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(71) Applicant (for all designated States except US): **BRAKE-SAFE LTD** [GB/GB]; Silverstone Innovation Centre, Silverstone Circuit, Silverstone, Northamptonshire NN12 8GX (GB).

(72) Inventor; and

(75) Inventor/Applicant (for US only): **KINGHAM, Allan** [GB/GB]; 16 Hertford Place, Bletchley, Milton Keynes MK3 7HE (GB).

(74) Agents: **GRAY, James** et al.; Withers & Rogers LLP, Goldings House, 2 Hays Lane, London SE1 2HW (GB).

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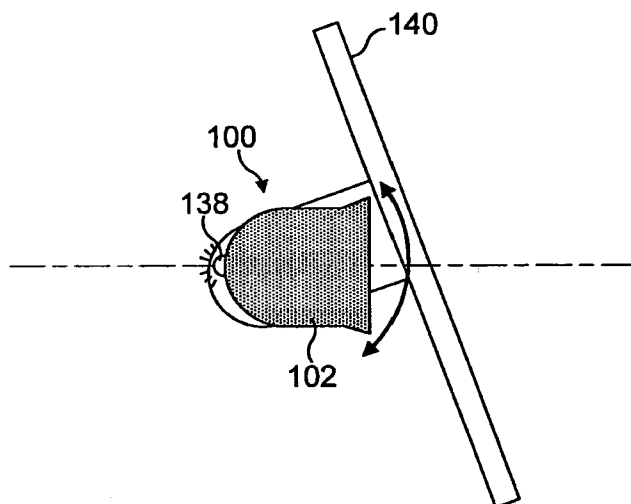
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(54) Title: DEVICE FOR DETECTING DECELERATION IN AUTOMOTIVE VEHICLES



(57) Abstract: An accelerometer is used to detect deceleration of a moving vehicle. The output from a brake light is varied in proportion to the forces detected by the accelerometer. The brake light can be an integral part of the vehicle or a self-contained unit, e.g. affixed to the rear window of a car. The accelerometer can also be used to alert the driver each time the applied braking force exceeds a threshold level, e.g. as a corrective tool for learner drivers. A status indicator is used to indicate whether the accelerometer is at optimum orientation.

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Device for detecting deceleration in automotive vehicles

This invention relates to a device for detecting deceleration in automotive vehicles, and more particularly, but not exclusively, to a device for displaying the relative braking force of a road vehicle to other road vehicles.

Most motor vehicles include at least one brake light for warning other motorists that the vehicle is decelerating.

It has already been proposed to provide a modified rear brake light to act as an indicator of braking force, wherein the intensity of illumination varies in relation to the rate of deceleration of the vehicle or the force applied to a brake lever. However, in bright conditions the relative increase in brake light intensity may not readily be apparent to other motorists. Moreover, the mechanism which enables the brake light to vary in intensity typically forms an integral part of the vehicle braking system and therefore may not be readily retrofitted to existing vehicles.

An object of the invention is to provide an alternative brake force indicator which addresses one or more of the above issues.

Accordingly, one aspect of the invention provides a brake force indicator in the form of a portable, self-contained device for mounting in the rear of a vehicle, the device having an accelerometer for detecting vehicle deceleration, and lighting configured to illuminate proportionally in response to signals from said accelerometer.

By providing the indicator as a self-contained device, the indicator can be readily fitted to existing motor vehicles. For example, the indicator can be mounted adjacent the rear window of a car, thereby providing an auxiliary brake light, thus overcoming the problems associated with integral brake force indicators.

The accelerometer is preferably a dual axis accelerometer, for providing indications of vertical and horizontal forces experienced by the vehicle during use, e.g. under braking or when driving over a pot hole or other such road surface disturbance.

In other embodiments, the accelerometer may be replaced by one or more other sensors capable of detecting accelerations/decelerations.

A status indicator may be provided, for indicating to a user that the sensor is in an optimum operative condition. This is particularly useful if the operative integrity of the sensor may be compromised if it is not arranged in a particular orientation. For example, the sensitivity of a dual axis accelerometer may be reduced if the axes are not arranged at 45 degrees to a horizontal datum and/or if the plane of the accelerometer is not in a generally vertical orientation.

