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(54) **Device for detecting a short-circuit bridge**

Detektionsvorrichtung einer Kurzschlussbrücke

Dispositif de détection de pont de court-circuit

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Description

[0001] The invention relates to a device for detecting a short-circuit bridge between or across the rails of a railway section, suitable for simulating the presence of a train in said railway section, comprising a first arm, which can be brought into electrical contact with a first rail; a second arm, which can be brought into electrical contact with the other rail; an electrical power source, as well as detection means for detecting and monitoring, in use, the short-circuit resistance of the short-circuit bridge realised by the two arms and between the two rails.

[0002] As is generally known, the Dutch railway network is divided into several sections, also referred to as track sections. The successive track sections are electrically isolated from each other. For reasons of track safety it is possible to determine by means of a so-called track circuit whether a train is present in the track section in question.

[0003] For each section the track circuit forming part of the railway safety system consists of an AC voltage source connected to the rails on one side of the section and a track relay connected to rails on the other side of the section. The moment a train enters the track section in question, the axles of the train cause a short-circuit with the AC voltage source across the two rails, as a result of which less current will flow to the track relay, causing it to drop out.

[0004] As a result of said dropping out of the track relay, the track signal associated with the track section in question will change to red, indicating to oncoming trains that the railway track selection ahead of them is not clear. Moreover, as a consequence of the track signal changing to the red, the railway track safety system will automatically stop any trains that enter the track section yet.

[0005] The moment work is to be carried out in a specific track section, it is desirable and usual to install a short-circuit bridge between the rails of the section in question, thus simulating the presence of a train in said track section. As a result, the track relay will drop out and the track signal in question will change to red.

[0006] This short-circuit bridge is realised by means of a so-called short-circuit lance as described in the introductory part of the main claim and as disclosed in, for example, Dutch patent publication No. 1000713 (corresponding with WO97/02169). The known short-circuit lance comprises two arms which are each brought into electrical contact with one of the two rails. The short-circuit realised by means of the short-circuit lance simulates the presence of a train, causing the track relay to drop out. As a result, the railway safety system "thinks" that a train is present in the track section in question and thus bars trains from entering said section by changing all the signals of tracks leading towards said section to red. This citation also discloses a specific design of the electrical power source and the detection means for detecting and monitoring the short-circuit bridge.

[0007] In a simple embodiment of the known short-circuit lance, a check needs to be made before work is started to verify whether the track relay in question has indeed dropped out. In order to be absolutely certain it is necessary in practice to walk to the signpost in question to check whether the installation of the short-circuit bridge with the short-circuit lance has indeed resulting in the track signal changing to red.

[0008] In addition to that there is a chance that for some reason the short-circuit resistance realised between the two rails will change while work is being carried out and run up so high that the track relay energises again. It stands to reason that this is an undesirable situation, because oncoming trains can now enter the initially protected track section.

[0009] A solution to the above problem is proposed in Dutch patent application No. 1000713. The short-circuit lance described in said publication comprises two arms, which can be brought into electrical contact with each of the rails, and which furthermore comprises a power source and as well as detection means, which, in use, detect and monitor the short-circuit resistance of the short-circuit bridge realised by the two arms and between the two rails.

[0010] To ensure a reliable operation, the short-circuit lance according to NL-1000713 must make a good electrical contact with the two rails, which means that the two arms must be capable of penetrating through rust and dirt that may be present on the sides of the rails. To that end it is proposed in another Dutch patent publication No. 1001121 (corresponding with WO97/09193) to provide the contact ends of the two arms with two electrically separated contacts, at least one electrical contact of which is arranged in a circular arc around the other electrical contact.

[0011] In DE405128 a device is described for establishing a short-circuit bridge between or across the rails of a railway section and is directed to a specific design for improving the electrical contact with the rail.

[0012] The drawback remains, however, that the known short-circuit lance is clamped between the rails only in two points, and that there is a chance that for some reason the electrical contact between one arm or both arms is broken in the course of time, so that the short-circuit effect is lost without this being noticed, causing the track relay to energise again.

[0013] The object of the invention is to provide a solution to the above problem, and according to the invention which is defined by the features of claim 1, whereby the device for detecting a short-circuit bridge between or across the rails of a railway section is characterised in that the detection means are provided with wireless communication means for wirelessly transmitting information regarding the status of the short-circuit resistance of the short-circuit bridge that has been realised. In this way it is no longer necessary to visit the track section in question to check the status of the short-circuit resistance.

[0014] In another functional embodiment, the wireless communication means comprise a GSM and/or GPRS

module. By means of said module the status of the detected short-circuit resistance can be transmitted to and/or retrieved from a central control unit or a responsible person.

