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(54) GUARDING A RAILROAD TRACK FOR WORKPLACE SECURITY

(57) Guarding method for workplace safety at a railway track, within the guarding method, one starts with the already present train protection system based on vital relays, and at the beginning of the implementation of the method modifications are carried out inside the relay box / housing of this existing train protection system, by locating for the vital relay of type TPR, an own and individual monitoring sensor permanently inside the relay box / housing, in which the TPR relay is located, said permanent monitoring sensor detects and / or monitors the position "open" and "closed" of the TPR relay, the monitoring sensors being arranged to individually collect and transmit the data for each associated TPR relay and, via a data connection, the status of these positions, individualized to each associated TPR relay, is reported to an associated and remote central warning computer adapted to use the data from the monitoring sensor to conclude whether the temporary mobile alarm system set up at the track workers should be instructed to provide, e.g. acoustically, the guaranteed warning to the track workers.

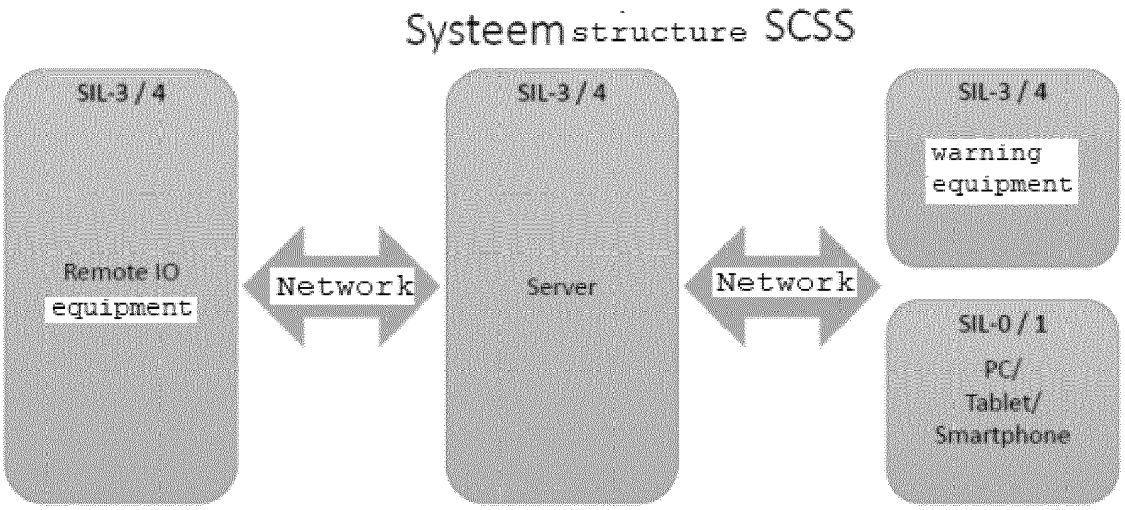

Fig. 3

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Description

[0001] The invention relates to the field of a passenger and freight railway, such as a train, tram or metro line, preferably with an overhead line above the railway for the electric supply of the train locomotive, whose train protection system is of the type "relay interlocking" or "electric interlocking", thus is based on, makes use of and is equipped with protection relays (so-called B-relay) in the electrical circuit. The invention may be embodied in a system and / or a method for workplace security (also known as: warning system or warning method, respectively).

[0002] EP1308366 (Alcatel) discloses a solution electronic interlocking (ESTW), thus designed for solid state technology. Less relevant state of the art show EP2990296 (Dual Inventive) and EP3257718 (VolkerRail).

[0003] In this document, the word "sensor", in addition to or in addition to or in replacement of the usual definition, is intended to mean an electrical or electronic device that collects information and / or data directly and / or indirectly and may also be "detector" or "relay interface". A sensor is for example a thermometer (an example of direct data collection) or a DI (digital input), which is an example of indirect data collection. This description is particularly intended for a sensor (also referred to as "monitoring sensor" in this document) that is associated with a relay in the manner according to the invention. The sensor is in communication with a processing unit, such as a server computer.

[0004] In this document, the abbreviation "Sil" refers to " Safety Integrity Level", which is part of the IEC61508, IEC61511 and IEC62061 standards. There are four levels and Sil-3 is the second highest level. The higher the level, the smaller the risk of dangerous failure of the system or method.

INTRODUCTION

[0005] Work on the Dutch track must be able to be carried out safely. The most secure is a so- called decommissioning. This prevents train movement can be set to work, with the goal to create a safe workplace. For short-term work, decommissioning is waived and "guaranteed workplace safety" used in which the train obtains unobstructed passage and the approach of a train is monitored by a warning system and people may only enter the track when an approaching train is still sufficiently far removed from the workplace. Has the train approached a critical distance, the system provides a guaranteed alert to the track workers which are then supposed to immediately leave the track.

[0006] The invention exclusively relates to "guaranteed workplace safety" by "guaranteed warning", using a warning system of sufficient reliability.

[0007] In the following, "decommissioning", "guaranteed work safety" and "safety relays" are explained first, and then the invention is discussed further.

DECOMMOSSIONING

[0008] To be able to work safely on a railway section (for example repairing a damaged rail), it must be guaranteed that train traffic in the relevant railway section (alternatively referred to as "section" or "track section" in this document) is blocked. To this end, it is known to use a so-called short-circuit lance (see, for example, EP0847339 and EP2067650) in the relevant section, with which the presence of a train in this section is simulated. This generates a track occupancy notification with the result that the next train is not allowed in this section by the train protection. However, placing a short-circuit lance is cumbersome and time-consuming and dangerous.

[0009] The self-signalling short-circuit lance (ZKL) is the most commonly used means in the Netherlands (workplace protection device) to take the track out of service. The decommissioning system is based on the and / or effective use of short-circuiting the track circuit. As a result, a train is simulated, a busy section is reported and it is no longer possible to send another train to this location. That way the work team can work safely. In most of the Netherlands track circuits used for train detection. This is an important condition for applying the ZK L. The operation of the track circuit is explained below. The ZKLs are placed in the track at the start of the work at the boundaries of the working area and removed from the track at the end. Only after installing the ZKLs is the work area out of service and work can commence. The disadvantage of this system is that it takes a relatively long time to install and remove the system and that it often involves several people, because ZKLs have to be placed on the edges of relatively large areas. In addition, these persons must enter the risk area and before the track is taken out of service. Efficiency and safety are not guaranteed optimally. It is inevitable that a ZKL will be installed at the wrong location or will fail during the decommissioning without being noticed immediately. In addition, the currently used workplace protection equipment requires a lot of maintenance.

[0010] The time required for security activation (i.e. the establishing and displaying the workplace) takes sometimes half an hour using ZKL ' s. During this time it is not possible to work on the railway, but no train traffic is possible. It is desirable to keep this time as short as possible, for example by taking and removing the safety measures more quickly in case of decommissioning.

[0011] The following actions currently take time: walk from one location to the other where the ZKLs must be placed; placing the ZKLs; communication between LWB (Leader Workplace Security) and LLV (Leader Local Security); checking

signals or switch positions in specific situations; create a safe work location for the official who must take the safety measures by preventing him from having to enter tracks that are not yet out of service at that time.

[0012] Recently, the proposal made for placing thousands of permanent ZKL ' s individually via remote control to be switched on and off. This saves time but has a lot of costs.

[0013] Train protection systems provide information to train drivers as to whether and, if so, at what speed a certain part can be safely driven by the train. For proper operation, these train protection systems require information from the track about the presence or absence of trains in a certain section of track. Train detection systems fulfil this function and pass on the status of a track to a train protection system. This operating principle is also used within the field of decommissioning to create a safe workplace for track workers. By thinking that a piece of track is 'occupied', the train protection system cannot allow other trains to access that piece of track.

[0014] The most widely used train detection systems in the Netherlands have the working principle of a track circuit. A track circuit is a circuit formed by an electrically insulated track section (section) . Hi there is an alternating voltage connected on one side and a relay on the other. In the idle state (that is, there is no train in the section), the circuit is closed and the corresponding B relay is switched on. If the two rails are now electrically connected to each other (shorted), the circuit changes and the current no longer flows through the relay. Even if the circuit is broken (break in the wiring or in one of the rails), the current from the power supply can no longer reach the relay. The B relay drops out and this is signalled and leads to the track occupancy message.

[0015] NL2013825 and NL1040280 relate to decommissioning. NL2013825 discloses an alternative to the ZKL, for which a provision is made inside a relay house. NL1040280 discloses arranging lights along the entire rail network and causing the lights to light up alongside service track so that track workers immediately see which track is safe.

GUARANTEED WORKPLACE PROTECTION / WARNING

[0016] If decommissioning is used to block train traffic, with workplace protection the passage of train traffic remains unobstructed and track workers are only warned about an approaching train. For the purpose of workplace protection, temporary sensors are currently being installed in the track whenever track workers have to enter the tracks. This temporary sensors are arranged to form a train directly to detect, for example, that the train locally a mechanically switch / pedal operates, or the earth's magnetic field or a locally generated magnetic field or ultrasonic signal, or electromagnetic beam aphid (for example, image IR, or visible light) or radiation image (for example, camera image). The temporary sensors are therefore designed for direct observation of the train and are therefore installed in the open air next to or in the track.

[0017] The temporary sensors communicate with a mobile alarm system that is temporarily installed in the vicinity of the track workers and gives an alarm to the track workers as soon as the warning system concludes on the basis of the signal coming from the temporary sensors that a train is at a critical distance is approached to where the track workers are busy in the ear.

