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Restraint Systems and Restraint System Methods

Abstract

Passenger restraint systems are provided. The restraint systems can include: a passenger seat supported by a frame; a restraint bar pivotably attached to the frame; and at least one piston operably engaged between the restraint bar and the frame. Restraint system pistons are provided. The pistons can include: a central chamber housing a piston head and rod; a fluid reservoir in fluid communication with the central chamber; and at least one electromechanical valve operable between an open and a closed position. Methods for restraining a passenger within a seat are also provided.

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Background/Summary

CROSS REFERENCE TO RELATED APPLICATION [0001] This application is a divisional of U.S. patent application Ser. No. 18/228,657 which was filed Jul. 31, 2023, which is a divisional of U.S. patent application Ser. No. 17/318,970 which was filed May 12, 2021, now U.S. Pat. No. 11,731,574 issued Aug. 22, 2023, which is a divisional of U.S. patent application Ser. No. 15/916,094 which was filed Mar. 8, 2018, now U.S. Pat. No. 11,007,960 issued May 18, 2021, which claims priority to and the benefit of U.S. provisional patent application Ser. No. 62/485,169 which was filed Apr. 13, 2017, entitled “Restraint Systems and Restraint System Methods”, the entirety of each of which is incorporated by reference herein.

TECHNICAL FIELD
[0002] The present disclosure relates to restraint systems and restraint system methods. In accordance with example implementations, these systems and methods can be utilized in connection with amusement park rides for example. Accordingly, example amusement park rides can include lap restraints that are operatively coupled to the frame of a car of the ride with a locking cylinder of the present disclosure as well as the locking cylinder in associated monitoring systems of the present disclosure.
BACKGROUND
[0003] Restraint systems are becoming increasingly important in amusement rides throughout the country. These restraint systems provide a rider with safety while experiencing varying G-forces about a ride for entertainment purposes. Previously, these restraint systems have taken the form of lap bars that can be pulled into place upon seating of the rider, and then engaged to remain in that place throughout the ride, and then released from that position upon ride completion. Accordingly, typical rides will require a rider to sit in place, pull the lap restraint toward the lap of the rider, and then prior to the ride commencing, a separate attendant will manually walk by each rider and pull the restraint away from the lap, and if the restraint does not move, then that seat is ready to be ridden in. The systems and methods of the present disclosure overcome the shortcomings of these prior art systems.
SUMMARY
[0004] Passenger restraint systems are provided. The restraint systems can include: a passenger seat supported by a frame; a restraint bar pivotably attached to the frame; and at least one piston operably engaged between the restraint bar and the frame, the piston moveable between a first position engaging the passenger in the seat and a second position disengaged from the passenger in the seat, wherein the piston comprises a cylinder head housing a pair of check valves.
[0005] Amusement ride passenger restraint systems are provided. The systems can include: a passenger seat attached to an amusement ride cart support frame; a restraint bar operable between a first position engaged with the passenger and second position disengaged with the passenger; and at least one piston operably engaged between the restraint bar and the cart support frame, the piston moveable between a first position engaging the passenger in the seat and a second position disengaged from the passenger in the seat, wherein the piston comprises at least one electromechanical valve operable between an open and a closed position.

[0006] Restraint system pistons are provided. The pistons can include: a central chamber housing a piston head and rod; a fluid reservoir in fluid communication with the central chamber; and at least one electromechanical valve operable between an open and a closed position.
[0007] Methods for restraining a passenger within a seat are also provided. The methods can include: moving a restraint bar in one direction from a disengaged position to an engaged position to restrain a passenger, the restraint bar being unable to proceed opposite the one direction when engaged; and moving the restraint bar opposite the one direction from an engaged position to a disengaged position after opening a valve in a piston operably coupled to the restraint bar.

