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(54) Detection device for a short-circuit bridge

(57) The invention relates to a device for detecting a short-circuiting bridge between or across rail bars of a section of a railway, comprising a first arm that can be brought into electrical contact with a first rail bar, a second arm that can be brought into electrical contact with the other rail bar, an electrical supply source, and detection means for detecting and monitoring, during operation, the short-circuit resistance of the short-circuiting bridge realized by said two arms between said two rail bars.

According to the invention, a device of the kind mentioned above is **characterised in that** it is further provided with a signal generation means which provides a signal to one or both or the rail bars on the basis of the detected short-circuit resistance.

The signal generation means provides a signal to one or both of the rail bars. This signal propagates itself through the relevant rail bar and can be detected at a relatively great distance from the short-circuiting bridge or crossbar, for example by means of a receiver that identifies the signal. The railway workers present there can then ascertain in a simple manner whether the short-circuiting crossbar is indeed present in the railway section in question.

Any confusion owing to miscommunication regarding any other parallel railway sections that may or may not be short-circuited is thus avoided. It can be ascertained by means of said signal whether the railway section is in the safe, short-circuited state and can be safely accessed by the railway worker(s).

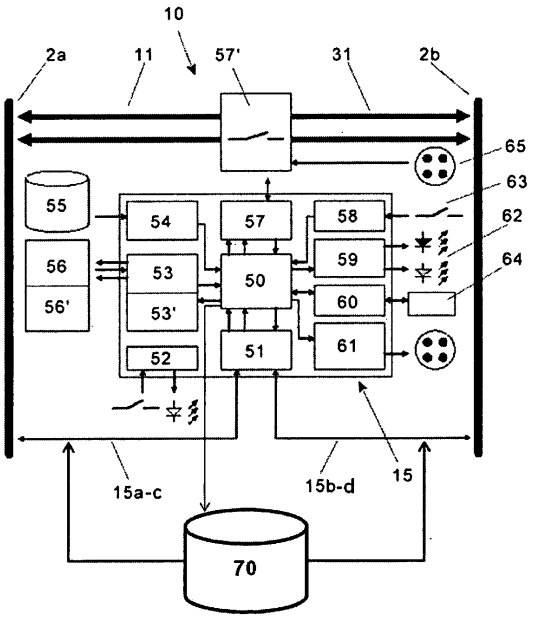

Fig. 3b

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Description

[0001] The invention relates to a device for detecting a short-circuiting bridge between or across rail bars of a section of a railway, comprising a first arm that can be brought into electrical contact with a first rail bar, a second arm that can be brought into electrical contact with the other rail bar, an electrical supply source, and detection means for detecting and monitoring, during operation, the short-circuit resistance of the short-circuiting bridge realized by said two arms between said two rail bars.

[0002] Such a device is known from Dutch patent NL 1 033 077. When certain track works are to be performed on a railway, it is usual to provide a short-circuiting bridge between the rail bars of a certain railway section so as to simulate the presence of a train in this railway section. This has the result that the rail safety system of the relevant railway section is activated and the signal switches to red. This constitutes deactivation of the railway section, i.e. it is taken out of service.

[0003] The known device comprises a short-circuiting crossbar with two arm parts that are clamped between two points on the rail bars. In order to ascertain that a good electrical contact between the rail bars is indeed established when the short-circuiting crossbar is connected, the known device is further provided with detection means for detecting and monitoring the short-circuit resistance realized by the arm parts and the rail bars.

[0004] In a practical embodiment, the detection means are provided with a supply source that is connected via power cables to the ends of the arm parts. During the short-circuit test, a certain current having a fixed frequency is passed through the short-circuited rail bars by the supply source, for example.

[0005] The known device furthermore comprises means for collecting data on the status of the detected short-circuit resistance and for passing these data on to a central control unit, for example via a wireless telecommunication link. Said status information may comprise information inter alia on the position and identity of the detection device as well as information on the status of the detection device, such as the current value of the measured short-circuit resistance. An example of such suitable means is a gsm unit and/or a GPS unit. Such means are known from Dutch patent NL 1 033 581.

