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(54) **Supervision device and sensor device comprising a supervision device**

Überwachungsvorrichtung und Sensorvorrichtung mit der Überwachungsvorrichtung

Dispositif de surveillance et dispositif de capteur comprenant un dispositif de surveillance

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Description

Background of the invention

[0001] The invention concerns a sensor device with a sensor element and supervision device for monitoring a mounting state of a sensor element to a track.

[0002] In case of an axle counter the sensor element to be supervised is a detection point for detecting passing axles. The detection points have to be fixed to a rail. It is known to mount detection points to the rail by screwing. In order to do so the track has to be prepared with drilled holes for attaching the sensor elements which is quite laborious. Another negative aspect is that the position of the sensor elements is fixed and cannot be varied easily.

[0003] In order to overcome the above mentioned disadvantages clamping solutions have been developed to fix a sensor element to a rail. Yet, sensor devices with clamped sensor elements cannot detect whether the clamp is properly fixed to the rail or not. Thus, if the clamp breaks or is damaged the axle counter could become blind, i.e. the detection point is assumed to work, but no more axles are counted by the detection point, which can result in dangerous situations.

[0004] DE 43 25 018 A1 discloses a device for detecting a mounting state of a sensor element to a track. The sensor element is mounted to the track via a mounting element and a clamp. A first sensor is attached to the mounting element and detects whether the mounting element is mounted correctly at the clamp. In case sensor element (together with mounting element) falls off (loose connection between mounting element and sensor element), sensor recognizes a change in distance or pressure and generates a warning signal. A second sensor is attached to the clamp and detects whether the clamp is mounted correctly at track. In case the clamp falls off (loose connection between mounting element and track, sensor recognizes a change in distance or pressure and generates a warning signal. Both sensors have to be connected electrically with sensor element, which makes the arrangement complex concerning wiring and maintenance.

[0005] EP 1 935 748 A1 discloses a short circuit bridge which can be bent down by foot.

Object of the invention

[0006] It is an object of the invention to provide a sensor device, which allows reliable detection of a dismounting or an improper mounting of the sensor element.

Description of the invention

[0007] This object is solved by a sensor device according to claim 1.

[0008] According to the invention the sensor device comprises a sensor element, a clamp for mounting the sensor element to a track and a supervision device for

monitoring a mounting state of the sensor element to the track. The supervision device comprises: a sensor contact element being adapted for attachment to the sensor element, a track contact element being adapted for attachment to the track, wherein one of the contact elements comprises two electrical contact points which are insulated from each other, and the other contact element comprises an electrical contact area, wherein in a mounted state of the sensor element the track contact element is mounted at the track and the contact area contacts both electrical contact points thereby forming an electrical contact between the two electrical contact points, and wherein in a dismounted state of the sensor element the contact area does not form an electrical contact between the two contact points.

[0009] The sensor element can have two mounting states: "mounted", i.e. the sensor is correctly mounted to the track for detection, or "dismounted", i.e. the sensor is dismounted or not correctly mounted to the track, e.g. due to broken clamps or a bad installation.

[0010] According to the invention a mechanical and electrical contact between the sensor contact element and the track contact element and thereby an electrical contact between the electrical contact points and the electrical contact area is provided (contact area and the electrical contact points coincide) if the sensor element is correctly mounted. The idea is to interrupt the electrical contact between the electrical contact points when the sensor element is not properly fixed to the rail. Thus a damaged or disconnected sensor element can be detected and the traffic controller can be informed, e.g. by raising an alarm.

[0011] Preferably the track contact element comprises the electrical contact area and the sensor contact element comprises the two insulated electrical contact points.

[0012] The track contact element can be designed small and requires only low mass since it merely has to carry the contact area or the contact points respectively. Therefore it can be easily and safely mounted to the track, e.g. a rail. Since in the mounted state the track contact element is covered by the sensor, there is no danger of damage due to flying objects as stones, hail etc. The danger of accidental dismounting of the track contact element is therefore extremely low.

[0013] The contact area can comprise a single electrical conducting area being dimensioned such that both single electrical contact points of the other contact element can be made to coincide with the contact area. In a preferred embodiment however the contact area comprises two further contact points and an electrical connection between the two further contact points, i.e. in this case the electrical contact points coincide with the further contact points of the contact area when the sensor element is correctly mounted. The further contact points of the contact area are preferably permanently connected by the electrical connection.

[0014] In a preferred embodiment of the supervision

device of the inventive sensor device a detection device is provided for detecting an electrical contact between the electrical contact points. The detection device can be an ampere meter, measuring whether there is an electrical current flow within a circuit comprising the electrical contact points and the contact area. The detection device can be used to trigger the power supply of the sensor elements (see below).

