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(54) SELF-DETECTING SHUNT BAR

(57) The present invention relates to a self-detecting shunt bar for creating a short-circuit bridge between or across two rails of a section of a railway track, comprising:
- a first connection which is configured to be brought into electrical contact with a first of the two rails;
- a second connection which is configured to be brought into electrical contact with a second of the two rails;
- a signal generator for providing a test signal across the short-circuit bridge;
- a detection device which is configured to measure and monitor a short-circuit resistance of the short-circuit bridge created, during operation, by measuring the test signal; and
- signalling means which are configured to signal the measured short-circuit resistance to a user of the shunt bar, characterized in that the shunt bar is integrated into a railway switch, and the electrical power source, the detection device and the signalling means are connected to, and energized by, a power supply of a motor of a switch actuator of the railway switch.

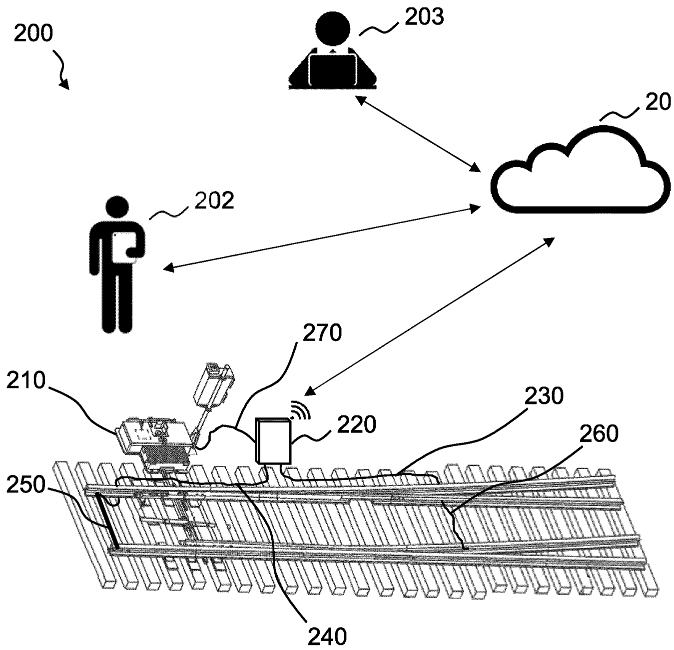

Fig. 2

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Description

[0001] The present invention relates to a self-detecting shunt bar for creating a short-circuit bridge between or across the two rails of a section of a railway track.

[0002] The safeguarding of a railway network by automatically signalling the presence of trains is generally known.

[0003] To this end, the tracks of the network are divided into electrically isolated sections which are connected to the so-called track circuit, by means of which it is possible to determine whether a train is present on this line section. This loop consists of an AC source which is connected to the rails at one end of the line section and of a relay (the so-called track relay) which is connected to the rails at the other end of the line section. When a train is present on the route, the axles of the train cause a short circuit with the AC source, as a result of which less current flows to the relay, causing it to drop out. The signal that permits access to this section turns red and prevents trains from entering.

[0004] In the case of work to be carried out in a line section, it is usual to install a short-circuit connection between the two rails, for example using a shunt bar as known from NL1033581. This simulates the presence of a train on said line section, as a result of which the track relay drops out.

[0005] However, the safeguarding when work is being carried out described above has the disadvantage that there is a need to check by means of a test procedure whether the track relay has actually dropped out.

[0006] In practice, this means that it is necessary first to walk to the signal in order to be certain that the signal has been compromised through the installation of the short-circuit connection.

[0007] NL1036399 discloses a shunt bar which can be used to check the status of the connection between the two rails; this is known as a self-detecting shunt bar. This known device comprises a signal-transmitting circuit and a signal-detecting circuit which are connected respectively to the right-hand rail and to the left-hand rail. It is detected whether the signal from one circuit is received by the other. When it is determined for one reason or another that the short-circuit resistance has changed and become so high that the track relay closes again, which results in trains being able to access the area which was secured in order for works to be carried out, this must be detected and signalled. The danger for track workers is therefore minimized and as such a safe working area can be provided.

