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VEHICLE COUPLING LINES STORAGE AND CONTROL ARRANGEMENT

Abstract

A storage arrangement for lines from a towing to a towed vehicle including at least one of an electrical line, a first pneumatic line, and a second pneumatic line includes a mounting structure configured to be secured to the towing vehicle, at least one receiver connected to the mounting structure and configured to couple to the at least one of the electrical line, the first pneumatic line and the second pneumatic line, and a control arrangement configured to operably couple to at least one receiver such that upon coupling of the at least one of the electrical line, the first pneumatic line and the second pneumatic line with the first receiver the control arrangement provides the operator with an indication of a coupling status of the select one of the electrical line, the first pneumatic line and the second pneumatic line with the storage arrangement via a status indicator.

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Background/Summary

[0001] This application is a continuation of U.S. patent application Ser. No. 17/804,672, filed May 31, 2022, entitled “VEHICLE COUPLING LINES STORAGE AND CONTROL ARRANGEMENT,” which is a continuation of Ser. No. 17/077,605, filed Oct. 22, 2020, entitled “VEHICLE COUPLING LINES STORAGE AND CONTROL ARRANGEMENT,” now U.S. Pat. No. 11,376,907, which is a continuation of U.S. patent application Ser. No. 15/897,818, filed Feb. 15, 2018, entitled “VEHICLE COUPLING LINES STORAGE AND CONTROL ARRANGEMENT,” now U.S. Pat. No. 10,850,782, which is a continuation of U.S. patent application Ser. No. 15/173,073, filed Jun. 3, 2016, entitled “VEHICLE COUPLING LINES STORAGE AND CONTROL ARRANGEMENT,” now U.S. Pat. No. 10,029,747, which claims benefit to U.S. Provisional Patent Application No. 62/175,711, filed Jun. 15, 2015, entitled “VEHICLE COUPLING LINES STORAGE AND CONTROL ARRANGEMENT,” and claims benefit to U.S. Provisional Patent Application No. 62/315,172, filed Mar. 30, 2016, entitled “VEHICLE COUPLING LINES STORAGE AND CONTROL ARRANGEMENT,” the entire disclosure of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION
Technical Field
[0002] The invention relates to a storage and control arrangement for storing electrical and pneumatic lines for connecting a tractor truck to a trailer when the lines are not in use, for communicating a coupling status of the lines and an associated fifth wheel hitch assembly, and for controlling the brakes of the associated truck and trailer as well as the coupling of the fifth wheel assembly.
BRIEF SUMMARY
[0003] One embodiment as shown and described herein may include a storage arrangement for lines from a towing vehicle to a towed vehicle including at least one of an electrical line, a first pneumatic line, and a second pneumatic line, the storage arrangement including a mounting structure configured to be secured to the towing vehicle external to a cab of the towing vehicle, a first receiver connected to the mounting structure and configured to couple to the at least one of the electrical line, the first pneumatic line and the second pneumatic line, and a control arrangement configured to operably couple to the first receiver such that upon coupling of the at least one of the electrical line, the first pneumatic line and the second pneumatic line with the first receiver the control arrangement provides the operator with an indication of a coupling status of the select one of the electrical line, the first pneumatic line and the second pneumatic line with the storage arrangement via a status indicator.
[0004] Another embodiment as shown and described herein may further or alternatively include a storage arrangement for lines from a towing vehicle to a towed vehicle including at least one of an

electrical line, a first pneumatic line, and a second pneumatic line, the storage arrangement that includes a mounting structure configured to be secured to the towing vehicle external to a cab of the towing vehicle, a first receiver connected to the mounting structure and configured to couple to the electrical line, a first sensor configured to sense whether the electrical line is coupled to the first receiver, and a control arrangement operably coupled to the first sensor such that upon coupling the electrical line with the first receiver the control arrangement provides the operator with an indication of a coupling status of the electrical line with the storage arrangement via a status indicator.

[0005] These and other features, advantages, and objects of the various embodiments will be further understood and appreciated by those skilled in the art by reference to the following specification, claims, and appended drawings.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] FIG. **1**A is a side elevational view of a tractor truck and trailer combination, where the trailer is coupled to the truck;

[0007] FIG. **1**B is a side elevational view of the truck and trailer where the trailer is uncoupled from the truck;

[0008] FIG. **2** is a rear elevational view of a storage and control arrangement attached to a rear panel of the truck;

[0009] FIG. **3** is a top perspective view of the storage and control arrangement;

[0010] FIG. **4** is a schematic view of the storage and control arrangement;

[0011] FIG. **5** is a top perspective view of the storage and control arrangement with a cover of a housing assembly removed to show internal components;

[0012] FIG. **6** is an exploded, front perspective view of the storage and control arrangement;

[0013] FIG. **7** is a schematic view of a fifth wheel hitch plate assembly;

[0014] FIG. **8** is a schematic view of an alternative embodiment of the storage and control arrangement;

[0015] FIG. **9** is a schematic view of an automatic vehicle component actuation arrangement in a first position;

[0016] FIG. **10** is a schematic view of the component actuation arrangement in a second position;

[0017] FIG. **11** is a schematic view of a safety automatic vehicle component actuation arrangement, wherein a first valve member and a second valve member are each in a first position;

[0018] FIG. **12** is a schematic view of the actuation arrangement of FIG. **11**, wherein the first and second valve members are in the respective first positions;

[0019] FIG. **13** is a schematic view of the actuation arrangement of FIG. **11**, wherein the first and second valve members are each in a second position;

[0020] FIG. **14** is a schematic view of the actuation arrangement of FIG. **11**, wherein the first and second valve members are each in the second position;

[0021] FIG. **15** is a schematic view of the actuation arrangement of FIG. **11**, wherein the first and second valve members are each in the first position;

[0022] FIG. **16** is a schematic view of the actuation arrangement of FIG. **11**, wherein the first and second valve members are each in the first position;

[0023] FIG. **17** is a schematic view of the actuation arrangement of FIG. **11**, wherein the first valve member is in the second position and the second valve member is in the first position;

[0024] FIG. **18** is a schematic view of the actuation arrangement of FIG. **11**, wherein the first valve member is in the second position and the second valve member is in the first position;

[0025] FIG. **19** is a schematic view of the actuation arrangement of FIG. **11**, wherein the first valve

member is in the first position and the second valve member is in the second position; and
[0026] FIG. **20** is a schematic view of the actuation arrangement of FIG. **11**, wherein the first valve member is in the first position and the second valve member is in the second position.

