US 20050128060A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2005/0128060 A1

Rennick et al. (43) Pub. Date: Jun. 16, 2005

(54) UNIVERSALLY USABLE OBJECT DETECTION SYSTEM AND METHOD

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(21) Appl. No.: **10/993,821**

(22) Filed: **Nov. 19, 2004**

Related U.S. Application Data

(60) Provisional application No. 60/523,459, filed on Nov. 19, 2003.

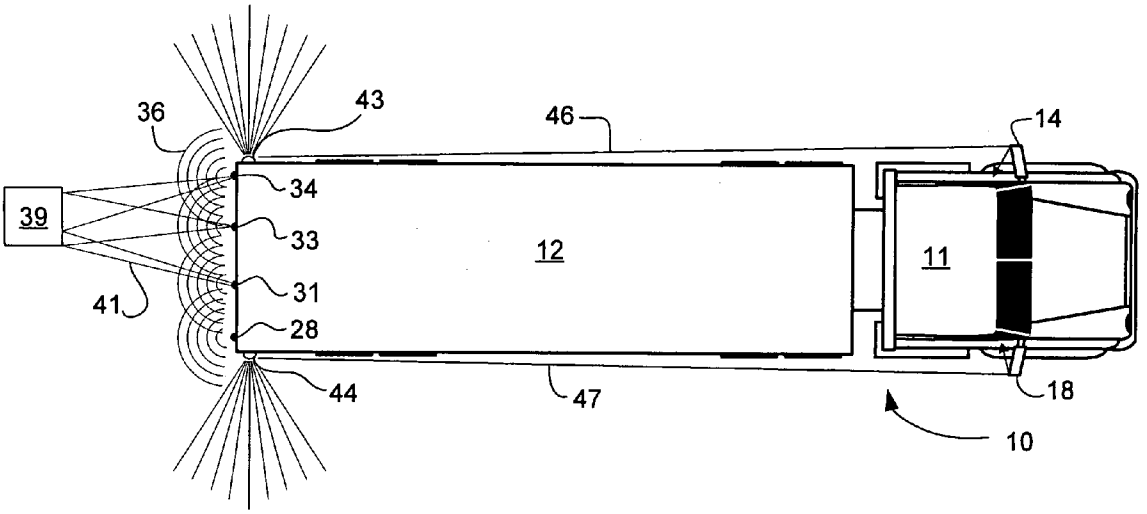
Publication Classification

(51) **Int. Cl.**[7] **G05D 1/00**

(52) **U.S. Cl.** **340/435**; 340/693.9

(57) **ABSTRACT**

The universally useable object detection system disclosed herein comprises a plurality of positionable sensors coupled to the vehicle and positioned so as to direct energy into a predetermined area respective to the vehicle. The sensors may be temporarily or permanently attached to the vehicle. A control unit is electrically coupled to each sensor and detachably coupled to the vehicle. The control unit receives signals from the sensors corresponding to a detected presence of an object within a predetermined range of one or more sensors. The control unit is also electrically coupled to a power source of the vehicle. One or more visual alerting devices is electrically coupled to the control unit and detectably coupled to the vehicle so that a driver of the vehicle can see the alerting devices through one or more rear view mirrors of the vehicle.



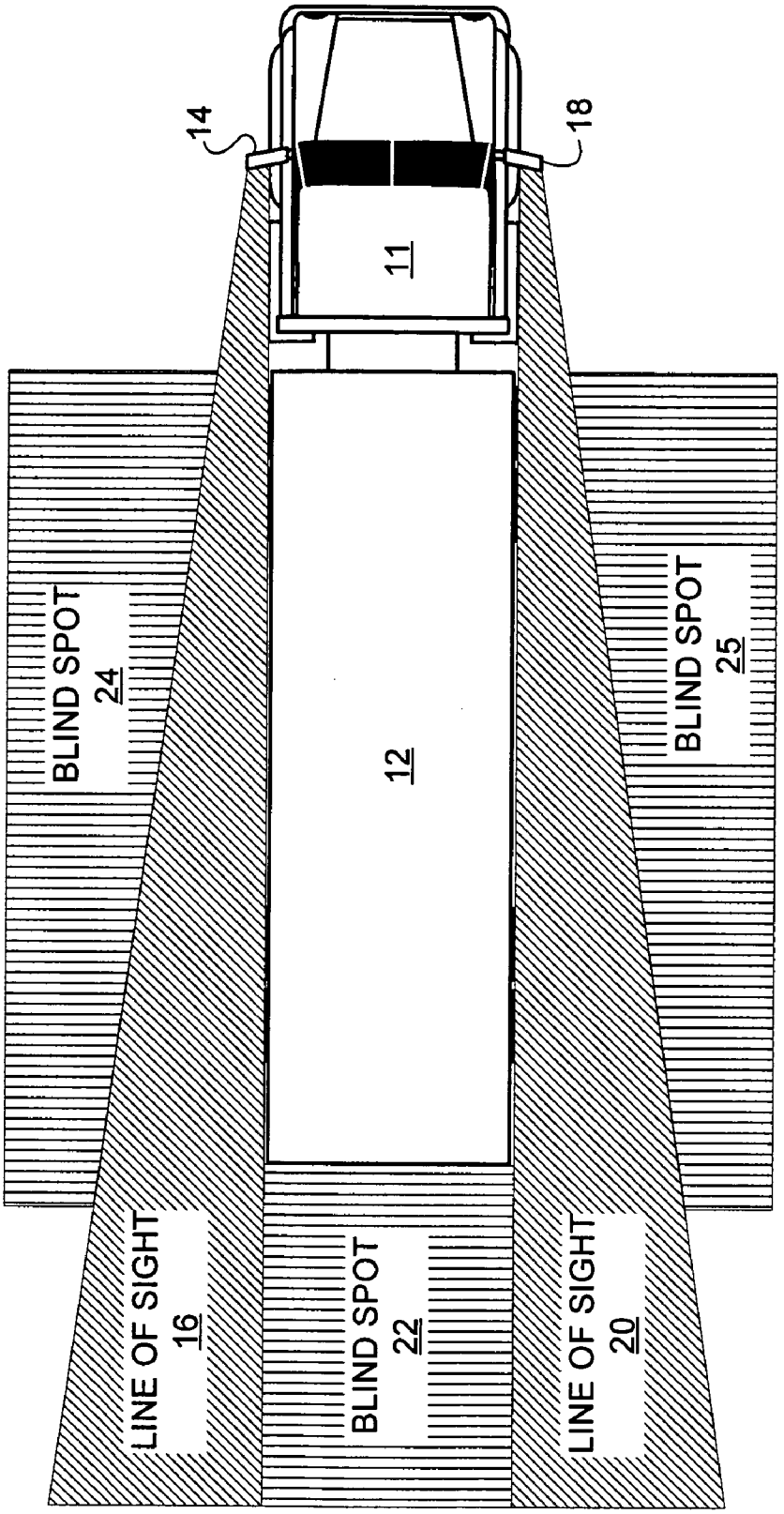

14
18
11
12
BLIND SPOT
24
BLIND SPOT
25
LINE OF SIGHT
16
BLIND SPOT
22
LINE OF SIGHT
20
10

FIG. 1

FIG. 2

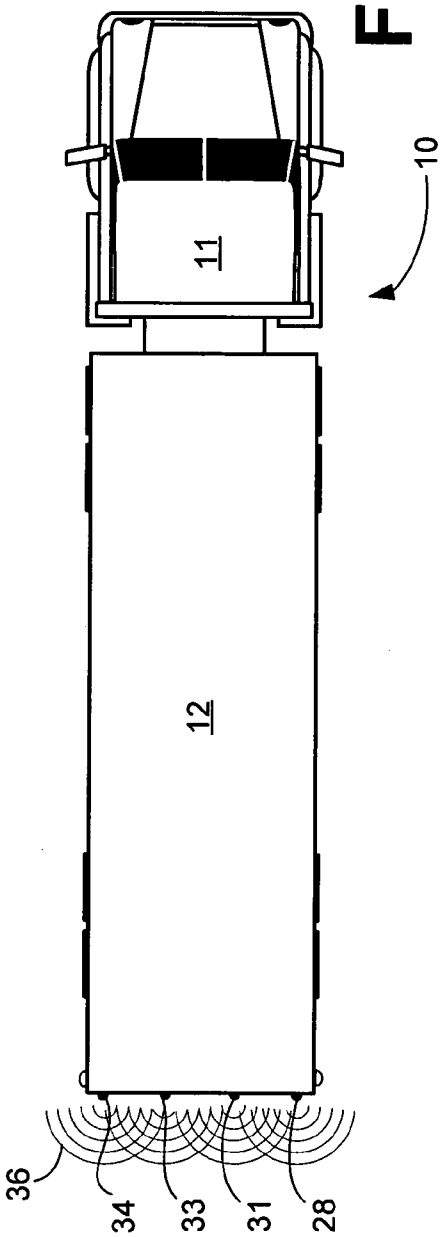
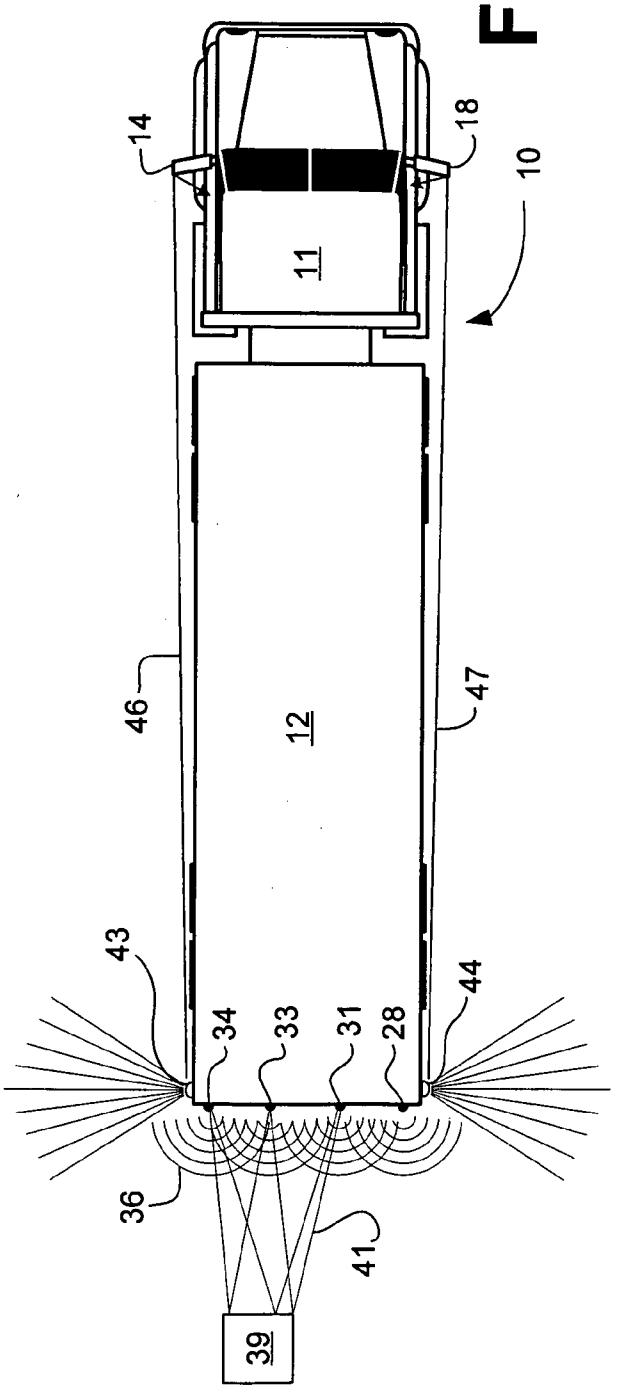


