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RAILWAY SIGNALING SYSTEM

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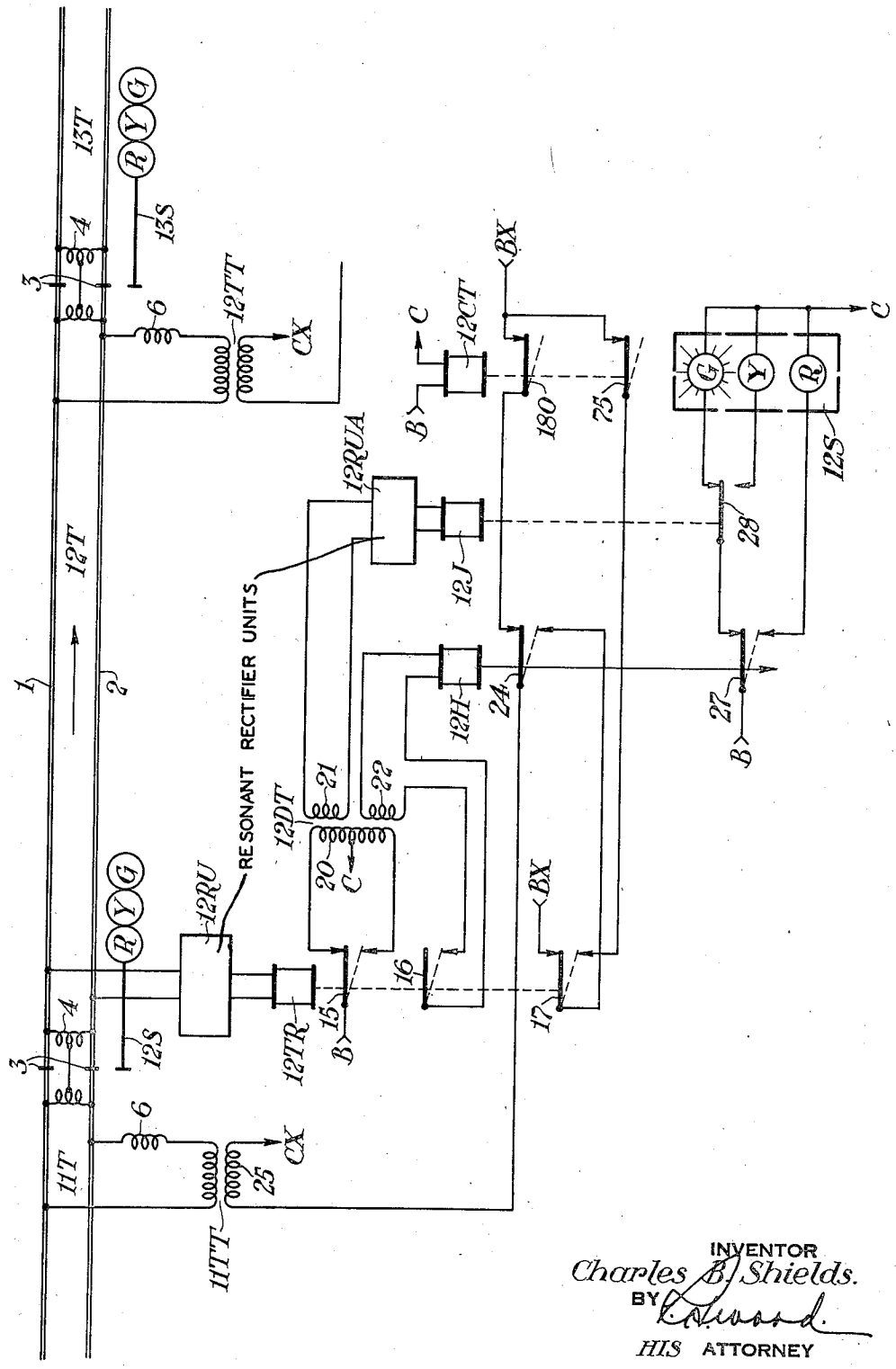

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RAILWAY SIGNALING SYSTEM

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6 Claims. (Cl. 246—33)

My invention relates to a railway signaling system employing coded or periodically interrupted current in the track circuits, and particularly to improved means for protecting against improper operation of the signaling system in the event an insulated joint separating two track sections becomes defective.