[0006] Although satisfactory results can be achieved with the known device as regards the location of the installed short-circuiting bridge, it remains a complicated matter for the railway worker to derive from this which railway section or sections is or are safe without having recourse to the safety instruction. The increased complexity of the deactivation process, however, has made the instruction also more complex. This makes it difficult to provide the railway workers with an unequivocal and correct instruction (within the available time). The instruction given to the railway worker often passes through various responsible agencies and must take place quite carefully.

[0007] There are a number of moments at which information is transferred, which deteriorates the quality and increases the risk of errors. What is more, the instruments (drawings and physical outdoor markings) for delimiting the deactivation region is some cases leave a few things to be desired. The consequence is that the railway worker himself in his local position is insufficiently capable of determining where he is and which rail section or sections is (are) safe. Local marks in the surroundings are then used, which may subsequently be incorrectly interpreted.

[0008] The fact that railway workers may be deployed at various different locations in a railway network of a country implies that local knowhow as a means of orienting oneself is not a realistic option. In addition, the provision of marking shields or colours on the railway or other such solutions is difficult to implement and labour-intensive as regards maintenance. The remedy may be worse than the disease from the point of view of risk management here. It is accordingly difficult for the railway workers at the moment to find out in a reliable manner whether a railway section is safe and, if so, which one.

[0009] The invention has for its object to provide a solution that eliminates the disadvantages mentioned above.

[0010] According to the invention, a device of the kind mentioned in the opening paragraph is to that end **characterised in that** it is further provided with a signal generation means, which provides a signal to one or both of the rail bars on the basis of the detected short-circuit resistance.

[0011] The signal generation means provides a signal to one or both of the rail bars. This signal propagates through the relevant rail bar and can be detected at a relatively great distance from the short-circuiting bridge or crossbar, for example by means of a receiver that identifies the signal. The railway workers present there can then ascertain in a simple manner whether the short-circuiting crossbar is indeed present in the relevant railway section.

[0012] Any confusion owing to miscommunication regarding any other parallel railway sections that may or may not be short-circuited is thus avoided. It can be ascertained by means of said signal whether the railway section is in the safe, short-circuited state and can be safely accessed by the railway worker(s).

[0013] Preferably, the signal generation means forms part of the detection means for detecting and monitoring the short-circuit resistance. Such a device has the advantage that the signal sent by the detection means for determining the short-circuit resistance, which is also transmitted through one or more rail bars, is not identified as denoting "safe" by a remote receiver and that the receiver will only detect and identify as "safe" the additional signal generated by the signal generation means in response to the detected short-circuit resistance. This enables the railway worker(s) and other persons to determine the "safe" status of a railway section in an unequivocal manner.

[0014] The signal generating means preferably comprises a generator which delivers a characteristic signal about the status of the short-circuit resistance. Such a signal then has a characteristic different from that of signals delivered by the detection means for detecting the short-circuit resistance.

[0015] In a practical embodiment, the signals delivered by the signal generation means are electrical sinusoidal pulse signals emitted by the supply source.

[0016] In such a case the frequencies or the waveforms of the two signals may differ from one another.

[0017] The receiver of the signals emitted by the signal generation means comprises an element for detecting said signal. Such an element is capable of recognizing characteristic electrical values and can be coupled to a rail bar by a user in a simple manner. This is achieved, for example, in that the signal generation means is made to emit repetitive pulses of a certain characteristic shape. These specific pulses are subsequently detected by the receiver. A communication via gsm units is not necessary then.

[0018] The receiver is preferably provided with a processing means for displaying to the user the status of the short-circuit resistance on the basis of the signal received from the signal generation means. Such a processing means is, for example, a calculating unit such as a computer or a laptop.

[0019] The invention will be explained in more detail below with reference to a drawing, in which:

Figures 1 a and 1b are situation sketches of a railway section protected by a railway safety system;
Figure 2 diagrammatically shows a detection device according to the prior art;
Figures 3a and 3b diagrammatically show a detection device with a signal generation means according to the invention;
Figure 4 graphically depicts the signals emitted by a generator in a device according to the invention; and
Figure 5 diagrammatically shows an embodiment of a receiver according to the invention.

