

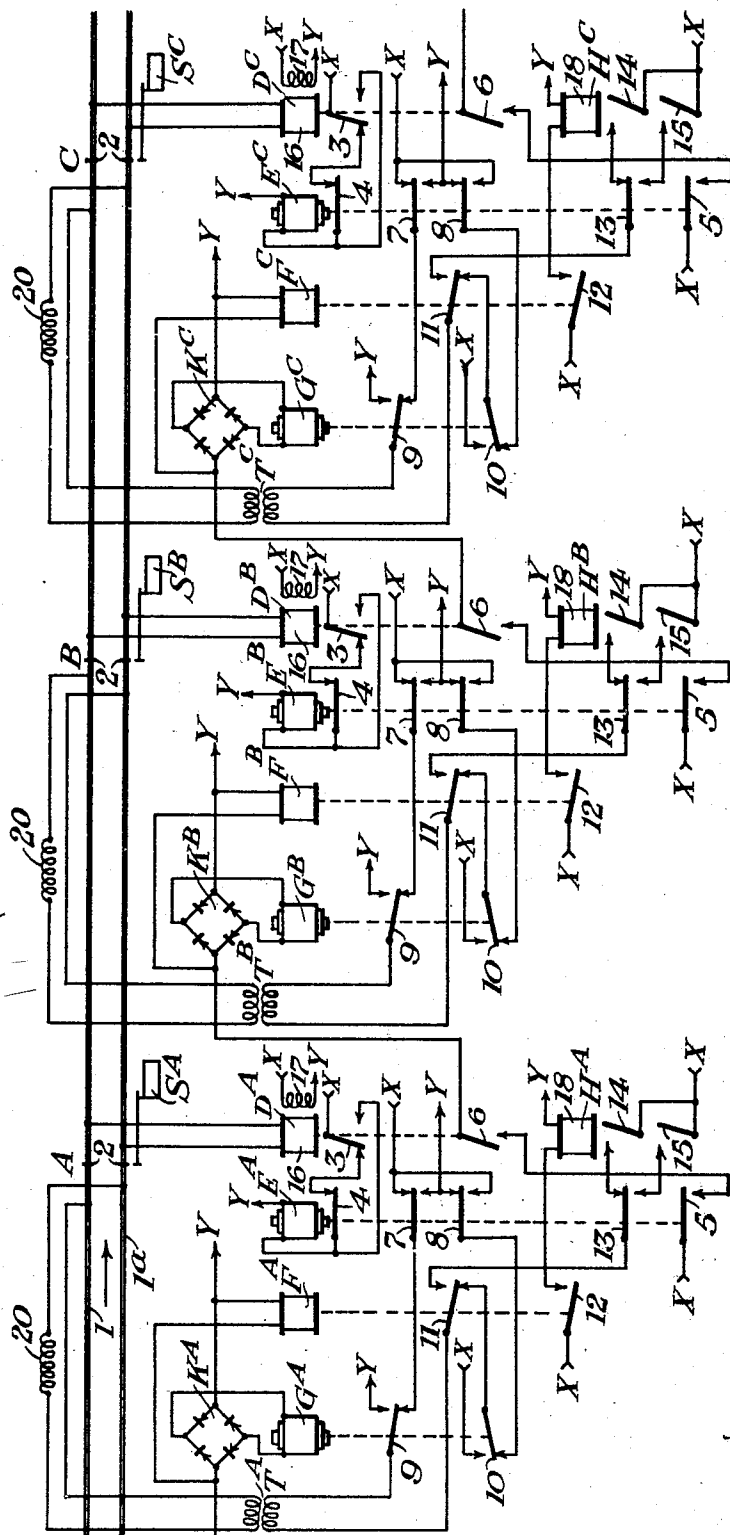
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H. A. THOMPSON

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RAILWAY TRAFFIC CONTROLLING APPARATUS

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INVENTOR:
H. A. Thompson,
by A. Z. Verneill,
His Attorney.