FIG. 3



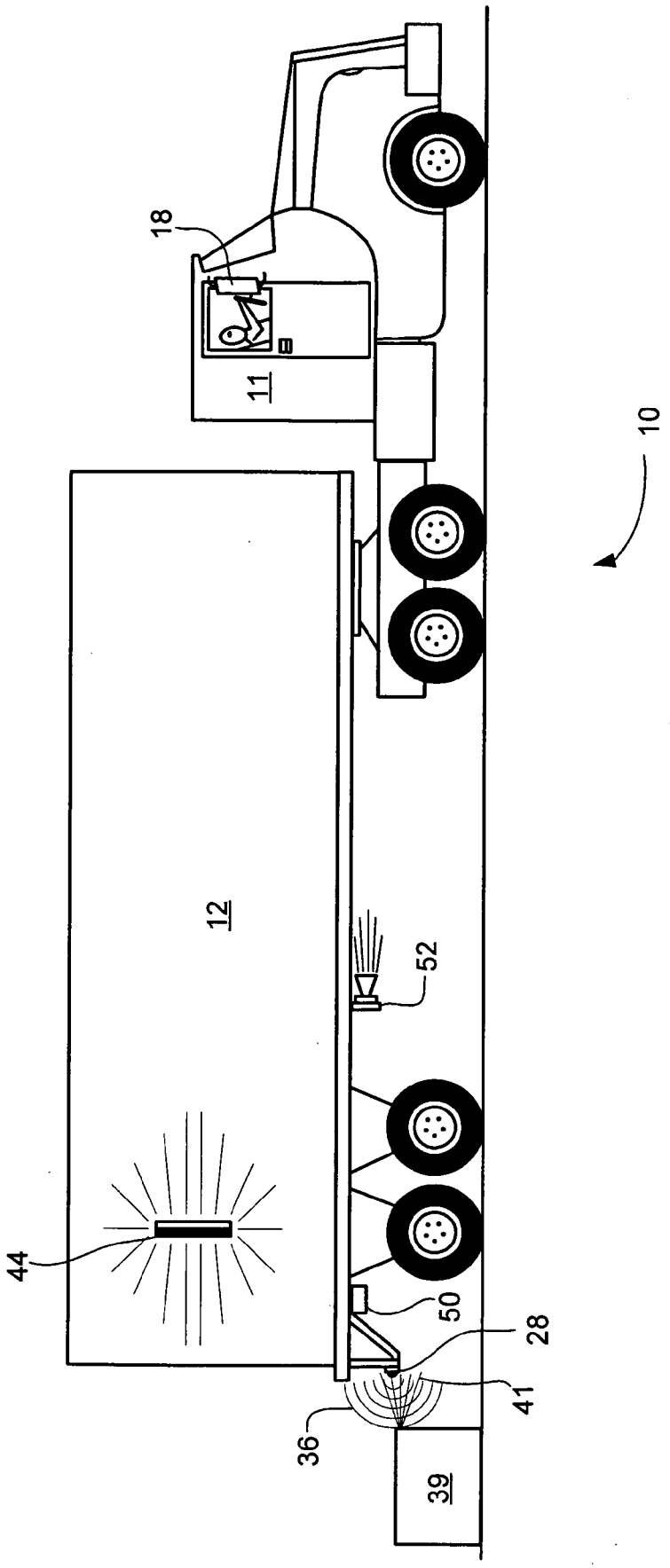


FIG. 4A

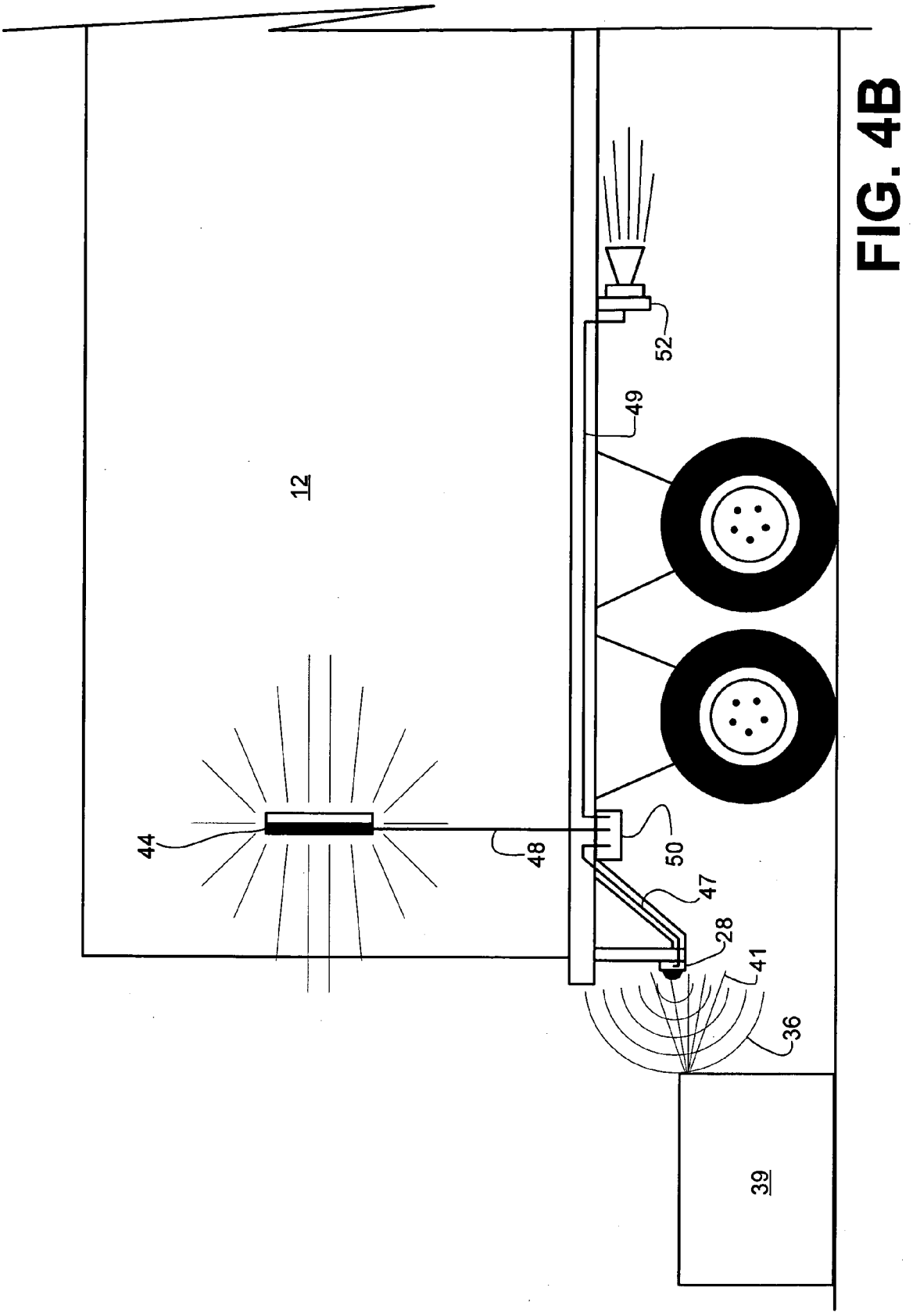
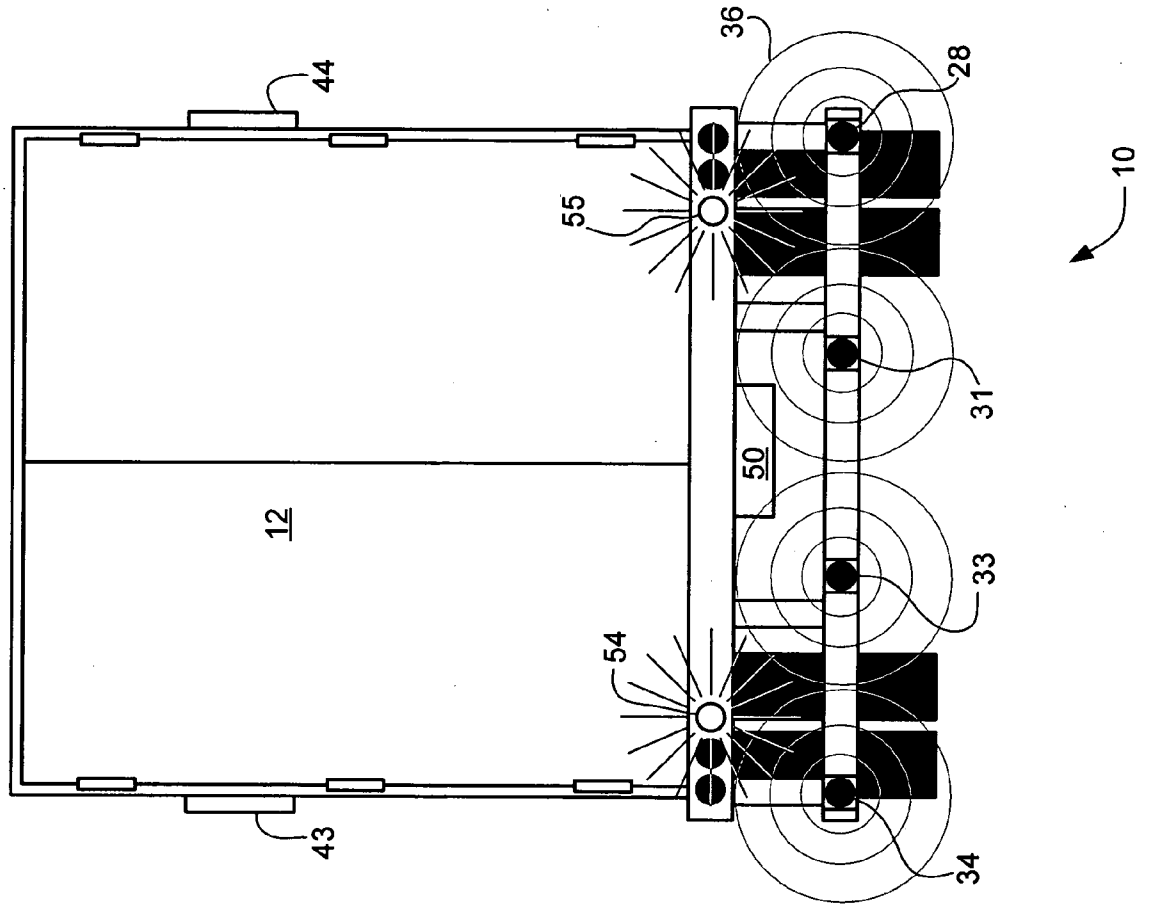


