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Industria y Comercio
SUPERINTENDENCIA

**DIVISION DE NUEVAS CREACIONES**

RADICACIÓN EXPEDIENTE No 03-90216

EXTRACTO DE LA PRESENTE SOLICITUD DE **MODELO DE UTILIDAD** NUMERO FUE PUBLICADO EN LA GACETA DE PROPIEDAD INDUSTRIAL No **535** DE FECHA **30 DE DICIEMBRE DE 2003** EL TERMINO HABIL SEÑALADO POR LA LEY EXPIRA EL **12 DE FEBRERO DE 2004.**

NOTA: Dentro del plazo de los tres (3) meses siguientes a partir de la fecha de publicación en la gaceta de Propiedad Industrial, deberá solicitar y cancelar el examen de patentabilidad so pena de que la solicitud caiga en abandono, de acuerdo con lo establecido en el Artículo 44 y en concordancia con el artículo 85 de la Decisión 486/2000.

SE PRESENTARON OPOSICIONES POR PARTE DE TERCEROS.

SI ____________ NO ____X____

62

US005736925A

# United States Patent [19]

Knauff et al.

[11] Patent Number: 5,736,925

[45] Date of Patent: Apr. 7, 1998

[54] VEHICLE WARNING SYSTEM CONTROLLER

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[73] Assignee: Weldon Technologies, Inc., Hilliard, Ohio

[21] Appl. No.: 666,120

[22] Filed: Jun. 21, 1996

[51] Int. Cl.$^6$ ........ B60Q 1/26

[52] U.S. Cl. ........ 340/468; 340/463; 340/472; 362/80

[58] Field of Search ........ 340/468, 469, 340/471, 463, 464, 815.45, 815.65, 472, 473, 479; 362/61, 32, 80

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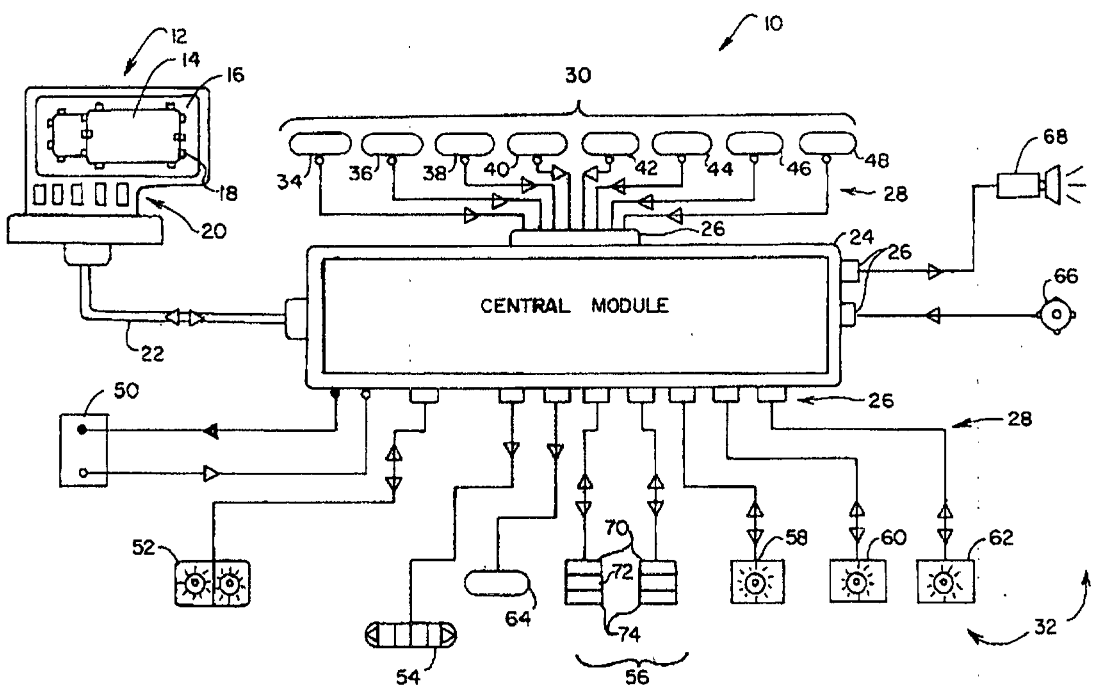
[57] ABSTRACT

A vehicle warning system controller is disclosed which controls and synchronizes all annunciators installed on a vehicle. The vehicle light control system takes a modular approach to vehicle light control. The first module is an operator module that accepts control commands from an operator and provides visual feedback to the operator. The second module is a central module which processes the commands and controls the attached annunciators and accessories. The vehicle light control system of the present invention has the ability to interface with and control several types of annunciators.

