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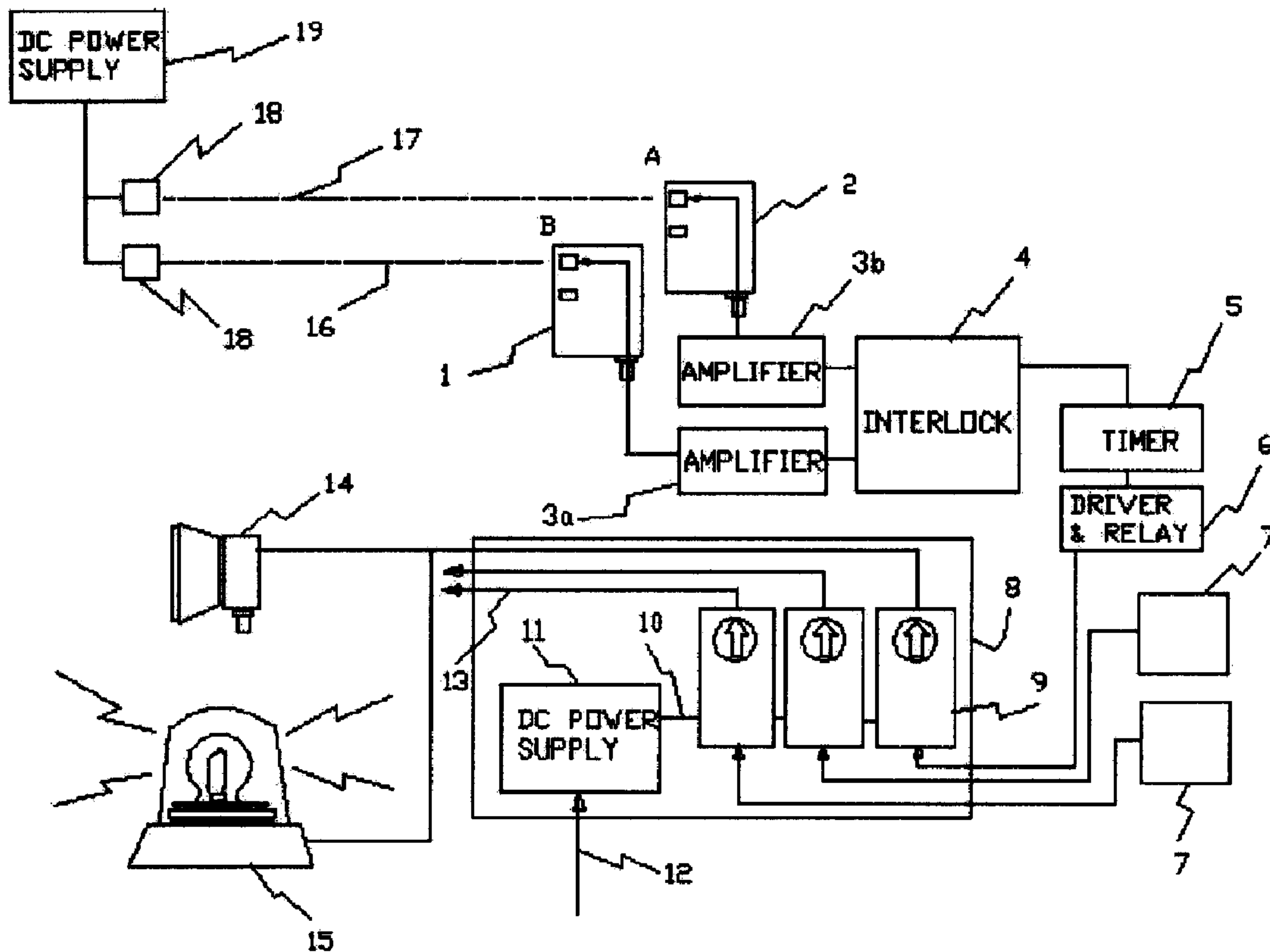
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(54) Titre : SYSTEME D'ALERTE ET DE DETECTION POUR CHARIOT ELEVATEUR A FOURCHES AVEC
ESTIMATION DE DIRECTION DE DEPLACEMENT

(54) Title: FORKLIFT DETECTION AND ALERT SYSTEM WITH MOVEMENT ESTIMATE



(57) Abrégé/Abstract:

Forklift Detection and Alert System with Movement Direction Estimate is provided and includes infrared transmitters and detectors for signals in association with an event or an object. The signals are adapted for triggering a controller means. The controller

(57) **Abrégé(suite)/Abstract(continued):**

means activates an alarm means in response to being triggered by 1 up to 8 transmitters and detectors group signals thereby providing an early and distinct warning to people in the vicinity of the sensors in order to eliminate or reduce the chances of the person sustaining injury. According to another aspect of the present invention there is provided a method of warning a person of the proximity of an object or event. When the object or event is leaving the monitoring area, the warning will not be activated. When the person and object or event are located within a predetermined distance from each other, the detector means transmits a signal to the controller means. In response, the controller means activates an alarm means in order to provide an early and distinct warning to the person in the vicinity of the object or event to alert the person to the presence of the object or event.