The status indicator is preferably an LED or other visual indicator which is configured to illuminate or provide a different signal when the sensor is aligned in optimum position and/ or if the sensor moves from its optimum position during use.

According to another aspect of the invention, there is provided a visual indicator for mounting in the rear of a vehicle as a display to trailing vehicles, the indicator having a display which is configured to vary in relation to the degree of deceleration of the vehicle.

The indicator is preferably arranged in communication with a sensor for detecting deceleration, and more preferably a controller for regulating the output from the display in proportion with the level of deceleration detected by the sensor. For example, the indicator may take the form of an auxiliary brake light, e.g. a self-contained high level brake light, which is illuminated under normal braking conditions, and wherein the controller is arranged to provide a pulsed warning signal via the brake light if the deceleration detected by the sensor is above a threshold value. Alternatively, the indicator may form an integral part of a conventional rear brake light or vehicle braking system.

The controller can be used to illuminate one or more lights, LEDs or such devices in response to the level of deceleration detected by the sensor, wherein the number of lights, intensity of illumination or the size of display area illuminated is greater under heavy braking than under normal braking.

The display, sensor and controller may be incorporated in a common housing, connectable via a lead to the vehicle accessory socket so as to derive operative power. Alternatively, the housing may include an energy store, for example at least one of a solar cell or battery. At least one of the display, sensor and controller may be housed remote from the other components.

The indicator may comprise an accelerometer and/or a status indicator of the kinds referred to above.

According to another aspect of the invention, there is provided a brake force indication device for a motor vehicle having a light body for emitting a visual brake warning signal and an accelerometer arranged for detecting vehicle deceleration, whereby the brake warning signal is varied proportionally in response to forces experienced by said accelerometer.

Again, the accelerometer is preferably a dual axis accelerometer, but may be replaced by one or more other sensors capable of detecting accelerations/decelerations.

Preferably, the light body is movably mounted on a support so that the light body can be mounted on or adjacent the rear window of a motor vehicle and directed so that its visual signal is directed outwards through the rear window.

In a preferred embodiment, the light body is pivotably mounted between opposing supports. Conveniently, the relative movement allowable between the light body and the supports may be limited to a number of predetermined positions, e.g. by a circular or arcuate latching or ratchet type arrangement.

The light body may be remote from the accelerometer or incorporated in a common housing.

In a preferred embodiment, the operative orientation of the accelerometer can be varied by moving the light body relative to its support. A status indicator of the kind referred to above may also be incorporated, for ensuring optimum performance from the device.

According to another aspect of the invention, there is also provided a brake force indication system for a motor vehicle, the system incorporating an accelerometer for detecting acceleration and/or deceleration of a vehicle, wherein a status indicator is provided for indicating when the operative position of the accelerometer has been optimised.

The status indicator is preferably of the kind referred to above. Again, the accelerometer is preferably a dual axis accelerometer, but may be replaced by one or more other sensors capable of detecting accelerations/decelerations.

The system may comprise an integral part of a vehicle braking system, wherein the forces detected by the accelerometer can be used to vary the warning signal generated by the vehicle brake lights, e.g. using a pulsed warning or a warning light of greater intensity under heavy braking conditions than the standard warning generated under normal braking conditions.

Alternatively, the accelerometer can be supplied as a retrofit unit, for example for use with an auxiliary brake light mounted on or adjacent the rear window of the vehicle. The accelerometer may be housed together with the auxiliary brake light or as a separate unit. In either case, the forces detected by the accelerometer can be used to vary the warning signal generated by the auxiliary brake light, e.g. using a pulsed warning or a warning light of greater intensity under heavy braking conditions than the standard warning generated under normal braking conditions.

According to other broad aspects of the invention, there is provided a vehicle brake light or vehicle breaking system which comprises or incorporates one or more of the above aspects of preferred features of the invention.

According to another aspect of the invention, there is provided a system for monitoring driving ability, the system including a sensor for detecting acceleration/deceleration of the vehicle, wherein the system is configured to detect when the output from the sensor has exceeded a threshold value.

Preferably the system includes a visual display to indicate each detected incident above said threshold. Additionally, an audible alert may be generated upon each such incident.

In a preferred embodiment, the sensitivity of the sensor may be selectively varied, for example so that the sensitivity setting for an experienced driver can be higher than for a novice driver, e.g. on a scale of 1 to 10, so that it can be more difficult for a skilled driver to control the vehicle without exceeding the threshold.