It has heretofore been proposed to provide means operable in the event an insulated joint separating two track sections is defective to establish a "lockout" circuit to supply steady uncoded energy to the section in the rear of the defective joint so that this energy will feed over the defective joint and maintain the track relay of the section in advance of the defective joint constantly energized to thereby cause the signal controlled by that track relay to display its most restrictive indication.

One means for accomplishing this result is shown in an application of Howard A. Thompson, filed May 28, 1938, Serial No. 210,743, for Railway traffic controlling apparatus, now U. S. Letters Patent No. 2,213,420, granted September 3, 1940.

It is an object of my invention to provide an improved coded signaling system incorporating a "lockout" circuit, the system being arranged so that less equipment is required than is necessary in the system heretofore known.

A further object of my invention is to provide an improved railway signaling system.

Other objects of my invention and features of novelty will be apparent from the following description taken in connection with the accompanying drawing.

I shall describe one form of railway signaling system embodying my invention, and shall then point out the novel features thereof in claims.

In the drawing the single figure is a diagram of a railway signaling system embodying my invention.

Referring to the drawing, there is shown therein a stretch of railway track having track rails 1 and 2 over which traffic normally moves in the direction indicated by the arrow, that is, from left to right. The rails of the track stretch are divided by insulated joints 3 into the customary successive track sections, and the rails of each of these sections form a part of a track circuit of the usual character.

The particular track stretch which is represented in the drawing is intended for use in a railway system employing electric current for propulsion purposes, and for this reason alternating current track circuit energy is used together with impedance bonds 4 of the customary form which conduct propulsion current around each pair of insulated rail joints. As the description proceeds, however, it will be apparent that the apparatus of this invention is equally well suited for use on a steam road in which the application of either direct or alternating current track circuit energy for the control of signals may be employed. In such an application the impedance bonds 4 would, of course, be omitted.

In the diagram comprising the drawing one complete track section, which is identified as section 12T, and parts of two other sections, identified as sections 11T and 13T, are shown. Each of these sections has located at the entrance end thereof a signal for governing movement of trains in the track stretch, the signal for section 12T being identified as 12S. The signal 12S illustrated is of the familiar color light type, having a green or proceed lamp G, a yellow or caution lamp Y, and a red or stop lamp R. While a color lamp signal is shown, it should be understood that any other appropriate type of signal may be employed if desired.

The rails of each of the track sections form a part of a track circuit to which coded alternating current signal control energy is supplied at the exit or leaving end from the secondary of a track transformer TT with a prefix corresponding to that of the associated track section. The circuit for supplying current from the secondary winding of each of the track transformers includes the usual current limiting reactor 6. The energy supplied to the track circuits is derived from any suitable source, and may be distributed throughout the track stretch by a transmission line, not shown. In the drawing the terminals BX and CX designate the terminals of such power supply source, and it will be assumed that the energy supplied from this source is alternating current with a frequency of 100 cycles per second.

Each of the signal locations has associated therewith a suitable source of direct current, such as a primary or storage battery, not shown, the terminals of which are designated in the drawing by the reference characters B and C.

The particular signaling system shown in Fig. 1 of the drawing is of the three-indication variety, and it makes use of track circuit energy coded at two different frequencies. This coded energy is provided by code transmitters CT which interrupt the supply circuits for the associated track transformers a definite number of times a

minute according to traffic or other conditions ahead. In the illustrative form shown, each code transmitter CT is provided with two circuit making and breaking contacts 75 and 180 which are continuously actuated by a motor or other suitable mechanism at two different speeds. For purposes of illustration it will be assumed that these speeds are such as respectively to provide 75 and 180 energy pulses per minute which are separated by periods of equal duration in which no energy is supplied.