[0020] Like parts will be denoted by the same reference numerals in the description below of the figures so as to provide a clearer understanding of the invention.

[0021] Figure 1 a shows a railway track 1 built up from consecutive railway sections 1_{-1}, 1_0, 1_{+1}, etc. The railway track consisting of a number of railway sections is built up from rail bars 2a-2b which are placed on supporting crossbeams or sleepers 3. The consecutive railway sections are separated from one another by means of insulating coupling bridges 4 provided in one, or as shown in the figure in both of the rail bars 2a-2b.

[0022] Each railway section 1_{-1}, 1_0, 1_{+1}, etc is provided with a rail current path, by means of which it can be verified whether a train is present in the relevant section. To this end, the rail current path of each railway section is composed of an AC source 5 that is connected to the rail bars 2a-2b via respective connection lines 5a-5b. At the other end of the railway section there is a cut-out or railway relay 6 that is also electrically connected to the two rail bars 2a-2b of the relevant section.

[0023] In the situation shown in figure 1a, there is no train in the railway section 10, which means that the AC voltage applied across the two rail bars 2a-2b (by the AC source 5) ensures that the (magnetic) relay 6 is energized and is open. This situation has the result that the railway signs belonging to this railway section are green and that the railway safety system allows trains to enter this railway section 10.

[0024] Figure 1b shows the situation in which a train 7 moving from left to right has entered the railway section 1_0. The axles 7a of the train effect a short-circuiting connection between the two rail bars 2a-2b, so that current will flow from the AC source 5 through the connection line 5a, the rail bar 2a, the axles 7a, the other rail bar 2b, and the connection line 5b back to the AC source 5. Less current will thus flow through the relay 6, so that the latter is de-energized. This situation is shown in figure 1 b.

[0025] The de-energizing of the relay 6 owing to the short-circuit created across the two rail bars will set the railway signs belonging to the relevant railway section 1_0 to red. Setting the railway signs to red means that the relevant railway section is protected and is not accessible to oncoming rail traffic for the time being.

[0026] In the case of maintenance work being carried out on the relevant railway section, such a short-circuiting of the railway section 1_0 by a passing train 7 can also be simulated by means of a "simulation train", using a short-circuiting crossbar, a prior art embodiment of which is shown in figure 2. The short-circuiting crossbar 10 according to the prior art is made up of a housing 10a, to which are coupled two arms 11-31 whose contact heads 17-37 can be brought into electrical contact with the respective rail bars 2a-2b.

[0027] The two arms 11-31 can be moved away from one another by means of a lever 10b so as to obtain a good clamping engagement, and accordingly a good electrical contact between the contact heads 17-37 and the two rail bars 2a-2b. The short-circuit realized in this manner between the two rail bars 2a-2b can be detected and monitored by a suitable detection means 15 which in this embodiment is shown as a separate unit and which is connected to each of the contact heads 17-37 via a respective connection lines 15a-15b.

[0028] The short-circuiting crossbar 10 as shown in figure 2 has a number of drawbacks, the principal drawback being the single point of contact between the two arms 11-31 and the rail bars 2a-2b. Apart from the fact that the electrical contact between the two arms 11-31 and the respective rail bars 2a-2b cannot be adequately realized and guaranteed at all times, the short-circuiting crossbar according to the prior art also has a substantial drawback in its practical use.

[0029] The short-circuiting crossbar 10 shown in figure 3a simulates a train in that it brings the two arms 11 and

31 with their arm parts plus contact points 38a-38b and 18a-18b into electrical contact with the respective rail bars 2a and 2b. The short-circuiting bridge is applied in a manner as described in NL 1 033 077.

[0030] The short-circuit thus realized between the two rail bars 2a and 2b by means of the two arms 11 and 31 and their arm parts plus contact points 15a-15c and 15b-15d, respectively, is detected and monitored by detection means in the housing 15. The detection means comprise a supply unit that is accommodated in the housing 15e. A signal generation means is also present therein, which supplies a signal to one or both of the rail bars on the basis of the detected short-circuit resistance. In the present example signals are delivered to both rail bars.