[0018] It is intended that temporary sensors detect an approaching train on time. After placement of the tide -friendly sensors must wait a next train passage to the reliable system operation to be tested, then the track workers in the track may. When, on the basis of the detection of the temporary sensors, the alarm will go off the track workers, the railway workers considered immediately leave the track to be, and should it pass back into the track when the train has passed. As soon as the track workers are ready, the temporary sensors and also the mobile alarm system must be removed. The use of temporary sensors is cumbersome, time-consuming, dangerous (because no safety system is in place during installation and removal) and unreliable.

[0019] NL1036793, NL2017659 and NL2014693 relate to guaranteed warnings and disclose a temporary sensor.

SECURITY RELAY (B-RELAY)

[0020] This invention is related to the timely warning of the track workers on a railway with protection relay (so-called. B-relay), so relay which at safety level used may be for track occupancy detection, such as a so-called. Track relay (TR relay) or track repeat relay (TPR relay) . For example Alstom Signaling Inc. (West Henrietta, NY, USA) sells this type of relay under the designation "Type B Vital Relay". Safety relays are placed in relay boxes (for example along the open track) and relay houses (for example on a railway yard, such as at marshalling grounds and train stations).

[0021] A B relay is a relay with a safety function in a railway protection installation (including NX protection). B relays have a very high degree of reliability, and will last for decades and years, provided they are regularly overhauled. Important properties of B-relays are that they are guaranteed to fall off when the coil voltage is without power, and that the normally closed contacts (in jargon "back contact") open before the make contacts ("front contact") are closed. There are various types of B relays, with specific characteristics. The most commonly used type is the 56001-783Gr1. This relay has two coils that operate on 12V DC, four changeover contacts ("full contacts"), second make contacts and a break contact. Furthermore, there are B-relays that come on with a delay, fall-off, are suitable for large currents, etc.

Another type of B relay is the track relay (TR). This relay is part of a track current loop, and is "on " when a track section is unoccupied, and drops out if the track section is occupied by a train. In the case of B-relays, in particular the B2-Vane relay (the "track relay"), a movable element is often used (in the case of the B2 relay the "vane", or the "vane") that is sensitive to magnetism and which is sensitive to or associated with a reset force such gravity, so that loss of it through one or more coils of the B-relay generated magnetic field, this element not in a deflected position is kept by the magnetic field and moves by the resetting force, such as gravity, which switches the B relay. A so-called B1 relay is usually equipped with a return spring and / or its own housing.

[0022] A protection relay is supplied in a sealed housing at the factory. The rear wall of the housing is, for example, equipped with contact ports corresponding to contact plugs (so-called terminals) protruding from a contact block (so-called plug board) in the relay box. For example, a B relay is placed by pressing its rear wall against the contact block, so that the terminals are inserted into the contact ports so that the B relay, via wires connected to the terminals, is galvanically connected to the relevant circuit in which the B relay must are included. If, after being delivered, the housing is modified or damaged by the factory or the seal is broken, the relevant product will be rejected.

[0023] For the internal space of the housing of the B relay, one or more of the following preferably applies: is a single internal space; contains one or more of a single or double galvanic magnet coil, preferably with a soft-iron core, an anchor, a return spring of the anchor, or the anchor designed or equipped with a so-called "vane" in which gravity, instead of a return spring, the restoring force provides for upon cessation of the magnetic field by switching off the magnet coil h moving et anchor in the other position to a change-over contact, a normally open contact, a normally closed contact; contains all components of the B relay; is hermetically sealed with respect to the environment; is sealed against unauthorized access; has a boundary wall that is transparent to visible light; at least one or two, preferably mutually parallel and / or straight, mounting sleeves extend through them, sealed relative thereto and flowing through the two opposite end wall walls and into the environment, so that in a mounting sleeve one on either side protruding mounting pin can be inserted (in a relay box a pair of mutually parallel, fixed mounting pins is available for each B relay on which a B relay housing is simply inserted so that its rear wall is placed against the contact block and then nuts are turned on the front wall of the B-relay housing protruding studs of these mounting pins so that the B-relay housing remains slidably on the mounting pins); one or more galvanic conductors, sealed by a boundary wall, protrude into this environment from this space; only one or more galvanic conductors extend from the space into the environment; the galvanic conductors are galvanically connected to one or more components in this space, such as a magnet coil or a switching contact; contains a directional relay.

[0024] Preferably, the rear wall of the B relay includes rear protruding contact members, for example pins in a pattern corresponding to the pattern of forward-facing, preferably complementary, contact members, such as holes on the front wall of the contact block, so that these members can be mutually galvanically connected, for example the contact pins can be inserted into the contact holes by pressing the B-relay against the contact block in the horizontal direction. Alternatives to the contact pins and holes are also conceivable, or the reverse situation.

INVENTION

[0025] The object of the invention is the guaranteed warning (and therefore the guaranteed workplace safety) t improving e, while avoiding the use of in the track to place the temporary sensors which a direct detection train.

[0026] In this document, "relay box" and "relay house" are synonyms for one another and one of these terms can mean both at the same time.

[0027] The proposal is, within the warning system that provides for guaranteed warning, the B-relay that is associated with the track occupancy notification of a section (i.e. the B-relay that drops as soon as a train enters the section or when a lock-in lance is placed that is placed) simulates a train in the section) to equip or associate with a permanently placed sensor (the "monitoring sensor ") that is preferably associated with or provided with a transmitter and / or receiver for wireless communication and is arranged such that this the position of the relevant B relay ("on" or "off") signals and communicates with a central warning computer. And this for preferably most or all, e.g., at least 30% or 50% or 80 % or 90%, sections of a continuous length of railway track, for example, open track, of, for example, at least 1 or 5 kilometre there and / or from a railway yard. Preferably, in this way, at least 25% or 50% of all B-b-free relay-service to and / or marshalling yards of the national railway network, for example, from Netherlands, furnished. All B relays involved at communicating preferably with the central warning computer common for these B-relay.

[0028] In this manner, detects the warning system for providing guaranteed warning (also called: "warning system") indirectly, a train through it with the help of permanent sensors to monitor the behaviour of part of the relay boxes along the free path security relays (the B relays), where the behaviour (i.e. "up" or "off") of those security relays is due to the behaviour (for example, the location, in particular the presence or absence) of the train in the corresponding track section.

[0029] Preferably, each B-relay in question equipped with its own individual permanently placed sensor, and / or each affected track section is equipped with at least one own individual permanently placed sensor. As a rule, of all the protective relays of the same type present a relay box (for example, type TR or type TPR) at least 30 % or 50 % or 80

% or 90%, preferably 100% are equipped with a own individual permanently placed sensor, wherein preferably this is the case for all or at least 30% or 50% or 80 % or 90 % of the relay boxes which are arranged directly after each other successively along a longitudinal free path for example at least 3 or 5 or 10 relay boxes. With regard to the above paragraph, the following is noted: alongside the railroad there are, for example, relay boxes as well as level switch boxes and also high voltage boxes and switch distribution boxes. These do not contain relays, such as type TR or TPR, that are part of the train protection system. The expression "relay box" or "relay house" therefore only means a weather protection housing containing relays, such as type TR or TPR, that are part of the train protection system. Furthermore, the invention takes into account that a series of a number, for example a minimum of five or ten, immediately consecutive sections, a partial number, for example one or two, the associated relay is not monitored according to the invention. So that such a section has been "skipped", for example because it is technically impossible or impractical to install a permanent sensor for the relay. For example, because the relevant relay, for example of TPR type, has no free contact to which the sensor can be connected. Such situation is probably permissible from the viewpoint of operational safety as long as a minimum of one or two sections, upstream and / or downstream are not "skipped" and / or at least 30% or 50% or 80% or 90 % of the sections belonging to the invention are not "skipped".

[0030] From the viewpoint of, for example, cost savings one or more relays and/or sections are skipped. Such a situation is probably permissible from the viewpoint of operational safety as long as a minimum of one or two sections, upstream and / or downstream are not "over beaten" and / or at least 30% or 50%, or 80% or 90 % of the sections of the invention are not "skipped".

[0031] The monitoring sensor is an example of a detection means for detecting the behaviour, such as the position or status of the B relay (for example, whether this is "on" or "off") and forwarding this information to the central warning computer, for example as a signal. The detection means is preferably adapted to transmit the behaviour of the one or more associated B-relays to the central warning computer in such a way that the latter receives and / or processes the information individually for each B-relay, such that the centralized warning computer this individualized email information may apply to declare any place along the track or which track section or in any place in a track section a train is located. An example of individualized B-relay delivery of the information is the equipping or associating of each B-relay involved with its own, individual monitoring sensor.

[0032] It is preferable to connect the sensor to a free contact of the relay, with a view to the undisturbed operation of the train protection system and sufficient reliability of the signalling by the sensor (e.g. minimum Sil-3 level). This type of connection could be called "direct" or "electrical" or "electronic" connected. An alternative, for example in the absence of a free contact of the relay for connection of a sensor, is the use of a contact-free monitoring sensor, preferably certified for a minimum Sil-3 level, for example as disclosed in NL- C-2016440 (VolkerRail Nederland bv; BMU), in order to determine the position of the relay, for example by magnetic, acoustic or optical detection. This type of connection could be called "indirect" or "contactless" connected. Another alternative is to associate a relay with the sensor of the relay that belongs to a preceding or following section, for example by configuring the software of the warning computer so that it is assumed that the status or condition of a section (i.e. or no train present in the section) is identical to the status or condition of a section before or after. This type of connection could be called "software connected". In the latter alternative (software type), the relay is preferably not directly or contactlessly connected to a sensor as referred to in this invention, and / or the status or condition of the associated section is determined by the immediately preceding or following section.