Each of the track sections includes a code following track relay designated TR together with an appropriate prefix. The track relay is located at the entrance end of the track section and may be of any suitable type. As shown, the track relay is of the direct current type having a winding which is connected to the track rails of the associated track section through a suitable resonant unit RU shown diagrammatically in the drawing.

Each of the resonant units RU comprises a transformer, a capacitor, and a reactor so arranged and proportioned as to freely pass the 100 cycle coded signal control energy, but so as not to pass propulsion current of a different frequency. Each resonant unit includes, in addition, a rectifier which converts into direct current the alternating current which is supplied through the unit.

The track relay 12TR has associated therewith auxiliary relays 12H and 12J, while each of the other signals in the track stretch has associated therewith equipment corresponding to that associated with signal 12S.

Referring to the drawing, the contact 15 of track relay 12TR is constantly connected to terminal B of a local source of direct current. The contact 15 when released engages a contact which is connected to one end terminal of the primary winding 20 of decoding transformer 12DT, while contact 15 when picked up engages a contact which is connected to the other end terminal of the primary winding 20. The center terminal of the winding 20 is connected to terminal C of the source of current.

The transformer 12DT is provided with two secondary windings identified by the reference characters 21 and 22. The winding 21 supplies energy to the relay 12J through a resonant unit 12RUA, while the winding 22 supplies energy to the winding of relay 12H.

One terminal of the secondary winding 22 is connected to one terminal of the winding of relay 12H, while the other terminal of the winding 22 is connected to a contact which is engaged by track relay contact 16 when contact 16 is in its released position. The track relay contact 16 is connected to a terminal of the winding of relay 12H.

The resonant unit 12RUA is similar in construction to the unit 12RU, and comprises a capacitor and a reactor which are arranged and proportioned so that the unit will transmit sufficient current to the winding of relay 12J to maintain the contact of that relay picked up when the frequency of the current induced in the transformer secondary winding 21 is that which is present when the track relay contacts are responding to energy of the 180 code frequency. The resonant unit 12RUA is also arranged and proportioned so that when the contacts of the track relay 12TR are responding to energy of any other code frequency, such as 75 code frequency, insufficient energy is supplied to the winding of the relay 12J to maintain the contact of that relay picked up. The resonant unit 12RUA includes a rectifier which rectifies the current which is supplied through the unit.

The relay 12H controls the supply of energy of the 180 code frequency to the primary winding of the track transformer 11TT. The circuit for supplying energy of 180 code frequency is complete when and only when the contacts of the relay 12H are picked up, and is traced from terminal BX of the source of current through contact 180 of code transmitter 12CT and front contact 24 of relay 12H to one terminal of the primary winding 25 of track transformer 11TT, the other terminal of which is connected to terminal CX of the source of signal control energy.

The track relay 12TR and the auxiliary relay 12H control the circuit for supplying energy of the 75 code frequency to the primary winding 25 of track transformer 11TT. This circuit is complete when and only when the contacts of the track relay and of the auxiliary relay 12H are released, and is traced from terminal BX of the source of signal control current through contact 75 of code transmitter 12CT, back contact 17 of track relay 12TR, and back contact 24 of relay 12H to the primary winding 25 of the track transformer.

The track relay 12TR and the relay 12H also control the "lockout" circuit for supplying steady energy to the track transformer 11TT. This circuit is complete when and only when the contacts of the track relay are picked up and the contacts of the relay 12H are released, and is traced from terminal BX of the source of signal control current through front contact 17 of track relay 12TR, and back contact 24 of relay 12H to the primary winding 25 of track transformer 11TT.

The auxiliary relays 12H and 12J cooperate to control the circuits of the lamps of the signal 12S in such a manner that the red lamp R is illuminated when the contacts of the relay H are released. The circuit for illuminating the red lamp is traced from terminal B of the local source of direct current through back contact 27 of relay 12H to one terminal of the red lamp R, the other terminal of which is connected to terminal C of the source of current.

