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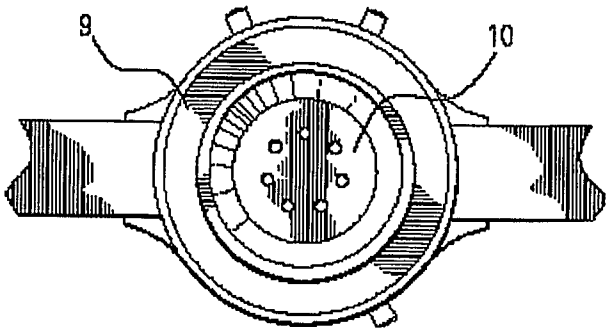

(57) Abstract: The present invention comprises a somnolence prevention and drowsiness detector device consisting of one or more pulse rate sensors that are attached to the operators' body of a motor vehicle. When the pulse rate sensors detect changes or a reduction in the heart pulse rate that is pre-determined according to a known measured standard pulse rate for an individual of the same approximate height and weight, an actuator component is activated by a central processing or computer unit which detects and analyzes when the heart rate falls within a range indicative of somnolence or sleepiness. The actuator component then produces a stimulation in the form of sound, vibration or mild electric shock that awakens the operator and makes him/her more cognizant of the moving environment which he/she is in thereby preventing accident or death.

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STAY AWAKE

Field of the Invention

The present invention relates generally to safety warning devices and methods for their use. More particularly, the present invention relates to warning devices that prevent operators of motor vehicles, boats, trains, airplanes and other types of mobile, heavy machinery from falling asleep during their operation thereby saving lives and costly structural and/or personal property damage.

Background of the Invention

The gradual onset of sleep unknown as somnolence or drowsiness is a common occurrence in individuals who have been operating a motor vehicle for long periods of time or who have endured a poor nights' sleep the night before. In the United States alone, the last decade has seen an exponential increase in the number of automobiles, trucks, sport utility vehicles ("SUVS") and other motorized vehicles of transportation such as motorcycles driven on the roads and highways each day and night. Moreover, the increasingly mechanical nature of the workforce has resulted in the development of massive earth movers, cranes, machines of manufacture and the like. Society has increasingly become a fast-paced, mechanically automated one in which man need only alertly control the automobile, truck, airplane or machine to get him across town or all over the world and achieve that which he desires. Failure to do so however can often result in costly, dire and sometimes deadly consequences.

Each year, numerous automotive and construction accidents and fatalities occur as a result of a sleepy driver or operator inadvertently dozing off while operating the vehicle or machine in question. Moreover, there is an increasingly growing problem whenever

people continue to drive their vehicle despite the fact they are too tired or drowsy to do so. In particular, families taking vacation or long haul truck drivers may start the journey wide awake and in good shape but after several hours of driving becomes drowsy and sleepy and no longer can properly focus or pay attention to the road. Yet, since they want/need to get to their destination within a certain timeframe they push themselves to continue on often with catastrophic results.

The present invention then is a non-intrusive device for measuring when a driver of a motor vehicle is in fact becoming drowsy. The drowsy condition is monitored by the device through the measurement of the pulse or heart rate and in reaction thereto provides a stimulus to wake him/her up so as to prevent a further decline in consciousness. The device is worn by the driver or individual in question and measures and monitors the individuals' heart rate and pulse. As an individual reaches a relaxed state and becomes sleepy and/or drowsy his/her heart rate declines as well and slows down considerably as that person approaches the early stages of sleep. In the present invention, once a pre-determined threshold level is reached, a sensor within the device actuates a warning means which creates a loud noise or physical stimulation such as a strong, vibratory shock which wakens the driver from the declining conscious state and prevents any accident that may have resulted therefrom.

Devices useful as somnolence detection and drowsiness warning system for the prevention of accidents due to a vehicle operators falling asleep are known in the art. United States Patent No. 6,822,573 to Bashir et al describes a non-intrusive system used to determine if the driver of a vehicle is drowsy and at risk of falling asleep at the wheel due to drowsiness. The system consists of two different drowsiness detection systems

and a control unit. This redundancy reduces the risk of a false drowsiness assessment. The first subsystem consists of an array of sensors, mounted in the vehicle headliner and seat, which detects head movements that are indicative characteristics of a drowsy driver. The second subsystem consists of heart rate monitoring sensors placed in the steering wheel. The control unit is used to analyze the sensory data and determine the driver's drowsiness state and therefore corresponding risk of falling asleep while driving. Through sensory fusion, intelligent software algorithms, and the data provided by the sensors, the system monitors driver characteristics that may indicate a drowsy driver. If the driver is found to be drowsy, a signal is outputted which may be used to activate a response system. This system is not limited to automobiles; this system may be used in any type of vehicle, including aircrafts, trains and boats.