FIG. 4B

FIG. 5



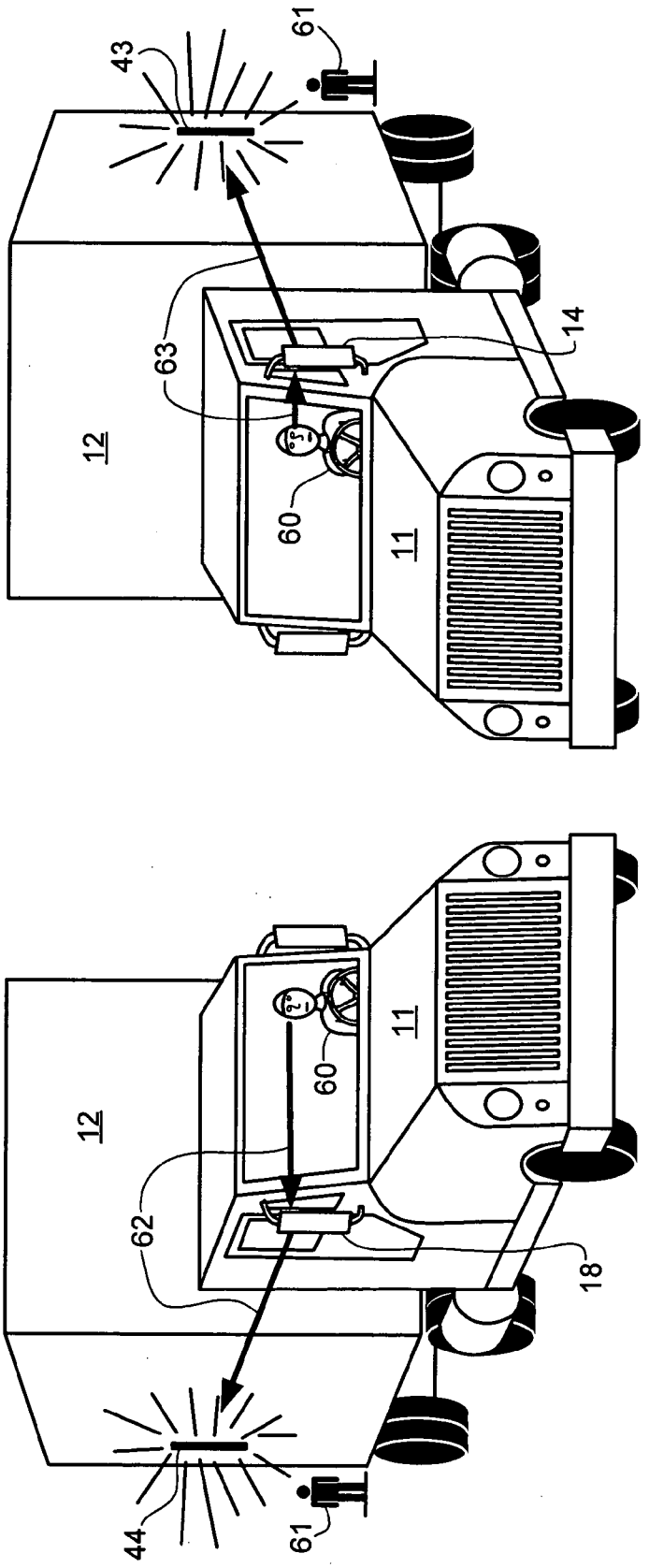


FIG. 6

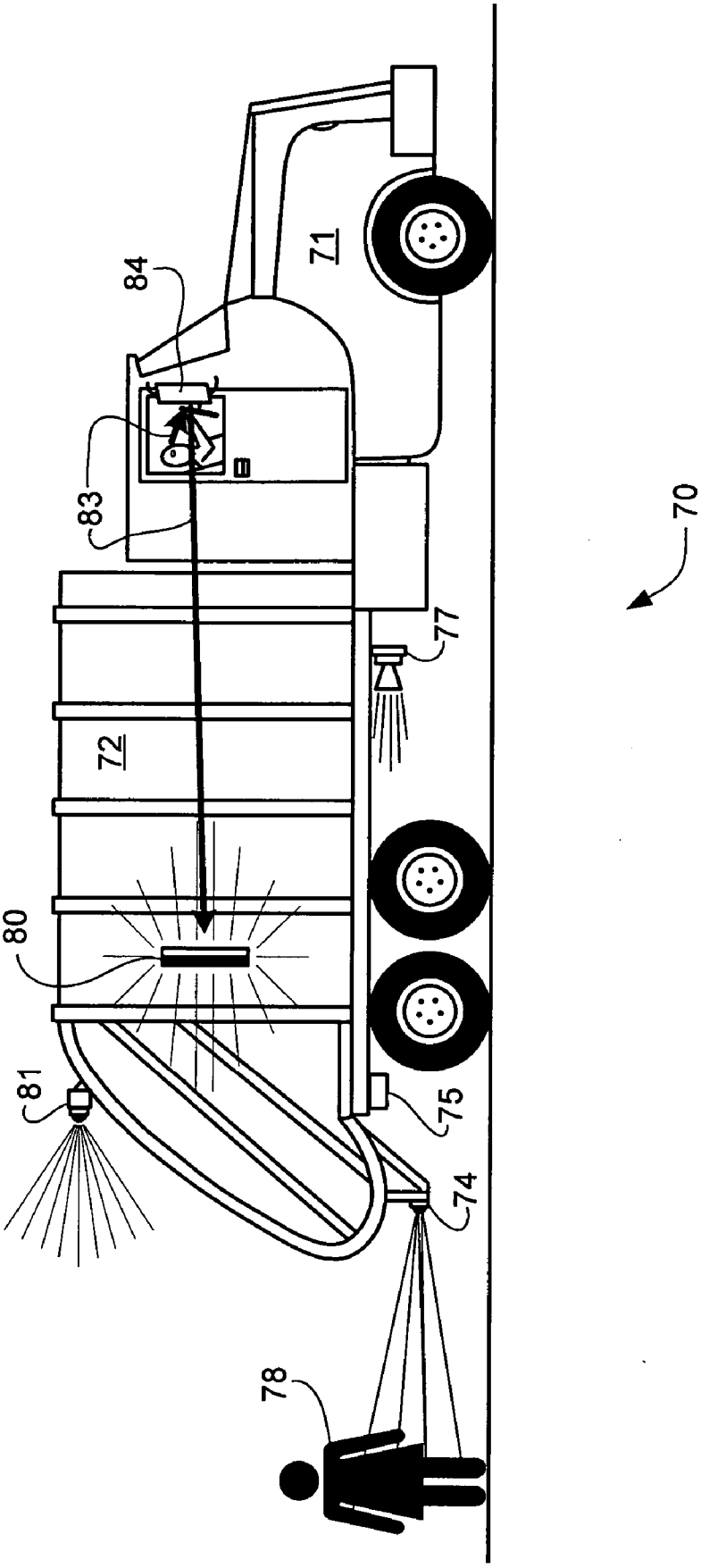


FIG. 7

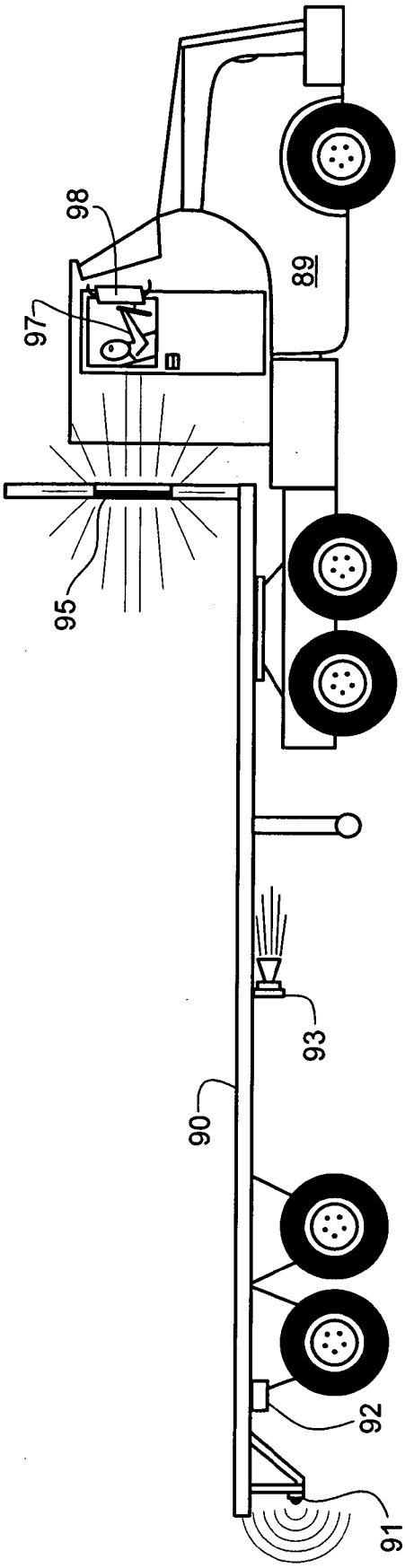