[0015] More specifically, in another embodiment the detection means are provided with positioning means for determining the geographic position of the detection device. Said geographic position can again be transmitted by means of the GSM and/or (GPRS) module via the wireless telecommunication link, so that also current information regarding the position identity of the detection device is obtained. The positioning means comprise a GPS module in that case.

[0016] As another additional functional aspect of the invention, the detection means are arranged for determining the current state of the electrical power source. This makes it possible to indicate in time that the electrical power source needs to be exchanged or that the supply voltage being delivered by the electrical power source is too low, which is undesirable, because the protected track section is thus inadequately monitored, which may lead to dangerous situations.

[0017] According to another functional aspect, the detection means may according to the invention comprise a remote-controlled switch, which switch is arranged for making or breaking the short-circuit bridge between the rails. This makes it possible to install the detection device semi-permanently in a track section and to activate or de-activate it by remote control, depending on whether or not track work is being carried out. This prevents personnel having to cover unnecessarily long distances for manually making and breaking the short-circuit bridge of the detection device.

[0018] In another preferred embodiment, the detection means comprise an impedance measuring circuit for detecting and monitoring the short-circuit resistance in use. More specifically, said impedance measuring circuit comprises an AC voltage source for applying an AC voltage signal to the rails via an ohmic resistance element. The impedance measuring circuit may furthermore be arranged for determining the current value of the short-circuit resistance on the basis of the ohmic resistance element, the applied AC voltage signal and the AC voltage signal measured across the ohmic resistance element.

[0019] Since the ohmic resistance element and the short-circuit resistance of the rails form a voltage divider, the current value of the short-circuit resistance, and thus the status of the detection device, can be determined in an efficient manner by carrying out two AC voltage signal measurements.

[0020] According to another functional embodiment, each arm member may furthermore be configured as a flexible member, in particular as a cable provided with a rail ground terminal. This makes it possible to install and connect the device in a track section in a simpler and more flexible manner.

[0021] The invention will now be explained in more detail with reference to a drawing, in which:

Figures 1a and 1b are plan views of a track section protected by a railway safety system;
Figure 2 shows a detection device according to the prior art;
Figure 3 shows an embodiment of a detection device according to the invention;
Figure 4 is a partial view of the embodiment of the detection device of figure 3.

[0022] For a better understanding of the invention, corresponding parts will be indicated by identical reference numerals in the description of the figures below.

[0023] Figure 1 shows a railway 1 built up of successive track sections 1_{-1}-1_0-1_{+1} etc. The track, which comprises several track sections, is built up of rails 2a-2b, which are fixed to sleepers 3. The successive track sections are separated from each other by means of insulating connecting bridges 4 provided in one of the rails 2a-2b or, as shown in the figure, in both rails.

[0024] Each track section 1_{-1}-1_0-1_{+1} is provided with a track circuit, by means of which the presence of a train in the section in question can be detected. To that end the track circuit of each track section is built up of an AC voltage source 5, which is connected to each rail 2a, 2b by means of connections 5a, 5b, respectively. On the other side of the track section in question a dropout or track relay 6 is provided, which is likewise electrically connected to the two rails 2a, 2b of the section in question by means of connections 6a, 6b, respectively.

[0025] In the situation shown in figure 1a, no train is present in the track section 1_0, which means that the AC voltage applied across the two rails 2a-2b (by the AC voltage source 5) keeps the (magnetic) relay 6 energised and open. This situation means that the track signals associated with the track section in question are green and that the track safety system allows trains to enter said track section 1_0.

[0026] Figure 1b shows the situation in which a train 7 enters the track section 1_0 from the left. The axles 7a of the train create a short-circuit between the two rails 2a-2b, causing current to flow from the AC voltage source 5, via the connection 5a, the rail 2a, the axles 7a and via the other rail 2b and the connection 5b back to the AC voltage source. As a result, less current will flow to the track relay 6, causing it to drop out. This situation is shown in figure 1b.

[0027] Said dropping out of the track relay 6 resulting from the short-circuit created across the two rails 2a-2b will cause the track signals associated with the track section 1_0 in question to change to red. Turning the track signals to red means that the track section in question is protected and for the time being inaccessible to subsequently arriving trains.

[0028] When work is being carried out in the track section in question, such short-circuiting of the track section 1_0 by a passing train 7 can also be simulated by a "sim-

ulation train", using a short-circuit lance, a prior art embodiment of which is shown in figure 2. The prior art short-circuit lance 10 is built up of a housing 10a, to which two arms 11-31 are connected, whose contact heads 17-37 can be brought into electrical contact with the respective rails 2a-2b.

[0029] The two arms 11-31 can be moved apart by means of a lever 10b so as to effect a good clamping engagement and thus a good electrical contact between the contact heads 17-37 and the two rails 2a-2b. The short-circuit thus realised between the two rails 2a-2b can be detected or monitored by means of suitable detection means 15, in this embodiment in the form of a separate unit, which is connected to each contact head 17-37 by means of connections 15a and 15b, respectively.