The sensor may be mounted in a portable housing that can be positioned on a surface within the vehicle, such as in a foot well. The sensor is preferably in the form of an accelerometer, and more preferably a dual axis accelerometer, which is capable of detecting both horizontal and vertical forces.

The system may be configured to account for road surface disturbances, such as potholes and speed bumps, since these will typically be associated with a 'vertical' reading, in addition to a 'horizontal' reading associated with a deceleration. Such results will tend to differ markedly from the horizontal readings associated with conventional deceleration under conventional braking or a change in gear. Hence, the system can be used to omit from consideration those readings deemed to be associated with surface disturbances.

The visual display may be incorporated in the sensor housing, in which case the housing may be connectable via a lead to the vehicle accessory socket, in order to derive operative power.

The sensor housing may include a status indicator to indicate that the sensor is in an optimum operative orientation. This is particularly useful if the sensor is in the form of an accelerometer, and more particularly a dual axis accelerometer of the kind referred to above. The status indicator is preferably an LED or other visual indicator which is configured to illuminate or provide a different signal when the sensor is aligned in optimum position and/ or if the accelerometer is moved from its optimum position.

According to another aspect of the invention, there is also provided an apparatus for use in monitoring the performance of a driver, the apparatus comprising at least one sensor for detecting at least one of acceleration or deceleration forces of a vehicle during use, and a controller for receiving signals or data from said sensor, wherein the controller is configured to indicate whether the sensor has detected a force which is above a predetermined threshold.

The apparatus may incorporate a visual display to indicate to the driver of the vehicle each detected incident above the threshold, e.g. as a running total. The display may be integral with the sensor and/or the controller. Additionally, an audible alert may be generated upon each such incident.

In a preferred embodiment, the sensitivity of the sensor may be selectively varied, for example so that the sensitivity setting for an experienced driver can be higher than for a novice driver, e.g. on a scale of 1 to 10, so that it can be more difficult for a skilled driver to control the vehicle without exceeding the threshold.

The controller may be configured to account for road surface disturbances, such as potholes and speed bumps, e.g. in the manner referred to above.

It will be understood that preferred features from one or more of the above aspects of the invention may be incorporated with other aspects of the invention.

Additional aspects and features of the invention will be readily apparent from the claims and the following description of preferred embodiments of the invention, made, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a schematic front view of a sensor unit for detecting braking force;

Figure 2 is a schematic plan view of the unit in Figure 1, showing internal components of the unit;

Figure 2A is an enlarged view showing the mounting of an accelerometer in the unit of Figures 1 and 2;

Figure 3 is a schematic rear view of the unit of Figures 1 and 2, showing the position of the batteries;

Figure 4 shows a typical mounting position for the unit on the rear window of a car;

Figure 5 is a schematic view illustrating a preferred method of installing the unit on the rear window of a car;

Figure 6 shows a preferred orientation of the unit from Figures 4 and 5;

Figure 7 is a schematic perspective side view of another sensor unit;

Figure 8 is similar to Figure 7 and shows the disassembled unit;

Figure 9 is a schematic view from the front of a further sensor unit; and

Figure 10 is a schematic view from one end of the sensor unit in Figure 9.

Referring firstly to Figure 1, a brake force indicator unit is indicated generally at 100, wherein a light body 102 is rotatably supported between two mounting blocks 104 via positioning joints 106. The front surface of the light body 102 includes or takes the form of at least one lens 108 through which light can be emitted from within the body 102, e.g. as a warning signal to trailing vehicles that the vehicle is braking.

Adhesive mounting pads (not shown) are provided on a front face of the mounting blocks 104. The pads may include a removable film cover for protecting the integrity of the adhesive prior to installation of the unit 100. The pads can be used to secure the unit 100 in position in a vehicle, for example by sticking the unit 100 to the rear window or shelf of a car.

As can be seen in Figure 2, a plurality of LEDs 112 are provided in spaced array inside the light body 102, generally along the longitudinal axis of the body 102. The LEDs 112 are arranged in communication with a PCB 114 having a processor.

The unit 100 includes a sensor in the form of an accelerometer 120, arranged in communication with the PCB 114. In this embodiment, the accelerometer 120 is mounted within the light body 102.

