousel configuration are also possible. For example, FIG. 7 is a schematic top-down view of an embodiment of the attraction system 10 of FIG. 1, where the attraction system 10 includes a rotatable carousel configuration. In FIG. 7, the fulcrum 16 may be formed by a wall 96 (e.g., inner wall) of the attraction system 10 via an opening 95 in the wall 96, where the opening 95 is configured to receive the arm 14. The wall 96 may be rotatable about a central axis 97 and relative to a stationary platform 98 via, for example, an actuator 99 (e.g., a motor). In this way, the wall 96 may itself be referred to as a vehicle, and the circular path along which the wall 96 travels may be referred to as a vehicle path.

[0044] Although not specifically illustrated in FIGS. 2-7, it should be understood that the control system 26 of the attraction system 10 of FIG. 1 may be employed in any of the embodiments illustrated in FIGS. 2-7, as outlined in the discussion of the embodiment of the attraction system 10 of FIG. 1. That is, the control system 28 may be employed for any or all movement of various movable features of the attraction system(s) 10 illustrated in FIGS. 2-7. As previously described, such control via the control system 28 may be pre-programmed, based on sensor data indicative of operating and/or environmental characteristics, based on guest and/or passenger inputs, or any combination thereof.

[0045] FIG. 8 is a process flow diagram illustrating an embodiment of a method 100 of operating an attraction system, such as the attraction system 10 of FIG. 1, employing a lever assembly configured to provide and/or enhance a perception of anti-gravity or weightlessness experienced by one or more passengers. An order of the steps in the method 100 illustrated in FIG. 8 may indicate the sequence of a particular embodiment but should not be taken as implying a sequence of every embodiment of the method 100, as other orders are also possible. Further, in certain embodiments, the method 100 may exclude certain steps illustrated in FIG. 8 and described below, and/or may include other steps not illustrated in FIG. 8 and not described below. FIG. 8 is merely an embodiment of the method 100, although other embodiments of the method 100 in accordance with the present disclosure are also possible.

[0046] As shown, the method 100 includes receiving (block 102) a passenger in the passenger vessel coupled to a first end of an arm, where the arm includes a second end opposing the first end and the arm is engaged with a fulcrum between the first end and the second end. As previously described, the passenger vessel may include one or more ride cabins, harnesses, seats, or the like, and may be configured to receive one or more passengers.

[0047] In the embodiment illustrated in FIG. 8, the method 100 also includes acquiring (block 104) sensor data indicative of one or more operational and/or environmental characteristics. As previously noted, certain steps of the method 100, including block 104,

may be excluded in certain embodiments of the method 100. In embodiments of the method 100 employing block 104, one or more sensors are configured to detect one or more operational and/or environmental characteristics, such as a speed, velocity, acceleration, deceleration, movement direction, or position characteristic (e.g., of the passenger vessel or other aspects of the attraction system described in detail below, such as a movement mechanism employed for controlling movement of the arm, a ride vehicle coupled to the fulcrum, etc.), a weight characteristic (e.g., of the passenger vessel, the passenger(s) within the passenger vessel, etc.), a status of a vehicle propulsion and/or braking assembly, and/or some other characteristic(s) associated with the attraction system or an environment (e.g., temperature, humidity, etc.) in which the attraction system is disposed. Any singular characteristic referenced above, or combination of characteristics referenced above, may be captured in the sensor data. One or more other characteristics included in the sensor data are also possible.

[0048] The method 100 also includes controlling (block 106) the arm (e.g., via a movement mechanism, such as a counterweight or arm path) to cause a movement of the second end of the arm and, by way of the fulcrum, an opposing movement of the first end of the arm. As previously described, controlling the arm may include controlling movement (e.g., translation) of a counterweight across a segment of the arm extending between the fulcrum and the second end of the arm, or movement of some other type of movement mechanism (e.g., arm track). In some embodiments, an actuator (e.g., hydraulic actuator, pneumatic actuator, electronic actuator, etc.) is controlled to cause the movement (e.g., translation) of the counterweight across the segment of the arm. The actuator may be controlled, for example, by a control system (e.g., one or more controllers) in real-time and/or based on pre-programmed counterweight movement instructions. In some embodiments, the control system includes a manually operable controller handled and operated by a person (e.g., a guest of an amusement park employing the attraction system, one of the passengers of the attraction system, an attraction system operator or attendant, etc.) as a cycle of the attraction system is administered. In other embodiments, an automation controller may be employed to control the movement of the counterweight based on pre-programmed instructions

and/or based on the sensor data described above with respect to block 104. In embodiments not employing the counterweight described above, an arm path (e.g., arm track) coupled to the second end of the arm may be employed for controlling the arm to cause the movement of the second end of the arm and, by way of the fulcrum, the opposing movement of the first end of the arm. While the arm path may include a pre-defined configuration, in some embodiments, the arm path configuration also may be controlled by the control system.

