

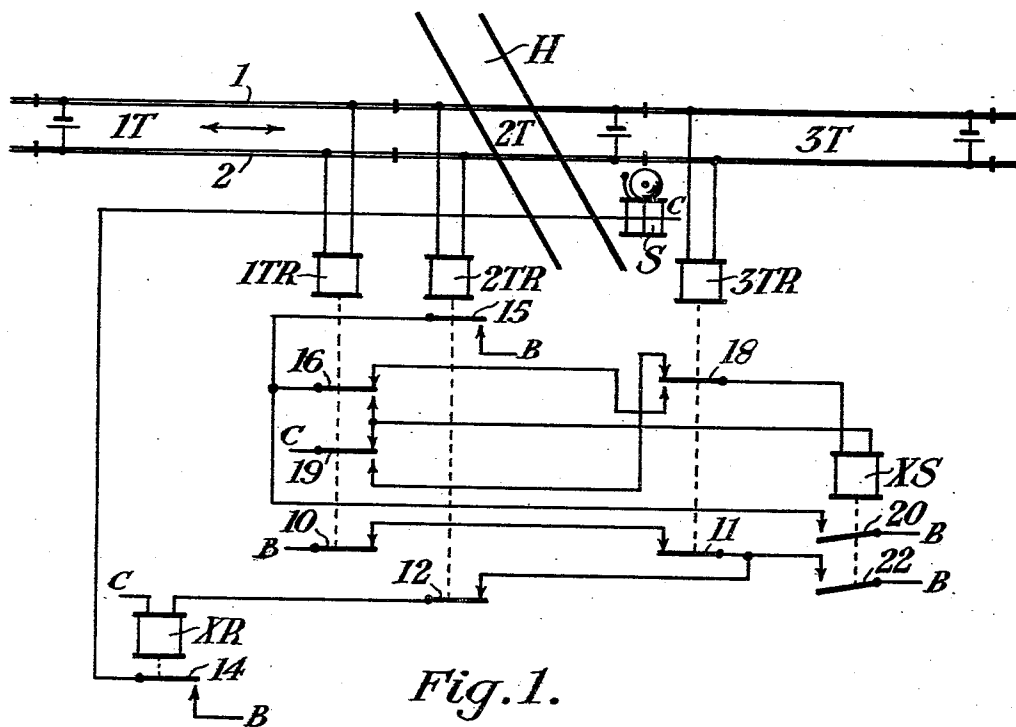
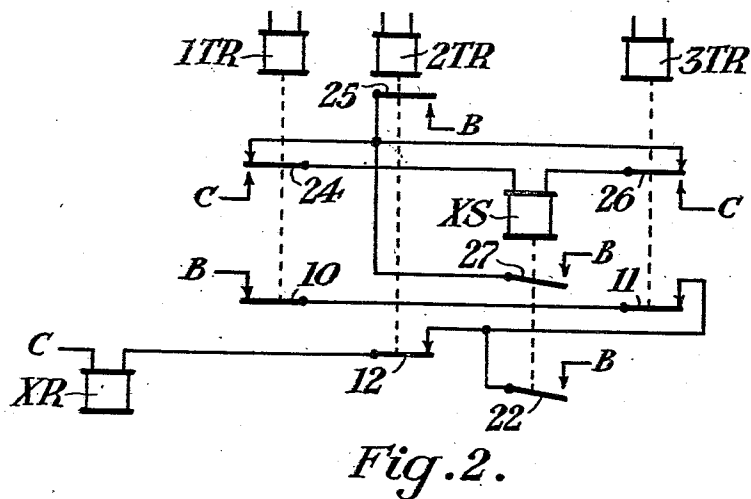
April 27, 1943.

T. W. TIZZARD, JR

2,317,562

RAILWAY SIGNALING APPARATUS

Filed Feb. 25, 1942



INVENTOR
 Thomas W. Tizzard Jr.
 BY *Robert*
 HIS ATTORNEY.