[0015] Preferably the track contact element and/or the sensor contact element are a contact plate. Contact plates are flat and therefore space saving.

[0016] The supervision device of the inventive sensor device is preferably used for railway applications, e.g. for supervision of balises or detection points of an axle counter.

[0017] Preferably, the track contact element is attached to the track.

[0018] The attachment of the track contact element is preferably detachable.

[0019] The sensor supervision device of the inventive sensor device ensures a high safety level since a disconnection or damage at the sensor element can be detected reliably.

[0020] According to the invention, a power supply is provided for powering the sensor element via a sensor circuit.

[0021] According to the invention, the electrical contact points and the contact area are part of a supervision circuit, wherein the supervision circuit switches the power supply.

[0022] The sensor circuit and the supervision circuit are separate circuits, i.e. each of the circuits form a current path. The two current paths are linked with each other in that the supervision circuit disconnects the power supply of the sensor circuit. Therefore the electrical contact points are connected to the power supply which powers the sensor element. By mounting/dismounting of the sensor element to/from the track the supervision circuit is closed/opened respectively. The supervision device controls whether the sensor circuit (and thereby the sensor element) is powered by the power supply or not. In case of a dismantled sensor element the supervision circuit is opened (no contact between the electrical contact points) and no current is supplied to the sensor element. Thus the sensor element can be identified to be "out of order", e.g. by measuring the current within the sensor circuit or the supervision circuit. For providing the supervision circuit additional wires are required in addition to the wires belonging to the sensor circuit.

[0023] In order to avoid modifications of existing sensor elements the sensor contact element is attached to the sensor element. For this embodiment additional cables have to be provided for the supervision circuit. The attachment of the sensor contact element and the track contact element is preferably detachable.

[0024] Alternatively the sensor contact element is integrated in the sensor element. No additional cables have to be provided along the track. Yet, a new design of the

sensor elements may be necessary in this case.

[0025] The advantages of the present invention come to bear particularly if the mounting device is a clamp. Clamping of the sensor element to the track is advantageous since no drilling holes have to be provided, thereby enabling a flexible positioning and an easy mounting. With the inventive sensor device clamping solutions with a high safety level can be provided. Nevertheless the inventive sensor device can be also applied with mounting devices comprising a screw mechanism.

[0026] In a special embodiment the sensor element is a detection point of an axle counter. The track to which the detection point is mounted is a rail.

[0027] In another embodiment the sensor element is a balise. The track to which the balise is mounted is a railway sleeper.

[0028] Further advantages can be extracted from the description and the enclosed drawing.

[0029] The embodiments mentioned are not to be understood as exhaustive enumeration but rather have exemplary character for the description of the invention. The invention is defined by the appended claims.

Drawings

[0030] The invention is shown in the drawing.

Fig. 1a shows a track contact element attached to a rail.

Fig. 1b shows a sensor contact element of a supervision device according to the invention and a sensor element in a dismantled state.

Fig. 1c shows the track contact element of fig. 1a and the sensor contact element of fig. 1b attached to the sensor element.

Fig. 1d shows a sensor device according to the invention, wherein the sensor element is mounted correctly by means of a clamp.

Fig. 2 shows a circuit diagram of a first embodiment of the inventive sensor device comprising a supervision device with sensor contact elements which are detachable from sensor elements, wherein a supervision circuit controls a sensor circuit.

Fig. 3 shows a circuit diagram of a second embodiment of the inventive sensor device comprising a supervision device with sensor contact elements which are integrated in sensor elements, wherein a supervision circuit controls a sensor circuit.

Fig. 4 shows a circuit diagram of a third embodiment of the inventive sensor device, wherein a su-

pervision circuit sends a supervision signal to a detection device without controlling the sensor circuit.

[0031] Fig. 1a shows a track contact element 1 of a supervision device of an inventive sensor device, the track contact element 1 being attached to a rail 2 and comprising two electrical contact points 3a, 3b, which are separated from each other, but are electrically connected, e.g. via a wire 3c (see fig. 2 and 3), the contact points 3a, 3b and the wire 3c forming a contact area.

[0032] Fig. 1b shows sensor elements 4 (here: two sensor elements 4 of a detection point of an axle counter are shown) and sensor contact elements 5 each of which can be attached to one of the sensor elements 4, e.g. by screwing. The sensor contact element 4 comprises contact points 6a, 6b which are separated and insulated from each other. The contact points 6a, 6b are positioned at that side of the sensor contact element which is opposite to the attached sensor element 1.