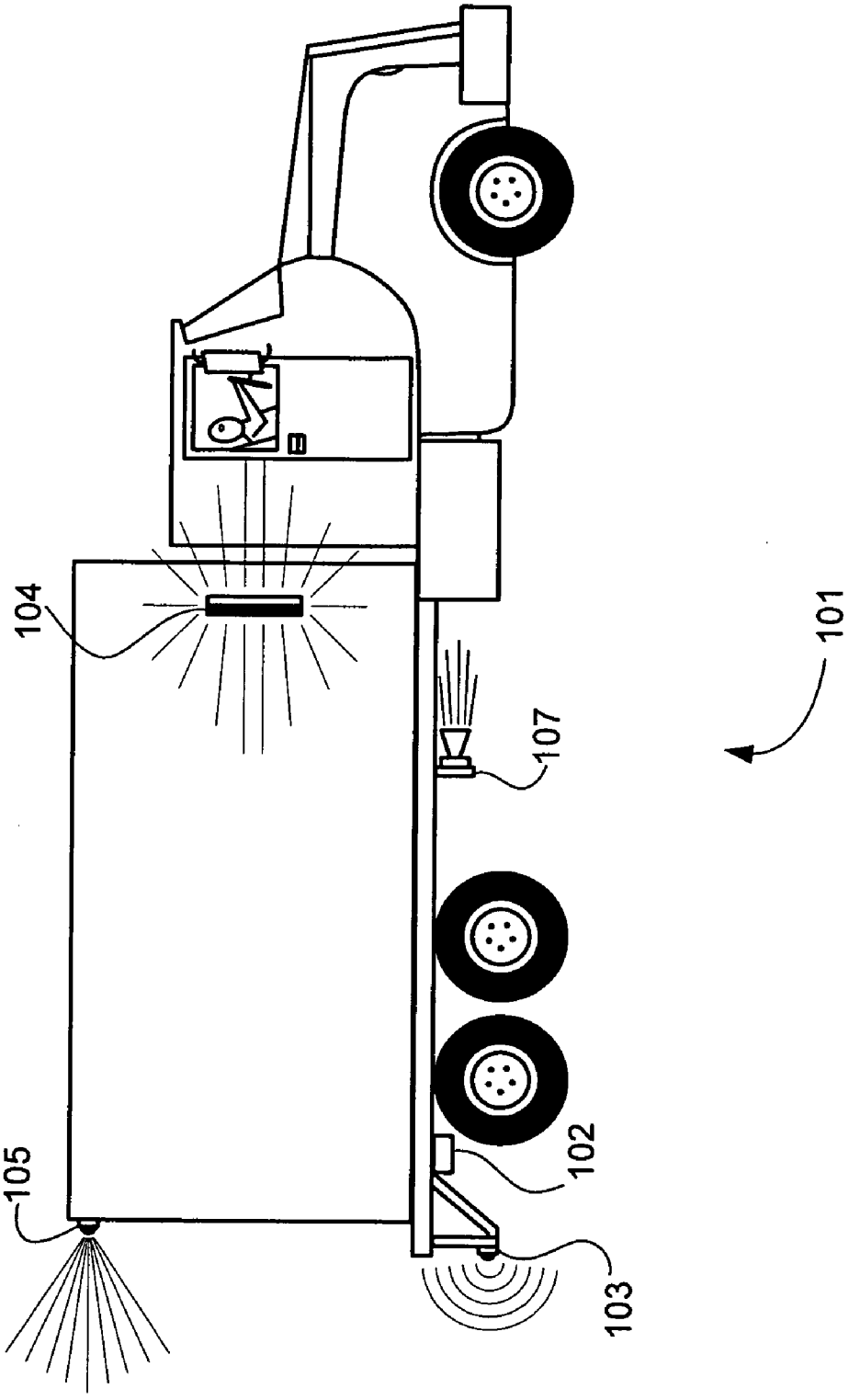


FIG. 8

FIG. 9



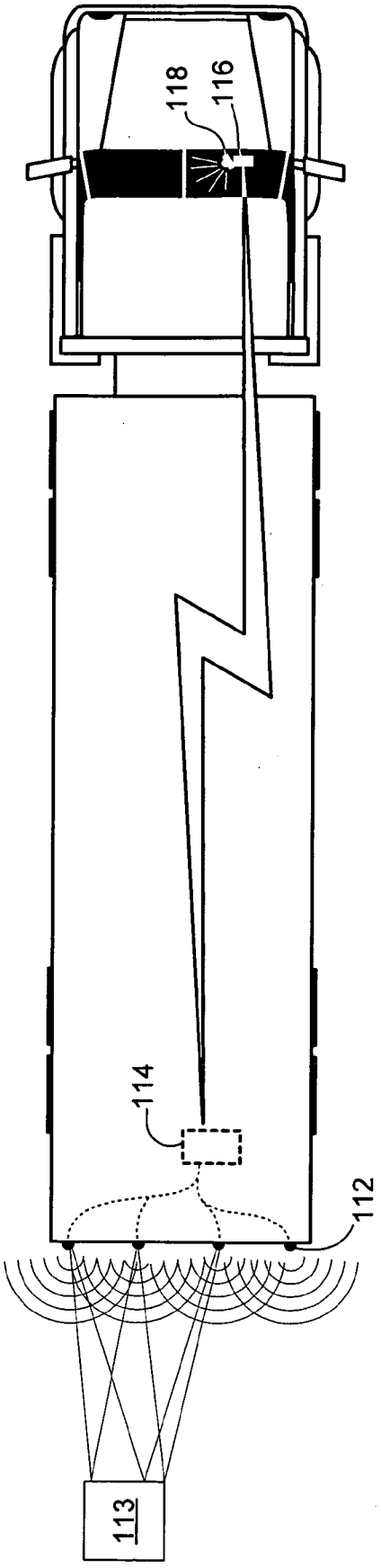


FIG. 10

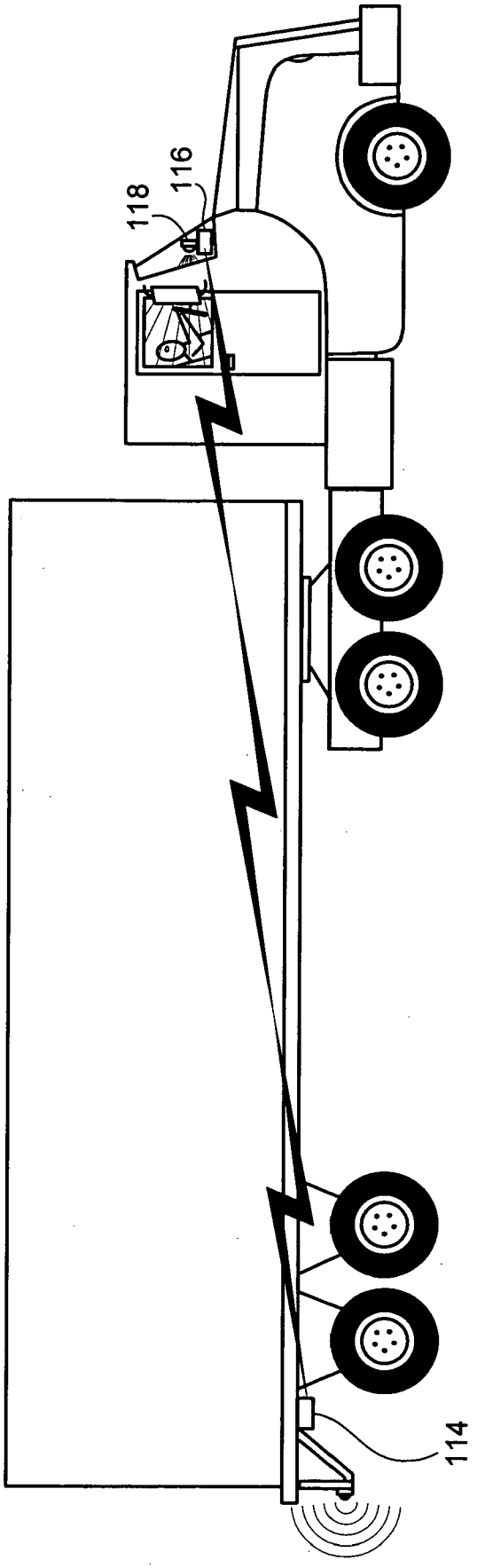
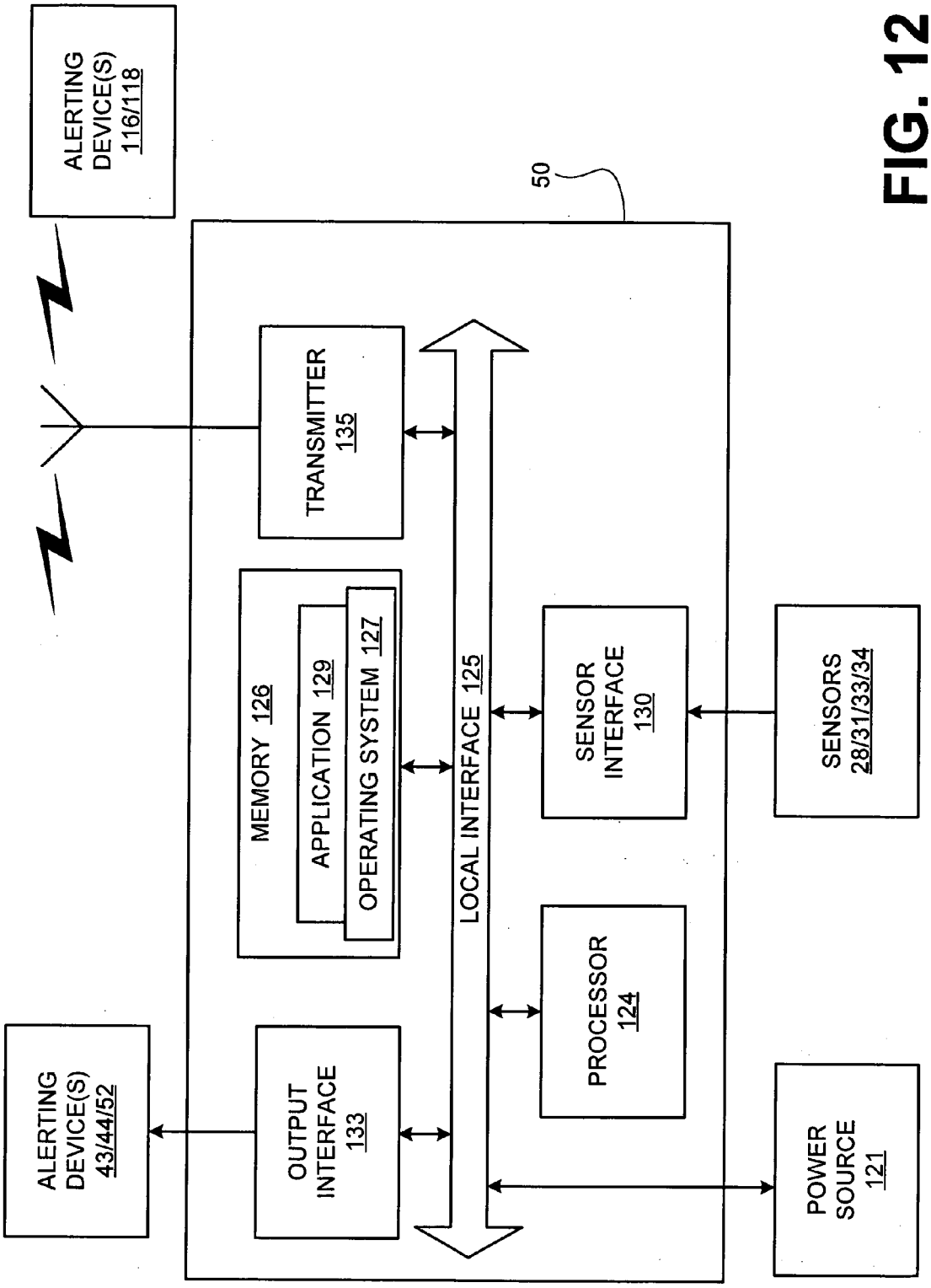


