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**(54) Equipment to measure driver acceleration patterns and report associated accident risks**

(57) A computer based logging device, including dual-axis accelerometers and capable of measuring forward and lateral accelerations, is installed in a road vehicle. Using acceleration data which has been measured over a period of time, the device classifies the driver into one of several groups, each of which is associated with a different level of accident risk. The device has a display panel to indicate to the driver the group to which he or she is currently assigned and advice on how to make his or her driving safer.

Each driver is identified by a separate programming means, to be applied to the logging device before driving the vehicle. The programming means is also used to transfer the results from the logger to a remote database, where accident risk and driver group parameters are determined.

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<p><b>Liberty Mutual</b> <b>Exhibit 1007</b></p>
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EQUIPMENT TO MEASURE DRIVER ACCELERATION PATTERNS  
AND REPORT ASSOCIATED ACCIDENT RISKS

Background

There is a widely acknowledged need for driver training, both immediately following the driving test and repeatedly during a lifetime spent driving on the roads. However, the cost and inconvenience of using human trainers and examiners are major obstacles. Consequently, there may be some interest in computer based equipments that are easily installed in road vehicles and which can measure safety related features of the driving. Such devices can act as both driver training aids and driver performance assessors.

Accidents are such rare events that individual drivers may not be aware of how their driving habits are contributing to the level of risk. However, a computer equipment could be programmed with information obtained from an extensive survey of drivers, so making the required experience available to the driver.

Reckless drivers could be detected by the equipment and their habits reported and possibly corrected before accidents are caused. This information could be of use to vehicle owners and insurers. By the same token, safe drivers would be able to demonstrate their competence to insurance companies.

Theory

This invention concerns an electronic device for measuring and recording the levels of acceleration applied by the drivers of road vehicles. These accelerations include forward acceleration, backward acceleration (braking) and left and right accelerations (cornering). The device contains a computer, which processes accumulated acceleration data to determine to which of several behavioural groups the driver belongs. Each group is associated with a significantly different level of accident risk. Measurements made on many drivers over a long period are used to establish these levels of accident risk.

The device supports a display panel, which indicates to the driver the group to which he or she has been assigned, together with a code indexing advice on how to change his or her driving habits to reduce accident risk.

A user manual explains the basis for the measurements and presents the mean time between accidents for drivers in each of the groups. The manual also contains instructions for using the device and advice on how to reduce accident risk, indexed by the group and advice codes.

The accident statistics are obtained from a national survey of drivers using the device. They might be updated annually and circulated to all registered users of the device.

The device is programmed and set up for a particular driver and vehicle. This may be achieved by inserting a suitable thin card or disk into an integral drive unit. Different programs are carried by different drivers, so that any driver with a suitable card or disk can be monitored whilst driving any equipped vehicle.

The programming means (eg card or disk) are initialised by a separate computer, which is also used to read the recorded acceleration patterns and the time history of driver group and advice codes. This information is added to a database, which is used to update the algorithms used for analysing the acceleration patterns and the accident statistics.

Further input, in the form of driver questionnaires, may be required to maintain accurate accident statistics.

The database might also be used by driver training officers, fleet vehicle operators or insurance companies, who wish to monitor the standard of driving of certain vehicles.

#### Description

The device is contained in a rigid rectangular box, which may have a spirit level on the top, to enable the user to install it in a level plane. The device comprises:-

- a) dual-axis accelerometers, aligned with the sides of the box, in the horizontal plane (The vertical acceleration component is not considered to depend on the driving style);
- b) an electronic computer which reads the accelerometers periodically and processes the acceleration data, to keep a running average of the driver's acceleration pattern. The computer may contain or access a clock, so that the data can be time stamped;
- c) a microphone (which may be external) and circuits to switch on the computer when the vehicle exhaust makes noise;
- d) a stabilised power supply for the computer, to enable it to be powered from the vehicle electrical system;
- e) a backup battery, to maintain power to the computer if the vehicle supply should fall temporarily, eg when cranking the motor;
- f) a display panel (or connections to a standard vehicle information display system), used to display the driver group and advice code;
- g) a means of programming the computer and of storing and removing the measured data, such as a thin card drive or a disk drive.

The device has a power lead, which should be connected to the vehicle supply (ie the battery).

Arrows on the top of the device indicate which side should face the front of the vehicle. The indicated axis of the device must be aligned with the wheelbase of the vehicle. The user must install it in the correct orientation and approximately level, with the vehicle standing on level ground. The device should be clamped or wedged to prevent it from moving about.

The driver must apply his or her programming means (eg card or disk) to the device before starting up the engine of the vehicle. When this is done, all subsequent acceleration data is attributed to that driver, until the device is re-programmed.

When the engine is started, the computer is switched on by the microphone circuit and acceleration data is logged. If the engine stops for longer than a programmed time interval, the computer terminates the logging and switches itself off.

The logging is resumed at the start of each journey, so that a cumulative pattern develops over a period of time spent driving. When sufficient data has been obtained to give a result, the device displays the driver group and advice code using the display means. This information may be latched so that it remains on display when the logging computer is off.

Programs in the computer determine how much data is needed to achieve a reliable result and this result is constantly updated using the most recent data recorded.

The time history of the driver's result and the corresponding patterns are stored on the programming means (eg removable card or disk) so that they can be processed by a remote computer installation.

CLAIMS

- 1 An electronic device using accelerometers, mounted in a road vehicle, which measures and records the vector accelerations of the vehicle, to build up a pattern that is used by the device to classify the driver. This classification is between several groups, each of which is associated with a different level of accident risk.
- 2 The provision to the driver of the equipped vehicle in Claim 1 of advice on how to reduce his or her accident risk, by changing the levels of acceleration habitually applied.

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