S. M. DAY.

BROKEN DOWN INSULATING JOINT PROTECTION.

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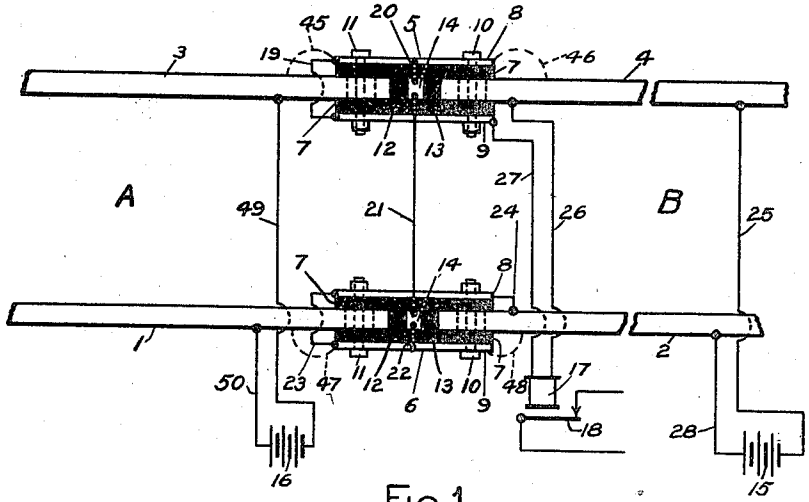


FIG. 1.

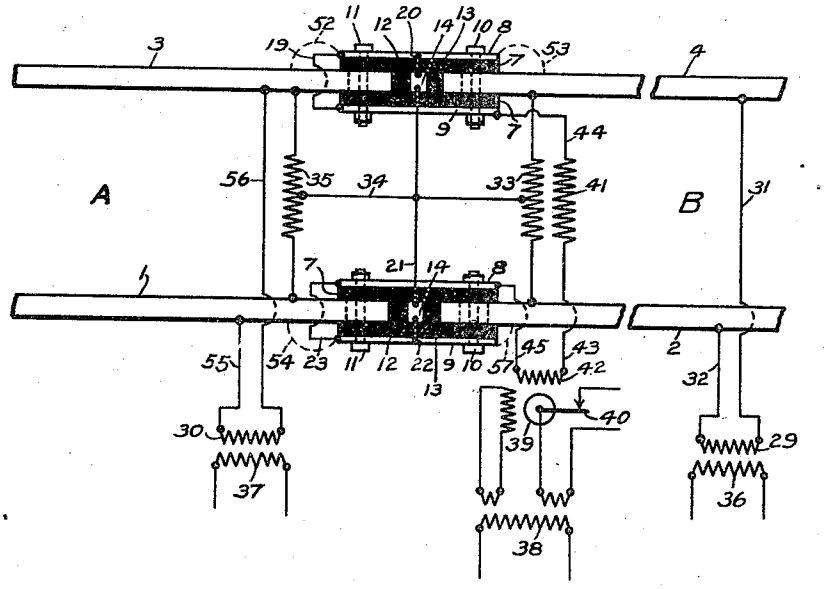


FIG. 2.

WITNESSES:

Lillian L. Phillips.

Lillian M. Mutschler.

INVENTOR

Salisbury M. Day.

BY

Lyman E. Dodge.

ATTORNEY

THE COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

SALISBURY M. DAY, OF ROCHESTER, NEW YORK, ASSIGNOR TO GENERAL RAILWAY SIGNAL COMPANY, OF GATES, NEW YORK, A CORPORATION OF NEW YORK.

BROKEN-DOWN-INSULATING-JOINT PROTECTION.

1,181,576. Specification of Letters Patent. Patented May 2, 1916.

Application filed September 6, 1912. Serial No. 718,838.

To all whom it may concern:

Be it known that I, SALISBURY M. DAY, a citizen of the United States, and a resident of the city of Rochester, in the county of Monroe and State of New York, have invented a new and useful Broken-Down-Insulating-Joint Protection, of which the following is a specification.

This invention relates to railway electric track circuits.

The primary object of this invention is to furnish means whereby a break in the means for guarding against the dangerous effects of "broken down insulating joints" will be indicated immediately.

Another object of the invention is to provide means for indicating the existence of a "break" of any nature whatsoever, in an insulating joint.

Other objects and advantages will appear as the description of the invention progresses, and the novel features of the invention will be particularly pointed out in the appended claims.