[0033] Fig. 1c shows the sensor element 4 attached to the sensor contact element 5 in a dismounted state. Wires 7 are provided forming a supervision circuit 9 (see fig 2).

[0034] Fig. 1d shows the sensor element 4 attached to the sensor contact element 5 in a mounted state. The sensor element 4 with its attached sensor contact element 5 is fixed to the rail 2 by means of a mounting device 8 (here: a clamp), thereby aligning the contact points 3a, 3b of track contact element 1 with the contact points 6a, 6b of the sensor contact element 5, i.e. the supervision circuit 9 is closed.

[0035] Fig. 2, 3 show circuit diagrams of two embodiments of the inventive sensor device. Two electrical circuits (supervision circuit 9 and sensor circuit 12) are provided.

[0036] The supervision circuit 9 (here with two sensor contact elements 5, 5') comprises the electrical contact points 3a, 3b, the electrical connections 3c between the electrical contact points 3a, 3b, the electrical contact points 6a, 6b of the sensor contact elements 5, a power supply 10, and an electronic unit 11. The sensor circuit 12 switches the power supply 10 which powers the sensor elements 4, 4' via the electronic unit 11. The sensor elements 4, 4' are connected inductively with each other.

[0037] In order to close the supervision circuit 9 the sensor contact element 5, 5' has to be properly mounted to the rail 2 such that the contact points 3a, 3b of the track contact element 1 coincide (or at least overlap) with the contact points 6a, 6b of the sensor contact element 5, 5', as shown in fig. 1d. The closed supervision circuit 9 connects the power supply 10 to the sensor circuit 12 for driving the sensor element 4, 4' via the electronic unit 11, i.e. in case the supervision circuit 9 is closed, the power supply 10 powers the sensor elements 4 via the sensor circuit 12.

[0038] In case the supervision circuit 9 is open (e.g. because of an improperly fixed sensor element 4), the

power supply 10 of the sensor elements 4 is cut off the sensor circuit 12 and the sensor element 4 is detected by a detection device 13 as being out of order. The detection device 13 may comprise a separate evaluator (e.g. an axle counter evaluator) which detects a disturbance of the detection point (sensor element and electronic unit). Sensor elements with sensor circuits as known from the state of the art can be used with this embodiment. It should be noted that it is also possible to provide the insulated contact points with the track contact element 1 and the contact area with the sensor contact element 5.

[0039] The sensor device shown in fig. 2 comprises detachable sensor contact elements 5, which can be attached to and detached from the corresponding sensor element 4. Separate cables 16, 17 have to be provided for the wires of the supervision circuit 9 and the sensor circuit 12.

[0040] Fig. 3 shows an alternative embodiment. The sensor contact elements 5' are permanently attached to sensor elements 4', i.e. the sensor contact elements 5' can be integrated in the sensor elements 4'. The wires of the supervision circuit 9 and the sensor circuit 12 can be carried in one common cable 18.

[0041] Fig. 4 shows another embodiment of the inventive sensor device, in which a supervision circuit 9' is provided which is not linked to the sensor circuit 12, i.e. the supervision circuit 9' does not control the sensor circuit 12 directly. More precisely, the power supply 10 is not part of the supervision circuit 9'. Instead a signal generator 14 is provided which generates a supervision signal within the supervision circuit 9' and checks the supervision signal availability. If all the contacts of the electrical contact points 3a, 3b, 6a, 6b, are closed, the supervision signal is available. Every open contact will be recognized by detecting a missing supervision signal and an alarm will be send to the detection device 13 via a network 15.

[0042] The circuit diagrams of fig. 2 - 4 show circuits with two sensor elements 4. Yet, it is clear, that only one sensor element 4 or more than two sensor elements can be provided within a sensor circuit.

[0043] Other sensor elements can be used for the present invention, e.g. balises.

List of reference signs

[0044]

1	track contact element
2	rail (track)
3a, 3b	electrical contact points of the contact area (further contact points)
3c	electrical connection between the electrical contact points 3a, 3b
4, 4'	sensor elements
5, 5'	sensor contact element
6a, 6b	electrical contact points
7	wires

- 8 mounting device
- 9, 9' supervision circuit
- 10 power supply
- 11 electronic unit
- 12 sensor circuit
- 12' combined sensor circuit
- 13 detection device
- 14 signal generator
- 15 network
- 16-18 cables