UNITED STATES PATENT OFFICE

2,317,562

RAILWAY SIGNALING APPARATUS

Thomas W. Tizzard, Jr., Downers Grove, Ill., assignor to The Union Switch and Signal Company, Swissvale, Pa., a corporation of Pennsylvania

Application February 25, 1942, Serial No. 432,217

5 Claims. (Cl. 246—130)

My invention relates to railway signaling apparatus, and particularly to apparatus for controlling highway crossing signals located at the intersection of a highway and a stretch of railway track over which trains move in both directions.

It has heretofore been proposed to control the crossing signals by employing a stick relay which is energized when the section including the highway is occupied and which when energized establishes a stick circuit to maintain itself energized as long as the section at one side of the intersection is vacant and the section at the other side of the intersection is occupied. This relay also operates when energized to establish a circuit to supply energy to the crossing signal control relay when the track section which includes the intersection is vacated.

Under normal conditions, therefore, when a train vacates the section beyond an intersection the stick relay is deenergized and the crossing signals are thereafter controlled by the track relays so that operation of the signals will be initiated on the approach of a second or following train.

However, with the arrangement heretofore employed if a second or following train enters the section on one side of an intersection at substantially the same instant that the first train vacates the section on the other side of the intersection, the stick circuit for the stick relay may be reestablished before this relay releases, and if this occurs the relay will remain energized and will prevent operation of the crossing signals to warn of the approach of the second train.

It is an object of this invention to provide improved means of the type described which is arranged so that the equipment is certain to operate to warn users of the highway of the approach of a second or following train.

A further object of the invention is to provide apparatus of the type described which is arranged so that the track relays for the sections on opposite sides of the intersection control the polarity of the energy supplied to the stick relay so that energy of one polarity is supplied to this relay when one of these track relays is released and the other is picked up, while energy of the other polarity is supplied to this relay when said other track relay is released and said one track relay is picked up. This insures that if the stick circuit for the stick relay is reestablished by a second or following train, as explained above, the polarity of the energy supplied over this circuit will be reversed so the stick relay is certain to release and cause

the crossing signals to operate to warn of the approach of the second train.

Another object of the invention is to provide improved means for controlling a stick relay.

In practicing my invention I modify the circuit heretofore known by having the pick-up as well as the stick circuit of the stick relay controlled by contacts of the track relays for the sections on opposite sides of the intersection, while these circuits are controlled in such manner that energy of one polarity is supplied at times and energy of the other polarity is supplied at other times.

I shall describe two forms of apparatus embodying my invention and shall then point out the novel features thereof in claims.

In the accompanying drawing, Fig. 1 is a diagrammatic view showing one form of apparatus embodying my invention, and

Fig. 2 is a fragmentary diagram showing a modified form of apparatus which I may employ.

Similar reference characters refer to similar parts in each of the two views.

Referring to Fig. 1 of the drawing, the reference characters 1 and 2 designate the track rails of a stretch of railway track over which traffic moves in both directions. The track rails are divided by insulated joints 3 into relatively long track sections 1T and 3T which are separated by a relatively short intermediate track section 2T which includes an intersection with a highway H. A crossing signal S is located adjacent the intersection to warn users of the highway of the approach of a train. The signal S may be of any appropriate form and as here shown is an audible signal in the form of an electric bell.

Each of the track sections is provided with a track circuit including a track battery connected across the section rails at one end of the section and a track relay, designated TR with an appropriate prefix, connected across the section rails at the other end of the section.

The crossing signal S is controlled by a control relay XR, while the relay R is controlled by the track relays and by an auxiliary or stick relay XS.

The equipment is shown in the condition which it assumes when the track stretch is vacant. At this time the track relays are picked up and energy is supplied to the relay XR by a circuit which includes front contact 10 of relay 1TR, from contact 11 of relay 3TR, and front contact 12 of relay 2TR.

The energy supplied to relay XR, as well as to the relay XS and the crossing signal S, may be supplied from a suitable source, such as a storage

battery or a primary battery, not shown, the positive and negative terminals of which are designated B and C, respectively.

As relay XR is energized its contact 14 is picked up and interrupts the circuit of the crossing signal S so that this signal is prevented from operating.