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Name: **Forklift Detection and Alert System with Movement Direction Estimate**

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ABSTRACT

Forklift Detection and Alert System with Movement Direction Estimate is provided and includes infrared transmitters and detectors for signals in association with an event or an object. The signals are adapted for triggering a controller means. The controller means activates an alarm means in response to being triggered by 1 up to 8 transmitters and detectors group signals thereby providing an early and distinct warning to people in the vicinity of the sensors in order to eliminate or reduce the chances of the person sustaining injury. According to another aspect of the present invention there is provided a method of warning a person of the proximity of an object or event. When the object or event is leaving the monitoring area, the warning will not be activated. When the person and object or event are located within a predetermined distance from each other, the detector means transmits a signal to the controller means. In response, the controller means activates an alarm means in order to provide an early and distinct warning to the person in the vicinity of the object or event to alert the person to the presence of the object or event.

BACKGROUND OF THE INVENTION

The present invention relates generally to detecting movement system and particularly to movement detection systems in combination with warning devices that are activated by the movement detection systems. The present invention relates to a forklift truck alert system to warn people in close proximity to the forklift of its presence so that people are aware that the forklift is close by so that they can take evasive action or remain out of dangerous area until the forklift moves away or departs the hazard zone. Also, the present invention relates to a portable hazard warning system that alerts people that they are approaching a hazardous area or zone.

The present invention can particular application as a safety system comprising the proximity detection system and warning system for use in a work place, such as for example, a factory, warehouse, transportation facility, such as an airport, or the like to alert workers to the proximity of a hazard.

Most industrial plants, including forklift trucks, pallet carriers, road transport vehicles, tractors, cranes, excavators, vehicles generally and the like often present a significant injury hazard to personnel in the work environment such as for example in factories, warehouses, transportation facilities or the like, when these vehicles are operating in area where pedestrians may also be present, particularly in confined areas where pedestrians and vehicles share a common path, roadway or similar. As the vehicles are often large and heavy, even when travelling at a slow speed, any pedestrian collision accidents are generally serious or fatal to the pedestrian, and often result in damage to surrounding structures.

There have been some other systems in use for detecting and warning of the presence of

industrial mobile plant and vehicles. On forklifts, a flashing hazard lamp, horn, reversing beeper or similar devices are used for fulfil a basic safety role, but have disadvantages that the hazard lamp or other visible warning device may not be visible to a pedestrian at an obscured location, such as at a doorway, in a corridor or at a corner where the vehicle is unsighted by the person until it is almost too late to avoid a collision. This is particularly so when the vehicle and pedestrian simultaneously approach the same closed swinging door from either side. Further, ambient site noise may mask the audible horn warning because the horn may be sounded on the other side of a doorway or closed door or the forklift driver or operator may forget to operate the horn, some noisy manufacturing environment, workers must wear ear plugs for health safety reason, so that the pedestrian is unaware of the approaching vehicle.

Some Radio frequency transponder-based system have the typical disadvantages of high directionality, and/or of restricted range which is typically of up to a few meters only which does not provide sufficient coverage of the work area and which is often insufficient to provide adequate warning for the person, respectively, in most industrial plant, high frequency interrupt because motors running or starting may cause the Radio frequency transponder-based system fail sometime.

Non-transponder based radio frequency systems have also been tried, however these typically suffer from difficulties in defining a stable triggering distance leading to false alarms being triggered and also difficulties in containing the triggering signal such that it does not trigger detectors in other zones by passing through walls.

According to one product on market combines with rotatable transmitter means which mounted on top of a forklift, one or more detectors mounted on the wall near sharp turn corners etc. when the forklift in those area the detectors receive the signal from the rotatable transmitter on the top of the forklift. Detector triggers alert lamp or warning devices. This product has disadvantages that including it cannot estimate forklift driving directions, even the forklift leaving from the area, the alert flashing light still is keeping on. The workers maybe do not trust the system completely. For that system need professional technician who very familiar with forklift or vehicles to install the rotatable transmitter means on the forklift, because the transmitter need a power supply feed from forklift's battery or somewhere. This product of the coverage of an extended detection area providing reliable and sufficiently early warning in all instances is difficult like long distance aisles is difficult, as well as expensive, to install and to maintain.

Another product on market is for intersection combine 4 cameras and alert flashing light in one box which hanging up on top of intersection's center, this product has same disadvantage is cannot estimate a forklift driving direction, and cannot be used for long distance aisle.

The present invention finds particular application as a safety system comprising the proximity detection system and warning system for use in a work place, not only for intersections, but also for long distance aisles, pallet carriers, road transport vehicles, tractors, cranes, excavators, etc. because the present invention using two present available technique long distance infrared beam transmitters and detectors sent two signals to a controller, the controller trigger alarm devices logically, when a forklift is approaching the hazard zone, alert light flashing and/or alarm horn on; when the forklift is leaving from the hazard zone, alarm devices will not be on. For example, when a forklift is closing to an intersection from one direction, on other two sides of intersection, the alert light flashing before the forklift arriving the intersection to give alarm pedestrians who cannot see a forklift on other side of intersection. If the forklift is leaving

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from intersection, even the detectors detect the forklift, the alert light will not be flashing, because no dangerous to intersection area.