[0030] Upon installation of the short-circuit lance 10 between the two rails 2a-2b, the arms 11-31 need to be moved apart by means of the lever 10b. Operating staff must to that end operate the lever 10b in a bent-over position in order to move the two arms 11-31 apart and into contact with the two rails 2a-2b. The user's bent-over position leads to a hazardous situation, since the person in question does not have a good view of the track section, which at that point is not protected and secured yet.

[0031] Figure 3 shows an embodiment of the detection device according to the invention, and more in particular the detection means that detect and monitor the short-circuit resistance of the short-circuit bridge realised between the two rails 2a-2b by the two arms 11-31. The core of the detection means 15 is formed by a central processing unit 50, also referred to as a "microcontroller". The microcontroller 50 controls the various parts of the detection means 15 so as to enable the detection device 10 to function correctly.

[0032] According to the invention, the detection means 15 are arranged for transmitting all kinds of collected status information to, for example, a central control unit or to a responsible person via a wireless communication link. Said central control unit may be a computer or a server, for example, which can be accessed via a network (the Internet) by persons/bodies who can use the status information of the detection device 10 in question and are authorized to do so.

[0033] Said status information may inter alia comprise information regarding the position and identity of the detection device, but above all information regarding the status of the detection device, such as the current value of the measured short-circuit resistance.

[0034] To enable wireless communication with equipment that is located elsewhere, wireless communication means 53 are provided, which are linked to a GSM module 56 (which may also be configured as a GRPS or UMTS module) and controlled by the microcontroller 50. A wireless communication link can thus be set up via said GSM/GPRS/UMTS module for transferring the required status information to the remote central control unit.

[0035] Furthermore, positioning means 53' forming part of the wireless communication means 53 are provided, which positioning means are linked to a GPS module 56'. Combined with said GPS module 56', the positioning means make it possible to make a position determination for use by the detection device. The geographic position thus determined can likewise be transmitted as part of the status information to be transmitted to the remote central control unit, using the wireless communication means 53. In this way the personnel present at the location of the central control unit can easily determine the location of the detection device 10 in question in a track section.

[0036] Similarly, information regarding the identity of the detection device 10 in question can be transmitted together with the status information.

[0037] The detection means 15 are further provided with suitable means 54, referred to as management unit, for monitoring the supply voltage of the electrical power source 55. In view of the autonomous nature of the detection device 10 and the fact that such a detection device must remain in a track section for a prolonged period of time, (rechargeable) batteries 55 are generally used. The limited life of such a battery 55 makes it necessary for the supply voltage to be monitored by a battery management unit 54. In the undesirable event of the voltage supplied by the battery 55 falling below a predetermined value, the detection means will drop out and thus cease to monitor the status of the short-circuit resistance. Unintentional and undesirable dropping out of the short-circuit resistance (e.g. due to vandalism) will thus remain unnoticed, as a result of which, due to the track signals undesirably changing to green without this being directly noticeable, the previously protected track section is no longer barred to regular trains rushing towards said track section. This latter fact is not noticed by the remote central control unit, for example the track manager.

[0038] The battery management 54 can thus forward specific information regarding the current power level of the battery 55 to the microcontroller 55, which in turn controls the wireless communication means 53 for transmitting the current power level of the battery 55, amongst other data. The detection means 15 may comprise suitable control units 59 as additional "teachers" for controlling status indicators 62, in this case preferably in the form of LEDs.

[0039] Reference numeral 63 indicates a (key) switch for activating or deactivating the entire detection device.

[0040] Reference numeral 52 indicates a lighting element for illuminating the device 10 and its direct surroundings when work is being carried out at night.

[0041] The detection means 15 may furthermore be provided with a slot 60, into which a memory card 64 can be inserted. Thus, all kinds of relevant information can be stored on said memory card 64 for backup, maintenance and checking purposes. On the other hand, reference number 61 indicates an external switch contact for connecting external auxiliary devices to the detection means 15.

[0042] In addition to the transmission of all kinds of status information by the wireless communication means 53, the detection means 15 are also capable of receiving an externally transmitted message, for example an SMS message, for activating the detection device 10 or retrieving a status report with current information regarding the status of the detection means (current voltage level of the battery 55), the geographic position as determined by the positioning means 53'-56', and the current value of the short-circuit resistance between the two rails 2a-2b. After receipt of such an external status request, the microcontroller 50 can control the various parts of the detection means 15 and transmit the various status information thus obtained to the remote central control unit via the wireless communication means 53.

[0043] In addition to that, the central control unit (or "server") can effect a direct communication link with the detection means 15 (for example via the VPN protocol). The direct communication link can be used for continuously retrieving status information or transmitting control signals.