When a train moving from left to right enters section 1T track relay 1TR releases and its contact 10 interrupts the circuit of the relay XR so that its contact 14 releases and establishes the circuit of crossing signal S which then operates to warn users of the highway of the approach of a train.

When the train advances into section 2T track relay 2TR releases and its contact 12 additionally interrupts the circuit of the relay XR, while contact 15 of relay 2TR establishes a pick-up circuit for the stick relay XS. This circuit is traced from terminal B through back contact 15 of relay 2TR, back contact 16 of relay 1TR, winding of relay XS, front contact 18 of relay 3TR, and back contact 19 of relay 1TR to terminal C.

When the train advances into section 3T track relay 3TR releases and its contact 18 interrupts the circuit traced above so that relay XS releases, while contact 11 of relay 3TR additionally interrupts the circuit of relay XR.

When the rear of the train vacates section 1T track relay 1TR picks up and establishes a pick-up circuit for relay XS which is traced from terminal B through back contact 15 of relay 2TR, front contact 15 of relay 1TR, back contact 18 of relay 3TR, winding of relay XS, and front contact 19 of relay 1TR to terminal C. The relay XS therefore picks up and its contact 20 establishes connection from terminal B to contact 16 of relay 1TR so that relay XS will continue to be energized after the train vacates section 2T.

In addition, on picking up of relay XS its contact 22 establishes a connection to supply energy to relay XR after the train vacates section 2T. Accordingly, when the train vacates section 2T and track relay 2TR picks up its contact 15 interrupts the pick-up circuit for relay XS, but this relay is held picked up by energy supplied over its stick circuit, while contact 12 of relay 2TR is closed so that energy is supplied to relay XR over the circuit established by contact 22 of relay XS. Relay XR, therefore, picks up and discontinues operation of the crossing signal S.

When the train advances far enough to vacate section 3T track relay 3TR picks up and its contact 11 completes one circuit for supplying energy to the relay XR, while its contact 18 interrupts the stick circuit for relay XS so relay XS releases and its contact 22 interrupts the circuit which it controls for supplying energy to relay XR. However, at this time relay XR is maintained picked up by current supplied over the contacts of the track relays and relay XR, therefore, remains picked up and prevents operation of the crossing signal.

The system of this invention is arranged so that if a second or following train enters section 1T before the first train vacates section 3T the crossing signal S will operate to warn of the approach of the second train.

As explained above, when the first train vacates section 2T track relay 2TR picks up and energy is supplied to relay XR over the circuit which includes front contact 22 of relay XS, while relay XS is energized by current supplied over the stick circuit which includes its own front contact 20, front contact 16 of relay 1TR, back contact 18

of relay 3TR, winding of relay XS, and front contact 19 of relay 1TR.

When the second or following train enters section 1T track relay 1TR releases and its contact 16 interrupts connection through back contact 18 of relay 3TR to one terminal of the winding of relay XS so that relay XS releases and its contact 22 cuts off the supply of energy to relay XR with the result that contact 14 establishes the circuit to supply energy to the signal S to thereby cause the signal to operate and warn users of the highway of the approach of the second train.

The system of this invention is also arranged to insure release of the relay XR and resultant operation of the crossing signal S if a second train enters section 1T at substantially the same instant that the first train vacates section 3T so that relay 1TR releases and relay 3TR picks up approximately at the same time.

On release of the contacts of relay 1TR or picking up of the contacts of relay 3TR, whichever occurs first, the stick circuit for relay XS is interrupted and after a short time interval contact 20 of relay XS will release and prevent reestablishment of the relay stick circuit by contacts of relays 1TR and 3TR. However, if the contacts of relay 1TR release and the contacts of relay 3TR pick up before the contacts of relay XS release, a circuit for supplying energy to the relay XS will be complete and is traced from terminal B through front contact 20 of relay XS, back contact 16 of relay 1TR, winding of relay XS, front contact 18 of relay 3TR, and back contact 19 of relay 1TR to terminal C. It will be seen that energy supplied over this circuit flows through the winding of relay XS in the opposite direction to that previously supplied to the relay, and when the flux in the relay core passes through the zero value the contacts of relay XS release and contact 20 interrupts the relay stick circuit so that the relay contacts remain released, while contact 22 of relay XS interrupts the circuit of relay XR and causes it to initiate operation of the crossing signal S. As there is a reversal of the polarity of the energy supplied to the relay XS at this time the relay is certain to release and cause the crossing signal to operate.

