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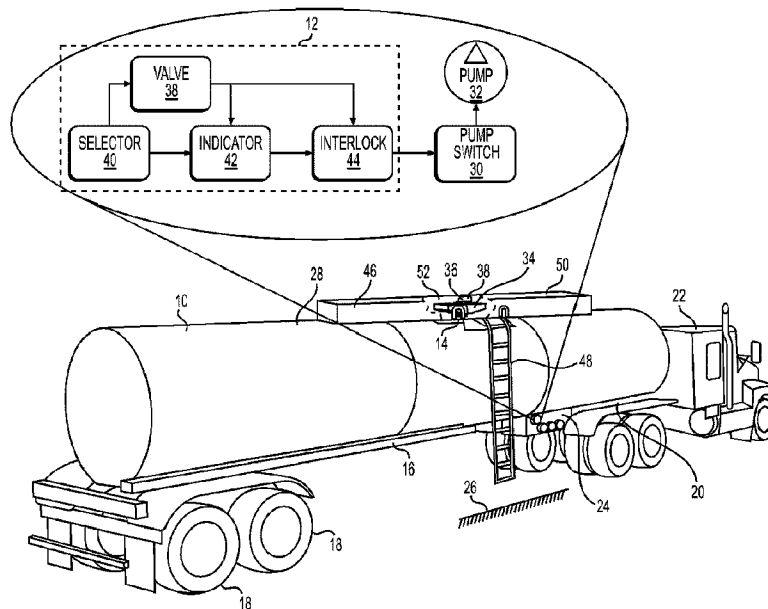
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(57) Abrégé/Abstract:

Systems and methods to vent a tank to enhance transporting asphalt when positioned in the tank may include connecting a vapor box to a tank. The vapor box may include one or more vents apertures and a valve associated with the one or more vent apertures and positioned to provide fluid flow between the interior of the vapor box and the exterior. The systems and methods may also include communication via a selector with the valve to cause the valve to switch between an open condition and a closed condition. The selector may be located remotely from the valve, and the systems and methods may also include communication with an indicator via one or more of the valve or the selector to provide an indication of one or more of the valve in the open condition or the valve in the closed condition.

Abstract

Systems and methods to vent a tank to enhance transporting asphalt when positioned in the tank may include connecting a vapor box to a tank. The vapor box may include one or more vents apertures and a valve associated with the one or more vent apertures and positioned to provide fluid flow between the interior of the vapor box and the exterior. The systems and methods may also include communication via a selector with the valve to cause the valve to switch between an open condition and a closed condition. The selector may be located remotely from the valve, and the systems and methods may also include communication with an indicator via one or more of the valve or the selector to provide an indication of one or more of the valve in the open condition or the valve in the closed condition.

SYSTEMS AND METHODS FOR VENTING ASPHALT TRANSPORT TANKS

Technical Field

[0001] The present disclosure relates to systems and methods for venting tanks.

[0002] More particularly, the present disclosure relates to systems and methods for venting tanks to enhance transporting asphalt.

Background

[0003] Trailers used to transport asphalt between locations may include a manway and a manually openable manhole on top of the trailer to allow vapors to vent from the interior of the trailer and ambient air to enter the interior of the trailer as the asphalt is pumped from the trailer. This prevents trailer from collapsing or imploding due to the pressure inside the trailer dropping as the asphalt is pumped from the trailer. For some trailers, the manhole is closed during transport of the asphalt between locations to prevent the asphalt from sloshing out of the manhole as the trailer pitches and rolls during transport. Once the trailer reaches a delivery location, the driver must climb a ladder to reach the manway and manhole, which is many feet above the ground and may present a hazard to the driver. In addition, the manhole may be difficult to manually open due, for example, to fouling over time from the asphalt, which may provide an additional hazard to the driver while manually opening the manhole. In addition, hydrogen sulfide gas, which may be present inside the trailer, is released from the interior of the trailer when the manhole is opened, and the gas may also present a hazard to the driver while the driver is located at the manhole.

[0004] Accordingly, it can be seen that a need exists for systems and methods that reduce risk when transporting and off-loading asphalt from a trailer or tank. The present disclosure may address one or more of the above-referenced drawbacks, as well as other possible drawbacks.

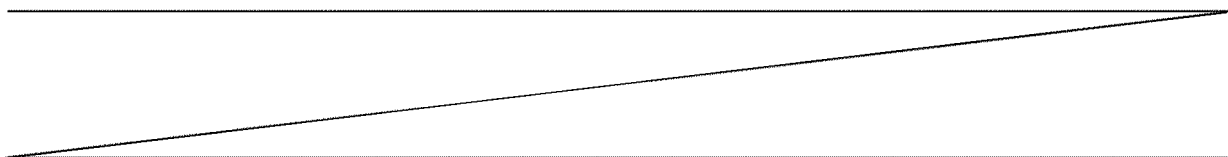
Summary

[0005] The present disclosure is generally directed to systems and methods for venting tanks to enhance transporting asphalt. For example, in some embodiments, a system to vent a tank for transporting asphalt when positioned in the tank may include a vapor box to connect to a tank. The vapor box may include one or more vent apertures. The system may also include a valve associated with the one or more vent apertures and positioned to provide fluid flow between an interior of the vapor box and an exterior of the vapor box. The system may further include a selector positioned in communication with the valve to cause the valve to switch between an open condition providing fluid flow between the interior of the vapor box and the exterior of the vapor box via the one or more vent apertures and a closed condition preventing fluid flow between the interior of the vapor box and the exterior of the vapor box via the one or more vent apertures. The selector may be located remotely from the valve. The system may also include an indicator positioned in communication with one or more of the valve or the selector to provide an indication of one or more of the valve in the open condition or the valve in the closed condition.

[0006] According to some embodiments, a system to vent a tank for transporting asphalt when positioned in the tank may include a vapor box to connect to a tank. The vapor box may include a cover including one or more vent apertures, and an inlet connected to the tank and positioned to provide fluid flow between an interior of the tank and an interior of the vapor box. The vapor box may also include a barrier extending between the cover and the inlet, the interior of the vapor box at least partially defined by the cover, the inlet, and the barrier. The system may also include

a valve associated with the one or more vent apertures and positioned to provide fluid flow between the interior of the vapor box and an exterior of the vapor box. The system may further include a selector spaced from and positioned in communication with the valve and to cause the valve to change between an open condition providing fluid flow between the interior of the vapor box and the exterior of the vapor box via the one or more vent apertures and a closed condition preventing fluid flow between the interior of the vapor box and the exterior of the vapor box via the one or more vent apertures.

[0007] According to some embodiments, a tank to enhance transporting asphalt between geographic locations may include a tank defining an interior volume to contain a material and one or more material ports positioned to facilitate one or more of flowing material into the interior volume of the tank or flowing material out of the interior volume of the tank. The tank may also include one or more vent ports to facilitate venting the tank. The tank may also include one or more pairs of wheels connected to the tank to facilitate movement of the tank to enhance transporting material in the interior volume of the tank between geographic locations. The tank may further include a system to vent the tank. The system may include a vapor box connected to the tank, and the vapor box may include one or more vent apertures. The system may further include a valve associated with the one or more vent apertures and positioned to provide fluid flow between an interior of the vapor box and an exterior of the vapor box, and a selector positioned in communication with the valve and to cause the valve to switch between an open condition providing fluid flow between the interior of the vapor box and the exterior of the vapor



box via the one or more vent apertures and a closed condition preventing fluid flow between the interior of the vapor box and the exterior of the vapor box via the one or more vent apertures.

[0008] According to some embodiments, a method for venting a tank from a location remote from a vent of the tank may include operating a selector positioned in communication with and remote from a valve associated with one or more vent apertures associated with the tank. The valve may be positioned to switch between an open condition providing fluid flow through the one or more vent apertures and a closed condition preventing fluid flow through the one or more vent apertures. The method may further include indicating via an indicator that the valve is in the open condition, the indicator being positioned in communication with one or more of the valve or the selector and positioned to provide an indication of one or more of the valve in the open condition or the valve in the closed condition.

[0008a] According to some embodiments, there is provided a system to vent a tank to enhance transporting asphalt when positioned in the tank, the system comprising:

- a vapor box to connect to an upper surface of a tank, the vapor box comprising:

- a cover including a vent aperture;

- an inlet connected to the tank and positioned to provide fluid flow between an interior of the tank and an interior of the vapor box; and

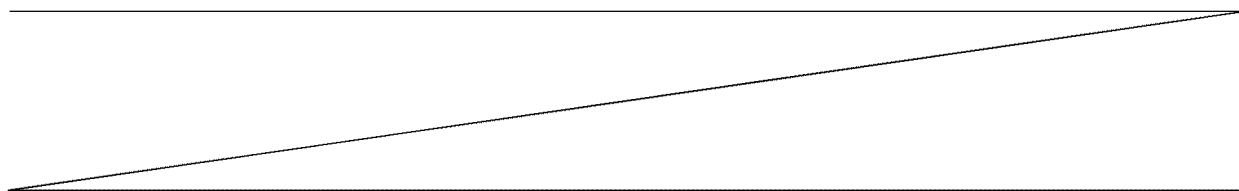
- a barrier extending between the cover and the inlet, the interior of the vapor box at least partially defined by the cover, the inlet, and the barrier;

- a valve (1) associated with the vent aperture, (2) positioned to extend through the cover such that a portion of the valve resides in the interior of the vapor box and another portion of the

valve resides in an exterior of the vapor box, and (3) configured to provide fluid flow between the interior of the vapor box and the exterior of the vapor box; and

a switch positioned remote from and in communication with the valve and to cause the valve to change between (a) an open condition providing, during asphalt off-loading from the tank, (1) pressure equalization between the interior of the tank and the exterior of the tank and (2) vapor flow between the interior of the vapor box and the exterior of the vapor box via the vent aperture and (b) a closed condition preventing fluid flow between the interior of the vapor box and the exterior of the vapor box via the vent aperture.

[0009] Still other aspects, embodiments, and advantages of these exemplary embodiments and embodiments, are discussed in detail below. Moreover, it is to be understood that both the foregoing information and the following detailed description provide merely illustrative examples of various aspects and embodiments, and are intended to provide an overview or framework for understanding the nature and character of the claimed aspects and embodiments. Accordingly, these and other objects, along with advantages and features of the present invention herein disclosed, will become apparent through reference to the following description and the accompanying drawings. Furthermore, it is to be understood that the features of the various embodiments described herein are not mutually exclusive and can exist in various combinations and permutations.



Brief Description of the Drawings

[0010] The accompanying drawings, which are included to provide a further understanding of the embodiments of the present disclosure, are incorporated in and constitute a part of this specification, illustrate embodiments of the present disclosure, and together with the detailed description, serve to explain principles of the embodiments discussed herein. No attempt is made to show structural details of this disclosure in more detail than can be necessary for a fundamental understanding of the embodiments discussed herein and the various ways in which they can be practiced. According to common practice, the various features of the drawings discussed below are not necessarily drawn to scale. Dimensions of various features and elements in the drawings can be expanded or reduced to more clearly illustrate embodiments of the disclosure.

[0011] FIG. 1 is a perspective view of an example tank to enhance transporting asphalt and a schematic view of an example system to vent a tank according to embodiments of the disclosure.

[0012] FIG. 2 is a perspective view of another example tank to enhance transporting asphalt and a schematic view of an example system to vent a tank according to embodiments of the disclosure.

[0013] FIG. 3 is a perspective view of yet another example tank to enhance transporting asphalt and a schematic view of an example system to vent a tank according to embodiments of the disclosure.

[0014] FIG. 4 is a partial perspective view of another example tank to enhance transporting asphalt and a schematic view of another example system to vent a tank according to embodiments of the disclosure.

[0015] FIG. 5 is a partial perspective view of another example tank to enhance transporting asphalt and a schematic view of yet a further example system to vent a tank according to embodiments of the disclosure.

[0016] FIG. 6 is a partial perspective view of another example tank to enhance transporting asphalt and a schematic view of still another example system to vent a tank according to embodiments of the disclosure.

[0017] FIG. 7 is a partial perspective view of another example tank to enhance transporting asphalt and a schematic view of still another example system to vent a tank according to embodiments of the disclosure.

