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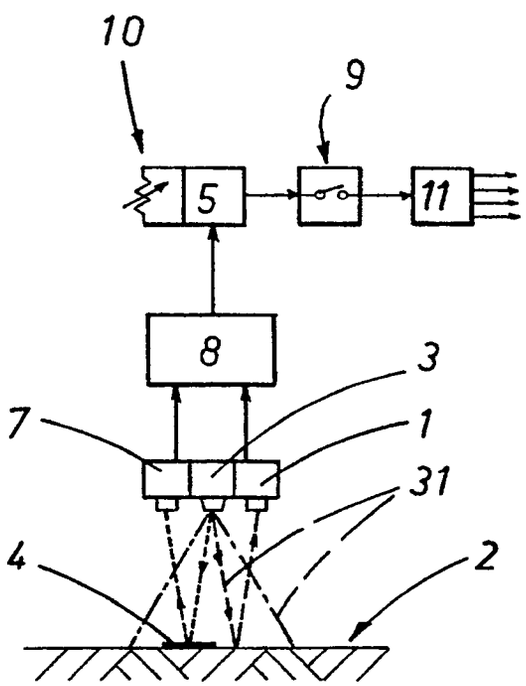
(54) An improved electronic safety device for trucks.

(57) The device utilizes two sensors (1, 7) of identical specification, and a light source (3), all of which mounted to a single bracket and directed at the road surface (2) in such a way that the beam from the source is reflected back at the sensors; the sensors are wired into a comparator (8) of which the output signal is used to pilot the activation of an alarm (6), and becomes operative whenever the signals from the two sensors become dissimilar by reason of the different luminous intensities and/or wavelengths in the beam when reflected in part by the natural road surface (2), and in part by the white or yellow lines (4) bordering a traffic lane or a hard shoulder.

FIG 1



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The present invention relates to an improved electronic safety device for trucks. Practically no commercial vehicles currently in circulation are equipped with any system capable of warning when the vehicle begins to stray from its traffic lane.

This is a shortcoming experienced in particular by the drivers of heavy goods vehicles, who must travel in all weathers and at any time of day or night, even in conditions of poor visibility (fog, rain etc.), and often find themselves operating in considerable discomfort and danger; added to such environmental factors are the potential risks of drowsiness or distraction to which the drivers of such vehicles are inevitably subject, and the consequent possibility that the vehicle may veer off the road, or at least wander out of its lane. In a bid to overcome such negative factors, the applicant has set forth an electronic safety device (disclosed in Italian patent 1,209,078) consisting in a sensor fitted to one or both sides of a truck, directed onto the road surface and serving to transduce a light input into an electrical signal that is a function of the intensity of the light source.

The electrical signal from the sensor is fed into a monitoring circuit of which the respective output signal becomes significant only when the sensor is exposed to an intensity of light equivalent, for example, to the yellow lines which border the hard shoulders of Italian motorways; the monitoring circuit is connected to an alarm circuit by which the driver is warned whenever the sensor produces an activating signal, i.e. whenever the vehicle encroaches on the yellow line.

The device in question betrays certain drawbacks in operation, however. To ensure efficient response of the sensor, the driver has continually to adjust the beam of light that provides the luminous input; in effect, an inappropriately adjusted source can render operation of the device ineffective during daylight or night hours (depending upon the last adjustment effected), and even to a false warning signal being triggered by traffic markings painted on the road surface.

Accordingly, the object of the present invention is to overcome the drawbacks outlined above through the embodiment of an improved electronic safety device which exploits the various features of the arrangement described above, while giving greater precision in sensing the light input and a more reliable adjustment of the output signal.

The stated object is realized in an electronic safety device as characterized in the appended claims, which comprises a first sensor directed at the road surface, and a second sensor located in close proximity to and having the same technical and operating specifications as the first sensor and directed likewise at the road surface; the two sensors are connected to the inputs of a single comparator circuit, of which the output signal serves to activate an alarm circuit each time the sensors generate respective and dissimilar signals in response to different luminous intensities and/or wavelengths in a beam of light projected toward and reflected onto the sensors simultaneously from two different heterochromatic areas of the road surface corresponding respectively to the bare surfacing material and to a white or yellow line, or other specific traffic markings.

