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SLEEP INHIBITOR FOR AUTOMOBILE DRIVERS

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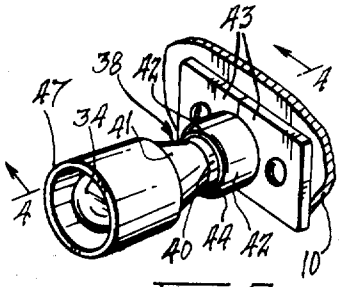


Fig. 3.

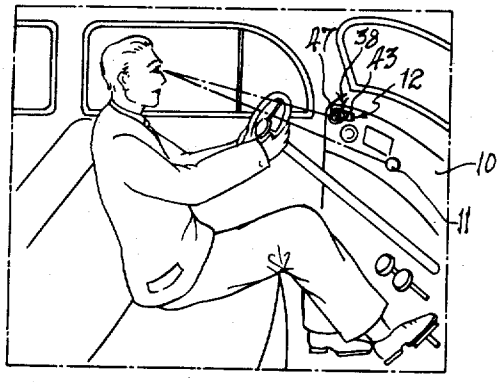


Fig. 1.

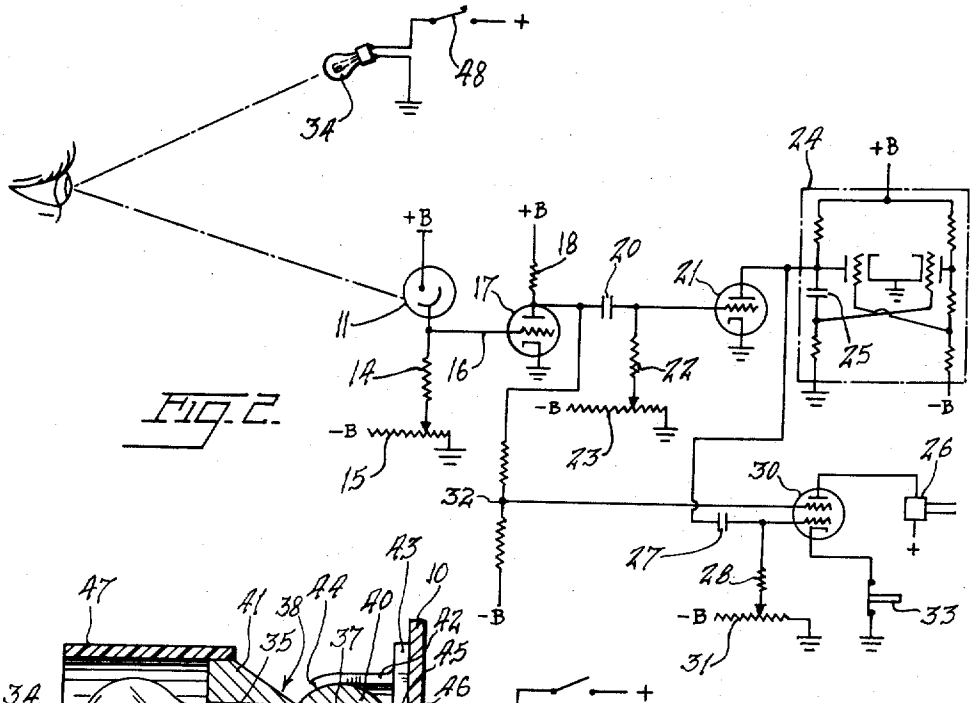


Fig. 2.

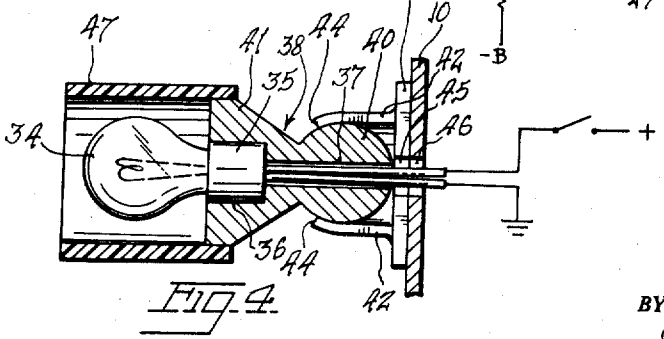


Fig. 4.