UNITED STATES PATENT OFFICE

HOWARD A. THOMPSON, OF EDGEWOOD BOROUGH, PENNSYLVANIA, ASSIGNOR TO THE UNION SWITCH & SIGNAL COMPANY, OF SWISSVALE, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA

RAILWAY-TRAFFIC-CONTROLLING APPARATUS

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My invention relates to railway traffic controlling apparatus, and particularly to apparatus of the type wherein periodically interrupted current in the track rails is used for the control of train governing mechanism.

The present invention relates specifically to the trackway portion of such apparatus, and has for an object the provision of means for preventing false indications due to the train governing current in the event of broken down insulated rail joints.

I will describe one form of apparatus embodying my invention, and will then point out the novel features thereof in claims.

The accompanying drawing is a diagrammatic view showing one form of apparatus embodying my invention.

Referring to the drawing, the reference characters 1 and 1^a designate the track rails of a stretch of railway track along which traffic normally moves in the direction indicated by the arrow. These rails are divided by insulated joints 2 into blocks or track sections A—B, B—C, etc. Each section is provided with an alternating current track relay which is responsive to reversals of the relative polarity of the current supplied thereto from the track rails. Each track relay is designated by the reference character D with an exponent corresponding to the location, and comprises a winding 16 connected across the rails adjacent the entrance end of the section, as well as a winding 17 constantly supplied with alternating current from a suitable source the terminals of which are designated X and Y. Each track relay comprises two contacts 3 and 6, which are swung to the left-hand or normal position when the track winding 16 is supplied with alternating current of normal relative polarity, and to the right-hand or reverse position when the track rails are supplied with alternating current of reverse relative polarity.

Each track section is provided with a repeater relay designated by the reference character E with an exponent corresponding to the location. Each repeater relay is controlled by the associated track relay D in such manner that the repeater relay may become

energized when and only when the associated track relay is energized in the reverse direction, but that the repeater relay when thus energized will remain energized while the track relay is energized in the normal direction. Referring, for example, to repeater relay E^B, this relay is provided with a pick-up circuit which passes from terminal X, through track relay contact 3 in the right-hand or reverse position, and the winding of relay E^B to terminal Y. Relay E^B is also provided with a holding circuit which passes from terminal X, through contact 3 in the left-hand or normal position, front contact 4 of relay E^B, and the winding of relay E^B to terminal Y. Each repeater relay is preferably slow-releasing in character, in order to prevent release of its front contacts while contact 3 of the track relay is swinging from its reverse to its normal position.

Each track section is provided with a quick-releasing auxiliary relay designated by the reference character F with an exponent corresponding to the location, and with a slow-releasing auxiliary relay designated by the reference character G with an exponent corresponding to the location. Each of these auxiliary relays is normally de-energized, but they both become energized when a train enters the corresponding track section. Referring to section A—B, for example, the circuit for relay F^B is from terminal X, through back contact 5 of repeater relay E^A, back contact 6 of track relay D^A, and the winding of relay F^B to terminal Y. The slow releasing auxiliary relay G^B is connected with the output terminals of a rectifier K^B, and the input terminals of this rectifier are connected in multiple with relay F^B in the circuit just traced for the latter relay. It follows that when this circuit is closed relay G^B is supplied with unidirectional current.

When relays G and F for a given section are both open, alternating track circuit current is supplied to the rails of the section, and this current is of normal or reverse relative polarity according as the repeater relay E for the section next in advance is energized or de-energized. Referring, for example, to section A—B, when relay E^B is energized,

track circuit current is supplied to the primary of a track transformer T^B , the circuit being from terminal X, through front point of contact 7 of track relay E^B , back point of contact 9 of relay G^B , primary of transformer T^B , back point of contact 11 of relay F^B , back point of contact 10 of relay G^B , and the front point of contact 8 of relay E^B to terminal Y. When relay E^B is de-energized, the circuit is the same except that it includes the back points of contacts 7 and 8, which contacts operate as a pole-changer, so that current of reverse relative polarity is then supplied to the primary of transformer T^B . The secondary of transformer T^B is connected across the track rails adjacent the exit end of section A—B, a reactor 20 being interposed between the secondary and one track rail for the usual purpose of limiting the current drawn from the transformer when a train stands opposite the point of connection of the secondary with the rails.