DETAILED DESCRIPTION

[0027] For purposes of description herein, the terms “upper,” “lower,” “right,” “left,” “rear,” “front,” “vertical,” “horizontal,” and derivatives thereof shall relate to the various embodiments as oriented in FIG. **1**A. However, it is to be understood that certain embodiments may assume various alternative orientations and step sequences, except where expressly specified to the contrary. It is also to be understood that the specific devices and processes illustrated in the attached drawings, and described in the following specification are exemplary embodiments of the inventive concepts defined in the appended claims. Hence, specific dimensions and other physical characteristics relating to the embodiments disclosed herein are not to be considered as limiting, unless the claims expressly state otherwise.
[0028] A tractor truck and trailer combination **10** (FIGS. **1**A and **1**B) includes a tractor truck **12** and a trailer **14**, wherein the tractor truck **12** includes a storage and controller arrangement **16** (FIGS. **1**A, **1**B and **2**) embodying the present invention. In the illustrated example, the tractor truck **12** includes a frame assembly **18** supporting a cab assembly **20** and a fifth wheel hitch plate assembly **22**. The trailer **14** includes a trailer body **24** and a kingpin assembly **26** extending downwardly therefrom and adapted to couple and lock with a fifth wheel hitch plate **28** of the fifth wheel hitch plate assembly **22** in a conventional manner.
[0029] The tractor truck and trailer combination **10** further includes a plurality of control and communication lines coupling the tractor truck **12** to the trailer **14**. Specifically, the truck and trailer combination **10** includes an electrical line **30** extending between an electrical outlet **32** associated with the truck **12**, and an electrical and pneumatic inlet arrangement **34** associated with the trailer **14**. A service air line **36** carries air controlled by a foot or hand brake of the truck **12** and provides pneumatic communication between a pneumatic outlet arrangement **38** associated with the truck **12** and the electrical and pneumatic inlet arrangement **34** of the trailer **14**. A supply or emergency air line **40** extends and provides pneumatic communication between the pneumatic outlet arrangement **38** of the truck **12** and the electrical and pneumatic inlet arrangement **34** of the trailer **14**. Alternatively, a second electrical line **31** may extend between the truck **12** and the trailer **14**, where the electrical line **30** provides power to the trailer **14** for operating items such as trailer lighting, while the second electrical line operates an electronic braking system of the trailer **14**.
[0030] In the illustrated example, the electrical outlet **32** of the truck **12** is provided electrical power from an electrical source **42** of the truck **12**, such as a battery, alternator, or the like. The pneumatic outlet arrangement **38** is provided with air pressure from a pneumatic source **44** of the truck **12**, such as a compressor, an air tank, and the like, via an air supply line **45**.
[0031] The storage and controller arrangement **16** (FIGS. **2** and **3**) includes a housing arrangement **46** that includes a housing **48** and a top cover **50** removably coupled to the housing **48** to allow access to an interior of the housing **48**. The housing arrangement **46** is connected to a rear panel **51** of the cab assembly **20** via a plurality of bolts or screws, adhesive, and the like. This arrangement allows the unit **16** to be easily connected and retrofitted to nearly any truck configuration, and further allows for easy replacement of the unit **16**, should the unit **16** become irreparably damaged. The unit **16** further includes a receiver or electrical coupler or socket **52** disposed on a front face **54** of the housing **48** and covered by a movable weather or socket cover **56**. The cover **56** is movable between an open position, thereby allowing coupling of an electrical plug **58** of the electrical line **30** with the electrical coupler **52**, and a closed position (as illustrated in FIG. **3**), where the electrical coupler **52** is protected from the elements when the plug **58** is not coupled with the electrical coupler **52**.
[0032] The unit **16** further includes a receiver or glad hand coupler or hanger **60** attached to a side wall **61** of the housing **48** and adapted to releasably couple with and support a glad hand **62** of the

service air line **36**. Another receiver or glad hand coupler or hanger **64** is attached to another side wall **66** and is configured to releasably couple with and support a glad hand **68** of the emergency or supply air line **40**.

[0033] The unit **16** may also include an actuator switch **70** disposed on the front face **54** of the housing **48** and covered by a movable weather or switch cover **72**. The actuator switch **70** is adapted to control a fifth wheel locking/unlocking actuator as described below. The unit **16** may further include an indicator **74** configured to provide a visual indication to the operator as to whether the associated fifth wheel hitch plate assembly **22** and the kingpin assembly **26** are in a condition for safely uncoupling the same, and/or whether the electrical line **30**, the service air line **36** and/or the supply line **40** are properly coupled to the unit **16**, and a system status screen or display **76** providing the operator with a current system status, each as described further below.