[0031] Figure 3b shows an embodiment of the detection device according to the invention, and more in particular the signal generation means 70 and the detection means 15 which detect and monitor the short-circuit resistance of the short-circuiting bridge realized between the two rail bars 2a-2b by the two arms 11-31. The short-circuit measurement takes place by means of the supply source in that every 500 ms a sinusoidal current having a suitable frequency and a strength of approximately 1 - 3 Amp. is passed through the arm parts plus contact points 15a-15c, 15b-15d and the rail bars 2a-2b during approximately 25 ms.

[0032] The signal generation means 70 sends additional signals of the same frequency to the two rail bars, also via the arm parts and their contact points 15a-15c and 15b-15d.

[0033] Two types of signal originating from the detection device according to the invention can accordingly be distinguished in the rail bars, i.e. a signal representing the short-circuit measurement by the detection means 15 and a signal from the signal generation means 70. The signals can be measured between the two rail bars at a distance of, for example, 3000 m from the short-circuiting crossbar 10. The value of the voltage measured between the rail bars at such a distance is approximately a few tens of millivolts. It is also possible to measure the signals between one rail bar and earth. The signals can be satisfactorily measured also in that case.

[0034] A receiver is thus highly practicable and easy to operate by a user in this manner. After all, measurements need not be performed between the two rail bars, but only between one rail bar and earth. In practice a user or component of the receiver then establishes a connection between the measuring electronics in the receiver and earth.

[0035] The graph of figure 4 represents the pulse-position modulation for the status unsafe/safe.

[0036] Level (a) herein denotes a situation in which the electrical supply source emits a pulse every 500 ms for monitoring the short-circuit resistance. These pulses are indicated at 80, 81 and 82 in (a), the x-axis being the time axis t.

[0037] These signals are received at a distance of, for example, 3000 m, whereupon the receiver gives an indication "unsafe", i.e. the situation of (a). The pulse width is 25 ms.

[0038] When the device is in the safe condition, the signal generation means generates an additional pulse alternating between 150 ms and 350 ms following the regular measuring pulse for the short-circuit resistance. This situation is shown at level (b).

[0039] These pulses are indicated at 90, 91 and 92 and are comparatively short, which not only limits the total power consumption but also provides a unique electronic characteristic in comparison with the pulses 80, 81 and 82. Said unique characteristic in the present example is accordingly a repetitive pulse train with intervals between pulses of 150 ms, 350 ms, 350 ms and 150 ms. The pulses have widths of 25 ms and 10 ms, respectively, upon measurement (indicated with vertical downward arrows 71, 72 and 73).

[0040] A receiver located at some distance (in this case approximately 3000 m) from the short-circuiting crossbar will thus recognize the unique electronic characteristic and deliver the signal "safe" to the user (for example a railway worker). If the unique electronic characteristic conforming to the signal waveform of (b) does not occur (only the waveform of (a) is present, or any other waveform), the receiver will give the sign "unsafe".

[0041] The receiver is provided next to, on, or in the railway track. It is indicated at 100 in figure 4. The receiver comprises an element for detecting the respective signals originating from the supply source, for detecting the short-circuit resistance, and for detecting the signal from the signal generation means. In the situation shown here, the receiver is connected to the two rail bars 2a and 2b (via respective connection cables 101 and 102), but it is alternatively possible to connect the receiver to only one rail bar, in which case the electronics in the receiver are connected to earth directly or via a user.

[0042] A functional embodiment of a receiver according to the invention comprises an electronic bandpass filter , a passband for the frequency range which is located, for example, between 5500 and 9000 Hz with a filter slope of, for example, 24 dB/octave of filter speed (not shown in the drawing). Suitable software is also present for displaying the waveforms, for example, on a laptop provided with an input for receiving said waveforms. Instead of a laptop some other embodiment may be used, for example any other acoustic and/or visual means for providing a warning to the user/railway worker. A laptop (or any other acoustic and/or visual warning means) enables a user to observe the safety situation in a simple manner.