When the contacts of the relay 12H are picked up and the contacts of the relay 12J are released, the circuit for illuminating the yellow lamp Y is established, and is traced from terminal B of the source of direct current through front contact 27 of relay 12H, and back contact 28 of relay 12J to one terminal of the yellow or caution lamp Y, the other terminal of which is connected to terminal C of the source of current.

When the contacts of the relays 12H and 12J are both picked up, the circuit for illuminating the green or proceed lamp G is complete, and is traced from terminal B of the source of direct current through front contact 27 of relay 12H, and front contact 28 of relay 12J to one terminal of the green lamp G, the other terminal of which is connected to terminal C of the source of current.

The equipment is shown in the condition which it assumes when the track sections 12T and 13T are vacant. At that time the equipment associated with section 13T operates in the manner hereinafter described in detail in connection with the equipment associated with section 12T to supply energy of the 180 code frequency to the track transformer 12TT, while this energy feeds

to the track relay 12TR and produces code following operation of the contacts thereof.

As the track relay contacts are responding to coded energy, the two end portions of the transformer primary winding 20 are alternately energized, and energy is induced in the secondary windings 21 and 22 of the transformer 12DT.

On movement of the track relay contacts to their released position contact 16 establishes a circuit to supply an impulse of energy from the secondary winding 22 of transformer 12DT to the winding of relay 12H. The value of these impulses is such as to maintain the contacts of the relay 12H picked up, while the relay 12H has a slow releasing characteristic so that the relay contacts remain picked up during the intervals between the supply of impulses of energy to the relay winding.

As the relay 12TR is responding to energy of the 180 code frequency, the frequency of the current induced in the secondary winding 21 is such that the energy is freely passed by the resonant unit 12RUA, and sufficient energy is supplied to the winding of relay 12J to maintain the contact of this relay picked up.

As the contacts of the relays 12H and 12J are both picked up, the circuit traced above for illuminating the green or proceed lamp G of signal 12S is complete, and, as the contacts of the relay 12H are picked up, the previously traced circuit for supplying energy of the 180 code frequency to the track transformer 11TT is established.

Operation of equipment on movement of a train in the normal direction of traffic

If a train moving in the normal direction of traffic enters section 12T, it shunts the track relay 12TR with the result that the contacts of this relay thereafter remain in their released position, and no further changes occur in the energization of the primary winding 20 of transformer 12DT with the result that current is no longer induced in the secondary windings 21 and 22 of this transformer. Accordingly, even though contact 16 remains in its released position and establishes the circuit for supplying energy from the secondary winding 22 to the winding of relay 12H, energy is not supplied to the winding of relay 12H and the contacts of this relay become released.

Similarly, as energy is no longer induced in the secondary winding 22 of transformer 12DT, energy is not supplied to the winding of relay 12J and the contact of this relay becomes released.

As a result of the release of the contact 27 of relay 12H, the circuit for illuminating the green or proceed lamp G of the signal 12S is interrupted, and the circuit for illuminating the red or stop lamp R is established.

In addition, as a result of movement of the contacts of relay 12H to their released position, the previously traced circuit for supplying energy of the 180 code frequency to the track transformer 11TT is interrupted, and since contact 17 of the track relay is also in its released position at this time, the circuit for supplying energy of the 75 code frequency to the track transformer 11TT is established.

As long as any portion of the train remains in section 11T, the track relay for that section is shunted and the signal controlled thereby displays its red or stop indication. When the rear of the train vacates section 11T, the energy of 75 code frequency supplied by transformer 11TT feeds to the track relay for that section, and the equipment operates in the manner hereinafter described in detail in connection with section 12T to condition the associated signal to display its yellow or caution indication, while energy of the 180 code frequency is supplied to the rails of the section in the rear of section 11T.

When the train advances in the track stretch far enough to enter section 13T, it shunts the track relay for that section with the result that signal 13S is caused to display its red or stop indication, while energy of the 75 code frequency is supplied to the track transformer 12TT.