[0049] The method 100 also includes controlling (block 108) a movement of a vehicle along a vehicle path, where the vehicle is coupled to the fulcrum. By coupling the vehicle to the fulcrum, movement of the vehicle along the vehicle path may also cause corresponding movement of the lever assembly (e.g., including at least the fulcrum coupled to the vehicle, the arm engaged with the fulcrum, and the passenger vessel). In embodiments employing the arm path (e.g., arm track) referenced above with respect to block 106, movement of the vehicle along the vehicle path may also cause movement of the second end of the arm along the arm path. However, it should be understood that the vehicle and vehicle path can also be employed in embodiments having the counterweight and not the arm path. In some embodiments, movement of the vehicle along the vehicle path may be controlled by the control system described above. Further, in some embodiments, movement of the vehicle along the vehicle path and movement of the arm (e.g., via the counterweight and/or the arm path) may be coordinated to enhance a perception of anti-gravity or weightlessness experienced by the passenger(s) in or at the passenger vessel.

[0050] FIG. 9 is schematic side view of an embodiment of a portion of the attraction system 10 of FIG. 1, including a lever engagement assembly 149 configured to facilitate engagement of the arm 14 of the lever assembly 12 with the fulcrum 16 of the lever assembly 12. As shown, the fulcrum 16 includes an opening 150 configured to receive the arm 14. The opening 150 is sized to accommodate movement (e.g., rotational movement) of the arm 14 therein without undesirable interference of the arm 14 with the fulcrum 16. In some embodiments, a pin 152 coupled to or otherwise engaged with the fulcrum 16 (e.g.,

on either side of the arm 14) extends through a pin opening in the arm 14, thereby coupling the arm 14 with the fulcrum 16. The pin 152 may be coupled to the fulcrum 16 via a slot 154 in the fulcrum 16. In some embodiments, the fulcrum 16 includes an additional instance of the slot 154 on the opposing side of the arm 14 (not illustrated due to perspective in FIG. 9). The slot 154 enables a movement 156 of the pin 152 therein (e.g., up to an end 157 of the slot 154) and an opposing movement 158 of the pin 152 therein (e.g., up to an opposing end 159 of the slot 154). Because the pin 152 extends through the arm 14, as previously described, the movement 156 and the opposing movement 158 of the pin 152 within the slot 154 also enables translation of the arm 14 along with the pin 152, in addition to rotation of the arm 14 (e.g., about an axis of the pin 152) as previously described. FIG. 9 is merely one embodiment of the engagement assembly 149, and it should be understood that other embodiments of the engagement assembly 149 that enable at least some rotation and at least some translation of the arm 14 are also possible.

[0051] FIG. 10 is a schematic side view of an embodiment of a portion of the attraction system 10 of FIG. 1, including a bogey engagement assembly 170 configured to engage the bogey 81 (e.g., illustrated in FIGS. 3 and 4) associated with the arm 14 of the lever assembly 12 with the arm path 80. As shown, the bogey 81 includes wheels 172 extending into a slot 174 formed in the arm path 80 The attraction system 10 may be configured such that the bogey assembly 81 exerts (e.g., always exerts) an upward force 176 against the arm path 80 and within the slot 174 of the arm path 80. In this way, contact between the wheels 172 of the bogey 81 and the arm path 80 is maintained through a duration (e.g., cycle) of the attraction system 10.

[0052] In general, embodiments described above are directed to attraction systems (e.g., ride systems, such as those employed in an amusement park) configured to provide and/or enhance a perception of anti-gravity or weightlessness experienced by passengers of the attraction system at a relatively low cost. Other technical benefits include improved interaction between passengers of the attraction system and/or between a passenger of the attraction system and a guest observing the attraction system.

[0053] While only certain features have been illustrated and described herein, many modifications and changes will occur to those skilled in the art. It is, therefore, to be understood that the appended claims are intended to cover all such modifications and changes as fall within the true spirit of the present disclosure.