The polarity of the track circuits for the adjacent sections is reversed. For example, the right-hand terminal of the secondary of transformer T^C is connected with the upper rail 1, the corresponding terminal of the secondary of transformer T^B is connected with the lower rail 1^a, and the right-hand terminal of the secondary of transformer T^A is connected with the upper rail 1. Similarly, the right-hand terminal of winding 16 of relay D^C is connected with the upper rail 1, the corresponding terminal of relay D^B is connected with the lower rail 1^a, and the corresponding terminal of relay D^A is connected with the upper rail 1, etc. When terminal X is connected with the upper rail 1 of section B—C, the current in this section is of normal relative polarity, whereas, when terminal X is connected with the lower rail 1^a in section A—B, the current in the rails of this section is of reverse relative polarity. (In making this statement the phase-shifting characteristics of the track transformers T are neglected to simplify the explanation.)

Each section is provided with a coding device, which is designated by the reference character H with an exponent corresponding to the location. Each coding device comprises an operating winding 18, and two contacts 14 and 15 which are periodically closed at different rates while the coding device is in operation. These coding devices may be of any suitable type, such, for example, as that shown in application for Letters Patent of the United States filed by P. N. Bossart on February 7, 1927, Serial No. 166,407. The operating winding 18 of each coding device is controlled by a front contact 12 of the associated auxiliary relay F, the circuit for this operating winding being obvious from the drawing without explanation. It follows that each coding device is normally at rest, but is set into operation whenever the aux-

iliary relay F^B for the associated section becomes energized.

Assuming for example, that section A—B is occupied, so that relays G^B and F^B are energized, the source of track circuit current is disconnected from transformer T^B by contacts 9, 10, and 11, and periodically interrupted train governing current is then supplied to this transformer through contact 14 or 15 of the coding device H^B according as relay E^B is energized or de-energized. Assuming that relay E^B is energized, the primary circuit for transformer T^B is from terminal X, through contact 14 of coding device H^B , front point of contact 13 of relay E^B , front point of contact 11 of relay F^B , primary of transformer T^B , and the front point of contact 9 of relay G^B to terminal Y. If relay E^B is de-energized, the circuit is the same as before, except that it includes contact 15 of coding device H^B and back point of contact 13 of relay E^B . It will be noted that when train governing current is being supplied to section A—B, terminal X is connected with the upper rail 1, and terminal Y is connected with the lower rail 1^a, so that the polarity of this current in the track rails corresponds to track circuit current of reverse relative polarity for the same section, but that the polarity of the train governing current in the rails of section A—B is the same as the normal polarity of the track circuit current in the rails of section B—C. The result of this is, that if section B—C is occupied, and one or both of the insulated joints 2 at point B should break down, the train governing current which would then be supplied to winding 16 of track relay D^B from transformer T^B would be of normal relative polarity, in so far as track relay D^B is concerned, so that this relay would become energized in the normal direction, but relay E^B would remain de-energized because its circuit would be open at its own contact 4. Train governing current would continue therefore to be supplied to the rails of section A—B through the back point of contact 13 of relay E^B and contact 15 of the coding device H^B , and since this current gives a caution indication aboard the train which is in section A—B, it follows that the false energization of relay D^B would not result in a false indication aboard the train.

The apparatus shown in the accompanying drawing is intended for co-operation with train carried mechanism which operates in such manner that a caution indication is given aboard the train in response to train governing current which is supplied through contact 15 of each coding device H, and a proceed indication is given aboard the train in response to train governing current which is supplied through contact 14 of each coding device.