[0008] Despite the fact that such known self-detecting shunt bars offer a wide range of advantages, there are also challenges. A wide range of electronic components need to be added in order to enable the shunt bar to signal problems relating to the short circuit itself, and the complexity of the device generally increases. It is therefore subsequently necessary to take extra measures to ensure the operational safety of the device. Various parts in known self-detecting shunt bars thus have a redundant design. It is known for example to design each arm of the shunt bar with two parallel arm elements, each of which can be brought into contact with a rail separately. This further reduces the risk of poor contact, for example due to rust formation on the rail.

[0009] In general, it can thus be stated that, on the one hand, there is a desire to make a shunt bar as simple as possible because complexity and the addition of parts generally reduce operational safety. On the other hand, there is a desire to add various extra functionalities to further increase operational safety or to compensate for the decrease in operational safety caused by the addition of a number of parts, for example by designing certain parts in a redundant manner.

[0010] The aim of the invention is to increase the safety of track workers even further when using a shunt bar by providing a self-detecting shunt bar which on the one hand is robust and affords a high degree of operational safety and on the other hand has a simplified design or at any rate does not increase the complexity of the shunt bar.

[0011] This aim is achieved according to the invention by a shunt bar in accordance with a first aspect of the present description and in accordance with Claim 1.

[0012] In a first aspect there is provided a self-detecting shunt bar for creating a short-circuit bridge between or across two rails of a section of a railway track, comprising:

- a first connection which is configured to be brought into electrical contact with a first of the two rails;
- a second connection which is configured to be brought into electrical contact with a second of the two rails;
- a signal generator for providing a test signal across the short-circuit bridge;
- a detection device which is configured to measure and monitor a short-circuit resistance of the short-circuit bridge created, during operation, by measuring the test signal; and
- signalling means which are configured to signal the measured short-circuit resistance to a user of the shunt bar, characterized in that the shunt bar is integrated into a railway switch, and the electrical power source, the detection device and the signalling means are connected to, and energized by, a power supply of a motor of a switch actuator of the railway switch.

[0013] The self-detecting shunt bar relates to a shunt bar having an electrical power source preferably integrated into the shunt bar or, alternatively, in the vicinity thereof, and a signal generator is provided, which generates a (test) signal which is used by a detection or measuring device in or in the vicinity of the shunt bar to measure the short-circuit resistance or to derive this from the measurement. This can be used to determine and monitor whether the short-circuit bridge has been installed successfully and remains so.

[0014] A shunt bar of this type is itself able to test the short-circuit resistance to assess whether it meets the requirements laid down for this. If this is not the case, this can be signalled in situ to a user (usually a track worker carrying out work in a work zone). This provides continuous signalling which affords a very high degree of safety.

[0015] Due to the fact that the shunt bar is self-detecting, it is provided with various circuits such as the signal generator, the measuring device and control means for comparing the measurement results with threshold values, and signalling means for signalling the result of the comparison. The self-detecting shunt bar may furthermore have a wireless design. A remote-controlled (RC), self-detecting shunt bar of this type comprises communication means for this purpose.

[0016] In order to ensure that the self-detecting shunt bar meets strict safety levels, certain parts, circuits or even whole units can have a redundant design on their own or in groups. Moreover, it is possible to select robust components for the same reasons of operational safety.

[0017] The increase in the amount of electronic components and circuits as well as the increase in complexity and robustness of the individual components significantly increases the reliance on the power source.

[0018] It is therefore also obvious to design the battery of the self-detecting shunt bar as redundant as well or to integrate alternative power supplies, such as solar cells. It is also obvious to add controllers to the battery, which controllers continuously measure whether the battery has enough capacity and the degradation of the battery falls within norms so as to be able to guarantee the operational safety of the self-detecting shunt bar.

[0019] The inventor has found that the operational safety of the self-detecting shunt bar is therefore greatly determined by the battery and the reliance thereon subsequently increases the complexity further through redundancy and/or the need for controllers.

[0020] This problem can be solved by supplying the power from another source, of which the operational safety in supplying the power is at least just as high as the demands placed on the self-detecting shunt bar. The inventor has found that the power supply of a switch actuator of a switch meets such requirements and can therefore be used with a high degree of operational safety as the power source for the self-detecting shunt bar. Subsequently integrating the self-detecting shunt bar into the switch makes it possible to take this section of the railway track out of service by installing the short-circuit bridge between the two rails of the switch, whereby the shunt bar receives the power supply from the motor of the railway switch and in particular the switch actuator. That is to say that the same power source that energizes the switch actuator is also used to energize the shunt bar.

