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(54) Apparatus for monitoring the state of a remotely controlled device.

(57) An apparatus for monitoring the state of a remotely controlled means, e.g. a points drive for the points of a railway, or a signal lamp along a railway, without erroneous monitoring results occuring should the lines between a controlling means and the remotely controlled device be incorrectly connected. The remotely controlled device includes one or more special encoding means (4a, 4b, 4). Each such means gives rise to a pulse pattern which is characteristic for the means in a current which flows through it. It can thus be decided at the controlling means whether a current through it also flows through a given conductor part at the remotely controlled device.

In accordance with a first embodiment, one of two different encoding means (4a, 4b) is connected into a current path in response to which of two different states a remotely controlled device assumes. According to a second embodiment an encoding means (4) is always connected in series with the remotely controlled device (6), the pulse pattern occuring when the remotely controlled device is supplied with current.

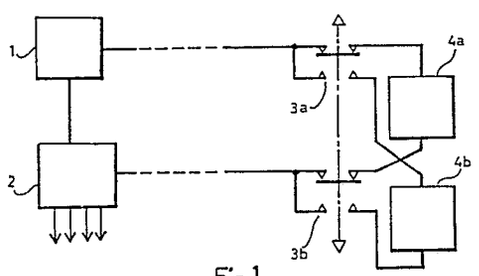

Fig.1

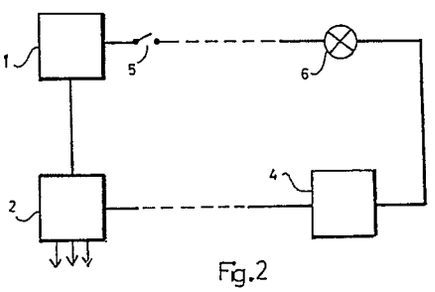

Fig.2

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Description

APPARATUS FOR MONITORING THE STATE OF A REMOTELY CONTROLLED DEVICE

TECHNICAL FIELD

The invention relates to an apparatus for monitoring the state of a remotely controlled device, e.g. the points drive of railway points or a signal lamp along a railway.

BACKGROUND ART

It is known to monitor the state of a remotely controlled points drive, i.e. check whether the points are in a left hand or right hand position, by a polarity check in the signal box. In such a case there are usually required three or four signal lines between the signal box and the points, and these lines are connected to such as two switching elements at the points drive. The switching elements are arranged to assume two different switch positions in response to the state of the points drive. The polarity of a DC voltage occuring between two of the signal lines, which are connected at the signal box, will thus be reversed when the state of the points drive is changed.

This method is not secure against erroneous connections, however. Should the signal lines be confused, either mutually or with signal lines to other points, there is namely a large risk that an incorrect checking result occurs.

With regard to remotely controlled signal lamps, it is known to monitor the state of such, i.e. monitor whether a lamp is illuminated or extinguished, with the aid of relays which are connected in series to the lamps. Extra line pairs are required here for each lamp, and erroneous monitoring results can occur as a result of erroneous connections in this case as well.

In both cases there is naturally the risk that erroneous monitoring results can result in serious accidents.

DISCLOSURE OF INVENTION

The object of the present invention is to provide an apparatus of the kind mentioned above, with which the state of the remotely controlled device can be monitored without an erroneous monitoring result occuring, should the lines from a controll means be confused or connected to the wrong means. This is achieved by the remotely controlled device being provided with one or more special encoding means, depending on the application. Each such means gives rise to a pulse pattern which is characteristic for precisely this means in a current passing through it. It can thus be decided at the control means whether a current through it also flows through a given conductor part at the remotely controlled device. If the latter consists of a points drive, it is suitable to utilise two encoding means, one being connected into a special current path when the points drive assumes one switch position, the other encoding means being connected into the current path when the points drive assumes its other switch position. If the remotely controlled device is a signal lamp, it is suitable to use a single encoding means, which is connected in series with the lamp and adjacent to it. The pulse pattern then occurs when the lamp is supplied with current.

The characterizing features of the invention are disclosed in the claims.