The ordinary and well known track circuit section is commonly constructed with a source of electro-motive force connected across the rails at one end of the section, and a translating device connected across the same rails at the other end of the same section, and adjacent sections are separated one from the other by means of what is known as an "insulating joint," which consists essentially of a fiber member interposed between the abutting rail ends of the two sections, and fiber plates interposed between the ordinary and well known splice plates and the rails, together with the suitable devices for properly preventing the bolts used for holding the whole together from coming in contact with the metal of both a rail and a splice plate.

As ordinarily constructed, if any defect occurs in any of the insulating material used, a conducting path for electricity may exist between the rail of one section and the rail of an adjacent section. In case only one joint breaks down there will probably be no injurious effect in the case of steam road direct current or alternating track circuits, but if both joints break down or in the case of track circuits employing reactance bonds if only one joint breaks down, then the source of electro-motive force connected across the rails at the end of one section can cause a flow of current to the relay connected at the proximate end of the adjacent section and, consequently, although the relay in the adjacent section should be deënergized, by reason of a car in the section to which it is connected, nevertheless it might be energized and probably would be, if the break down between the sections was complete, by reason of a flow of current from the track battery in the adjacent section. Such a condition, of course, is extremely dangerous. Various means for remedying the possibility of such a dangerous failure have been devised. The method most commonly used is to reverse the polarity of the leads from the source of electro-motive force to the rails of the track sections in adjacent sections. This method is not, however, applicable to the ordinary battery fed track section employing a neutral relay as a translating device, for such a relay is operably energized irrespective of the direction of the current flow therethrough. The method is, however, applicable if used in connection with track circuit sections fed from a source of alternating current and in which the translating device is constructed in the form and in accordance with the principle of the well known induction motor having a stator with two windings thereon and a squirrel cage armature, because current flowing to the induction motor relay will cause a movement of the armature of the induction motor in one direction when fed thereto from the proper track circuit section, but will cause a reverse movement of the armature when fed to the induction motor from the source of current connected to the track rails of the adjacent section. Even when alternating current is employed for feeding the track circuit sections, it is impossible to obtain the above mentioned method of operation under all conditions, because when what is known as the "wireless track circuit" is employed, as is well known to those skilled in the art, the polarity of the current supplied to the track rails of the track circuit sections is changed depending upon the position of the semaphore resulting from train movement or other causes, so that a broken down joint would allow current to flow from an adjacent section to the relay of the proximate section

at some times in a proper direction to cause a "false caution" signal. It being possible to so arrange track circuit polarities, with wireless control, as to avoid the more dangerous "false clear" indication. In order to remedy such defects in a track circuit, a conductor has been connected to each of two metal posts which have been placed one in each line of rails at the abutting ends of two track circuits, and separated from the rails by insulating posts. This construction protects against a break down due to the creeping of the rails, but does not protect against some break downs due to other causes, furthermore, the entire protection is lost if the conductor becomes broken. Applicant's invention as heretofore stated has as its main objects the elimination of such defects.

In describing the invention in detail, reference is had to the accompanying drawings, wherein I have illustrated a preferred physical embodiment of my invention, and wherein like characters of reference designate corresponding parts throughout the several views, and in which—

Figure 1 is a schematic representation of the ordinary track rails and insulating joints at the abutting ends of two direct current track circuit sections, together with sources of electro-motive force and a translating device as commonly constructed, with applicant's invention applied thereto; Fig. 2, is a schematic representation of the ordinary track rails and insulating joints at the abutting ends of two alternating current track circuit sections employing balanced reactance bonds, together with sources of electro-motive force and a translating device as commonly constructed for electrically propelled railways, with applicant's invention applied thereto.

Referring to Fig. 1, numerals 1, 2, 3 and 4 designate the ordinary and well known rails of a railway track; 5 and 6 designate generally an insulating joint which is in the main, identical with the well known forms of insulating joints, as will readily be perceived by those skilled in the art of railway signaling. It consists of insulating plates 7 which separate the splice plates 8 and 9 from contacting with the rails 1 and 2 or 3 and 4, and it further consists of bolts 10 and 11 which bind the plates 7, 8 and 9 and the rails 1 and 2 and 3 and 4 tightly together. In order to separate the ends of the rails 1 and 2 and 3 and 4, one from the other, the end posts 12 and 13 employed are made from insulating material and have placed therebetween the conducting member 14. The sources of current 16 and 15 are shown connected across the rails of the sections A and B respectively and a translating device 17, including the armature 18, which controls a signal mechanism—not shown—is delineated connected to the section B. The connections of the sources of current are as usual. One terminal of the translating device 17 is also connected, as is usual, to one of the track rails, in this case 4; the other terminal of the translating device 17 is connected to the splice plate 9, which in turn is connected by means of the conductor 19, with the splice plate 8; splice plate 8 is connected by means of the conductor 20 with the conducting member 14, the conducting member 14 is connected by means of the conductor 21 with the conducting member 14 placed in the opposite line of rails; the conducting member 14 is connected by means of conductor 22 to the splice plate 9, which in turn is connected by means of conductor 23 to splice plate 8, which is connected by conductor 24 with the rail 2. It will thus be seen that current flows from the source of current 15 through conductor 25, rail 4, conductor 26, translating device 17, conductor 27, splice plate 9, conductor 19, splice plate 8, conductor 20, conducting member 14, conductor 21, conducting member 14 on the other side of the track, conductor 22, splice plate 9, conductor 23, splice plate 8, conductor 24, rail 2 and conductor 28 to the other terminal of the source of current. The current flowing through the above traced path of course energizes the translating device 17 and causes the armature 18 to be held in its upper position so that the signal controlled thereby would as is well understood by those skilled in the art, be moved to and held in its clear position.