Infrared transmitter and detector technique products have been applied widely for industrial manufacturing processing more than 10 years, but distance is limited from 1mm to 2 m, in 4-5 years some products can detect distance to 2.5m, those products widely have been applying for garage door opener etc. in present time, new infrared sensors are on market, the detect distance is up to 20m or more, and cost much lower than 2 years ago. So now the present invention is available and economically for application.

BRIEF SUMMARY OF THE INVENTION

According to the present invention there is provided a movement detection and warning system comprising infrared transmitter and detector means for transmitting signals in association with an event or an object, the signals being adapted for triggering alarm means by a controller. A controller employs one or more fixed linear infrared beam transmitters and detectors which trigger an or more alarm when the linear beam is broken or otherwise interrupted by passage of a vehicle across the beam which temporarily disrupts the beam allowing the alarm to be activated. An alarm means in response to being triggered by the transmitted signal thereby providing an early and distinct warning to people in the vicinity of the hazard zone in order to eliminate or reduce the chances of the person sustaining injury.

Typically, the detection system is combined movement detection and warning systems. More typically, the movement detection and warning system provide advance warning of the presence of a hazard or potentially dangerous object or event. More typically, the object is a moveable object. Even more typically, the moveable object is a vehicle or mobile plant equipment, preferably a forklift truck. Typically, the event is a hazardous event, such as a disaster area, accident site, spill of toxic chemicals or similar.

Typically, one transmitter means is two linear infrared transmitters and detectors group, both transmitters and both detectors are parallel installed from each other. More typically, each transmitter transmits a linear infrared beam, if an object from far way is going to the hazard zone, the beam of first infrared transmitter is broken by the object, the controller allow the alarm to be activated; if the object is leaving from hazard zone, the object breaks the beam of second infrared transmitter as interlock transmitter firstly, the controller interlock the alarm means, the alarm is not activated in this status.

Typically, the transmitted signal is an infrared beam and the transmitter means is an infrared transmitter.

Typically, the detector means is an infrared beam receiver, the detector means receive a linear infrared beam transmitted from the infrared transmitter which working with the infrared detector together.

Typically, the transmitter means is located on the wall, construction or close to event, height is lower than top of object, but higher than people, the leaner infrared beams cannot be broken by people to make wrong alarm.

Typically, the vehicle may approach the transmitter means from any horizontal direction as the leaner infrared beam can be broken by any angle.

Typically, the infrared transmitter is a static light-emitting Diode (LEDs). More typically, LEDs

is able to be illuminated all time.

Typically, the controller embodies the detection, environment electro-magnetic interruption isolation and alarm functions.

Typically, the alarm means includes an audible and visible warning.

Typically, the signal transmitted by the transmitter means is used to remotely operate access control devices. More typically, the access control devices include boom gate, swing, roller and sliding doors or other operating mechanisms.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

The present invention will now be described by way of example with reference to the accompanying drawings in which:

FIG.1 is schematic view of one form of the overall detection and warning system of the present invention.

FIG.2 is a schematic view of the components of one form of the detection and warning system of the present invention showing the circuit details and components in schematic block form.

FIG.3 is a side cross-sectional view of one form of the first infrared sensor as detecting sensor and second infrared sensor as interlock sensor useful in the detection and warning system when an object is approaching the hazard zone.

FIG.4 is a side cross-sectional view of one form of the first infrared sensor as detecting sensor and second infrared sensor as interlock sensor useful in the detection and warning system when an object is leaving the hazard zone.

DETAILED DESCRIPTION

With particular reference to FIG.1, one form of the overall detection and warning system will now be described in general to provide an idea of the system and how it operates. A mobile plant, in the form of a forklift, general denoted as **101**, is provided with two infrared transmitters and detectors **102** for transmitting two infrared beams transmission. Transmitters and detectors are energized by a controller **103**. Infrared transmitters are always transmitting linear infrared beams (invisible light) cross aisles etc. transmitters **102** are provided throughout the building or similar at spaced apart strategic locations along the itinerary of the forklift truck **101**. A zone controller **103** is provided at a convenient location for receiving signals from linear infrared transmitters **102** and sending a corresponding signal to a suitable warning device in the form of a warning light/siren **105**. When the infrared beams of infrared transmitters **102** are broken by forklift truck **101** which is in close proximity, the transmitters activate pedestrian audible and/or visible alarm **105** via zone controller **103**.

In one embodiment zone controller **103** terminates the cables from infrared transmitters **102** and supplies power to infrared transmitters **102** and the circuits associated with alarm **105** as well as facilitating pre-setting of the alarm timing characteristics for each detection zone. The alarm **105** may be located remote from where detection occurs or remote from the location of the infrared transmitters **102**.