Description

DRAWINGS
[0008] Embodiments of the disclosure are described below with reference to the following accompanying drawings.
[0009] FIGS. **1-4** depict example views of a passenger restraint system according to embodiments of the disclosure.
[0010] FIGS. **5-11** depict example views of a restraint system piston according to embodiments of the disclosure.
[0011] FIGS. **12-15** depict additional example views of the restraint system piston of FIGS. **5-11** according to embodiments of the disclosure.
[0012] FIGS. **16-18** depict example views of a piston head and rod assembly of the restraint system pistons according to embodiments of the disclosure.
[0013] FIGS. **19-20** depict disassembled views of the piston head and rod assembly of FIGS. **16-18** according to embodiments of the disclosure.
[0014] FIGS. **21-23** depict views of an electromechanical valve assembly according to embodiments of the disclosure.
DESCRIPTION
[0015] This disclosure is submitted in furtherance of the constitutional purposes of the U.S. Patent Laws “to promote the progress of science and useful arts” (Article 1, Section 8).
[0016] The systems and methods of the present disclosure will be described with reference to FIGS. **1-23**. Referring first to FIGS. **1-4**, views of example restraint systems are shown. In accordance with example implementations, the restraint system **10** can include a passenger seat **12** supported by a frame **14**. Frame **14** can be a frame assembly or solid frame for example.
[0017] System **10** can include a restraint bar **16** pivotably attached at **17** to frame **14**. This can be considered a combination lap bar and a car chassis for example. System **10** can include at least one piston **20**; multiple pistons may be used as shown, operably engaged between bar **16** and frame **14**. Piston **20** can be moveable between a first position engaging the passenger in seat **12** (as shown without passenger) and a second position disengaged from the passenger in the seat (restraint bar allowing access or egress from seat **12**).
[0018] The piston can be coupled between a lower end of the restraint bar, which pivots upon a pivot point **17** on the car chassis. In accordance with example implementations, the restraint bar can have two positions and rotate variably between the two positions with a full upright and a locked position. The full upright position allows the rider access to the chair, while the locked position restrains the rider within the chair. As can also be seen, there is a place for two pistons operatively engaged with the restraint bar.
[0019] Referring next to FIGS. **5-11**, a restraint system piston **20** according to an example implementation is depicted that includes a central chamber **52** that may be considered a main cylinder. Chamber **52** is operatively associated with another chamber **56** such as a fluid reservoir. These two chambers can be operatively engaged via a manifold **53**. Manifold **53** can facilitate fluid

flow between the chambers as well as provide housing for additional valves that may be electromechanically controlled.

[0020] Piston **20** can include a rod **54** operatively engaging chamber **52** as well as coupling end **80** of rod **54**. Piston **20** can also include electromechanical valve **58** such as a poppet valve. Piston **20** can have chamber **52** aligned below both valve **58** and chamber **56**. Chamber **56** and valve **58** may be aligned in parallel as well. In accordance with example implementations, coupling end **82** may be operatively associated with manifold **53**.

[0021] Referring next to FIGS. **11**-**15**, more detailed views of piston **20** are shown. For example, piston **20** can include a piston head **110** coupled to rod **54**. Head **110** can reside with chamber **52** and be configured to allow fluid flow between portions of chamber **52** separated by head **110**. Within head **110** can be a pair of check valves **120** and **122**. As can be seen one of the check valves **122** resides within head **110** while the other of the check valves can reside at least partially within rod **54**.

[0022] Further, chamber **56** can include another head **14** configured to provide positive pressure within chamber **56**. Each of these heads can define recesses such as recess **138** configured to receive multiple gaskets **140** and **142**. Pairs of gaskets **140** and **142** within the recesses **138** may be constructed of differing materials.

[0023] Referring next to FIGS. **16**-**20**, more detailed views of head **110**/rod **54** assembly are shown. Terminus of head **110** can include opening **170** to facilitate the flow of fluid through head **110** and between portions of chamber **52**. Gaskets **140**/**142** may reside partially outside recesses **138** when disengaged from chamber **52**. Additional gaskets **190** may be provided between check valves **120** and **122** when these check valves are provided in series. The piston head in the main cylinder, the heads themselves can have both a combination of rubber and/or Teflon rings associated therewith which allow the cylinders to slide more freely and be more durable, thereby lasting substantially longer than prior art locking cylinders. The cylinder head is shown with a Teflon and a rubber O-ring. The Teflon O-ring can be supported by a rubber O-ring. The cylinder head may also include two Teflon rings. Both of these Teflon rings can be supported by rubber O-rings.

[0024] Referring next to FIGS. **21**-**23**, more detailed views of electromechanical valve **58** are shown. In accordance with example implementations, valve **58** can include a valve end **220** that is operatively aligned within the manifold and electronically controlled. Further, valve **58** configured as a poppet valve can include a structure **222** that is mechanically coupled to valve end **220**, wherein when valve end **220** is open the structure **222** is in one position in relation to valve **58** and when valve end **220** is closed, structure **222** is in another position. The position of structure **222** can be monitored electronically to verify open/closed configuration of valve end **220**.