[0033] Preferably, a length of free path of at least 1 or 5 kilometres, and / or from a railway yard, at all or at least 30 % or 50 % or 80 % or 90 % of the B-relays of a particular type, e.g., TPR, which have a free contact, an individual sensor "directly" connected to the free contact, wherein optionally one or more of those B and relay the appropriate "directly" connected individual sensor can be replaced by a "contactless" connected individual sensor.

[0034] Preferably the invention is applied to a minimum of 30 % or 50% or 80% or 90% of all of the sections belonging to at least two or three or four railroad yards, each with a station or a stop, and that, preferably directly, connect, preferably free from train station or stop, rail track between them.

[0035] The invention is applicable to sections of the free track and also of railway yards. In English, a railway yard is called a "rail yard". In this document, the expressions "free lane" and "railway yard" have the meanings known to those skilled in the art. A definition of a railway yard known to the person skilled in the art is as follows: An area of the railway infrastructure that is intended and arranged for trains, start, end, overtake, cross, set up or shunt trains and which is provided with at least one switch. A railway yard includes for example one or more of: a) all tracks, indicated by a number; b) the track sections of the switch complex; all tracks adjacent to the tracks as referred to under a and b up to a maximum distance of 100 or 200 meters for the access signal of that railway yard. According to an alternative definition, a railway yard is a railway infrastructure consisting of points and operated signals and the roadways are offered by the train controller. On a railway yard the signals are red as standard and only when the roadway has been laid in by the train service manager do the signals turn green. As an alternative, a railway yard is defined in this document as an area of the railway where one or more points are located. This area is delimited by an entry signal and an exit signal or by a length rail of 100 meters from a turnout. A railway yard preferably comprises at least two points with preferably a piece

of railway of at least 10 meters between them.

[0036] The pieces of track between two railway emplacements is called free path, and one or more of the following applies : no switches; the signals along the free lane are automatic signals, the so-called P signals; the train controller can only set the direction of travel on the free lane; b within a free lane is not a turn-off option for a movement; there are no switches that can be operated by the process manager for routes; a free job consists of one or more free job tracks; the signals along the free lane are green as standard; The free track is invisible to the train controller.

[0037] The central warning computer communicates with the (preferably mobile and / or temporarily placed) alarm system located at the track workers and therefore has a communication connection thereto, preferably wireless, for example radio such as GSM. The alarm system can include collective and / or personal warning equipment.

[0038] Preferably, the central warning computer continuously receives updates, for example, every 5 minutes or 10 seconds or more frequently, for example every second, from each of the permanently placed sensors, about the status of the associated B-relays, so that the signals at the central warning computer data available to date may be held n. Each permanently placed sensor delivers at least one update to the server every time period, whereby a time period preferably lasts a maximum of 60 or 10 or 1 second. Thus, at any time, the current status is known at the warning system. Depending on the status of the B relay, the central warning computer can follow the course of the trains. In this way, the central warning computer at all times knows where the trains are located. The central warning computer can also use the status report to predict train movement in the near future. By comparing this prediction with the actual situation in the relevant time period, the central warning computer can detect a deviation that leads to the conclusion that a B relay or the associated permanently placed sensor is not in order. This means that the central warning computer knows at any time throughout the year which B relays (due to the aforementioned malfunction) are unsafe for use in the guaranteed warning system.

[0039] At some arbitrarily chosen time after taking into operation of the warning system and while the monitoring sensors the positions pass from the associated B-relay on the warning computer, can be a user through a suitable MMI (Man Machine Interface), such as I / O means, to the central warning computer send a request for one or more directly to each connected sections to set guaranteed warning. From that moment be watching the central warning computer this track area (for example, the critical distance of the train) and once a train this secure track area is approached sufficiently close (for example, the critical distance), the central warning computer the alarm command to alert the track staff. If the central warning computer has detected an unsafe B relay belonging to the protected track area, it also instructs the alarm system to alert the on-site staff. This selection by an operator of monitoring a track section can be cancelled by the central warning computer over time. A new selection can be made by the operator at a later time, for example for monitoring another track section, and this selection is cancelled after some time. During the time period, which lasts for example at least one or ten or one hundred days, within which at least two or five or ten or one hundred of these selections take place, the warning system remains in operation (possibly apart from temporary interruption for, for example, maintenance, resetting, malfunction) and / or will not be dismantled.

[0040] With the invention, it is unnecessary to wait for the next train to pass before the track workers are allowed to enter the track, since the central warning computer continuously tests the safe operation of the warning system. The track workers can therefore quickly enter the track. Because the central warning computer already follows an approaching train from afar through the behaviour of the B-relay of many upstream sections prior to the protected track area, it can be ruled out that an approaching train will be 'overlooked' by the warning system. The central warning computer can show on a screen or similar MMI which section is protected, so that an on-site official can ensure that the requested track area is protected. Particularly useful is the invention for use on a railway yard, because a train in that area of the monitored railway section, which contains the railway workers, may approach along many paths because of the many supply and branch sections, thereby all on the approach of a train must be monitored, which means that many sensors must be involved in the monitoring.

[0041] With the invention is monitored and / or for game d or an approaching train, within a given time elapse, for example 25 seconds, in the work area of the track workers will arrive. If that is the case, the warning computer issues the instruction to the local warning equipment / alarm system to give a warning signal.

[0042] The sensor is preferably located on or in close proximity to the frame on which the B relay is mounted. D e sensor is located in a relay box or a relay. Preferably an intervention within the housing of the B relay is avoided, more preferably the housing of the B relay remains unaffected.

[0043] Preferably, all or at least 30% or 50% or 80% or 90% of the relay boxes along a contiguous length portion railway track of at least 1 or 5 kilometres have at least one sensor according to the invention. Preferably, all, preferably at least 30% or 50% or 80% or 90% of the relay boxes or B-relays of a type, for example, track relay (e.g. TR) and / or rail repeat relay (e.g. TPR) is equipped with its own individual sensor according to the invention.

[0044] As a rule, the track retrieval relay (e.g., TPR) is used for the invention.

[0045] However, the central warning computer that communicates with the permanently placed sensors (input side) and with the alarm system (output side) set up locally at the track workers is not part of the central train control and protection, but can be communicating with it.

[0046] The invention can be used to quickly and safely a maintenance area to secure and through guaranteed warning. It may thereby go to a single section, or two or more contiguous sections and / or a region with a length of 100 meters or more.

[0047] The invention is applicable, for example, to railways with the following types of rail profile: UIC 60; U IC 5 4; NP 46 and / or a track width that is 1435 (+2 / -0) mm, measured on the side of the rail head at a height of 14 mm below the head of the rail.

[0048] The invention offers a solution to a remote-controlled warning system for work place safety, and makes use of the existing, located in the relay boxes and relay houses standing, part of the train detection of the protection, through the interior of the relay boxes and / or relay houses modifications to for realizing the warning system according to the invention, for example by equipping or associating each relevant B-relay with its own permanent sensor. After the monitoring sensors have been installed, the warning system can be put into operation. A solution is offered outside the risk profile of the track, can be permanently and is not affected by weather. Moreover, this is robust, virtually maintenance-free and it can be deployed rapidly, since it builds on the already -installed and taken in operation and with B-relay equipped train detection of the train protection. The officer in charge of taking the safety measures is located outside the risk area until the track is safe. It is avoided that a track that is in service must be crossed by the relevant officer before the protection is switched on. This means that the safety officer runs no risk of collision.

[0049] Control respectively monitoring of the position of the B-relays, such as trace repeat relay (e.g. TPR), for example, the "off" are of it, is preferably done by means of guaranteed monitoring of one another relay involved in the track occupied message, preferably where the first-mentioned relay is mutually associated (e.g., the track relay (e.g., TR) in the case of the track repeat relay).

[0050] It monitors or read from a relevant relay, such as a track repeat relay, is preferably done by means of the remote IO devices in, for example, a relay box or house. Remote IO device is preferably through secure and safe data communication connections over public networks in conjunction with a central processing unit such as a warning computer, for example, a server computer (in this document called "server").

[0051] The remotely controlled monitoring of a railroad track, or portion thereof, such as a section, as well as the control / monitoring of the status of this part, is preferably regenerated by a central warning computer, such as server. For example, by means of a secure web application, accessible through the Internet with, for example, a PC, smartphone, or tablet, is one or more of the following are possible: the server configure acids; operations are done; the status of the workplace security is clear.

[0052] In an implementation, the invention is based on predefined 'standard' monitoring zones. This is a work area by a security guard of a workplace protection per monitoring configuration, a workplace protection draft prepared. On the basis of the device on the server will be sent by monitoring via a single command in all designated parts / the measures implemented fiend sections e to the total working area to which track workers need to have access, security warning is applicable.

[0053] The invention preferably detects the track circuit and / or local circuit on the relay side of a part / section. For this purpose, equipment is permanently installed in a relay box or house. The position of a relay is detected indirectly.

[0054] The invention offers one or more of the following advantages: is variably configurable; is safe; used public GSM; can safely be installed (in that it does not enter track have to be pre-installation of the equipment); can rely on choices to be installed (for example, by the use of the sensor does the train protection not need to be functionally modified, and the majority of the installation can in be carried out operation); can quickly be installed (for example, that a plurality of sections are available in a single relay box or housing); works reliably (for example by applying robust electrical connections and components to the quality level of train protection in a protected environment); requires a low maintenance effort (for example due to the presence of permanent power supply, a well-protected and sealed environment, good accessibility for service work and no need for periodic inspections); disassembly is easy (can be removed without functional change to the train protection).