In use, the output from the LEDs 112 is intended to vary dependent on signals received by the PCB 114 from the accelerometer 120, wherein the signal emitted by the unit 100 is proportional to or otherwise indicative of the deceleration forces experienced by the accelerometer 120. Hence, the unit 100 provides as a proportionate warning signal to other motorists.

In this embodiment, the accelerometer 120 consists of a dual axis device arranged perpendicular to the longitudinal axis of the light body 102. The axes are mounted at 45 degrees within the body 102, as illustrated in Figure 2A.

Operative power for the unit 100 is supplied via batteries 130 that are received in ports provided in the rear of the light body 102. Hence, the unit 100 is capable of operating independently within a vehicle. A removable cover 132 is provided over the battery ports, whose position is indicated at 134 in Figure 3.

A power switch 136 is provided in the rear of the light body 102, for switching the unit 100 on or off, as desired. An LED 138 is also provided next to the power switch 136. This LED is configured to illuminate when the axes of the accelerometer 120 are detected as being at 45 degrees to a horizontal datum, as will be described below, since this has been found to significantly enhance the sensitivity and therefore the operative integrity of the unit 100. This LED 138 may also be used to indicate that the batteries need to be replaced.

An example of one possible application for the unit 100, including a preferred method of installation, will now be described with reference to Figures 4 to 6.

In this example, the unit 100 is to be installed on the rear window 140 of a car in a position indicated in Figure 4. It has been found that the sensitivity of the unit 100 in detecting deceleration of the vehicle in use is enhanced if the unit 100 is installed with the accelerometer 120 arranged in a substantially vertical orientation with respect to the vehicle chassis. As such, the unit 100 should preferably be installed when the vehicle is located on substantially horizontal, level ground. The surface onto which the unit 100 is to be affixed should then be cleaned, before removing the film protector from the mounting pads and affixing the unit 100 in place. In this example, lines on the rear window can be used to ensure that the unit 100 is arranged horizontally with respect to the vehicle chassis, as indicated in Figure 6, thereby ensuring that the accelerometer 120 is arranged generally vertically.

The positioning joints 106 may be universal, for example ball and socket, to enable the unit 100 to be mounted in the desired orientation when affixed to a curved or otherwise non-planar surface.

As mentioned above, the sensitivity of the unit 100 is improved if the accelerometer 120 is arranged with its axes at 45 degrees to a horizontal datum, for example as shown by the dotted line in Figure 5. In the preferred embodiments, the unit 100 is switched on and the light body 102 can be rotated between its supports 104 until the LED 138 is illuminated, thereby signalling that the accelerometer axes are correctly aligned for optimum sensitivity. If the LED 138 fails to illuminate, this is indicative of a lack of sufficient power from the batteries, which should then be replaced.

An auxiliary power supply, external to the light body 102, may be connected to the unit 100, if preferred. Power may be taken directly from the vehicle via a loom, for example.

Once the unit 100 has been installed, the vehicle can be driven in the knowledge that the sensor 120 will detect relative deceleration of the vehicle. When said deceleration exceed a predetermined minimum level, one or more of the LEDs 112 are illuminated, to thereby provide an additional brake warning signal to conventional brake warning emitted by the vehicle braking system.

The PCB 114 is configured to illuminate all of the LEDs 112 to maximum intensity when the deceleration forces exceed a maximum predetermined threshold value.

Between the minimum and maximum threshold values, the PCB 114 is configured to vary the light emitted by the unit 100 accordingly, in proportion to the deceleration forces experienced by the accelerometer 120. The warning signal may take any appropriate form, for example a flashing or pulsed illumination/and/or a graphic symbol.

The illustrated unit 100 consists of a portable, self-contained device which can be mounted at any position on a vehicle, preferably at the rear of a vehicle, and which can be readily fitted to existing motor vehicles to provide an auxiliary brake warning system. The unit 100 is particularly advantageous in that the operative position of the

accelerometer and/or the direction of the visual warning signal can be optimised by articulation of the light body 102.

The LEDs may be replaced by other light sources which may be operated in any suitable pattern or manner, so as to provide a visual warning signal which varies proportionally in response to forces detected by the accelerometer or other such force detecting device.