BRIEF DESCRIPTION OF DRAWINGS

The invention will now be described in more detail with reference to the drawings, where

Figures 1 and 2 illustrate two different embodiment examples of an apparatus in accordance with the invention,

Figure 3 illustrates a first embodiment example of an encoding means included in the apparatus according to Figures 1 and 2,

Figure 4 is an example of a pulse pattern obtained with the encoding means according to Figure 3,

Figure 5 illustrates a second embodiment of an encoding means in accordance with the above,

Figure 6 illustrates an example of a pulse pattern obtained with an encoding means according to Figure 5, and

Figure 7 illustrates a third embodiment of an encoding means in accordance with the above.

BEST MODES FOR CARRYING OUT THE INVENTION

In Figure 1 there is illustrated a first embodiment example of an apparatus in accordance with the invention. The numeral 1 denotes a voltage source and the numeral 2 a special monitoring receiver, which are assumed to be situated in a railway signal box. 3a and 3b respectively denote two switching elements and 4a and 4b two special encoding means, which are assumed to be situated in a switch drive (not illustrated in the Figure) to a railway switch or points. The switching elements are conventionally disposed for being switched by the points drive. The switch positions illustrated in the Figure are those taken up in one switch position of the points, one encoding means 4a being connected in series with the voltage source 1 and the monitoring receiver 2. In the other switch position of the points, the switching elements are reversed, and the second encoding means 4b is connected in series with the voltage source and the monitoring receiver.

Each of the encoding means 4a and 4b is disposed to give rise to a characteristic pulse pattern for the respective means in the current which flows through it when it is connected into a loop with a voltage source. This takes place by the impedance of the encoding means being changed with time in a characteristic way between two different values. A single pulse pattern is formed irrespective of the polarity of the voltage source, and the pulse pattern is suitably repeated without interruption. The monitoring receiver 2 in the signal box is disposed for detecting and separating

different pulse patterns in a current flowing through it irrespective of the current direction. The receiver can thus comprise a current sensing receiver of a known kind.

By monitoring the received pulse pattern it can thus be decided which of the encoding means is connected into the loop. It can thus be also decided whether the points are in the right or left hand position. It does not matter whether both lines between the signal box and the points drive are mixed up and have changed places. Neither does the polarity of the voltage source make any difference. If the pulse pattern also contains information as to which of several different points it comes from, the risk of an erroneous monitoring result is also avoided should the lines have been erroneously connected to the wrong points.

The monitoring receiver 2 in this example suitably has four outputs, whereby left hand position, right hand position, incorrectly received pulse pattern and no received pulse pattern can be indicated. An erroneous pulse pattern can mean that the lines are connected to another set of points than the one intended. Receiving no pulse pattern can mean that the points drive is in an intermediate position, neither of the encoding means 4a and 4b having been connected.

It is of course conceivable to replace the switching elements 3a and 3b with a single switching element which, in a first switch position couples in the encoding means 4a in series with the voltage source 1 and the monitoring receiver 2, and in a second switch position couples in the encoding means 4b in series with these units instead.

In Figure 2 there is illustrated a second embodiment example of an apparatus in accordance with the invention. As in Figure 1, a voltage source is denoted by 1 and a monitoring receiver by 2, these being situated in a signal box. The units to the right of the dashed parts of the lines are assumed in this case to be situated at a signal lamp 6 along a railway. The lamp is illuminated by closing a switch 5 in the signal box. Current through the lamp 6 also goes through an encoding means 4 connected in series with the lamp and of the same kind as the encoding means 4a and 4b as above.

In practice the lamp 6 illustrated in the Figure and the remaining units are of course only a single one of a plurality of similar arrays. Each individual signal lamp is thus connected in series with an encoding means which gives rise to a pulse pattern which is characteristic for precisely this encoding means. It can thus be decided in each monitoring receiver whether the current supply connected by a given switch really passes through the signal lamp for which the switch is intended.

Erroneous signal formations caused by erroneously connected supply lines to the signal lamps are thus discovered by this apparatus without any special signal lines being utilised. Erroneous connections can depend on mixing up different line pairs, which can result in a "clear" signal instead of a "stop" signal. Of course, line ruptures or broken signal lamps are also discovered, since no pulse patter is received in such cases. Short-circuiting can also be discovered in certain circumstances.

The monitoring receiver 2 suitably has three outputs in this case, whereby correctly received pulse pattern, incorrectly received pulse pattern and no received pulse pattern can be indicated.