[0021] This not only has many advantages in terms of integrating, and thus permanently using, the shunt bar in a railway switch, but it also makes it possible to use the power supply of the switch actuator to supply power to the shunt bar as well. The power supply of the switch actuator must meet a high, equal or higher degree of reliability as that placed on a shunt bar. Furthermore, a switch actuator requires a relatively demanding power supply, with this far outweighing the relatively low power consumed by the shunt bar. The extra connection of the shunt bar to the power supply of the motor of the switch actuator surprisingly enough does not lead to a decrease in the operational safety of the switch. The disadvantages of using a battery, and thus also the necessary increase in the number of components and the complexity as a result of the use of a battery, are therefore eliminated without this jeopardizing or even impairing the operational safety of other components on the track.

[0022] In one example, the shunt bar is permanently integrated with the railway switch and in particular wherein the first and second connection are permanently integrated with the railway switch.

[0023] The shunt bar consists of two parts, each of which may be electrically connected or brought into contact with a respective rail. These parts may be designed as flexible parts, such as a cable, or as rigid parts, such as a (mechanical) arm, where the two arm parts can pivot with respect to one another.

[0024] Both the flexible and the rigid design can be permanently integrated into the switch, which means that it is not releasable and is thus better able to withstand coming loose as a result of vibrations and/or unwanted external interference. The result of this is that the short-circuit bridge is thus more robust and therefore the operational safety is increased as well.

[0025] Preferably at least one part, more preferably all parts, of the self-detecting shunt bar is or are accommodated in a separate housing which is located in the rail, or more preferably is located next to or close to the rail. According to the present invention, this central housing is connected to the switch in order to receive power from the switch. The housing comprises outlets or connections to one or more shunt bars. That is to say that a plurality of cables can run from said housing to the various opposite rails. There is one pair of cables at least for each pair of rails for installing the short-circuit bridge, but more preferably there is also one pair of cables so as to be able to take a measurement across this short-circuit bridge and as such to monitor same over a relatively long period. The central housing may be provided with multiple such outlets. That is to say a first group of wires for both creating the short circuit and for measuring and monitoring the short-circuit resistance, all of this in a first position between two opposite rails, and a second group (and possible further groups) for creating the short circuit, measuring and monitoring the short-circuit resistance in a second position (and possible further positions) between two opposite rails. Most preferably, the switch comprises four cables (in a conventional switch this is thus three) for any switch point or connection, two of said four cables being configured to implement the short-circuit bridge between the rails and the other two being configured to measure the short-circuit resistance.

[0026] In one example, the shunt bar is completely integrated with the railway switch and in particular wherein the first and second connection are permanently integrated with the railway switch.

[0027] In one example, the first and second connection are permanently integrated into one or more railway sleepers between the two rails of the railway switch.

[0028] The permanently integrated shunt bar may also be permanently integrated such that it constitutes an integral or monolithic element of a part of the switch. For example, by permanently connecting it to a railway sleeper or incorporating it integrally in the railway sleeper. For example, in the case of a concrete or plastic railway sleeper, it may be cast in the mould. This also has the effect that the short-circuit bridge is thus more robust and therefore the operational safety is increased as well.

[0029] In one example, the first and second connection are designed as a first and second arm which are pivotable with respect to one another and which first and second connection are preferably each provided with two or more arm parts in order to be brought into electrical contact with a first or respectively second rail separately in parallel with one another.

[0030] In one example, the first and second connection are designed as flexible first and second connections and in particular as cables, which flexible first and second connection are preferably each provided with two or more connection terminals in order to be brought into electrical contact with a first or respectively second rail separately in parallel with one another.

[0031] In one example, the electrical power source of the shunt bar comprises a converter for converting the supply voltage of the power supply of the motor of the railway switch to a power supply which is required for the shunt bar.

[0032] The power supply of the switch which energizes the motor actuator will be able to deliver a sufficient current intensity, amperes, but may possibly deliver another voltage, depending on the type of motor actuator. For this purpose, the shunt bar may be provided with a converter which can be used to increase or decrease the voltage of the power supply of the switch to a voltage which is required for the (parts of the) shunt bar.

[0033] In one example, the shunt bar further comprises a communication device for communicating the status of the shunt bar to a central processing unit.