U.S. Patent No. 6,337,629 to Bader discloses and claims a method and a system for monitoring an individual's autonomic nervous system in order to detect when that individual's level of wakefulness decreases. Changes that are detected in the stimuli of the autonomic nervous system are reflected by changes in the behaviors of certain physiological parameters. Sensors attached to the body of the driver measure respiration, cardiac activity and body movements and any reduction of the cardiac or pulmonary parameters. The sensors can be of any type and are preferably a conventional sensor such as PVP type sensors. The sensors are attached to a data collecting computer unit and further to either a light emitting device, a siren or a vibrating device which is activated when lower heart rates are measured.

U.S. Patent No. 6,575,902 to Burton et al discloses and claims a device for monitoring the "awareness" or vigilance of an individual operating a vehicle or the like.

The apparatus includes a number of sensor means such as electroencephalograms (EEG) electro-oculograms (EOG) or electro-myelograms (EMG) which, when monitoring live physiological parameters below a predetermined threshold level, will turn off the vehicle and/or trigger an additional vibratory or sound device to wake up the otherwise drowsy individual.

United States Patent No. 6,147,612 to Ruan et al teaches a duel function optic sleep prevention device to prevent drivers of vehicles from falling asleep behind the wheel comprising a micro-optic eyelid monitor, a micro-optic tilting monitor, a signal combination circuits and an alarming unit. The eyelid monitor is placed in the vicinity of an eye by an appropriate mounting device when in use, using a emitter to transmit modulated appropriate light signals towards the eye, and using optic sensors to sense the influenced light by the eyelid, to detect the movement of eyelid. The tilting monitor comprises an optic tilt switch set on the side head of a user, using a micro- optic monitor to detect a small ball's rolling in a closed tube system inside the switch when tilting. Both the monitors are connected to a signal combination circuits, which has an input signal filtering device, a switch part and a counter. The filtering device sets an appropriate time delay range to pick up dangerous long symptoms, base on signal length and the difference between a monitor signal's appearing time and another monitor's. The counter circuits records the times of those signals' occurrence. When finding such a symptom, the combination circuits will stimulate a pre-alarming immediately to detect the sleepy state of a user. A fully alarming will follow if the user has no response after a limited waiting time, or if the times of repeating pre-alarming reaches a criteria value set in the counter.

U.S. Patent No. 6,154,123 to Kleinberg teaches a driver alertness monitoring system. A driver alertness monitoring system for motor vehicles which issues visual or audible signals to the driver, and which monitors visual, audible or mechanical responses received from the driver to determine driver alertness. An electronic control unit, preferably incorporated in the circuitry of existent vehicle safety systems, controls the activation of these visual or audible signals and determines appropriate actions based on the response of the driver. The system includes auxiliary sensors which can be used to control and modify the function of the system to reduce unnecessary activation.

United States Patent No. 6,734,799 to Munch describes an apparatus that monitors the health and fitness of a motor vehicle driver comprising a number of sensor means, communicating means, transmitting means and responder means operatively connected in tandem for reporting a health factor or condition of an individual outside of the norm and means for responding thereto. The apparatus may also be connected to the drive mechanism of the vehicle so as to be able to shut it off if exigent circumstances require.

U.S. Patent No. 5,807,267 to Bryars et al discloses a pulse rate monitor for sensing a pulse wave produced at an arterial pulse source of the wearer. Piezo pressure sensors or optical sensors outside the surface of the skin produce an electrical signal upon detecting the presence of a pulse in the artery. When using the piezo sensors, a second (background) sensor is employed. Signals from this background sensor are digitally subtracted from the primary pulse sensor thus significantly reducing the effects of body motion signals. Optical sensor configurations typically use only a single sensor. Signals from the sensors are amplified and passed through appropriate filters to reduce the bandwidth of the input circuitry to pass only the signals of interest. The filtered signals

are converted to digital signals in a microprocessor. These signals are then digitally processed to produce an output on the display in pulses per minute. The unit may be worn in the same manner as a wrist watch and powered from a small battery. Some embodiments of this device may have all the time keeping capability of a digital wrist watch.