In Figure 3 there is illustrated a first embodiment example of the encoding means included in the apparatus described above. The encoding means according to this example is intended for being fed with a DC voltage from the signal box, which means that the voltage source 1 mentioned above is a DC source. The encoding means includes a Zener diode bridge 10 and an energy storage capacitor 11, the task of these being to provide an internal feed voltage. The polarity of this voltage is independent of the polarity of the voltage source 1, according to the above, and of how the lines from the voltage source are connected. The numeral 12 denotes a self-oscillating clock pulse generator, which generates pulses having a predetermined frequency. The clock pulses are supplied to a clock pulse input CL on a parallel-to-serial converter 13. A symbolically depicted, adjustable circuit 14 is connected to the parallel inputs of the converter, and desired pulse patterns can be set with the aid of this circuit, e.g. by strapping.

The pulses forming the pulse pattern are read out from the converter 13 in serial form and are supplied to an optocoupler comprising a light emitting diode 15 and a phototransistor 16. The pulses from the optocoupler are inverted in a circuit comprising a resistor 17, a Zener diode 18 and a transistor 19. This circuit is connected via a diode rectifier bridge 20 to the series circuit, which includes the encoding means. The Zener voltage across the diode 18 is selected such that it is somewhat greater than the voltage across the phototransistor 16 when the transistor is fully on. The transistor 19 is therefore off when the phototransistor is on. The current through the series circuit is thus determined by the resistance in it outside the encoding means, inter alia in the receiver, by the resistance of the resistor 17 and by the feed voltage reduced by the voltage drop across the phototransistor 16 and diode bridges 10 and 20. The phototransistor is non-conducting when the transistor 19 is on. The current through the series circuit is then determined by the resistance in it outside the encoding means, and by the feed voltage reduced by the voltage drop across the diode 18, transistor 19 and diode bridges 10 and 20.

With the aid of diode bridges 10 and 20, the current can pass through the encoding means in both directions in response to the polarity of the voltage source and connection of the lines.

In Figure 4 there is illustrated an example of a pulse pattern obtained with an encoding means according to Figure 3. The encoding means is fed with a DC voltage and gives rise to a square wave-shaped current due to the impedance in the means changing with time. An example of a binary pulse pattern has been indicated in the Figure.

In Figure 5 there is illustrated a second embodiment example of an encoding means in accordance with the above. The means in this case is intended to be fed by a pulsed voltage e.g. a square wave

voltage. The voltage source 1, mentioned above, is thus not a DC voltage source in this case. The means differs from the one according to Figure 3 in that a differentiating circuit 25, 26, a diode 27 and a resistor 28 have been added. Furthermore, the clock pulse generator is not self-oscillating but is controlled. This generator is now denoted 12′ instead of 12 and has an input S for synchronising pulses.

In operation, short pulses are formed by the differentiating circuit 25, 26, these pulses being supplied to the synchronising input S of the generator 12′. Clock pulses are thus generated which are synchronous with the pulsed feed voltage, and which are supplied to the clock input CL on the parallel-to-serial converter 13. The resistor 28 accelerates discharge of the blocking capacitance in the diode 27 and diode bridge 10, so that the synchronising pulses will be more distinct even if the synchronising input S is high-impedance.

The synchronisation is intended to facilitate detection of the pulse pattern in the receiver by enabling synchronous detection. The feed voltage does not need to have pulse form, and it can have some other form varying uniformly with time, e.g. sinus form, from which synchronising pulses can be derived.

In Figure 6 there is illustrated an example of a pulse pattern which is obtained with an encoding means according to Figure 5. The feed voltage is assumed to be square wave-shaped, is denoted v and gives rise to a square wave-shaped current i. The current assumes a higher value during certain voltage pulses and a lower value during the remaining voltage pulses, due to the encoding means impedance changing with time. The same binary pulse pattern as in Figure 4 has also been indicated in this Figure.

Certain encoding means can give rise to pulse patterns corresponding to a considerably higher current average value than what is obtained with other encoding means. In the case of signal lamps, in order that these shall illuminate equally as strongly, it can therefore be suitable to adjust the feed voltage to each individual lamp, or components in each encoding means, according to the pulse pattern to which the respective encoding means gives rise.