[0018] FIG. 8 is a partial top view of an example tank to enhance transporting asphalt, including a top view of an example vapor box according to embodiments of the disclosure.

[0019] FIG. 9 is a partial side section view of an example tank to enhance transporting asphalt, including a partial side section view of the example vapor box taken along line 9-9 shown in FIG. 8 according to embodiments of the disclosure.

[0020] FIG. 10 is a partial end view of an example tank to enhance transporting asphalt, including an end view of the example vapor box shown in FIG. 8 according to embodiments of the disclosure.

[0021] FIG. 11 is a partial end section view of an example tank to enhance transporting asphalt, including a partial end section view of the example vapor box taken along line 11-11 shown in FIG. 8 according to embodiments of the disclosure.

Detailed Description

[0022] Referring now to the drawings in which like numerals indicate like parts throughout the several views, the following description is provided as an enabling teaching of exemplary

embodiments, and those skilled in the relevant art will recognize that many changes can be made to the embodiments described. It also will be apparent that some of the desired benefits of the embodiments described can be obtained by selecting some of the features of the embodiments without utilizing other features. Accordingly, those skilled in the art will recognize that many modifications and adaptations to the embodiments described are possible and can even be desirable in certain circumstances. Thus, the following description is provided as illustrative of the principles of the embodiments and not in limitation thereof.

[0023] The phraseology and terminology used herein is for the purpose of description and should not be regarded as limiting. As used herein, the term “plurality” refers to two or more items or components. The terms “comprising,” “including,” “carrying,” “having,” “containing,” and “involving,” whether in the written description or the claims and the like, are open-ended terms, i.e., to mean “including but not limited to,” unless otherwise stated. Thus, the use of such terms is meant to encompass the items listed thereafter, and equivalents thereof, as well as additional items. The transitional phrases “consisting of” and “consisting essentially of,” are closed or semi-closed transitional phrases, respectively, with respect to any claims. Use of ordinal terms such as “first,” “second,” “third,” and the like in the claims to modify a claim element does not by itself connote any priority, precedence, or order of one claim element over another or the temporal order in which acts of a method are performed, but are used merely as labels to distinguish one claim element having a certain name from another element having a same name (but for use of the ordinal term) to distinguish claim elements.

[0024] FIG. 1 is a perspective view of an example tank 10 to enhance transporting asphalt when positioned in the tanks and a schematic view of an example system 12 to vent the tank 10 according to embodiments of the disclosure. Asphalt may include any known asphalt products including, or

derived from, petroleum reserves. In some examples, the tank 10 may maintain the asphalt at a temperature greater than ambient temperature. As discussed herein, the tank 10 may include any type of container to hold and/or transport asphalt between two or more geographic locations. For example, the tank 10 may be at least partially filled with asphalt at a first geographic location, travel in either a self-propelled manner or pulled, pushed, or carried by a vehicle, such as a truck, locomotive, or aircraft, to one or more different geographic locations at which at least a portion of the asphalt is off-loaded, for example, via pumping.

[0025] In some examples, the tank 10 may define an interior volume to receive, store, and/or carry asphalt, one or more material ports positioned to facilitate flowing asphalt into the interior volume of the tank 10 or flowing material out of the interior volume of the tank 10. The tank 10 may also include a vent port 14 (see also FIGS. 9-11) positioned to facilitate venting the tank 10, for example, during off-loading of asphalt from the tank 10. In some examples, the vent port 14 may be opened or allowed to provide fluid flow between the interior volume of the tank 10 and the ambient surroundings, so that as asphalt is off-loaded from the tank 10, pressure inside the tank 10 may substantially equalize with the ambient or surrounding pressure to prevent the tank 10 from collapsing or imploding during the off-loading process.

[0026] In some examples, the tank 10 may include one or more pairs of wheels to facilitate transport of the tank 10 to enhance transporting asphalt in the interior volume of the tank 10 between geographic locations. For example, as shown in FIG. 1, an example chassis 16 is connected to the tank 10 and one or more pairs of wheels 18 positioned to facilitate movement of the tank 10. The example shown in FIG. 1 also includes a coupling 20 connected to the chassis 16 and positioned to be connected to a truck 22 to move the tank 10 between geographic locations.

[0027] As schematically shown in FIG. 1, the tank 10 may also include a control panel 24, which may be positioned on or adjacent a side of the tank 10, for example, at a location to facilitate operation by an operator or driver while standing on a surface 26 supporting the tank 10 (e.g., the ground) to initiate off-loading of at least a portion of the asphalt, for example, without requiring the operator or driver to leave the surface 26 and/or climb onto the tank 10 or an upper surface 28 of the tank 10.

[0028] As schematically shown in FIG. 1, the control panel 24 may include one or more pump switches 30 positioned in communication with one or more pumps 32 positioned to off-load or pump at least a portion of the asphalt carried in the interior volume of the tank 10 out of the tank 10, for example, into another reservoir or location, depending on, for example, the intended intermediate or end use. The one or more pump switches 30 and/or the one or more pumps 32 may be any known and/or suitable types of pump switches and/or pumps for off-loading or pumping the asphalt.

[0029] As schematically shown in FIG. 1, the example system 12 to vent the tank 10 may include a vapor box 34 connected to the tank 10. For example, the vent port 14 (see also FIGS. 9-11) of the tank 10 at, or in the vicinity of, the upper surface 28 of the tank 10, and the vapor box 34 may be connected or mounted to the upper surface 28 and define one or more vent apertures 36. The vent port 14 may be positioned to provide fluid flow between the interior volume of the tank 10, and the vapor box 34 may be mounted to the tank 10, such that the one or more vent apertures 36 of the vapor box 34 may be provide fluid flow via the vent port 14 between the interior volume of the tank 10 and the environment surrounding the tank 10.

[0030] As schematically shown in FIG. 1, the system 12 may include a valve 38 associated with the one or more vent apertures 36 and positioned to provide fluid flow between an interior of the

vapor box 36 and an exterior of the vapor box 36, according to some embodiments of the disclosure. For example, the valve 38 may be configured to switch between an open condition providing fluid flow between the interior of the vapor box 34 and the exterior of the vapor box 34 via the one or more vent apertures 36 and a closed condition preventing fluid flow between the interior of the vapor box 34 and the exterior of the vapor box 34 via the one or more vent apertures 36. The valve 38 may be pneumatically operated, hydraulically operated, and/or electrically operated to switch between the open condition and the closed condition, for example, as explained herein.

[0031] As schematically shown in FIG. 1, the system 12 may also include a selector 40 positioned in communication with the valve 38 and to cause the valve 38 to switch between the open condition and the closed condition, according to some embodiments of the disclosure. For example, the selector 40 may include a switch (e.g., a physical switch and/or a virtual switch on a computer screen) that may be positioned on or adjacent the tank 10 at a location to facilitate operation by an operator or driver while standing on the surface 26 supporting the tank 10 (e.g., the ground) to initiate switching the valve 38 from the closed condition to the open condition, for example, as described herein. In some examples, the valve 38 may be switched to the open condition to facilitate off-loading (e.g., pumping) at least a portion of the asphalt out of the interior volume of the tank 10. For example, prior to off-loading, the operator or driver may manipulate the selector 40 to cause the valve 38 to change to the open condition. Thereafter, the operator or driver may manipulate the pump switch 30 to cause one of more of the pumps 32 to pump at least a portion of the asphalt from the tank 10.

[0032] Because the valve 38 is in the open condition, the pressure in the tank 10 may substantially equalize with the ambient pressure outside the tank 10 during pumping of the asphalt, thereby

preventing the tank from imploding or collapsing due to a pressure drop inside the interior volume of the tank 10 during pumping. In addition, in some examples, because the operator or driver is able to cause the valve 38 to change to the open condition while standing on the surface 26, the operator or driver does not need to climb to the upper surface 28 of the tank 10, thereby reducing risk of injury to the operator or driver. In addition, in some examples, because the operator or driver is on the surface 26, the operator or driver is not directly exposed to hydrogen sulfide gas, which may be present inside the tank 10 and which may be released from the interior volume of the tank 10 when the valve 38 is switched to the open condition, thereby reducing another potential hazard to the operator or driver.

[0033] As shown in FIG. 1, some examples of the system 12 may include an indicator 42 positioned in communication with one or more of the valve 38 or the selector 40 to provide an indication that the valve 38 is in the open condition and/or the valve 38 is in the closed condition. In some examples, the indicator 42 may be positioned to provide an indication that the valve 38 is in a substantially or fully open condition in contrast with the valve 38 being in a slightly, partially, halfway, or slightly more than halfway open condition. For example, because it is not necessary for the operator or driver to climb to the upper surface 28 of the tank 10 to open the valve 38 and/or access the vent port 14 of the tank 10, it may be impractical or inconvenient for the operator to confirm that the valve 38 is in an at least substantially or fully open condition. Thus, in some examples, the indicator 42 may be positioned on or adjacent the tank 10 at a location to facilitate receipt of the indication by an operator or driver while standing on the surface 26 supporting the tank 10 (e.g., at ground level), for example, at a location near the pump switch 30 for convenience. In addition, because the valve 38 may be fouled by the asphalt, for example, if some of the asphalt comes in contact with the valve 38 during transport of the asphalt due to sloshing and/or splashing,

operation of the selector 40 may result in the valve 38 only partially opening. If the valve 38 only partially opens and the amount of opening is insufficient to allow a sufficient equalizing of pressure between inside the interior volume of the tank 10 and the ambient pressure surrounding the tank 10 during pumping of asphalt from the tank 10, the tank 10 may be damaged, at least partially implode, or at least partially collapse. Thus, in some examples, the indicator 42 may be positioned to indicate the valve 38 is in the open condition, only if the valve 38 is sufficiently open to prevent damage, at least partial implosion, and/or at least partial collapse of the tank 10. In some examples, the indicator 42 may be positioned receive a signal (e.g., a pneumatic, hydraulic, and/or electric signal) via the valve 38 and/or via the selector 40, for example, as described herein.

[0034] As shown in FIG. 1, the system 12 may in some examples include an interlock 44 positioned to prevent operation of the one or more pumps 32, unless the valve 38 is sufficiently open to prevent damage to the tank 10 during pumping of asphalt from the tank 10. For example, the interlock 44 may prevent operation of the pump switch 30 and/or prevent the pump switch 30 from activating the one or more pumps 32 (e.g., by preventing an activation signal from the pump switch 30 from activating the one or more pumps 32). The interlock 44 may include a physical interlock, for example, an actuator connected to a latch or rod that prevents operation of the pump switch 30 by the operator or driver, and/or an electrical interlock, for example, an electric signal that prevents activation of the one or more pumps 32. Other types of interlocks are contemplated.

[0035] As shown in FIG. 1, in some examples, the vapor box 34 may be mounted on the upper surface 28 of the tank 10 in the vicinity of a platform or manway 46, also on the upper surface 28 of the tank 10. The platform or manway 46 may be positioned to provide support for an operator or driver to access the upper surface 28, for example, during filling of the tank 10 and/or to access the vent port 14. In some examples, the tank 10 may include a ladder 48 connected to the side of

the tank 10 for the operator or driver to climb to reach the upper surface 28 and the platform or manway 46.

[0036] As schematically depicted, in some examples, of the system 12, the vapor box 34, and/or the platform or manway 46 may be positioned, such that the highest point of the vapor box 34 and/or the valve 38 is below an upper surface or highest point 50 of the platform or manway 46. For example, the vapor box 34 and/or valve 38 may be positioned in a recess 52 in the platform or manway 46, such that the highest point of the vapor box 34 and/or the valve 38 is below the upper surface or highest point 50 of the platform or manway 46 (see also FIGS. 9-11). This may reduce or prevent damage to the valve 38 and/or the vapor box 34 that might occur if the tank 10 were to overturn during an accident or strike an overhead object such as a walkway or bridge under which the tank 10 is travelling. This, in turn, may reduce the likelihood and/or prevent unintended release of asphalt from the tank 10 into the environment during such accidents or incidents.

[0037] FIG. 2 is a perspective view of another example tank 10 to enhance transporting asphalt and a schematic view of an example system 12 to vent a tank 10 according to embodiments of the disclosure. In the example shown in FIG. 2, the tank 10 is connected to chassis 16 of a truck 54 including a cab 56 and a power source 58 to provide torque for propelling the tank 10 between geographic locations and transporting the asphalt. In some examples, the system 12 shown in FIG. 2, may have at least some features in common with the system 12 shown and described with respect to FIG. 1.