Finally, U.S. Patent No. 5,846,206 to Boder discloses an claims a device for monitoring and estimating a person's wakefulness comprised of a stationary pressure sensor that contacts part of that person's body and generates a signal corresponding to that person's body movements relative to the sensor. A detector/filter circuit connected to the sensor separates signals corresponding to true body movements, heartbeat-related body movements, and respiration-related body movements. Calculation and comparison circuits are adapted to receive these signals and compare them with previously received signals to determine possible changes. A correlator correlates the output signals from the calculation and comparison circuits to produce a resulting change signal which is compared with a preset wakefulness threshold in a threshold detector circuit. An alarm device is triggered, when the preset threshold is reached as an indication of a reduced degree of wakefulness.

None of the above-described inventions are compact in size and exist as a self-contained unit designed to be worn on the body of the driver for the detection and measurement of the drivers' heart rate and pulse. None of the aforementioned devices are designed to be comfortably worn on the drivers' body for the immediate detection and response to a decrease in the wearers pulse and/or heart rate which is coincidental with the onset of drowsiness of an individual behind the wheel. None of the previous devices

are able to respond immediately, waking the driver from an onset of sleep prior to the onset of stage/sleep thereby preventing accident, injury and possibly catastrophic consequences.

Summary of the Invention

The present invention comprises a device for monitoring an individuals' pulse rate who is driving a motor vehicle, boat or operating machinery. The device is designed to detect a reduction in the wearers' pulse or blood pressure that indicates the wearer is becoming drowsy and not alert, thereby risking serious bodily injury if not pulled over. The device itself is comprised of a housing or casing, one or more sensor pulse rate monitors contained therein, a control processing unit for translation and an activation of a kinetic energy enhancer that provides stimulation to the wearer/operator for the prevention of drowsiness.

Detailed Description of the Invention

Whereas the present invention is a device and method for the prevention of drowsiness/sleepiness in an individual operating machinery, the device itself may exist in a number of different embodiments, all of which are essentially comprised of one or more heart rate or pulse sensors which detect set threshold decrease in the heart rate or pulse and respond thereto to firing an electric signal to a warning device which produces a noise or vibration to alert the wearer to his state of drowsiness and prevent further lapse into unconsciousness.

The one or more sensor means measure the drop or decrease in the heart rate or pulse of the wearer which occurs when drowsiness, sleepiness or narcolepsy sets in after many hours of a tedious activity such as long distance driving or the operation of heavy

machinery for long periods of time. The sensor means monitor the heart pulses or beats of the user and produces an electrical signal if a pulse is detected below the rate of a pre-determined value indicating the onset of somnolence. Said pre-determined value is set according to what a normal pulse or heart rate would be for an individual of the operator's height and weight in the awake non-exercised state. For example, arousal heart pulse ranges generally from 65-75 beats/minute in the resting state. The one or more sensor means detects a change in the heart rate and produces a varying electrical sensor signal that is capable of accurate measurement and the production of these electrical sensor signals which will be picked up and translated by a central processing unit (CPU) which, in turn, triggers a vibratory or sound actuator thereby awaking the operator who had been succumbing to the drowsiness or narcolepsy.

In one embodiment of the present invention, the sensors are simultaneously contained within a small housing unit or cover which can be attached anywhere on the body wherein the wearers pulse is detectable. Preferably, the heart pulse monitor is attached to the operators' chest so that the sensors are in contact with the skin somewhere in the vicinity of the heart. The sensor(s) may be comprised of any one of the well known pressure sensors known in the art which sense the pulse wave transmitted from the heart through the arteries. One such known sensor is disclosed in United States Patent No. 3,838,684 to Manuel et. al. which is hereby incorporated by reference. The central processing or computer unit (CPU) is connected to an alarm-generating or physico-stimulation unit which may be comprised of several different types of alarm-generating devices. For example, the unit can comprise a siren, bell or horn-sounding device, a light-emitting device, a vibrator and the like. If the alarm unit is connected to a vibrator, the

vibrating unit can be placed in the car seat or elsewhere on the drivers' body. The object of the alarm unit is to indicate to the driver that he/she is falling asleep and at risk of having an accident. The audio/vibrator stimulation unit is then activated and is amplified to a degree that prevents the driver from falling asleep which could otherwise have serious and dire consequences. The alarm/actuator system could also conceivably be set up so as to turn off the motor vehicle if necessary.