[0034] The shunt bar is preferably designed with communication means or a communication device which can be used to establish a connection with a central processing unit via a wired but preferably a wireless connection of for example a public telecommunication network, such as a 3G, 4G, 5G or other generation cellular network. The state (short-circuit resistance) of the short-circuit bridge in the switch can thus be disclosed to a central server or another central processing unit, as a result of which shunt bars of various switches which are part of different locally organized safety zones can be monitored centrally.

[0035] The communication means also make it possible to not only read out and therefore disclose the measurement data but also to control the shunt bar from a distance in order to thus switch the permanently implemented shunt bar on and off from a distance. The effect of this is that it is possible to provide a simple way to take out of service one or more sections of a railway track centrally and across several locally organized safety zones, and without demarcating them. Furthermore, the process for taking the sections out of service can be performed with a high degree of operational safety and the complexity of the shunt bar is reduced with an equal or higher degree of operational safety due to making use of the power supply of the switch.

[0036] In one example, the signalling means comprise one or more auditory and visual signalling means and are accommodated in a housing of the shunt bar in order to signal to the user of the shunt bar by auditory and/or visual means a deviation between the measured short-circuit resistance and a preset threshold value for the short-circuit resistance.

[0037] In one example, the shunt bar further comprises a control unit for comparing the measured short-circuit resistance with a reference value and wherein the signalling means only signal the measured short-circuit resistance if the measured short-circuit resistance exceeds the reference value by a predetermined threshold.

[0038] In one embodiment, the signalling means can display the short-circuit resistance to the local user of the shunt bar. The user will then themselves have to make an assessment regarding the extent to which this resistance value deviates from the norm. However, it is preferred that the norm and/or a set threshold value as a deviation from the norm is set, or is even set remotely, on the shunt bar itself. The shunt bar, or at least a control unit thereof, will then evaluate whether the measured value deviates from the norm and will accordingly provide a signal only if this situation occurs.

[0039] The invention will now be discussed in more detail below on the basis of the drawings.

[0040] The drawings show:

Fig. 1a and 1b a plan of a section of railway track which is protected by a railway track safety system;

Fig. 2 a schematic illustration of multiple self-detecting shunt bars in a switch according to one embodiment of the present invention.

Fig. 1a shows a railway 1 which is composed of consecutive rail track sections 1_{-1}-1-1_{+1} etc. The line section which is made up of the various rail track sections is composed of rails 2a-2b which are placed on the railway sleepers 3. The consecutive rail track sections are separated from one another by means of insulating coupling bridges 4 which are provided in one of the rails 2a-2b or, as shown here in the figure, in both rails.

[0041] Each rail track section 1_{-1}-1-$1+_{1}$ is provided with a track circuit which can be used to detect the presence of a train in the section in question. To that end, the track circuit of each rail track section is composed of an AC voltage source 5 which is connected to each rail 2a and 2b, respectively, by means of connections 5a-5b. On the other side of the rail track section in question, a dropout or track relay 6 is provided, which is likewise electrically connected to the two rails 2a and 2b, respectively, of the section in question by means of connections 6a-6b.

[0042] In the situation shown in Fig. 1a, there is no train present on the rail track section 1_0, which means that the AC voltage applied across the two rails 2a-2b (by the voltage source 5) keeps the (magnetic) relay 6 energized and open. This situation means that the track signals associated with the rail track section in question are green and that the railway track safety system allows trains to enter said rail track section 1_0.

[0043] Fig. 1b shows the situation in which a train 7 enters the rail track section 1o from left to right. The axles 7a of the train create a short-circuit bridge between the two rails 2a-2b, causing current to flow via the AC voltage source 5 and the connection 5a back to the AC voltage source. As a result, less current flows to the track relay 6, causing it to drop out. This situation is shown in Fig. 1b.

[0044] Said dropping out of the track relay 6 resulting from the short-circuit bridge created across the two rails 2a-2b will cause the track signals associated with the rail track section 1o in question to change to red. Turning the track signals to red means that the rail track section in question is protected and for the time being is inaccessible to subsequently arriving rail traffic.

[0045] When work is being carried out in the rail track section in question, such short-circuiting of the rail track section 1_0 by a passing train 7 can also be simulated by a "simulation train", using a shunt bar.

[0046] If regulations for the work require it, a shunt bar of the type which implements a short-circuit bridge between or across the two rails of a section of a railway track is used when work is being carried out on the rail. In order to make good contact, it is essential for the operation of the shunt bar that the shunt bar must be able to get through the rust on the side of the rails. The shunt bar implements a short circuit or short-circuit bridge and thus imitates a train; it thus ensures that the track relay drops out, as described above. This makes the safety system think that a train is present on the section and blocks access to the section in question by changing the signals to red.