FIG. 11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50
TRANSMITTER 135
MEMORY 126
APPLICATION 129
OPERATING SYSTEM 127
LOCAL INTERFACE 125
SENSOR INTERFACE 130
SENSORS 28/31/33/34
ALERTING DEVICE(S) 43/44/52
OUTPUT INTERFACE 133
PROCESSOR 124
POWER SOURCE 121

FIG. 12

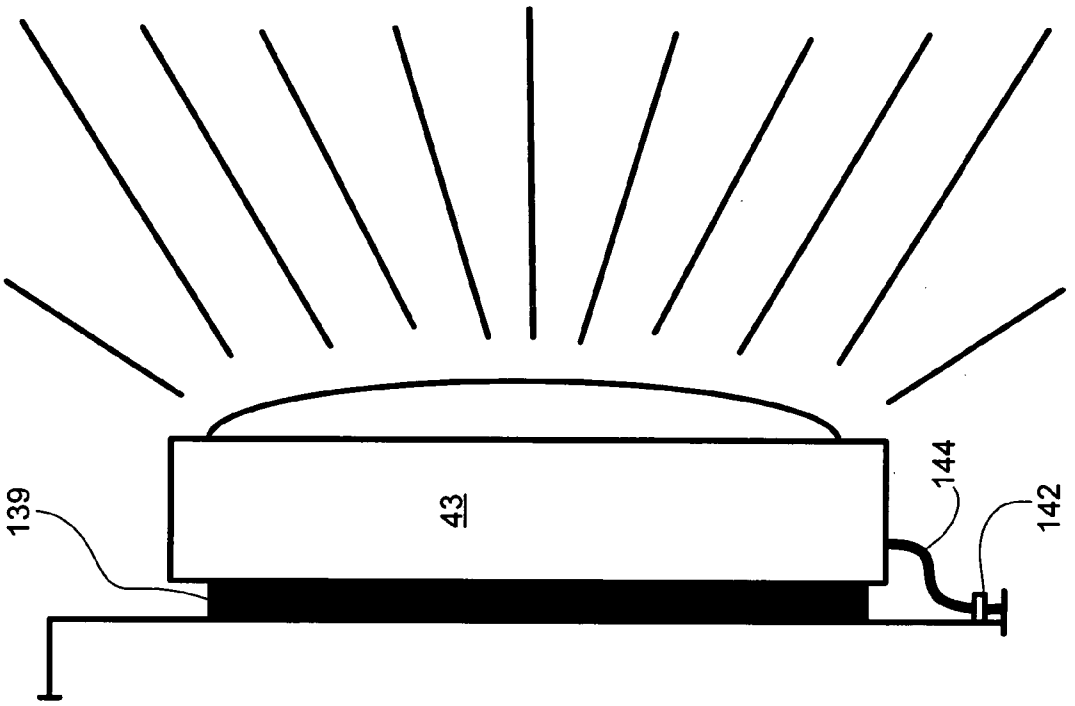

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FIG. 13

UNIVERSALLY USABLE OBJECT DETECTION SYSTEM AND METHOD

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority to copending U.S. provisional application entitled, "Universally Usable Reverse Detection System," filed November 19, 2003 and having application Ser. No. 60/523,459, which is entirely incorporated herein by reference.

TECHNICAL FIELD

[0002] The present disclosure generally relates to object detection systems and, more particularly, to a system and method for detecting objects and obstacles in the rear path of a vehicle.

BACKGROUND

[0003] Each year, many accidents occur when a driver of a vehicle attempts to move the vehicle in reverse, subsequently resulting in a collision with another object. A driver's view when driving in reverse is typically not as good as when the vehicle is moving forward, thereby causing most drivers to rely on rear view mirrors and/or to constantly turn in an attempt to find obstacles within the path of the vehicle. However, due to the relative position of the driver in the vehicle, the driver's vantage point oftentimes results in the failure to see and/or maneuver around various stationary or moving obstacles. It is not uncommon for drivers of rear moving vehicles to strike other people who may walk or otherwise move into the path of the rear-moving vehicle, unbeknownst to the driver. In these situations, when the obstacle is a person, such as a child who may dart into the path of the rear-moving vehicle, the consequences can be catastrophic.

[0004] Even when relying on rear view mirrors and moving in reverse, a driver still may not be able to see a stationary or moving object that may be in the driver's blind spot. Thus, late model vehicles are increasingly being equipped by manufacturers with object detection systems that aid the driver handle the vehicle so as to avoid obstacles in the path of the rear-moving vehicle.

[0005] Although such systems vary, at least one such solution includes the placement of a camera in the rear portion of the vehicle so as to capture images of the area behind the vehicle, which is simultaneously displayed on the screen viewable by the driver. In this way, a driver at least has a viewable image of the area behind the rear-moving vehicle so as to see obstacles that may be in the path.

[0006] However, even cameras are constrained by the respective fields of view, which means that a camera may also have a blind spot or experience poor resolution depending on ambient lighting conditions. Furthermore, weather conditions and other environmental conditions may result in a poor image quality viewed by the driver, thereby negating any substantial beneficial effect that a camera system may provide.

[0007] Manufacturers also have begun equipping new vehicles with automatic sensing systems to detect objects by including in the newly manufactured vehicle one or more rear facing sensors that may detect the presence of objects within a predetermined range. When an obstacle comes within the vehicle's path, an emitted signal wave may be disturbed or reflected back to the sensor, thereby indicating to the driver by processing electronics that an obstacle is in the path of the rear moving vehicle. Thus, it is possible according to this solution to increase the awareness of the driver as to obstacles that may be in the rear path so as to prevent damage to the vehicle and/or injury to passengers in the vehicle or to persons that may be within the path of the vehicle.

[0008] While such systems may be employed in newly manufactured vehicles to effectively reduce the number of collisions by such vehicles when moving in reverse, this solution does not account for the millions of existing vehicles that are in use and were manufactured prior to the development of such safety systems, as well as particular vehicle configuration types that may not necessarily lend themselves to these manufacturer-installed detection systems.

[0009] The use of object detection systems to aid a driver when moving in reverse is found mostly in passenger vehicles and conventional light trucks. The application of these safety systems to larger trucks and especially to tractor-trailer rigs and specialty vehicles, such as sanitation trucks and dump trucks, is found much less frequently. For example, many current object detection systems utilize a hardwiring harnesses to electrically connect the sensors in the rear of the vehicle to an electrical control unit that may be in the front portion of the vehicle to audio or visual alerting means that may also be in the front of the vehicle. Depending on the vehicle type, extending a wiring harness throughout the length of a vehicle may be prohibited due to vehicle construction.

[0010] As a nonlimiting example, a rear loading sanitation truck that has various moving parts at the rear portion of the vehicle may not be ideally suited for the installation of certain obstacle detection systems after initial manufacture. Because of the moving parts on this vehicle associated with trash collection, placing the various components and routing the associated wiring harnesses may be impractical, especially if the control unit is positioned away from the sensors and alerting devices.

[0011] There have been attempts to overcome these limitations; however, the solutions have been limited. For example, transmitting data from sensors to a control unit near the front of the vehicle via wireless means, such as radio or microwave, is one such solution. However, this scheme often is not practical for trucks with detachable trailers due to the fact that a driver of a vehicle may tow a multitude of trailers in relatively short periods of time. Thus, such wireless transmitters are typically either universal or configured in such a way wherein the driver may easily determine and tune to the appropriate frequency so as to receive and understand communications from a transmitter in the rear portion of the vehicle.

[0012] If such devices are configured to include a wide range of frequencies, efforts need to be made to prevent unintentional interception by a receiver of another vehicle. More specifically, and as a nonlimiting example, if one vehicle is moving in reverse at, for example, a truck stop and detects an obstacle, the wireless communication reporting the detected obstacle may very well be received by a nearby

vehicle also moving in reverse, which would thereafter be reported to the driver as an obstacle within the rear path of his vehicle, even though the obstacle is in the rear path of another vehicle.

[0013] The complexity and function of hardwired or radio frequency systems may ultimately render these systems impractical for use in certain situations and applications. Sanitation trucks, as a nonlimiting example, have an articulated chassis and carry electromechanical equipment that may interfere with a transmitted RF signal. So as to overcome interference with other electrical components in an effort to increase the efficiency of the wireless communications, the cost of such components may be greater.

