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[54] MONITORING METHOD FOR BLINKING LAMPS AND THEIR FAILURE

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[58] Field of Search 340/52, 72, 73, 76, 251, 253

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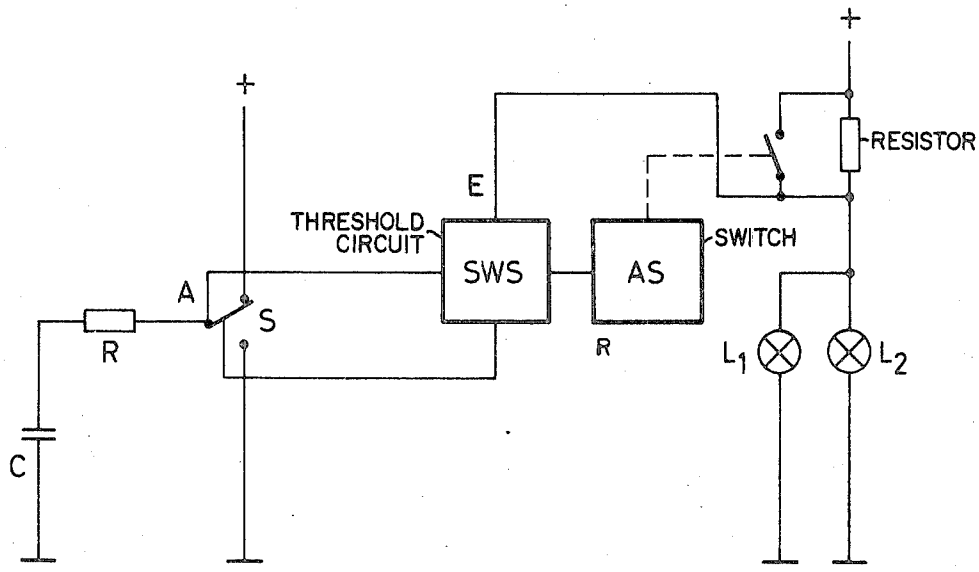
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[57] ABSTRACT

The monitoring of blinking lamps in motor vehicles is achieved by scanning, after passage of half of the dark period, a control voltage derived from the decreasing voltage of the dark period. If a lamp is defective the frequency of the oscillator will be raised.