[0038] FIG. 3 is a perspective view of yet another example tank 10 to enhance transporting asphalt and a schematic view of an example system 12 to vent a tank 10 according to embodiments of the disclosure. In the example shown in FIG. 3, the tank 10 is connected to a chassis 16 of a railcar 60 to enhance transporting the asphalt when positioned in the tank and having at least one rail

coupling 62 to connect the railcar 60 to at least one other railcar and/or a locomotive. In some examples, the system 12 shown in FIG. 3, may have at least some features in common with the system 12 shown and described with respect to FIG. 1.

[0039] FIG. 4 is a partial perspective view of another example tank 10 to enhance transporting asphalt and a schematic view of another example system 12 to vent a tank 10 according to embodiments of the disclosure. In the example shown in FIG. 4, the system 12 includes a selector communication conduit 64 between the valve 38 and the selector 40. The selector communication conduit 64 may include one or more of a pneumatic conduit, a hydraulic conduit, or an electrical conduit, for example, as explained herein. For example, in FIG. 4, the valve 38 may be actuated via fluid pressure. In some examples, an air supply 66 may be in flow communication with the selector 40 (e.g., a pneumatic selector), which may be a pneumatic switch (e.g., a pneumatic valve) positioned to communicate with the valve 38 via the selector communication conduit 64 (e.g., an air conduit). The air supply 66, in some examples, may be provided by the chassis or vehicle to which the tank 10 is connected. In some examples, the air supply 66 may include air or one or more gasses provided at high pressure. In some examples, the high pressure may be provided by a high-pressure tank and/or a compressor, for example, associated with the chassis or vehicle to which the tank 10 is connected.

[0040] In some examples, the valve 38 may include a crude oil vapor valve configured to be activated to switch between the closed and open conditions via air pressure. In some examples, the valve 38 may be a dual-stage poppet valve configured to activate via 35 pounds per square inch of pressure or more. In some examples, the indicator 42 (e.g., a pneumatic indicator) may be configured to be pneumatically activated. For example, the selector 40, the selector communication conduit 64, and the indicator 42 may at least partially form a pneumatic circuit.

The indicator 42 may be configured to provide one or more of a visual indication (e.g., illumination of a light), an audible indication (e.g., sounding of an alarm, siren, and/or beep), or a tactile indication (e.g., activation of a buzzing and/or vibrating of the pump switch 30, etc.). In some examples, the indication may be communicated to a fleet management site located at a geographic location remote from the tank 10, for example, via a transmitter (see also, for example, FIG. 7).

[0041] As shown in FIG. 4, some examples of the interlock 44 may be pneumatically activated, for example, via air pressure received from the valve 38 and/or the indicator 42, for example, as part of a pneumatic circuit. In some such examples, the interlock 44 may be a physical interlock, such as a rod or latch connected to a pneumatic actuator positioned to cause movement of the rod or latch upon receipt of a signal from the pneumatic circuit. In some examples, the physical interlock may include a biasing member (e.g., a spring) connected to the interlock 44 and positioned to bias the interlock 44 in a position and/or orientation that prevents the pump switch 30 from activating the one or more pumps 32, for example, unless the interlock 44 receives an air signal with sufficient pressure to overcome the biasing force of the biasing member, thereby facilitating operation of the pump switch 30 to activate the one or more pumps 32 to pump at least a portion of the asphalt from the tank 10. In some examples, the interlock 44 may be positioned to receive the pneumatic signal and cause an electric switch to prevent operation of the one or more pumps 32, unless the pneumatic switch is activated.

[0042] FIG. 5 is a partial perspective view of another example tank 10 to enhance transporting asphalt and a schematic view of yet a further example system 12 to vent a tank 10 according to embodiments of the disclosure. As shown in FIG. 5, in some examples, the system 12 may include a hydraulic reservoir 68 positioned to contain a supply of hydraulic fluid. The system 12 may also include a hydraulic pump 70 positioned to draw hydraulic fluid from the hydraulic reservoir 68

and pump the hydraulic fluid under pressure to the selector 40. The selector communication conduit 64 may be a hydraulic conduit. The selector 40 may be a hydraulic selector (e.g., a hydraulic valve or hydraulic switch) positioned to change the valve 38 between the closed condition and the open condition. In some examples, the valve 38 may be configured to be activated via receipt of hydraulic fluid under pressure. For example, the valve 38 may include a hydraulic actuator 65, such as a rod and cylinder-type actuator connected to the valve 38 and to cause the valve 38 to change between the closed and open conditions.

[0043] In some examples, the indicator 42 (e.g., a hydraulic indicator) may be configured to be hydraulically activated. For example, the selector 40, the selector communication conduit 64, and the indicator 42 may at least partially form a hydraulic circuit. The indicator 42 may be configured to provide one or more of a visual indication (e.g., illumination of a light), an audible indication (e.g., sounding of an alarm, siren, and/or beep), or a tactile indication (e.g., activation of a buzzing and/or vibrating of the pump switch 30). In some examples, the indication may be communicated to a fleet management site located at a geographic location remote from the tank 10, for example, via a transmitter.

[0044] As shown in FIG. 5, some examples of the interlock 44 may be hydraulically activated, for example, via hydraulic fluid under pressure received from the valve 38 and/or the indicator 42, for example, as part of the hydraulic circuit. In some such examples, the interlock 44 may be a physical interlock, such as a rod or latch connected to a hydraulic actuator positioned to cause movement of the rod or latch upon receipt of a signal from the hydraulic circuit. In some examples, the physical interlock may include a biasing member (e.g., a spring) connected to the interlock 44 and positioned to bias the interlock 44 in a position and/or orientation that prevents the pump switch 30 from activating the one or more pumps 32, for example, unless the interlock 44 receives

a hydraulic signal with sufficient pressure to overcome the biasing force of the biasing member, thereby facilitating operation of pump switch 30 to activate the one or more pumps 32 to pump at least a portion of the asphalt from the tank 10. In some examples, the interlock 44 may be positioned to receive the hydraulic signal and cause an electric switch to prevent operation of the one or more pumps 32, unless the hydraulic switch is activated.

[0045] FIG. 6 is a partial perspective view of another example tank 10 to enhance transporting asphalt and a schematic view of still another example system 12 to vent a tank 10 according to embodiments of the disclosure. As shown in FIG. 6, in some examples, the system 12 may include an electric power source 72 to provide a supply of electric power for operation of one or more of the selector 40, the valve 38, the indicator 42, or the interlock 44. For example, the electric power source 72 may include one or more batteries and/or electric power supplied by the chassis and/or vehicle to which the tank 10 is connected. As shown in FIG. 6, the electric power source 72 may be positioned to supply electric power to the selector 40, which may be an electric selector, such as an electric switch. The selector communication conduit 64 may be an electric circuit, and the selector 40 may be positioned to change the valve 38 between the closed condition and the open condition. In some examples, the valve 38 may be configured to be activated via receipt of an electric signal from the selector 40. For example, the valve 38 may include an electric actuator 73, such a linear actuator and/or motor connected to the valve 38 and positioned to cause the valve 38 to change between the closed and open conditions.

[0046] In some examples, the indicator 42 (e.g., an electric indicator) may be configured to be electrically activated. For example, the selector 40, the selector communication conduit 64, and the indicator 42 may at least partially form an electric circuit, and the indicator 42 may be configured to provide one or more of a visual indication (e.g., illumination of a light), an audible

indication (e.g., sounding of an alarm, siren, and/or beep), or a tactile indication (e.g., activation of a buzzing and/or vibrating of the pump switch 30). In some examples, the indication may be communicated to a fleet management site located at a geographic location remote from the tank 10, for example, via a transmitter

[0047] As shown in FIG. 6, some examples of the interlock 44 may be electrically activated, for example, via an electric signal received from the valve 38 and/or the indicator 42, for example, as part of the electric circuit. In some such examples, the interlock 44 may be a physical interlock, such as a rod or latch connected to an electric actuator positioned to cause movement of the rod or latch upon receipt of a signal via the electric circuit. In some examples, the physical interlock may include a biasing member (e.g., a spring) connected to the interlock 44 and positioned to bias the interlock 44 in a position and/or orientation that prevents the pump switch 30 from activating the one or more pumps 32, for example, unless the interlock 44 receives an electric signal (e.g., to power the electric actuator) to overcome the biasing force of the biasing member, thereby facilitating operation of pump switch 30 to activate the one or more pumps 32 to pump at least a portion of the asphalt from the tank 10. In some examples, the interlock 44 may be configured to receive the electric signal and cause an electric switch to prevent operation of the one or more pumps 32, unless the electric switch is activated.

[0048] FIG. 7 is a partial perspective view of another example tank 10 to enhance transporting asphalt and a schematic view of still another example system 12 to vent a tank 10 according to embodiments of the disclosure. The example system 12 shown in FIG. 7 may include a computing device 74, such as a portable computing device (e.g., a laptop, tablet, smartphone, and/or a purpose-built portable controller) that acts as the selector 40. In some examples, the computing device 74 may be located at any geographic location remote from the tank 10, such as at a fleet

management site. As shown, an operator or driver 76 (or a fleet operator located remotely from the tank 10) may use the computing device 74 to communicate with an actuator 78 connected to the valve 38 to cause the valve 38 to change between the closed condition and the open condition, for example, as described herein.

[0049] For example, the computing device 74 may include a transmitter 80 (e.g., a selector transmitter) and a receiver 82 (or a transceiver), and the operator or driver 76 may use the computing device 74 to communicate a signal to the actuator 78 to a receiver 84 connected to the actuator 78 and positioned to activate the actuator 78 to cause the valve 38 to change from the closed condition to the open condition. For example, the computing device 74 may include a graphical user interface to facilitate selection by the operator or driver 76 to cause the valve 38 to open.

[0050] The system 12 may include an electric power source configured to provide a supply of electric power for operation of one or more of the actuator 78, the valve 38, the indicator 42, or the interlock 44 (see, e.g., FIG. 6). For example, the electric power source may include one or more batteries and/or electric power supplied by the chassis and/or vehicle to which the tank 10 is connected.

[0051] As shown in FIG. 7, some examples of the system 12 may also include one or more sensors 86 configured to generate one or more signals indicative of whether the valve 38 is sufficiently open to effectively equalize the pressure in interior volume of the tank 10 with the ambient pressure surrounding the tank 10 to prevent damage, implosion, and/or collapse when the one or more pumps 32 pump asphalt from the tank 10. The one or more sensors 86 may be communicatively connected to a transmitter 88 (e.g., a valve transmitter) configured to transmit one or more signals from the one or more sensors to the computing device 74 and/or the interlock 44, which may be

an electrically activated interlock. In some examples, the transmitter 88 may be configured to receive one or more signals from the actuator 78 and/or the valve 38 indicative of the condition of the valve 38 (e.g., open or closed), and transmit one or more signals (e.g., one or more valve signals) for receipt by the receiver 82 associated with the computing device 74.

[0052] In some examples, the valve 38 may be configured to be activated via receipt of one or more signals from the computing device 74, which may serve as a selector. For example, the actuator 78 maybe an electric actuator, such as a linear actuator and/or motor connected to the valve 38 and positioned to cause the valve 38 to change between the closed and open conditions. In some such examples, the selector communication conduit 64 may be a communications link (wired and/or wireless) between the computing device 74, the receiver 84, the actuator 78, the valve 38, the transmitter 88, the receiver 82 of the computing device 74, and/or the interlock 44.

[0053] In some examples, the indicator 42 (e.g., an electric indicator) may be incorporated into the computing device 74. The indicator 42 may be configured to illicit indication of the valve 38 being sufficiently open via one or more of a visual indication, for example, illumination of a light, such as display of a message on the graphical user interface of the computing device 74, an audible indication, for example, sounding of an alarm, siren, beep, and/or other audible notification, a tactile indication, for example, activation of a buzzing and/or vibrating of the computing device 74. In some examples, the indication may be communicated to a fleet management site located at a geographic location remote from the tank 10, for example, via the transmitter 80 and/or the transmitter 88.