[0014] Thus, there is a heretofore unaddressed need to resolve the deficiencies and problems described above.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] Many aspects of the invention can be better understood with reference to the following drawings. The components in the drawings are not necessarily to scale, emphasis instead being placed upon clearly illustrating the principals of the present invention. Moreover, in the drawings, like reference numerals designate corresponding parts throughout the several views.

[0016] **FIG. 1** is a diagram of a tractor trailer rig comprised of a tractor and a trailer.

[0017] **FIG. 2** is a diagram of an exemplary embodiment of the tractor trailer rig of **FIG. 1** equipped with rear detection sensors on the rear portion of the trailer to detect objects behind the tractor trailer rig.

[0018] **FIG. 3** is a diagram of an exemplary embodiment of the tractor trailer rig of **FIGS. 1 and 2** with sensors configured to detect the presence of an obstacle and to report the detection of that presence to the driver in the tractor.

[0019] **FIG. 4A** is a side view diagram of an exemplary embodiment of the tractor trailer rig of **FIG. 3** approaching an obstacle.

[0020] **FIG. 4B** is a diagram of an exemplary embodiment of a rear portion of the trailer of **FIG. 4A** to show at least a nonlimiting example of the object detection system disclosed herein and as shown in **FIG. 3**.

[0021] **FIG. 5** is a diagram of an exemplary embodiment of a rear portion of the trailer of the tractor trailer rig of **FIG. 1**.

[0022] **FIG. 6** is a perspective view diagram of an exemplary embodiment of the tractor trailer rig of **FIG. 3**.

[0023] **FIG. 7** is a nonlimiting example diagram of a sanitation truck equipped with an object detection system of **FIGS. 2-4A**.

[0024] **FIG. 8** is a diagram of an exemplary embodiment of the flatbed tractor trailer rig equipped with an object detection system, as shown in **FIG. 4A**.

[0025] **FIG. 9** is a diagram of an exemplary embodiment of a box truck that is also configured with an object detection system of **FIG. 4A**.

[0026] **FIG. 10** is a diagram of an exemplary embodiment of the tractor trailer rig of **FIG. 1** equipped with an object detection system having a wireless transmission system.

[0027] **FIG. 11** is a side view diagram of an exemplary embodiment of the tractor trailer rig of **FIG. 10** depicting the alerting mechanism of alert and receiver upon the detection of an object in the rear driving path of the tractor trailer rig.

[0028] **FIG. 12** is a diagram of an exemplary embodiment of the electrical control unit of **FIG. 4A**

[0029] **FIG. 13** is a diagram depicting an exemplary embodiment of the visual indicator coupled to the side of the trailer of **FIG. 4A**.

DETAILED DESCRIPTION

[0030] In addition to the drawings discussed above, this description describes one or more embodiments as illustrated in the above-referenced drawings.

[0031] However, there is no intent to limit this disclosure to a single embodiment or embodiments that are disclosed herein. On the contrary, the intent is to cover all alternatives, modifications, and equivalents included within the spirit and scope of this disclosure and as defined by the appended claims.

[0032] A universally useable object detection system is disclosed herein, which may be temporarily or permanently positioned on an existing vehicle not previously equipped with such a system during manufacture. As a nonlimiting example, a driver of any tractor trailer rig for pulling commercial trailers may be able to simply connect to any trailer so equipped with a universally useable object detection system and be able to use it without any additional equipment in the cab of the tractor trailer rig so as to be able to move in reverse and to detect obstacles within the rear path of the vehicle.

[0033] In one embodiment among others, a universally useable object detection system comprises a plurality of positionable sensors, such as ultrasonic sensors, positioned on a vehicle in a direction so as to direct energy into a predetermined area respective to the vehicle, such as, for example, in the rear driving path of the vehicle. A control unit is electrically coupled to each sensor and is also detachably coupled to the vehicle proximate to the sensors. As a nonlimiting example, the control unit may be located under the vehicle near the rear of the vehicle. The control unit may be configured to receive signals from the sensors corresponding to a detected presence of an object within a predetermined range of one or more of the sensors. One or more audio and/or visual alerting devices are electrically coupled to the control unit and detachably coupled to the vehicle so that a driver of the vehicle can see the one or more alerting devices through one or more rear view mirrors of the vehicle.

[0034] **FIG. 1** is a diagram of tractor trailer rig **10** comprised of tractor **11** and trailer **12**. When tractor trailer rig **10** moves in reverse, the driver may utilize mirror **14** to view obstacles that may be in the line of sight area **16** on the left side of the vehicle. Similarly, the driver may utilize rear view mirror **18** to view into the line of sight area **20** for detecting obstacles and objects in this region to the right side of the vehicle. Thus, as the driver moves in reverse, objects that reside in line of sight areas **16, 20** may be viewable to the driver through rear view mirrors **14, 18** so that the driver may take evasive maneuvers to avoid collisions.

[0035] However, the driver of tractor **11** has at least three blind spots that include blind spot **22** directly behind trailer **12**, as well as blind spots **24**, **25** which are beyond the line of sight areas **16**, **20** described above. Thus, for an obstacle residing in any of these blind spots **22**, **24**, **25**, the driver of tractor **11** may not see these obstacles, thereby resulting in a collision when moving in reverse.

[0036] Further, due to the long distances from the driver as positioned in tractor **11** and the rear of the trailer to a loading dock or other obstacle, the ability of the driver to precisely judge the distance from the rear of the trailer to the obstacle even with use of the rear view mirrors may be greatly impeded. With rigs not equipped with the object detection systems described above, a driver may typically maneuver the vehicle by rear view mirrors **14**, **18** so as to place the dock or other intended final destination within the line of sight areas **16**, **20**. However, due to the inexperience of the driver and/or other conditions, such as a moving obstacle that may come into the path of the rear moving tractor trailer rig **10**, the driver may not always be aware of whether the path behind the tractor is clear for attempting maneuvers.

[0037] **FIG. 2** is a diagram of an exemplary embodiment of tractor trailer rig **10** equipped with rear detection sensors **28**, **31**, **33**, and **34** on the rear portion of trailer **12** to detect objects behind the tractor trailer rig **10**. In this nonlimiting example, sensors **28**, **31**, **33**, and **34** may be any type of ultrasonic, microwave, infrared, or scanning laser type detectors that may be fastened or otherwise attached to a rear area of trailer **12**. More specifically, one of ordinary skill would know of various sensor technologies that could operate as sensors **28**, **31**, **33**, and **34** and also that a greater or lesser number of sensors may be implemented in an application.

[0038] If sensors **28**, **31**, **33**, and **34**, as a nonlimiting example, are ultrasonic sensors, ultrasonic energy **36** is emitted in the rear driving path of tractor trailer rig **10** into a predetermined area for detecting objects. Furthermore, sensors **28**, **31**, **33**, and **34** may be fastened to tractor trailer rig **10** by any known means such as screws, bolts, straps, magnets, clips, as well as any other means known to one of ordinary skill in the art. In this way, these sensors **28**, **31**, **33**, and **34** may be fastened to trailer **12** that was not otherwise equipped with such sensors during its manufacture.

[0039] **FIG. 3** is a diagram of an exemplary embodiment of the tractor trailer rig **10** of **FIGS. 1 and 2** with sensors **28**, **31**, **33**, and **34** configured to detect the presence of an obstacle and to report the detection of that presence to the driver in tractor **11**. In this nonlimiting example, obstacle **39** may be detected by the ultrasonic energy **36** which is reflected back to the sensors, as shown by reference numeral **41**. An electrical control unit, which is not shown in **FIG. 3** but is shown in subsequent figures, receives a signal from sensors **28**, **31**, **33**, and/or **34** corresponding to the detection of object **39**. The electrical control unit thereafter activates visual alerting indicators **43**, **44** positioned on either side of trailer **12**, as shown in **FIG. 3**. The visual alerting indicators **43**, **44** may be configured to go from a state of "off" to "on" or perhaps to otherwise go from one type of light to a different type of light so as to indicate to the driver the detection of obstacle **39**. As a more specific nonlimiting example, indicators **43** and **44** may be configured to change colors from, as a nonlimiting example, green to red upon the detection of obstacle **39** or may be simply configured to go from an "off" status to an illuminated status such that light beams **46** and **44** are reflected from rear view mirrors **14** and **18** respectively to the driver in tractor **11**. Upon detection of these light beams, the driver may, through the driver's rear view mirror, interpret this alert to mean that an obstacle is within the rear driving path of the vehicle, thereby leading the driver to take evasive maneuvers to avoid collision with the object.

[0040] One of ordinary skill would also know that the visual alerting indicators **43**, **44** may be configured to flash or otherwise communicate distance information via changing the lighting pattern or brightness as trailer **12** approaches object **39**. Stated another way, as tractor trailer rig **10** moves closer to object **39**, the electrical control unit may receive a varied signal from the sensors **28**, **31**, **33**, and **34** indicating the closing proximity of object **39**. Thus, the electrical control unit may cause the visual alerting indicators **43**, **44** to flash in a more rapid sequence or to change color to yet a third or a different color configuration to indicate the closing proximity. One of ordinary skill would know that indicators **43**, **44** could be configured in a variety of illumination formats so as to communicate the detection of an object to the driver and/or range to the object.

[0041] **FIGS. 4A and 4B** are side view diagrams of an exemplary embodiment of the tractor trailer rig **10** approaching obstacle **39**, as shown in **FIG. 3**. In the side view diagram, tractor trailer rig **10**, while moving in reverse toward object **39**, is in pending danger of colliding with object **39**, thereby causing damage to either trailer **12** and/or object **39**.

[0042] However, the object detection system as described herein may include sensor **28** that emits ultrasonic energy **36**, as a nonlimiting example, which strikes object **39** and is reflected back as reflected energy **41**. Reflected energy **41** is detected by sensor **28**. This detected reflection is communicated to electrical control unit **50**, which recognizes the signal as indicating the detected presence of an object within the rear driving path of tractor trailer rig **10**. Electrical control unit **50** may thereafter activate visual alerting indicator **44** (and also indicator **43** in **FIG. 3**) as well as audio alerting indicator **52** in order to notify the driver in tractor **11**. Thus, the driver in tractor **11**, when looking through rear view mirror **18**, may see the illumination of visual alerting indicator **44** communicating the presence of object **39** within the rear driving path of the tractor trailer rig **10**.