[0043] It should be noted that alternative practical embodiments of a receiver according to the invention are possible, which embodiments have other specifications as regards the frequency range used, the filter slope, and the electronic components used.

Claims

1. A device for detecting a short-circuiting bridge between or across rail bars of a section of a railway, comprising

   a first arm that can be brought into electrical contact with a first rail bar,
   a second arm that can be brought into electrical contact with the other rail bar, an electrical supply source, and
   detection means for detecting and monitoring, during operation, the short-circuit resistance of the short-circuiting bridge realized by said two arms between said two rail bars, **characterised in that** the device is further provided with a signal generation means, which provides a signal to one or both of the rail bars on the basis of the detected short-circuit resistance.

2. A device according to claim 1, **characterised in that** the signal generation means forms part of the detection means for detecting and monitoring the short-circuit resistance.

3. A device according to claim 1 or 2, **characterised in that** the signal generating means comprises a generator which delivers a characteristic signal about the status of the short-circuit resistance.

4. A device according to claim 3, **characterised in that** said characteristic signal is an electrical sinusoidal supply signal.

5. A signal generation means for use in a device according to one or several of the preceding claims.

6. A receiver for cooperating with a device according to claim 1, 2, 3, 4 or 5, comprising an element designed to detect a signal generated by the signal generation means.

7. A receiver according to claim 6, provided with a processing means for displaying to a user the status of the short-circuit resistance on the basis of the signal received from the signal generation means.

8. An assembly comprising a device according to claim 1, 2, 3 or 4, a signal generation means according to claim 5, and a receiver according to claim 6 or 7.