[0044] In other words, such an externally transmitted request received by the detection means 15 may contain various control signals, which control or instruct the microcontroller 50 to collect the status information of the various parts (battery 55, geographic positioning means 56', current short-circuit resistance as measured by the measuring circuit 51, the relay 57') and transmit it via the wireless communication means 53. Such a control signal may also activate or de-activate the detection device 10. In the latter case, the received control signal can be used by the microcontroller 50 for turning a relay switch 57' on or off by means of the switch unit 57, thereby making or breaking the short-circuit bridge between the rails 2a-2b.

[0045] As a result, the detection device 10 can be installed more or less semi-permanently in a track section and be activated by remote control in dependence on whether or not track work is being carried out in said section. This prevents personnel having to cover unnecessarily long distances for manually making and breaking the short-circuit bridge of the detection device 10 between the rails 2a-2b. Said making or breaking of the short-circuit bridge between the two rails 2a-2b by means of the (relay) switch 57' is detected by the switch unit 57 and fed back as status information to the microcontroller 50, which can transmit said status information to the central control unit via the wireless communication means 53.

[0046] Reference numeral 65 indicates an external switch contact on the detection device 10, to which an external power source can be connected for energizing the relay 57' for a prolonged period of time.

[0047] The detection means 15 are provided with an impedance measuring circuit 51 for detecting or monitoring the short-circuit resistance of the short-circuit bridge realised between the rails 2a-2b by the two arms 11-31. Said impedance measuring circuit 51 is shown in more detail in figure 4. According to the invention, the impedance measuring circuit 51 is built up round a galvanically isolated milliohm measuring unit 510. Said milliohm measuring unit 510 must be galvanically isolated so as to be more adequately shielded from any and all interference voltage in the rails 2a-2b.

[0048] In order to prevent interference caused by such interference signals in the rails 2a-2b, use is made of a sinusoidal AC voltage source 511, which optionally applies an AC voltage signal V_{ref} to the rails 2a-2b via a transformer and an ohmic resistance element 512. The rails 2a-2b themselves have an internal impedance Z, which impedance is schematically indicated at 513 in figure 4. The impedance Z of the rails 2a-2b and the ohmic resistance element 512 are connected in series. The ohmic resistance value of the resistance element 512 is precisely known. To measure the short-circuit resistance Z between the rails 2a-2b, the voltage signals V_m is measured directly downstream of the ohmic resistance element 512.

[0049] Together with the short-circuit impedance Z, the ohmic resistance element 512 forms a block 513, a voltage divider, wherein the relation between V_{ref} and V_m is as follows:

$$V_m = V_{ref\,x} (R + Z) / Z$$

[0050] On the basis of this equation the short-circuit resistance Z between the rails 2a-2b can be measured. It will be understood that the power supply signals V_{ref} being applied and the measured voltage signal V_m derived therefrom are sensitive to all kinds of interference signals, whose amplitude and power may be larger than those of the actual measuring signal being generated. Such interference can be eliminated in large measure by building up the detection means 15, and more in particular the impedance measuring circuit 51, of digital components, in which case the various measuring signals are digitally generated and processed.

[0051] Since a single frequency reference is used for generating, filtering, obtaining and processing the various measuring signals, the measurement of the short-circuit impedance Z can be realised in a very precise manner. Since the same frequency reference is used for generating, filtering and processing the signals, any deviation during the generation of the signals will result in an identical deviation during the further processing thereof, so that the final measuring result will not be adversely affected.

[0052] Although the measurement of the short-circuit impedance between the rails 2a-2b can be carried digitally in this way, analog components are needed for the further processing of the measuring results, for example for supplying the information in question to, for example, the wireless communication means 53 by analog means. Said analog components can no longer interfere with the final measuring result, however.

[0053] By comparing the measured short-circuit resistance Z with a value previously programmed into the detection means 15, essential status information regarding the value of the short-circuit resistance between the rails 2a-2b can be transmitted to the remote central control unit on the basis of said comparison. Any decrease of the short-circuit resistance Z can thus be detected and communicated in time, so that any unforeseen and unintentional breaking of the short-circuit contact between the two rails 2a-2b can be anticipated at an early stage, thereby preventing dangerous situations due to the track section undesirably being cleared.

[0054] In another functional embodiment, each arm member may furthermore be configured as a flexible member, in particular as a cable provided with a rail ground terminal. This enables a simpler and more flexible installation and connection of the device in a track section.

[0055] It will be apparent that the short-circuit lance as described herein provides a more versatile but above all more reliable and especially safer embodiment, which significantly enhances the level of safety and reliability of the work being carried out on the railway.