[0047] Since it is essential that the short-circuit bridge functions correctly and the safety of the track workers depends greatly on this, it is desirable and known that the shunt bar is designed as a self-detecting shunt bar. Shunt bars of this type have the possibility of checking whether the short-circuit resistance is sufficient, that is to say is sufficiently low, for the relay to drop out. Furthermore, it is possible for the short-circuit resistance to change and become so high that the track relay picks up again, with the result that the protected area becomes accessible to trains again. A self-detecting shunt bar itself indicates that the resistance is sufficient and reports this to the user who implements the short-circuit bridge. Said user is often one of the track workers who is carrying out work on site.

[0048] Using a self-detecting shunt bar which is provided with wireless communication means, track workers can take the section of the railway track out of service in an automated and controlled manner and from a safe distance, thus creating a safe work environment.

[0049] A self-detecting shunt bar of this type comprising wireless communication means can be placed in the track on a one-time basis, in advance of the works, and subsequently be switched on and off remotely via a computer, tablet, mobile telephone or a dedicated device.

[0050] The switching on and off can preferably be carried out by means of a give and take principle, which means that a third person, for example a train service controller, can prepare the work and can set up a track closure to actually be taken out of service by the track worker. Conversely, the train service controller cannot independently cancel the track closure by removing the short circuit of the shunt bar, rather this can only be done once the track worker who is present on site has enabled them to do so. For this purpose, the shunt bar according to the present description can be provided with a three-position switch element, or a switch element that can be locked, making it possible for a third party, such as the train service controller, who is preferably in a different location, to be able to block the changing of the positions of the switch element.

[0051] The self-detecting shunt bar can thus be switched on and off remotely by means of for example a mobile telephone. This has the advantage that the shunt bar can be fitted in the rail at a selected time instead of this having to be done when the work starts. A more favourable and less busy time can then be chosen to place the shunt bar. This has the advantage that safety significantly increases because, when the shunt bar is fitted, that part of the track is not yet out of service at that moment and is therefore dangerous.

[0052] An even safer situation results if the shunt bar can remain in the track permanently. Ideally, shunt bars that can be easily switched on and off remotely should be fitted in different strategic places. And because this involves self-detecting shunt bars, a high degree of safety is provided and the shunt bars have a high degree of operational safety. Furthermore, after the one-time fitting, there is no longer a need for anyone to access the track without it being taken out of service.

[0053] However, if a shunt bar is permanently fitted and must be able to be switched on and off remotely, this must thus be ensured by an adequate and reliable power supply. Only an adequate and reliable power supply can create a safe work environment for a sufficient length of time with a high degree of operational safety.

[0054] Fig. 2 shows an embodiment of a self-detecting shunt bar system 200. Said system comprises one or more self-detecting shunt bars 250, 260, 220 which are permanently integrated into a track switch.

[0055] The shunt bars as shown in Fig. 2 are purely for illustrative purposes. It is emphasized that, within the context of the present application, a shunt bar according to the invention may be designed as a self-detecting shunt bar 250 having two pivoting arms which can as such pivot with respect to one another and can thus be pressed between two rails. However, the self-detecting shunt bar 260 can also be designed with flexible connections between the two rails or also with cables between the two rails. In another embodiment, which is not shown, the self-detecting shunt bar can be incorporated completely in, and enclosed by, a railway sleeper of the switch.

[0056] Fig. 2 shows by way of example two self-detecting shunt bars, but it is emphasized that a switch can also be provided with a single self-detecting shunt bar or with a plurality of 2, 3, 4, 5, 6 or more self-detecting shunt bars.

[0057] The self-detecting shunt bar as shown in Fig. 2 is connected to a central housing 220 which is part of the self-detecting shunt bar system 200 according to the present invention. That is to say that one or more parts of a currently known self-detecting shunt bar are accommodated in said central housing 220. The system is preferably provided with a central housing 220 of this type, from where the one or more self-detecting shunt bars 250, 260 are energized by means of a power supply cable 230, 240, in this way because the central housing 220 obtains the power supply via a power supply cable 270 from the motor controller of the switch actuator 210 of the switch.