The invention will now be described in detail, by way of example, with the aid of the accompanying drawings, in which:

- fig 1 is a block diagram of the electronic safety device disclosed;
- figs 2a and 2b are schematic front elevations illustrating a part of the device in two different configurations, one active and the other inactive;
- fig 3 illustrates a road vehicle, in perspective, fitted with the electronic device according to the invention;
- fig 4 illustrates a possible embodiment of the electronic device disclosed, viewed in elevation;
- fig 5 shows the essential parts of the electronic device of fig 4, exploded and in perspective. As illustrated in the accompanying drawings, an electronic safety device according to the present invention comprises a first sensor 1, consisting for example in a photoconductive cell, positioned on one or both sides of a motor vehicle 9 (fig 3) and directed at the road surface 2 (figs 1...3) on which the vehicle stands.

3 denotes a light source located alongside and within the operating field of the first sensor 1, also directed at the road surface 2.

The first sensor 1 is invested by a beam emitted from the light source 3 and reflected off the road surface 2, which it transduces into an electrical signal that is a function of the luminous intensity or wavelength of the light input, these parameters in turn being influenced by the presence of a white or yellow line 4 or other specific traffic markings applied to the road surface 2. The signal from the first sensor 1 provides the input to a monitoring circuit 5, of which the output furnishes a signal capable of activating an alarm circuit 6 whenever the beam from the light source is reflected from the lines 4 or other road markings.

In the improved device according to the invention, use is made of a second sensor 7 positioned in close proximity to and having the same technical and operating specifications as the first sensor 1; the second sensor 7 is also directed at the road surface 2, needless to say.

As may be observed from figs 1, 2, 4 and 5, the sensors 1 and 7 are positioned one on either side of the light source 3, parallel one with the other, and connected one to each input of a comparator circuit 8 of which the output pilots the operation of the alarm circuit 6.

The comparator circuit 8 might be an integrated circuit, for example, of which the inputs are in receipt of the signals from the first and second sensors 1 and 7; more exactly, the comparator 8 is located between the two sensors 1 and 7 on the one hand, and the monitoring circuit 5 by which the alarm circuit 6 is activated, as aforementioned, on the other.

Activation of the alarm circuit 6 occurs every time dissimilar output signals are emitted by the first sensor 1 and the second sensor 7 in response to different luminous intensities and/or wavelengths in the same reflected beam of light, to which both sensors are exposed; the difference in question is due to the fact that the beam is thrown at one and the same moment onto two dissimilar heterochromatic surfaces, corresponding respectively to the bare road surface 2, and to the white or yellow line 4 or other road marking applied to the surface (see fig 2a).

In short, the alarm circuit 6 is activated by the monitoring circuit 5 whenever a given part of the beam is reflected back onto the one sensor off the bare road surface 2, whilst the remaining part of the beam is reflected back onto the other sensor off a line 4 or other marking, given that it is a disparity between the two transduced signals that causes the comparator 8 to activate the monitoring circuit 5. Accordingly, as long as the position of the two sensors 1 and 7, hence of the vehicle 9, remains stably within the confines of the traffic lane or carriageway, such that a light of uniform intensity and/or wavelength is reflected back onto both of the sensors 1 and 7, then identical signals are returned to the comparator 8 and no activating signal will be received by the monitoring circuit 5 from the comparator (fig 2b). The advantage of such an arrangement is that, when the vehicle and the device pause or pass over road markings other than lane or carriageway lines 4, e.g. exit arrows or lines running across the carriageway, the output signals from the sensors 1 and 7 remain identical (both sensors exposed to light reflected from the arrow or the line), and the monitoring circuit 5 receives no signal from the comparator circuit 8 capable of activating the alarm circuit 6, which would serve only to disturb the driver in such a situation.

The preferred location of an electronic safety device according to the invention is illustrated in fig 3, which shows a truck 9 fitted with two such devices 100 positioned one at each end of the front bumper bar 14.