The operation of the apparatus is as follows: As shown in the drawing, all sections are unoccupied, so that all track relays are energized in the normal direction, all repeater relays are energized, and all auxiliary relays F and G are de-energized. Assuming now that a train enters section A—B, track relay D^A will become de-energized, with the result that repeater relay E^A will also become de-energized. The closing of back contacts 6 and 5 of these two relays will cause relays F^B and G^B to become energized, so that periodically interrupted train governing current will be supplied to the rails of section A—B through contact 14 of coding device H^B. The train will therefore receive a proceed indication while passing through this section. When the train passes out of section A—B and into section B—C, it will de-energize relays D^B and E^B. The first impulse of train governing current to reach track relay D^A will be of reverse relative polarity, so that this relay will become energized in the reverse direction, and so will cause its repeater relay E^A to become energized. The opening of back contacts 6 and 5 of these two relays will de-energize relays F^B and G^B, so that the supply of train governing current will be discontinued. Track circuit current of reverse relative polarity will then be supplied to the rails of section A—B, because relay E^B is de-energized. When the train passes out of section B—C, track relay D^B will become energized in reverse direction, with the result that relay E^B will become energized, so that track circuit current of normal relative polarity will be supplied to the rails of section A—B and so track relay D^A will become energized in the normal direction.

The reason for the slow-releasing auxiliary relay G, is as follows: Assuming, for example, that relay G^B were omitted, and that a train should enter section A—B and should then back out of this section, track circuit current of reverse relative polarity would immediately be supplied to the rails of the section, so that track relay D^A would become energized in the reverse direction. The opening of back contact 6 of relay D^A would de-energize relay F^B and this relay would connect track circuit current of normal relative polarity to the rails over the front points of contacts 7 and 8 of relay E^B. Relay D^A would, therefore, close its reverse contact and again open it so quickly that relay E^A would not have time to close. With the circuit as shown, when the train backs out of section A—B, the rails of this section will first receive track circuit current of reverse relative polarity over coder contact 14. As soon as back contact 6 of relay D^A opens, relay F^B will become de-energized, and the front point of contact 11 of this relay will cut off the current of reverse relative polarity while the

back point of contact 11 will supply steady energy of reverse relative polarity to the rails over the front point of contact 10 of relay G^B as long as the latter relay remains closed. When relay G^B opens, steady track circuit current of normal relative polarity will be supplied to the rails over the back points of contacts 9 and 10 and the front points of contacts 7 and 8 of relay E^B. Thus relay G^B will continue to supply track circuit current of reverse relative polarity for a period long enough to permit relay D^A to cause relay E^A to become energized over contact 3 in the reverse position.

Each section is provided with a signal designated by the reference character S with an exponent corresponding to the location. These signals may be controlled in the usual manner by the associated relays D and E, but inasmuch as the control of these signals forms no part of my present invention, I have omitted the circuits in order to simplify the drawing.

Although I have herein shown and described only one form of apparatus embodying my invention, it is understood that various changes and modifications may be made therein within the scope of the appended claims without departing from the spirit and scope of my invention.

Having thus described my invention, what I claim is:

1. In combination, a stretch of railway track divided into sections, a track circuit for each section including a source of track circuit current reversibly connected with the rails of the section and a track relay responsive to reversals of current, a repeater relay for each section, means for energizing each repeater relay when and only when the associated track relay is energized in reverse direction and for subsequently keeping the repeater relay energized when the track relay becomes energized in normal direction, and means controlled by each repeater relay for supplying to the rails of the associated section train governing current of such characteristic as to give a less restrictive or a more restrictive indication according as the repeater relay is energized or de-energized, the relative polarity of the train governing current in each section being the same as that of the track circuit current normally supplied to the section next in advance, so that if an insulated joint fails and the track relay for the section in advance of such joint becomes energized by train control current from the section in the rear while the advance section is occupied, the repeater relay for the rear section will remain de-energized and the more restrictive indication will be given in the rear section.