In another embodiment, as an example of remote sitting of the infrared transmitters **102**,

alarm **105** maybe located on a pedestrian **106** walkway that approaches the hazard zone. In this way, pedestrian **106** can be clearly warned of the presence of forklift truck **101** or similar when the forklift truck enters or is in the or one of the designated hazard zones, even though the vehicle may not yet be visible to the pedestrians. Thus, the present invention can provide an early and distinct warning to pedestrians automatically without having to rely on operators of the forklift trucks remembering to activate the warning alarms. The infrared transmitters **102** will be triggered when the vehicle approaches the hazard zone and breaks the infrared beams from a wide range of different angles when the vehicle is closer than the predetermined distance between the transmitter and pedestrian to activate the warning system.

The detection and warning system of the present invention may be applied, in one embodiment, to improving the safety of pedestrians and mobile plant operations in industrial and other commercial operations including transport facilities or other areas associated with the intensive movement of vehicles in a crowded or confined area in which vehicles and pedestrians share a common pathway. Other applications of the systems of the present invention also include mounted at a hazardous site such as for example, an excavation, road works or similar and which will trigger small versions of the detectors/alarm devices worn or carried by personnel.

Details of the circuitry and components of the present invention will now be described in detail with reference to FIG.2 to 4.

With reference to FIG.2 When an object breaks of linear Infrared beam **16** or **17** which transmitted by the transmitters **18**, the detectors **1** & **2** sent out PNP/NPN or NO signals to photodiode amplifier **3a** & **3b** . Before the signals are amplified by photodiode amplifier **3a** & **3b**, the signals are isolated from main logical circuit to avoid the environment electro-magnetic interrupt noisy to cause fault activate to the system in amplifier.

With reference to FIG.3, When a forklift truck **301** is approaching to hazard zone such as for example sharp turn corner **306**, forklift truck **301** goes to direction as **309** to break the infrared beam **302** of detecting transmitter **304A** firstly, the signal from detecting transmitter **304A** goes through interlock circuit **4** which is shown in FIG.2, continually, the signal activates timer circuit **5** to drive alarm devices.

With reference to FIG.4, When a forklift truck **403** is leaving from the hazard zone such as for example sharp turn corner **406**, forklift truck **403** breaks the infrared beam **405** of interlock transmitter **404B** firstly, the signal from interlock transmitter **404B** activates interlock circuit **4** which is shown in FIG.2, the forklift truck continually go ahead the direction as **402** to break the infrared beam **401** of detecting transmitter **404A**, the signal from detecting transmitter **404A** which is shown in FIG.2 comes to amplifier **3b** and interlock circuit **4**, but interlock circuit **4** was activated by the interlock transmitter signal already, the detecting signal can not go through to timer circuit **5**, so alarm devices can not be triggered. Because the forklift truck leave from hazard zone already, alarm devices do not give alert, pedestrians can walk to or work in the zone area.

With reference to FIG.2, The outputs of detectors **1** & **2** are routed to amplifier **3a** & **3b**, which is connected to one form of a zone controller by cable or other suitable means. More than one infrared transmitters **18** and detectors **1** & **2** may be used in any particular application, and the output of the detectors may be connected in parallel to one zone controller circuit in the case where more than one infrared transmitters is used in one hazard zone such as intersection and long distance aisle, or alternatively one or more transmitters indicated in block form **7** may be used for different hazard zones. For each hazard zone, the zone controller has an individual alarm

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circuit, which may contain a timer 9, which permits the on-time of the alarm once triggered to be pre-set for a period of typically up to 30 seconds and is re-triggerable such that it stays on and refreshes the 30 second timer each time.

The pedestrian alarm configuration may take many forms, include but not limited to that shown in FIG.2 in which an audible alarm 14, a flashing visible hazard beacon 15. Mains electrical power 12 is supplied also to a DC power supply 11 in the zone controller, which in turn provides power for the detectors 1 & 2. the infrared transmitters 18 can get power from the zone controller, also the infrared transmitters 18 can get power from a separate DC power supply. Timer 9 contain a relay or contactor to energize the alarm circuits.

The entire system constitutes a hazard or proximity warning system, which is capable of signalling the proximity of plant or other hazard to pedestrians or workers, thus improving the safety of the pedestrians and/or workers.

Advantages of the present invention include the following: compare with a radio frequency, the infrared signal does not penetrate walls, and hence the detection zone can be more readily defined by the building walls than what would be the case for a radio frequency signal, which might penetrate a wall and falsely trigger detectors in a different zone located in another part of the building. Infrared signal does not create a source of any electro-magnetic noisy to interrupt any equipment, devices and system in the plant. Also the invisible nature of the beam does not create a source of annoyance for people located in the area and forklift drivers as well. The described arrangement has been advanced by explanation and many modifications may be made without departing from the spirit and scope of the invention which includes every novel feature and novel combination of features herein disclosed.

Those skilled in the art will appreciate that the invention described herein is susceptible to variations and modifications other than those specifically described. It is understood that the invention includes all such variations and modifications which fall within the spirit and scope.