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SLEEP INHIBITOR FOR AUTOMOBILE DRIVERS

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12 Claims. (Cl. 340—279)

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

This invention relates to a device for preventing accidents due to drivers falling asleep at the controls of their motor vehicles because of fatigue.

Severe accidents and death are commonplace which are caused by overtiredness of motor vehicle drivers. Generally, the overtiredness cause the driver to close his eyes and perhaps to nap momentarily. During this period the vehicle which he is driving strays from the proper path with disastrous results. It has been found that this type of accident is also caused in an increasing number of instances by drowsiness brought on by boredom. This boredom is occasioned by the uninterrupted flow of traffic and the relatively unchanging scenery which is associated with modern high speed parkways and turnpikes.

Prior art devices have been proposed to alarm a driver as soon as he begins to drowse. However, these types have for one reason and another failed to prove sufficiently satisfactory to gain wide usage. One class of prior art devices, for example, depends for operation upon the driver's head slumping down substantially from its normal position as he drowses. However, in many instances, the head does not slump substantially until the driver is completely asleep, by which time his vehicle may have already strayed into an oncoming lane of traffic or off the road entirely.

The principal object of the invention, therefore, is the provision of means for alerting the motor vehicle driver whenever [be] *he* begins to drowse, which overcomes the disadvantages of prior art devices.

Another object of the invention is to construct the alerting means in such manner that it is adjustable to compensate for differences in the positions of the heads of drivers both vertically and laterally.

For further comprehension of the invention, and of the objects and advantages thereof, reference will be had to the following description and accompanying drawings, and to the appended claims in which the various novel features of the invention are more particularly set forth.

In the accompanying drawings forming a material part of this disclosure:

Fig. 1 is a partially diagrammatic side elevational view of the driver's compartment of a motor vehicle, illustrating a sample embodiment of the means of the invention.

Fig. 2 is a wiring diagram of the means of the invention.

Fig. 3 is an enlarged fragmentary perspective view of a portion of the means of the invention shown in Fig. 1.

Fig. 4 is an enlarged sectional view on line 4—4 of Fig. 3.

Referring to Fig. 1 the reference numeral **10** designates the dashboard of a motor vehicle in which is mounted a photocell **11** which may be of any suitable type, as will be more fully described hereinafter. Preferably the

photocell **11** is mounted in the dashboard to the right of the driver of the vehicle so that light beams projected from a source **12** located to the left of the driver and reflected from either or both of his eyeballs will impinge upon it. As shown, the source **12** may be mounted on the dashboard at the left of the driver. The source may be of any suitable sort but preferably it is of a type which produces a high concentration of radiation of the type most compatible with the selected photocell. Also, the photocell *or receiver* may, if desired, be replaced by any other light sensitive means either electrical, mechanical or chemical. *In fact, it will be observed that the system is typified by the provision of a source of radiated energy and means to convert such radiated energy into a useful signal.*

Referring now to Fig. 2 it will be seen that the anode of photocell **11** is connected to a source of positive potential designated +B. The cathode of the photocell is connected through a large resistor **14** to a source of biasing potential, preferably, to the tap of a potentiometer **15** connected between ground and a source of negative potential, designated —B. An output line **16** extended from the cathode of the photocell is directly coupled to the grid of a triode **17** having its cathode grounded and its anode connected through a resistor **18** to the +B source. The anode of triode **17** is coupled through a condenser **20** to the grid of a triode **21**. This grid is also connected through a resistor **22** to a source of biasing potential, preferably the tap of a potentiometer **23** connected between ground and the —B source. The cathode of triode **21** is grounded and its anode is directly coupled to the anode of the normally nonconducting tube of a one shot multi-vibrator **24** of familiar design.

The operation of the means of the invention thus far described is as follows: While the driver of the vehicle is awake, light from the source **12** reflects from either or both of his eyeballs and impinges on photocell **11**. Under these conditions output line **16** of the photocell is at a relatively high potential which maintains triode **17** in the conducting state. As soon as the driver's eye closes or otherwise stops reflecting the light of the photocell, as, for example, when the eye is moved some distance out of its normal position, the potential on output line **16** drops significantly and cuts off triode **17**. This effects a rise in potential at the anode of the triode and the differentiator circuit comprising condenser **20** and resistor **22** delivers a single, sharp, positively directed pulse to triode **21**. This pulse upsets the normal nonconducting state of this triode and effects momentary conduction thereof. As a result, the multivibrator **24** is triggered and changes state for a period of time determined by the magnitude of the condenser **25** which couples the anode of the normally cutoff tube thereof to the grid of the other tube in the usual manner. When the condenser **25** discharges, the multivibrator resumes its normal state.