2. In combination, a stretch of railway track divided into sections, a track circuit for each section including a track relay responsive

to the relative polarity of the current in the rails of the section, a repeater relay for each section, means for energizing each repeater relay when and only when the associated track relay is energized in the reverse direction and for subsequently keeping the repeater relay energized when the track relay is energized in the normal direction, means for supplying each block with track circuit current of normal or reverse relative polarity according as the repeater relay is energized or de-energized, and means controlled by each repeater relay for supplying to the rails of the associated section train governing current of such characteristic as to give a less restrictive or a more restrictive indication according as the repeater relay is energized or de-energized, the relative polarity of the train governing current in each section being the same as that of the track circuit current normally supplied to the section next in advance, so that if an insulated joint fails and the track relay for the section in advance of such joint becomes energized by train control current from the section in the rear while the advance section is occupied, the repeater relay for the rear section will remain de-energized and the more restrictive indication will be given in the rear section.

3. In combination, a stretch of railway track divided into sections, a track circuit for each section including a source of track circuit current reversibly connected with the rails of the section and a track relay responsive to reversals of current, a repeater relay for each section, a pick-up circuit for each repeater relay including a reverse contact of the associated track relay, a holding circuit for each repeater relay including a normal contact of the associated track relay and a front contact of the repeater relay, and means controlled by each repeater relay for supplying to the rails of the associated section train governing current of such characteristic as to give a less restrictive or a more restrictive indication according as the repeater relay is energized or de-energized, the relative polarity of the train governing current in each section being the same as that of the track circuit current normally supplied to the section next in advance, so that if an insulated joint fails and the track relay for the section in advance of such joint becomes energized by train control current from the section in the rear while the advance section is occupied, the repeater relay for the rear section will remain de-energized and the more restrictive indication will be given in the rear section.

4. In combination, a stretch of railway track divided into sections, a track circuit for each section including a track relay responsive to the relative polarity of the current in the rails of the section, a repeater relay for each section, a pick-up circuit for each repeater relay including a reverse contact of

the associated track relay, a holding circuit for each repeater relay including a normal contact of the associated track relay and a front contact of the repeater relay, means for supplying each block with track circuit current of normal or reverse relative polarity according as the repeater relay is energized or de-energized, and means controlled by each repeater relay for supplying to the rails of the associated section train governing current of such characteristic as to give a less restrictive or a more restrictive indication according as the repeater relay is energized or de-energized, the relative polarity of the train governing current in each section being the same as that of the track circuit current normally supplied to the section next in advance, so that if an insulated joint fails and the track relay for the section in advance of such joint becomes energized by train control current from the section in the rear while the advance section is occupied, the repeater relay for the rear section will remain de-energized and the more restrictive indication will be given in the rear section.

5. In combination, a stretch of railway track divided into sections, a track relay for each section responsive to the relative polarity of the current in the rails of the section, a repeater relay for each section, means for energizing each repeater relay when and only when the associated track relay is energized in the reverse direction and for subsequently keeping the repeater relay energized when the track relay is energized in the normal direction, a quick releasing auxiliary relay and a slow releasing auxiliary relay for each section both of which are normally de-energized, means operating when the track relay and repeater relay for a given section are de-energized to energize both of said auxiliary relays for the same section, means operating when said auxiliary relays are both open to supply the rails of the associated section with track circuit current of normal or reverse relative polarity according as the repeater relay for the section next in advance is energized or de-energized, means operating when the auxiliary relays for a given section are closed to disconnect the source of track circuit current from the rails of the section and to supply said rails with periodically interrupted train governing current having the same polarity as that of the track circuit current normally supplied to the section next in advance, and means operating when the quick releasing relay for a given section is open and the associated slow releasing relay is closed to supply the rails of the section with current of reverse relative polarity.

In testimony whereof I affix my signature.
HOWARD A. THOMPSON.