3 Claims, 2 Drawing Figures



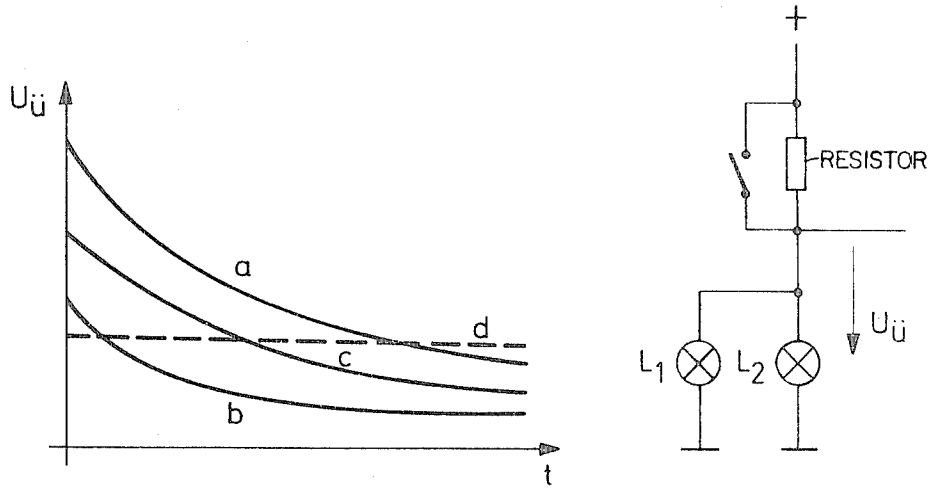


Fig. 1

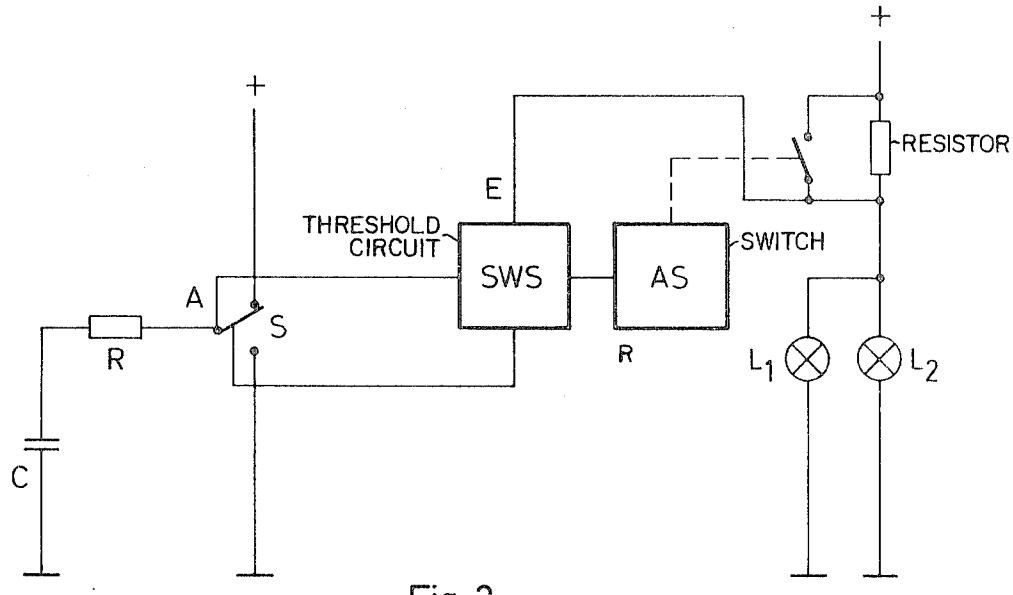


Fig. 2

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MONITORING METHOD FOR BLINKING LAMPS AND THEIR FAILURE

It is required from the traffic safety point of view that it is unambiguously indicated to the driver in a motorcar whether, upon operation of the direction indicator, both of the blinking lamps operate satisfactorily. A failure may be indicated, for example, in that the control lamp as arranged on the control panel either displays a permanent light, or permanently remains dark. Since, however, when the driver concentrates his attention on the road, this control lamp is lying at the extreme end of the driver's visual field, such an indication, owing to the fact that impressions resulting from the extreme visual field, are only noticed to a reduced conscientious extent, is easily overlooked. On the other hand, the inspection of the control or monitoring lamp again detracts the driver's attention from what is happening on the road.

It, therefore, is desirable to be able to dispose of an improved indicating method. To this end there is offered the possibility of drastically increasing the blinking frequency rate in the event of a failure of the blinking lamp operation, because a higher blinking frequency, in the event of a failure, is optically easier perceptible and, in addition thereto, can also be indicated acoustically. For this purpose, however, it is necessary to supervise the electrical functioning of the lamps. As an electrical quantity from which a supervisory or monitoring signal can be derived, there may be taken the lamp current.

To this end it is well known to arrange within the lamp circuit a small resistor across which the flowing lamp current produces a voltage which is in proportion to the number of lamps. It is also known to produce a similar lamp supervisory or monitoring signal by arranging a resistor parallel in relation to the contact switching on the lamps. In this case the supervisory signal is produced when the switching contact is open, hence during the dark period of the lamps.

As is well known, the cold resistance of a glowlamp is substantially lower than the resistance existing during the lighting period which, hereinafter, is referred to as the warm resistance. It is due to this matter of fact that in the moment of switching off, the supervisory signal has its highest amplitude, dropping off to the extent in which the filament gets cold. The cooling process is effected in the course of this owing to the heat capacitance of the lamp in accordance with an e-function. FIG. 1 of the accompanying drawing shows the course of the supervisory signal relating to the two cases of interest, namely in which both lamps are in proper functioning condition, or in which one of the lamps fails to operate. The upper curve indicated by the letter *a*, corresponds to the last-mentioned case, in which one lamp has failed to operate. The lower curve indicated by the letter *b*, corresponds to the case in which both lamps are in a proper functioning condition.

A distinction between these two possible cases, for example, can be made in that one voltage level lying between these two curves, is chosen as the operating threshold for a frequency increase. This means to imply, however, that, in order to obtain an unambiguous statement, there will likewise have to be used a timely variable voltage in accordance with an e-function as the criterion, as is denoted by curve *c*. The origin of coordinates of FIG. 1 corresponds to the moment in which the switching-off is effected. As the ordinate there is plotted in FIG. 1 the voltage $U_{\ddot{u}}$, of the supervisory (monitoring) signal, and as the abscissa the time *t*.

The provision of an operating threshold in the form of an e-function, however, requires a considerable expenditure from the circuit-technical point of view. It is intended, therefore, to provide a timely constant advance operating threshold as is denoted by the horizontal dashline *d*. As will be easily recognized, the voltage drop occurring immediately after the switching off of the lamps in the case of two lamps which are in a proper functioning condition, is greater than that particular voltage drop occurring at the end of the dark period and, consequently, that of the cooling down time in the case of one lamp which fails to operate. Accordingly, no voltage threshold can be stated, in comparison with which the voltage drop across two lamps which are in proper functioning condition, is lower or smaller at all times than the voltage drop occurring in the case of one lamp which fails to operate.

Here the invention starts, and has for its object to provide a monitoring method whose operating threshold is chosen thus that there will become possible an unambiguous distinction between two properly functioning lamps and one defective lamp. Accordingly, the invention relates to a monitoring method for blinking lamps and their failure, for example, in motor vehicles.