If the drivers' state of consciousness or concentration decreases due to fatigue or monotony caused by long distance motor vehicle operation, the system may also be calibrated to calculate and deduce an appropriate point at which the driver should be alerted. The appropriate point may be determined from a combination of pre-calibrated data for a specific driver and/or pre-programmed patterns, states or trends in the data including relative and absolute pressure values obtained from a set or subset of the alertness devices' sensors.

As discussed previously, the anti-snooze or alertness device of the present invention is comprised of a number of sensors strategically positioned at a point on the drivers' body wherein the drivers' heart rate is readily measureable. This would particularly include the extremities such as the neck and legs, the torso over the heart and the wrists. The sensors are connected to central processing or computer unit (CPU) which functions as a acquisition and processing apparatus which further functions as a monitoring means designed to amplify, filter and convert (digital to analog) the drivers' heart rate signals from the sensors to a form that actuates the waking means (sound, vibration, mild electricity, etc.). This may also include a calibration algorithm and a drowsiness detection algorithm for heightened sensitivity. This will allow the device to

detect not only reduced heart rate as an indicator of drowsiness but the onset of a more relaxed body state as well.

The heart pulse monitor drowsiness detector device may also preferably take the form of a wrist watch as the sensors may detect the pulse at the underside of the wrist. In this embodiment, the heart rate monitor is comprised of a casing in the general form of a wrist watch which has the sensor(s) located in the backing that, when wornabuts up against the veins of the underside of the wrist. The "watch" measures and presents the heart rate in digital form on a display unit in the front face of the "watch" and has a suitable strap attached to diametrically opposite sides of the watch to secure and hold the casing to the wrist of the user/operator with the sensor located in its' correct position. The strap may be comprised of any conventional, suitable material known in the art but preferably is formed from an elastic such as rubber so that the back panel containing the sensor(s) can be tightly secured to the wrist for the best accuracy of the read-out results and so that it can remain securely in position despite and movement of the operators' arm.

The watch casing then comprises the sensor(s) embedded in the back of the casin which are coupled to a transducer which transforms each of the detected heart beat pulses in an electrical signal and a CPU for detecting and analyzing said signals when they fall below a pre-determined rate for drowsiness. This in turn activates an actuator that is located either within the casing or detachably connected outside thereto that then provides stimulation either in the form of sound, physical vibration or mild electric shock of a sufficient degree to alert the driver/operator out of his/her oncoming slumber. This

would generally occur whenever the pulse rate drops a significant degree below about 72 heart beats per minute.

The present invention then, comprises one or more heart pulse rate sensors for attachment to an individuals' body at an appropriate, specified location so that the pulse rate is detected by the sensors. Preferably, the sensors are comprised of one or more piezo-electric sensor devices which detect the pulse and convert it to an electrical signal which is transmitted to a central process unit (CPU). Here the pulse rate is converted to electrical signals which activates an actuator amplifier which converts said electrical signals to electrical, audio (sound) or vibrating stimulation.

Since the housing means which contains the three sensor device elements, i.e. the pulse rate sensors, the central processor unit (CPU) and the actuator amplifier unit is attached to a specified location on the operators body, detection of a drop in the pulse rate of an individual is immediately detected, and the pulse rate analyzed by the CPU, with the electrical signals instantly transmitted thereby activating the actuator amplifier which then emits an audio, electrical or vibratory emission which wakens the operator from the oncoming drowsiness.