As long as any portion of the train remains in section 12T, the track relay 12TR continues to be shunted, but when the rear of the train vacates section 12T, the energy of 75 code frequency supplied by transformer 12TT feeds to the track relay 12TR and effects code following operation of the contacts thereof.

On the supply of the first impulse of energy to the winding of track relay 12TR, the contacts of the relay become picked up and contact 17 interrupts the previously traced circuit for supplying energy of the 75 code frequency to the transformer 11TT, and establishes the "lockout" circuit for supplying steady energy to the transformer 11TT.

In addition, on initial movement of the contacts of the track relay from their released to their picked up position, contact 15 interrupts the circuit for energizing the lower portion of primary winding 20 of decoding transformer 12DT and establishes the circuit for energizing the upper portion of the primary winding 20. As a result of this change in energization of the primary winding 20 of transformer 12DT, an impulse of energy is induced in the secondary winding 22, but since track relay contact 16 is picked up at this time, the circuit of the winding of relay 12H is interrupted and energy is not supplied from the transformer secondary winding 22 to the winding of relay 12H.

On the first "off" period in the code supplied by the transformer 12TT following the first "on" period, the contacts of the track relay 12TR become released and contact 17 of track relay 12TR interrupts the "lockout" circuit, while there is another change in energization of the primary winding 20 of transformer 12DT, and another impulse of energy is induced in secondary winding 22. At this time contact 16 of the track relay 12TR is in its released position so that the circuit of the winding of relay 12H is complete, and an impulse of energy is supplied from the transformer secondary winding 22 to the winding of relay 12H to cause the contacts of relay 12H to become picked up.

On picking up of contact 24 of relay 12H both the "lockout" circuit and the circuit for supplying energy of the 75 code frequency to the transformer 11TT are interrupted, while the circuit for supplying energy of the 180 code frequency to the transformer 11TT is established.

In addition, as a result of the picking up of the contacts of relay 12H, the circuit of the red lamp R of signal 12S is interrupted, and the circuit of the yellow or caution lamp Y is established.

When the train has advanced far enough in the track stretch to vacate section 13T, energy of the 75 code frequency is supplied to the rails of that section, while the equipment associated therewith operates in the manner described in detail in connection with section 12T to supply

energy of the 180 code frequency to the rails of section 12T.

From the foregoing, it will be seen that the signaling system provided by this invention incorporates means operative on initiation of code following operation of the track relay contacts to establish a "lockout" circuit to supply steady uncoded energy to the adjacent section in the rear, and that the circuit for supplying steady energy to the section in the rear is interrupted, and a circuit for supplying coded energy to the section in the rear is established, if the contacts of the track relay continue to respond to coded energy subsequent to establishment of the circuit for supplying steady energy to the section in the rear.

The normal operation of the equipment having been explained, its operation in the event an insulated joint separating two track sections becomes defective will now be considered.

Operation of the equipment in the event an insulated joint breaks down as a result of passage of a train

For purposes of illustration it will be assumed that the track stretch is vacant so that energy of the 180 code frequency is supplied to the rails of section 12T, that a train moving in the normal direction of traffic passes through the track stretch, and that an insulated joint 3 separating sections 11T and 12T breaks down as a result of passage of the train.

In electrified territory because of the well-known operation of the impedance bonds 4, breaking down of one insulated joint has the same effect as breaking down of both insulated joints in steam propulsion territory, and permits the energy supplied to the section in the rear of the defective joint to feed to the track relay of the section in advance of the defective joint.

When the train under consideration enters section 12T, it shunts the track relay 12TR and the equipment associated therewith operates in the manner heretofore explained in detail to condition the signal 12S to display its red or stop indication, while energy of the 75 code frequency is supplied to the transformer 11TT.

When the train advances in the track stretch far enough for the rear end thereof to be located in advance of the track relay 12TR, impulses of energy supplied to the rails of section 11T will feed over the defective insulated joint to the winding of relay 12TR, but because of the shunting action of the wheels and axles of the vehicles forming the train, too little current will be supplied to the winding of the track relay to pick up the contacts thereof.