13 Claims, 14 Drawing Sheets



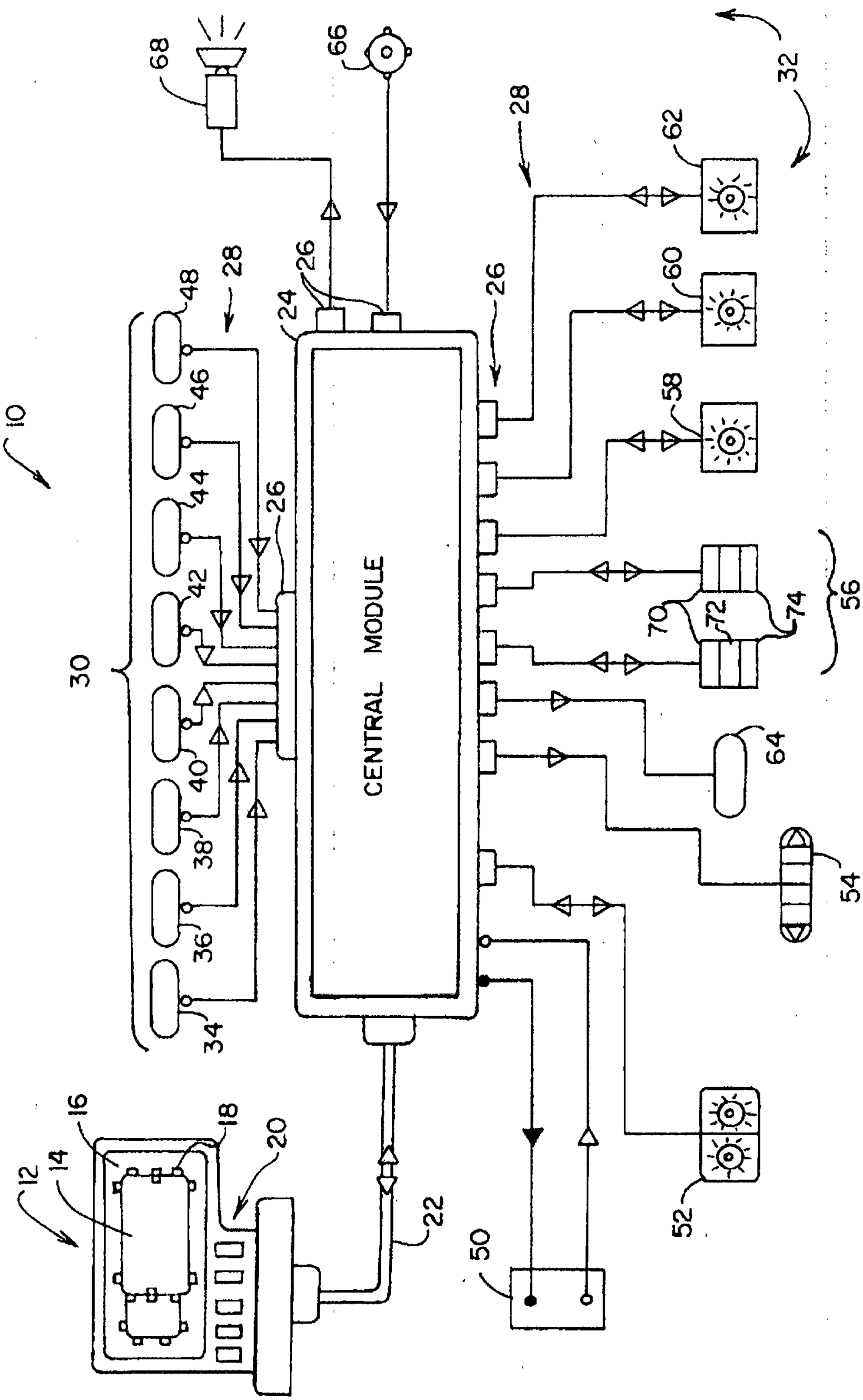



FIG. 1

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## VEHICLE WARNING SYSTEM CONTROLLER

### BACKGROUND

The present invention is directed generally to a vehicle warning system controller and more particularly to an emergency vehicle warning light control system. Light systems may be utilized on many different types of vehicles such as police cars, fire trucks, ambulances, tow trucks, utility trucks, maintenance trucks, as well as other vehicles such as aircraft which may benefit from a warning light system. Lighting systems may include lightheads mounted on the exterior of any vehicle such as light bars, as well as headlights and tail lights.