[0055] The remote IO equipment in a relay box is preferably powered from the 110V or 230V, 75Hz signal supply. The remote IO equipment in a relay house is preferably powered from the 230 V, 50 Hz mains supply.

[0056] If the power supply fails, the failsafe principle preferably comes into effect. In addition, the central server failure of equipment will Remote IO bi j preferably immediately notice it and for this purpose a fault generating notification.

[0057] The invention can be used at various locations. It is preferred that the remote IO equipment is a structure permanently build in a relay box, and / or -house. The installation and commissioning of the equipment can largely be done according to OVS / ISV / ACP61101 and removal according to SLV61101. The remaining lesions after the removal of the remote IO equipment structure are minimal: in the relay box / the relay housing may be some screw-gate remain visible on the positions where the equipment has been mounted.

[0058] An application is as follows: first place the workplace security of a certain (standard) WBI prepared by a first person from an office location. This can then be activated by a second person. This role is guaranteed. At time of activate them, the second person self-reference profiles. He can be instructed in advance by the first person.

[0059] One or more of the following applies: the central server configuration includes an overview of sections that are

connected; means a web application to consult this list; there is an installed list available; there is an installation drawing of the various installations in the field.

[0060] Use is preferably made of a public data communication connection and / or internet.

[0061] Security is preferably on differences in the areas and levels provided against use by unauthorized persons or spontaneously on / off, such as one or more of : remote IO equipment (application of the equipment in relay boxes and houses, and / or application of failsafe principles at least SIL-3 and / or extensive system health monitoring and / or secure data communication connections); central server (applicating in highly secured data centre and / or use of failsafe principles to SIL 3 and / or broken extension system health monitoring and / or secure data links and / or application firewalls and / or secure configurations); Web applications (secured data links (SSL certificates) and / or two-factor authentication and / or application of time slots).

[0062] A central application is preferably set up for the control of workplace security, whereby one or more of the following advantages arise: rapid implementation; simple management of configuration changes; direct control would enhance local adjustments / provisions require; availability for monitoring purposes.

[0063] One possibility is the central server only via a private letting communicate and data communication to the outside impossible to make or block.

[0064] User applications talk preferably with the central server via secure data links (for example, SSL certificates), the web application 's preferred feature two-factor authentication.

[0065] The central server preferably monitors the status / status of the workplace security warning system. The status / status can be monitored by the users via, for example, various channels (including web application, E-mail, WhatsApp and SMS).

HARDWARE (warning system)

[0066] Meaning of the abbreviations used:

- A = Adapter (B-relaisadapter)
- COM = Communicatie Module (modem / router)
- CPU = Central Processing Unit (processorunit)
- DI = Digital Input
- DO = Digital Output
- IO = Input Output
- PC = Personal Computer
- PLC = Programmable Logic Controller
- PSU = Power Supply Unit
- SIL = Safety Integrity Level
- TPR = Track Repeater Relay (spoorherhaalrelais)
- TR = Track Relay (spoorrelais)

[0067] One or more of the following is applied: B-relays secure in reading from a central server; fully minimal SI L-3; the remote I / O contains one or more of a modem, GPS receiver, power supply, CPU; at least one or two DIs connected to a single TPR; at least one or two DI-s actions on a single TR; the TR is NOT directly connected to the one or more DI-s and, for example, to the necessities, the galvanic separation with the train protection to lock; TPR is directly connected to one or more DIs; the DI and form sets that are monitored for alternation (if one is "on", the other must be "finished", otherwise an error message) ; modem for public GSM, preferably with application of the Safety communication protocol (SafetyNet p); remote I / O sends DI data to central server; time server; GPS Time Sync.

[0068] For the guaranteed warning, the invention can be realized without command generators (such as the DOs) and the actuators and switches connected thereto and the associated B relay. Only the position of a B-relay (such as TPR) will be read so that the server can determine whether or not a true warning signal must be given to the people who work on the track.

NON-LIMITED EMBODIMENTS

[0069] The invention is further described with reference to the drawing. Hereby shows:

FIG. 1 a perspective view of a B-relay, mounted on a contact block;
FIG. 2 a photo of a B relay;
FIG. 3 an exemplary system structure;
FIG. 4 an example of the structure of the system part on the relay side;
FIG. 5 and 6 show a detail of fig. 4 in two operating positions;
FIG. 7 an example of the server;
FIG. 8 a warning device in perspective;

FIG. 9 a double railway or railroad track in perspective;
FIG. 10 is a cross-sectional view of a portion of the track of FIG. 1.

[0070] Fig. 3 - 7 are schematic block circuit diagrams.

[0071] Meaning of the abbreviations used:

- A = Adapter (B-relaisadapter)
- COM = Communicatie Module (modem / router)
- CPU = Central Processing Unit (processorunit)
- DI = Digital Input
- DO = Digital Output
- IO = Input Output
- PC = Personal Computer
- PLC = Programmable Logic Controller
- PSU = Power Supply Unit
- SIL = Safety Integrity Level
- TPR = Track Repeater Relay (spoorherhaalrelais)
- TR = Track Relay (spoorrelais)

[0072] Scss stands for signalling controlled safety system and provides rail workers with a guaranteed warning that a train is approaching and also offers the option of safely taking a section out of service.

[0073] FIG. 1 shows the block-shaped relay housing 1 which hermetically closes a single internal space from the environment. At a high level, two parallel, straight mounting sleeves 2 run through the interior space and protrude through both end walls. These mounting sleeves are sealed with respect to the internal space. A mounting pin longer than the sleeve can protrude from the sleeve at both sleeve ends.

[0074] The internal space contains all components of the B relay, of which only the magnet coil is shown. This is at a low level. This magnet coil switches the relay and is located at the bottom of the B relay.

[0075] Further, FIG. 1 shows an element 3 (shown in phantom) and a contact block 4. Projecting from the contact block 4 (such as temporary), the two mounting pins (not visible in Fig. 1) on which the B-relay 1 has been inserted (the mounting pins stick in the mounting sleeves 2). These mounting pins are rigidly fixed on the contact block 4 and protrude perpendicularly from the contact block, extending substantially horizontally. the element 3 comprises switching the switch with the associated wireless receiver for wirelessly at a distance from the B-relay between "on" and "off" for the simulation of a train occupancy.

[0076] FIG. 2 shows the block-shaped, hermetically sealed relay housing and now also most components of the B relay inside this relay housing, including: a galvanic magnetic coil with a soft-iron core, an anchor, a reset of the anchor, a changeover contact, a make contact, a break contact. The mounting sleeves are also visible.

[0077] FIG. 3 shows an example of the invention. The central server communicates (e.g. wirelessly via GSM) with warning equipment (for the purpose of guaranteeing an approaching train) and / or a user interface so that a user can enter a command (for example to activate the guaranteed warning in a section) and / or receive feedback or a status overview from the server. One or more of the four components shown has level SIL-3 or higher.

[0078] FIG. 4 shows in more detail the remote IO equipment in the relay box or relay house. The remote I / O devices includes the relevant B-relay associated sensors (the DI-s), and to communicate (e.g. wirelessly via GSM), with the central server for sharing with the sensor data associated data for updating the server.

[0079] Also shown in Fig. 4 are command generators (the DOs) which supply commands intended for controlling the actuators. A command provider controls an actuator (for example a relay) or a switch. These commanders do not belong to the invention and offer the option of decommissioning. It has been shown that the commanders are connected to an adapter A that provides an interface so that the commanders communicate indirectly with the associated relay TR.

[0080] The COM is equipped with an antenna, as shown in fig. 4. For the purposes of the guaranteed warning, only the position of a B relay (such as TPR) is read using two DIs so that the server can safely determine whether a warning signal should be given to the people working on the track.

[0081] FIG. 5 and 6 show one embodiment for reading in of the position of a relay (e.g. TPR) by means of two DI's.

[0082] FIG. 7 shows the structure of the server. The array of PLCs has a minimum Sil-3 level.

[0083] FIG. 8 shows an example of a warning device 20 which communicates wirelessly with the central server via the network. The device 2 0 is portable and is placed on or next to the track.

[0084] The railway of fig. 9 is electrified, therefore there are portals (one of which is visible) along it, which carry the contact wire. FIG. 10 shows how the gantry leg 6 is founded by a prefab element 5 based on steel next to or in the edge area of the ballast bed 2 which carries the sleepers 3 with the rails 4 thereon. With a gap of at least 100 meters, there are relay boxes along the length of the railway that each contain a TPR relay and have been modified to be arranged in accordance with the invention to provide workplace protection.

[0085] The measures disclosed herein can be taken individually in any other conceivable combination and permutation to provide an alternative to the invention. Also included are technical equivalents and genus or generalizations of the

measures disclosed. A measure of an example is also generally applicable within the scope of the invention. A measure disclosed herein, for example of an example, can be readily generalized for inclusion in a general definition of the invention, for example found in a patent claim.