The arrangement as shown in Fig. 2, is that which would be used upon an electrically propelled railway where the ordinary and well known form of balanced reactance bonds were used to allow propulsion current to flow from block section to block section.

Numerals 1, 2, 3 and 4 designate the rails of the trackway as in Fig. 1, and 7 designates fiber insulating plates which prevent splice plates 8 and 9 from coming in contact with the rails. The fiber plates and splice plates are held in place, as in Fig. 1, by bolts 10 and 11. Fig. 2 also shows the conducting posts 14 interposed in both lines of rails and separated from the ends of the adjoining rails by means of the insulating pieces 12 and 13 just as in Fig. 1. The splice plates 8 and 9, applied to the upper rail, are connected together by conductor 19 and those applied to the lower rail are connected together by the conductor 23.

The alternating current required with a system of signaling on an electrically propelled road is here shown as supplied by means of transformers 36 and 37. The secondary winding of 36 is connected by means of wires as 31 and 32 to the two track rails 2 and 4, and the secondary winding of 37 by means of wires 56 and 57 to rails 1 and 3.

Another transformer 38 supplies current to one winding of the induction motor type of relay 39, which has the movable member 40 attached, to make and break a circuit controlling a signal, not shown.

The balanced reactance bond 33 has its ends connected one to each rail, and its center point connected by means of wire 34 to the center point of a balanced reactance bond 35, the ends of which are connected to the rails 1 and 3 in the adjoining block. The reactance bond 33 has the coil 41 wound in inductive relation thereto so that the two virtually form a transformer of which the winding 33 is the primary and the winding 41 is the secondary, and the primary is supplied by current from the secondary winding 29 of the transformer 36. The complete circuit for the track fed winding 42 of relay 39 is as follows: one terminal of winding 42, wire 43, secondary 41, wire 44, splice plate 9, wire 19, splice plate 8, wire 20, conducting post 14, wire 21, conducting post 14 in the other line of rails, wire 22, splice plate 9, wire 23, splice plate 8 and wire 45 to the other terminal of the winding 42. Current flowing in the above traced path at the same time that current is flowing in the other winding of the relay causes the member 40 to make contact so as to complete the circuit of the signal.

It should be noticed that the conductor 21 in Fig. 1, and the conductor 21 in Fig. 2, would each form a path of low resistance for the sources of energy connected to section A if rail 1 should come in contact with post 14 in the lower rail and rail 3 should come in contact with post 14 in the upper rail. As posts 14 are placed directly in line with rails 2 and 4, it would be impossible for rails 2 and 4 to abut rails 1 and 3 without also having posts 14 abut rails 1 and 3, consequently, any contact of rails 2 and 4 with rails 1 and 3 must be made through posts 14, but if such contact is made through post 14, then the source of energy in block A has a path of low resistance through conductor 21 offered to it, so that even if relay 17 were connected directly across rails 2 and 4, and relay 39 were connected directly across rails 2 and 4, no current would flow to the relays. Even with conductor 21, however, the connection of relays 17 and 39 directly across the rails would render them liable to be affected by broken down insulating joints if the conductor 21 were broken, or if some other path for current from rail 1 to rail 2 and from rail 3 to rail 4 were formed other than that through the conducting post 14.

In the present case the conductor 21 is made a part of the complete circuit of the relay, consequently, if it becomes broken and thereby loses its power of protection, the relay immediately becomes deënergized and by placing the signal at danger with no train in the block, will immediately cause the defect to be noticed, and by causing the splice plates to also form part of the complete circuit of the relays, any form of broken down joints will cause a shunt to be placed either upon the relay or upon the source of current in the adjacent block.