[0054] The techniques presented and claimed herein are referenced and applied to material objects and concrete examples of a practical nature that demonstrably improve the present technical field and, as such, are not abstract, intangible or purely theoretical. Further, if any claims appended to the end of this specification contain one or more elements designated as "means for [perform]ing [a function]..." or "step for [perform]ing [a function]...", it is intended that such elements are to be interpreted under 35 U.S.C. 112(f). However, for any claims containing elements designated in any other manner, it is intended that such elements are not to be interpreted under 35 U.S.C. 112(f).

CLAIMS:

1. An attraction system, comprising:

an arm having a first end and a second end;

a passenger vessel coupled to the first end of the arm and configured to receive at least one passenger;

a fulcrum engaged with the arm and disposed between the first end of the arm and the second end of the arm;

a counterweight disposed on a segment of the arm between the second end of the arm and the fulcrum, wherein the counterweight is movable across the segment of the arm; and

a vehicle coupled to or integrated with the fulcrum, wherein the vehicle is configured to be moved along a vehicle path.

2. The attraction system of claim 1, comprising a control system configured to control a movement of the counterweight across the segment of the arm.

3. The attraction system of claim 2, wherein the control system comprises a manually operable controller such that the movement of the counterweight across the segment of the arm is controllable in real-time during a cycle of the attraction system.

4. The attraction system of claim 2, wherein the movement of the counterweight across the segment of the arm is pre-programmed to the control system prior to starting a cycle of the attraction system.

5. The attraction system of claim 2, wherein the control system is configured to control the movement of the counterweight across the segment of the arm based on:

a speed or velocity characteristic of the passenger vessel;

an acceleration or deceleration characteristic of the passenger vessel;

a weight characteristic of the passenger vessel, the at least one passenger, or a combination thereof;

a passenger vessel position characteristic; or

a counterweight position characteristic.

6. The attraction system of claim 1, comprising a track corresponding to the vehicle path.

7. The attraction system of claim 1, comprising a carousel configuration.

8. The attraction system of claim 1, comprising an actuator configured to move the counterweight across the segment of the arm, wherein the actuator comprises a hydraulic actuator, a pneumatic actuator, an electronic actuator, or any combination thereof.

9. An attraction system, comprising:

an arm having a first end and a second end;

a passenger vessel coupled to the first end of the arm and configured to receive at least one passenger;

a fulcrum engaged with the arm and disposed between the first end of the arm and the second end of the arm; and

an arm path coupled to the second end of the arm and configured to enable the second end of the arm to move along the arm path, wherein movement of the second end of the arm path along the arm path is configured to impart movement to the first end of the arm and the passenger vessel.

10. The attraction system of claim 9, wherein the fulcrum is coupled to or integrated with a vehicle.

11. The attraction system of claim 10, comprising a vehicle path along which the vehicle is configured to be moved.

12. The attraction system of claim 9, comprising a carousel configuration.

13. The attraction system of claim 9, wherein the second end of the arm is coupled to the arm path via a bogey.

14. The attraction system of claim 9, comprising an arm path adjustment assembly, the arm path adjustment assembly comprising:

a rotatable unit;

the arm path coupled to the rotatable unit; and

an additional arm path coupled to the rotatable unit, wherein the rotatable unit is configured to be rotated to enable selective engagement of the second end of the arm with the arm path and the additional arm path.

15. The attraction system of claim 9, comprising:

a frame structure engaged with the arm path; and

one or more actuators configured to move the arm path from a first position relative to the frame structure to a second position relative to the frame structure.

16. A method of operating an attraction system, the method comprising:

receiving a passenger in a passenger vessel coupled to a first end of an arm, wherein the arm comprises a second end opposing the first end, and the arm is engaged with a fulcrum between the first end and the second end;

controlling a movement of the second end of the arm and, by way of the fulcrum, the first end of the arm; and

controlling an additional movement of a vehicle coupled to or integrated with the fulcrum.

17. The method of claim 16, comprising controlling the movement of the second end of the arm by controlling translation of a counterweight across a segment of the arm extending between the second end of the arm and the fulcrum.

18. The method of claim 17, comprising controlling the translation of the counterweight across the segment of the arm in real-time via a manually operable controller during a cycle of the attraction system.

19. The method of claim 17, comprising controlling the translation of the counterweight across the segment of the arm via a controller configured to receive pre-programmed counterweight movement instructions prior to a cycle of the attraction system.

20. The method of claim 16, comprising controlling the movement of the second end of the arm via an arm path coupled to the second end of the arm and configured to guide the movement of the second end of the arm.