With reference to figs 4 and 5, which illustrate a preferred embodiment of the device, it will be observed that the sensors 1 and 7 and the light source 3, consisting in an electric lamp 15, are mounted to a hollow bracket 12 (shown to advantage in fig 5). The bracket 12 is embodied substantially as a cup with a peripheral flanged fixing lip 121, insertable into a sealed cover 20, and affords an external, essentially central socket (not visible in the drawings) for accommodation and retention of the lamp 15, to which electrical power is supplied by way of contacts 21 coinciding with the socket and passing through the bracket 12.

122 denotes a threaded outer boss afforded by the bracket in a position coaxial with the socket, onto which a collar 22 is screwed to retain the lamp 15. The collar 22 is also threaded externally, at least in part, to permit of attaching one threaded end of a sleeve 17 accommodating an optical assembly 13. More exactly, the space encompassed by the sleeve 17 accommodates a second sleeve 16 embodied in two matching halves 16a, 16b disposed on either side of a longitudinal median plane of the sleeve itself. The inner sleeve 16 is held internally of the outer sleeve 17 by a terminal annular lip not visible in the drawings, and affords three distinct annular grooves 161 at given points along its own length, as discernible in fig 5, in which to accommodate a pair of lenses 131, 132 constituting the optical assembly 13, and a protective glass 18. The lenses 131 and 132 are positioned nearer to the lamp 15, whilst the glass 18 (which in practice might be embodied in any suitable transparent material) is accommodated within and in sealed association with the groove 161 farthest from the lamp 15.

The bracket 12 further comprises two holes located one on either side of the contacts 21 by means of which to fix the sensors 1 and 7, which might be photoresistors or photodiodes, internally of two cylindrical tubes 23 extending parallel with and substantially equal in length to the sleeve 17, as discernible from fig 4.

The provision of the tubes 23 has the effect of exposing the sensors 1 and 7 only to the beam 31 radiating from the electric lamp 15, focused by the lenses 131 and 132 and reflected back off the road surface 2 or the line 4.

The bracket 12 is thus fixed to the underside of the front bumper bar 14 of the truck 9 in such a way as to dispose the sleeve 17 and the tubes 23 substantially vertical and aligned in a direction perpendicular to the path followed by the vehicle, hence to the line 4.

The device as illustrated in figs 1 to 3 can be completed (as shown in fig 4) by cascading the alarm circuit 6, or the monitoring circuit 5 (see phantom line), into a switch 19 and a timer 11. Thus, selected warning and/or safety systems of the vehicle 9 can be interlocked to the timer 11, and in the event that the switch 19 remains closed and a signal is emitted continuously from the output of the monitoring circuit 5 or the alarm circuit 6 for longer than a prescribed period, the systems in question will be triggered into operation. By way of example, systems interlocked to the timer 11 might be the hazard warning lights, the brakes and the ignition/fuel supply circuits of the vehicle 9, in such a way that operation of the timer 11 causes the hazard warning lights to flash, the brakes to be applied and

the engine to cut out.

The device according to the invention thus provides a highly effective and dependable safety mechanism, by virtue of using two sensors which, in practice, control one another; the use of two sensors also enables a better utilization of the device during daytime hours (i.e. in diffused light), without necessarily having to adjust the alarm setting. Such an adjustment can be made nonetheless, for example by way of a potentiometer 10 associated with the monitoring circuit 5, which permits of selecting the threshold above which the monitoring circuit 5, in receipt of an output signal from the comparator circuit 8, triggers the alarm circuit 6 into operation.