Claims

1. A device (10) for detecting a short-circuit bridge between or across the rails (2a-2b) of a railway section, suitable for simulating the presence of a train in said railway section, the device comprising
   a first arm (11), which can be brought into electrical contact with a first rail (2a);
   a second arm (31), which can be brought into electrical contact with the other rail (2b);
   an electrical power source (55), as well as
   detection means (15) for detecting and monitoring, in use, the short-circuit resistance of the short-circuit bridge realised by the two arms and between the two rails, **characterised in that** the detection means are provided with wireless communication means (53) for wirelessly transmitting information regarding (the status of) the short-circuit resistance of the short-circuit bridge that has been realised.

2. A detection device according to claim 1, **characterised in that** the detection means are capable of receiving externally transmitted control signals for controlling or instructing the device.

3. A detection device according to claim 1 or 2, **characterised in that** the wireless communication means comprise a GSM and/or GPRS module.

4. A detection device according to claim 1,2 or 3, **characterised in that** the detection means are provided with positioning means (53') for determining the geographic position of the detection device (10).

5. A detection device according to claim 4, **characterised in that** said positioning means (53') comprise a GPS module.

6. A detection device according to any one or more of the preceding claims, **characterised in that** the detection means (15) are arranged for determining the current condition of the electrical power source (55).

7. A detection device according to any one or more of the preceding claims, **characterised in that** the detection means (15) comprise a remote-controlled switch (57-57'), which switch is arranged for making or breaking the short-circuit bridge between the rails.

8. A detection device according to any one or more of the preceding claims, **characterised in that** the detection means comprise an impedance measuring circuit (51) for detecting and monitoring the short-circuit resistance in use.

9. A detection device according to claim 8, **characterised in that** said impedance measuring circuit (51) comprises an AC voltage source (511) for applying an AC voltage signal to the rails via an ohmic resistance element (512).

10. A detection device according to claim 9, **characterised in that** said impedance measuring circuit (51) is arranged for determining the current value of the short-circuit resistance on the basis of the ohmic resistance element (512), the applied AC voltage signal and the AC voltage signal measured across the ohmic resistance element.

11. A detection device according to any one or more of the preceding claims, **characterised in that** each arm member is configured as a flexible member, in particular as a cable provided with a rail ground terminal.

Patentansprüche

1. Vorrichtung (10) zur Erfassung einer Kurzschlussbrücke zwischen oder an den Schienen (2a-2b) eines Bahnabschnitts, die dazu geeignet ist, das Vorhandensein eines Zugs in dem Bahnabschnitt zu simulieren, wobei die Vorrichtung Folgendes aufweist:

   einen ersten Arm (11), der mit einer ersten Schiene (2a) in elektrischen Kontakt gebracht werden kann;
   einen zweiten Arm (31), der mit der anderen Schiene (2b) in elektrischen Kontakt gebracht werden kann;
   eine Stromquelle (55) sowie
   Erfassungsmittel (15) zur Erfassung und Über-

wachung, im Gebrauch, des Kurzschlusswiderstands der Kurzschlussbrücke, die durch die beiden Arme und zwischen den beiden Schienen gebildet ist, **dadurch gekennzeichnet, dass** die Erfassungsmittel mit Funkverbindungsmitteln (53) zur drahtlosen Übermittlung von Informationen zum Kurzschlusswiderstand (zum Status des Kurzschlusswiderstands) der Kurzschlussbrücke, die gebildet wurde, ausgestattet sind.

2. Erfassungsvorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** die Erfassungsmittel dazu geeignet sind, extern übermittelte Steuersignale zu empfangen, um die Vorrichtung zu steuern oder dieser Anweisungen zu geben.

3. Erfassungsvorrichtung nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** die Funkverbindungsmittel ein GSM- und/oder GPRS-Modul umfassen.

4. Erfassungsvorrichtung nach Anspruch 1, 2 oder 3, **dadurch gekennzeichnet, dass** die Erfassungsmittel mit Positioniermitteln (53') zur Bestimmung der geographischen Position der Erfassungsvorrichtung (10) ausgestattet sind.

5. Erfassungsvorrichtung nach Anspruch 4, **dadurch gekennzeichnet, dass** die Positioniermittel (53') ein GPS-Modul umfassen.

6. Erfassungsvorrichtung nach mindestens einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Erfassungsmittel (15) dazu angeordnet sind, den aktuellen Zustand der Stromquelle (55) zu bestimmen.

7. Erfassungsvorrichtung nach mindestens einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Erfassungsmittel (15) einen fernbetätigten Schalter (57-57') aufweisen, wobei der Schalter dazu angeordnet ist, die Kurzschlussbrücke zwischen den Schienen zu bilden oder zu unterbrechen.

8. Erfassungsvorrichtung nach mindestens einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Erfassungsmittel eine Impedanzmessschaltung (51) zur Erfassung und Überwachung des Kurzschlusswiderstands im Gebrauch aufweisen.