Claims

1. Sensor device with a sensor element (4, 4'), a clamp (8) for mounting the sensor element (4) to a track (2), and a supervision device for monitoring a mounting state of the sensor element (4, 4') to the track (2), **characterized in that** the supervision device comprises:

a sensor contact element (5, 5') being adapted for attachment to the sensor element (4, 4'),
 a track contact element (1) being adapted for attachment to the track (2),
 wherein one of the contact elements (1, 5, 5') comprises two electrical contact points (6a, 6b) which are insulated from each other, and the other contact element (1, 5, 5') comprises an electrical contact area (3a, 3b, 3c),
 wherein in a mounted state of the sensor element (4, 4') the track contact element (1) is mounted at the track (2) and the contact area (3a, 3b, 3c) contacts both electrical contact points thereby forming an electrical contact between the two electrical contact points (6a, 6b), and
 wherein in a dismounted state of the sensor element (4, 4') the contact area (3a, 3b, 3c) does not form an electrical contact between the two contact points (6a, 6b),
 that a power supply (10) is provided for powering the sensor element (4, 4') via a sensor circuit (12, 12'), and
 that the electrical contact points (6a, 6b) and the contact area (3a, 3b, 3c) are part of a supervision circuit (9), wherein the supervision circuit (9) switches the power supply (10).

2. Sensor device according to claim 1, **characterized in that** the contact area (3a, 3b, 3c) comprises two further contact points (3a, 3b) and an electrical connection (3c) between the two further contact points (3a, 3b).
3. Sensor device according to one of the preceding claims, **characterized in that** a detection device (13) is provided for detecting an electrical contact be-

tween the electrical contact points (6a, 6b).

4. Sensor device according to one of the preceding claims, **characterized in that** the track contact element (1) and/or the sensor contact element (5) is a contact plate.
5. Sensor device according to one of the preceding claims **characterized in that** the track contact element (1) is mounted at the track (2).
6. Sensor device according one of the claims 1 through 5, **characterized in that** the sensor contact element (5) is attached to the sensor element (4).
7. Sensor device according one of the claims 1 through 5, **characterized in that** the sensor contact element (5') is integrated in the sensor element (4').
8. Sensor device according to one of the claims 1 through 7, **characterized in that** the sensor element (4, 4') is a detection point of an axle counter.
9. Sensor device according to one of the claims 1 through 7, **characterized in that** the sensor element is a balise.

Patentansprüche

1. Sensoreinrichtung mit einem Sensorelement (4, 4'), einer Klammer (8) zum Befestigen des Sensorelements (4) an einer Schiene (2) und einer Überwachungseinrichtung zum Überwachen eines Befestigungszustands des Sensorelements (4, 4') an der Schiene (2),
dadurch gekennzeichnet, dass die Überwachungseinrichtung umfasst:
 ein Sensorkontaktelement (5, 5'), das zur Befestigung an dem Sensorelement (4, 4') geeignet ist,
 ein Schienenkontaktelement (1), das zur Befestigung an der Schiene (2) geeignet ist,
 wobei eines der Kontaktelemente (1, 5, 5') zwei voneinander isolierte elektrische Kontaktstellen (6a, 6b) aufweist und das andere Kontaktelement (1, 5, 5') einen elektrischen Kontaktbereich (3a, 3b, 3c) aufweist,
 wobei in einem montierten Zustand des Sensorelements (4, 4') das Schienenkontaktelement (1) an der Schiene (2) montiert ist und der Kontaktbereich (3a, 3b, 3c) beide elektrischen Kontaktstellen berührt und dadurch einen elektrischen Kontakt zwischen den beiden elektrischen Kontaktstellen (6a, 6b) bildet, und
 wobei in einem demontierten Zustand des Sensorelements (4, 4') der Kontaktbereich (3a, 3b,

3c) keinen elektrischen Kontakt zwischen den beiden Kontaktstellen (6a, 6b) bildet, dass eine Stromversorgung (10) zur Speisung des Sensorelements (4, 4') über eine Sensorschaltung (12, 12') vorgesehen ist, und dass die elektrischen Kontaktstellen (6a, 6b) und der Kontaktbereich (3a, 3b, 3c) Teil einer Überwachungsschaltung (9) sind, wobei die Überwachungsschaltung (9) die Stromversorgung (10) schaltet.

2. Sensoreinrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** der Kontaktbereich (3a, 3b, 3c) zwei weitere Kontaktstellen (3a, 3b) und eine elektrische Verbindung (3c) zwischen den beiden weiteren Kontaktstellen (3a, 3b) umfasst.
3. Sensoreinrichtung nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** eine Detektionseinrichtung (13) zur Erfassung eines elektrischen Kontaktes zwischen den elektrischen Kontaktstellen (6a, 6b) vorgesehen ist.
4. Sensoreinrichtung nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** das Schienenkontaktelelement (1) und/oder das Sensorkontaktelelement (5) eine Kontaktplatte ist.
5. Sensoreinrichtung nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** das Schienenkontaktelelement (1) an der Schiene (2) befestigt ist.
6. Sensoreinrichtung nach einem der Ansprüche 1 bis 5, **dadurch gekennzeichnet, dass** das Sensorkontaktelelement (5) an dem Sensorelement (4) befestigt ist.
7. Sensoreinrichtung nach einem der Ansprüche 1 bis 5, **dadurch gekennzeichnet, dass** das Sensorkontaktelelement (5') in das Sensorelement (4') integriert ist.
8. Sensoreinrichtung nach einem der Ansprüche 1 bis 7, **dadurch gekennzeichnet, dass** das Sensorelement (4, 4') ein Zählpunkt eines Achszählers ist.
9. Sensoreinrichtung nach einem der Ansprüche 1 bis 7, **dadurch gekennzeichnet, dass** das Sensorelement eine Balise ist.

Revendications

1. Dispositif de capteur muni d'un élément de capteur (4, 4'), d'un moyen de serrage (8) pour monter l'élément de capteur (4) sur un rail (2) et d'un dispositif de surveillance pour surveiller un état de montage

de l'élément de capteur (4, 4') sur le rail (2) ;

caractérisé en ce que le dispositif de surveillance comprend :

un élément de contact de capteur (5, 5') qui est adapté pour être lié à l'élément de capteur (4, 4') ; et
un élément de contact de rail (1) qui est adapté pour être lié au rail (2) ;

dans lequel l'un des éléments de contact (1, 5, 5') comprend deux points de contact électrique (6a, 6b) qui sont isolés l'un de l'autre, et l'autre élément de contact (1, 5, 5') comprend une zone de contact électrique (3a, 3b, 3c) ;
dans lequel, dans un état monté de l'élément de capteur (4, 4'), l'élément de contact de rail (1) est monté au niveau du rail (2) et la zone de contact électrique (3a, 3b, 3c) entre en contact avec les deux points de contact électrique, d'où par voie de conséquence la formation d'un contact électrique entre les deux points de contact électrique (6a, 6b) ; et
dans lequel, dans un état démonté de l'élément de capteur (4, 4'), la zone de contact électrique (3a, 3b, 3c) ne forme pas un contact électrique entre les deux points de contact électrique (6a, 6b) ; et

caractérisé en ce que :

une alimentation en énergie électrique (10) est prévue pour alimenter en énergie électrique l'élément de capteur (4, 4') via un circuit de capteur (12, 12') ; et **en ce que** les deux points de contact électrique (6a, 6b) et la zone de contact électrique (3a, 3b, 3c) constituent une partie d'un circuit de surveillance (9), dans lequel le circuit de surveillance (9) commute l'alimentation en énergie électrique (10).

2. Dispositif de capteur selon la revendication 1, **caractérisé en ce que** la zone de contact électrique (3a, 3b, 3c) comprend deux autres points de contact électrique (3a, 3b) et une connexion électrique (3c) entre les deux autres points de contact électrique (3a, 3b).
3. Dispositif de capteur selon l'une quelconque des revendications précédentes, **caractérisé en ce qu'un** dispositif de détection (13) est prévu pour détecter un contact électrique entre les deux points de contact électrique (6a, 6b).
4. Dispositif de capteur selon l'une quelconque des revendications précédentes, **caractérisé en ce que** l'élément de contact de rail (1) et/ou l'élément de

contact de capteur (5) sont/est une plaque de contact.

5. Dispositif de capteur selon l'une quelconque des revendications précédentes, **caractérisé en ce que** l'élément de contact de rail (1) est monté au niveau du rail (2). 5
6. Dispositif de capteur selon l'une quelconque des revendications 1 à 5, **caractérisé en ce que** l'élément de contact de capteur (5) est lié à l'élément de capteur (4). 10
7. Dispositif de capteur selon l'une quelconque des revendications 1 à 5, **caractérisé en ce que** l'élément de contact de capteur (5') est intégré dans l'élément de capteur (4'). 15
8. Dispositif de capteur selon l'une quelconque des revendications 1 à 7, **caractérisé en ce que** l'élément de capteur (4, 4') est un point de détection d'un compteur d'essieux. 20
9. Dispositif de capteur selon l'une quelconque des revendications 1 à 7, **caractérisé en ce que** l'élément de capteur est une balise. 25