One function of an emergency vehicle is to traverse a distance in the shortest time and safest manner possible. To assist in achieving the goal of shortest time, emergency vehicles may be permitted to ignore the standard traffic controls which apply to other vehicles. Emergency vehicles commonly ignore traffic lights and speed limits. In addition to ignoring traffic controls while in motion, emergency vehicles are often required to stop and provide service in heavily trafficked areas. As a result, other drivers can be startled by the presence of such an emergency vehicle disrupting the normal traffic flow pattern. These situations can place both the startled driver and the emergency vehicle personnel, as well as others, in danger as they attempt to react to each other. To minimize the risk of surprise, emergency vehicles generally utilize a combination of sirens and lights to catch the attention of other drivers. Such systems are designed to permit others to perceive the emergency vehicle early enough to allow an appropriate reaction to the emergency vehicle, thus avoiding potentially dangerous situations. The more conspicuous the warning system on the vehicle, the more likely drivers of other vehicles will be able to respond in a timely manner to the emergency vehicle's presence.

Emergency vehicle warning systems generally utilize both halogen, or incandescent, lamps in combination with xenon-type strobe lamps, as well as audio annunciators to gain the attention of the drivers of other vehicles. An incandescent lamp may be on constantly or may be flashed to gain attention. Incandescent lamps have the advantage of being easily perceived and tracked by an observer. However, incandescent lamps have the disadvantage of having a low degree of conspicuity, that is, the ability of commanding an observer's attention peripherally or from a distance. Flashing incandescent lamps are commonly utilized because they are already present on the vehicle, being used as turn and brake signals, traffic control signals and other warning signals. As a result, an emergency vehicle's flashing incandescent lamps may blend into a background of other flashing lights and be indistinguishable to an observer.

By contrast, xenon-type strobes possess a high degree of conspicuity. Their high intensity light is very conspicuous against most backgrounds and is easily detected, even when outside a direct line of sight of the observer. However, because strobe pulses are visually difficult to locate and track, a pulsing strobe light may appear to be moving toward an observer when, in fact, it is stationary or moving away from the observer. Thus strobe lights, if used alone as an emergency warning system, can introduce an undesirable visual ambiguity in an emergency situation.

When incandescent and strobe lamps are used in combination, the benefits of each can compensate for the disadvantages of the other. The strobes may be pulsed to



command attention, thus prompting an observer to seek out the source of the light. Alternately, the incandescent may be flashed between strobe pulses to indicate the light source to the observer. The alternating combination of the two sources of light results in a greater overall level of conspicuity, thus producing a more effective emergency vehicle warning system.

Heretofore, emergency vehicle warning light systems have utilized separate control systems for each of the incandescent and strobe lamp systems. The flashing of the incandescent lamps and the pulsing of the strobe lamps were not synchronized with each other. Therefore, while incandescent and strobe lamps have been utilized together on vehicles, their operation has not been synchronized to fully utilize the visual advantages of the combining the two lamp types.

In order to operate strobe lamps, constant voltages of hundreds of volts and triggering voltages of several thousand volts may be required. Such high voltage lines generate large amounts of radio-frequency interference (RFI) which can adversely affect a vehicle's electrical system. A high degree of shielding insulation and electronic filtering is generally required to minimize such RFI. There is a need for a system which effectively minimizes RFI and thus eliminate or otherwise minimize the need for such shielding and filtering.

Emergency vehicle warning light systems have been designed to command different levels of attention for varying conditions. For example, an ambulance speeding enroute to an emergency site will generally require a high level of attention. The same ambulance will require even higher levels of attention for particularly dangerous areas through which it may pass, such as through an intersection where crossing traffic may encounter the emergency vehicle quite suddenly. Once an emergency vehicle arrives at the scene a lower degree of conspicuity is generally desired as a stationary, or otherwise idle, emergency vehicle does not pose as great a danger as a moving one. Additionally, a high attention level of lighting and audio annunciators may be distracting to emergency personnel operating at the scene and third party observers. To avoid these problems a warning mode employing a lower level of conspicuity may be used which does not disturb and distract the personnel on the scene but still observers to locate and avoid the emergency situs. As an example, under low light environmental conditions, such as at night, emergency personnel operating around an ambulance can be adversely affected by the intensity of the vehicle's warning lights. Proximate exposure to high intensity strobe lights may cause disorientation and loss of low light vision adaptation.