[0034] A schematic representation of the storage and controller arrangement **16** and the related truck and trailer components are illustrated in FIG. **4**. In the illustrated example, a control arrangement **80** includes a logic circuit **82** operably coupled and receiving an input from the electrical line **30**, the service air line **36** and the supply air line **40**. The logic circuit **82** may be provided as an electrical logic circuit **83** (FIG. **5**), a pneumatic logic circuit, or combinations thereof. As illustrated, the logic circuit **82** is powered by the electrical input provided by the electrical line **30**. However, power may also be provided by a separate electrical line **84** extending from the electrical source **42** and operably coupled with the electrical coupler **52**, or directly to the unit **16** and the logic circuit **82** from the electrical source **42** of the truck **12**. The latter option would require hard wiring the unit **16** to the electrical source **42** of the truck **12**.

[0035] The unit **16** includes an optical sensor arrangement **86** (FIG. **6**) positioned within the housing arrangement **46** and the glad hand coupler **64**, and configured to optically sense the positioning of the glad hand **68** within the glad hand coupler **64**. A similar optical sensor arrangement (not shown) is located within the housing arrangement **46** and the glad hand coupler **60** so as to sense the positioning of the glad hand **62** within the glad hand coupler **60**. Alternatively, an additional optical sensor arrangement (not shown) may be utilized to sense the positioning of the plug **58** of the electrical line **30** within the electrical coupler **52**. Alternative sensor arrangements may also be utilized in place of the optical sensor arrangement **86**, such as contact switches, toggle switches, proximity sensors, and the like. In another alternative embodiment, the service air line **36** and/or the supply air line **40** may be pneumatically coupled and provide pneumatic input to the unit **16** when the glad hands **62**, **68** are coupled with the glad hand couplers **60**, **64**, thereby augmenting or replacing the electrical or optical input from the optical sensor arrangements to the logic circuit **82**.

[0036] In operation, pneumatic air pressure is provided to the unit **16** via the pneumatic source **44** of the truck **12**. In the example illustrated in FIG. **4**, the pneumatic source **44** is provided in the form of an air reservoir tank, however, other sources may also be utilized, including compressors, or secondary air reservoirs **88** associated with the storage and controller arrangement **16** or the trailer **14**, thereby allowing operation of the overall system without pneumatic input from the truck **12**. The air supply as supplied from the pneumatic source **44** is received by a valve arrangement **90**, which is controlled by the logic circuit **82**. The valve arrangement **90** prevents air pressure from travelling beyond the valve arrangement **90** until the valve arrangement **90** is opened by the logic circuit **82**.

[0037] During disconnect of the trailer **14** from the truck **12**, the operator of the vehicle must determine that certain components of the truck and trailer **10** are in a proper configuration so as to safely disconnect the trailer **14** from the truck **12**. For example, the operator must determine that the electrical line **30**, the service line **36** and the supply line **40** are properly disconnected from the electrical and pneumatic inlet arrangement **34** of the trailer **14**, so that these lines are not sheared or broken as the truck **12** is driven away from the trailer **14**. In order to assure that damage to the lines **30**, **36**, **40** does not occur, the overall system is adapted to apply the brakes of the truck, apply the

brakes of the trailer, and/or prevent unlocking of the kingpin assembly **26** from the fifth wheel hitch plate assembly **22**. These situations are described in greater detail in Schutt et al., U.S. Pat. No. 7,548,155, the entire disclosure of which is incorporated by reference herein. Prior to the coupling of at least one the electrical line **30**, the service air line **36** and the supply air line **40** with the unit **16**, the valve arrangement **90** is in a closed position. At least one of several configurations of the truck and trailer combination **10** is required when the valve arrangement **90** is in the closed condition, such as the brakes of the truck **12** may be not be disengaged, the brakes of the trailer **14** may not be disengaged, and/or the kingpin assembly **26** may not be unlocked from within the fifth wheel hitch plate assembly **22**. Opening of the valve arrangement **90** allows an operator to disengage the brakes of the truck **12**, disengage the brakes of the trailer **14**, and/or unlock the kingpin assembly **26** from the fifth wheel hitch plate assembly **22**, as described below. In the illustrated example, the electrical line **30** is engaged within the electrical coupler **52** of the unit **16**, thereby providing power to the unit **16**. In this configuration, power is supplied to the unit **16** by the electrical line **30** only. The logic circuit **82** can be configured to sense the supply of power from the electrical line **30**, thereby automatically opening the valve arrangement **90**, whereafter the overall system of the truck and trailer combination **10** may automatically disengage the brakes of the truck **12**, disengage the brakes of the trailer **14**, and/or unlock the kingpin assembly **26** from the fifth wheel hitch plate assembly **22**. Alternatively, the unit **16** includes an operator controlled secondary valve arrangement **92** operably coupled and activated via the actuator switch **70**. In this example, the logic circuit **82** opens the valve arrangement **90** thereby extending the air supply to the secondary valve arrangement **92**, operated by the actuator switch **70**. The operator of the vehicle can then determine whether a safe condition exists to uncouple the trailer **14** from the truck **12** by making a visual inspection of the overall system. It is noted that the actuator switch **70** may be located within the unit **16**, thereby allowing the operator to decouple the kingpin assembly **26** from the fifth wheel hitch plate assembly **22** without re-entering the cab **20**. Alternatively, the operator may activate the system via a remote switching device via hard wire, Wi-Fi®, BLUETOOTH®, cell phone signal, IR signals, radio signals, touch screen interface, voice activation, and the like. Alternatively, the indicator **74** of the unit **16** may provide the operator with a visual feedback indicating whether the system is in a safe condition for uncoupling. These conditions may include monitoring the coupling of the electrical line **30**, the service air line **36** and/or the supply air line **40** with the unit **16**, and/or the relative positioning of the kingpin assembly **26** within the fifth wheel hitch plate assembly **22**. While the present example includes a logic circuit **82** being configured to determine whether the electrical line **30** is coupled with the electrical coupler **52** in order to determine whether a safe condition for uncoupling the trailer **14** from the truck **12** exists, alternative arrangements may also be employed. Specifically, the unit **16** may be configured such that the logic circuit **82** determines that a safe condition exists when any one of the three lines including the electrical line **30**, the service air line **36** and the supply air line **40** are properly coupled to the unit **16**, any combination of two of the lines **30**, **36**, **40** are properly coupled to the unit **16**, or only when all three of the lines **30**, **36**, **40** are properly coupled to the unit **16**. A similar arrangement may be configured for those systems that include a first electrical line **30**, a second electrical line **31**, a first air line **36** and a second air line **40**. Preferably, the unit **16** and the logic circuit **82** would be configured such that the indicator **74** would not indicate to the operator that a safe condition for uncoupling the trailer **14** from the truck **12** exists unless the logic circuit **82** determines that each and every one of the lines **30**, **36**, **40** are properly coupled to the unit **16**, thereby absolutely preventing the possibility of shearing or breaking the lines **30**, **36**, **40** when uncoupling the trailer **14** from the truck **12**.