Although described as a single unit, the sensor may be mounted remote from the light box. Indeed, the skilled person would understand that the principle behind the above embodiment may be readily incorporated into a conventional vehicle braking system. Hence, in another embodiment, the accelerometer or other such acceleration/deceleration force detecting device or sensor forms part of a vehicle braking system, wherein the output is utilised to vary the visual impact from the vehicle brake lights (whether a high level brake light or the two conventional brake lights). Again, it is preferable if the system is configured to detect whether the sensor is arranged for in an optimised orientation, as well as to signal if the position changes during use.

The system can be used to pulse the brake lights if the output from the accelerometer exceeds a maximum threshold value, for example, and/or to increase in the intensity of the brake lights accordingly. Additionally or alternatively, a visual depiction, such as an indication of the speed to which the vehicle is slowing down, or a hazard signal such as an exclamation mark or other graphic symbol, can be displayed by the vehicle brake lights if said threshold value is exceeded.

In a further embodiment, the unit 100 or indeed an accelerometer or other such acceleration/deceleration detecting device or sensor can be used to monitor the performance of driver, e.g. for use in a driving schools. The sensor is preferably connected to a controller or processor which is configured to record or indicate when the vehicle exceeds a minimum threshold value during acceleration or braking. Each such instance (and/or a total) can be displayed on a separate display, for example a dash

incorporated or dash mountable display, so that the driver can assess his performance. An audible signal may be preferred.

In addition, the sensitivity of the sensor can be altered. For example, it may be preferred to set a lower sensitivity for novice drivers and to increase the sensitivity for more experienced drivers. It is hoped that such a system will be an effective tool in improving driving skills, since the results from the unit can be used to indicate excessive braking/acceleration, as well as providing an indication of gear shift quality. For example, the processor can be used to generate a graph or other visual indicator of the forces recorded over a period of time of driving. It is hoped that by improving driver skills, overall fuel consumption can be reduced.

An alternative sensor unit 200 is shown in Figure 7, wherein a sensor housing 202 is pivotable relative to a mounting bracket 204, via a connection pin 206. An accuracy LED 208 is provided on the sensor housing 202, for indicating when the sensor housing is in its optimum orientation, e.g. in the manner described above. A display may be provided integral or remote from the sensor unit 200.

Relative movement between the sensor housing 202 and the mounting bracket 204 is limited, in this embodiment by means of a ratchet type mechanism which consists of a first engagement surface 210 provided on the sensor housing 202 about an aperture 212 for the connection pin 206, and a correspondingly arranged engagement surface 214 on the mounting bracket 204 (about an aperture 216 for the connection pin 206).

Once assembled, the surfaces 210, 214 are in engagement with one another and define a plurality of stop positions for the sensor housing 202 relative to the mounting bracket 204. For example, the first surface 210 may be knurled (see Figure 8) and the second surface 214 may take the form of a circular array of projections or recesses, with which the knurled surface engages so as to hold the sensor housing 202 in a first position relative to said mounting bracket 204. Thereafter, if an attempt is made to manually rotate the sensor housing 202, e.g. to optimise the orientation of the sensor housing, the frictional engagement between the surfaces 210, 214 is overcome, and the mounting

bracket can be rotated to another position in which the knurled surface cooperates with the recesses or projections to hold the sensor housing 202 in its new position.

Other forms of stop mechanism may be incorporated, for example the opposing surfaces 210, 214 may define a radial array of ribs and grooves, wherein the two members can be rotated relative to one another by displacing respective pairs of ribs and grooves from inter engagement.

The bracket 204 has mounting apertures (indicated by dotted lines in Figures 7 and 8) by means of which the unit 200 can be affixed to another object or portion of a vehicle.

Figure 9 shows an integrated box unit 300, which may include a deceleration sensor. The unit 300 has a display screen 302 and a reset button 304 for the controller/display, as well as an accuracy LED 306. Figure 10 shows that the unit 300 has a power socket 308, e.g. for connection of the device to an auxiliary power port in a vehicle, such as a cigarette lighter socket.