In addition to the human factors, power requirements for emergency lighting systems are substantial, especially when operating all lights at full power. It is desirable that the warning systems on emergency vehicles be effectively operable at lower levels which would, in turn, lower the vehicle's load demand.

One example of a vehicle light system typically is found on an ambulance and is characterized as having three banks of lights attached at various locations on its exterior. A first bank of ten lightheads are positioned high at the corners and at the center front and rear of the vehicle, and are commonly referred to as the "A" lights. A second bank consists of one, centered, rearward-facing lighthead, and is referred to as the "B" light. A third bank of five lightheads are mounted low on the forward end of the vehicle with two facing forward on the grill, two facing sideways and one mounted high in the center front of the vehicle. This bank is commonly referred to as the "C" lights.

Heretofore, ambulance warning light systems have only three modes of operation: "primary"; "secondary"; and "off". The primary mode of operation generally consists of a flashing pattern of "A" lights alternating with the "B" and "C" lights. The primary mode is used when a high degree of attention must be commanded, such as when trying to clear traffic. The secondary mode generally consists of a flashing pattern of"A" lights alternating with the "B" light. The secondary mode is used when a lower degree of conspicuity is desired such as when the emergency vehicle is at the emergency situs. A vehicle light control system that provides wider variety of control over the operation of the vehicle lightheads and other annunciating components is needed.

Under some environmental conditions, flashing incandescent lamps and pulsing strobe lamps of an emergency vehicle may effect the ability of the driver to safely operate the vehicle. Under conditions of precipitation, such as rain, fog, or snow, driver visibility may be limited by the vehicle's emergency lights being reflected by the precipitation back into driver's eyes. The high intensity of strobes pose an extra hazard as the reflected light during a short strobe pulse may cause the driver to experience a brief, but repeating, "white out" effect, thus causing the driver to momentarily lose the ability to see through the precipitation. When confronted with such an undesirable condition, a driver may wish to avoid the use of the strobe lamps altogether. However, under such adverse environmental conditions it becomes even more important to alert observers of the presence and intent of the emergency vehicle. There is consequently a need for a vehicle light control system which permits the operator to choose an intermediate intensity level or lower "skip pulse" pattern of lighthead operation as an acceptable operating compromise between the conflicting visual reactions of the driver and those of the third-party observers.

Previous vehicle light control systems are difficult to maintain and to troubleshoot. Heretofore, diagnosis of operational problems of previous light control systems typically involve operating the lightheads while simultaneously observing the exterior of the vehicle on which the lightheads are installed. Unfortunately, from the exterior of the vehicle it is most difficult, if not impossible, to observe the synchronization of all lightheads since all lightheads are not visible from a single vantage point. Consequently, them is a need for a diagnostic and monitoring system for a vehicle light control system.

Installation of previous vehicle light control systems often require the installer to determine and to distinguish the polarity of the various inputs to the vehicle light control system. In the past, if the installer mistakenly reversed the polarity of the connection several systems may have been damaged. The difficulties involved in the diagnosis of vehicle light control system problems explained above have only exasperated this situation. A vehicle light control system having input autopolarity correction is needed to prevent damage during installation.

## BRIEF DISCLOSURE OF THE INVENTION

The present invention satisfies the objectives and solves the problems of previous vehicle light control systems with a modular approach. The first module is an operator module which provides an emergency vehicle operator with control over the system while simultaneously enabling the operator to monitor the operation of the entire vehicle light control system. The second module is the central processing module



which processes the commands, controls the operation of the attached lightheads, other annunciators, and accessories while generating feedback for operational monitoring purposes. The third module comprises the lightheads, annunciators and attached accessories under the control of the central module.

The present invention permits synchronization of the operation of both the incandescent and strobe lamps either separately or together. The control and synchronization of both the incandescent and strobe lamps by a single controller provides greater flexibility for programming patterns into the light system. For example, the present invention may be programmed to flash the incandescent lamps in a pattern that alternates with strobe pulses. The high intensity light of the strobe lamps would not wash out the light of the incandescent lamps when alternating in this manner. With such an alternating pattern, an observer would visually connect the two light sources together thus enhancing the overall conspicuity of the system.