Having described the invention in detail and by reference to preferred embodiments thereof, it will be apparent that modifications and variations are possible without departing from the scope of the invention defined in the appended claims. More specifically, although some aspects of the present invention are identified herein as preferred or particularly advantageous, it is contemplated that the present invention is not necessarily limited to these preferred aspects of the invention.

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What is claimed is:

1. Forklift Detection and Alert System with Movement Direction Estimate comprising linear infrared transmitters for transmitting a linear infrared beam, and detectors which working with transmitters together for giving signals in association with die occurrence of an event or an object, the signals being adapted for triggering a zone controller, said transmitter, detector and controller being mounted on building wall. Said detector being tuned to only detect the infrared beam transmitted by transmitter. When the infrared beams are broken by a movable event or object, said detector activating an alarm for providing a warning to a person in the vicinity of the alarm in response to being triggered by the detector signal thereby providing an early and distinct warning to the person in the vicinity of the detector in order to eliminate or reduce the chances of the

person sustaining injury.

2. A system according to claim 1, in which the infrared transmitted signal is a linear infrared beam.
3. A system according to claim 1, in which the event or object is movement of a vehicle through a prearranged zone or a vehicle arriving at a predetermined location.
4. A system according to claim 3, in which the vehicle is a mobile plant or industrial equipment.
5. A system according to claim 4, in which the vehicle is a forklift truck.
6. A system according to claim 1, in which the infrared transmitter is mounted on the building.
7. A system according to claim 1, in which the detector is mounted on the building.
8. A system according to claim 1, in which the transmitter and detector are located remote from the vehicle and detector is triggered in response to detecting the infrared beam broken by movement event or object.
9. A system according to claim 3, in which the alarm system is activated in response to the detector detecting the infrared beam broken by an event or object, when the vehicle is located at or within the predetermined distance between the transmitter and the detector.
10. A system according to claim 1, in which the detector and the alarm are located remote from each other.
11. A system according to claim 3, in which the vehicle can approach the detector from any horizontal direction.
12. A system according to claim 1, in which the transmitter includes a Light Emitting Diodes (LEDs)
13. A system according to claim 12, in which the Light Emitting Diodes are arranged in effect a linear beam of infrared illumination.
14. A system according to claim 1, in which the detector comprises a detection and alarm function.
15. A system according to claim 1, in which the detector is powered by isolated power source in the zone controller.
16. A system according to claim 1, in which the detector is fixed to a substrate at a strategic location.
17. A system according to claim 1, in which the alarm includes an audible alarm, a visible alarm, a digital alarm or other warning device, including combinations thereof.
18. A system according to claim 1, in which the signal transmitted by the transmitter is used to remotely operate an access control device.
19. A system according to claim 18, in which the access control device includes a boom gate, a roller door, a swing door, a sliding door, a barrier, or other moving or operating mechanisms.
20. A method of warning a person of the proximity of an object or event comprising associating the object or event with a transmitter for transmitting a linear infrared signal, the signal triggering a detector when the linear infrared beam broken by an object or event, said transmitter and detector being mounted on building, said detector being tuned to only detect the signal transmitted by the transmitter so that when the object or

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event are located within a predetermined distance and break the infrared beam, the detector activates an alarm in order to provide an early and distinct warning to the person in the vicinity of the object or event in order to alert the person to the presence of the object or event.

- 21.** A method of warning a person of the proximity of an object or event comprising associating the object or event with two transmitter for transmitting two infrared signals parallel, one signal for detecting detector, another signal for interlock detector. When an object or event is approaching to the hazard zone, the detecting detector is triggered first, the detecting detector activates an alarm in order to provide an early and distinct warning to the person in the vicinity of the object or event in order to alert the person to the presence of the object or event. When an object or event is leaving from the hazard zone, the interlock detector is triggered before the detecting detector. Interlock detector activates interlock circuit inside of the zone controller, an alarm will not be activated.
- 22.** Forklift Detection and Alert System with Movement Direction Estimate for alerting a person to the close proximity of a moving vehicle, said system including two transmitters for transmitting two linear infrared signals for a preset time for triggering a detecting detector and a interlock detector, said detectors being tuned to detect the linear infrared signals transmitted by the transmitters only when the linear infrared beams are broken by an object or event, an alarm is activated in response to the detecting detector sensing the linear infrared signal for the preset time so as to provide an early and distinct warning to the person in the vicinity of the vehicle in order to eliminate or reduce the chances of the person sustaining injury.

