that is gripped. The transducer **15** will have a maximum value of resistance when the steering wheel **17** is not being gripped.

Although a transducer using a variable resistance mechanism is disclosed, other methods known in the art for developing a variable pressure signal **27**, shown in FIG. **3**, are also acceptable. One such method is the use of a sealed air tube as shown in the Gerger patent, in conjunction with a solid-state piezoresistive pressure transducer. Another method is the use of a coaxial cable with an easily deformable solid or foam dielectric, the varying capacitance of the cable providing the pressure signal

Returning to FIG. **1**, the display means for the driver alarm is a display unit **29** attached to the steering wheel **17**. The unit **29** has a number of light emitting diodes (LED's) **31** that indicate the driver's level of drowsiness as determined by the driver alarm **11**. The LED's **31** may be configured in a three color triad to simulate a stoplight as shown, or as a bar graph or other means as desired.

As shown in FIG. **3**, the pressure signal **27** from the transducer **15** is sent to an analog-to-digital convertor (A/D) **33**, which digitizes the pressure signal **31** and transmits it to a control unit **35** via a data bus **37**. The data bus **37** contains circuitry that provides bidirectional serial communication between the elements on the steering wheel **17** and the control unit **35**. 1he data bus **17** also provides power to the components on the steering wheel **11**. When grounding is available on the steering wheel **17**, then a single wire such as the 'hot' wire leading to the horn contacts (not shown) in the steering wheel **17** may be used in the data bus **37**. When a single wire is used, data is impressed over the battery voltage. The direct current power and the data signal, which is alternating current, are then separated at the receiving end of the data bus **37** before being used.

The control unit **35** is the control means for the driver alarm **11** and includes a data interface **39**, a microcontroller **41**, and a power switch **43** that supplies power to the data interface **39** and microcontroller **41**. The data interface **39** converts data from the data bus's serial format to the microcontroller's parallel format and vice versa. The alarm means **45** for the driver alarm **11** is an electroacoustic transducer such as a buzzer. The alarm means **45** may be packaged in a box with the control unit **35** for convenience or physically separate to allow installation of the alarm means **45** in a desired location.

A speed sensor **47**, of the type used in cruise control devices, measures vehicle speed. The speed sensor **47** develops a speed signal **49** that is used by the microcontroller **41** to determine when to bypass activation of the alarm. The speed signal **49** is a series of pulses, compatible with the logic levels in the microcontroller **41**, whose frequency is proportional to vehicle speed.

The microcontroller **41** performs several functions. It monitors the signals from the pressure transducer **15** and the speed sensor **47**. It calculates the likelihood that the driver is falling asleep and activates the alarm means **45**. It also creates a display signal **51**, corresponding to an arbitrary scale of driver drowsiness, that is sent to the display unit **27**. Drive electronics (not shown) in the display unit **29** decode the signal **51** and drive the appropriate LED's **31**.

When the power switch **43** is turned on, the microcontroller **41** starts to measure the frequency of the speed signal **49**, determines the vehicle speed, and compares this value to a threshold value held in a nonvolatile memory (not shown), which may be located in the microcontroller **41** itself. While the vehicle speed is less than the threshold value, the alarm means **45** is disabled. This prevents the alarm from sounding if the car is parked or in city traffic.

Upon power up, the microcontroller **41** also begins measuring the signal from the pressure transducer **15**. During roughly the first fifteen seconds of operation, the microcontroller **41** keeps track of the highest and lowest measured pressure values. These values are stored in the microcontroller's **41** memory registers for reference, and represent the highest and lowest normal values of hand grip pressure. These values allow the microcontroller **41** to set a baseline of operation and allow the driver alarm **11** to adjust itself to each individual driver.

After the values are stored, the microcontroller **41** calculates an alarm point corresponding to a grip pressure at a safe margin below the lowest normal hand grip pressure value. If the hand grip pressure drops below this alarm point, the microcontroller **41** instantly activates the alarm means **45**. In addition, the microcontroller **41** can monitor the transient behavior of the pressure signal **27**, and determine the driver's state of drowsiness in the same manner used in the art for monitoring steering wheel oscillations. The driver alarm **11** can thus respond to slow deterioration in driving response as well as a sudden loss of hand grip pressure.

Minor refinements to operation and setup of the driver alarm **11** are necessary when the device is installed as an add-on item rather than being designed into the car as original equipment. Such things as setting the low speed threshold, and compensating for the value of the pressure signal **27** when there is no hand grip pressure, can be accomplished by means known in the art.

The driver alarm **11** of the invention has several advantages over the prior art. The driver alarm operates with a minimum of interference with normal driving. Because it adjusts to each driver's particular gripping pressure, it does not require the driver to grip the wheel in an unusual manner, thus reducing fatigue. It can respond rapidly to a sudden loss of hand grip pressure, yet still respond to slow deterioration in driving response as the driver slowly becomes drowsy.

The invention has been shown in only one embodiment. It should be apparent to those skilled in the art that the invention is not so limited, but is susceptible to various changes and modifications without departing from the spirit of the invention.

What is claimed is:

1. A driver alarm for alerting a driver of a hazardous condition of the onset of sleepiness or lack of attentiveness, wherein the driver alarm comprises:

a transducer, adapted to be attached to a steering element on a vehicle, for converting hand grip pressure on the steering element into a variable, electrical pressure signal corresponding to the hand grip pressure;

a speed sensor for detecting the vehicle's speed and creating a speed signal corresponding to the vehicle's speed;

alarm means for alerting the driver of the hazardous condition; and

control means for monitoring the speed signal and the pressure signal, creating an alarm point based on the monitored speed signal and a portion of the monitored pressure signal during an initial start-up interval of each session of operation of the driver alarm, and determining that the hazardous condition occurs when the alarm point is exceeded, and activating the alarm means.

2. A driver alarm as recited in claim **1**, further comprising display means for displaying the status of the control means' assessment of the existence of the hazardous condition.