[0043] **FIG. 4B** is a diagram of an exemplary embodiment of the rear portion of trailer **10** and object **39** to describe at least a nonlimiting example of the object detection system disclosed herein and as shown in **FIG. 3**. In this nonlimiting example, the electrical control unit **50** is placed in the rear portion of trailer **12** proximate to sensor **28** (and the other sensors not shown in this figure) so that the communication path via a wiring harness **47** may be relatively short. Likewise, electrical control unit **50** is also coupled to visual alerting indicator **44** by wiring harness **48**, which in this nonlimiting example is a relatively short span. Finally, electrical control unit **50** is coupled to audio alerting indicator **52** by wiring harness **49** in similar fashion.

[0044] As a further nonlimiting example, the electrical control unit **50** may be attached to the underportion of trailer **12** by screws, bolts, or other attaching means, as one of

ordinary skill in the art would know, and also electrically coupled with the existing power system of the trailer. More specifically, a trailer may be electrically connected to the battery or other power source within the tractor **11** of **FIG. 4A**; however, the electrical control unit may be electrically coupled with the existing wiring harness to lights, for example, so as to draw power from the power source within tractor **11** for activating and operating the object detection system described herein. For this reason, electrical control unit **50**, sensor **28** (as well as the other sensors described above), visual indicator **44**, and audio indicator **52** may either temporarily or permanently remain on trailer **12** irrespective of any additional configuration in tractor **11**. As further described above, any tractor **11** may be coupled to trailer **12** as shown in **FIG. 4A** and be able to detect objects within the rear driving path of the vehicle without additional equipment and additional specialized equipment within the tractor **11** because the entire object detection system, including sensors, the control unit, and visual and audio indicators, is contained on trailer **12**.

[**0045**] As to the operation of the object detection system in **FIG. 4B**, the emitted ultrasonic energy **36** impacts object **39** and is reflected as signal waves **41** back to sensor **28**. Sensor **28** communicates this detected presence to the electrical control unit **50** on the underside of trailer **12** via harness **47**, which, thereafter, activates visual indicator **44** and audio indicator **52** by wiring harnesses **48** and **49**, respectively.

[**0046**] **FIG. 5** is a diagram of an exemplary embodiment of a rear portion of trailer **12** of the tractor trailer rig **10** of **FIG. 1**. In this nonlimiting example, the tractor trailer rig **10** is prepared to move in reverse, as indicated by reverse indicator lights **54** and **55**. As these lights **54**, **55** are illuminated, the electrical control unit **50** is thereby activated, causing sensors **28**, **31**, **33**, and **34** to activate as well. As a result, ultrasonic energy **36** is emitted from each of sensors **28**, **31**, **33** and **34** into the area behind the rear of trailer **12**. Although not shown illuminated, visual indicators **43** and **44** are positioned along either side of trailer **12** such that, when illuminated, the driver in tractor **11** may detect the illumination of indicators **43** and **44** in this position.

[**0047**] One of ordinary skill in the art would know that various types of cabling and/or wiring harnesses may be implemented for connecting control unit **50** with each of sensors **28**, **31**, **33**, and **34**, as well as visual indicators **43** and **44**. As one nonlimiting example, cabling with detachable connectors may be utilized for temporary or extended use applications of the object detection system on trailer **12** in **FIG. 5**.

[**0048**] **FIG. 6** is a perspective view diagram of an exemplary embodiment of the tractor trailer rig **10** of **FIG. 3**. More specifically, **FIG. 6** depicts two perspective view diagrams of tractor trailer rig **10** to show the illumination of the visual indicators **43** and **44** respective to the driver **60** of the tractor trailer rig **10**. On the left side portion of **FIG. 6**, driver **60** may view the illumination of visual indicator **44** via rear view mirror **18**. Thus, sight line **62**, as reflected through mirror **18**, enables the driver to see the illumination of visual indicator **44** on the side of trailer **12**. So a person **61** positioned within the rear driving path of tractor trailer rig **10** may be detected by the sensors described and shown in **FIG. 5** so as to cause the visual indicator **44** to illuminate, thereby notifying the driver of the presence of an obstacle behind the tractor trailer rig **10**.

[**0049**] Likewise, the right side portion of **FIG. 6** shows the driver's **60** viewing of the illumination of visual indicator **43** through right side rear view mirror **14**. Sight path **63** enables the driver to look through rear view mirror **14** to see the illumination of visual indicator **43** when person **61** is positioned within the rear driving path of tractor trailer rig **10**.

[**0050**] Thus far, the object detection system of this disclosure has been described as implemented on a tractor trailer rig **10**. However, one of ordinary skill in the art would know that this system may be implemented on various types of vehicles, either permanently or temporarily, irrespective of any special electronics within the driving cab of the vehicle for which the system is installed.

[**0051**] **FIG. 7** is a nonlimiting example diagram of a sanitation truck **70** equipped with an object detection system described above. In this nonlimiting example, sanitation truck **10** includes one or more sensors **74** positioned so as to emit ultrasonic energy, in this nonlimiting example, into a rear driving path of the sanitation truck **70**. As discussed above, sensors **74** are electrically coupled to electrical control unit **75**, which is configured to receive signals corresponding to the detected presence of an obstacle, such as person **78**, within the rear driving path of sanitation truck **70**. In such instances, electrical control unit **75** causes audio indicator **77** to produce an alerting sound that may be recognizable by the driver of the sanitation truck **70** in cab **71** as well as by the person **78** within the rear driving path of the sanitation truck. As described above, the driver in cab **71** via sight path **83** and rear view mirror **84** may see the illumination of visual indicator **80** placed upon the side of the rear portion **72** of sanitation truck **70**.

[**0052**] One or more additional visual indicators **81** may be positioned at the rear of sanitation truck **70** so as to give person **78** within the rear driving path of the vehicle an additional warning of the approaching sanitation truck **70**. The inclusion of visual indicator **81** and audio indicator **77** on sanitation truck **70** is merely a nonlimiting example, as one of ordinary skill in the art would know that one or both of these alerting devices as well as other types of alerts may be activated by the electrical control unit **75** upon the detection of person **78** (or other object) within the rear driving path of sanitation truck **70**. As an additional nonlimiting example, electrical control unit **75** may be configured to produce an output signal that causes the sanitation truck **70** to automatically actuate its brakes or otherwise terminate its engine so as to cease the rear movement toward person **78**.

[**0053**] It should be noted that the object detection system shown in **FIG. 7** may be installed on sanitation truck **70** in a manner so as to avoid any moving portions of the truck. By locating electrical control unit **75** near the sensors **74**, installation of the system is simpler due in part to the avoidance of extended wiring runs. Installation in this manner enables use of the system, irrespective of the vehicle's moving components.

[**0054**] **FIG. 8** is a diagram of an exemplary embodiment of a flatbed tractor trailer rig **88** comprising a tractor **89** and flatbed trailer **90**. In this nonlimiting example, one or more

sensors **91** may be positioned at a rear portion of the vehicle by one or more of the means described above and electrically coupled to electrical control unit **92** in the same manner as described above, which is positioned near the rear of flatbed trailer **90**. Upon the detection of an obstacle within the rear driving path of flatbed tractor trailer rig **88**, electrical control unit **92** may activate audio indicator **93** and/or visual indicator **95**, which in this nonlimiting example is positioned near the front portion of flatbed trailer **90** proximate to the tractor **89**. Just like above, visual indicator **95** may be on either side of flatbed trailer **90** so that the driver may view the illumination of visual indicator **95** through rear view mirror **98** on the right side of the vehicle and through the similar rear view mirror on the left side of the vehicle (not shown). Thus, driver **97** may use rear view mirror **98** to view the illumination of visual indicator **95** upon the detection of an object within the rear driving path of flatbed tractor trailer rig **88**.

[**0055**] **FIG. 9** is a diagram of an exemplary embodiment of box truck **101** that is also configured with an object detection system including one or more sensors **103** coupled to the electrical control unit **102**. In this nonlimiting example, box truck **101** may be equipped with the object detection system described in this disclosure subsequent to its manufacture by attaching electrical control unit **102**, sensors **103**, visual indicators **104** and **105**, and audio indicators **107** to the box truck **101**. Similarly, electrical wiring harnesses may be routed between the various components described above, as one of ordinary skill in the art would know. Thus, the driver of box truck **101** may utilize rear view mirror **109** to view the illumination of visual indicator **104** as well as hear the report of audio indicator **107**. As similarly discussed above, visual indicator **105** may be positioned in the rear portion of box truck **101** so as to alert a person who may be within the rear driving path of the vehicle so as to take evasive action as the box truck **101** approaches.

[**0056**] Although some of the problems of wireless communications in object detection systems are described above, the electrical control unit may indeed be programmed with a transmitter so as to securely, reliably, and wirelessly communicate the detection of objects within the rear driving path of a vehicle to an alerting device that may be positioned on another part of the vehicle. More specifically, **FIG. 10** is a diagram of an exemplary embodiment of tractor trailer **110** equipped for wireless alerts. In this nonlimiting example, tractor trailer **110** includes one or more sensors **112** positioned so as to emit ultrasonic energy, as a nonlimiting example, into the rear driving path of the tractor trailer **110**. The sensors **112** are electrically coupled to electronic control unit **114**, which is shown in dashed lines as it may be positioned on an under portion of tractor trailer **110**, as described above. Thus, upon the detection of object **113** within the rear driving path of tractor trailer **110**, sensors **112** communicate the detected presence to electrical control unit **114**.

[**0057**] In this nonlimiting example, electrical control unit **114** may be equipped with a wireless communication device such as an RF transmitter or other similar device so as to communicate an alerting message to a wireless receiver **116** that may be positioned within the cab of the tractor trailer **110**. Although shown as separate components, one of ordinary skill in the art would know that visual and/or audio alerting device **118** may be an integral portion with receiver **116** or a separate component that is electrically coupled to the receiver **116**. In this nonlimiting example, receiver **116** receives a wireless communication from the transmitter of electrical control unit **114**, and alerting indicator **118** thereafter produces an alerting message, which is either visual, audio, or both, to the driver of tractor trailer rig **110**.