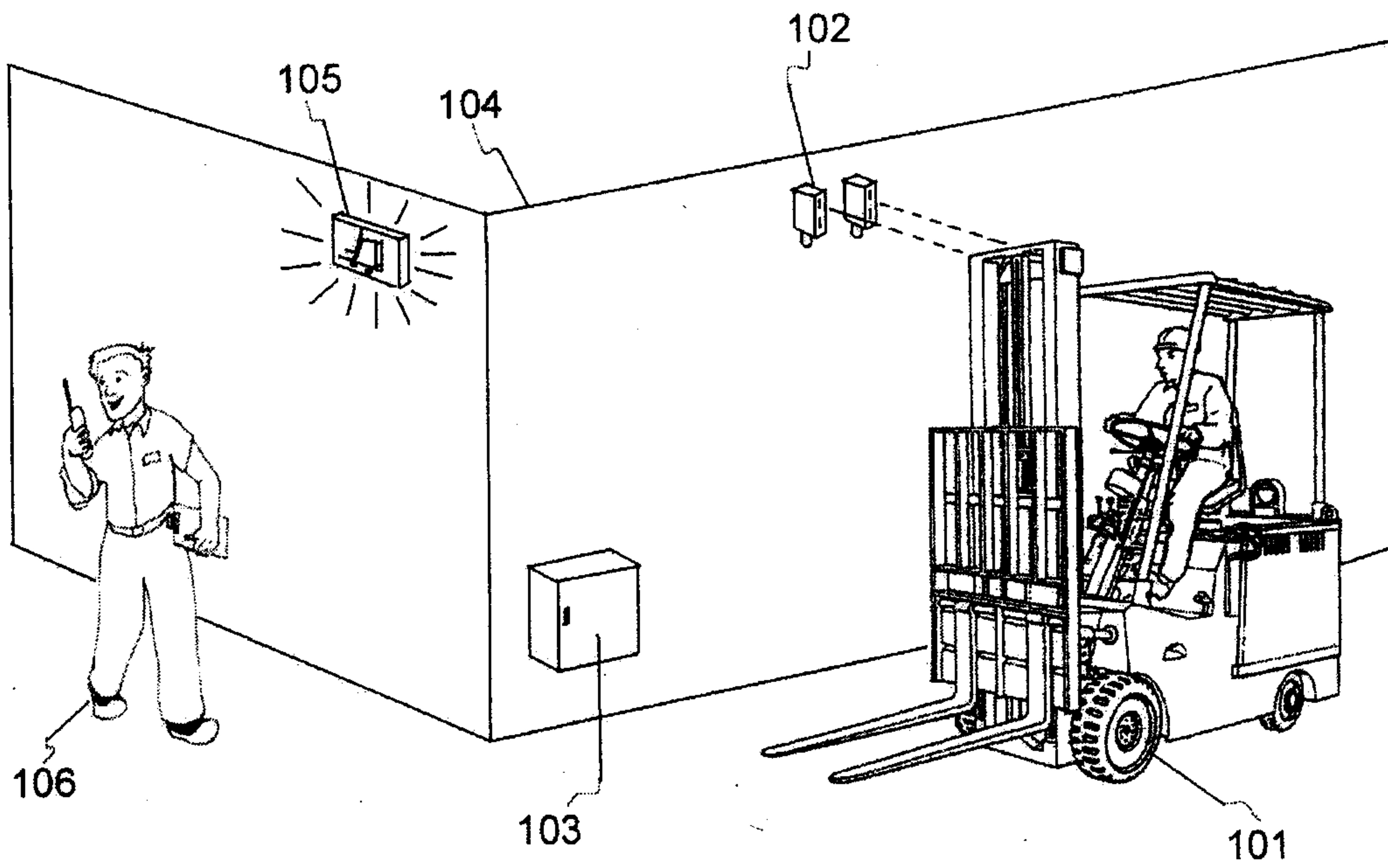


FIG. 1