At this point it is deemed desirable to point out that the potentiometers **15** and **23** may be adjusted to provide optimum results in properly controlling the photocell, particularly where the ambient light is relatively high with respect to the control radiation.

In order to alert the driver of the vehicle whenever light from the source **12** fails to impinge on the photocell **11** for an appreciable predetermined length of time which is chosen to take into account the normal movements of a driver's head and other normal functions such as blinking and the like, the condenser **25** of the multivibrator is so selected as to provide a relatively long time constant, say one-half second. *The function of the multivibrator and associated circuitry, as will be clear, is to provide an appropriate signal when the radiated energy is cut off from the receiver for a predetermined period of time. This*

function may be performed by other apparatus is desired. The actual alerting of the driver may be performed by any suitable alarm means, for example, an electrical horn **26** *in response to the signal.*

According to the invention, the horn **26** is sounded whenever the triode **17** remains in the cutoff state due to failure of light from the source **12** to impinge on the photocell, for a period of time greater than that for which the multivibrator is in its upset state; that is, when the triode **17** is still cut off after the multivibrator has been restored to its normal state. To this end the anode of the normally cutoff tube of the vibrator is coupled through a differentiator circuit comprising a condenser **27** and a resistor **28** to the control grid of a thyratron of the type **2D21**. The resistor **28** is connected to a source of bias, preferably the tap of a potentiometer **31** connected between ground and the —B source. The second grid of the thyratron is connected through a voltage divider **32** to the anode of the triode **17**. Preferably the divider **32** is also connected to the —B source so as to provide potentials suitable to maintain the thyratron cutoff when the triode **17** is conducting and to allow conduction of the thyratron when the triode **17** is cut off.

The arrangement is such that when triode **17** is cut off under control of photocell **11** is applies a relatively high potential to the second grid of thyratron **30** to condition the latter for conduction. However, the bias applied to its control grid through resistor **28** maintains the thyratron cutoff. Later, when the multivibrator is restored to its normal state the anode of its normally nonconductive tube assumes a high potential which is applied to the differentiator **27, 28**. The latter applies a sharp positively directed pulse to the control grid of the thyratron which fires and sounds horn **26**. In the usual manner the thyratron remains in the conductive state until outside intervention breaks its cathode, anode path. In the instant embodiment of the invention the cathode of the thyratron is returned to ground through a switch **33** which the operator of the vehicle would open after having been alerted.

In order to adapt the means of the invention to drivers of various heights sitting in various lateral positions, the source of light **12** is constructed as shown in Figs. 3 and 4. As indicated, the source comprises an electric lamp **34** mounted in an insulated socket **35** secured to dashboard **10** by a suitable ball and socket joint. Socket **35** is fixed in a counterbore **36** of a bore **37** extending through a member **38** which comprises the ball **40** of a ball and socket joint and an integral, flaring extension **41** of the ball. As shown the ball is rotatively mounted in a split comprising opposed semi-cylindrical socket pieces **42** welded or otherwise secured to base plate **43**. The free ends of the pieces **42** are curved inwardly to embrace the ball as indicated at **44**. Referring particularly to Fig. 3, the base plates **43** are secured to dashboard **10** with their adjacent edges and those of the socket pieces **42** abutting one another, thus the socket pieces **42** form a suitable socket for the ball **40**.

As best shown in Fig. 4 the base plates **43** are provided with matched semicircular holes **45** communicating with the bore **37** and through which the wires for socket **35** are led. A matching hole **46** is also provided in dashboard **10**. The size of the holes **45** is selected to permit free access to the bore **37** throughout the range of movement of the ball permitted by the flare **41** and the inwardly curved ends of the socket.

Preferably a cylindrical shield **47** is provided for lamp **34**, being secured on the end of flare **41**. Shield **47** serves to prevent the rays of lap **34** from radiating in any direction other than toward a driver's eyes as determined by the positioning of the ball and, therefore, the shield.

As shown in Figs 2 and 4, the circuit for lamp **34** extends from ground through the lamp and a suitable switch **48** to positive supply.