In Figure 7 there is illustrated a third embodiment of an encoding means in accordance with the above. According to this example, the Zener diode bridge 10 in the above-described encoding means has been dispensed with, and has been replaced by a single Zener diode 29 between the optocoupler 15, 16 and the diode bridge 20. The differentiating circuit 25, 26 and the diode 27 have been drawn with dashed connection lines, which is intended to convey that they are a part of the encoding means in the case where the latter is intended for a feed voltage varying with time. An advantage with this embodiment compared with the ones described above is that there is a saving in three Zener diodes.

The optocoupler 15, 16 described above and illustrated in Figures 3, 5 and 7 has the task of electrically insulating the parallel-to-serial converter 13 from the means 16-19. However, the optocoupler can be eliminated if the converter 13 is given the same zero potential as the transistor 16. This can be achieved, at least in the case with DC current, by connecting an insulating DC voltage converter (DC/DC converter) into the current supply to the pulse generator 12 and converter 13. The series output of the converter 13 is then connected directly to the transistor 16, which becomes an ordinary transistor and not a phototransistor.

The adjustable ciruit 14 which is connected to the converter 13 can also be replaced by a ROM memory. In such a case a longer bit pattern can be obtained than with what is practically possible with strapping according to the above.

Conceivable fields of use for the apparatus in accordance with the invention other than for railway signaling are such as control of valve states, doors, freight room hatches and position limiting in different machines.

Claims

1. Apparatus for monitoring the state of a remotely controlled device, e.g. a points drive for railway points, characterized in that the apparatus includes a series circuit with a voltage source (1) and a receiving means (2), first and second encoding means (4a, 4b) situated at the remotely controlled device, and each disposed such that when it is passed through by a current it gives rise to a pulse pattern characteristic for it in the current, and switching means (3a, 3b) for connecting said first encoding means (4a) into the series circuit for a first state of the remotely controlled device and for connecting said second encoding means (4d) into the series circuit for a second state of the remotely controlled device, and in that said receiving means (2) is disposed to send logical signals in response to what pulse pattern is occuring in the series circuit (Figure 1).

2. Apparatus as claimed in claim 1, characterized in that each of the encoding means (4a, 4b) includes a means (10, 11, 28) for generating an internal feed voltage in the means when a current flows through it, the polarity of the voltage being independent of the direction of the current, a pulse generator (12, 12′) for generating clock pulses, a means (13, 14) for generating in time with the clock pulses a pulse train forming a characteristic pulse pattern for the encoding means, a means (16-19) having an impedance which changes between two different values in response to the pulses in the pulse pattern, and a DC bridge (20) which achieves that a current through the encoding means passes through said means (16-19), the impedance of which changes between two different values, in a single direction irrespective of the direction of the current.

3. Apparatus as claimed in claim 2, characterized in that the voltage source (1) generates a DC voltage and that the pulse generator (12) is self-oscillating.

4. Apparatus as claimed in claim 2, characterized in that the voltage source (1) generates a voltage varying uniformly with time, e.g. a pulsed voltage or a sinus voltage, in that each of the encoding means (4a, 4b) also includes a differentiating circuit (25,26) for generating pulses in time with the varying voltage, and in that the pulse generator (12′) is controlled by these pulses.

5. Apparatus for monitoring the state of a remotely controlled means, e.g. a signal lamp along a railway, characterized in that the apparatus includes an encoding means (4) situated at the remotely controlled device (6) and connected with it in series so that when it is passed through by a current it gives rise to a characteristic pulse pattern for this means in the current, and a receiving means (2) in series with the remotely controlled device (6) and encoding means (4), said receiving means (2) being disposed to send logical signals in response to whether said pulse pattern is received or not (Figure 2).

6. Apparatus as claimed in claim 5, characterized in that the encoding means (4) includes means (10, 11, 28) for generating an internal feed voltage in it when a current flows through it, the polarity of this voltage being independent of the current direction, a pulse generator (12, 12′) for generating clock pulses, a means (13, 14) for generating in time with the clock pulses a pulse train which forms a characteristic pulse pattern for the encoding means, a means (16-19), the impedance of which changes between two different values in response to the pulses in the pulse pattern, and a rectifier bridge (20) which achieves that a current through the encoding means passes through said means (16-19), the impedance of which is changed between two different values, in a single direction irrespective of the current direction.

7. Apparatus as claimed in claim 6, characterized in that the voltage source (1) generates a DC voltage and in that the pulse generator (12) is self-oscillating.