Claims

1) An improved electronic safety device for trucks comprising a first sensor (1) directed toward a road surface (2), a light source (3) positioned alongside the first sensor (1), directed likewise at the road surface and designed to emit a luminous signal that is reflected onto and transduced by the first sensor into an electrical signal dependent on the luminous intensity and/or wavelength of the reflected signal, which is dependent in turn upon the presence on the road surface (2) of a white or yellow line (4) or other specific traffic marking; and a monitoring circuit (5) of which the input is in receipt of the signal from the sensor and the output is used to activate an alarm circuit (6) whenever the luminous signal is reflected from the line (4) or other road marking,
characterized

- in that it further comprises a second sensor (7) located in close proximity to and possessing the same technical and operating specifications as the first sensor (1) and directed likewise at the road surface (2); and
- in that both sensors (1, 7) are connected to the inputs of a comparator circuit (8), of which the output signal activates the alarm circuit (6) each time the two electrical signals returned by the respective sensors become dissimilar by reason of different luminous intensities and/or wavelengths in the beam of light emitted from the source (3) and reflected from two different heterochromatic surfaces corresponding respectively to the bare road surface (2) and to a white or yellow line (4) or other specific traffic marking applied to the road surface.

2) An electronic device as in claim 1, wherein the first and second sensors (1, 7) are positioned one on each side of the light source (3) and disposed mutually parallel.

3) An electronic device as in claim 1, wherein the comparator circuit (8) consists in an integrated circuit of which the inputs are in receipt of the electrical signals from the first and the second sensor (1, 7).

4) An electronic device as in claim 1, wherein the comparator circuit (8) is located between the first and second sensors (1, 7) on the one hand, and on the other, the monitoring circuit (5) by which the alarm circuit (6) is activated.

5) An electronic device as in claim 1, wherein the output either of the monitoring circuit (5) or of the alarm circuit (6) is cascaded into a timer (11) of which the purpose is to trigger the operation of warning and/or safety systems of the truck (9) in the event of an alarm signal being emitted through the output of the monitoring circuit for a duration longer than a previously selected or predetermined limit.

6) An electronic device as in claim 1, wherein the first and second sensors (1, 7) and the light source (3) are mutually aligned in a direction transverse to the longitudinal axis of the truck, one sensor on each side of the source, and mounted thus to a hollow bracket (12) suitable for fitment to the bottom front part of a truck and carrying an optical assembly (13), secured to its underside in alignment with the light source (3), by means of which to focus the beam (31) of light emitted by the source.

7) An electronic device as in claim 6, wherein the first and second sensors (1, 7) are accommodated internally of respective tubes (23) secured to the bracket (12), in such a way as to remain exposed only to the beam (31) of light emitted from the source (3) and reflected from the road surface (2) or from a white or yellow line (4) or other marking applied to the surface.

