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PROGRESSIVE BRAKING SYSTEM

BACKGROUND TO THE INVENTION

THIS invention relates to a progressive braking system.

The use of a so-called third brake light in motor vehicles has become popular in recent times. The third brake light is typically positioned so as to be more visible to a driver of a following vehicle. However, the use of this third brake light does not alleviate a problem associated with braking in general and that is the problem of a following driver not being able to determine whether the vehicle in front is being braked lightly or being braked under emergency conditions.

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SUMMARY OF THE INVENTION

According to the invention a progressive braking system for a vehicle comprises:

sensor means arranged to sense the degree of application or release of the brakes of the vehicle; and

a brake light display arrangement comprising a plurality of individual lights or light units arranged to be illuminated or extinguished in sequence or progressively, in response to the degree of application or release of the brakes, respectively.

The system preferably comprises control means for receiving a signal from the sensor means and controlling the sequence of illumination or extinguishment of the lights or light units.

The sensor means is preferably an optical sensor arranged to sense the movement or displacement of the brake pedal as it is depressed or released.

The sensor typically comprises two pairs of opposed infrared emitters and receivers arranged respectively to sense the movement of a slotted or apertured wheel or bar passing through the respective infrared beams when the brake pedal is depressed or released.

The brake light display arrangement preferably comprises a single row of

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lights arranged to light up progressively from each end towards the middle, the greater the application of the brakes the greater the number of lights that is illuminated.

The lights are preferably light emitting diodes (LEDs).

The control means typically comprises a control module or unit comprising a microcontroller and ancillary circuitry arranged to control the logical functions of the system.

The system is preferably linked to an existing brake switch, the system being activated only once the brake switch has been triggered.

The brake light display arrangement is preferably configured to illuminate and extinguish in rapid succession when the brakes are applied fully in an emergency braking situation.

In a preferred version of the invention in which the system is suitable for the aftermarket or retrofit market, the system preferably includes setting means for setting the system in relation to the respective distance the brake pedal for a particular vehicle is arranged to travel.

An embodiment of the invention is described in detail in the following passages of the specification which refer to the accompanying drawings. The drawings, however, are merely illustrative of how the invention might be put into effect, so that the specific form and arrangement of the features shown is not to be understood as limiting on the invention.

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BRIEF DESCRIPTION OF THE ACCOMPANYING DRAWINGS

The invention will now be described in more detail, by way of example only, with reference to the accompanying drawings in which:

Figure 1 is a schematic block diagram of a progressive braking system according to the invention; and

Figure 2 is a software flow chart for the progressive braking system of Figure 1.

DETAILED DESCRIPTION OF INVENTION

The crux of the invention lies in providing a light arrangement which is arranged to illuminate or extinguish in a pre-determined sequence in response to the degree of application of the brakes of a vehicle.

Referring to Figure 1, the essential components of the progressive braking system of the invention consist of a brake sensor, control module and bar display or brake light display which is arranged to work in conjunction with an existing brake light switch of the vehicle.

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Various sensor options such as optical sensors, potentiometer or resistance sensors, speed transducers and accelerometers, strain gauges and linear displacement sensors, for example, can be used. The preferred sensor, however, is an optical sensor of the type commonly used in a PC mouse to control the cursor on a computer screen.

The optical sensor in question consists of two pairs of opposed infrared emitters and receivers arranged to emit and receive respective infrared beams through which a slotted wheel rotates. The slotted wheel is fixed to a spring-loaded hub onto which a cable is attached. In use, the sensor is mounted to a fixed point on the vehicle and the free end of the cable attached to the brake pedal, or vice versa. As the pedal is depressed the cable is wound around the spring-loaded hub causing the hub (and thereby the slotted wheel) to rotate. As the slotted wheel rotates through the respective infrared beams, the number of pulses is recorded which is translated to linear displacement to sense the travel distance of the pedal. The infrared emitters and receivers are arranged in such a way as to provide an approximately 90-degrees offset to enable direction to be determined as well as distance.

The progressive braking system is linked to the existing brake light switch which is a piece of original equipment that is fitted to standard types of motor vehicles. The switch is used to activate the rear brake lights of a motor vehicle when the brake pedal is depressed. Only once the existing brake light switch has been triggered will the system become active.

The control module which provides the heart of the system consists of a microcontroller and ancillary circuitry which is arranged to perform all of the

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logical functions of the system. Thus, the control module will receive a signal from the brake sensor when the brake pedal is either depressed or released and control the illumination of the bar display or progressive lights in accordance with the signal received.

The brake light display arrangement consists of a single row of LEDs (light emitting diodes) which, in use, are fitted to the rear of the vehicle to display the progressive stages of braking.

The brake light display is arranged such that the LEDs are illuminated progressively from the outer ends towards the middle thereof in response to the amount of pressure applied to the brake pedal. Thus, if the brake pedal is only lightly touched, only a few of the outer LEDs will light up. On the other hand, if the brake pedal is depressed fully, such as in an emergency braking situation, all of the lights will light up in sequence from the outside towards the middle.