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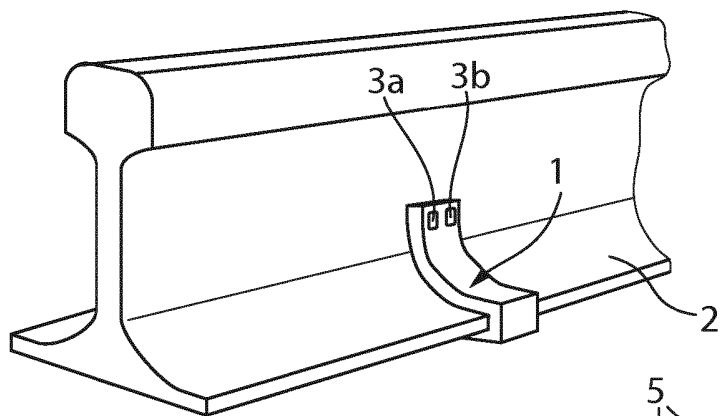


Fig. 1a

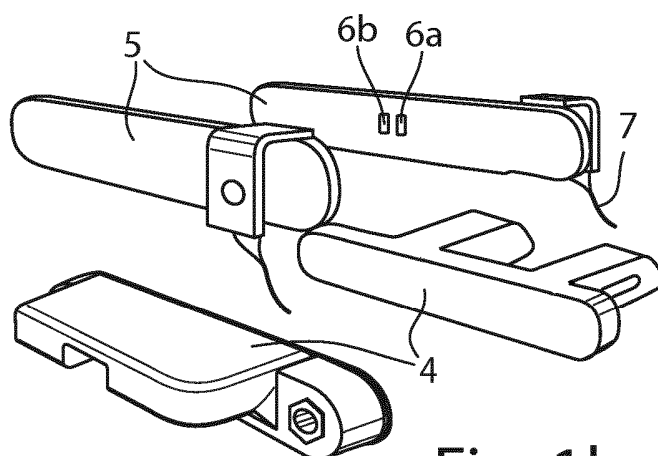


Fig. 1b