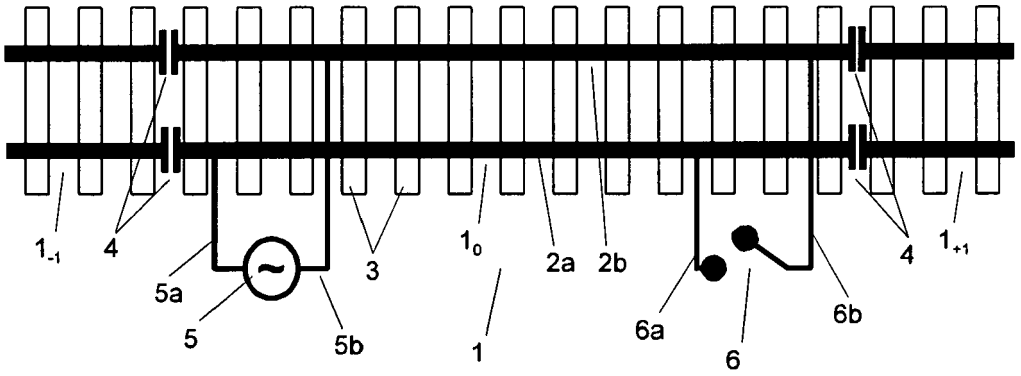


Fig. 1a

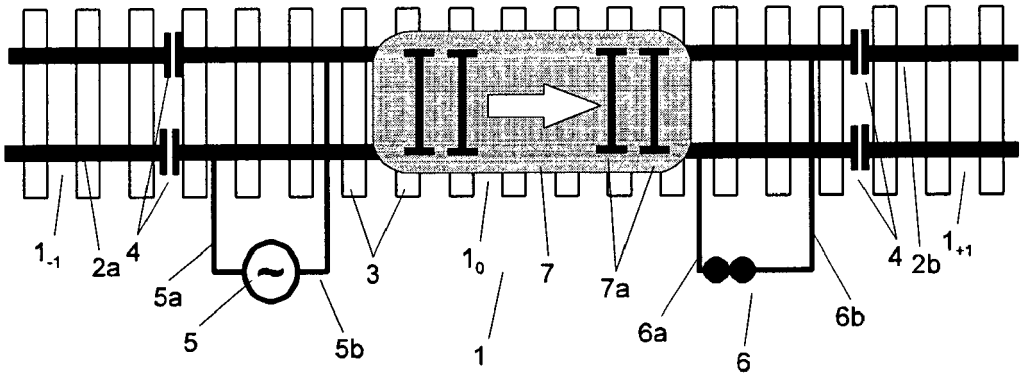


Fig. 1b