FIG1

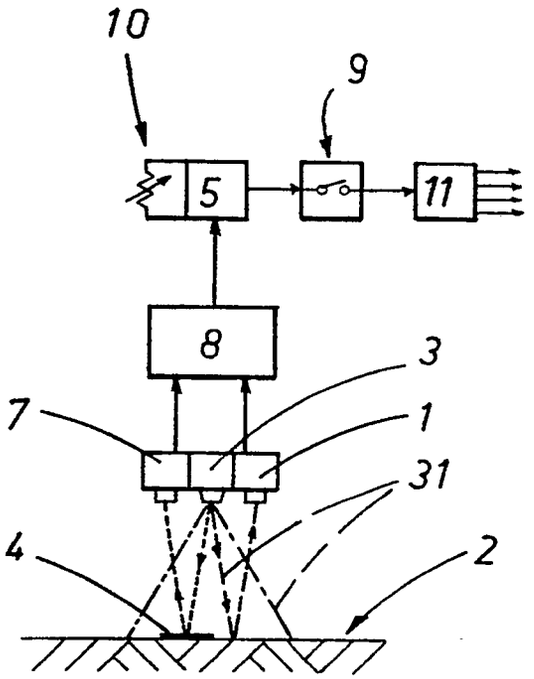

FIG2a

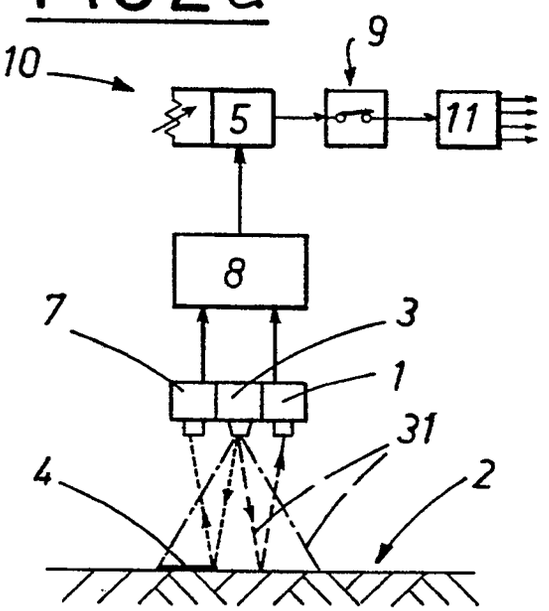

FIG2b