It is to be mentioned that if the described delay between interruption of the beam to photocell **11** and operation of horn **26** is not desired, the horn may be driven by a second triode like the triode **17** and driven thereby.

While we have illustrated and described the preferred embodiment of our invention, it is to be understood that we do not limit ourselves to the precise construction herein disclosed and that various changes and modifications may be made within the scope of the invention as defined in the appended claims.

Having thus described our invention, what we claim as new, and desire to secure by United States Letters Patent is:

1. In an automotive vehicle the combination of a source of light, a photocell adapted to be controlled by light from said source, the positions of the source and the cell relative to the driver of the vehicle being such that the light is reflected from the former to the latter by an eye of the driver, and a one-shot multivibrator having a predetermined time controlled condenser actuated by said photocell on interruption of the light reflected thereto from the source, and an alarm actuated by said multivibrator.

2. The invention according to claim 1 and including a control circuit actuated by the photocell to energize said alarm comprising a normally conducting triode cutoff on interruption of light to the photocell, a second normally nonconducting triode, a differentiator connecting the first triode to the second to effect conduction of the latter on cutoff of the former, said one shot multivibrator being triggered on conduction of the second triode and thyratron controlled jointly by the first triode and the multivibrator to fire only when the triode remains cut off after the multivibrator returns to normal after having been triggered.

3. The combination according to claim 2 and including a differentiator connected between the multivibrator and the thyratron to effect firing of the latter as the multivibrator is restored to normal.

4. The combination according to claim 3 wherein the alarm is connected in the anode circuit of the thyratron and including a switch in the anode-cathode current path of the thyratron to extinguish the latter.

5. In an automotive vehicle the combination of a source of light, a photocell adapted to be controlled by light from said source, the positions of the source and the cell relative to the driver of the vehicle being such that the light is reflected from the former to the latter by an eye of the driver, a one-shot multivibrator having a predetermined time controlled condenser actuated on interruption of the reflected light to the photocell, an alarm actuated by said multivibrator, said light source being adjustably mounted to direct its beam differentially to compensate for varying heights of drivers and for varying lateral positions of drivers.

6. The combination according to claim 5 and including a control circuit actuated by the photocell to energize said alarm comprising a normally conducting triode cutoff on interruption of light to the photocell, a second normally nonconducting triode, a differentiator connecting the first triode to the second to effect conduction of the latter on cutoff of the former, said one shot multivibrator being triggered on conduction of the second triode and a thyratron controlled jointly by the first triode and the multivibrator to fire only when the triode remains cut off after the multivibrator returns to normal after having been triggered.

7. The combination according to claim 6 and including a differentiator connected between the multivibrator and the thyratron to effect firing of the latter as the multivibrator is restored to normal.

8. The combination according to claim 7 wherein the alarm is connected in the anode circuit of the thyratron and including a switch in the anode-cathode current path of the thyratron to extinguish the latter.

9. The combination according to claim 8 wherein the light source includes an electric lamp, and wherein the

mounting therefor includes a socket therefor, a ball and socket joint adjustably mounting said socket, and a shield for directing radiation from the lamp to the driver's eyes.

10. In an automotive vehicle the combination of a source of light, a photocell adapted to be controlled by light from said source, the positions of the source and the cell relative to the driver of the vehicle being such that the light is reflected from the former to the latter by an eye of the driver, and a one-shot multivibrator having a predetermined time controlled condenser actuated by said photocell on interruption of the light reflected thereto from the source, and an alarm actuated by said multivibrator, the said source of light being adjustable to compensate for differences in the positions of drivers' eyes.

11. A vehicle alarm comprising a source of radiation energy, a receiver adapted for being controlled by the radiated energy, the positions of said source and said receiver being such that the energy is reflected from said source by the eye of the driver of the vehicle to said receiver, an alarm, and means coupling said receiver to said alarm and actuating said alarm in response to interruption of the reflection of energy to said receiver for a predetermined period of time.

12. A vehicle mechanism comprising a source of radiation energy, a receiver adapted for being controlled by the radiated energy, the position of said source and said receiver being such that the energy is reflected from said source by the eye of the driver of the vehicle to said receiver, utilization means, and means coupling the said receiver to said utilization means and actuating said utilization means in response to interruption of the reflection of energy to said receiver for a predetermined period of time.

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