The present invention also reduces the RFI associated with high voltage transmission through a vehicle's electrical wiring system. The present invention avoids the transmission of high voltages through the entire length of a vehicle's wiring harness by locating strobe light power supplies proximate to each strobe lighthead. Thus, while the central module of the present invention provides triggering signals for the strobe light it does not produce the high voltages which are required to operate the strobe lamps. Rather, the power supply located at the lighthead produces these high voltages to power the strobe lights. In an alternate embodiment, a conventional strobe power supply is separate from the lighthead but still accepts trigger signals from the central module of the present invention. Therefore, by locating the high voltage power supply proximate to the strobe lamp, the present invention eliminates the need for lengthy high voltage lines and avoids the problems inherent with such lines. Additionally, the present invention utilizes optical isolators which are effective in reducing cross-talk or high voltage feedback and RFI.

The present invention increases the effectiveness and conspicuity of an ambulance warning light system by synchronizing all of the incandescent and strobe lamps. In addition, the present invention provides for many other modes of operation which have not been available with previous systems. For example, the present invention provides a third, "skip pulse" mode which operates at lower power levels. Rather than flashing the incandescent lamps only once between two strobe pulses, as is disclosed in the art, this additional mode alternates flashing "A" lights with "B" lights with two incandescent flashes alternating with two strobe pulses.

The present invention permits users to select the types of lights and other annunciating devices, such as horn, sirens and other audio warning systems, that can operate within various patterns. The present invention permits a user to specify the use of incandescent lamps only, strobes only, both incandescent lamps and strobes, or other combinations which may additionally include other annunciating devices. Thereby providing the ability to find a compromise between conflicting goals.

The present invention enables a vehicle to more readily accept a combination of lighthead types. The central module of the present invention permits the use of a wide variety of lightheads, such as incandescent only, strobe only, and combination incandescent and strobe lightheads. For instance, a strobe/incandescent combination lighthead may be located at the front of the vehicle to clear a right of way; strobe lamps may be mounted on the rear of the vehicle for warning of a stopped condition; and incandescent lamps may be located on the sides of the emergency vehicle where higher attention commanding levels are not necessary. Such a system saves energy over a conventional system or a system in which strobe/incandescent lamps are operated on all sides of a vehicle. Additionally, the present invention permits the use of a greater number of patterns which can be programmed to consume lower levels of power and thus lower the power drain on the vehicle's electrical system.

The present invention provides convenient, real-time diagnosis of warning system problems by constantly monitoring each lighthead or other annunciator on the vehicle and then signaling corresponding lights on a graphical representation of the vehicle. The status lights, which may consist of LED's or other visual means, provides a means for monitoring of all of the lighting sequence patterns utilized by the emergency vehicle. Observation of the status light while the vehicle warning system is operating provides an instant indication of the activity of each lighthead or other annunciator relative to the others. Should an annunicator malfunction, its corresponding LED will not light when expected, thus indicating an error condition. Additionally, the activity of an LED of a malfunctioning lighthead will indicate exactly what the lighthead is doing.

The present invention also simplifies installation of a vehicle light control system by providing complete auto-polarity correction for existing vehicle sensors and inputs. The present invention avoids requiring an installer to determine the polarity of inputs prior to connecting them to the light system since it is designed to operate regardless of the polarity of the inputs to the system. Consequently, the installation time is greatly decreased and the risk of damaging the system is greatly reduced.

These and other advantages of the present invention will become obvious to one of skill in the art after a review of the following detailed description.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 depicts an overall system lock diagram depicting various modular components of the present invention;

FIG. 2 depicts a graphic representation of one embodiment of an operator diagnostic module of the present invention;

FIG. 3 depicts an annunciator sequencing and diagnostic chart of one embodiment of the present invention;

FIG. 4 depicts a front elevational view of one embodiment of a face panel of the central module of the present invention;

FIG. 5 depicts a plan view of the central module of FIG. 4;

FIGS. 6A–6H depict, in combination, an electrical schematic of one embodiment of the central module and operator module of the present invention;

FIG. 7 depicts an electrical schematic of one embodiment of a power supply circuit for an enhanced lighthead of the present invention; and

FIG. 8 depicts an electrical schematic of one embodiment of a monitor and feedback circuit of the present invention.

In describing the preferred embodiment of the invention which is illustrated in the drawings, specific terminology will be resorted to for the sake of clarity. However, it is not intended that the invention be limited to the specific terms so selected and it is to be understood that each specific term includes all technical equivalents which operated in a similar manner to accomplish a similar purpose. For example, the word "connected" or the phrase "in communication with" or terms similar thereto are often used. Such terms are not limited to direct connection but include connection through other circuit elements where such connection is recognized by one skilled in the art. In addition, circuits are illustrated which are of a type which perform well-known operations on electronic signals. Those skilled in the art will recognize that there are many, and in the future may be additional, alternative circuits which are recognized as equivalent because they provide the same operations on the signals.