[0038] The unit **16** may also be utilized to assist the driver in coupling the trailer **14** with the truck **12**. Specifically, the logic circuit **82** can be configured to receive an input from a fifth wheel sensor arrangement or assembly **94**, such as that disclosed in Schutt et al, U.S. Pat. No. 7,548,155. The fifth wheel sensor arrangement **94** may be configured to provide an input to the logic circuit **82**

regarding whether a proper alignment of the kingpin assembly **26** has been achieved with respect to the fifth wheel hitch plate assembly **22** during coupling of the trailer **14** to the truck **12**. The fifth wheel sensor arrangement **94** and the unit **16** may be hard wired to one another, or may communicate via Wi-Fi®, BLUETOOTH®, and the like. The control arrangement **80** may be configured such that the valve arrangement **90** remains closed if proper alignment of the kingpin assembly **26** with the plate assembly **22** has not been achieved, thereby preventing an unsafe coupling of the trailer **14** with the truck **12**. Once proper alignment of the kingpin assembly **26** with the plate assembly **22** has been sensed by the fifth wheel sensor arrangement **94**, a logic circuit **82** may be configured to open the valve arrangement **90**, thereby passing the air supply to the secondary valve arrangement **92** and giving the operator the ability to lock the kingpin assembly **26** with the fifth wheel hitch plate assembly **22** via the actuator switch **70**.

[0039] As best illustrated in FIG. **4**, the output of the control arrangement **80** may be an electrical output **96**, a pneumatic output **98** or a combination thereof depending upon the components to be manipulated and the output desired. For example, FIG. **7** illustrates a schematic view of an automated fifth wheel coupling/decoupling arrangement **100** that is configured to unlock the kingpin assembly **26** from the fifth wheel hitch plate assembly **22**. The fifth wheel coupling/decoupling arrangement **100** may be pneumatic, electric, hydraulic, or combinations thereof. As noted above, the output of the control arrangement can be configured as required to run systems and subassemblies such as the fifth wheel coupling/decoupling arrangement **100** as shown.

[0040] The reference numeral **16***a* (FIG. **8**) generally designates another embodiment of the storage and controller arrangement **16**, wherein the unit **16***a* is an all-electric arrangement. Since the storage and controller arrangement **16***a* is similar to the previously described unit **16**, similar parts appearing FIGS. **2-7** and FIG. **8** respectively are represented by the same, corresponding reference numeral, except for the suffix “a” in the numerals of the latter. In the illustrated example, the unit **16***a* receives an electrical input from the electrical line **30***a*. The associated logic circuit (not shown) receives an input from the fifth wheel sensor arrangement **94***a*. The logic circuit may be configured to determine whether a proper arrangement between the kingpin assembly **26** and the fifth wheel hitch plate assembly **22** exists, and/or whether any or all of the lines **30***a*, **36***a*, **40***a* are properly coupled to the unit **16***a*. The control arrangement **80***a* may be configured to then allow the operator to couple or uncouple the kingpin assembly **26** from the fifth wheel hitch plate assembly **22** via the actuator switch **70***a* actuating the fifth wheel coupling/decoupling arrangement **100***a*.

[0041] The storage and controller arrangement **16** may also be configured to support and/or operate additional utility or indication lighting. For example, the unit **16** may also include an LED utility light arrangement **110** (FIG. **2**) located so as to illuminate the area of the unit **16** associated with coupling of the lines **30**, **36**, **40** thereto, and/or an area about the fifth wheel hitch plate assembly **22** to allow the operator to more easily inspect the physical alignment and coupling of the kingpin assembly **26** with the fifth wheel hitch plate assembly **22**. Further, indication lights may be controlled by the logic circuit **82** and provided near the fifth wheel hitch plate assembly **26** and color coded so as to communicate to the driver that a proper coupling between the kingpin assembly **26** and the fifth wheel hitch plate assembly **22** has been achieved, e.g., “red” for unsatisfactory or unsafe, and “green” for satisfactory or safe.

[0042] The system may further be configured to operate a status indicator lighting arrangement **200** (FIGS. **1**A and **1**B) located remotely from the unit **16**. The status indicator lighting arrangement **200** is operably coupled to the unit **16** via hard wire **205** (FIG. **6**), Wi-Fi®, BLUETOOTH®, and the like, and the unit **16** is coupled to the sensor assembly or arrangement **94**, such that the lighting arrangement **200** provides a visual feedback to the operator indicating that a proper coupling between the kingpin assembly **26** and the fifth wheel hitch arrangement **22** has been obtained. In the illustrated example, the status indicator lighting arrangement **200** is positioned so as to be readily viewable by the operator in a rearview mirror **203**, thereby allowing the operator to concentrate and visually monitor the position of the trailer **14** while simultaneously watching the

status indicator lighting arrangement **200**. This position of the lighting arrangement **200** also provides a convenient viewing location for the operator while manually decoupling the kingpin assembly **26** from the fifth wheel hitch plate assembly **22**. For this purpose, the lighting arrangement **200** may also be positioned at other locations that are readily viewable by the operator without requiring the operation to peer beneath the trailer **14**, such as the positons represented by reference numerals **201** and **203**.