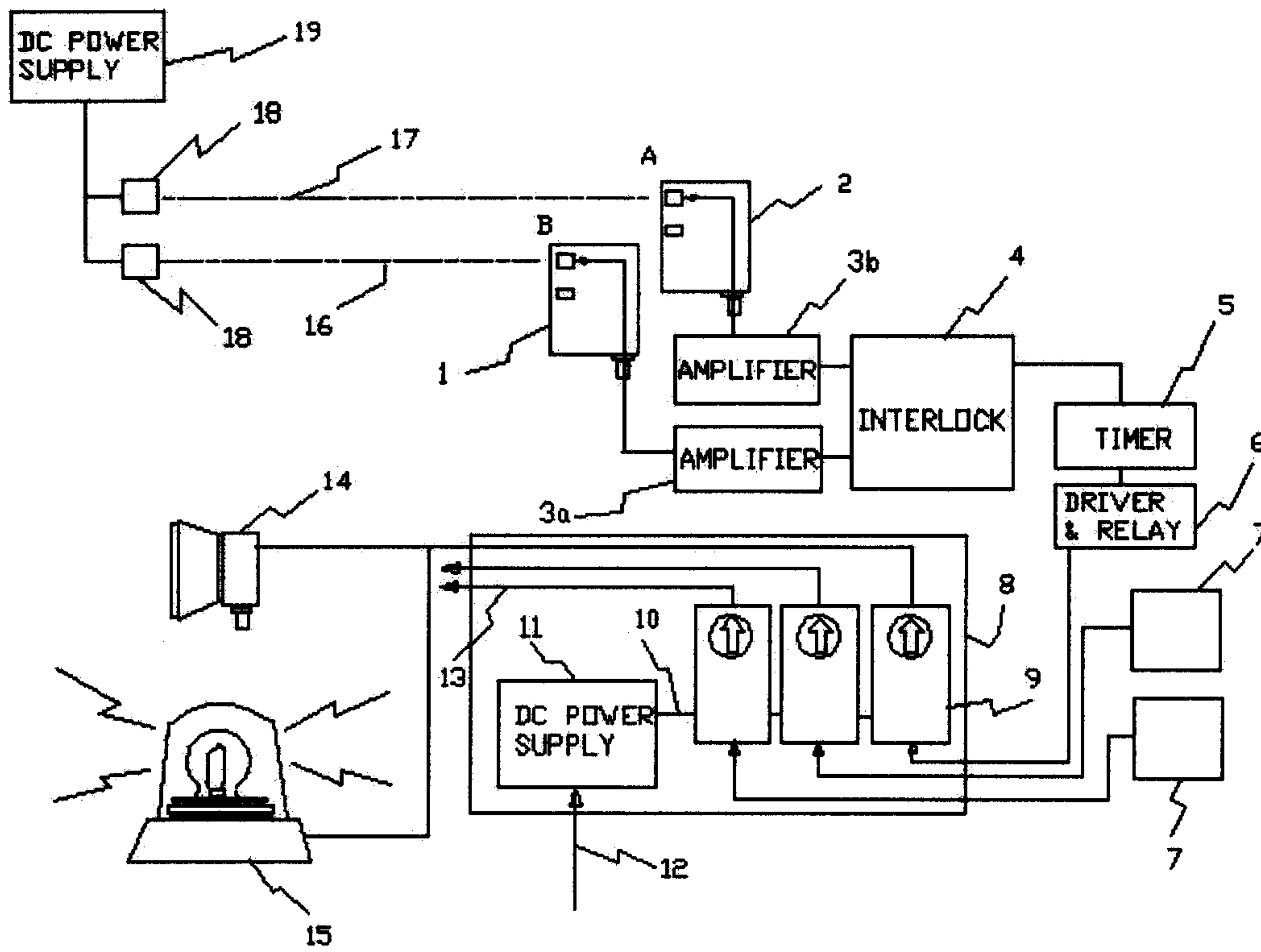


FIG. 2

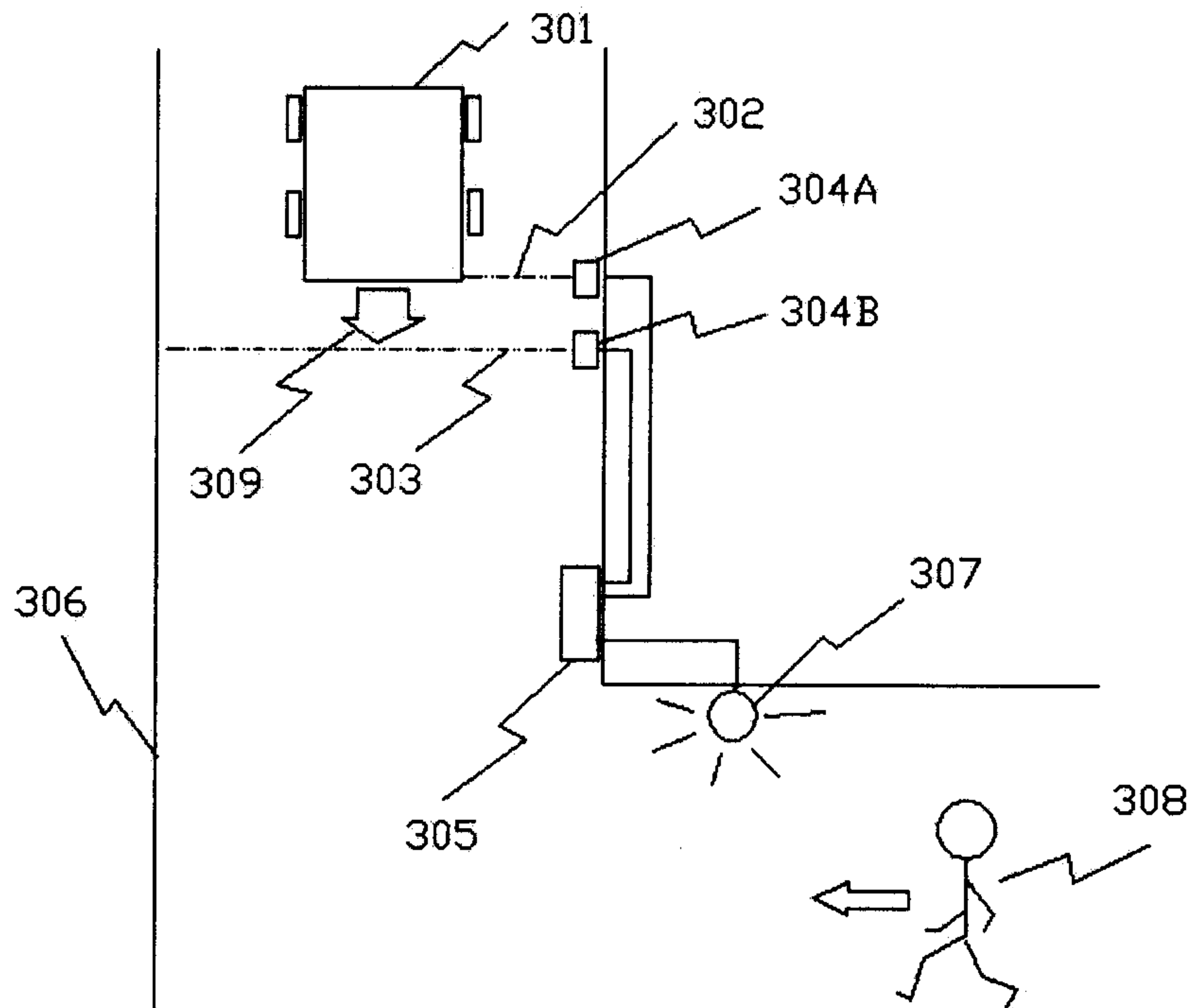