An example will serve to show how applicant's method protects against broken down insulating joints. Referring to Fig. 1, suppose that fish plate 8, attached to the upper rail should become conductively connected to rail 3, illustrated by the dotted line 45, and the same plate should also become conductively connected with rail 4, illustrated by dotted line 46, and at the same time the splice plate 9, attached to the lower rail should become conductively connected with rail 1, illustrated by the dotted line 47, and with the rail 2, illustrated by the dotted line 48. Under such conditions a path for the flow of current from the source 16 would be formed from rail 1 to rail 2 and from rail 3 to rail 4. If the relay 17 were connected directly across the rails, and the heretofore known method of connecting conductor 21 were employed, it would be energized by the improper flow of current even if a train were in a remote part of block B, and this would be so even if conductor 21 were intact, but in applicant's invention, as shown in Fig. 1, the current from the source 16 would flow through wire 49, rail 3, path 45, splice plate 8, wire 20, post 14, wire 21, post 14 in the lower line of rails, wire 22, splice plate 9, conducting path 47, rail 1 and by means of wire 50 to the other terminal of the sources of current 16. The relay 17 would thus be effectually shielded from the effects of the current flowing from the source 16 due to the presence of broken down insulating joints. At the same time the relay would be deënergized due to the fact that a shunt would be formed in which current would flow as follows: source 15, wire 25, rail 4, conducting path 46, splice plate 8, conductor 20, post 14, conductor 21, post 14 in the lower line of rails, wire 22, splice plate 9, conducting path 48, rail 2, and conductor 28 to the other terminal of the source.

Although one example only has been given, it will be found that any combination of conducting paths which would allow current to flow to the rails of one block from a source connected to the rails in an adjoining block would cause either a path of low resistance to be formed for the improperly flowing current or a shunt to be formed upon the relay or both.

If the arrangement as shown in Fig. 2, is considered, the same results will be shown as pointed out in Fig. 1. As an example, consider that splice plate 8 is connected by conducting path as 52 with rail 3, and by

conducting path as 53 with rail 4, and that splice plate 9 in the lower line of rails is connected by means of a conducting path as 54 with rail 1 and by means of conducting path 55 with rail 2. If the winding 42 of relay 39 were connected directly across rails 2 and 4 then current would flow from the primary 30 of transformer 37 to the winding 42 and this would be so even if conductor 21 were intact. In applicant's arrangement, however, such a condition would not result in the energization of winding 42 because a path for the current from secondary 30 would be formed as follows: one terminal of secondary 30, wire 56, track rail 3, conducting path 52, splice plate 8, wire 20, conducting post 14, conductor 21, conducting post 14 in the lower line of rails, conductor 22, splice plate 9 and conducting path 54, rail 1, and by conductor 57 to the other terminal of secondary 30. At the same time the following circuit would be formed, secondary 29, wire 31, rail 4, conducting path 53, splice plate 8, wire 20, conducting post 14, conductor 21, conducting post 14 in the lower line of rails, conductor 22, splice plate 9, conducting path 55, rail 2, and conductor 32 to the other terminal of the secondary 39. The existence of either of the above traced paths would prevent an energization of winding 42 either from the source in the block A or from the proper source in block B.

The arrangement shown by Fig. 2 has the further advantage not possessed by the arrangement of Fig. 1, namely: the breaking down of one joint will render inoperative both track circuits which abut at the joint; and the partial breaking down will render one track circuit inoperative. If rail 1 comes in contact with post 14, then the lower half of bond 35 will be shunted, which will be equivalent to so reducing its impedance to the current flowing from primary 30, as to allow so much current to flow locally that the translating device—not shown—at the other end of the section will not receive sufficient current to operate it. If rail 2 comes in contact with post 14, then the lower half of bond 33 will be shunted, under which condition secondary 41 will not be sufficiently energized to operate relay 39.

If rails 1 and 2 both contact with post 14 both of the abutting track circuits will become inoperative. With systems as commonly used in which the relays are connected directly across the track rails, without the post 14 and conductor 21, and without applicant's invention, if rail 1 should come in contact with rail 2 then current would flow from wire 57, through rail 1, rail 2, bond 33, wire 34, bond 35, rail 3 and wire 56 to the primary of transformer 30. In such case by auto-transformer action the voltage across the terminals of bond 33 would be raised, and consequently the relay in section B would be falsely operatively energized.