Although it is not essential that the LEDs illuminate from the ends towards the middle, this is preferred from a practical point of view as the length of the third brake light is immediately discernible when the brake pedal is depressed and the degree of pressure applied to the brake pedal can be gauged by the number of lights being illuminated in relation to the total length of the third brake light.

In a preferred version of the invention, motion of the light illuminating from the outer ends inwards is repeated rapidly in the event of an emergency braking situation with the pedal fully depressed. This not only raises

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awareness of the light but also distinguishes it from other conventional third brake lights. In addition it will remain in this mode until the brake pedal is completely released so as to retain the warning to approaching cars that an emergency brake was necessary.

Referring to Figure 2, it can be seen that only once the existing brake light switch has been triggered will the system become active. The system will now check the brake sensor for any movement of the brake pedal. If movement is detected, the control module will either light up or switch off respective lights on the brake light display to indicate whether the brake pedal is being depressed or released and the amount of pressure still applied to the brake pedal. If the brake light switch becomes inactive at any stage, such as when the brake pedal is released completely, the system will deactivate thereby switching off all of the lights of the brake light display.

As an option for the aftermarket or retrofit market, the control module includes setting means in the form of a "learn function" to "learn" the travel distance of the brake pedal of a specific vehicle. The "learn button" is first pressed and the pedal is then fully depressed. The maximum value of the pulse count is retained in the memory and processed accordingly, resulting in the product effectively being tailor-made for that vehicle. This allows a standard product for all vehicles eliminating the need for a large number of different models of intelligent brake lights. Although an optical brake sensor is used in this embodiment, it is to be understood that any other appropriate sensor means can be used to sense the degree of application of the brakes.

Thus, for instance, a speed transducer attached to the speedometer cable on the

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output drive of the gear box or a direct input into the control module from the speed transducer of a vehicle that does not have a speedometer cable, can be used.

Likewise, a strain gauge can be fitted to the brake pedal to measure strain applied on the brake pedal during braking. Strain gauges can also be fitted to other components that might be acted upon when the brake pedal is moved.

Further, a pressure transducer or sender unit can be fitted onto the master cylinder or brake lines to measure actual braking pressure.

Alternatively, a derivative of the preferred optical sensor can be configured in such a way that the sensor arrangement consists of a bar with apertures or holes defined therein which are arranged to move past the two emitters and receivers as previously discussed.

Finally, resistance type sensors could be used. An example of this would be a potentiometer, which is configured in a similar manner to the optical sensor, but the infrared emitters and receivers are replaced with a potentiometer. A change in the resistance on the potentiometer will thus cause a change in voltage and current which in turn can be detected by the control module, and the data processed accordingly.

Once again, although a control module using a microcontroller is preferred as it is software programmable, a control module without a microcontroller can be used. A microcontroller is, however, preferred as the system can be upgraded by simply upgrading the software, providing greater flexibility.

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Referring to the brake light display, it is to be understood that although a linear display arrangement having individual LEDs is preferred, any other appropriate light arrangement can be used provided the lights or light units light up in a sequence or progressively in relation to application of the brakes.

It is believed that the progressive braking system of the invention provides a number of advantages over existing brake light systems. The brake light indicator not only acts a third brake light, it also provides an indication of the degree of application of the brakes of a vehicle. Accordingly, the driver of a following vehicle is in a better position to determine how hard the brakes of his or her vehicle are to be applied.

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**CLAIMS**

1. A progressive braking system for a vehicle comprising:

sensor means arranged to sense the degree of application or release of the brakes of the vehicle; and

a brake light display arrangement comprising a plurality of individual lights or light units arranged to be illuminated or extinguished in sequence or progressively, in response to the degree of application or release of the brakes, respectively.
2. A system according to claim 1, further comprising control means for receiving a signal from the sensor means and controlling the sequence of illumination or extinguishment of the lights or light units.
3. A system according to claim 1 or claim 2, wherein the sensor means is an optical sensor arranged to sense the movement or displacement of the brake pedal as it is depressed or released.
4. A system according to claim 3, wherein the sensor comprises two pairs of opposed infrared emitters and receivers arranged respectively to sense the movement of a slotted or apertured wheel or bar passing through the respective infrared beams when the brake pedal is depressed or released.
5. A system according to any one of the preceding claims, wherein the



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brake light display arrangement comprises a single row of lights arranged to light up progressively from each end towards the middle, the greater the application of the brakes the greater the number of lights that is illuminated.

6. A system according to claim 5, wherein the lights are light emitting diodes (LEDs).
7. A system according to any one of the preceding claims, wherein the control means comprises a control module or unit comprising a microcontroller and ancillary circuitry arranged to control the logical functions of the system.
8. A system according to any one of the preceding claims, wherein the system is linked to an existing brake light switch, the system being activated only once the brake light switch has been triggered.
9. A system according to any one of the preceding claims, wherein the brake light display arrangement is configured to illuminate and extinguish in rapid succession when the brakes are applied fully in an emergency braking situation.
10. A system according to any one of the preceding claims suitable for the aftermarket or retrofit market, wherein the system includes setting means for setting the system in relation to the respective distance the brake pedal for a particular vehicle is arranged to travel.