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SIGNALLING DEVICE FOR VEHICLES

The present invention relates to a signalling device for vehicles, comprising a tube having resilient walls, and detecting means arranged within the tube to detect the compression thereof.

5 When closing doors of buses and other common means of transportation dangerous situations arise when persons or objects remain between the closing door and the door frame while the driver is obstructed from seeing the doors. For this reason there has arisen a need to develop devices by
10 means of which a compression produced against the edge of a door in said dangerous situations can be reliably identified and a corresponding alarm given. In order to solve this problem devices have been constructed by means of which the compression or bending of a border rubber at
15 the edges of doors can be measured. Inside the border rubber is arranged, for example, a hose which is filled with air under pressure and to the end of which a pressure switch is connected. As the internal pressure in the hose exceeds a set limit value, the switch closes the circuit
20 for an alarm.

A device also previously known in which a wire is positioned inside the border rubber and a microswitch is connected to one of the ends of said wire. As the border rubber is compressed, the wire is bent whereby the
25 microswitch functions.

Each device suffers from the disadvantage that the smallest compression producing a signal varies according to ambient conditions and with time. In the case of a pressure hose, these variations are due, for example, to
30 temperature variations and a gradual leakage of air under pressure from the hose. The length of the wire is in a corresponding manner dependent on the temperature and/or humidity of the air, and the wire is gradually stretched. For these reasons, these known devices cannot be made very
35 sensitive so that the border rubbers must be considerably

compressed before the device gives an alarm. For the same reason, the devices also have a relatively short life. Another disadvantage associated with the wire construction is that it can be used only in straight border rubbers.

5 The object of the present invention is to provide a signalling device by means of which a sufficiently high sensitivity can be achieved to detect, for example, a compression of the border rubber corresponding to a person's wrist being caught because its operation is not
10 dependent on the ambient conditions.

 Accordingly, this invention provides a signalling device for vehicles, comprising a tube having resilient walls, and detecting means arranged within the tube to detect the compression thereof, which detecting means
15 comprises a light transmitter and a light receiver spaced apart within the tube, and circuit means associated with the light transmitter and with light receiver which circuit means is arranged to operate on the light receiver output to produce a signal when the compression of the tube
20 exceeds a given limit value, and is arranged to produce a compensating change in the intensity of the light emitted by the light transmitter a pre-determined period of time after a change in the intensity of light received by the light receiver is detected.

25 By using a light beam to detect compression and by including in the circuit means of the device compensation for long-term and/or slow changes taking place in the device due to ambient conditions or wear of the device, it is possible to make the device very sensitive because these
30 slow changes need not be taken into account when determining the limit value for the alarm. The device also has a long life because the changes in the properties due to time are compensated by increasing or reducing the light intensity of the light transmitter according to the
35 situation. In addition, it is obvious that the reflection of light from the inner surfaces of the border rubber

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permits the use of the device also in curved border rubbers. Due to the fact that the device can be adjusted to be very sensitive it has surprisingly been noted that the device, in addition to the above-mentioned application, 5 can also be used as a stop-signalling switch in buses whereby the signal is given by compressing the tube with a finger.

The use of a light beam in connection with signalling is known. In DOS 1,945,621 is described a device which 10 activates air cushions and comprises straight and rigid tubes which are fastened to the outer surface of a vehicle and which at their ends are provided with a light receiver and a transmitter and which activate the air cushions as they are compressed in a collision, because the light 15 connection between the light transmitter and receiver in such a case entirely and finally is broken. It is obvious that the rigidity of the tube prevents the use of this known device as a safety device in doors or as a stop-signalling switch. In time, dust and other corresponding 20 factors may, in addition, weaken the light intensity received by the receiver to such a degree that the air cushions are activated without the tube being compressed.

The signalling device according to the invention will be described in the following in more detail with reference 25 to the accompanying drawings, in which:

Figure 1 illustrates the operating principle of the device, Figure 2 is a block diagram of a D.C. coupling of the device, and

Figure 3 is a block diagram of a A.C. coupling of the device.

30 Figure 1 shows a door 1 of a vehicle. The vertical edge of the door is provided with a hollow border rubber tube 2 or any other corresponding resilient profile.

The tube may also comprise a profile which in cross-section corresponds to a section of the periphery of a 35 circle and which together with the door edge forms a closed space.

In the lower end of the inner space of the border rubber is arranged a light transmitter 3, such as a bulb, LED or similar, and the upper end of the space is provided with a light receiver 4, such as a light diode, transistor, resistor or similar.

The light transmitter 3 produces a light beam which passes in the inner space of the border rubber into the light receiver 4.