[0086] Thus, in an embodiment, the invention relates to a method based on an existing system of train detection in track sections with B-relays, such as TPR relays, in relay boxes along the track, wherein first a warning system is built in which for each B-relay a, preferably own, monitoring sensor is placed in the relay boxes with which the status, that is, the "closed" and "open" of the B-relay is monitored, then the warning system is put into operation whereby all monitoring sensors are operated during operation regularly, for example every second, transmit the status of the associated B relay to the central warning computer, which thereby knows and tracks the position of all trains in a given track area, and, after the warning system has been operational for some time, an operator presents a track section for selects guaranteed warning in the central warning computer, on which for that track section, the central warning computer monitors the approach of a train to a critical distance on the basis of the current status of the associated B-relay which is, for instance each second, received from the monitoring sensors and, if the central warning computer detects that a train of the selected track section has approached to the critical distance, the central computer sends a command to the near the railway workers disposed alarm system to give a warning; this selection is preferably cancelled by an operator of monitoring a track section over time by the central warning computer; preferably at a later time a next selection is done by the operator, for monitoring, for example, a different track section, and preferably, this next selection is after a period of time; it is preferable to reset the warning system in operation during the period of time, which is, for example, at least one or ten or one hundred days duration, within which at least two or five or ten or one hundred of these selections take place.

[0087] As an alternative, the invention in one embodiment is a method and / or a system with the use of a next to or close to a railway track, established and / or associated therewith a relay box or a relay which a large number of B relay of the track occupied message contains of which at least one, or all, of these B-relay participates in the inventive method, respectively, is part of the inventive system, with one or more of the following:

- to which relays belong that are applied at security level or used for track occupancy reporting, such as a so-called repeat relay;
- adapted to monitor whether a particular railway section is approached by a train, with a sensor (DI) permanently placed in a relay house or box which emits a measurement signal which depends on whether or not a relay is on or off, preferably of type TPR or similar track repeat relay, and an alarm system which gives track workers in the track a warning that a train is approaching; and a processing unit which is adapted to process the measurement signal and to control the alarm system to give the warning;
- with a relay sensor (DI) which outputs a relay signal with which the system can determine the position (i.e. energized or not energized) of a galvanic relay associated with the track, such as of type TPR or similar track repeat relay, which is involved in checking the occupancy of the track, the processing unit being adapted to process the relay signal;
- arranged for in the monitoring to take into account the time lag from the occurrence of a given event, for which purpose preferably use is made of a to the system belonging timer;
- equipped with a memory containing a reference value which is compared with an actual value determined on the basis of the DI and determined and, in the case of a difference value greater than a predetermined value, it is decided to give the alarm system a command to give a warning;
- the TR is associated with two DIs and / or the TPR is associated with two DIs;
- all or at least 30 or 50 or 80 or 90% of the relay boxes with TPR-relays, and / or all or a minimum of 30% or 50% or 80% or 90% of the sections of a piece of railway with a length of at least 1 or 5 kilometres are arranged according to the invention.

Claims

1. A method for "guaranteed workplace safety" for work safety for maintenance workers, in the track with, for example, rails type UIC 60 and / or a track width 1435 (+ 2 / -0) mm, of a rail track for passenger and freight per train with overhead contact line above the track for the electrical supply of the train locomotive, of which the train protection system uses and is equipped with safety relays placed in relay boxes and relay houses, so-called B-relays, which in the case of "guaranteed workplace safety", the train traffic gets unobstructed passage over the track on which the track workers are working and the approach of a train is monitored by a warning system for providing guaranteed warnings and the track is only entered by the track workers when an approaching train is still far enough away from the workplace, and when the train has approached a critical distance, it will alert the system to ensure a guaranteed warning is given to the track workers who are subsequently expected to leave the track immediately and / or leave the track immediately;

within the present method, one starts with the train protection system, and at the beginning of the implementation of the method modifications are carried out inside the relay box / housing of this existing train protection system by locating for the B relay, preferably of a specific type, such as the track repeatability B-relay of, for example, type TPR, preferably an own and / or individual, monitoring sensor permanently inside the relay box / housing, in which the B-relay (hereinafter, represented by: TPR relay), is located, said permanent monitoring sensor detects and / or monitors the position "up" and "off" of the TPR relay of the track occupancy system, the placed monitoring sensor(s) being arranged to individually collect and transmit the data for each associated B relay and, via a data connection, the status of these positions, individualized to each associated B relay, is reported to an associated and remote central warning computer adapted to use the data from the permanently placed monitoring sensor to conclude whether the temporary mobile alarm system set up at the track workers should be instructed to provide, e.g. acoustically, the guaranteed warning to the track workers; wherein of the already for some time prior to the start of the implementation of the method adjacent the railway track disposed relay box / housing containing a large number of B-relays of the track occupation system, at least one, preferably all of the existing TPR relays is associated with the method by permanently associating or equipping it, at the start of the method, inside the relay box / housing with a, preferably own and / or individual, monitoring sensor; wherein preferably one or more of the following applies: the method is carried out so that of a piece of rail having a length of, for example, a minimum of 5 kilometres, at least one, preferably all, relay boxes / houses with TPR-relay and / or at least one, preferably all of the sections are arranged, according to the invention at the beginning the execution of the method to modify these relay boxes / housings by permanently placing the monitoring sensors associated with the TPR relays therein;

wherein each permanently placed monitoring sensor is connected to a free contact of the associated TPR relay;

for the inner space of the housing of the TPR relay at least three of the following applies: is a single interior space; contains a single or double galvanic magnet coil with soft iron core, an anchor, a return spring of the anchor, in the event of failure of the magnetic field by switching off the magnet coil, to move the anchor to the other position, a changeover contact, a make contact, a break contact; contains all components of the TPR relay; is hermetically sealed with respect to the environment; is sealed against unauthorized access; has a boundary wall that is transparent to visible light; two mutually parallel and straight installation ducts extend through it, are sealed to it, and extend through the two opposite end boundary walls and open into the surroundings, and in each installation duct extends a mounting pin, protruding on either side, and in the relay box / house for each TPR relay a pair of mutually parallel, fixed mounting pins is available on which a TPR relay housing is placed so that its rear wall is placed against the contact block, and nuts are placed on the out of the front wall of the TPR relay housing to the front protruding threaded ends of these mounting pins so that the TPR relay housing remains free of sliding on the mounting pins; one or more galvanic conductors protrude through this boundary wall into the surroundings from this internal space of the TPR relay; only galvanic conductors extend from the internal space into the environment; galvanic conductors are electrically connected to one or more components in the internal space, such as a solenoid or a switching contact; the rear wall of the TPR relay includes rearwardly extending contact pins in a pattern corresponding to the pattern of forward-facing, complementary, contact holes at the front wall of the contact block, so that these members are mutually connected, whereby the contact pins in the contact holes are inserted by pressing the TPR relay backwards in the horizontal direction against the contact block;

for each of the with the method associated TPR-relay the "on" or "off" is detected by the associated permanently disposed monitoring sensor, and this monitoring sensor indicates this position, preferably individualized to the corresponding TPR-relay, to the central warning computer, so that all permanently placed monitoring sensors transmit the positions of the relevant TPR relay, preferably individualized to the associated TPR relay, to the central warning computer and, preferably for that purpose, each permanently placed monitoring sensor detects the track circuit and / or the local circuit at the relay side;

in this manner the warning system detects in an indirect way a train, with the aid of the at the beginning of carrying out the method inside the relay boxes / houses on the TPR-relay of the train protection system arranged permanent monitoring sensors, monitoring of the state of the, for example all involved, already prior to the carrying out of the method in the relay boxes along the railway track, for example of the continuous track or a rail yard, present TPR-relay, in which the position (i.e., "on" or "off") of those TPR relays is due to the presence or absence of the train in the corresponding track section;

the central warning computer communicates with the mobile and temporarily placed alarm system at the track workers and for this purpose has a, preferably wireless, communication connection with it;

the central warning computer receives on a regular basis, for example at least quasi- continuous, updates, for example, at least every second, from each of said permanently placed sensors, so that at any time the status is known all with the warning system associated TPR relay sand and based on the monitoring sensors, permanently placed at the TPR relays, the computer follows the course of the trains such that at any time the central warning computer knows where the trains are located; at any given moment after the permanent monitoring sensors have been installed and the warning system has been put into operation and the permanently installed monitoring sensors

transmit the relay positions to the central warning computer, a user directs via a suitable HMI (Human Machine Interface), such as I/O means, to the central warning computer a selection request to set up a warning for a track area of one or more sections immediately following a section and from that moment on the central warning computer monitors this protected track area for trains as it approach a critical distance and as soon as a train has approached this protected track area to the critical distance, the central warning computer instructs the alarm system to alert the track workers, because the central warning computer is already following an approaching train from afar via the "on" and "off" from the TPR relays of the sections upstream from the secured track area provided by the permanently placed monitoring sensors;
after some time the central warning computer will stop monitoring;
then, without any interruption of operation or dismantling of the warning system, a new selection request is sent by the user to the central warning computer for another track area and the central warning computer performs monitoring for that other track area;
each monitoring sensor is located on the frame on which the associated TPR relay is mounted;
none of the with the warning system associated TPR relays experiences an operation inside the casing;
the housing of all TPR relays associated with the warning system remains unaffected;
the central warning computer that communicates with the permanently placed monitoring sensors (input side) and with the alarm system (output side) installed locally at the track workers is not part of the central train control and protection system.