[0025] According to example implementations and methods, as the piston and rod engage the main cylinder, fluid is displaced between opposing sides of the piston head as well as the reservoir cylinder. When fluid is freely exchanged between those three zones within the locking cylinder, the piston can traverse the extent of the main cylinder freely. However, when fluid is restricted between the reservoir and the main cylinder, the piston rod can be locked in place. With the use of operatively aligned check valves, the rod and piston can be restricted from movement in one direction when locked but allowed to move in the opposite direction. In accordance with example implementations, as to prevent fluid from moving in and out of the reservoir, a poppet valve assembly can be de-energized to fix a poppet valve to restrain fluid flow in at least one direction when using a check valve to allow flow in the opposite direction, thereby preventing the piston from moving in at least one direction.

[0026] The poppet valve can include an energizer coil that can be used to fix the poppet valve assembly in that one locking position. Accordingly, when the poppet valve assembly is fixed in that one position, fluid can only move in one direction and not in both directions, thereby preventing the piston and rod from moving in at least one direction. In accordance with example implementations, this can be considered the lap bar moving further in the restraining position while

being unable to move in the unrestrained position.
[0027] In accordance with example implementations, the present disclosure also provides a monitored valve to ensure that the valve is in the engaged position and not in the dis-engaged position. In accordance with example implementations, that can include engaging a mechanical rod to the valve and monitoring the position of that mechanical rod. The monitored poppet valve assembly can include an energizing portion with an industrial electrical plug and a monitoring portion to the left with a 5-pin assembly. The monitoring portion can be associated with a fluid exchange portion that entertains the reservoir piston as well as the main piston.
[0028] While recommended sizes are shown and depicted in the accompanying drawings, these should not be considered limiting the scope of this disclosure as the only operable size that will per operable. What should be considered is that the poppet valve is actually monitored to be in the engaged position, which is a first in the industry. In accordance with example implementations, operator houses and amusement rides can now be equipped with panels that can indicate the engaged or dis-engaged position of the poppet valve. In certain circumstances, this can be a double check to an attendant walking the cars and checking to ensure that they are in a locked position prior to engaging the ride. Also, upon use and testing, the ride can be monitored to ensure that the locking valves are engaged and therefore in the locked position. While not depicted in the present application, it is envisioned that a panel can include a representation of a car or multiple cars with individual seats, and each individual seat having an engaged or “go” or “no go” light associated therewith, allowing an operator to review same, and if all are in “go” positions, allowing the ride to proceed, but if only one is a “no go” position, that restraint is checked to make sure it is working properly and if not, that seat is removed from service. This is a substantial increase in the safety of amusement rides worldwide and is the first time that these kinds of precautions have been viewed by an operator remote from the ride itself.
[0029] The present disclosure provides increased safety for retaining the restraint system in place by using a modified locking cylinder such as a single locking cylinder that may be used in duplicate for each lap restraint. Therefore, there may be two single locking cylinders.
[0030] In compliance with the statute, embodiments of the invention have been described in language more or less specific as to structural and methodical features. It is to be understood, however, that the entire invention is not limited to the specific features and/or embodiments shown and/or described, since the disclosed embodiments comprise forms of putting the invention into effect.

Claims

1. A restraint system piston comprising: a central chamber housing a piston head and rod; a fluid reservoir in fluid communication with the central chamber; and at least one electromechanical valve operable between an open and a closed position.
2. The restraint system piston of claim 1 further comprising a pair of check valves aligned in series.
3. The restraint system piston of claim 2 further comprising a cylinder head within the central chamber, the cylinder head confining at least one of the pair of check valves.
4. The restraint system piston of claim 3 further comprising a rod extending from the cylinder head, wherein at least one of the check valves is aligned with the rod.
5. The restraint system piston of claim 4 wherein at least one of the pair of check valves at least partially resides within a perimeter defined by the rod.
6. The restraint system piston of claim 3 wherein the cylinder head defines an opening in fluid communication with at least one of the check valves.
7. The restraint system piston of claim 3 further comprising a second cylinder head within the fluid reservoir, wherein each of the cylinder heads defines one or more recesses about a perimeter of the heads and configured to receive at least a pair of gaskets within each recess.

8. The restraint system piston of claim 7 further comprising a pair of gaskets within at least one of the recesses.
9. The restraint system piston of claim 8 wherein the pair of gaskets are stacked within the recess.
10. The restraint system piston of claim 1 further comprising a manifold operably engaged between the central chamber and the fluid reservoir.
11. The restraint system piston of claim 10 wherein the electromechanical valve is affixed to the manifold.
12. The restraint system piston of claim 10 further comprising an optical sensor within the manifold, the optical sensor configured to detect the presence or absence of a structure associated with the position of the electromechanical valve.