What I claim is:

1. A pulse rate sensor device for the detection of drowsiness in an individual operating machinery and a means for the prevention thereof once detected comprising:
   a) one or more pulse rate sensors in contact with said individual at a specified location on the individuals' body capable of producing a varying electrical sensor signal representative of the individuals pulse rate;
   b) a central processing unit for the detection of changes in pulse readings by said pulse rate sensors and the conversion of said pulse readings to electrical impulses for transmission; and
   c) an actuator means for receiving and translating said electrical impulses into electrical, audio (sound) or vibrating stimulation which is passed back to the wearer at a frequency sufficient to startle the operator from said drowsiness.
2. The pulse rate sensor device of claim 1 wherein pulse rate monitors detect a decrease in the heart pulse rate when the individual begins to become drowsy.
3. The pulse rate sensor device of claim 2 wherein said pulse rate sensors, central processing unit and actuator amplifier means are all contained within a one (1) piece housing attachable to an individual operators' body.
4. The pulse rate sensor device of claim 3 wherein said housing comprise a wrist watch.
5. The pulse rate sensor device of claim 3 wherein said sensor means comprise piezo-electric sensor means.
6. A method for the prevention of sleepiness or drowsiness in an individual operating an automobile or some other type of heavy machinery comprising:

a) detecting a change or reduction in the heart rate or pulse of the operator

b) converting that change to an electrical signal in a central processing unit

c) transmitting that electrical signal to an actuator amplifier for the conversion of said signal to electrical, audio or vibratory stimuli

d) contracting the operator with said stimuli so as to awaken the operator from said drowsiness.

d) index of watch

1.) watch

2.) face of watch

3.) dial setting for pulse

4.) pulse, push on-pull off

5.) push for buzzer –pull for off

6.) push for vibration pull for off

7.) watch band

8.) wrist

9.) back of watch

10.) perforated holes to pick up pulse

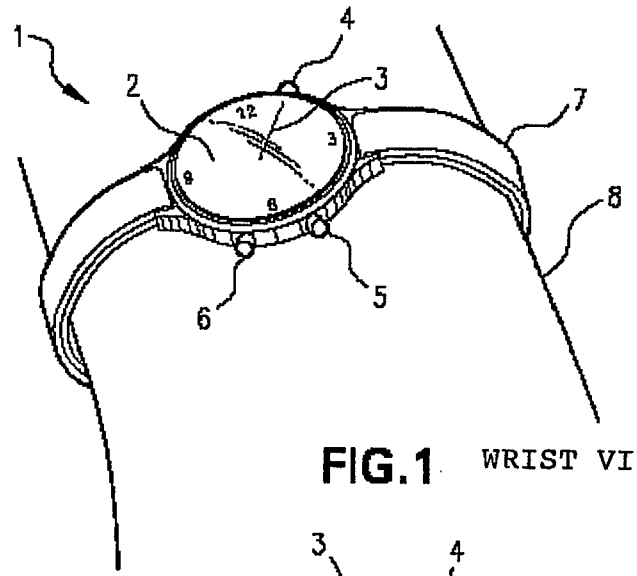

FIG.1 WRIST VIEW

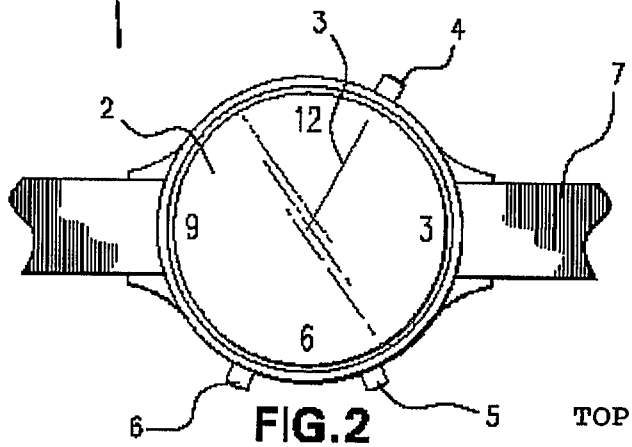

FIG.2 TOP VIEW

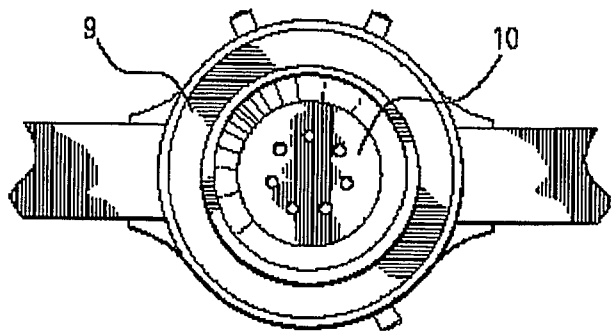

FIG.3 BOTTOM VIEW