[**0058**] One of ordinary skill in the art would know, however, that other nonlimiting examples may be implemented in addition to the receiver **116** and indicator **118**. As a nonlimiting example, the transmitter in electrical control unit **114** may transmit an AM or FM signal receivable by an in-dash radio in the cab of the tractor trailer rig **110**, which the driver may tune to when attempting reverse driving. Thus, when object **113** is detected, a signal is broadcast from electrical control unit **114** that is received and output by the radio system in the cab of tractor trailer rig **110**, thereby informing the driver of the presence of the detected object.

[**0059**] **FIG. 11** is a side view diagram of an exemplary embodiment of the tractor trailer rig **110** depicting the alerting mechanism of alert **118** and receiver **116** upon the detection of an object in the rear driving path of tractor trailer rig **110**. As discussed in **FIG. 10**, electrical control unit **114** in this nonlimiting example is positioned on the underside of the tractor trailer **110** and is equipped with a wireless transmitter to communicate the detection of an object within the rear driving path of the tractor trailer rig **110** to the driver in the cab. The output of alert indicator **118** may be audio, visual, or both as described above, so as to communicate to the driver the detection of an object within the rear driving path of tractor trailer rig **110**.

[**0060**] **FIG. 12** is a diagram of an exemplary embodiment of the electrical control unit **50** of **FIG. 4A** and is described in this disclosure. In this nonlimiting example, electrical control unit **50** may be coupled to a power source **121**, such as a battery within the tractor **11** of **FIG. 3** or a rechargeable battery device.

[**0061**] Electrical control unit **50** includes a processor **124** that executes instructions contained in memory **126**. More specifically, memory **126** includes an operating system **127** executable by the processor and one or more application programs **129** for executing instructions and determining whether an object is detected within the rear driving path of tractor trailer **10** of **FIG. 3** so that appropriate action can be taken thereafter.

[**0062**] As described above, one or more sensors **28**, **31**, **33**, and **34** (**FIG. 3**) may be electrically coupled to the electrical control unit **50** via sensor interface **130**. Thus, the sensor interface **130** may receive a signal from one or more of the sensors **28**, **31**, **33**, and **34**, which is communicated via local interface **135** to processor **124** and/or memory **126**. Processor **124** is configured to recognize the signal received as indicating the detected presence of an obstacle or object within the rear driving path of tractor trailer **10** of **FIG. 3** when one is detected. Upon such recognition, processor **124** thereafter may be configured to cause one or more alerting devices to activate.

[**0063**] In one nonlimiting example, processor **124** may communicate an output signal to output interface **133**, which is electrically coupled to one or more alerting devices, such as visual alerting indicators **43** and **44** of **FIG. 3**, as well as

audio alerting indicator **52** of **FIG. 4A**. As described in regard to **FIGS. 10 and 11**, processor **124** may also be configured to communicate an output signal to transmitter **135**, which broadcasts an output signal wirelessly to receiver **116**. One of ordinary skill in the art would know that a variety of communication methods and protocols could be used to wirelessly communicate the output from processor **124**.

[**0064**] One of ordinary skill in the art would also know that electrical control unit **50** may be placed within a housing sufficient for withstanding the environmental conditions for which the electrical control unit may otherwise be subjected to. By positioning the electrical control unit **50** near the sensors **28**, **31**, **33**, and **34**, the electrical control unit may be subject to temperature, moisture, and perhaps even road debris during normal operation. So the housing of electrical control unit **50** is configured to withstand these conditions so as to protect the processor and other components described in **FIG. 12**.

[**0065**] Each of the components described in the object detection system above may be coupled to a vehicle for operation in a variety of mechanisms, as one of ordinary skill in the art would know.

[**0066**] **FIG. 13** is a diagram depicting an exemplary embodiment of the visual indicator **43** coupled to the side of trailer **12** of **FIG. 3**. In this nonlimiting example, visual indicator **43** may be attached to the side wall of trailer **12** via magnet **139** if trailer **12** is of the appropriate metal such that the magnet **139** may attach. However, one of ordinary skill in the art would know that visual indicator **43**, as well as each other component described above, may be fastened by screws, bolts, straps, clips, adhesives, ties, etc. as one of ordinary skill in the art would know.

[**0067**] To continue with this nonlimiting example, visual indicator **43** may include electrical connector **144** so as to connect visual indicator **43** with electrical control unit **50**, as shown in **FIG. 3**. One or more cable routing stays **142** may be attached to the side of trailer **12** by the same means described above in regard to visual indicator **43**. Thus, as a nonlimiting example, one may install an object detection system as described above by attaching an electrical control unit near the rear portion of the trailer **12** in conjunction with a plurality of sensors **28**, **31**, **33**, and **34**. Furthermore, visual indicators **43** and **44** may be magnetically placed or attached by other means upon the side of the trailer **12** with cabling routed and positioned by magnetic stays **142** so that the trailer now becomes equipped with an object detection system that may actually be permitted to remain on the trailer for an extended time. However, the object detection system may likewise be moved quickly and simply to another trailer if so desired. In each instance, though, the driver of the tractor pulling trailer **12** does not need specialized equipment within the cab portion of the tractor for implementing the object detection system, thereby increasing the simplicity of use of the object detection system of this disclosure.

[**0068**] It should be emphasized that the above-described embodiments and nonlimiting examples are merely possible examples of implementations, merely set forth for a clear understanding of the principles disclosed herein. Many variations and modifications may be made to the above-described embodiment(s) and nonlimiting examples without departing substantially from the spirit and principles disclosed herein. All such modifications and variations are intended to be included herein within the scope of this disclosure and protected by the following claims.

I claim:

1. An object detection system for a vehicle, comprising:

a plurality of positionable sensors detachably coupled to the vehicle and oriented in a direction so as to direct energy into a predetermined area respective to the vehicle;

a control unit electrically coupled to each of the plurality of positionable sensors and detachably coupled to the vehicle proximate to the sensors and configured to receive a signal from one or more of the sensors, the signal corresponding to a detected presence of an object within a predetermined range of the one or more sensors, the control unit electrically coupled to a power source of the vehicle; and

one or more visual alerting devices electrically coupled to the control unit and detachably coupled to the vehicle so that a driver of the vehicle can see the one or more alerting devices through one or more rear view mirrors of the vehicle.

2. The system of claim 1, further comprising:

an audio alerting device electrically coupled to the control unit that is configured to produce an audio alert when the control unit receives a signal from one or more sensors corresponding to a detected presence of an object within the range of the sensor such that the control signal outputs a signal to the audio alerting device to activate the audio alert.

3. The system of claim 1, wherein the plurality of sensors are ultrasonic sensors.

4. The system of claim 1, wherein the control unit is electrically coupled to a circuit that energizes when the vehicle is placed into reverse gear so as to activate the plurality of sensors.

5. The system of claim 4, wherein the control unit keeps the plurality of sensors in an inactive mode when the circuit that energizes when the vehicle is placed in reverse is not energized.

6. The system of claim 1, wherein the plurality of sensors and the one or more visual alerting devices are detectably coupled to the vehicle by a magnet positioned on each sensor and visual alerting device.

7. The system of claim 1, wherein the control unit is positioned proximate to the rear of the vehicle on an underside portion of the vehicle.

8. The system of claim 1, further comprising:

one or more additional visual alerting devices electrically coupled to the control unit and detachably positioned on a rear portion of the vehicle so as to communicate the detection of an object within a detection range of the one or more sensors to an area behind the vehicle.

9. The system of claim 8, wherein an audio alert is produced to warn a person in the rear driving path of the vehicle of the approaching vehicle.

10. A method for detecting the presence of objects within the rear driving path of a vehicle, comprising the steps of:

attaching one or more sensors onto a rear portion of a vehicle so that the sensors direct energy into a predetermined area behind the vehicle;

positioning a control unit module proximate to the one or more sensors so that the control unit may receive a signal from the one or more sensors, the signal corresponding to the detection of an object within the detection range of the one or more sensors; and

activating one or more visual indicators positioned on the side of the vehicle electrically coupled to the control unit so that the driver of the vehicle can visually detect activation of the visual indicators through one or more rear view mirrors of the vehicle.

11. The method of claim 10, wherein the visual indicators are activated by a signal output by the control unit when the control unit receives a signal from the one or more sensors indicating the detected presence of an object within the rear driving path of the vehicle.

12. The method of claim 10, further comprising the steps of:

electrically coupling the control unit to a circuit in the vehicle that energizes when the vehicle is placed into reverse gear so that the one or more sensors are activated when the vehicle is placed in reverse gear.

13. The method of claim 10, further comprising the step of: connecting the control unit to each of the one or more sensors and to the one or more visual indicators.

14. An object detection system for a vehicle, comprising:

a plurality of positionable sensors detachably coupled to the vehicle and oriented in a direction so as to direct energy into a predetermined area respective to the vehicle;

a control unit electrically coupled to each of the plurality of positionable sensors and detachably coupled to the vehicle proximate to the sensors and configured to receive signals from one or more of the sensors, the signal corresponding to a detected presence of an object within a predetermined range of the one or more sensors, the control unit electrically coupled to a power source of the vehicle;

a wireless transmitter coupled to the control unit for wirelessly communicating a signal corresponding to a detected presence of an object within a predetermined range of the one or more sensors; and

one or more alerting indicators having a receiver configured to receive the wirelessly communicated signal, the one or more indicators configured to produce an alert indication upon receipt of the wirelessly communicated signal.

15. The system of claim 14, wherein at least one of the one or more alerting indicators is an illuminating device that is visible to the driver when activated.

16. The system of claim 15, wherein illuminating device is positioned so that a driver of the vehicle can see the one or more illuminating device through a rear view mirror of the vehicle.

17. The system of claim 16, wherein the illuminating device is positioned within a viewable range of the driver in front of the driver on the vehicle.

18. The system of claim 14, wherein at least one of the one or more alerting indicators is a sound producing device that is produces an audio alert when activated.

19. An object detection system for a vehicle, comprising:

a plurality of positionable sensors detachably coupled to the vehicle and oriented in a direction so as to direct energy into a predetermined area respective to the vehicle;

a control unit electrically coupled to each of the plurality of positionable sensors and detachably coupled to the vehicle proximate to the sensors and configured to receive a signal from one or more of the sensors, the signal corresponding to a detected presence of an object within a predetermined range of the one or more sensors, the control unit electrically coupled to a power source of the vehicle; and

an audio alerting device electrically coupled to the control unit that is configured to produce an audio alert when the control unit receives a signal from one or more sensors corresponding to a detected presence of an object within the range of the sensor such that the control signal outputs a signal to the audio alerting device to activate the audio alert.

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