[0058] The central housing 220 preferably also comprises central communication means which establish a connection which is preferably wireless and provided over a public telecommunication network and has a cloud environment 201 or central processing unit. In such an embodiment, in accordance with the illustration in Fig. 2, the power supply cables 230, 240 are also able to supply data relating to the measurement of the short-circuit resistance via said cable to the central housing 220. However, it is also possible to provide separate power supply cables and data cables if the power supply is connected in a wired manner 230, 240, whereas a wireless (short distance) connection is established between the shunt bars 250, 260 and the central housing 220 for the purpose of transmitting data between them. Finally, it is also possible that the shunt bars 250, 260 are connected in a wired manner 230, 240 to the central housing 220 for the power supply and are thus energized by a power supply of a motor of a switch actuator 210 of the railway switch, whereas the data relating to the measurements of the short-circuit resistance are directly supplied wirelessly to a central processing unit or are disclosed to the cloud 201.

[0059] The cloud environment 201 is used to enable different people to access or store or further process the measurement data but also to take action and to control the self-detecting shunt bars 240, 250 remotely, whether or not on the basis of said measurement data. A planning engineer 203 or train service controller can thus prepare work centrally and remotely so that the work assignment states which section or sections of a railway track, which are part of one or more locally orientated parts of the railway safety systems, can be taken out of service. The foreman 202, who is often present on site, or another track worker may then also actually establish the track closure locally in advance of the works by activating the self-detecting shunt bars 240, 250.

Claims

1. Self-detecting shunt bar for creating a short-circuit bridge between or across two rails of a section of a railway track, comprising:

    - a first connection which is configured to be brought into electrical contact with a first of the two rails;
    - a second connection which is configured to be brought into electrical contact with a second of the two rails;
    - a signal generator for providing a test signal across the short-circuit bridge;
    - a detection device which is configured to measure and monitor a short-circuit resistance of the short-circuit bridge created, during operation, by measuring the test signal; and
    - signalling means which are configured to signal the measured short-circuit resistance to a user of the shunt bar, **characterized in that** the shunt bar is integrated into a railway switch, and the electrical power source, the detection device and the signalling means are connected to, and energized by, a power supply of a motor of a switch actuator of the railway switch.

2. Self-detecting shunt bar according to Claim 1, wherein the shunt bar is permanently integrated with the railway switch and in particular wherein the first and second connection are permanently integrated with the railway switch.

3. Self-detecting shunt bar according to either of the preceding claims, wherein the shunt bar is completely integrated with the railway switch and in particular wherein the first and second connection are permanently integrated with the railway switch.

4. Self-detecting shunt bar according to any one of the preceding claims, wherein the first and second connection are permanently integrated into one or more railway sleepers between the two rails of the railway

switch.

5. Self-detecting shunt bar according to any one of the preceding claims, wherein the first and second connection are designed as a first and second arm which are pivotable with respect to one another and which first and second connection are preferably each provided with two or more arm parts in order to be brought into electrical contact with a first or respectively second rail separately in parallel with one another.

6. Self-detecting shunt bar according to any one of the preceding claims, wherein the first and second connection are designed as flexible first and second connections and in particular as cables, which flexible first and second connection are preferably each provided with two or more connection terminals in order to be brought into electrical contact with a first or respectively second rail separately in parallel with one another.

7. Self-detecting shunt bar according to any one of the preceding claims, wherein the electrical power source of the shunt bar comprises a converter for converting the supply voltage of the power supply of the motor of the railway switch to a power supply which is required for the shunt bar.

8. Self-detecting shunt bar according to any one of the preceding claims, wherein the shunt bar further comprises a communication device for communicating the status of the shunt bar to a central processing unit.

9. Self-detecting shunt bar according to any one of the preceding claims, wherein the signalling means comprise one or more auditory and visual signalling means and are accommodated in a housing of the shunt bar in order to signal to the user of the shunt bar by auditory and/or visual means a deviation between the measured short-circuit resistance and a preset threshold value for the short-circuit resistance.

10. Self-detecting shunt bar according to any one of the preceding claims, wherein the shunt bar further comprises a control unit for comparing the measured short-circuit resistance with a reference value and wherein the signalling means only signal the measured short-circuit resistance if the measured short-circuit resistance exceeds the reference value by a predetermined threshold.