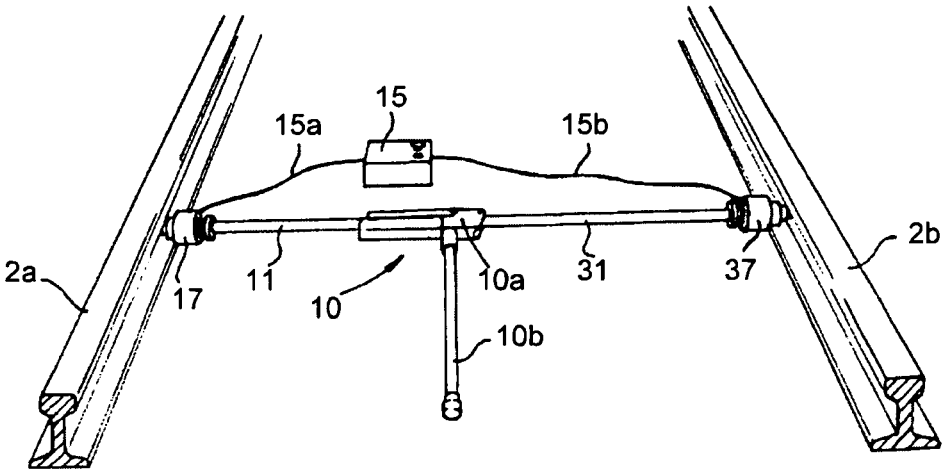


Fig. 2
Prior art

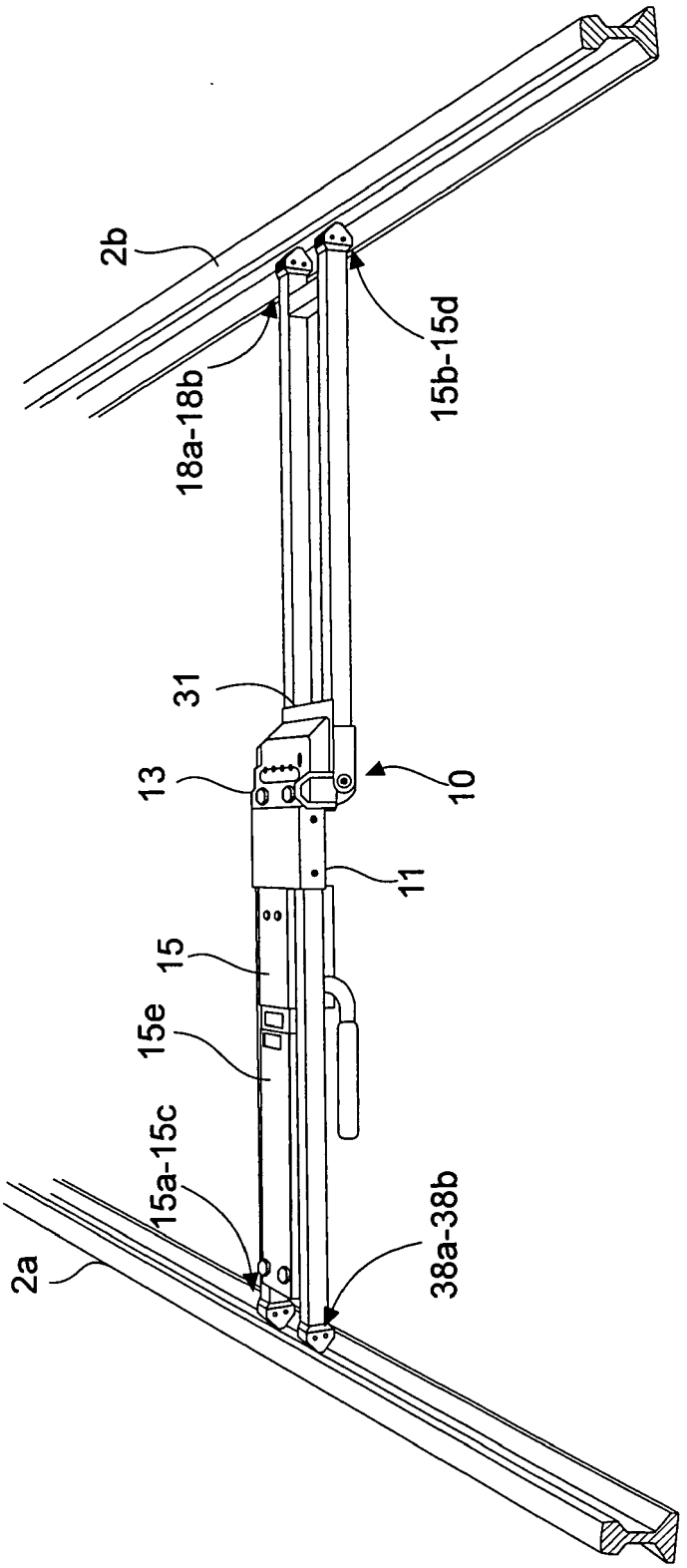
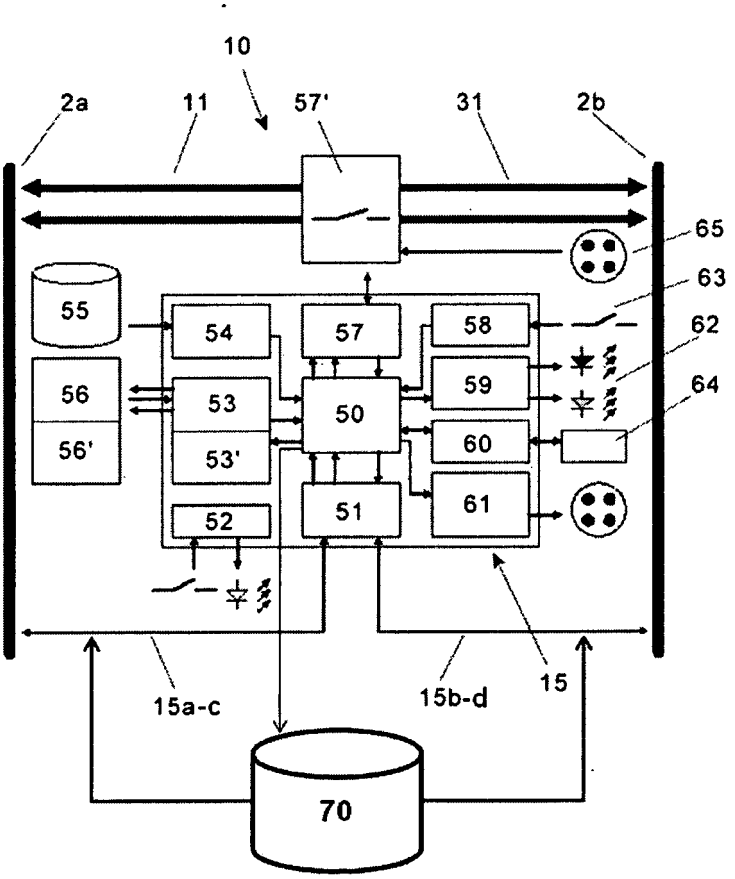