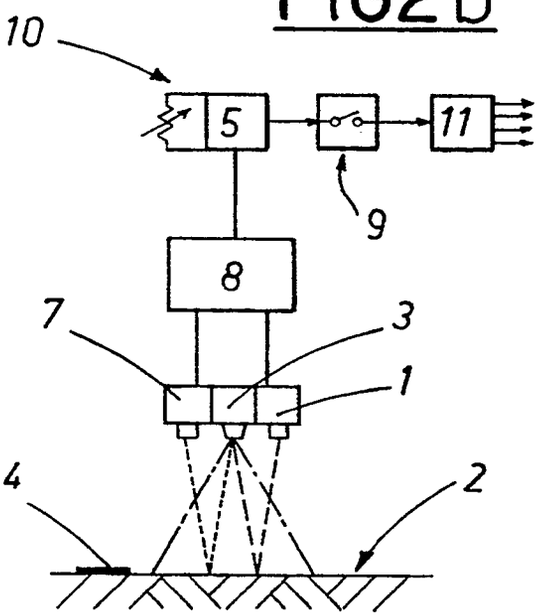

FIG4

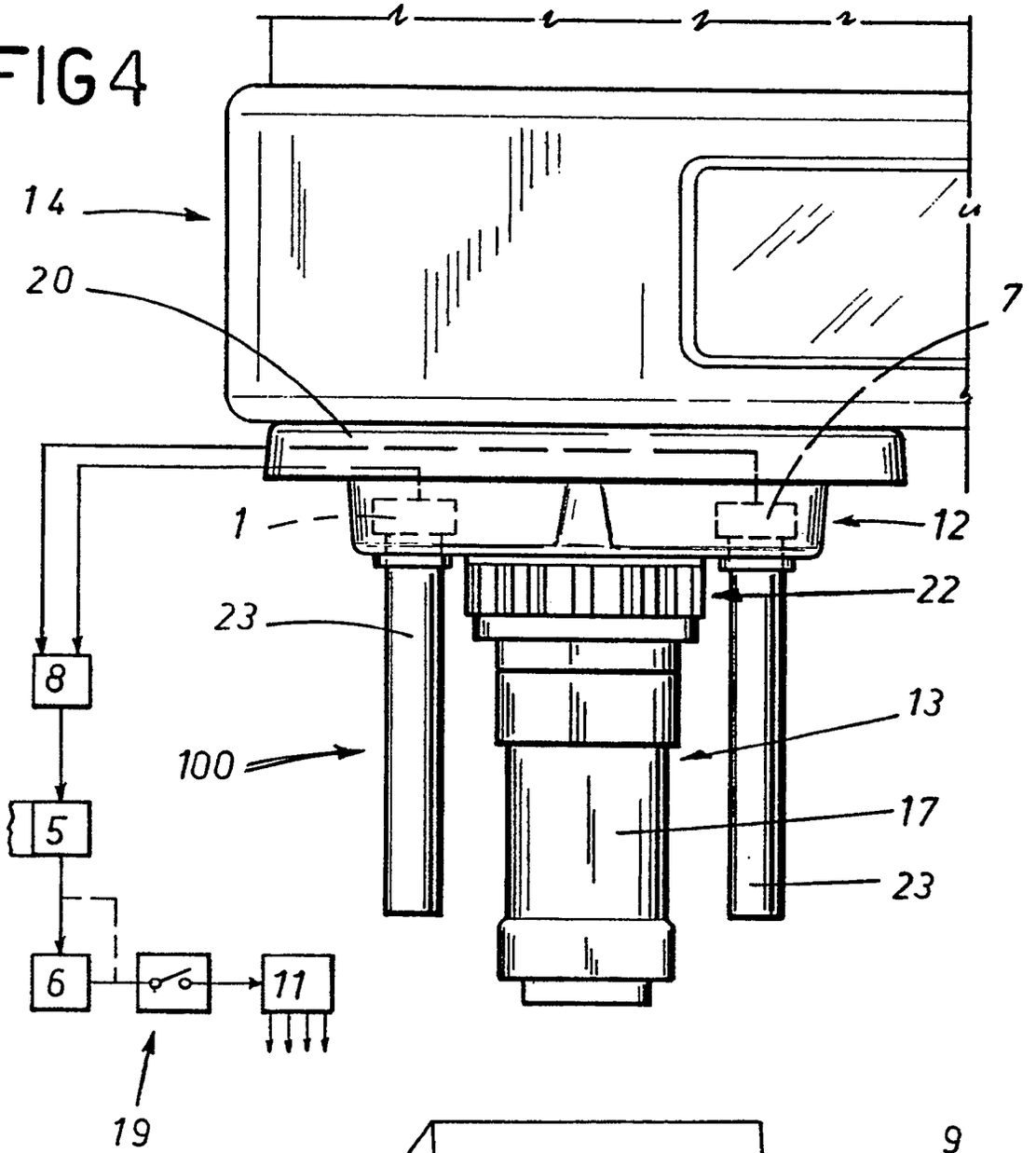

FIG3

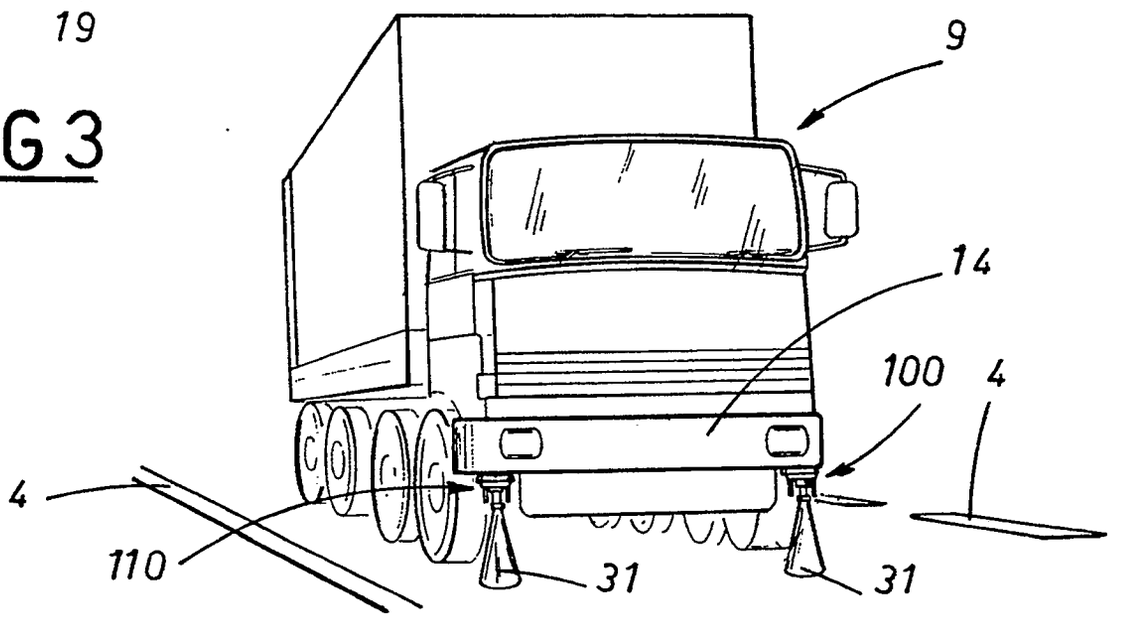

FIG 5