However, as soon as the train has advanced far enough in the track stretch for the rear end of the train to be located some distance in advance of the point of connection of the winding of the track relay 12TR with the track rails of section 12T, sufficient energy will be supplied to the winding of the relay 12TR as a result of the impulses of energy feeding from the section 11T over the defective joint 3 to effect code following operation of the track relay contacts.

On the first movement of the track relay contacts to their picked up position contact 17 interrupts the circuit for supplying energy of the 75 code frequency to the track transformer 11TT, and establishes the "lockout" circuit for supplying steady energy to the track transformer 11TT. This steady energy feeding over the defective joint 3 to the track relay 12TR maintains the contacts of the track relay picked up with the result that they do not thereafter move to their released position.

As a result of initial movement of the contacts of track relay 12TR to their picked up positions, there is a change in energization of the primary winding 20 of track transformer 12TT, as explained above, and an impulse of energy is induced in secondary winding 22, but since contact 16 of the track relay 12TR is in its picked up position, the circuit of the winding of relay 12H is interrupted and energy is not supplied to this relay winding. Accordingly, the contacts of the relay 12H remain released, and contact 24 maintains the steady energy or "lockout" circuit for supplying uncoded energy to the track transformer 11TT, with the result that steady energy will continue to feed to the winding of the track relay 12TR and maintain the track relay contacts picked up.

In addition, as the contacts of relay 12H remain released, the circuit for illuminating the red or stop lamp R of signal 12S is maintained, and the signal 12S continues to display its stop indication.

When the train has advanced far enough in the track stretch to vacate section 12T, the energy of 75 code frequency supplied to transformer 12TT by the equipment associated with section 13T feeds to the track relay 12TR of section 12T. However, at this time as the "off" periods of the code supplied by transformer 12TT are filled in by steady energy feeding over the defective joint from the rails of section 11T, the contacts of the track relay 12TR are maintained constantly picked up and contact 17 maintains the "lockout" circuit for supplying steady energy to the transformer 11TT.

Operation of equipment if an insulated joint breaks down when the track stretch is vacant

For purposes of illustration it will be assumed that an insulated joint 3 separating sections 11T and 12T breaks down at a time when the track stretch is vacant, at which time energy of the 180 code frequency is supplied to the rails of sections 12T and 11T.

At this time as relay 12TR is responding to coded energy, the contacts of relay 12H are picked up and energy of the 180 code frequency is supplied to the track transformer 11TT and thus to the rails of section 11T.

If an insulated joint 3 separating sections 11T and 12T breaks down at a time when the impulses of energy supplied to the section 11T are out of step with those supplied to the section 12T, the impulses of energy supplied to the rails of section 11T, and feeding over the defective insulated joint to the relay 12TR, will fill in the "off" periods in the code supplied to section 12T with the result that the contacts of the track relay 12TR will be maintained picked up all or substantially all of the time.

If at the time the insulated joint separating sections 11T and 12T becomes defective the impulses of coded energy supplied to the two sections are substantially in step with each other they will soon become out of step. This will be true because the code transmitters for the two sections are driven by electric motors, and these motors will not operate at exactly the same speed.

Accordingly, if the contacts of track relay 12TR are not held picked up for an abnormally large proportion of the time immediately upon

breaking down of the insulated joint, they will soon be held picked up an abnormally large proportion of the time because of the increase in the time during which energy is supplied to the track relay winding when the codes for the sections 11T and 12T get out of step.

In consequence of the lengthened picked up periods of the track relay contacts, contact 16 does not engage its back contact, or engages it for such short time intervals that energization of the winding of relay 12H is reduced below the value effective to maintain the relay contacts picked up. Accordingly contacts of relay 12H become released.