9. Erfassungsvorrichtung nach Anspruch 8, **dadurch gekennzeichnet, dass** die Impedanzmessschaltung (51) eine Wechselspannungsquelle (511) aufweist, um ein Wechselspannungssignals über ein ohmsches Widerstandselement (512) an die Schienen anzulegen.

10. Erfassungsvorrichtung nach Anspruch 9, **dadurch gekennzeichnet, dass** die Impedanzmessschaltung (51) zur Bestimmung des gegenwärtigen Werts des Kurzschlusswidersands auf der Basis des ohmschen Widerstandselements (512), des angelegten Wechselspannungssignals und des am ohmschen Widerstandselement gemessenen Wechselspannungssignals angeordnet ist.

11. Erfassungsvorrichtung nach mindestens einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** jedes Armelement als flexibles Element, insbesondere als mit einer Schienenerdungsklemme versehenes Kabel ausgebildet ist.

Revendications

1. Dispositif (10) pour détecter un pont de court-circuit entre ou sur les rails (2a, 2b) d'une section de voie ferrée, approprié pour simuler la présence d'un train dans ladite section de voie ferrée, le dispositif comprenant
un premier bras (11) qui peut être amené en contact électrique avec un premier rail (2a) ;
un second bras (31) qui peut être amené en contact électrique avec l'autre rail (2b) ;
une source de courant électrique (55), ainsi que
des moyens de détection (15) pour détecter et surveiller, à l'usage, la résistance au court-circuit du pont de court-circuit réalisé par les deux bras et entre les deux rails, **caractérisé en ce que** les moyens de détection sont dotés de moyens de communication sans fil (53) pour transmettre, sans fil, des informations concernant (l'état de) la résistance au court-circuit du pont de court-circuit qui a été réalisé.

2. Dispositif de détection selon la revendication 1, **caractérisé en ce que** les moyens de détection peuvent recevoir des signaux de commande transmis extérieurement pour contrôler ou donner des instructions au dispositif.

3. Dispositif de détection selon la revendication 1 ou 2, **caractérisé en ce que** les moyens de communication sans fil comprennent un module GSM et/ou GPRS.

4. Dispositif de détection selon la revendication 1, 2 ou 3, **caractérisé en ce que** les moyens de détection sont dotés de moyens de positionnement (53') pour déterminer la position géographique du dispositif de détection (10).

5. Dispositif de détection selon la revendication 4, **caractérisé en ce que** les moyens de positionnement

(53') comprennent un module GPS.

6. Dispositif de détection selon l'une quelconque ou plusieurs des revendications précédentes, **caractérisé en ce que** les moyens de détection (15) sont agencés pour déterminer la condition actuelle de la source de courant électrique (55).

7. Dispositif de détection selon l'une quelconque ou plusieurs des revendications précédentes, **caractérisé en ce que** les moyens de détection (15) comprennent un commutateur commandé à distance (57-57'), lequel commutateur est agencé pour établir ou rompre le pont de court-circuit entre les rails.

8. Dispositif de détection selon l'une quelconque ou plusieurs des revendications précédentes, **caractérisé en ce que** les moyens de détection comprennent un circuit de mesure d'impédance (51) pour détecter et surveiller la résistance au court-circuit, à l'usage.

9. Dispositif de détection selon la revendication 8, **caractérisé en ce que** ledit circuit de mesure d'impédance (51) comprend une source de tension AC (511) pour appliquer un signal de tension AC sur les rails via un élément de résistance ohmique (512).

10. Dispositif de détection selon la revendication 9, **caractérisé en ce que** ledit circuit de mesure d'impédance (51) est agencé pour déterminer la valeur actuelle de la résistance au court-circuit en fonction de l'élément de résistance ohmique (512), le signal de tension AC appliqué et le signal de tension AC mesuré sur l'élément de résistance ohmique.

11. Dispositif de détection selon l'une quelconque ou plusieurs des revendications précédentes, **caractérisé en ce que** chaque élément de bras est configuré comme un élément flexible, en particulier comme un câble prévu avec une borne de terre de rail.