Claims

1. A system for monitoring driving ability, the system including a sensor for detecting acceleration/deceleration of a vehicle, wherein the system is configured to
5 indicate when the output from the sensor has exceeded a threshold value, and wherein the sensitivity of the sensor can be selectively varied to accommodate for drivers of different skill level.
2. A system according to claim 1 wherein the sensor is mounted in a portable
10 housing.
3. A system according to claim 2 wherein a visual display is incorporated in the sensor housing.
- 15 4. A system according to any of claims 1 to 3, further comprising an audible alert to indicate each detected incident above said threshold.
5. A system according to any of claims 1 to 4 wherein the sensor is a dual axis accelerometer.
20
6. A system according to claim 5, further comprising a status indicator to indicate when the accelerometer is in an optimum operative orientation.
7. A system according to any preceding claim wherein the system is configured to
25 account for road surface disturbances.
8. Apparatus for use in monitoring the performance of a driver, the apparatus comprising at least one sensor for detecting at least one of acceleration or deceleration forces of a vehicle during use, and a controller for receiving signals or data from said
30 sensor, wherein the controller is configured to indicate whether the sensor has detected a force which is above a predetermined threshold.

15

9. Apparatus according to claim 8, further comprising a visual display to indicate to the driver of the vehicle each detected incident above the threshold.
10. Apparatus according to claim 8 or 9 wherein the sensitivity of the sensor may
5 be selectively varied.
11. Apparatus according to any of claims 8 to 10 wherein the sensor is a dual axis accelerometer and the controller is configured to account for road surface disturbances.
- 10 12. A method of testing a driver's ability comprising the steps of providing a vehicle with a sensor for detecting at least one of acceleration or deceleration forces of the vehicle during use, driving the vehicle, and electronically recording each incident in which the force detected by the sensor is above a predetermined threshold.
- 15 13. A method according to claim 12, wherein the sensitivity of the sensor is selected proportionate to the perceived level of skill of the driver.
14. A method according to claim 12 or 13, wherein the sensor is a dual axis accelerometer and the controller discounts forces associated with a road surface
20 disturbance.
15. A device for indicating that a vehicle is braking, the device having a display to be viewed by trailing vehicles and a sensor for detecting deceleration, wherein the output from the display is regulated in proportion to the level of deceleration detected
25 by the sensor.
16. A device according to claim 15 wherein the sensor is an accelerometer and the device includes a status indicator for indicating that the accelerometer is arranged at in optimum orientation.
- 30 17. A device according to claim 15 or 16 wherein the display is rotatably held between opposing supports so as to be rotatable between a number of positions.

18. A device according to any of claims 15 to 17 wherein the sensor and display are co-mounted.
- 5 19. A brake force indication system for a motor vehicle, the system incorporating an accelerometer for detecting accelerations and/or deceleration of a vehicle, wherein a status indicator is provided for indicating when the operative position of the accelerometer has been optimised.
- 10 20. A brake force indication system according to claim 21 wherein the accelerometer is a dual axis accelerometer.
21. A brake force indication system according to claim 19 or 20, comprising an integral part of a vehicle braking system, wherein the forces detected by the
15 accelerometer can be used to vary the warning signal generated by the vehicle brake lights.
22. A brake force indication system according to claim 19 or 20, comprising a retrofit unit.
- 20 23. A brake force indication system according to claim 22 wherein the unit includes a visual display which is pivotably mounted between opposing supports.
24. A brake force indication system according to claim 23 wherein the relative
25 movement allowable between the visual display and the supports is limited to a number of predetermined positions.