[0054] As shown in FIG. 7, the interlock 44 may be configured to receive one or more signals from the transmitter 88 associated with the sensor 86 and/or the actuator 78, which may electrically activate the interlock 44. In some such examples, the interlock 44 may be a physical interlock,

such as a rod or latch connected to an electric actuator positioned to cause movement of the rod or latch upon receipt of a signal via the electric circuit. In some examples, the physical interlock may include a biasing member (e.g., a spring) connected to the interlock 44 and positioned to bias the interlock 44 in a position and/or orientation that prevents the pump switch 30 from activating the one or more pumps 32, for example, unless the interlock 44 receives an electric signal (e.g., to power the electric actuator) to overcome the biasing force of the biasing member, thereby facilitating operation of pump switch 30 to activate the one or more pumps 32 to pump at least a portion of the asphalt from the tank 10. In some examples, the interlock 44 may be configured to receive the electric signal and cause an electric switch to prevent operation of the one or more pumps 32, unless the electric switch is activated.

[0055] FIGS. 8, 9, 10, and 11 illustrate an example vapor box 34 according to embodiments of the disclosure. For example, FIG. 8 is a partial top view of an example tank 10 to enhance transporting asphalt, including a top view of an example vapor box 34, and FIG. 9 is a partial side section view of the example tank 10 to enhance transporting asphalt, including a partial side section view of the example vapor box 34 taken along line 9-9 shown in FIG. 8, according to embodiments of the disclosure.

[0056] As shown in FIGS. 8 and 9, the example vapor box 34 may include a cover 90 including the vent aperture 36 and an inlet 92 to connect to the tank 10 and provide fluid flow between the interior volume of the tank 10 and an interior 94 of the vapor box 34. In some examples, the vapor box 34 may also include a barrier 96 extending between the cover 90 and the inlet 92, and the cover 90, the inlet 92, and the barrier 96 may at least partially define the interior 94 of the vapor box 34. As described herein, the valve 38 may be associated with the vent aperture 36 and may

be positioned to provide fluid flow between the interior 94 of the vapor box 34 and an exterior of the vapor box 34 (e.g., to the ambient surroundings of the vapor box 34).

[0057] In some examples, as shown in FIG. 9, the barrier 96 may include a first end wall 98 and a second end wall 100 opposite the first end wall 98. As shown in FIGS. 10 and 11, the barrier 96 may also include a first side wall 102 extending longitudinally between the first end wall 98 and the second end wall 100, and a second side wall 104 opposite the first side wall 102 and extending longitudinally between the first end wall 98 and the second end wall 100. In some examples, one or more of the first end wall 98, the second end wall 100, the first side wall 102, or the second side wall 104 may be substantially planar. It is contemplated that one or more of the first end wall 98, the second end wall 100, the first side wall 102, or the second side wall 104 may have non-planar aspects.

[0058] As shown in FIGS. 8 and 9, in some examples of the vapor box 34, the cover 90 and/or the barrier 96 may include an inspection opening 106 to facilitate a view of at least a portion of the interior 94 of the vapor box 34. For example, the cover 90 includes two inspection openings 106a and 106b, and the example barrier 96 (e.g., the second side wall 104) includes an inspection opening 106c. In addition, the example vapor box 34 also includes an inspection opening cover 108 removably connected to the vapor box 34, such that the inspection opening cover 108 at least partially blocks the one or more inspection openings 106 and is separable from the vapor box 34 to facilitate the view of the at least a portion of the interior 94 of the vapor box 34. For example, as shown in FIGS. 8 and 9, inspection opening covers 108a, 108b, and 108c may be connected to the cover 90 and the barrier 96, for example, via fasteners (e.g., screws and/or bolts) to block the inspection openings 106a, 106b, and 106c, respectively.

[0059] Removal of one or more of the inspection opening covers 108 may provide access to the interior 94 of the vapor box for inspection, for example, to determine whether asphalt has built-up in the interior 94 of the vapor box 34, and if so, may facilitate cleaning of the interior 94 of the vapor box 34 to remove at least some of the asphalt from the interior 94 of the vapor box 34. For example, during transport of asphalt in the tank 10, asphalt may slosh and/or splash up into the interior 94 of the vapor box 34. Over time, the build-up of asphalt in the interior 94 of the vapor box 34 may inhibit the effectiveness of the vapor box 34, potentially preventing the valve 38 from opening substantially or fully, which may lead to unintended damage to the tank 10, for example, during pumping of asphalt from the interior volume of the tank 10. Periodic inspection and/or cleaning of the interior 94 of the vapor box 34 may reduce the likelihood or prevent the occurrence of such situations.

[0060] As shown in FIG. 9-11, some examples of the vapor box 34 may also include a base 110 connected to the barrier 96 and defining an inlet opening 112. The inlet 92 may be connected to the base 110 and define a passage 114 between the interior volume of the tank 10 and the inlet opening 112. For example, as shown, the inlet 92 may include a tubular member 116 connected to the base 110 and the tank 10 to provide fluid flow between the interior volume of the tank 10 and the interior 94 of the vapor box 34. In the example shown, a flange 118 is connected to a first end 120 of the tubular member 116 and the tank 10 (e.g., the upper surface 28), and a second end 122 of the tubular member 116 is connected to the base 110 of the vapor box 34, thereby connecting the vapor box 34 to the tank 10, such that fluid flow exists between the interior volume of the tank 10 and the interior 94 of the vapor box 34.

[0061] As shown in FIG. 9, for some examples of the base 110 of the vapor box 34, the base 110 may include a first portion 124 extending from the barrier 96 (e.g., from the first end wall 98)

toward the inlet opening 112 at an angle β oblique with respect to at least a portion of the barrier 96 (e.g., the first end wall 98). The base 110 may also include a second portion 126 extending from the barrier 96 (e.g., from the second end wall 100) toward the inlet opening 112 at an angle μ oblique with respect to at least a portion of the barrier 96 (e.g., the second end wall 100) and the first portion 124. For example, the vapor box 34 may define a longitudinal vapor box axis X extending between the first end wall 98 of the vapor box 34 and the second end wall 100 of the vapor box 34. In some examples, the first portion 124 of the base 110 may extend from the first end wall 98 of the vapor box 34 toward the inlet opening 112, and the second portion 126 of the base 110 may extend from the second end wall 100 of the vapor box 34 toward the inlet opening 112.

[0062] In some examples, the first portion 124 of the base 110 and the second portion 126 of the base 110 may at least partially define a v-shaped cross-section viewed perpendicular relative to the longitudinal vapor box axis X (see FIG. 9) and may cause material to flow toward the inlet opening 112. For example, during transport of asphalt, asphalt may slosh or splash up into the inlet opening 112 and the interior 94 of the vapor box 34. The example configuration of the first portion 124 and second portion 126 of the base 110 may cause any asphalt that sloshes or splashes into the interior 94 of the vapor box 34 to flow toward the inlet opening 112 and out of the interior 94 of the vapor box 34. In some examples, one or more of the first portion 124 or the second portion 126 may be substantially planar, for example, as shown in FIG. 9. It is contemplated that one or more of the first portion 124 or the second portion 126 may have non-planar aspects.

[0063] FIG. 10 is a partial end view of an example tank 10 to enhance transporting asphalt, including an end view of the example vapor box 34 shown in FIG. 8, and FIG. 11 is a partial end section view of the example tank 10, including a partial end section view of the example vapor

box 34 taken along line 11-11 shown in FIG. 8 according to embodiments of the disclosure. As shown in FIGS. 10 and 11, the first side wall 102 and/or the second side wall 104 may define one or more vent openings 128 to provide fluid flow between the interior 94 of the vapor box 34 and exterior of the vapor box 34, (e.g., the ambient air surrounding the exterior of the vapor box 34). For example, as shown in FIGS. 8 and 9, some examples may include two vent openings 128a and 128b in the second side wall 104 of the vapor box 34. In some examples, a duct 130 may be associated with the exterior of the vapor box 34 and the one or more vent openings 128. The example shown in FIGS. 9 and 10 includes a first duct 130a associated with the first vent opening 128a, and a second duct 130b associated with the second vent opening 128b. The one or more ducts 130 may redirect flow from a first flow direction to a second flow direction different than the first flow direction. For example, each of the example ducts 130a and 130b shown in FIGS. 10 and 11 includes a ninety-degree elbow mounted to the second side wall 104 of the vapor box 34, such that vapor initially exiting via the vent openings 128a and 128b flows substantially horizontally and thereafter is redirected to flow substantially vertically downward.

[0064] In some examples, the vapor box 34 may also include a restrictor 132 associated with the interior 94 of the vapor box 34 and the one or more vent openings 128. The example shown in FIGS. 9-11 includes a first restrictor 132a associated with the first vent opening 128a, and a second restrictor 132b associated with the second vent opening 128b. The one or more restrictors 132 may at least partially obstruct the associated vent opening 128. For example, the example restrictors 132 shown define a length of half pipe 134 connected to an interior side of the second side wall 104 and extending inward toward the first side wall 102 and terminating at a restrictor flange 136. In some examples, the half pipe 134 and flange 136 may reduce the likelihood that

asphalt sloshed or splashed up into the interior 94 of the vapor box 34 during transport will exit the vapor box 34 via the vent openings 128.

[0065] As shown in FIGS. 9-11, some examples of the vapor box 34 may also include a first baffle 138 between the base 110 and the cover 90 and extending between the first side wall 102 and the second side wall 104. As shown, in some examples, the first baffle 128 may be substantially longitudinally aligned with the inlet 92. In some examples, the first baffle 138 may define a first baffle dimension D in a direction parallel to the longitudinal vapor box axis X exceeding an inlet dimension I defined by the inlet 92 in the direction parallel to the longitudinal vapor box axis X . For example, the first baffle dimension D may be greater than twice the inlet dimension I .

[0066] As shown in FIG. 9, the first baffle 138 may include a first baffle portion 140 and a second baffle portion 142 connected to the first baffle portion 140. In some examples, the first baffle portion 140 and the second baffle portion 142 may define an obtuse first included angle δ having a first baffle vertex 144 extending between the first side wall 102 and the second side wall 104 (see FIGS. 9 and 11). As shown in FIG. 9, in some examples, the first included angle δ defined by the first baffle 138 opens toward the inlet 92.

[0067] As shown in FIGS. 9-11, the vapor box 34 may also include a second baffle 146 between the first baffle 138 and the cover 90 and extending between the first side wall 102 and the second side wall 104. In some examples, the second baffle 146 may be substantially longitudinally aligned with the first baffle 138 and/or the inlet 92. The second baffle 146 may define a second baffle dimension D' in a direction parallel to the longitudinal vapor box axis X exceeding the inlet dimension I defined by the inlet 92 in the direction parallel to the longitudinal vapor box axis X . In some examples, the first baffle dimension D may exceed the inlet dimension I , and in some

examples, the second baffle dimension D' may exceed the first baffle dimension D . For example, the second baffle dimension D' may be greater than twice the first baffle dimension D . Other relative sizes and dimensions are contemplated.

[0068] As shown in FIG. 9, the second baffle 146 may include a first baffle portion 148 and a second baffle portion 150 connected to the first baffle portion 148. In some examples, the first baffle portion 148 and the second baffle portion 150 of the second baffle 146 may define an obtuse second included angle σ having a second baffle vertex 144 extending between the first side wall 102 and the second side wall 104 (see FIGS. 9 and 11). As shown in FIG. 9, in some examples, the second included angle σ defined by the second baffle 146 may open toward first baffle 138 and/or the inlet 92.

[0069] In some examples, the first baffle 138 and/or the second baffle 146 may at least partially define an inverted v-shaped cross-section viewed perpendicular relative to the longitudinal vapor box axis X (e.g., see FIG. 9) and may cause material to flow toward the inlet opening 112. For example, during transport of asphalt when positioned in the tank, asphalt may slosh or splash up into the inlet opening 112 and the interior 94 of the vapor box 34. The example configuration of the first baffle 138 and/or the second baffle 146 may prevent asphalt from sloshing or splashing up onto the inlet of the valve 38 and/or cause the asphalt in the interior 94 to flow down toward the inlet opening 112 and out of the interior 94 of the vapor box 34. In some examples, one or more of the portions of the first baffle 138 and/or one or more portions of the second baffle 146 may be substantially planar, for example, as shown in FIG. 9. It is contemplated that one or more of the portions of the first baffle 138 and/or the second baffle 146 may have non-planar aspects.