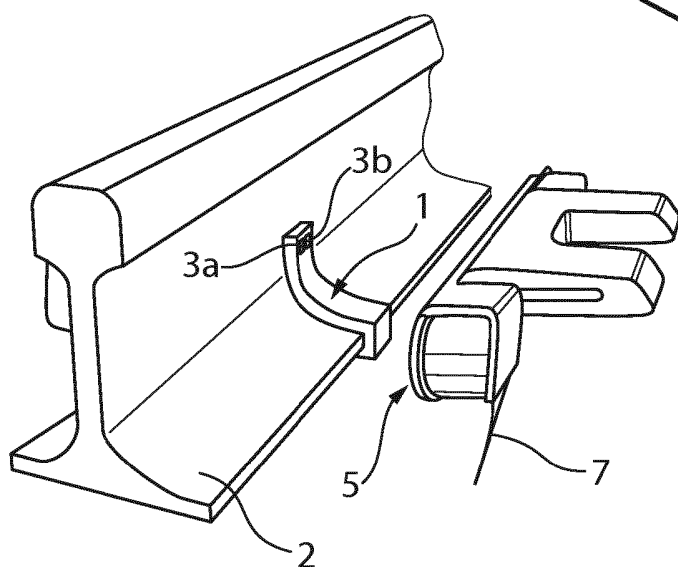


Fig. 1c

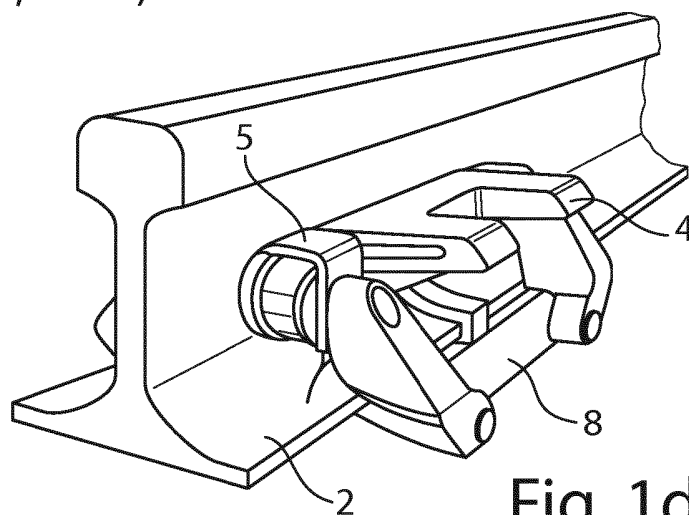


Fig. 1d

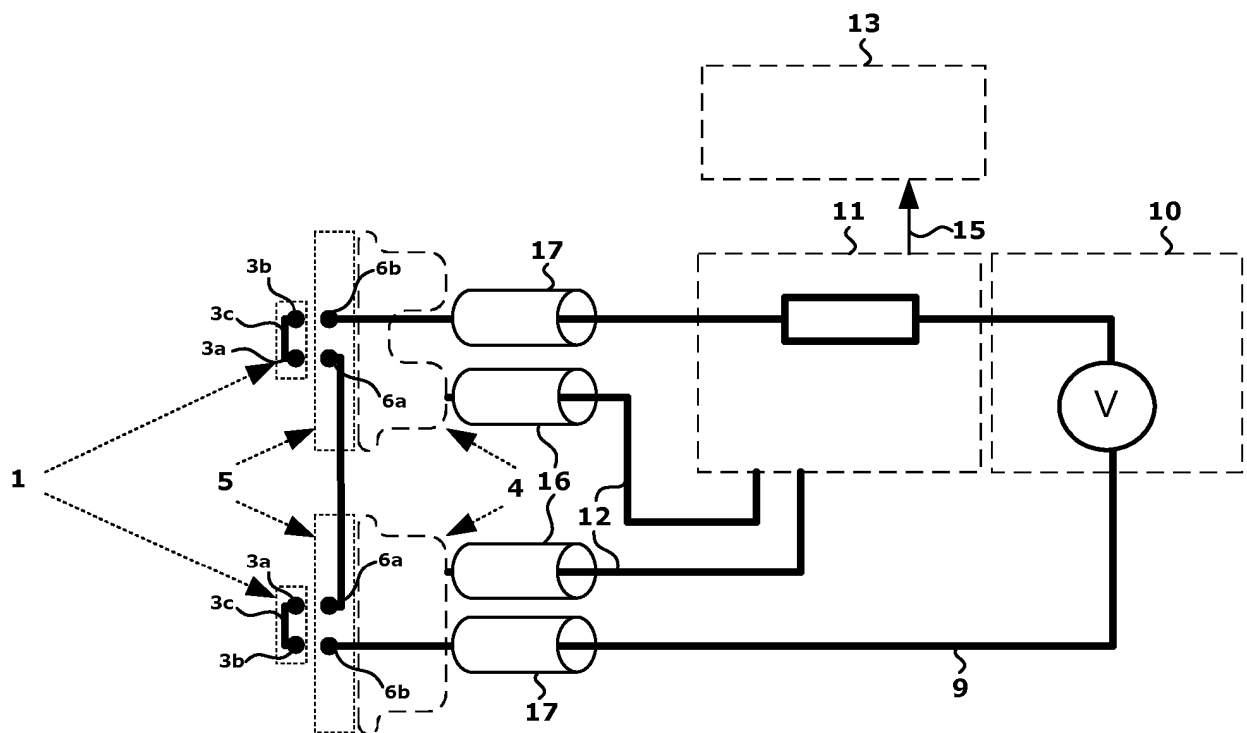


Fig. 2

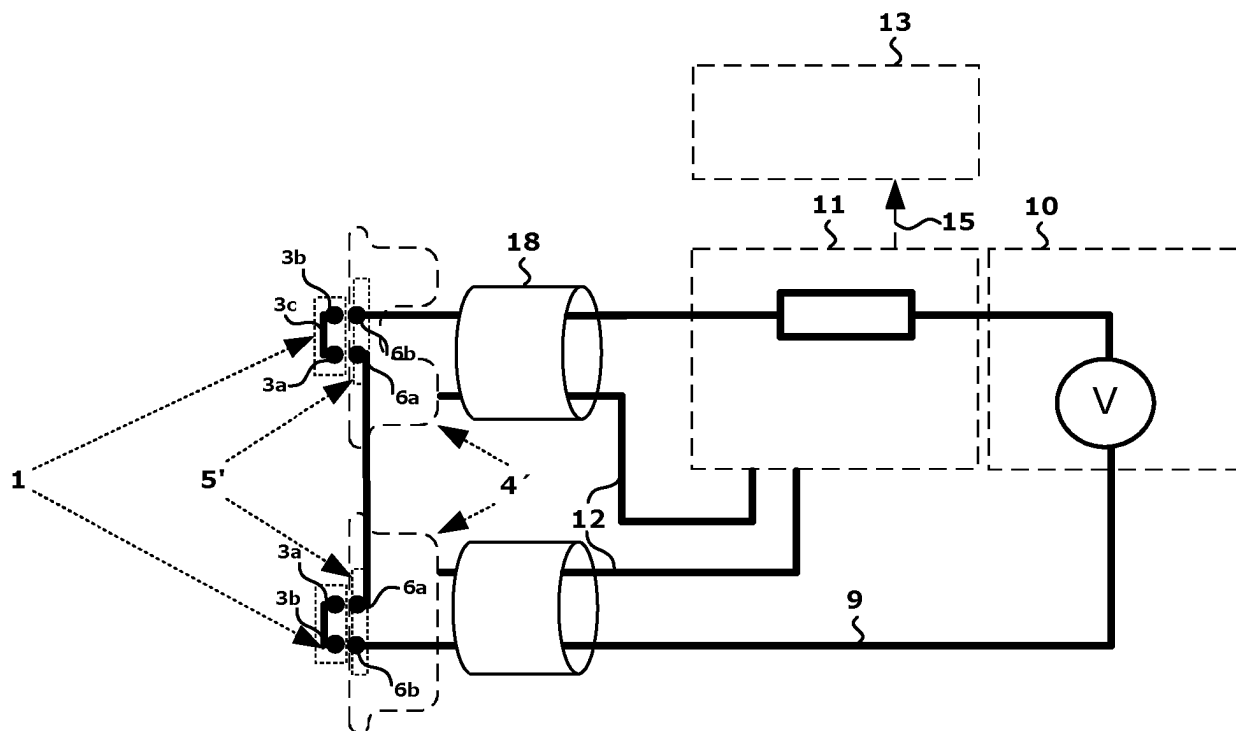