1 / 3

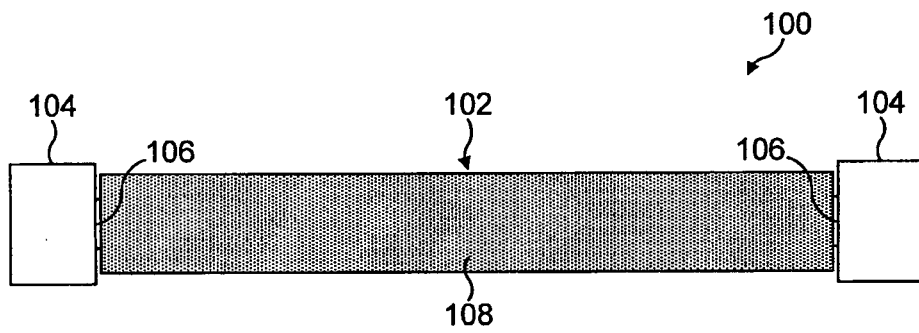


FIG. 1

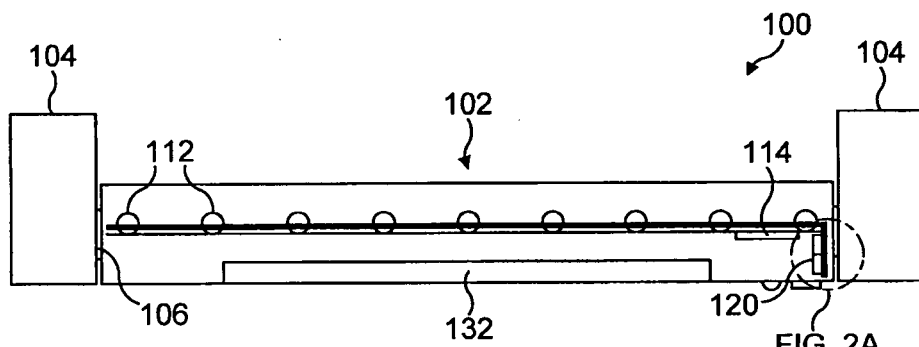


FIG. 2

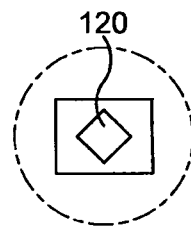


FIG. 2A

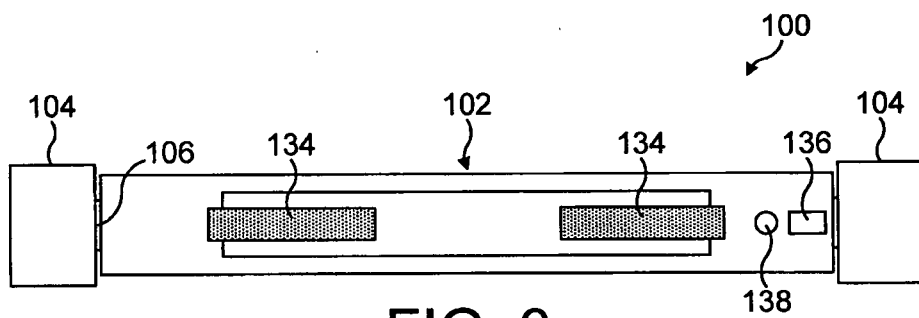


FIG. 3

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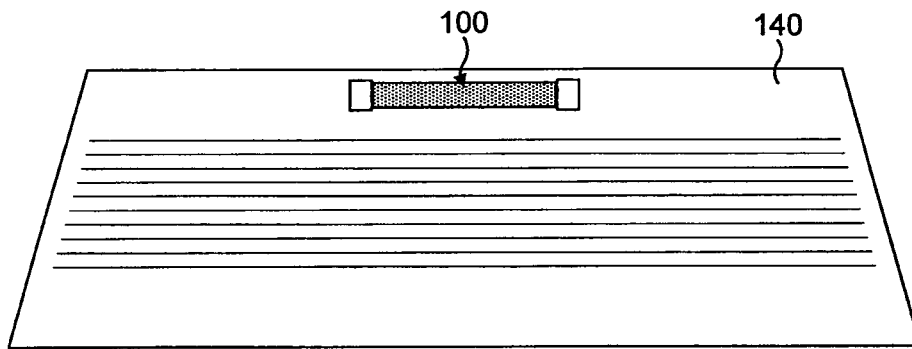