The particular and specific physical instruments herein shown as embodiments of applicants' means in no wise exhaust the various physical forms in which it may be embodied, because many other forms are now known to the applicant, and furthermore, many different forms will immediately suggest themselves to those skilled in the art; nevertheless, applicant desires to have it understood that he considers all such forms to be within the scope of his invention as defined by the claims.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. In railway electric track circuits; two lines of electrically conductive rails forming a trackway; means for dividing said trackway into electrically independent track circuit sections; a source of electro-motive force connected between the rails of each section; means to prevent current from one section flowing to the rails of an adjacent section when the corresponding rails of adjacent sections come into electrical contact with each other; a translating device in each section including said last mentioned means in its operating circuit and energized by the source of electro-motive force connected between the rails of the same section.

2. In a railway electric track circuit; two lines of electrically conductive rails forming a trackway; insulating joints composed of electrically conductive members and insulating members, and each having an electrically conductive post situated in line with the rails but electrically separated therefrom, said joints being interposed in each line of rails, at intervals, forming electrically independent track circuit sections; an electrical conductor joining the posts of the corresponding joints; translating devices each in a circuit including the corresponding posts adjacent thereto, said electrical conductor, and said electrical conductive members of the corresponding insulating joints; a source of electro-motive force connected between the rails of each section at a point remote from the translating devices in each section for energizing said translating devices.

3. In a track circuit for railways, in combination with the track rails of the trackway, an insulating joint in each of said track rails and dividing said track rails into electrically isolated sections, a track circuit for each of said sections, a conductor of low resistance adjacent to said insulating joints and normally disconnected from said track rails, said conductor being included in one of said track circuits, and means for electrically connecting the ends of said conductor to said track rails when the corre-

sponding ends of said track rails separated by said insulating joints come into electrical contact.

4. In a track circuit for railways, two lines of electrical conductive rails forming a trackway, an insulating joint in each line of rails and comprising a body of insulating material interposed between the adjacent ends of the rails of that line, each of said joints also comprising two splice plates secured to the corresponding line of said rails and insulated therefrom, and electric conductors of low resistance connecting both of said splice plates of both of said joints in series.

5. In a track circuit for railways, two lines of electrically conducting rails forming a trackway, a source of current associated with said lines of rails, an insulating joint in each of said lines of rails comprising a body of insulating material interposed between the adjacent ends of the rails of that line, a metallic post inclosed in each of said bodies of insulating material in line with the corresponding line of rails and insulated therefrom, a conductor of low resistance electrically connecting said posts, a translating device, and a circuit for said translating device including said conductor.

6. In a track circuit for railways, two lines of electrically conducting rails forming a trackway, a normally closed track circuit associated with said lines of rails, and including a source of current, an insulating joint in each of said line of rails comprising splice plates fastening said rails together and insulated therefrom, and a metallic post interposed between the adjacent separated ends of the rails and insulated from said rails and from the corresponding splice plates, said splice plates and said posts of said joints being electrically connected in series with said track circuit.

7. In a track circuit for railways, two lines of electrically conducting rails forming a trackway, a pair of insulating joints in said lines of rails each comprising a metallic post interposed between the adjacent separated ends of said rails and insulated therefrom, an impedance bond on each side of said pair of joints and connected across said rails, a conductor between the middle points of said impedance bonds and another conductor connected to said first-mentioned conductor and to said posts, whereby the breaking down of the insulation between one of said rails and its corresponding post will short-circuit one-half of the corresponding impedance bond.

8. In a signaling system for railways, in combination with the track rails of a trackway, insulating joints arranged in pairs and dividing said track rails at intervals into electrically independent track sections, a source of current and a relay associated with each track section, a conductor of low resistance adjacent to each pair of said insulating joints and normally disconnected from said track rails, and means for electrically connecting the ends of said conductor to said track rails when the corresponding track rails of adjacent track sections come into electrical contact.

9. In a signaling system for railways, in combination with the track rails of a trackway, insulating joints arranged in pairs and dividing said track rails at intervals into electrically independent track sections, each of said insulating joints comprising splice plates fastening said rails together and insulated therefrom, a metallic post interposed in each joint between the ends of the corresponding track rails and insulated therefrom and from said splice plates, an impedance bond on each side of each pair of joints and connected across the track rails, a conductor between the middle points of said impedance bonds, another conductor connected to said first-mentioned conductor and to said posts of the corresponding joint, a translating device associated with each pair of joints and a circuit for said translating device including in series said splice plates, said posts of that pair of joints and the corresponding second-mentioned conductor.

SALISBURY M. DAY.

Witnesses:
LILLIAN L. PHILLIPS,
L. MUTSCHLER.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."