8. Apparatus as claimed in claim 6, characterized in that the voltage source (1) generates a voltage varying uniformly with time, e.g. a pulsed voltage or a sinus voltage, in that the encoding means also includes a differentiating circuit (25,26) for generating pulses in time with the varying voltage and in that the pulse generator (12′) is controlled by these pulses.

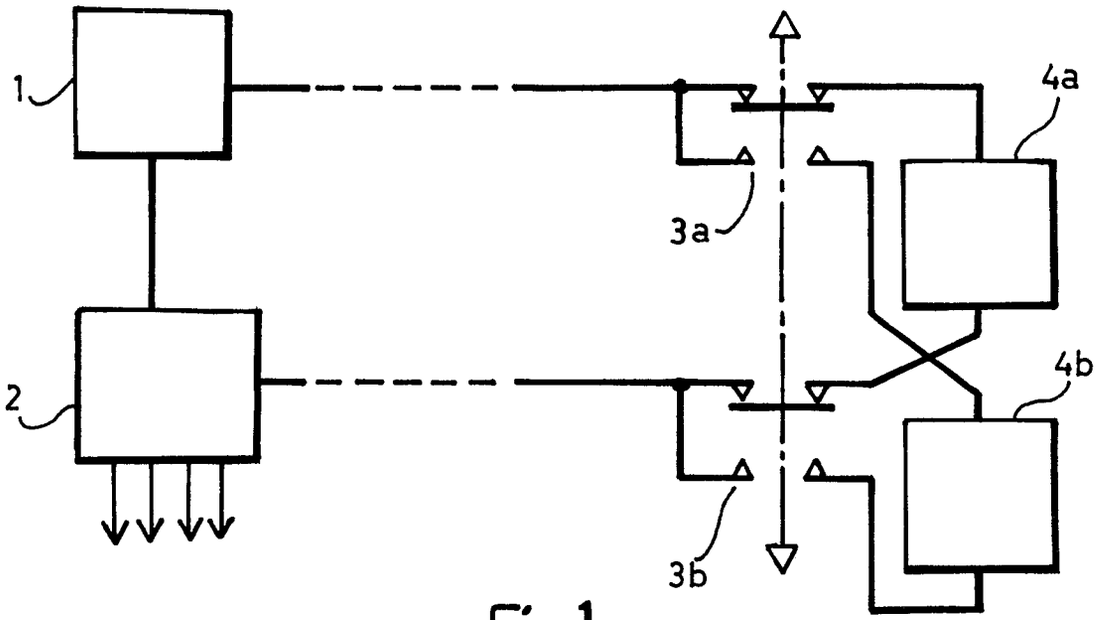