FIG. 3

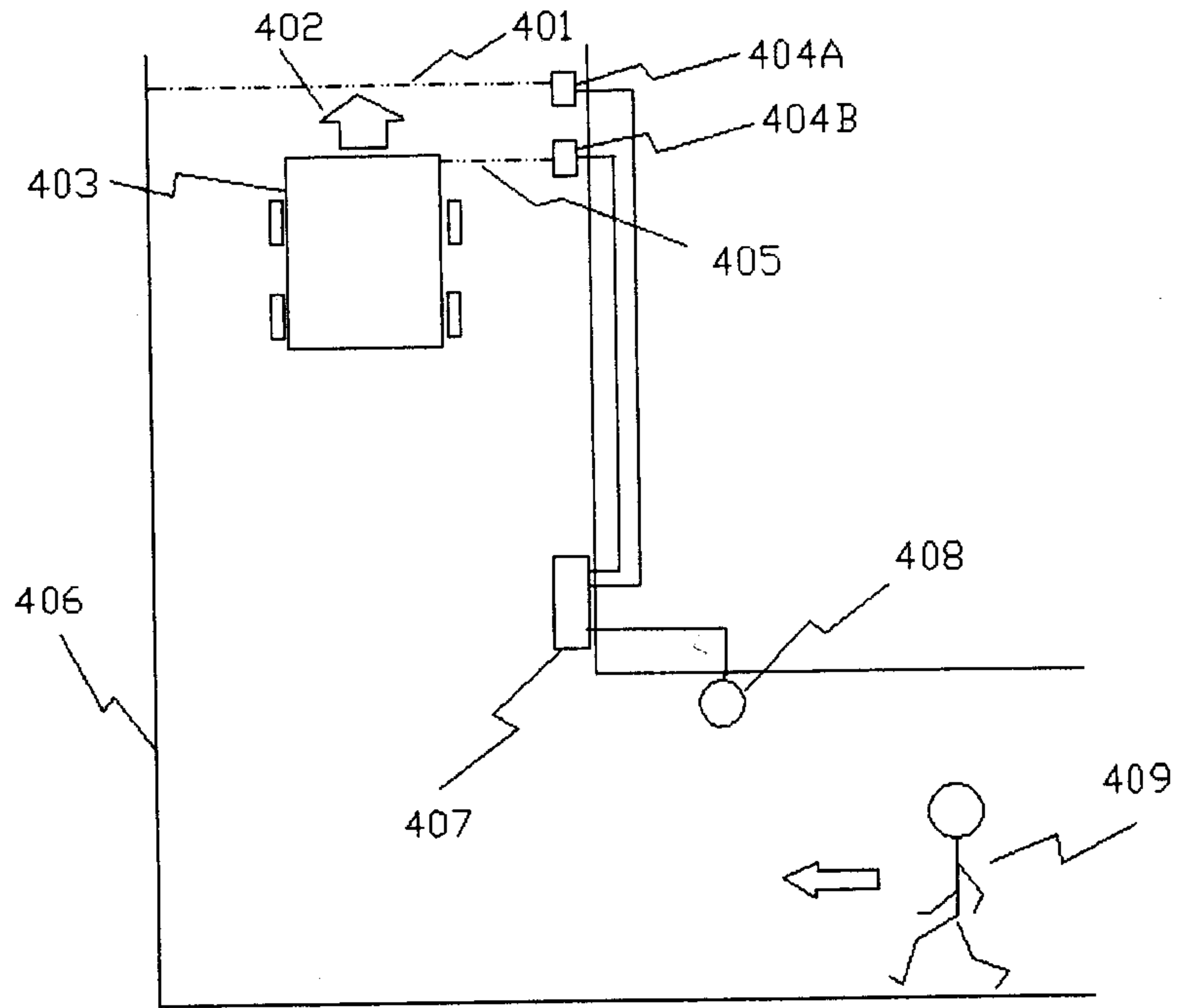


FIG. 4