[0070] Having now described some illustrative embodiments of the invention, it should be apparent to those skilled in the art that the foregoing is merely illustrative and not limiting, having

been presented by way of example only. Numerous modifications and other embodiments are within the scope of one of ordinary skill in the art and are contemplated as falling within the scope of the invention. In particular, although many of the examples presented herein involve specific combinations of method acts or system elements, it should be understood that those acts and those elements may be combined in other ways to accomplish the same objectives. Those skilled in the art should appreciate that the parameters and configurations described herein are exemplary and that actual parameters and/or configurations will depend on the specific application in which the systems and techniques of the invention are used. Those skilled in the art should also recognize or be able to ascertain, using no more than routine experimentation, equivalents to the specific embodiments of the invention. It is, therefore, to be understood that the embodiments described herein are presented by way of example only and that, within the scope of any appended claims and equivalents thereto, the invention may be practiced other than as specifically described.

[0071] Furthermore, the scope of the present disclosure shall be construed to cover various modifications, combinations, additions, alterations, etc., above and to the above-described embodiments, which shall be considered to be within the scope of this disclosure. Accordingly, various features and characteristics as discussed herein may be selectively interchanged and applied to other illustrated and non-illustrated embodiment, and numerous variations, modifications, and additions further can be made thereto without departing from the spirit and scope of the present invention as set forth in the appended claims.

CLAIMS

What is claimed is:

1. A system to vent a tank for transporting asphalt when positioned in the tank, the system comprising:

a vapor box to connect to the tank, the vapor box including one or more vent apertures;

a valve associated with the one or more vent apertures and positioned to provide fluid flow between an interior of the vapor box and an exterior of the vapor box;

a selector positioned in communication with the valve to cause the valve to switch between an open condition providing fluid flow between the interior of the vapor box and the exterior of the vapor box via the one or more vent apertures and a closed condition preventing fluid flow between the interior of the vapor box and the exterior of the vapor box via the one or more vent apertures, the selector being located remotely from the valve; and

an indicator positioned in communication with one or more of the valve or the selector to provide an indication of one or more of the valve in the open condition or the valve in the closed condition.

2. The system of claim 1, wherein the system further comprises a selector communication conduit extending between the valve and the selector, the selector communication conduit comprising one or more of a pneumatic conduit, a hydraulic conduit, or an electrical conduit.

3. The system of claim 2, wherein the valve is positioned to be actuated via fluid pressure, and wherein the selector communication conduit comprises one of a pneumatic conduit or a

hydraulic conduit, and wherein the selector comprises one of a pneumatic conduit or a hydraulic conduit.

4. The system of claim 1, wherein the valve comprises one of a pneumatically-actuated valve, a hydraulically-actuated valve, or an electrically-actuated valve, the system further comprising an indicator communication conduit extending between the valve and the indicator, the indicator communication conduit comprising one or more of a pneumatic conduit, a hydraulic conduit, or an electrical conduit, and wherein the indicator is positioned to be actuated via fluid pressure.

5. The system of claim 1, further comprising a selector transmitter associated with the selector and to wirelessly communicate a selector signal to the valve, the selector signal providing a command to cause the valve to switch between the open condition and the closed condition, and wherein the selector comprises a hand-held computing device.

6. The system of claim 1, further comprising one or more of a selector transmitter associated with the selector or a valve transmitter associated with the valve, the one or more of the selector transmitter or the valve transmitter positioned to wirelessly communicate a valve signal to the indicator, the valve signal positioned to cause the indication of one or more of the valve in the open condition or the valve in the closed condition.

7. The system of claim 1, further comprising an interlock to prevent operation of a pump unless the valve is in the open condition, and wherein the interlock comprises one or more of a

physical interlock preventing operation of a switch to activate the pump or an electrical interlock preventing the switch from activating the pump.

8. A system to vent a tank for transporting asphalt when positioned in the tank, the system comprising:

a vapor box to connect to the tank, the vapor box comprising:

a cover including one or more vent apertures;

an inlet connected to the tank and positioned to provide fluid flow between an interior volume of the tank and an interior of the vapor box; and

a barrier extending between the cover and the inlet, the interior of the vapor box at least partially defined by the cover, the inlet, and the barrier;

a valve associated with the one or more vent apertures and positioned to provide fluid flow between the interior of the vapor box and an exterior of the vapor box; and

a selector positioned spaced from and in communication with the valve and to cause the valve to change between an open condition providing fluid flow between the interior of the vapor box and the exterior of the vapor box via the one or more vent apertures and a closed condition preventing fluid flow between the interior of the vapor box and the exterior of the vapor box via the one or more vent apertures.

9. The system of claim 8, wherein the valve and the selector are positioned to be located remotely from one another, and wherein the system further comprises a selector communication conduit extending between the valve and the selector, the selector communication conduit comprising one or more of a pneumatic conduit, a hydraulic conduit, or an electrical conduit.

10. The system of claim 9, wherein the valve is positioned to be actuated via fluid pressure, and wherein the selector communication conduit comprises one of a pneumatic conduit or a hydraulic conduit, and wherein the selector comprises one of a pneumatic conduit or a hydraulic conduit.

11. The system of claim 8, wherein the valve comprises one of a pneumatically-actuated valve, a hydraulically-actuated valve, or an electrically-actuated valve, the system further comprising an indicator communication conduit extending between the valve and the indicator, the indicator communication conduit comprising one or more of a pneumatic conduit, a hydraulic conduit, or an electrical conduit, and wherein the indicator is positioned to be actuated via fluid pressure, and wherein the indicator communication conduit comprises one of a pneumatic conduit or a hydraulic conduit.

12. The system of claim 8, further comprising a selector transmitter associated with the selector and to wirelessly communicate a selector signal to the valve, the selector signal providing a command to cause the valve to switch between the open condition and the closed condition, and wherein the selector comprises a hand-held computing device.

13. The system of claim 11, further comprising one or more of a selector transmitter associated with the selector or a valve transmitter associated with the valve, the one or more of the selector transmitter or the valve transmitter positioned to wirelessly communicate a valve signal

to the indicator, the valve signal positioned to cause the indication of one or more of the valve in the open condition or the valve in the closed condition.

14. The system of claim 8, further comprising an interlock to prevent operation of a pump unless the valve is in the open condition, and wherein the interlock comprises one or more of a physical interlock preventing operation of a switch to activate the pump or an electrical interlock preventing the switch from activating the pump.

15. The system of claim 8, wherein one or more of the cover or the barrier defines an inspection opening positioned to facilitate a view of at least a portion of the interior of the vapor box.

16. The system of claim 15, further comprising an inspection opening cover positioned to be removably connected to the vapor box such that the inspection opening cover at least partially blocks the inspection opening and is separable from the vapor box to facilitate the view of the at least a portion of the interior of the vapor box.

17. The system of claim 8, wherein the vapor box further comprises a base connected to the barrier and defining an inlet opening.

18. The system of claim 17, wherein the inlet comprises a tubular member connected to the base, the system further comprising a flange connected to a first end of the tubular member

and positioned to be connected to the tank, and wherein a second end of the tubular member is connected to the base.

19. The system of claim 8, wherein the vapor box further comprises a base connected to the barrier and defining an opening, and the base having (a) a first portion extending from the barrier toward the opening at an angle oblique with respect to at least a portion of the barrier, and (b) a second portion extending from the barrier toward the opening at an angle oblique with respect to at least a portion of the barrier and the first portion.

20. The system of claim 19, wherein the vapor box defines a longitudinal vapor box axis extending between a first end of the vapor box and a second end of the vapor box opposite the first end of the vapor box, wherein the first portion of the base extends from the first end of the vapor box toward the opening, and wherein the second portion of the base extends from the second end of the vapor box toward the opening.

21. The system of claim 20, wherein the first portion of the base and the second portion of the base at least partially define a v-shaped cross-section viewed perpendicular relative to the longitudinal vapor box axis and positioned to cause material to flow toward the opening.

22. The system of claim 8, wherein the barrier comprises: a first end wall, a second end wall opposite the first end wall, a first side wall extending longitudinally between the first end wall and the second end wall, and a second side wall opposite the first side wall and extending longitudinally between the first end wall and the second end wall.

23. The system of claim 22, wherein one or more of the first side wall or the second side wall defines an inspection opening positioned to facilitate a view of at least a portion of the interior of the vapor box.

24. The system of claim 22, wherein one or more of the first side wall or the second side wall defines a vent opening positioned to provide fluid flow between the interior of the vapor box and the exterior of the vapor box.

25. The system of claim 24, further comprising a duct associated with the vent opening and extending exterior to the vapor box, the duct positioned to redirect flow from a substantially horizontal direction internal to the interior of the vapor box to a substantially vertical direction external to the exterior to the vapor box, and a restrictor to at least partially obstruct the vent opening.

26. The system of claim 22, further comprising a first baffle between the base and the cover and extending between the first side wall and the second side wall, wherein the vapor box defines a longitudinal vapor box axis extending between the first end and the second end wall, wherein the first baffle defines a first baffle dimension in a direction parallel to the longitudinal vapor box axis exceeding an inlet dimension defined by the inlet in the direction parallel to the longitudinal vapor box axis, and wherein the first baffle dimension is greater than twice the inlet dimension.

27. The system of claim 26, wherein the first baffle comprises a first baffle portion and a second baffle portion connected to the first baffle portion, the first baffle portion and the second baffle portion defining an obtuse first included angle having a first baffle vertex extending between the first side wall and the second side wall, and wherein the first included angle defined by the first baffle opens toward the inlet.

28. The system of claim 22, further comprising a first baffle between the base and the cover and extending between the first side wall and the second side wall, wherein the vapor box defines a longitudinal vapor box axis extending between the first end wall and the second end wall, the system further comprising a second baffle between the first baffle and the cover and extending between the first side wall and the second side wall, and wherein the second baffle is substantially longitudinally aligned with one or more of the first baffle or the inlet.

29. The system of claim 22, further comprising a first baffle between the base and the cover and extending between the first side wall and the second side wall, wherein the vapor box defines a longitudinal vapor box axis extending between the first end wall and the second end wall, and wherein the second baffle defines a second baffle dimension in a direction parallel to the longitudinal vapor box axis exceeding an inlet dimension defined by the inlet in the direction parallel to the longitudinal vapor box axis.

30. The system of claim 29, wherein the second baffle comprises a third baffle portion and a fourth baffle portion connected to the third baffle portion, the third baffle portion and the fourth baffle portion defining an obtuse second included angle having a second baffle vertex extending

between the first side wall and the second side wall, and wherein the second included angle defined by the second baffle opens toward one or more of the first baffle or the inlet.

31. The system of claim 8, further comprising an interlock positioned to prevent operation of a pump unless the valve is in the open condition, and wherein the interlock comprises one or more of a physical interlock preventing operation of a switch to activate the pump or an electrical interlock preventing the switch from activating the pump.

32. A tank for transporting asphalt between geographic locations, the tank comprising:
a tank body defining:

an interior volume positioned to contain a material therein;

one or more material ports positioned to facilitate one or more of flowing material into the interior volume of the tank or flowing material out of the interior volume of the tank; and

one or more vent ports positioned to facilitate venting the tank; and

one or more pairs of wheels connected to the tank and positioned to facilitate movement of the tank to transport material positioned in the interior volume of the tank between geographic locations; and

a vent system to vent the tank, the vent system comprising:

a vapor box connected to the tank, the vapor box including one or more vent apertures;

a valve associated with the one or more vent apertures and positioned to provide fluid flow between an interior of the vapor box and an exterior of the vapor box; and

a selector positioned in communication with the valve to cause the valve to switch between an open condition providing fluid flow between the interior of the vapor box and the exterior of the vapor box via the one or more vent apertures and a closed condition preventing fluid flow between the interior of the vapor box and the exterior of the vapor box via the one or more vent apertures.

33. The tank of claim 32, further comprising a pump positioned to pump at least a portion of the asphalt from the tank body, a pump switch to activate the pump, and an interlock to prevent operation of the pump unless the valve is in the open condition, and wherein the interlock comprises one or more of a physical interlock to prevent operation of a switch to activate the pump or an electrical interlock to prevent the switch from activating the pump.