Fig. 3

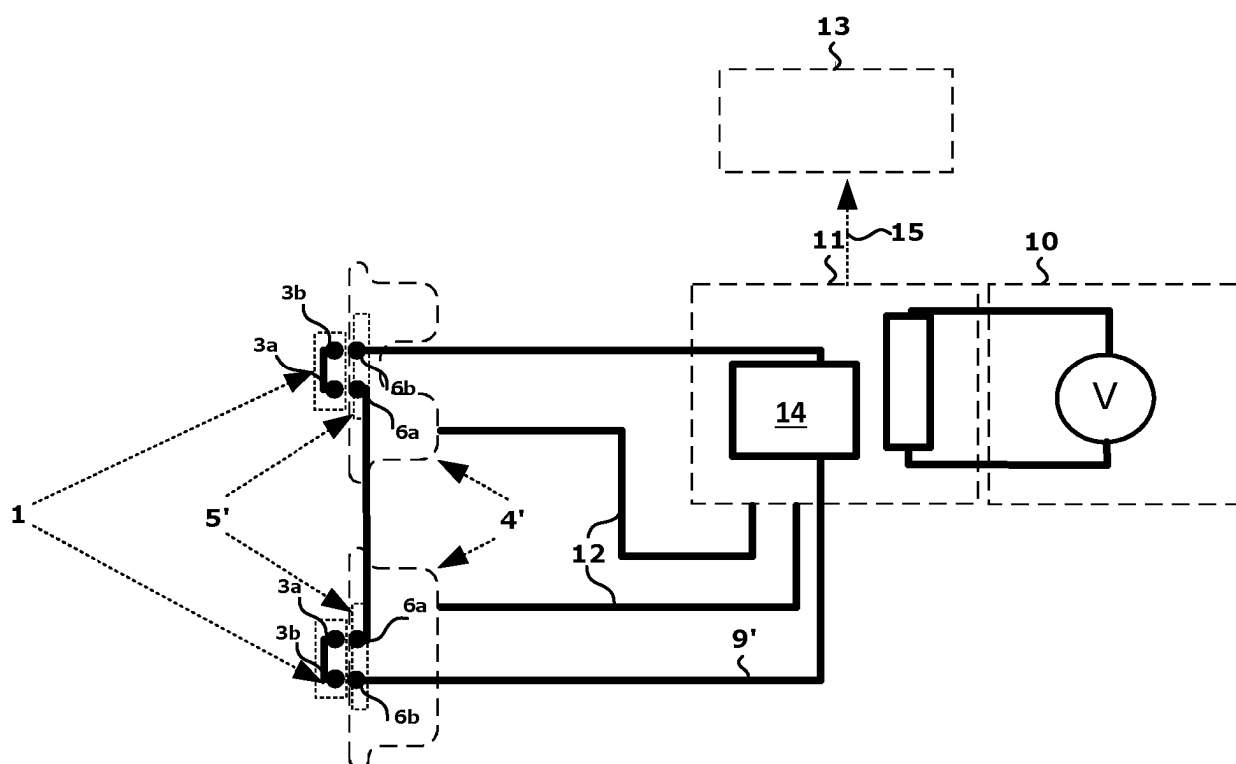


Fig. 4

REFERENCES CITED IN THE DESCRIPTION

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