Figure 2 illustrates the block diagram of a D.C. coupling of the device. In accordance therewith, a current generator 5 is connected to the transmitter diode 3, while a PIN diode functioning as receiver is connected to a two-stage D.C. amplifier circuit 6 and 7. The output of the latter amplifier 7 is connected to two parallel comparators 8 and 9, of which the comparator 9 compares the signal coming from the amplifier 7 with a limit voltage U_{limit} . The comparator 9 is connected to an SR flip-flop 10 which is further connected to a relay 11 which releases an alarm.

According to the invention, the comparator 8 comparing with a reference voltage U_{ref} is connected to a delay circuit 12 which has a delay time of, for example, 10 s and which is connected to the current generator 5 via an automatic gain control (AGC) circuit 13. To said circuit 13 is, moreover, connected a third generator 14 which compares the signal of the circuit 13 with the limit voltage U_{limit} . The comparator is connected to a failure alarm device (not shown).

In operation, the current given by the current generator 5 determines the light intensity of the light transmitter 3. The current given by the diode 4 is amplified in the amplifiers 6, 7 and brought to the comparators 8, 9. The comparator 9 senses sudden changes in this signal exceeding the limit voltage and due to a sudden compression of the tube and sets the flip-flop 10 which further controls the relay 11.

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If the level of the signal from the amplifier 7 changes so slowly that U_{limit} is not exceeded within the time set in the delay circuit 12, no alarm is produced but the signal is in this case transferred from the delay circuit via the AGC circuit 13 to the current generator which is controlled so that it changes, for example, increases the light intensity of the transmitter 3 until the light intensity received by the receiver 4 is reset to the former level, at which moment the level of the signal received by the comparators 8, 9 is reset to the normal constant level. In this way, the device compensates slow changes which affect the intensity of the light beam and are caused by external factors, due to which the device can be made very sensitive. At the same time, an alarm produced by slow changes which in time may be quite sizeable is prevented.

However, if the signal level of the AGC circuit has changed, for example, increased to such an extent that it exceeds the limit voltage set in the comparator 14, a failure alarm is produced because the compensating capability of the device has then been exhausted.

The A.C. coupling shown in Figure 3 in principle operates in the same manner as the above described D.C. coupling. In this case, however, an oscillator 15 is connected to the current generator 5 so that the transmitter diode 3 is controlled in a pulse-like manner. In addition, the second D.C. amplifier 7 is replaced by an A.C. amplifier 16 which separates the background of the pulse-like signal from the D.C. component and after which a peak value indicator 17 is connected for indicating the signal. The peak value indicator is followed by similar comparator, delay and AGC circuits as in the D.C. coupling.

Due to the sensitivity of the above described principle, also other kinds of alarm and signalling devices can be realized, such as, for example, stop-signalling switches in buses and safety border switches



5 in working machines. In this case the profile comprises
a long, continuous tube which has resilient walls and
inside which a light connection is provided from a
transmitter to a receiver and which in the embodiment
comprising a signalling switch is fastened on the wall
of a bus, for example, in a horizontal position above
the row of windows. When the tube is compressed in any
location, a change is produced in the light intensity
coming to the light receiver which change is interpreted
10 as an ON/OFF information by means of threshold value
comparison.

The light transmission ability of the tube can
be improved by providing within it an inner tube or
coating which reflects light better than the tube proper.



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CLAIMS

- A signalling device for vehicles, comprising a tube having resilient walls, and detecting means arranged within the tube to detect the compression thereof, which detecting means comprises a light transmitter and a light receiver spaced apart within the tube, and circuit means associated with the light transmitter and with light receiver which circuit means is arranged to operate on the light receiver output to produce a signal when the compression of the tube exceeds a given limit value, and is arranged to produce a compensating change in the intensity of the light emitted by the light transmitter a pre-determined period of time after a change in the intensity of light received by the light receiver is detected.
2. A signalling device according to claim 1, wherein the circuit means includes a comparator which compares the output of the light receiver with a reference voltage, a delay circuit and an automatic gain control circuit which is connected to a current generator for the light transmitter.
3. A signalling device according to claim 2, wherein the time constant of the delay circuit is about 10 s.
4. A signalling device according to claim 2 or claim 3, wherein a further comparator is connected to the automatic gain control circuit, to compare the level of



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the signal of the automatic gain control circuit fed to the current generator with a given limit voltage, whereby an alarm signal may be produced when the level of the limit voltage is exceeded.

- 5 5. A signalling device according to any of the preceding claims wherein the light transmitter comprises a bulb or an LED and the light receiver comprises a photo-diode, a photo-transistor or a light-dependent resistor.
- 10 6. A signalling device according to any of the preceding claims, wherein the inner surface of the tube is provided with a light-reflective coating.
7. A signalling device substantially as hereinbefore described, with reference to and as illustrated in the
- 15 accompanying drawings.
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