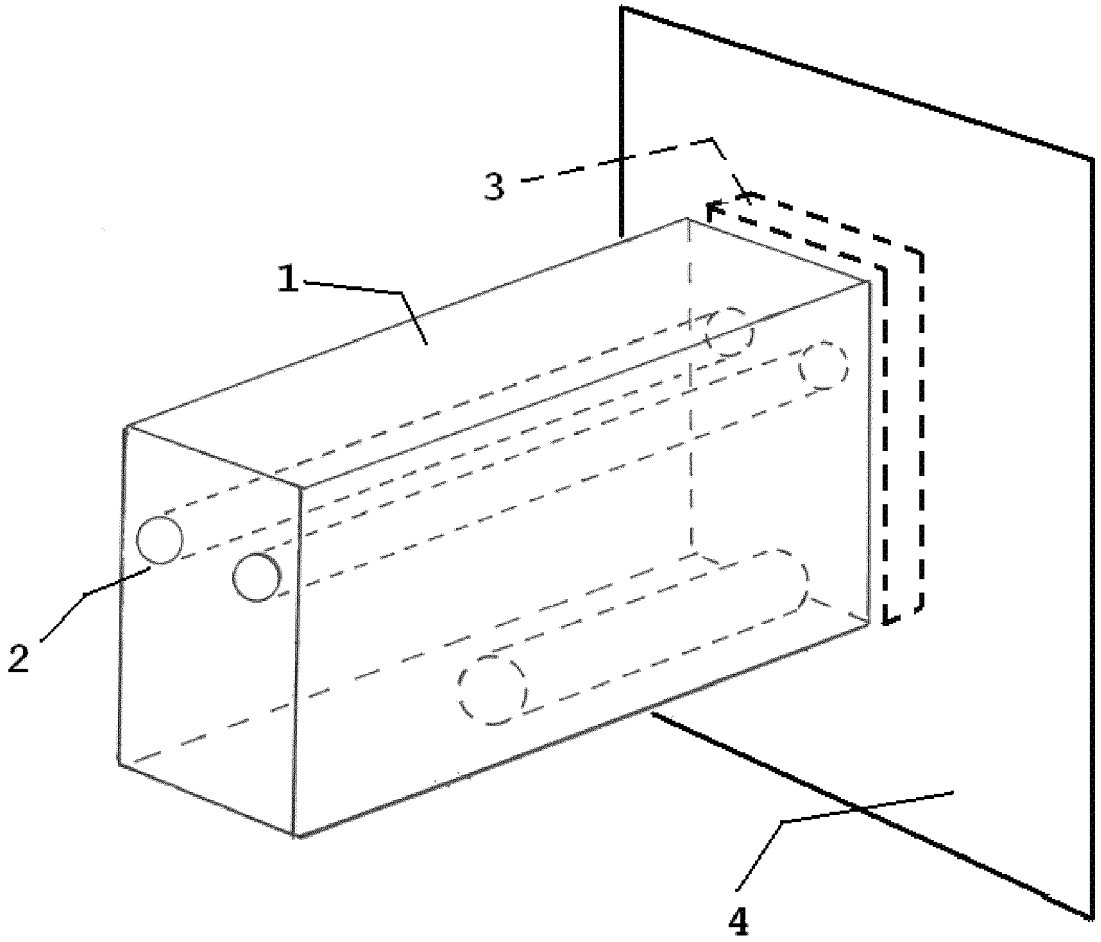

Fig. 1

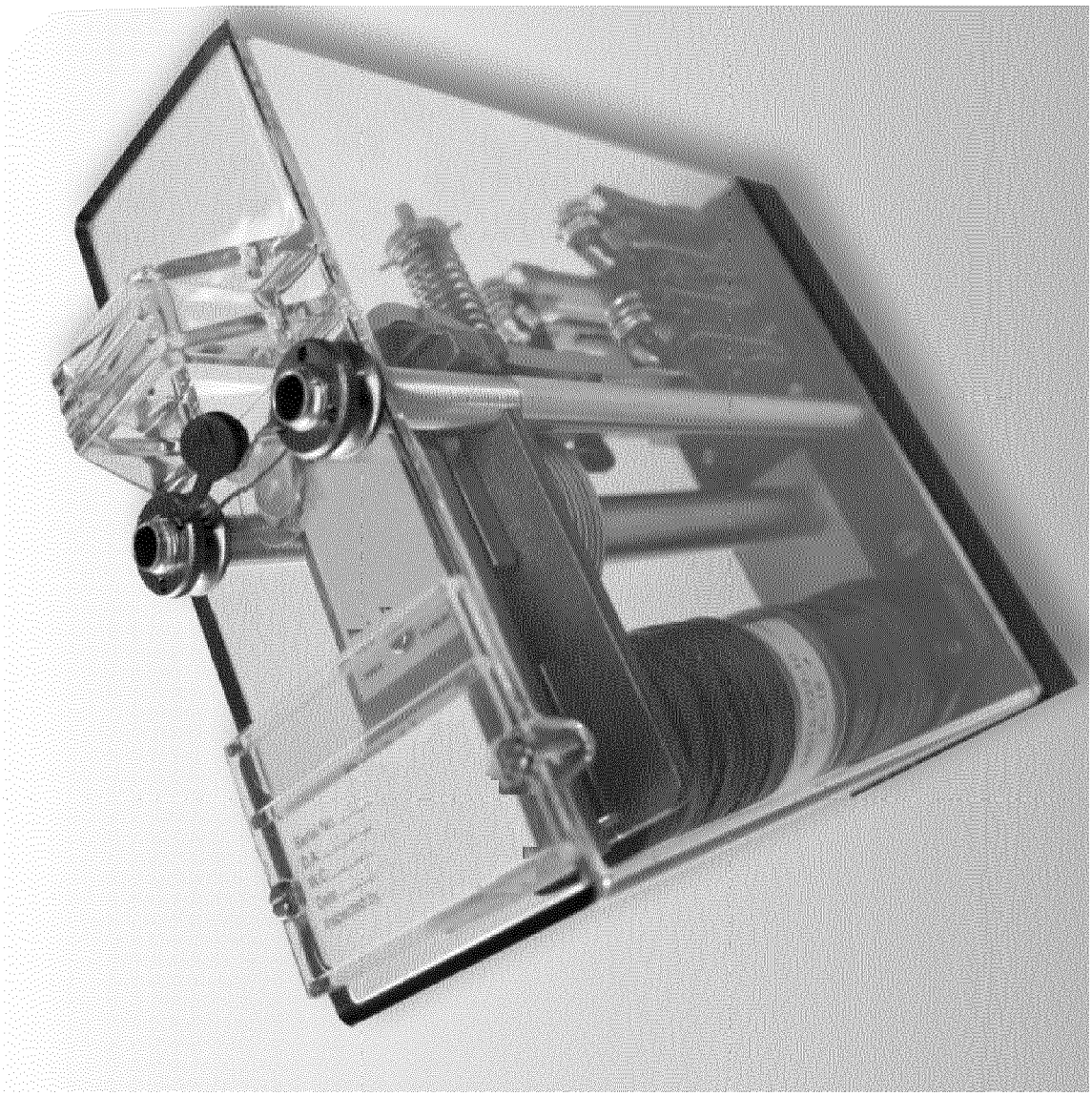

Fig. 2

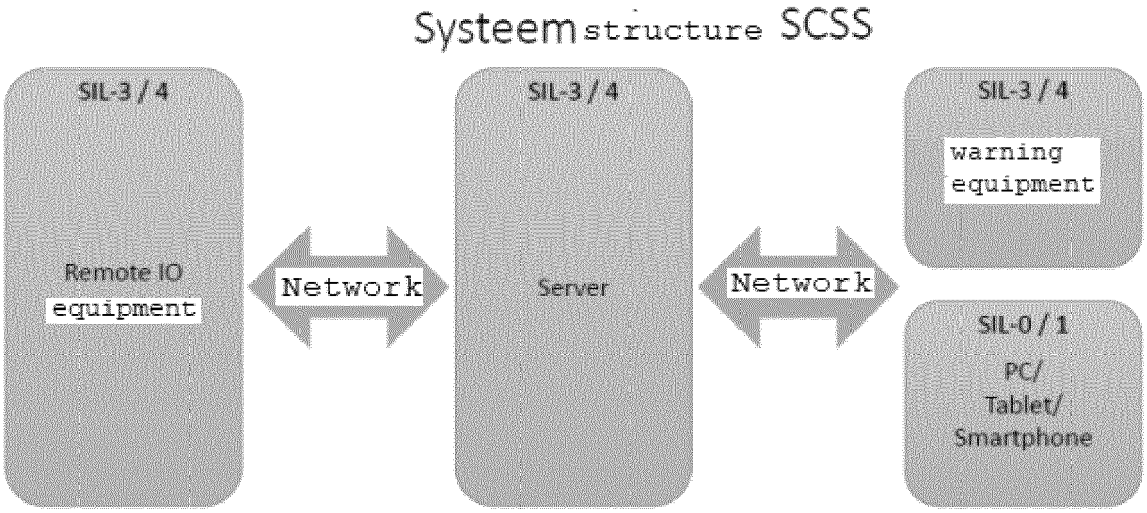
Systeem structure SCSS
SIL-3 / 4
Remote IO
equipment
Network
SIL-3 / 4
Server
Network
SIL-3 / 4
warning
equipment
SIL-0 / 1
PC/
Tablet/
Smartphone