[0043] In another alternative embodiment, the storage and controller arrangement **16** (FIG. **2**) further includes an automatic vehicle component actuation arrangement **205** (FIG. **9**). In the illustrated example, the actuation arrangement **205** includes an activation valve arrangement **202** pneumatically coupled to the supply air line **40** via a T-fitting **204** and a valve supply air line **206**, to the pneumatic source **44** via a first air line **208** and a second air line **209**, and to a vehicle component such as the fifth wheel coupling/decoupling arrangement **100** via an air line **210**. The automatic component actuation arrangement **205** is configured to automatically actuate a vehicle component such as the fifth wheel coupling/decoupling arrangement **100** when the glad hand **68** associated with the supply air line **40** is uncoupled from the electrical and pneumatic inlet arrangement **34** associated with the trailer **14**.

[0044] In the illustrated example, the valve arrangement **202** includes a valve assembly **214** that includes a valve housing **216** having a valve bore **218**, and a valve member **220** slidably received within the valve bore **218**. The valve member **220** includes a first end **222** and a second end **224** and is configured to define a first chamber **226**, a second chamber **228**, a third chamber **230**, and a fourth chamber **232** within the valve bore **218**. A spring member **234** biases the valve member **220** in a direction **236**. As illustrated, the valve housing **216** includes a first port **238** in pneumatic communication with the first chamber **226** and the supply air line **40** via the air line **206**, a second port **240** in pneumatic communication with the second chamber **228** and the pneumatic source **44** via the first air line **208**, a third port **242** in pneumatic communication with the third chamber **230** and the fifth wheel coupling/decoupling arrangement **100** via the air line **210**, and a fourth port **244** in pneumatic communication with the fourth chamber **232** and the pneumatic source **44**.

[0045] In operation, the first chamber **226** is provided an air pressure as supplied to the air line **206** from the supply air line **40**, which acts on the first end **222** of the valve member **220** along with the spring member **234** to force the valve member in the direction **236**. In this condition, the air pressures within the second air chamber **228** and the third air chamber **230** are each in a state of equilibrium in that the respective air pressures do not move the valve member **220** within the valve bore **218**. Air pressure is also provided to the fourth chamber **232** from the pneumatic source **44** and acts on the second end **224** of the valve member **220** but is insufficient to overcome the force exerted on the first end **222** of the valve member **220** by the air pressure within the first chamber **226** and the spring member **234** while the supply air line **40** is connected to the inlet arrangement **34** of the trailer **14** and is pressurized. In further operation, the fifth wheel coupling/decoupling arrangement may be automatically actuated by removing the air pressure from the supply line **40**. Removing the air pressure from the supply line **40** may be accomplished by the operator via a selection switch located within the cab assembly of the truck **12**, or by disconnecting the glad hand **68** of the supply line **40** from the inlet arrangement **34**. Once the air pressure from the supply air line **40** is removed from the first chamber **226**, the air pressure in the fourth chamber **232** supplied by the pneumatic source **44** forces the valve member in a direction **250** (FIG. **10**) until the second port **240** and the third port **242** are both in pneumatic communication with the third chamber **230**, thereby allowing air pressure from the pneumatic source **44** to travel along an air path **251** to the fifth wheel coupling/decoupling arrangement **100** to decouple or unlock the hitch plate assembly **22** from the kingpin **26**.

[0046] In another alternative embodiment, the storage and controller arrangement **16** includes a safety automatic vehicle component actuation arrangement **300** (FIGS. **11** and **12**) replacing the automatic component actuation arrangement **200**. In the illustrated example, the component

actuation arrangement **300** includes an activation valve arrangement **302** pneumatically coupled to the supply air line **40** via the T-fitting **204** (FIG. **12**) and the valve supply air line **206**, to the pneumatic source **44** via the air line **209** and a solenoid arrangement **308** and to a vehicle component such as the fifth wheel coupling/decoupling arrangement **100** via the air line **210**. While the fifth wheel coupling/decoupling arrangement **100** is used as an example of the vehicle component, other vehicle arrangements may also be controlled via the actuation arrangement **300**, such as automated landing gear arrangements, auxiliary lift axle arrangements, and the like. The safety automatic component actuation arrangement **300** is configured to automatically actuate a vehicle component such as a fifth wheel coupling/decoupling arrangement **100** when the glad hand **68** (FIG. **2**) associated with the supply air line **40** is uncoupled from the electrical and pneumatic inlet arrangement **34**, while simultaneously preventing accidental uncoupling of the fifth wheel assembly **22** from the kingpin **26**. Alternatively, the fifth wheel coupling/decoupling arrangement **100** may be actuated by an operator via a selection switch located within the cab assembly of the truck **12**. Further, alternatively, the vehicle component may comprise a landing gear arrangement and/or an auxiliary lift axle assembly including pressure sensors, ride height sensors, and the like, that communicate the necessity of support via the landing gear arrangement and/or auxiliary lift axle assembly.