34. The tank of claim 33, further comprising a platform connected to the upper surface of the tank body and to support a person, the platform having an upper surface, wherein an upper surface of the valve is below the upper surface of the platform.

35. The tank of claim 34, further comprising a chassis connected to the tank body and the one or more pairs of wheels and a coupling connected to the chassis and positioned to connect to a truck to move the tank between geographic locations, and wherein the chassis is positioned to connect to a cab and a power source to provide torque to propel the tank between geographic locations.

36. The tank of claim 34, further comprising a chassis connected to the tank and the one or more pairs of wheels and a railway coupling connected to the chassis, wherein the one or more pairs of wheels are positioned to engage railroad tracks.

37. The tank of claim 33, wherein the tank is positioned to maintain the material at a temperature greater than ambient temperature, and wherein the tank body is configured contain asphalt material therein.

38. A method for venting a tank from a location remote from a vent of the tank for transporting asphalt, the method comprising:

operating a selector positioned in communication with a valve associated with one or more vent apertures associated with the tank, the selector positioned in communication with the valve to switch the valve between an open condition providing fluid flow through the one or more vent apertures and a closed condition preventing fluid flow through the one or more vent apertures; and

indicating via an indicator that the valve is in the open condition, the indicator in positioned in communication with one or more of the valve or the selector to provide an indication of one or more of the valve in the open condition or the valve in the closed condition.

39. The method claim 38, wherein operating the selector comprises operating one or more of a pneumatic switch, a hydraulic switch, or an electrical switch, and wherein the indicating via an indicator that the valve is in the open condition comprises one or more of providing a visual indication that the valve is in the open condition, providing an audible indication that the valve is in the open condition, or providing a tactile indication that the valve is in the open condition.

40. The method of claim 38, further comprising preventing, when the valve is not in the open condition, operation of a pump to pump at least a portion of the asphalt from the tank; and located at a geographic location remote from the tank.

41. The system of claim 8, wherein the selector comprises one or more of a physical switch or virtual switch, and wherein the physical switch comprises one or more of a pneumatic switch, a hydraulic switch, or an electric switch.

42. A system to vent a tank to enhance transporting asphalt when positioned in the tank, the system comprising:

a vapor box to connect to an upper surface of a tank, the vapor box comprising:

a cover including a vent aperture;

an inlet connected to the tank and positioned to provide fluid flow between an interior of the tank and an interior of the vapor box; and

a barrier extending between the cover and the inlet, the interior of the vapor box at least partially defined by the cover, the inlet, and the barrier;

a valve (1) associated with the vent aperture, (2) positioned to extend through the cover such that a portion of the valve resides in the interior of the vapor box and another portion of the valve resides in an exterior of the vapor box, and (3) configured to provide fluid flow between the interior of the vapor box and the exterior of the vapor box; and

a switch positioned remote from and in communication with the valve and to cause the valve to change between (a) an open condition providing, during asphalt off-loading from the tank,

(1) pressure equalization between the interior of the tank and the exterior of the tank and (2) vapor flow between the interior of the vapor box and the exterior of the vapor box via the vent aperture and (b) a closed condition preventing fluid flow between the interior of the vapor box and the exterior of the vapor box via the vent aperture.

43. The system of claim 42, wherein the switch is positioned on a side of the tank and proximate a lower surface of the tank.