Fig. 3

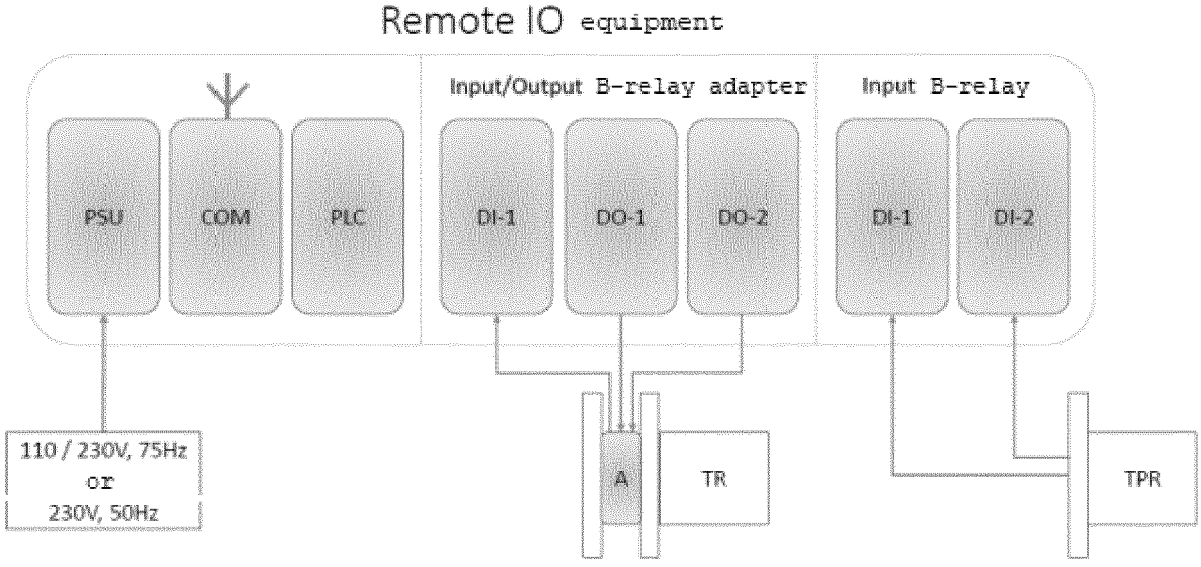
Remote IO equipment
Input/Output B-relay adapter
Input B-relay
PSU
COM
PLC
DI-1
DO-1
DO-2
DI-1
DI-2
110 / 230V, 75Hz
or
230V, 50Hz
A
TR
TPR

Fig. 4

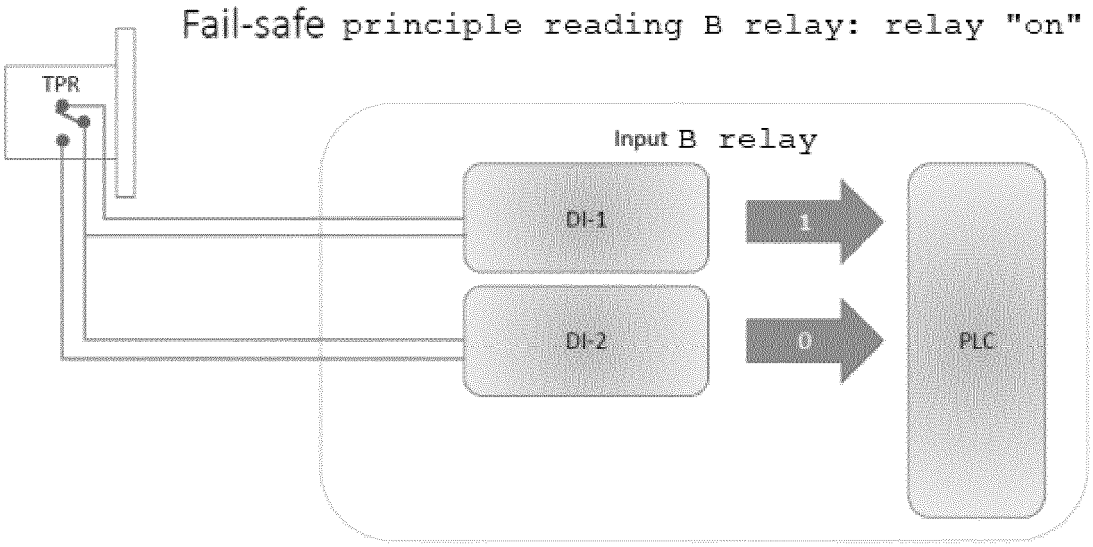
Fail-safe principle reading B relay: relay "on"
TPR
Input B relay
DI-1
DI-2
1
0
PLC

Fig. 5

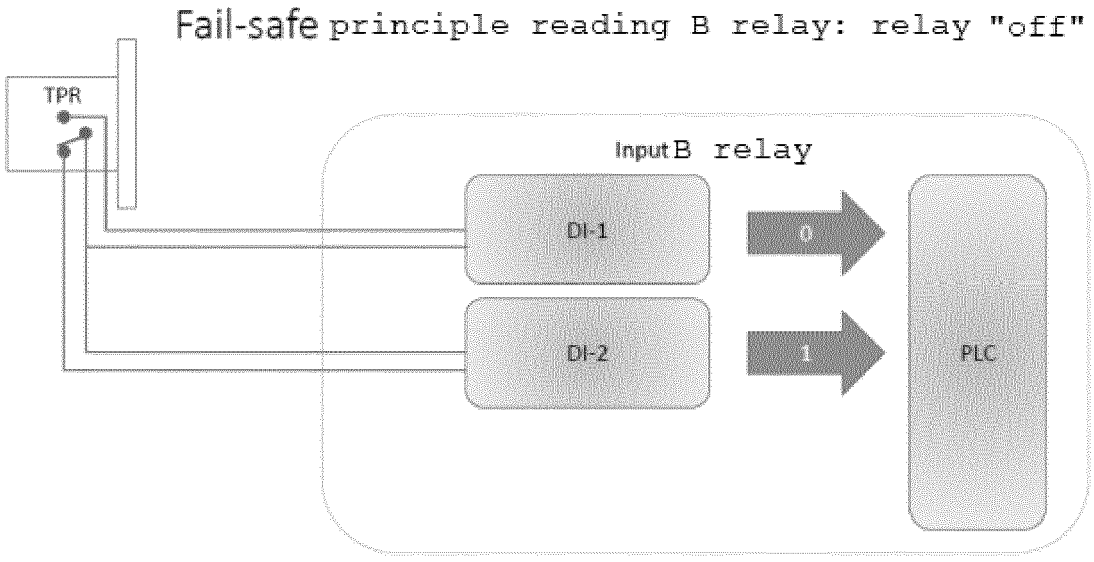
Fail-safe principle reading B relay: relay "off"
TPR
Input B relay
DI-1
DI-2
0
1
PLC

Fig. 6

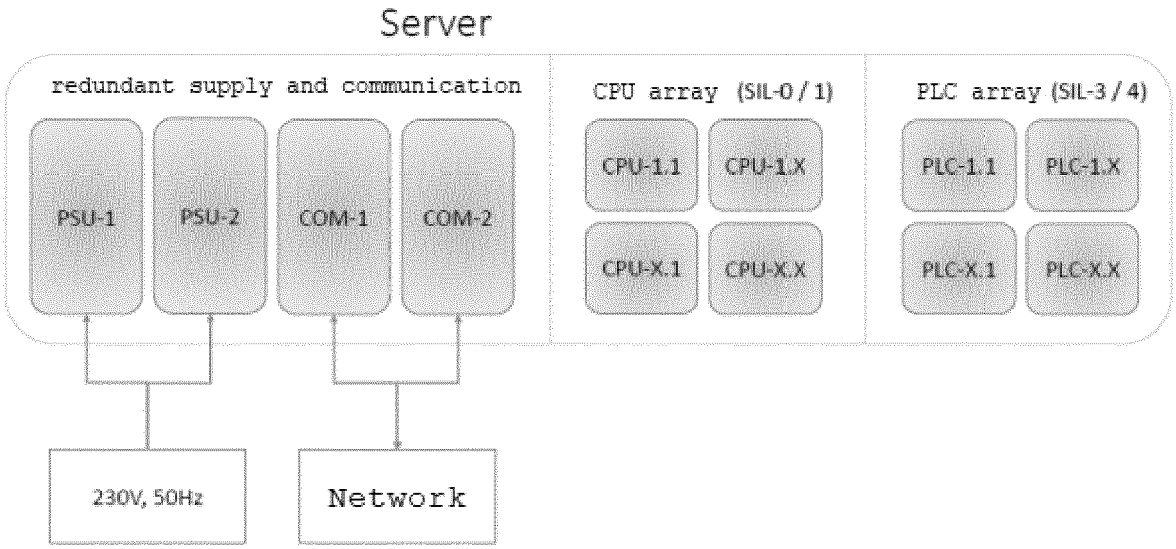
Server
redundant supply and communication
PSU-1
PSU-2
COM-1
COM-2
CPU array (SIL-0 / 1)
CPU-1.1
CPU-1.X
CPU-X.1
CPU-X.X
PLC array (SIL-3 / 4)
PLC-1.1
PLC-1.X
PLC-X.1
PLC-X.X
230V, 50Hz
Network