## DETAILED DESCRIPTION OF THE PRESENT INVENTION

It is to be understood that while the following description describes an ambulance warning light system that the present invention may be utilized anywhere that an annunicator control system, which may include lights and audio devices, may be employed.

Referring to FIG. 1, an overall system block diagram generally showing the modular nature of the present invention is shown at **10**. The operator module **12** of the present invention is shown having an overhead vehicle view **14** on its face **16** and lamp monitor LED's located at corresponding locations on the vehicle, as at **18**. Additionally, the operator module **12** may be provided with numerous selection switches **20** to permit operator selection between various modes of display operation. The operator module **12** communicates with the central module **24** through cable **22**.

The central module **24** communicates through connectors and cables, shown generally as **26** and **28**, respectively, with vehicle sensor/switch inputs shown generally at **30** and supported lightheads and accessories, shown generally as **32**. Central module **24** includes the processing means (described later) which controls, synchronizes and monitors attached lightheads and accessories **32**.

The vehicle sensor/switch inputs **30** shown in FIG. 1 include a reverse switch **34**, a brake sensor **36**, turn signal switch **38**, hazard light switch **40**, door open sensor **42**, horn switch **44**, parking brake sensor **46** and an accessory control input **48**. Typically, the vehicle sensor/switch inputs **30** will already be installed on a vehicle and will only require connection to the central module **24** via connectors **26**. It is to be appreciated that any number of different types of connectors **26** may be utilized and still remain within the scope of the claimed invention.

A power source **50**, such as a 12 Vdc automotive battery, is connected to central module to provide power for operating the present invention.

Supported lightheads and accessory outputs **32** includes a dual lighthead **52**, a directional light bar **54**, rear tri-cluster lightheads **56**, an "A" lighthead **58**, a "B" lighthead **60**, a "C" lighthead **62**, a provisional accessory **64**, an ambient light sensor **66** and a horn **68**. The rear tri-cluster lightheads **56** is typically configured to include brake/running lamps **70**, turn/hazard signal lamps **72** and backup lamps **74**.

Referring now to FIG. 2, the overhead vehicle diagram **14** of FIG. 1 is shown in greater detail. In this particular embodiment, an overhead view of an ambulance with an arrangement of LEDs corresponding to the placement of annuniciators on vehicle **18** is shown. The LED pattern **18** represents the actual placement of lightheads **58**, **60**, **62** mounted upon the ambulance in which the present invention is installed. Each lighthead has its own corresponding LED in the pattern **18**. Operation of the "A" lightheads **58**, "B"

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(12) UK Patent Application (19) GB (11) 2 186 131 (13) A

(43) Application published 5 Aug 1987

(21) Application No 8701924

(22) Date of filing 28 Jan 1987

(30) Priority data
(31) 8602166 (32) 29 Jan 1986 (33) GB
8604272 20 Feb 1986

(51) INT CL⁴
B60Q 1/44 // 1/30 1/34 1/46

(52) Domestic classification (Edition I):
H2H 31 32 SV2 SV4

(56) Documents cited
GB A 2130030 GB 1417124 GB 1239523
GB A 2064238 GB 1386457 US 4097839
GB 1421262 GB 1297856

(58) Field of search
H2H
Selected US specifications from IPC sub-class B60Q

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## (54) Vehicle braking indicator-lamp controller responsive to hazardous conditions

(57) A controller monitors (on inputs WS or RFLS) if either the windscreen wipers or rear fog lights of a vehicle are energised (indicative of hazardous visibility driving conditions) and further monitors (on input BLS) for application of the footbrake whilst either the wipers or rear fog lights are energised, to actuate rear lights of the vehicle over output RFL. This provides a distinctive warning indication at the rear of the vehicle and during poor visibility conditions that the vehicle is braking. The output RFL may cause the rear fog lights to be pulsed. If the brakes remain energised for longer than a period set by a relay generator 4, the pulsing ceases. The controller may also monitor (on input RTIS) operation of the right-turn indicator switch (for a RHD vehicle) so that if the brakes remain energised for longer than the delay of generator 4 whilst that turn switch is operated, the rear fog lights are pulsed. A rear light or lights other than the fog lights may be actuated by the controller and may be turned on continuously, or pulsed, in the above situations. The controller may be implemented in micro-processor form, (Fig. 2).