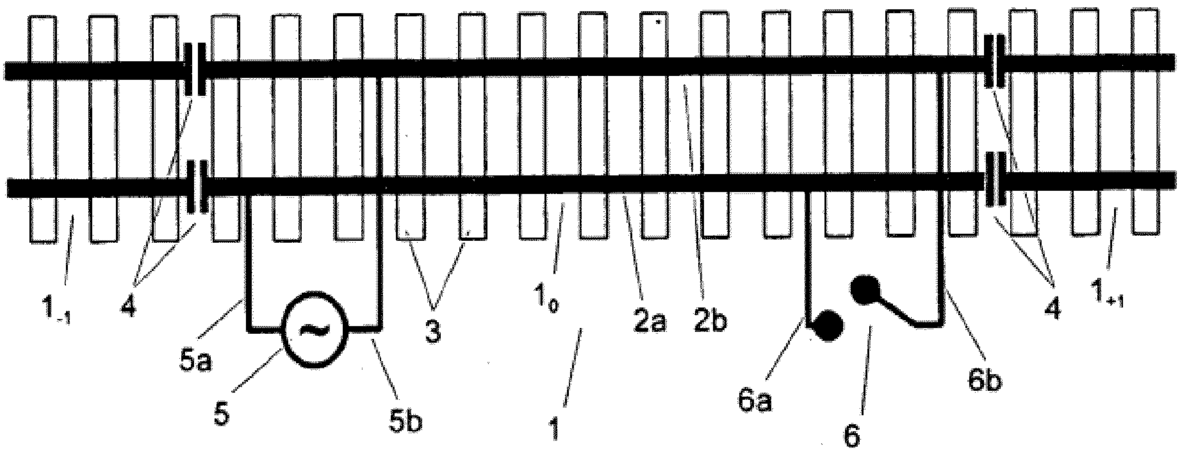
1_{-1}
4
5a
5
5b
3
1_0
1
2a
2b
6a
6
6b
4
1_{+1}

Fig. 1a

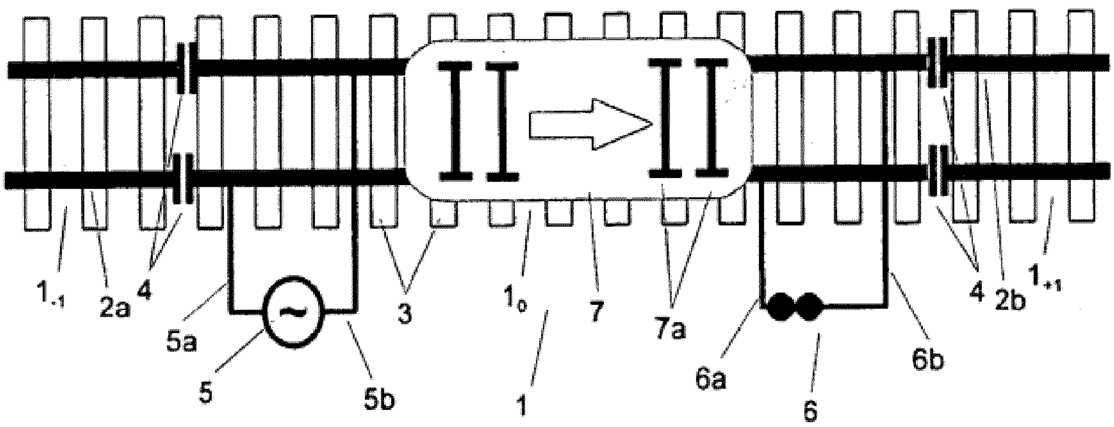
1_{-1}
2a
4
5a
5
5b
3
1_0
1
7
7a
6a
6
6b
4
2b
1_{+1}