According to this method the lamps, during their dark period, are supplied with operating voltage via a series resistor which, during the light period of the lamps, is short-circuited and in which, moreover, the supervisory signal, during the dark period of the lamps, is taken off either across the series resistor or at the lamps, and in which method the blinking frequency of the oscillator generating the blinking pulses, is acted upon in dependence upon the supervisory signal. The given problem is solved by the invention in that the supervisory signal acts upon an oscillator generating a delta voltage comprising a DC component as well as an equifrequency rectangular voltage, and whose frequency, in the case of a constant pulse duty factor, is adjusted by varying the maximum and/or minimum value of the delta voltage, that from the supervisory signal and, consequently, from the lamp dark current, by comparison with a reference signal, there is derived a reference signal at that particular time position in which the dark period, if necessary, is to be interrupted, and that in the event of a failure of one lamp, the dark period is shortened and, simultaneously, the blinking frequency is at least doubled.

Accordingly, it has been recognized by the invention that the constant operating threshold as well as the operating threshold following in accordance with an e-function, can be replaced in that at a predetermined and favorable time position, the control signal is derived from the supervisory (monitoring) signal.

It is of a particular advantage that after the lapse of half a dark period, there is derived the control signal, that in the event of a lamp failure, the dark period is interrupted at the same time position, and the blinking frequency is doubled. With respect to this time position it is possible to state a threshold at which the voltage drop across two periodically switched lamps, is always lower or smaller than the voltage drop across one lamp only.

The invention will now be described with reference to FIGS. 1 and 2 of the accompanying drawing.

FIG. 2 schematically shows the oscillator as acted upon by the supervisory signal, and which serves to generate the blinking pulses. This oscillator consists of one single capacitor C which, by switching over of the switch S, and across the resistor R, is periodically charged and discharged. The switch S which may be an electronic switch, is controlled in such a way by the threshold circuit SWS that, from the voltage at point A, there is obtained a criterion for switching over the threshold circuit. The threshold circuit has an upper response threshold upon reaching of which the threshold switch responds and, at this moment, changes the switch S into its other switching position. In synchronism therewith, the threshold circuit switches the response threshold to a lower value upon reaching of which there is effected a switching back into the original state. Accordingly, at point A there will appear a somewhat delta-shaped voltage, whereas at the output of the threshold circuit there will appear a rectangular voltage which, via the output stage, is fed to the two lamps L_1 and L_2.

The supervisory signal in the form of the voltage $U_{\ddot{u}}$ is fed to the control input E of the threshold circuit, to which it is permanently applied. The control input acts in such a way upon the threshold circuit that it will affect the upper and/or lower response threshold, so that accordingly also the maximum and/or minimum value of the delta voltage will be varied.

The control signal is now obtained by a comparison with the reference signal at a time position in which, in the case of a de-

fective lamp, the dark period is interrupted and, simultaneously, by varying the response threshold of the threshold circuit, the frequency is being changed.

The reference signal is likewise derived from the supervisory signal and is firmly given. It is advantageously equal to the arithmetic mean value of the supervisory signal appearing in the case of two lamps which are in proper functioning condition (curve *b* FIG. 1), and to the supervisory signal appearing in the case of one defective lamp (curve *a* in FIG. 1). Both the reference signal and the supervisory signal are compared with one another at that particular time position in which, if necessary, the dark period is to be terminated, and an increased frequency is to be caused in the event of a lamp failure. The comparison, for example, may be carried out with the aid of a differential amplifier.

We claim:

1. A monitoring method for detecting the failure of blinking lamps and providing an indication of failure, comprising supplying an operating voltage directly across a pair of lamps in parallel during a lighted period, supplying said operating voltage across said lamps via a series resistor during the dark period of said lamps, taking a supervisory signal off said series resistor during the dark period and applying said monitoring signal to a threshold circuit, said threshold circuit responding to an upper threshold level of said monitoring signal to change over a switch controlling an oscillator generating blinking pulses, said oscillator generating a delta voltage comprising a DC component as well as an equifrequency rectangular voltage, whose frequency, in the case of a constant pulse duty factor is adjusted by varying the amplitude of the delta voltage, that from the supervisory signal and, consequently, from the lamp dark current, by comparison with a reference signal, there is derived a reference signal at that particular time position in which the dark period is to be interrupted, and that in the event of a failure of one lamp, the dark period is interrupted and simultaneously, the blinking frequency produced by the oscillator is at least doubled.

2. A method according to claim 1, in which after the lapse of one-half of the dark period, there is derived the control signal in order to interrupt the dark period at the same time position in the event of a defective lamp, and to double the blinking frequency.

3. A method according to claim 1 in which said reference signal is chosen to be equal to the arithmetic mean value of the monitoring signal resulting in the case where two lamps are in the proper functioning condition, and to that of the monitoring signal resulting in the case where one lamp has failed to operate.

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