Fig. 3a


10
2a
11
57'
31
2b
65
63
62
64
55
54
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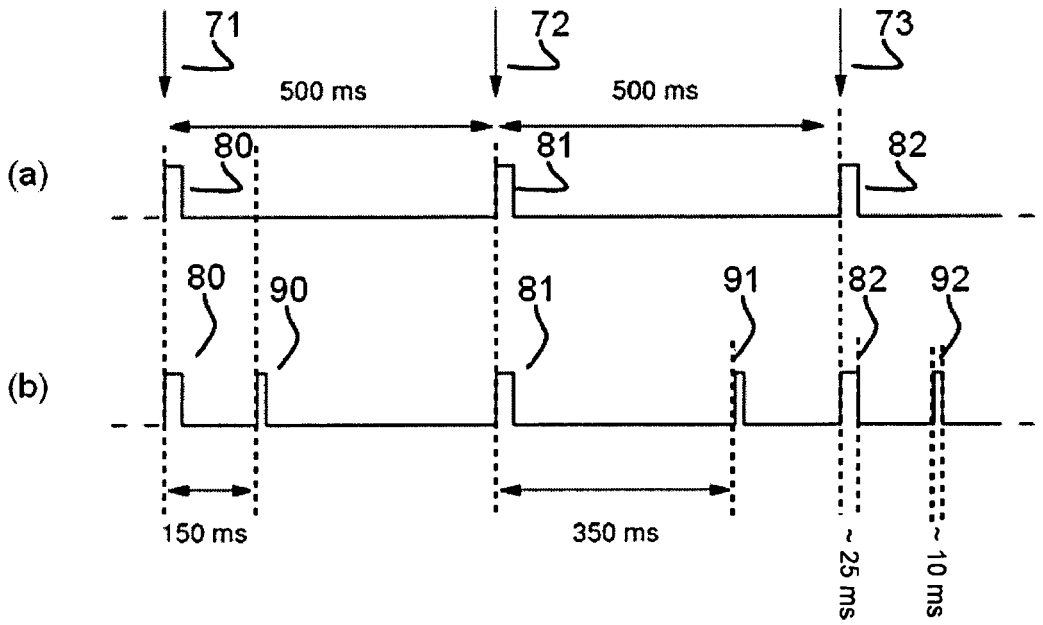
59
60
52
51
61
15a-c
15b-d
15
70

Fig. 3b


71
72
73
500 ms
500 ms
(a)
80
81
82
80
90
81
91
82
92
(b)
150 ms
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~ 25 ms
~ 10 ms

Fig. 4

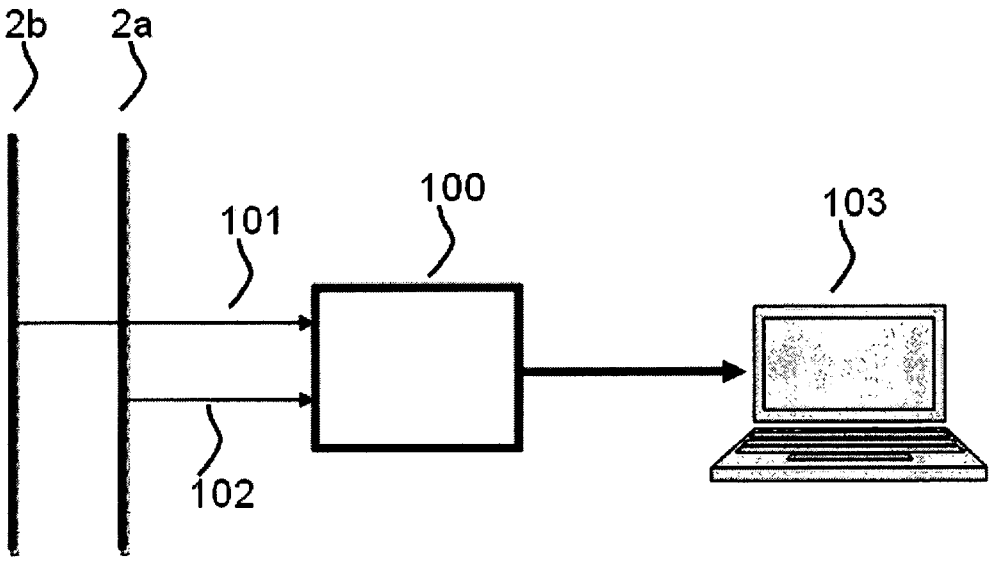

Fig. 5

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EUROPEAN SEARCH REPORT

Application Number
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	1 April 2010	Massalski, Matthias

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EUROPEAN SEARCH REPORT

Application Number
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