FIG. 4

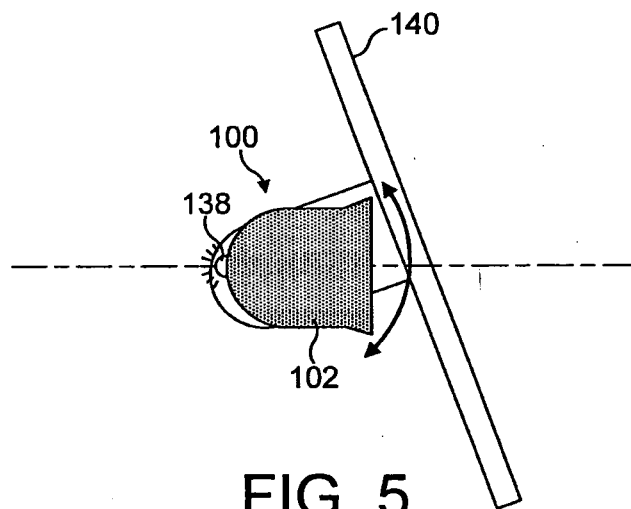


FIG. 5

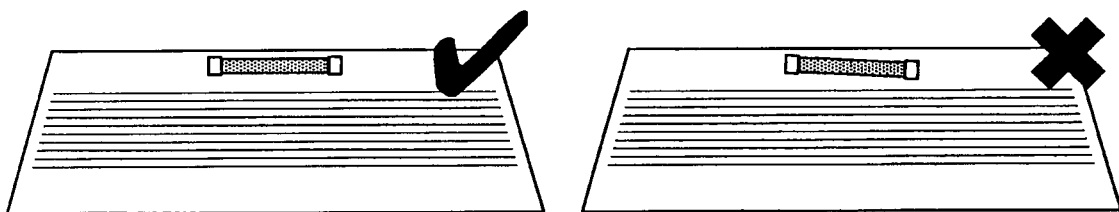


FIG. 6

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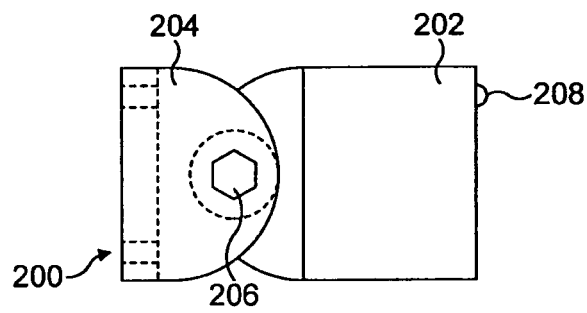


FIG. 7

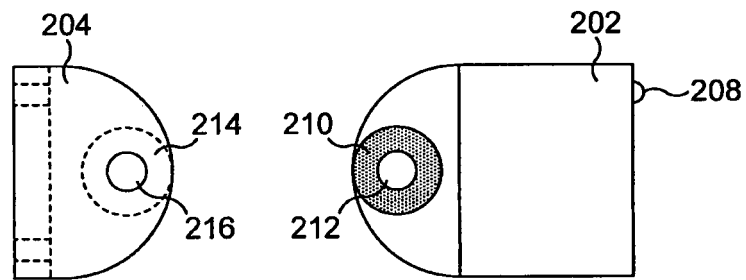


FIG. 8

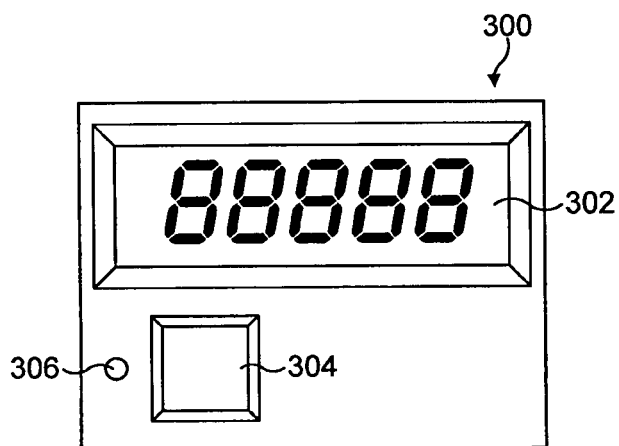


FIG. 9

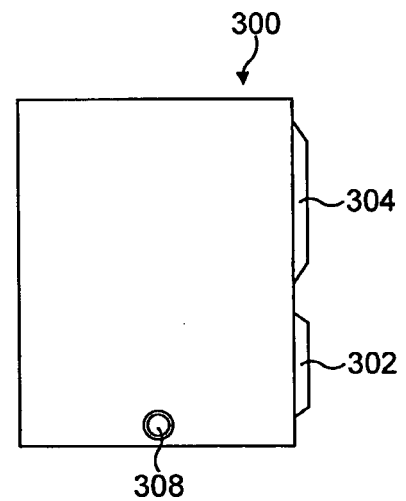


FIG. 10