[0047] In the illustrated example, the activation valve arrangement **302** includes a first valve assembly **310** and a second valve assembly **311** that include a valve housing **312** having a first valve bore **314** and a slidably receiving a first valve member **316**, and a second valve bore **318** slidably receiving a second valve member **320**. The first valve member **316** includes a first end **322** and a second end **324**, and is configured to define a first chamber **326**, a second chamber **328**, a third chamber **330**, a fourth chamber **332**, and a fifth chamber **334** within the first valve bore **314**. The first end **322** of the first valve member **316** has a greater surface area than the second end **334**, such that an equal air pressure within the first chamber **326** and the fifth chamber **334** forces the first valve member toward the fifth chamber **334**. The second valve member **320** has a first end **336** and a second end **338**, and is configured to define a first chamber **340**, a second chamber **342**, a third chamber **344**, a fourth chamber **346** and a fifth chamber **348** within the second valve bore **318**. The first end **336** of the second valve member **320** has a greater surface area than the second end **338**, such that an equal air pressure within the first chamber **340** and the fifth chamber **348** forces the second valve member **320** toward the fifth chamber **348**.

[0048] As illustrated in FIGS. **11** and **12**, the valve housing **312** incudes a first port **350** in pneumatic communication with the first chamber **326** of the first valve bore **314**, the first chamber **340** of the second valve bore **318** and the supply air line **40** via the T-fitting **44** and the air line **206**, a second port **352** in pneumatic communication with the fifth chamber **234** of the first valve bore **314** and the pneumatic source **44** via the air line **209** and the solenoid arrangement **308**, a third port **354** in pneumatic communication with the fifth chamber **348** of the second valve bore **318** and the pneumatic source **44** via the air line **209** and the solenoid arrangement **308**, a fourth port **356** in pneumatic communication with the fifth wheel coupling/decoupling arrangement **100** via the air line **210**, a sixth port or exhaust port **358** (FIG. **14**) in pneumatic communication with the second chamber **342** of the second valve bore **318**, and a seventh or exhaust port **360** in pneumatic communication with the third chamber **344** of the second valve bore **318**. In the illustrated configuration and position, the valve housing **312** further includes a first conduit **362** providing pneumatic communication between the first chamber **326** of the first valve bore **314** and the first chamber **340** of the second valve bore **318**, a second conduit **364** providing pneumatic communication between the second chamber **328** and the fourth chamber **332** of the first valve bore **314**, a third conduit **366** providing pneumatic communication between the third chamber **330** of the first valve bore **314** and the second chamber **342** of the second valve bore **318**, a fourth conduit **368** providing pneumatic communication between the fourth chamber **332** of the first valve bore **314** and the third chamber **344** of the second valve bore **318**, and a fifth conduit **370** providing fluid

communication between the fourth chamber **332** of the first valve bore **314** and the fourth chamber **346** of the second valve bore **318**.

[0049] A first spring member **372** abuts the valve housing **312** and the first end **322** of the first valve member **316**, thereby biasing the first valve member **316** in a direction **374**. A second spring member **376** abuts the valve housing **312** and the first end **336** of the second valve member **320**, thereby biasing the second valve member **320** in a direction **378**.

[0050] The solenoid arrangement **308** includes a first solenoid **380** and a second solenoid **382** that are in pneumatic communication with the pneumatic source **44** via the air line **209**, a T-fitting **384** and a pair of air lines **386**. The solenoids **380**, **382** control air flow from the air lines **386** to corresponding air lines **388** in pneumatic communication with the second port **352** and the third port **354**. It is noted that while a solenoid arrangement **308** is shown within the illustrated embodiment, other valve arrangements suitable for the application may also be utilized.

[0051] During vehicle operation, the solenoid **380** and the solenoid **382** are both closed such that air does not flow from the pneumatic source **44** to the fifth chamber **334** of the first valve bore **314** and the fifth chamber **348** of the second valve bore **318**, such that the first valve member **316** and the second valve member remain in a first or closed position as shown in FIGS. **11** and **12**. Once the vehicle is stopped and parked, the solenoids **380**, **382** are opened either by an affirmative step taken by the operator, such as an input via an activation switch (not shown), or automatically when the operator performs a task such a setting the parking brake of the vehicle. Once the solenoids **380**, **382** are opened, air pressure is supplied through the ports **352**, **354** and into the fifth chamber **334** and the fifth chamber **348**. It is noted that in this state, the pneumatic pressure acting on the first end **332** of the first valve member **316** and the first end **336** of the second valve member **320** plus the biasing force of each of the springs **372**, **376** on the valve members **316**, **320**, respectively, is greater than the force exerted on the second ends **324**, **338** of the valve members **316**, **320** such that the valve members **316**, **320** do not move within the respective valve bores **314**, **318**. The fifth wheel coupling/decoupling arrangement **100** is then automatically actuated by removing the air pressure from within the supply air line **40**. Removing the air pressure from within the supply air line **40** may be accomplished by the operator via a selection switch located within the cab assembly of the truck **12**, or automatically by disconnecting the glad hand **68** of the supply line **40** from the inlet arrangement **34**. Once the air pressure is removed from within the first chamber **326** and the first chamber **340**, the air pressure within the fifth chamber **334** and the fifth chamber **348** overcomes the biasing force being exerted on the first valve member **316** and the second valve member **320**, respectively, such that the first valve member **316** moves in a direction **390** and the second valve member **320** moves in a direction **392**. The first valve member moves in the direction **390** until the fifth chamber **334** of the first valve bore **314** pneumatically communicates with the third chamber **330** of the first valve bore **314** via the second conduit **364**. The second valve member moves in the direction **392** until the fifth chamber **348** of the second valve bore **318** in in pneumatic communication with the fifth chamber **334** of the first valve bore **314** via the fifth conduit **370**, the third chamber **330** of the first valve bore **314** is in pneumatic communication with the third chamber **344** of the second valve bore **318** via the third conduit **366**, and the third chamber **344** of the second valve bore **318** is in fluid communication with the fourth port **356**, thereby allowing air to travel from the pneumatic source **44** to the fifth wheel coupler/decoupler arrangement **100** along an air path **393** and actuate the fifth wheel coupler/decoupler arrangement **100**. Alternatively, the fifth wheel coupler/decoupler arrangement **100** may be replaced or supplemented with either a landing gear arrangement and/or auxiliary lift axle arrangement, where the air traveling from the pneumatic source actuates the landing gear arrangement and/or auxiliary lift axle arrangement. Specifically, additional sensors configured to monitor systems configurations and states, such as trailer weight, air spring pressure, trailer ride height, fifth wheel coupling/uncoupling status, and the like, communicate with the controller arrangement **16**, and automatically deploy and/or retract the landing gear assembly and/or auxiliary lift axle assembly depending on the configuration and