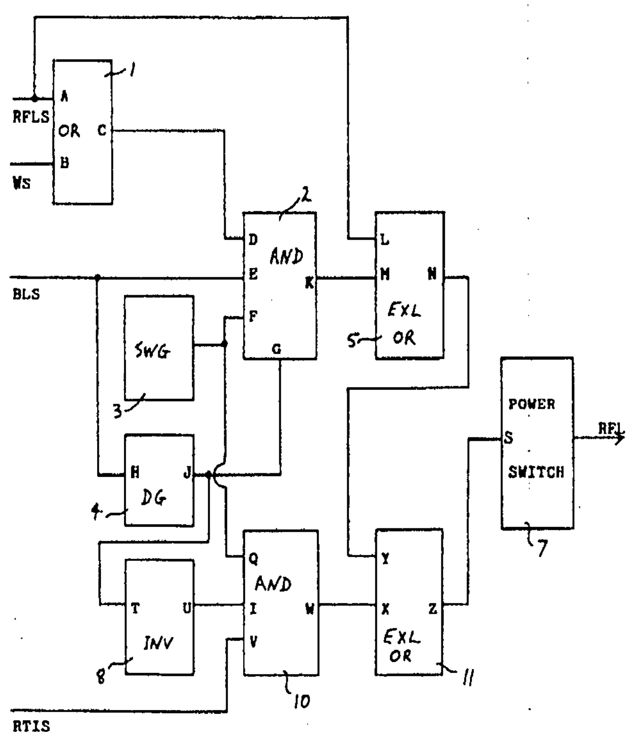


FIGURE 1

The drawing(s) originally filed was/were informal and the print here reproduced is taken from a later filed formal copy.

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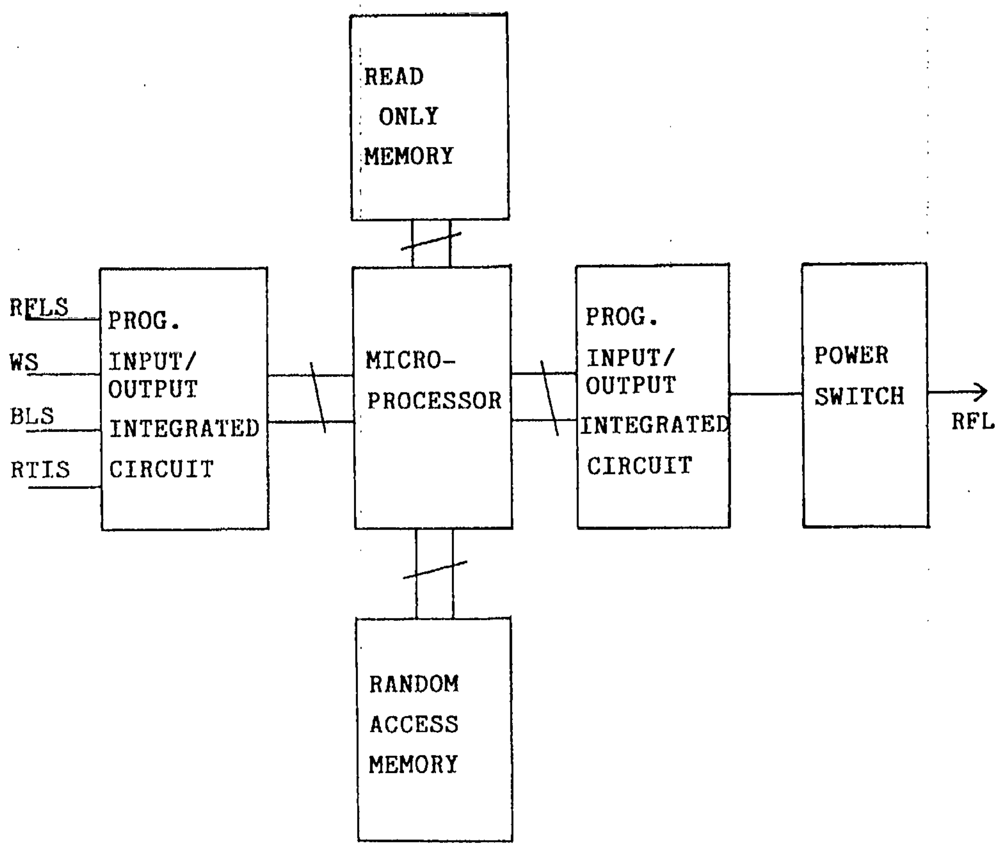
READ ONLY MEMORY
RFLS
WS
BLS
RTIS
PROG. INPUT/ OUTPUT INTEGRATED CIRCUIT
MICRO- PROCESSOR
PROG. INPUT/ OUTPUT INTEGRATED CIRCUIT
POWER SWITCH
RFL
RANDOM ACCESS MEMORY

FIGURE 2

SPECIFICATION

**Automatic high intensity braking indicator-lamp controller for vehicles**

This invention relates to a controller for supplementary braking indicator lamps on vehicles, operating automatically to cause these lamps to provide a high intensity indication in the event of braking, so as to provide a sure warning to the driver of any following vehicle and thereby enhance safety on the road.