Fig. 7

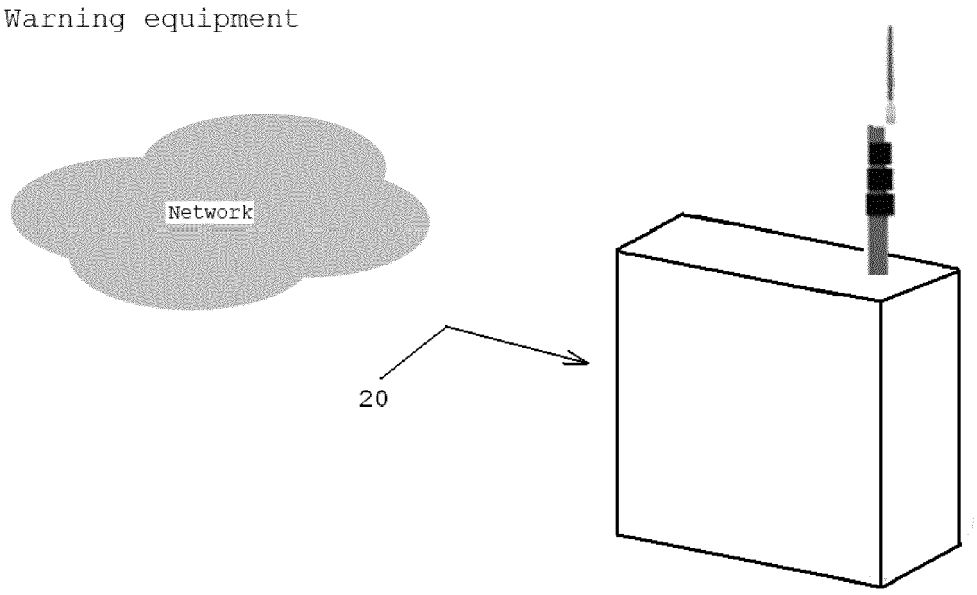
Warning equipment
Network
20

Fig. 8

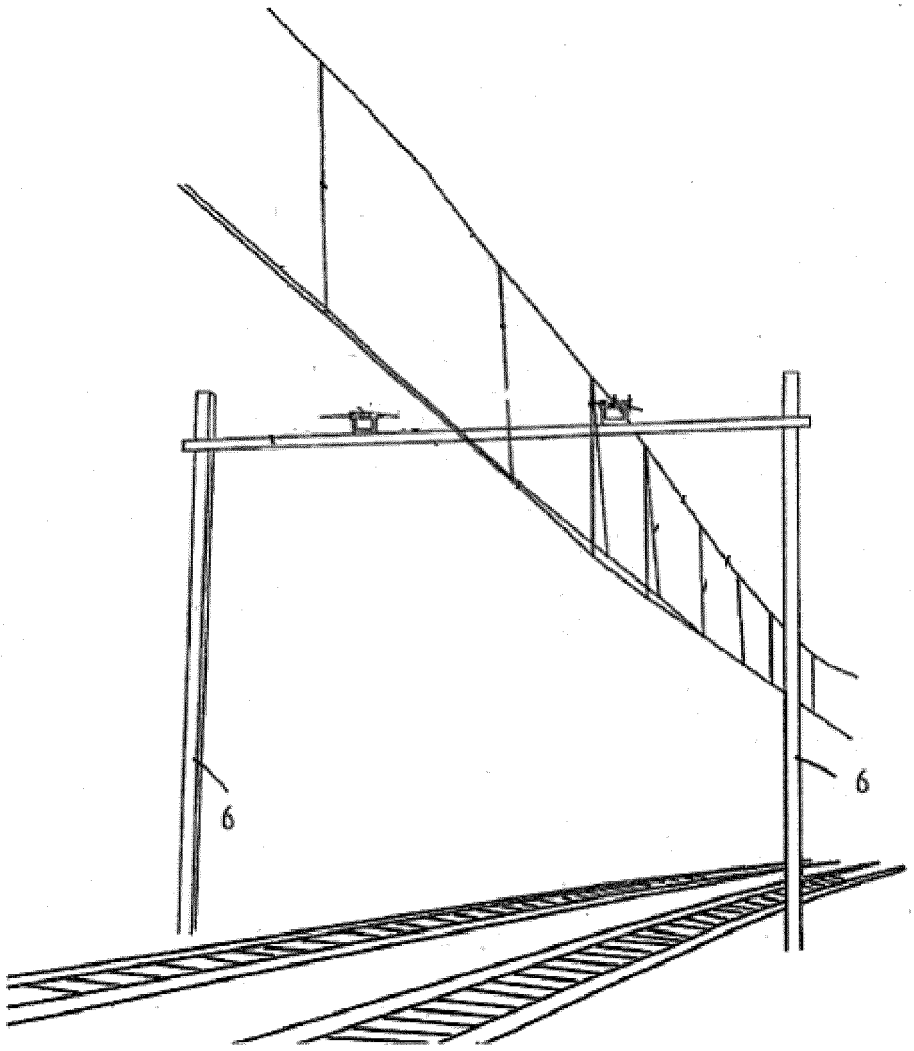

Fig. 9

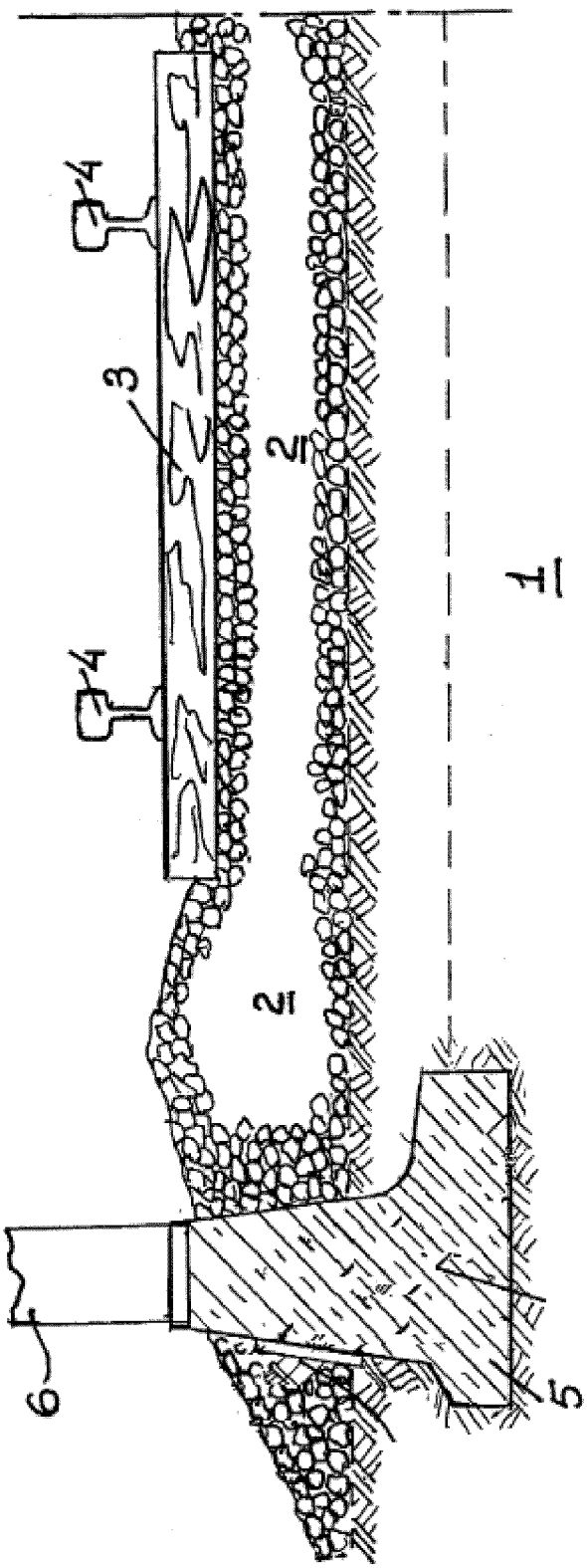

Fig.10

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EUROPEAN SEARCH REPORT

Application Number
EP 19 21 3698

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 1 308 366 A1 (CIT ALCATEL [FR]) 7 May 2003 (2003-05-07) * paragraphs [0006], [0008], [0010], [0021] - [0055]; figures 1-6 *	1	INV. B61L23/06
A	EP 2 990 296 A1 (DUAL INVENTIVE HOLDING B V [NL]) 2 March 2016 (2016-03-02) * paragraphs [0022], [0023], [0026], [0028] - [0030], [0035], [0036], [0039], [0045] - [0048], [0064] - [0089]; figures 3-5 *	1	
A	EP 3 257 718 A1 (VOLKERRAIL NEDERLAND BV [NL]) 20 December 2017 (2017-12-20) * paragraphs [0005] - [0017], [0037], [0040] - [0045]; figures 1-4 *	1	
A	EP 3 069 953 A1 (VOLKERRAIL NEDERLAND BV [NL]) 21 September 2016 (2016-09-21) * paragraphs [0001], [0003], [0006], [0008], [0019] - [0024]; figures 1-4 *	1	TECHNICAL FIELDS SEARCHED (IPC)
A	SCHMIDT K ET AL: "Stellwerksgebundenes Rottenwarnsystem der OEBB - von der Pilotanlage zur Serienreife", SIGNAL UND DRAHT: SIGNALLING & DATACOMMUNICATION, EURAILPRESS, DE, vol. 101, no. 1/2, 1 January 2009 (2009-01-01), pages 19-24, XP001518437, ISSN: 0037-4997 * page 19, paragraph 2 - page 20, paragraph 3; figure 2 *	1	B61L

-/--

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	24 April 2020	Massalski, Matthias

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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L : document cited for other reasons

& : member of the same patent family, corresponding document

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European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 19 21 3698

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	DURINA E ET AL: "AUTOMATISCHES ROTTENWARNSYSTEM FUER DIE NEUBAUSTRECKEN DER DEUTSCHEN BUNDESBAHN", SIGNAL UND DRAHT: SIGNALLING & DATACOMMUNICATION, EURAILPRESS, DE, vol. 82, no. 1 / 02, 1 January 1990 (1990-01-01), pages 20-26, XP000244316, ISSN: 0037-4997 * page 21, paragraph 1.2 * * page 21, paragraph 2. - page 23, paragraph 2.3 * * figure 4 * -----	1	

TECHNICAL FIELDS SEARCHED (IPC)

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	24 April 2020	Massalski, Matthias

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 19 21 3698

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