On release of contact 24 of relay 12H the circuit for supplying energy of the 180 code frequency to the track transformer 11TT is interrupted, and since contact 17 of the track relay 12TR is in its picked up position, the "lockout" circuit for supplying steady energy to the transformer 11TT is established. On the supply of steady energy to the transformer 11TT, steady energy is supplied to the track rails of section 11T, and feeds over the defective joint 3 to the track relay 12TR so that thereafter the contacts of the track relay 12TR are maintained picked up to thereby maintain the "lockout" circuit.

In addition, on release of the contacts of relay 12H, contact 27 interrupts the circuit of the green or proceed lamp G, and establishes the circuit of the red or stop lamp R.

From the foregoing it will be seen that my invention provides an improved railway signaling system which operates to establish a "lockout" or steady energy supply circuit in the event an insulated joint is defective, and furthermore that the system employs a minimum of apparatus to accomplish this result.

Although I have herein shown and described only one form of railway signaling system 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 a coded railway signaling system, in combination, a stretch of railway track having a pair of track rails divided by insulated joints into successive track sections including adjoining forward and rearward sections, means for at times supplying coded energy to the rails of the forward section, a code following track relay having a winding receiving energy from the rails of said forward section, an auxiliary relay associated with said track relay, means responsive to code following operation of the track relay contacts for supplying impulses of energy to the winding of the auxiliary relay, said means being operative to supply energy to the auxiliary relay winding only when the track relay contacts are in their released position, a first supply circuit for supplying coded energy to the rails of said rearward section, said first supply circuit being complete when and only when the contacts of the track relay and of the auxiliary relay are released, a second supply circuit over which steady energy may be supplied to the rails of said rearward section, said second supply circuit being complete when and only when the contacts of the track relay are picked up and the contacts of the auxiliary relay are released, whereby said second supply circuit is maintained with resultant supply of steady energy to the rails of said rearward section if energy supplied over said circuit feeds to said track relay, and whereby said second supply circuit is interrupted if said track relay becomes released subsequent to establishment of said circuit, and a third supply circuit for supplying coded energy to the rails of said rearward section, said third supply circuit being complete when the contacts of the auxiliary relay are picked up.

2. In a coded railway signaling system, in combination, a stretch of railway track having a pair of track rails divided by insulated joints into successive track sections including adjoining forward and rearward sections, means for at times supplying coded energy to the rails of said forward section, a code following track relay having a winding receiving energy from the rails of said forward section, an auxiliary relay associated with said track relay, a first supply circuit for supplying coded energy to the rails of said rearward section, said first supply circuit being complete when and only when the contacts of the track relay and of the auxiliary relay are released, a second supply circuit over which steady energy may be supplied to the rails of said rearward section, said second supply circuit being complete when and only when the contacts of the track relay are picked up and the contacts of the auxiliary relay are released, a third supply circuit for supplying coded energy to the rails of the rearward section, said third supply circuit being complete when the contacts of the auxiliary relay are picked up, means responsive to code following operation of the track relay contacts for supplying impulses of energy to the winding of the auxiliary relay, said means being operative to supply energy to the auxiliary relay winding only on movement of the track relay contacts to their released position, whereby on initial movement of the track relay contacts to their picked up position the first supply circuit is interrupted and the second supply circuit is established, and whereby if energy supplied over said second supply circuit feeds to said track relay said second supply circuit will be maintained with resultant supply of steady energy to the rails of said rearward section and if code following operation of the track relay contacts continues subsequent to establishment of said second supply circuit said second supply circuit will be interrupted and the third supply circuit will be established.

3. In a coded railway signaling system, in combination, a stretch of railway track having a pair of track rails divided by insulated joints into successive track sections including adjoining forward and rearward sections, means for at times supplying coded energy to the rails of said forward section, a code following track relay having a winding receiving energy from the rails of said forward section, a first supply circuit for supplying coded energy to the rails of said rearward section, said first supply circuit including a contact of the track relay and being complete only when said contact is in its released position, a second supply circuit over which steady energy may be supplied to the rails of said rearward section, said second supply circuit including a contact of the track relay and being complete only when said contact is in its picked up position, an auxiliary relay operative when its contacts are picked up to interrupt both the first and the second supply circuits and to establish a third supply circuit to supply coded energy to the rails of said rearward section,