state of the system. For example, an auxiliary lift axle assembly may be automatically retracted when the glad hand **68** associated with the air line **40** is uncoupled from the electronic and pneumatic inlet arrangement **34**, or when the fifth wheel assembly **22** is moved to an uncoupled position, or when the operator actuates the auxiliary lift axle assembly via a selector switch located at the controller arrangement **16** or within the cab of the truck **12**. In the latter example, the controller arrangement **16** may be configured to allow retraction or deployment of the auxiliary lift axle assembly only subsequent to the glad hand **68** is uncoupled from the electronic and pneumatic inlet arrangement **34**.

[0052] Subsequent to the fifth wheel uncoupling process, the solenoids **380**, **382** dump the air pressure within the fifth chamber **334** (FIGS. **15** and **16**) of the first valve bore **314** and the fifth chamber **348** of the second valve bore **318**, thereby allowing the biasing force of the spring member **372**, **376** to force the first valve member **316** and the second valve member **320** in the directions **396**, **398**, respectively. The first valve member **316** moves in the direction **396** until the second chamber **328** of the first valve bore **314** is in pneumatic communication with the fourth chamber **328** of the first valve bore **314** via the second conduit **364**, the fourth chamber **346** of the second valve bore **318** is in fluid communication with the fourth chamber **328** of the first valve bore **314** via the fifth conduit **370**, the fourth chamber **328** of the first valve bore **314** is in fluid communication with the third chamber **344** of the second valve bore **318**, and the third chamber **344** of the second valve bore **318** is in pneumatic communication with the fifth wheel coupler/decoupler arrangement **100** and the exhaust port **360**, thereby allowing a spring force within the associated fifth wheel hitch plate assembly **22** to return the fifth wheel coupler/decoupler arrangement **100** to an unactuated position and the air pressure within the fifth wheel coupler/decoupler arrangement **100** to travel along a path **399** and to pass through the fourth port **356** and the exhaust port **360**.

[0053] The safety automatic component actuation arrangement **300** is further configured to prevent unintentional or accidental actuation of the coupler/decoupler arrangement **100** by alerting the operator of potential damage of one of the solenoids **380**, **382**. Failure of either of the solenoids **380**, **382** may be detected by the operator when pressure is removed from within the supply air line **40** either via a switch input or when the glad hand **64** is disconnected from the input arrangement **34** as previously described. By way of example, when the operator disconnects the glad hand **64** from the input arrangement **34**, a failure of the first solenoid **380** allows air to travel past the first solenoid and into the fifth chamber **334** via the second port **352**, thereby forcing the first valve member **316** in a direction **400**. The first valve member **316** travels in the direction **400** until the fifth chamber **334** of the first valve bore **314** is in pneumatic communication with the fourth chamber **346** of the second valve bore **318** via the fifth conduit **370** and the third chamber **330** of the first valve bore **314** via the second conduit **364**, the third chamber **330** of the first valve bore **314** is in fluid communication with the second chamber **342** of the second valve bore **318** via the third conduit **366**, and the second chamber **342** of the second valve bore **318** is in fluid communication with exhaust port **358**, such that air received by the second port **352** travels along an air path **401** and exits the exhaust port **358**. Air exiting the exhaust port **358** provides an audible “hissing” noise, thereby alerting the operator to potential damage or faulty operation of one of the solenoids **380**, **382**.

[0054] A similar audible noise alert is also provided if the second solenoid **382** fails, thereby allowing air to pass by the second solenoid **382** and to the fifth chamber **348** of the second valve bore **318**. Specifically, when the operator disconnects the glad hand **64** from the input arrangement **34**, a failure of the second solenoid **382** allows air pressure to travel past the second solenoid **382** and into the fifth chamber **348** via the third port **354**, thereby forcing the second valve member **320** in a direction **404** (FIGS. **19** and **20**). The second valve member **382** travels in the direction **404** until the fifth chamber **348** of the second valve bore **318** is in fluid communication with the fourth chamber **332** of the first valve bore **314** via the fifth conduit **370**, the fourth chamber **332** of the

first valve bore **314** is in fluid communication with the second chamber **328** of the first valve bore **314** via the second conduit **364** and the fourth chamber **346** of the second valve bore **318** via the fourth conduit **368**, and the fourth chamber **346** of the second valve bore **318** is in fluid communication with the exhaust port **360**, such that air received by the third port **354** travels along an air path **405** and exits the exhaust port **360**. Air exiting the exhaust port **360** provides an audible "hissing" noise, thereby alerting the operator to potential damage or faulty operation of one of the solenoids **380**, **382**.