Fig.1

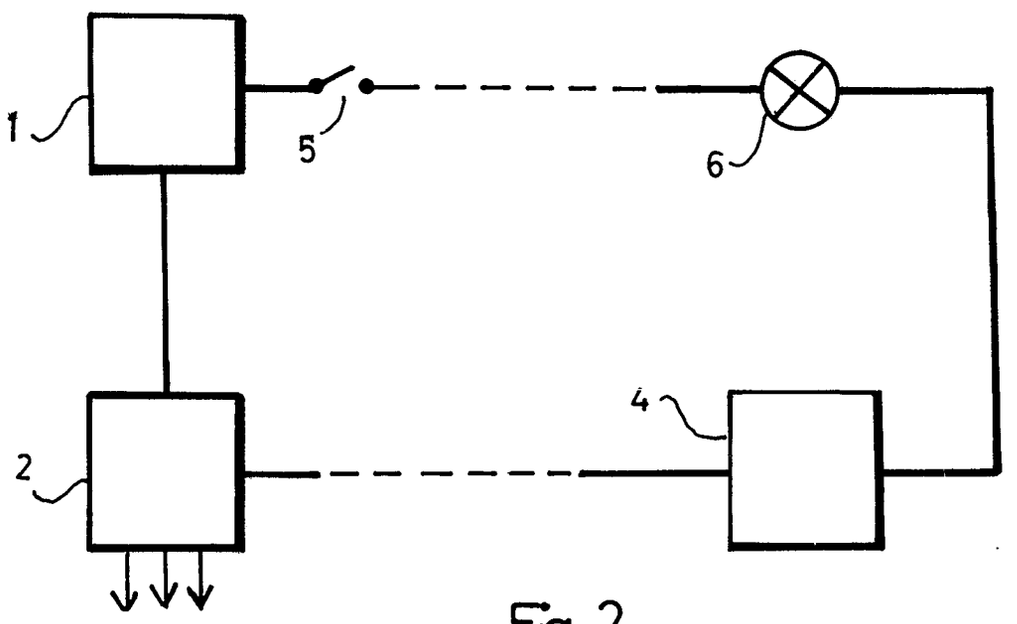

Fig.2

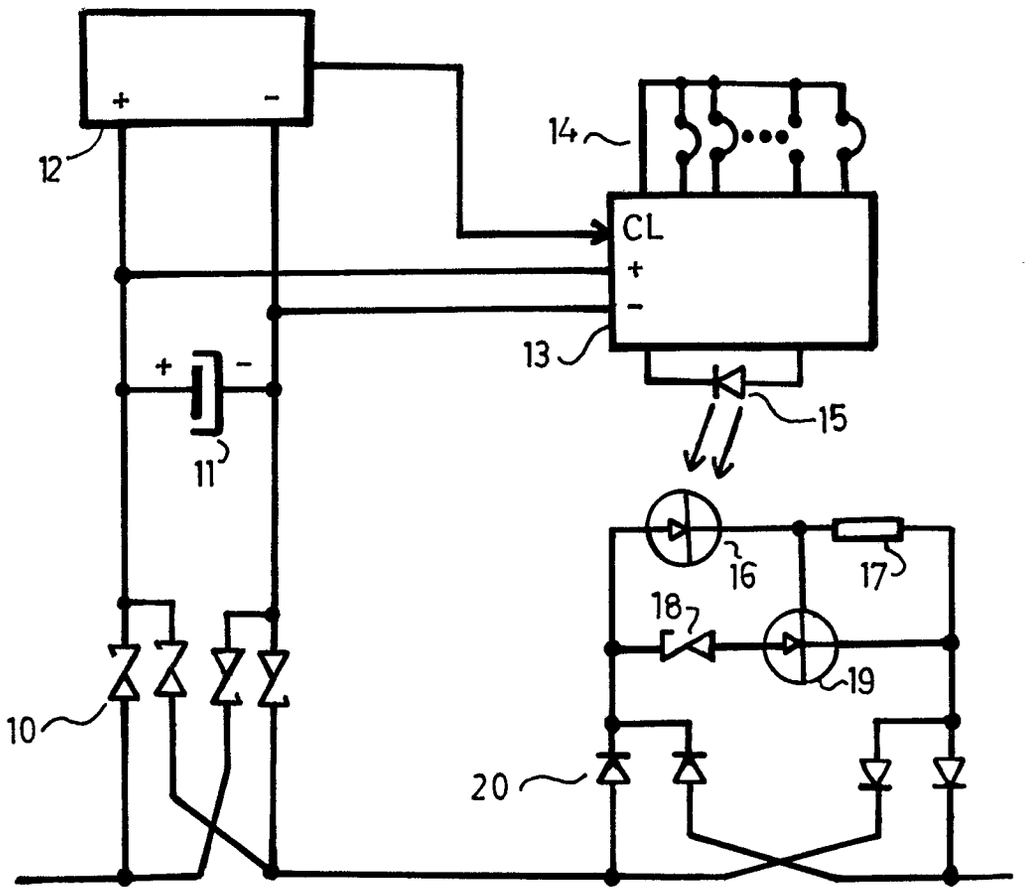

Fig.3

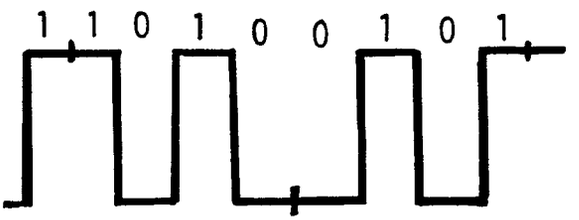

Fig.4

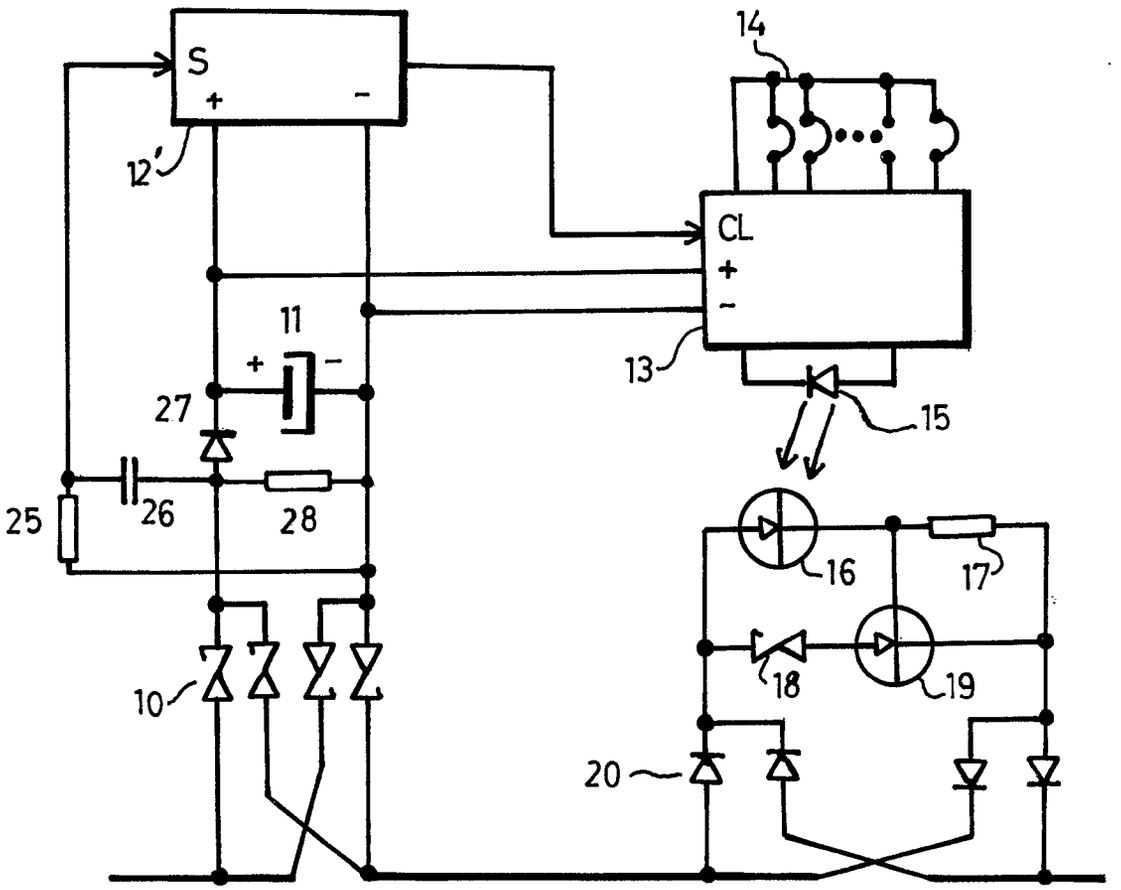

Fig.5

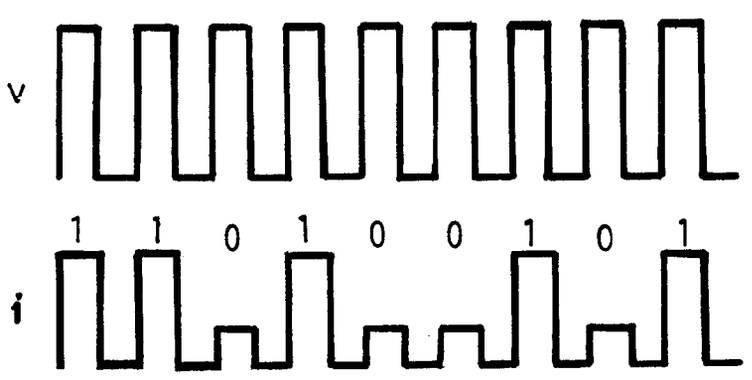

Fig.6

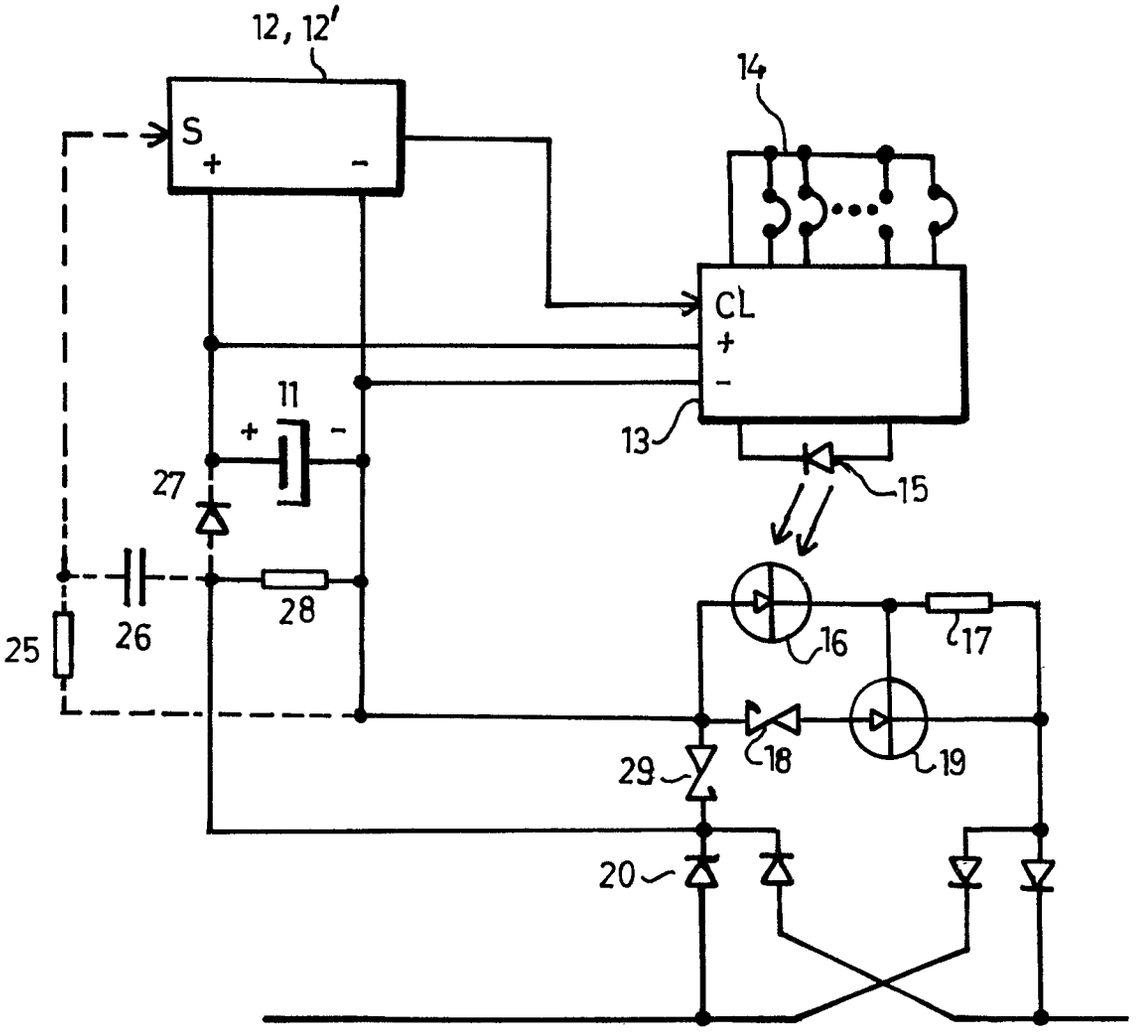

Fig.7

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EUROPEAN SEARCH REPORT

Application number
EP 89850088.9

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl 4)
A	DE-C2-3 223 779 (LICENTIA-PATENT-VERWALTUNGS-GMBH) *Claim 1*	1-8	B 61 L 7/06 G 08 G 1/097
A	US-A- 4 356 485 (BOSCHULTE ET AL) *Col. 1, line 62 - col. 2, line 21*	1-8	
	US-A- 4 376 910 (PESLIER) *Col. 2, lines 35-45*	5	
A	Derwent's abstract No. K1294B/43, SU-643 388	1-8	
A	Derwent's abstract No. 84-087078/14, SU-1024 341	1-8	
A	Derwent's abstract No 84-317630/51, SU-1090 608	1-8	
A	Derwent's abstract No. 86-244902/37, SU-1212 859	1-8	

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

B 61 L
G 08 G

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
STOCKHOLM	12-07-1989	FENGER-KROG S.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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