means responsive to and operative during code following operation of the track relay contacts for supplying energy to the winding of said auxiliary relay, said means being operative to supply energy to said auxiliary relay winding only when the track relay contacts are in their released position, whereby on initial movement of the track relay contacts to their picked up position the first supply circuit is interrupted and the second supply circuit is established, and whereby if energy supplied over said second supply circuit feeds to said track relay said second supply circuit will be maintained with resultant supply of steady energy to the rails of said rearward section and if code following operation of the track relay contacts continues subsequent to establishment of said second supply circuit energy will be supplied to the auxiliary relay winding and the contacts of said auxiliary relay will become picked up to interrupt said second supply circuit and to establish the third supply circuit to supply coded energy to said rearward section.

4. In a coded railway signaling system, in combination, a stretch of railway track having a pair of track rails divided by insulated joints into successive track sections including adjoining forward and rearward sections, means for at times supplying coded energy to the rails of said forward section, a code following track relay having a winding receiving energy from the rails of said forward section, a first supply circuit for supplying coded energy to the rails of said rearward section, said first supply circuit including a contact of the track relay and being complete only when said contact is its released position, a second supply circuit over which steady energy may be supplied to the rails of said rearward section, said second supply circuit including a contact of the track relay and being complete only when said contact is in its picked up position, an auxiliary relay operative when its contacts are picked up to interrupt both the first and the second supply circuits and to establish a third supply circuit to supply coded energy to the rails of said rearward section, a transformer having a primary winding and a secondary winding, means responsive to code following operation of the track relay contacts for varying energization of the transformer primary winding, and means responsive to code following operation of the track relay contacts for supplying energy from the transformer secondary winding to the auxiliary relay.

5. In a coded railway signaling system, in combination, a stretch of railway track having a pair of track rails divided by insulated joints into successive track sections including adjoining forward and rearward sections, means for at times supplying coded energy to the rails of said forward section, a code following track relay having a winding receiving energy from the rails of said forward section, a first supply circuit for supplying coded energy to the rails of said rearward section, said first supply circuit including a contact of the track relay and being complete only when said contact is in its released position, a second supply circuit over which steady energy may be supplied to the rails of said rearward section, said second supply circuit including a contact of the track relay and being complete only when said contact is in its picked up position, an auxiliary relay operative when its contacts are picked up to interrupt both the first and the second supply circuits and to establish a third supply circuit to supply coded energy to the rails of said rearward section, a transformer having a primary winding and a secondary winding, means responsive to code following operation of the track relay contacts for varying energization of the transformer primary winding, and means responsive to code following operation of the track relay contacts for supplying energy from the transformer secondary winding to the auxiliary relay, said last named means being operative when the track relay contacts have been in their released position for a time interval to supply to the winding of the auxiliary relay energy effective to cause the contacts of said relay to become picked up only on a movement of the track relay contacts subsequent to initial movement of said contacts from their released position to their picked up position.

6. In a coded railway signaling system, in combination, a stretch of railway track having a pair of track rails divided by insulated joints into successive track sections including adjoining forward and rearward sections, means for at times supplying coded energy to the rails of said forward section, a code following track relay having a winding receiving energy from the rails of said forward section, a first supply circuit for supplying coded energy to the rails of said rearward section, said first supply circuit including a contact of the track relay and being complete only when said contact is in its released position, a second supply circuit over which steady energy may be supplied to the rails of said rearward section, said second supply circuit including a contact of the track relay and being complete only when said contact is in its picked up position, an auxiliary relay operative when its contacts are picked up to interrupt both the first and the second supply circuits and to establish a third supply circuit to supply coded energy to the rails of said rearward section, a transformer having a primary and a secondary winding, means responsive to code following operation of the track relay contacts for varying energization of the transformer primary winding, and means for supplying energy from the transformer secondary winding to the auxiliary relay winding, said means comprising a circuit which is complete only when the track relay contacts are in their released position.

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