The "rear end" type of impact is all too common on the road, particularly on motorways and other fast roads and particularly in hazardous driving conditions e.g. fog, spray and darkness. Often for example the driver is confronted with an indistinct and bewildering panorama of rear lights, rear fog lights, indicators, hazard warning lights and oncoming headlights. Against this general background, it frequently occurs that the driver fails to notice or react quickly to conventional brake lights being illuminated on the vehicle or vehicles in front. This, can all too easily result in a serious "rear end" impact, the extended reaction time plus the braking time determining a stopping distance which is greater than the distance to the vehicle in front. In effect, the extended reaction time is due to a form of information overload on the driver, namely the quantity, clarity and varying form of lights confronting the driver seriously delay him reacting to the normal brake lights illuminating on the vehicle ahead. The "rear end" type of impact is particularly common on motorways for example, in high traffic density, high speed, hazardous visibility (e.g. due to spray, fog and driving rain) and contra-flow conditions.

In accordance with this invention there is provided a controller for one or more rear lights of a vehicle, which controller monitors if either the vehicle windscreen wipers or the rear fog lights are energised, and further monitors for application of the footbrake, whilst either the wipers or rear fog lights are energised, to actuate said one or more rear lights so as to provide a warning indication.

Hazardous visibility conditions e.g. wet or fog, will cause the driver to switch on the windscreen wipers and/or the rear fog lights. Then, when he brakes, the controller automatically actuates said one or more rear lights.

The controller may actuate the vehicle's rear fog lights, which are now a statutory requirement on modern vehicles, by pulsing them on and off. Instead, some other light or lights may be provided to the rear of the vehicle and either pulsed or energised continuously. The controller may form a unit readily and simply fitted to existing road vehicles, or to vehicles at manufacture.

Typically the controller may pulse said one or more rear lights on and off at approximately 120 (and in general 90–150) flashes per minute. Preferably the controller is arranged so that, should the brakes be held on for an extended period of time (say 10–15 seconds), the flashing or other actuation will cease and the lights restored to their previous condition. This will prevent annoyance to the driver of the following vehicle, particularly in a stationary queue of traffic. However, the controller will cause the flashing or other actuation to commence again if the brakes are released and then reapplied.

Preferably also the controller is arranged to monitor the operation of the right-turn indicator (or left-turn indicator in the case of left hand drive vehicles): if the brakes have been applied for an extended period of time (say 10–15 seconds) whilst the right turn indicator is operating, then the controller automatically actuates said one or more rear lights (whether or not the wipers or rear fog lights are otherwise energised). This provides a distinctive warning of a stationary vehicle waiting in the middle of the road to rurn right.

Embodiments of this invention will now be described by way of examples only and with reference to the accompanying drawing, in which:

*Figure 1* is a block diagram of a controller in accordance with the invention; and

*Figure 2* is a block diagram of a corresponding microprocessor implementation of the controller.

In the example of controller unit shown in Fig. 1, signals RFLS and WS from a rear fog light switch and the wipers switch, respectively, are applied to inputs A, B of an OR gate 1. A signal BLS from the brake light switch is applied to an input E of an AND gate 2. Operation of the wiper switch applies a high to input B of OR gate 1, in turn providing a high at its output C and this is applied to an input D of AND gate 2. If then the brakes are applied, a high is applied to input E of AND gate 2 and to input H of a delay generator 4. Input G of AND gate 2 is normally high (being the untriggered state of output J of delay generator 4). Input F of AND gate 2 alternates between high and low logic levels at a rate determined by a square wave generator 3-typically 0.25 sec ON/0.25 sec OFF.

Thus, under the above circumstances of the brakes being applied whilst the wipers are on, inputs D, E, F and G of AND gate 2 combine together to produce an alternating high/low logic output (at K). This pulsing output is applied to input M of an exclusive OR gate 5 and transmitted from output N of this gate, through an exclusive OR gate 11 and to input S of a power switch 7: this power switch feeds power to the rear fog lamps over line RFL and thus these rear fog lamps produce a