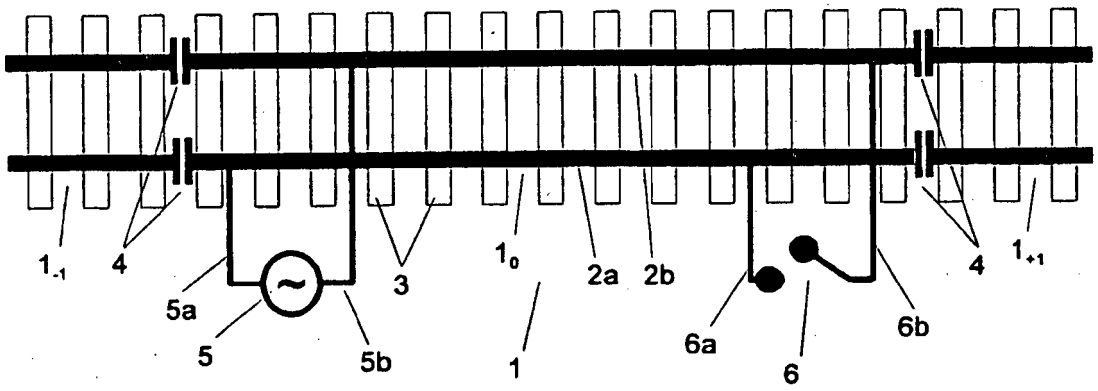

Fig. 1a

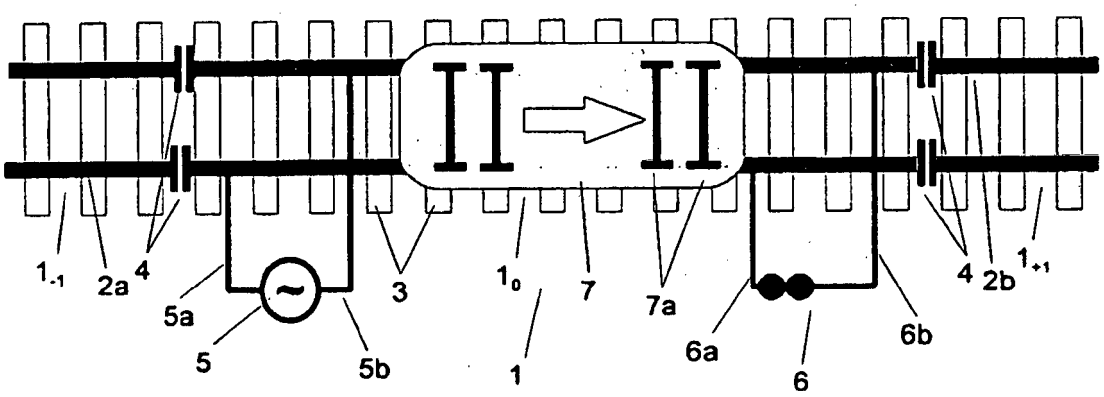

Fig. 1b

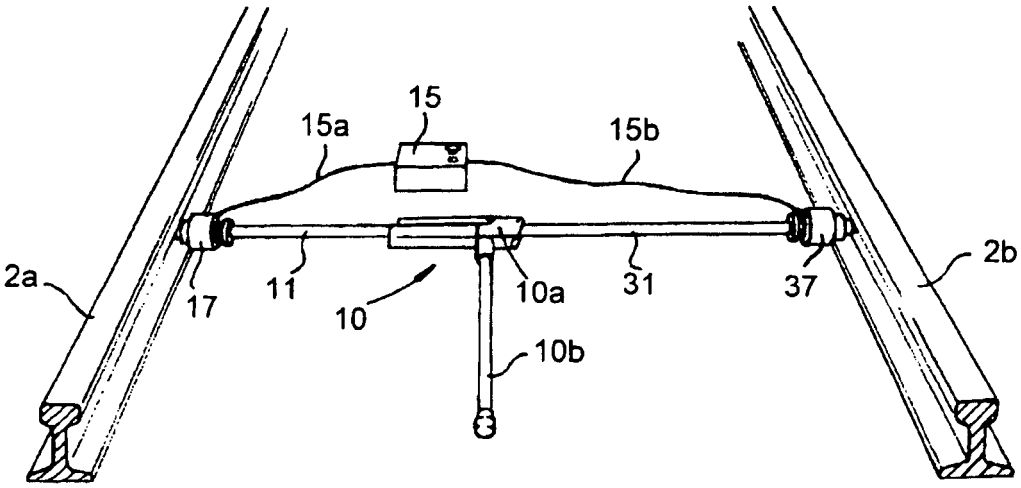

Fig. 2
(state of the art)