Date Reçue/Date Received 2020-08-04

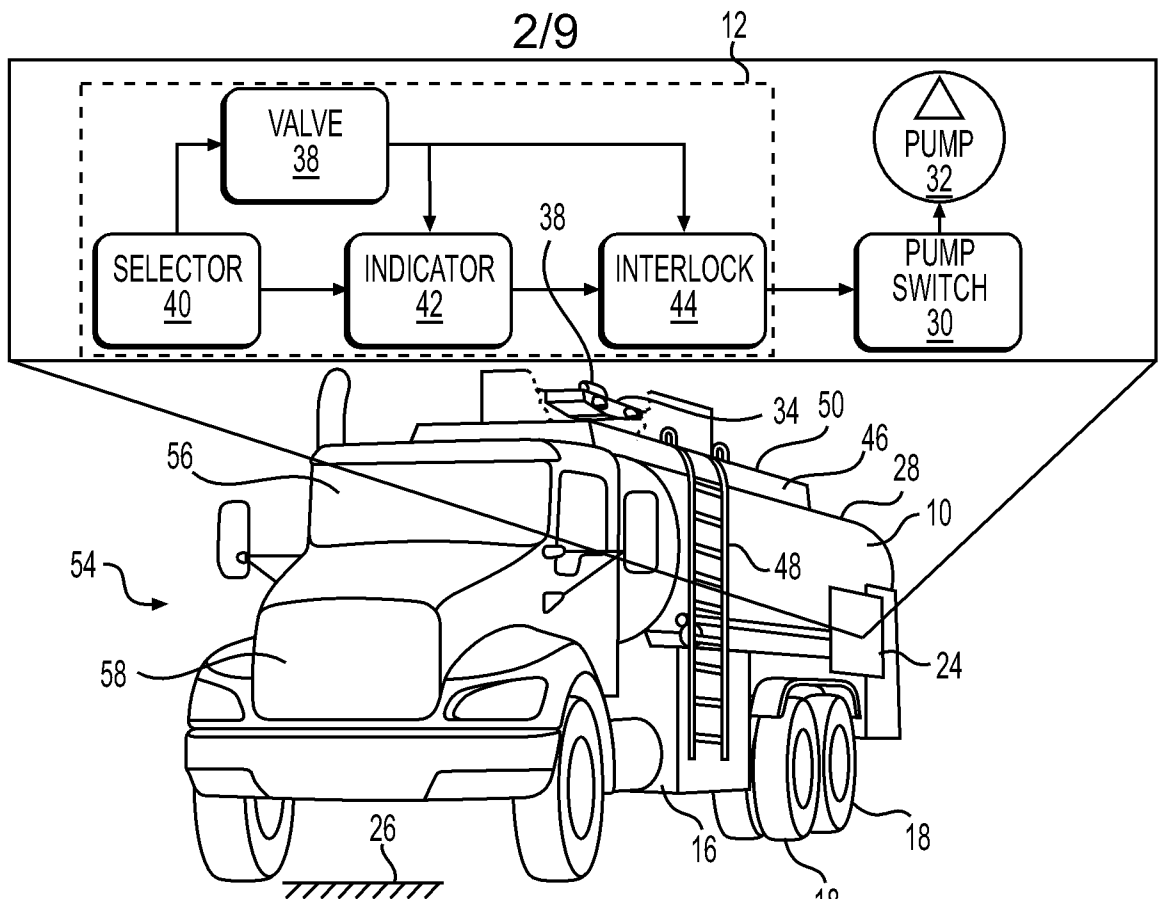


FIG. 2

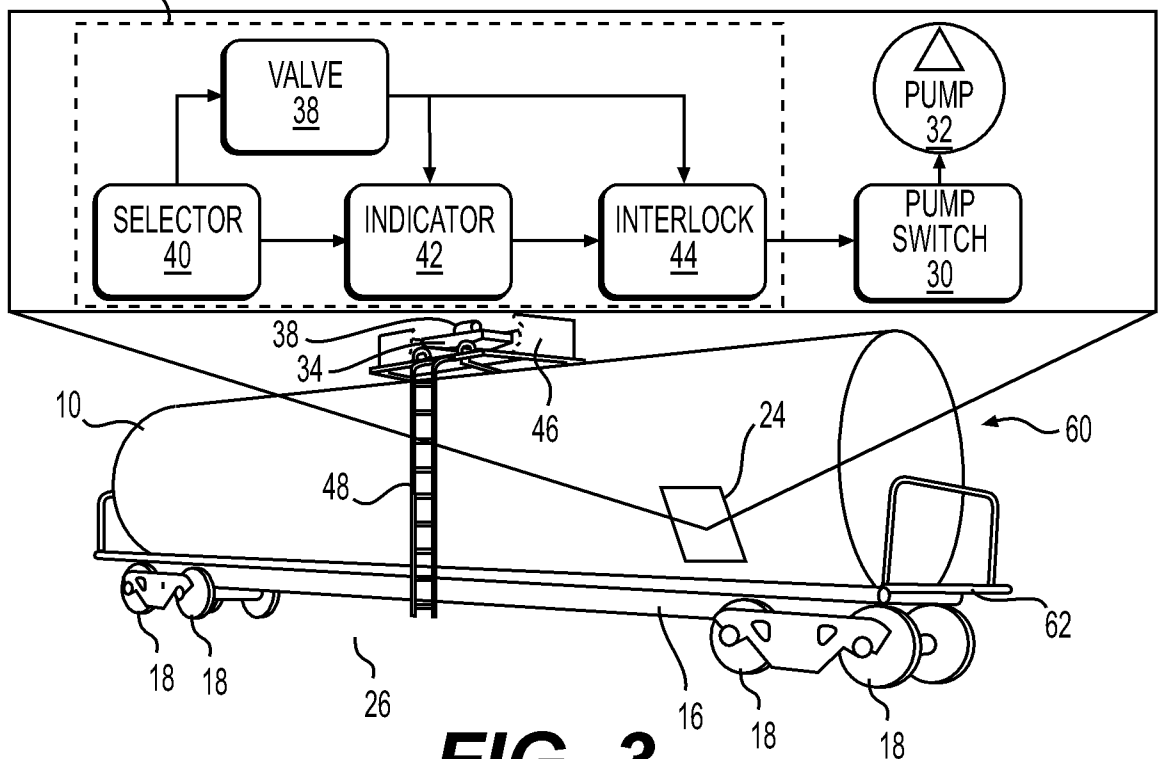


FIG. 3

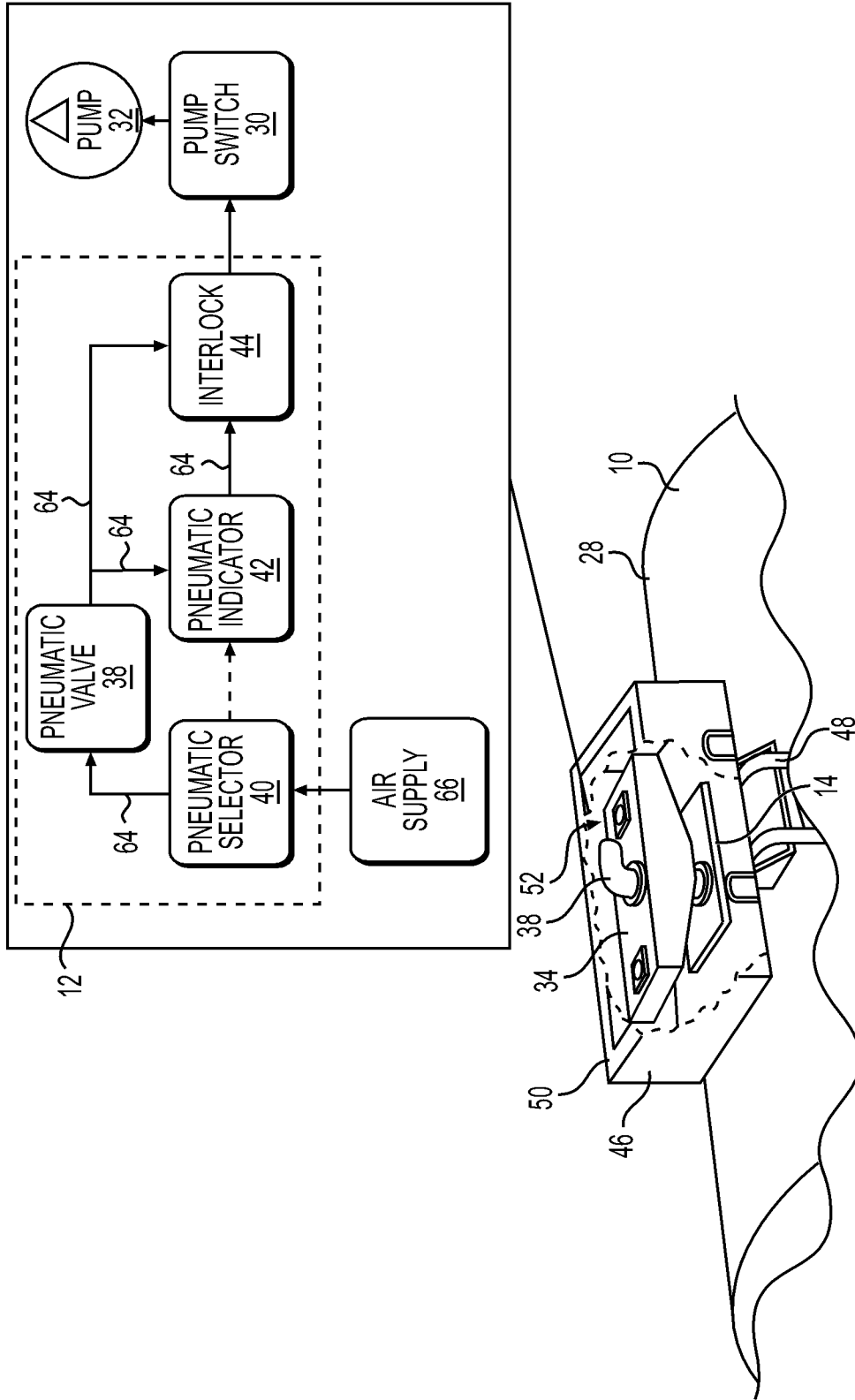
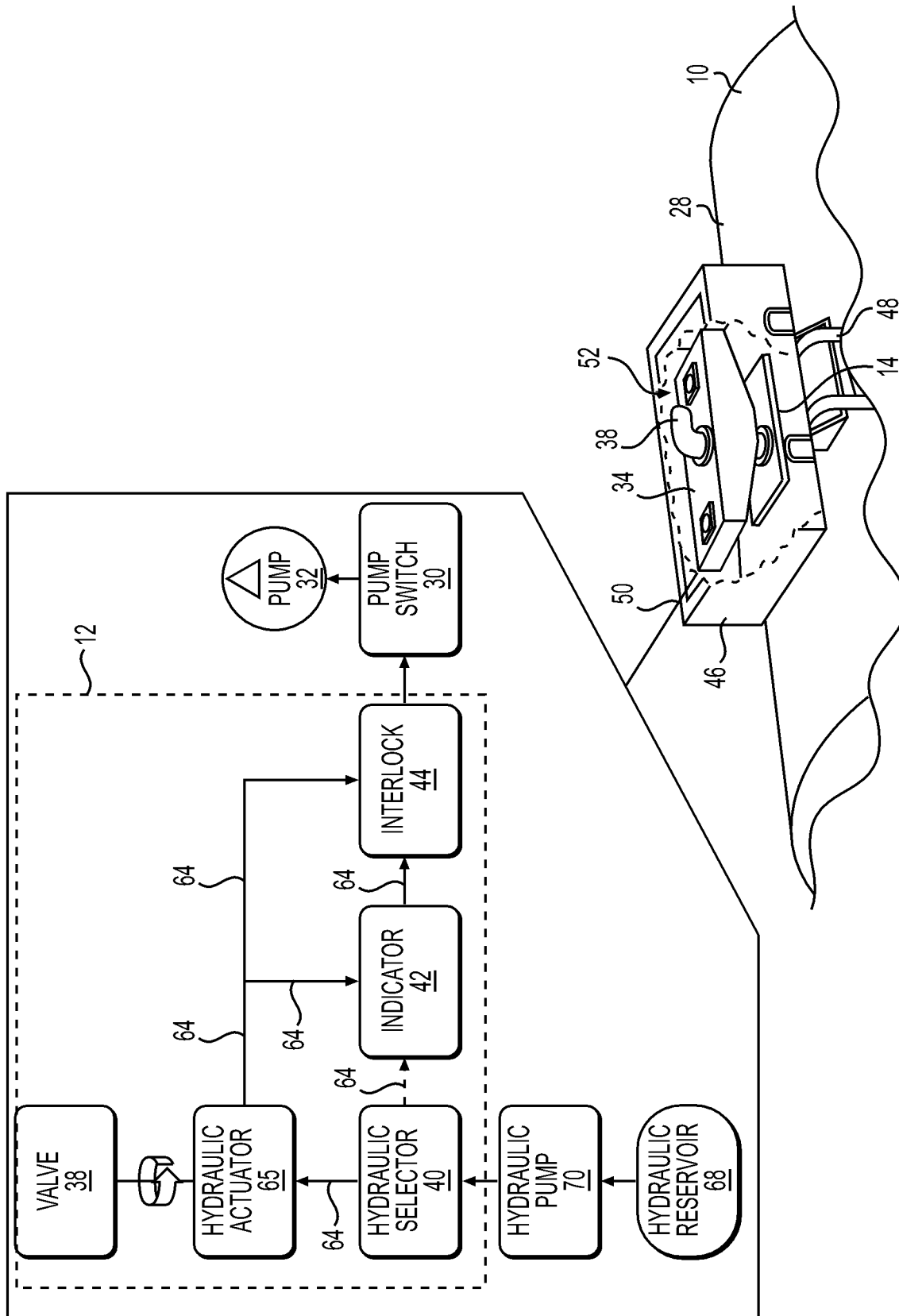


FIG. 4

**FIG. 5**

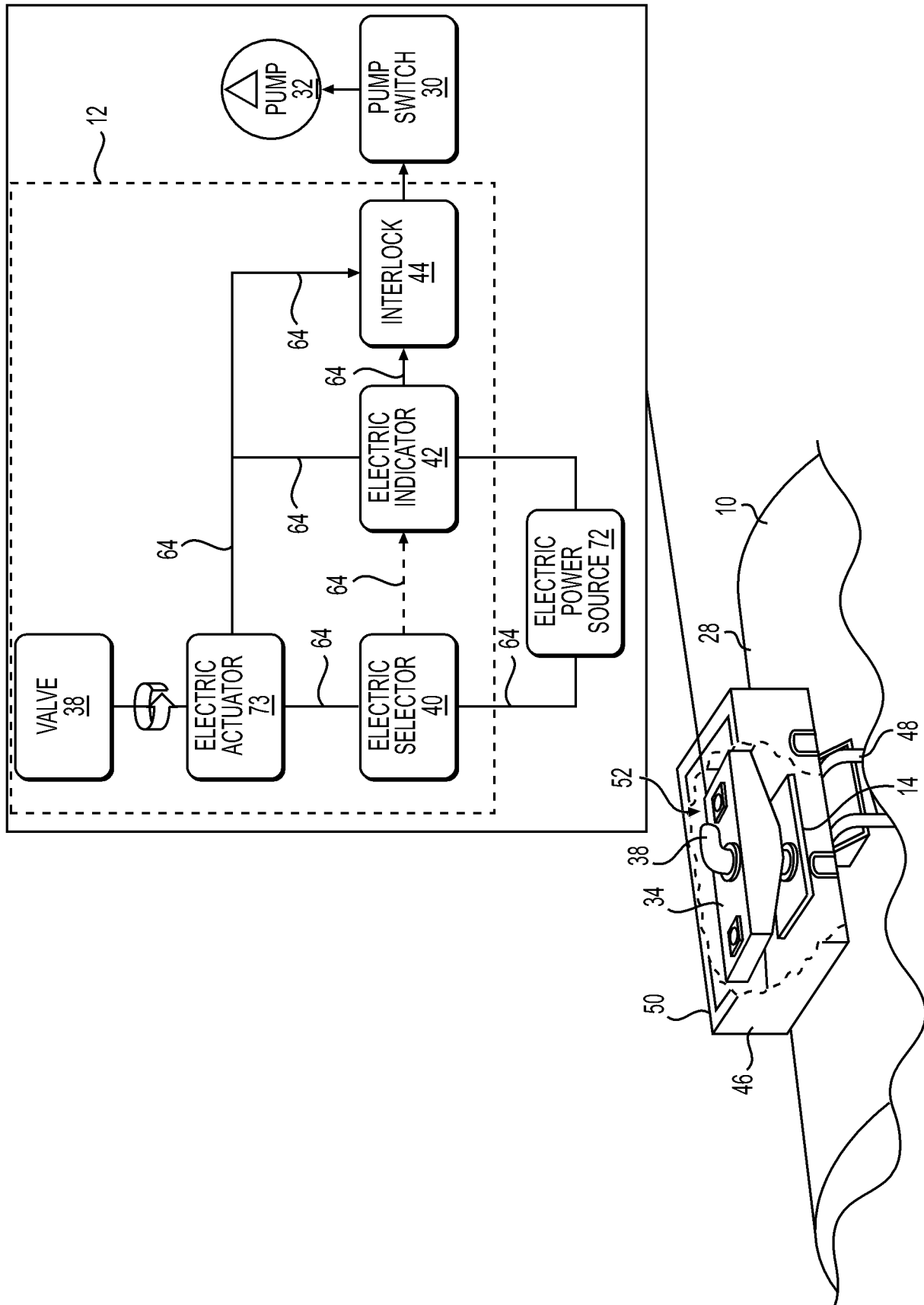
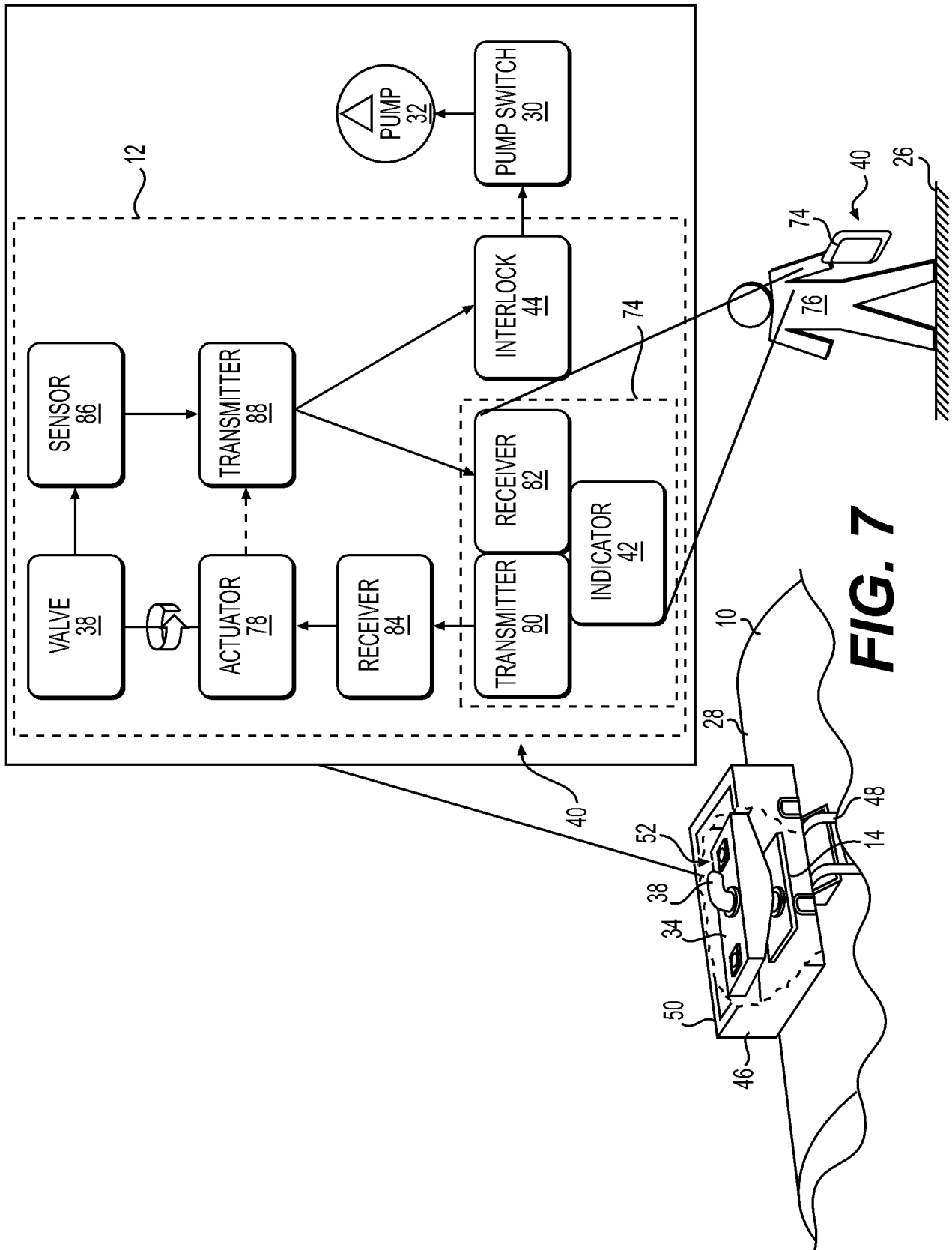