Fig. 1b

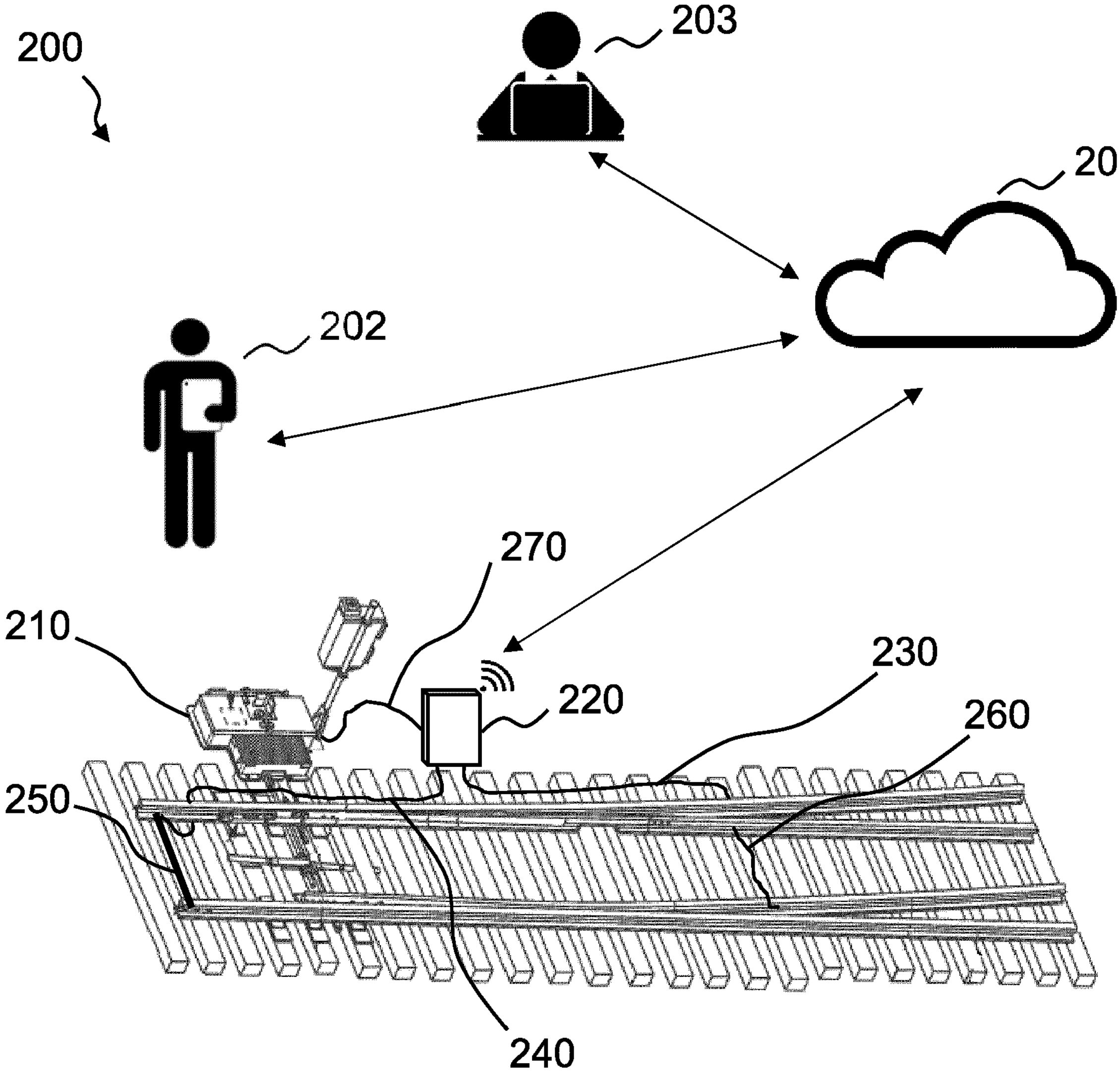

Fig. 2

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EUROPEAN SEARCH REPORT

Application Number
EP 24 16 1237

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	EP 2 206 635 A1 (DUAL INVENTIVE B V [NL]) 14 July 2010 (2010-07-14) * paragraph [0005] * * paragraph [0013] * * paragraph [0026] - paragraph [0028] * * paragraph [0030] - paragraph [0033] * -----	1-10	INV. B61L1/02 B61L1/20 B61L5/06 ADD. B61L1/18
A	DOMMELEN VAN F A B ET AL: "SELBSTSIGNALISIERENDE KURZSCHLUSSLANZE IM GLEISNETZ DER NS", SIGNAL UND DRAHT: SIGNALLING & DATACOMMUNICATION, EURAILPRESS, DE, vol. 88, no. 10, 1 October 1996 (1996-10-01), pages 31-34, XP000779918, ISSN: 0037-4997 * page 32, left-hand column, paragraph 2 * * page 33, left-hand column, paragraph 1 - paragraph 3 * * page 33, middle column, last paragraph * -----	1-10	
			TECHNICAL FIELDS SEARCHED (IPC)
			B61L

The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
Munich	30 July 2024	Janssen, Axel

CATEGORY OF CITED DOCUMENTS

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