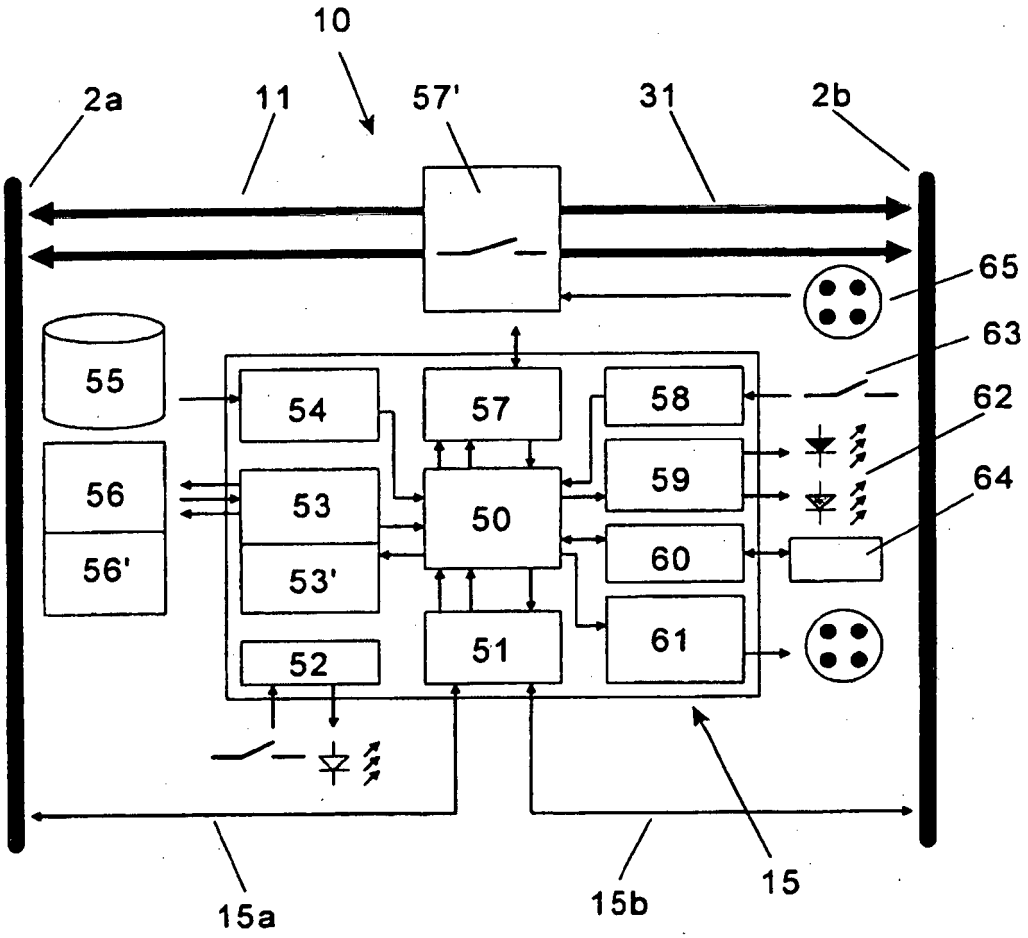
10
2a
11
57'
31
2b
65
63
62
64
55
56
56'
54
53
53'
52
57
50
51
58
59
60
61
15a
15b
15

Fig. 3

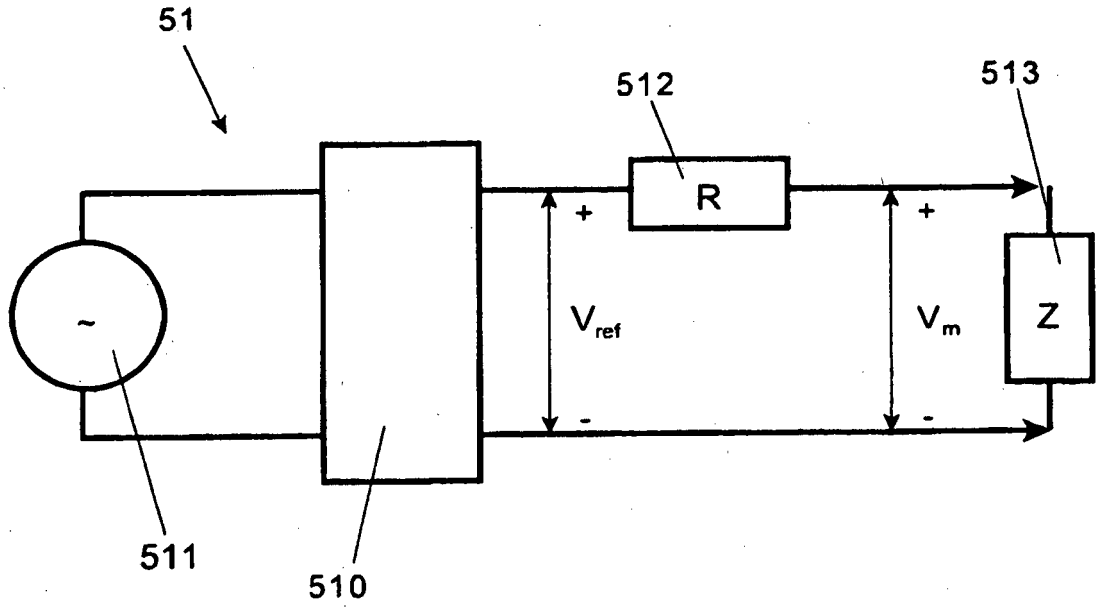

Fig. 4

REFERENCES CITED IN THE DESCRIPTION

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