FIG. 6

**FIG. 7**

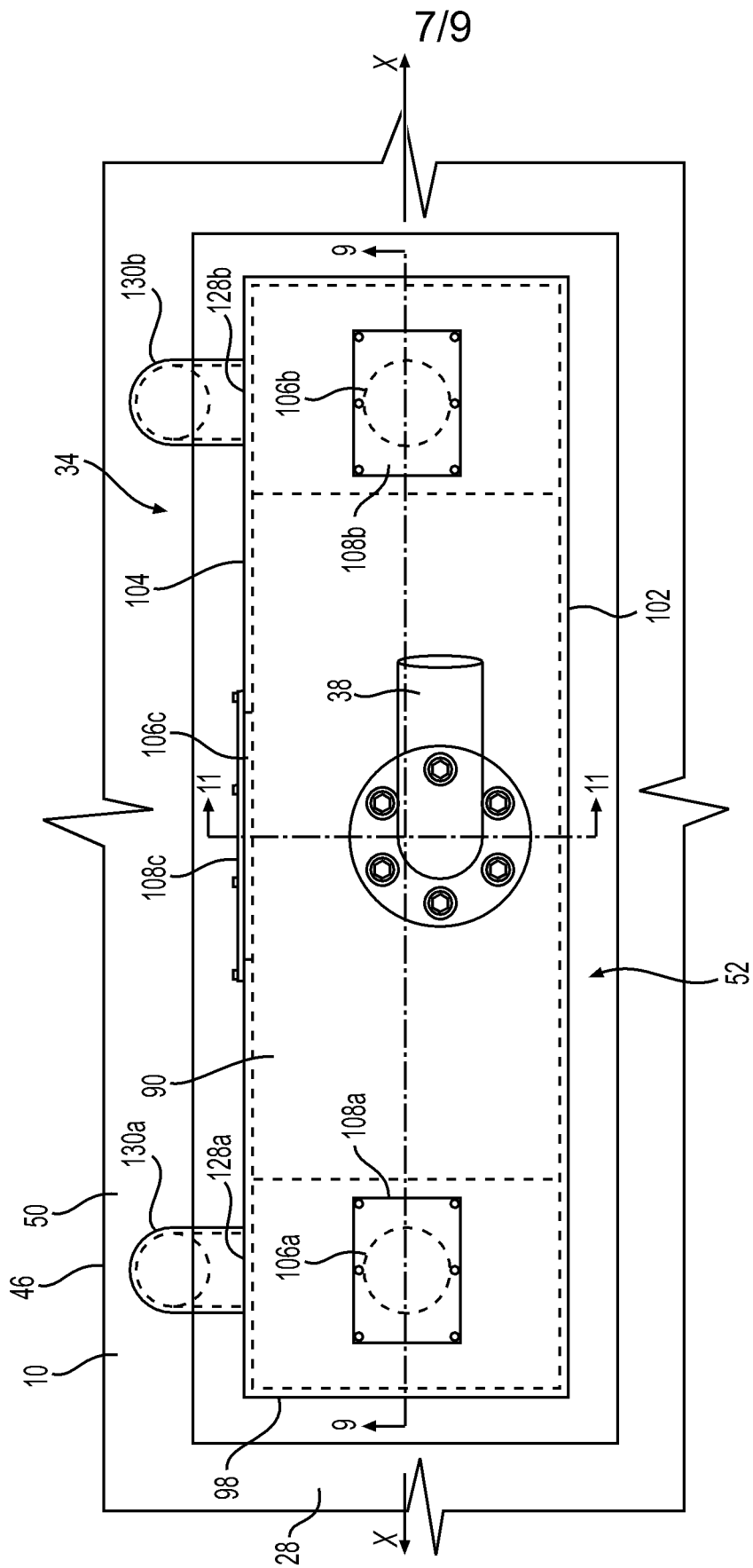


FIG. 8

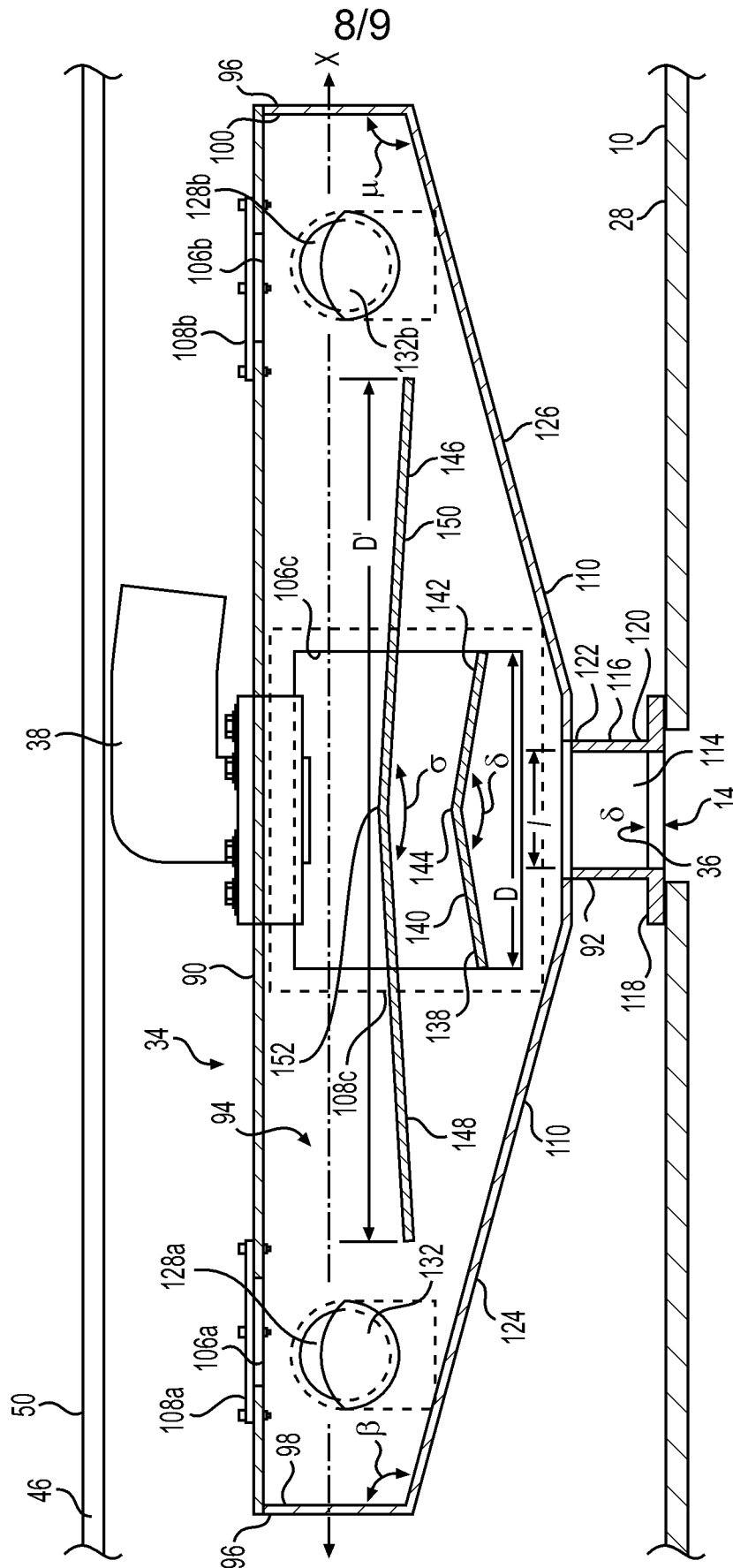


FIG. 9

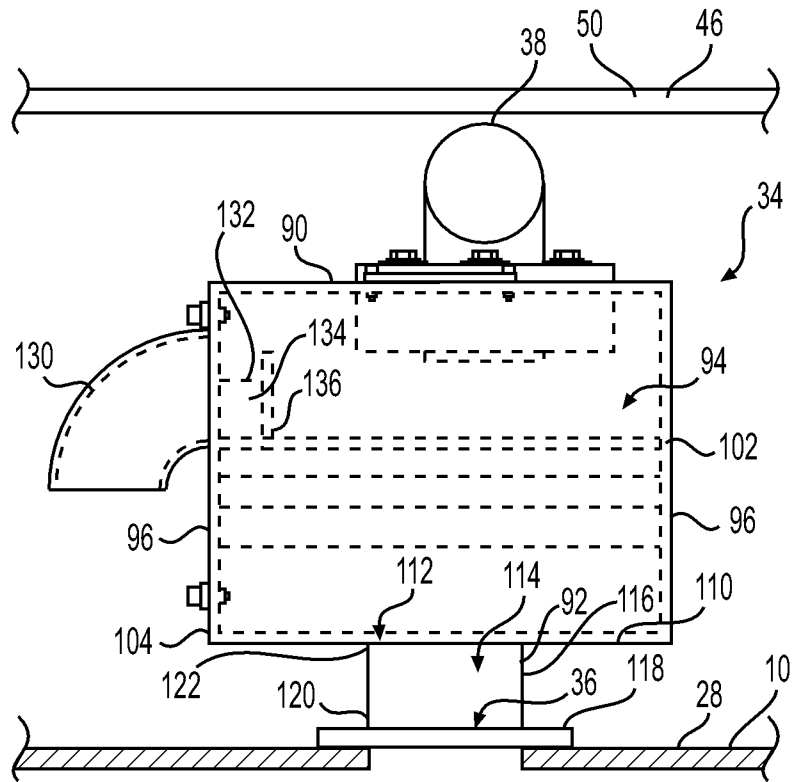


FIG. 10

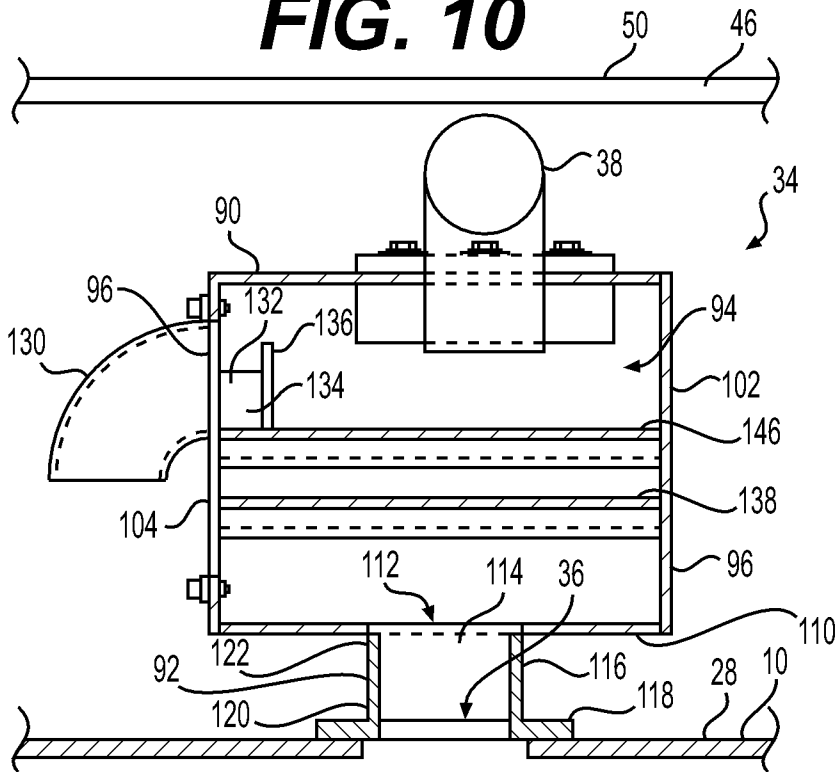


FIG. 11