[0055] In another alternative embodiment, the unit **16** may also be operably coupled with the fifth wheel sensor arrangement or assembly **94** (FIG. **4**) so as to provide a separate audible or visual warning to the operator warning of an unsafe coupling state. Specifically, a T-fitting **420** (FIG. **2**) may be located along the length of the supply air line **40** to supply air to a pressure switch **412**, which is in turn in electronic communication with the fifth wheel sensor arrangement or assembly **94** as described in Schutt et al., U.S. Pat. No. 7,548,155. As previously described, the fifth wheel sensor arrangement **94** is in communication with the logic circuit **82**, which is in turn capable of providing an electronic output **96**. In the present example, the electronic output may be used to provide either an audible or visual warning to the driver. Specifically, the logic circuit **82** receives a signal from the pressure switch **412** indicating that the pneumatic pressure has been supplied to the supply air line **40**, and then determines whether a proper coupling arrangement has been met via the signal received from the fifth wheel sensor arrangement **94**. If a proper coupling arrangement has not been met, the logic circuit **82** provides the electronic output **94** that is then utilized to power an audible and/or visual warning to the driver indicating an improper or hazardous coupling state.

[0056] The various embodiments of the storage and control arrangements assist in ensuring that electrical and pneumatic lines connecting a tractor truck to a trailer are not sheared or accidentally damaged while uncoupling the trailer from the truck. The storage and control arrangement also provides feedback to an operator regarding the status of the coupling of the lines to the overall unit, as well as the status of the relative arrangement of associated kingpin and fifth wheel hitch assemblies, thereby increasing operational safety and decreasing the likelihood of injury to the operator and damage to the truck and trailer. The system disclosed further provides for the automatic coupling/decoupling of an associated fifth wheel hitch arrangement upon disconnect of pneumatic lines from the trailer. The system disclosed herein further increases the operational safety by providing feedback to the operator alerting the operator to potential system damage. The configuration of the storage and control arrangement allows use on new vehicle builds, as well as easy and inexpensive adaption in retrofitting nearly any truck platform. The storage and control arrangement is efficient in use, capable of a long operating life, and is particularly well adapted for the proposed use.

[0057] In the foregoing description, it will be readily appreciated by those skilled in the art that modifications may be made to the invention without departing from the concepts disclosed herein. Such modifications are to be considered as included in the following claims, unless these claims by their language expressly state otherwise.

Claims

1. A storage arrangement for lines from a towing vehicle to a towed vehicle including at least one of an electrical line, a first pneumatic line, and a second pneumatic line, the storage arrangement comprising: a mounting structure configured to be secured to the towing vehicle external to a cab of the towing vehicle; a first receiver connected to the mounting structure and configured to couple to the at least one of the electrical line, the first pneumatic line and the second pneumatic line; and a control arrangement configured to operably couple to the first receiver such that upon coupling of the at least one of the electrical line, the first pneumatic line and the second pneumatic line with the first receiver the control arrangement provides the operator with an indication of a coupling status

of the select one of the electrical line, the first pneumatic line and the second pneumatic line with the storage arrangement via a status indicator.

2. The storage arrangement of claim 1, wherein the at least one of the electrical line, the first pneumatic line and the second pneumatic line includes the electrical line.

3. The storage arrangement of claim 1, further comprising: a first sensor configured to sense whether the electrical line is coupled to the first receiver, the first sensor operably coupled with the control arrangement.

4. The storage arrangement of claim 3, wherein the first sensor includes a proximity sensor.

5. The storage arrangement of claim 1, wherein the status indicator is located proximate the mounting structure.

6. The storage arrangement of claim 1, wherein the status indicator is located within a cab of the towing vehicle.

7. The storage arrangement of claim 1, wherein the status indicator is visual.

8. The storage arrangement of claim 7, wherein the control arrangement illuminates the status indicator when the electrical line is coupled with the first receiver.

9. The storage arrangement of claim 1, wherein the control arrangement prevents the towing vehicle from moving if the electrical line is not coupled to the first receiver.

10. The storage arrangement of claim 9, wherein the control arrangement prevents the towing vehicle from moving by preventing the operator from at least one of releasing brakes of the towing vehicle and releasing brakes of the towed vehicle.

11. The storage arrangement of claim 1, wherein the mounting structure includes a housing having an interior space.

12. The storage arrangement of claim 1, wherein the control arrangement comprises an electrical circuit.

13. A storage arrangement for lines from a towing vehicle to a towed vehicle including at least one of an electrical line, a first pneumatic line, and a second pneumatic line, the storage arrangement comprising: a mounting structure configured to be secured to the towing vehicle external to a cab of the towing vehicle; a first receiver connected to the mounting structure and configured to couple to the electrical line; a first sensor configured to sense whether the electrical line is coupled to the first receiver; and a control arrangement operably coupled to the first sensor such that upon coupling the electrical line with the first receiver the control arrangement provides the operator with an indication of a coupling status of the electrical line with the storage arrangement via a status indicator.

14. The storage arrangement of claim 13, wherein the first sensor includes a proximity sensor.

15. The storage arrangement of claim 14, wherein the status indicator is located proximate the mounting structure.

16. The storage arrangement of claim 14, wherein the status indicator is located within a cab of the towing vehicle.

17. The storage arrangement of claim 14, wherein the status indicator is visual.

18. The storage arrangement of claim 17, wherein the control arrangement illuminates the status indicator when the electrical line is coupled with the first receiver.

19. The storage arrangement of claim 13, wherein the control arrangement prevents the tractor from moving if the electrical line is not coupled to the first receiver.

20. The storage arrangement of claim 19 wherein the control arrangement prevents the towing vehicle from moving by preventing the operator from at least one of releasing brakes of the towing vehicle and releasing brakes of the towed vehicle.

21. The storage arrangement of claim 13, wherein the mounting structure includes a housing having an interior space.

22. The storage arrangement of claim 13, wherein the control arrangement comprises an electrical circuit.