The system of this invention operates in a similar manner on movement of trains through the track stretch from right to left. When a train moving in this direction enters section 3T track relay 3TR releases and its contact 11 interrupts the circuit of relay XR and this relay causes signal S to operate.

When the train enters section 2T track relay 2TR releases and its contact 12 additionally interrupts the circuit of relay XR, while its contact 15 establishes a pick-up circuit for relay XS. This circuit is traced from terminal B through back contact 15 of relay 2TR, front contact 16 of relay 1TR, back contact 18 of relay 3TR, winding of relay XS, and front contact 19 of relay 1TR to terminal C.

When the train enters section 1T track relay 1TR releases and its contact 16 interrupts the circuit traced above for energizing relay XS while its contact 10 additionally interrupts the circuit of relay XR.

When the train vacates section 3T track relay 3TR picks up and establishes a pick-up circuit for relay XS which is traced from terminal B through back contact 15 of relay 2TR, back contact 16 of relay 1TR, winding of relay XS, front contact 18 of relay 3TR, and back contact 19 of relay 1TR to terminal C. The relay XS, there-

fore, picks up and its contact 20 establishes connection from terminal B to contact 16 of relay 1TR to maintain the relay XS energized after the train vacates section 2T.

When the train vacates section 2T track relay 2TR picks up and interrupts the pick-up circuit for relay XS but this relay is maintained picked up by energy supplied over its stick circuit. When relay 2TR picks up energy is supplied to relay XR over the circuit including front contact 22 of relay XS, and front contact 12 of relay 2TR, and contact 14 of relay XR picks up to discontinue operation of the crossing signal S.

When the train vacates section 1T track relay 1TR picks up and interrupts the stick circuit for relay XS and the contacts of this relay release, while relay XR is maintained energized by current supplied over the front contacts of the track relays.

The system of this invention is arranged so that if a second or following train enters section 3T before the first train vacates section 1T, the crossing signal S will operate to warn of the approach of the second train.

As pointed out above, after the first train vacates section 2T, and while it is still in section 1T the relay XS is energized by current supplied over a stick circuit which includes front contact 18 of relay 3TR. When a second or following train enters section 3T, track relay 3TR releases and its contact 18 interrupts the stick circuit for relay XS so that relay XS releases and its contact 22 interrupts the circuit of relay XR so that relay XR releases and causes the crossing signal S to operate, while contact 20 of the relay XS additionally interrupts the stick circuit for relay XS.

The system of this invention is also arranged so that if a second or following train moving from right to left enters section 3T substantially at the instant the first train vacates section 1T the relay XS will be certain to release and initiate operation of the crossing signal S to warn of the approach of the second train.

As previously pointed out when a train moving from right to left has vacated section 2T but is still present in section 1T, the relay XS is maintained energized by current supplied over the stick circuit which is traced from terminal B through front contact 20 of relay XS, back contact 16 of relay 1TR, winding of relay XS, front contact 18 of relay 3TR, and back contact 19 of relay 1TR to terminal C.

When the first train vacates section 1T track relay 1TR picks up and interrupts the stick circuit just traced, while when the second train enters section 3T track relay 3TR releases and additionally interrupts the stick circuit traced above. However, if relay 1TR picks up and relay 3TR releases before the contacts of relay XS release another circuit is established for supplying energy to relay XS and is traced from terminal B through front contact 20 of relay XS, front contact 18 of relay 1TR, back contact 18 of relay 3TR, winding of relay XS, and front contact 19 of relay 1TR to terminal C. The energy supplied over this circuit to the relay XS flows through the relay winding in the opposite direction to that of the energy previously supplied to the winding. The contacts of relay XS therefore will release and its contact 20 will interrupt the circuit just traced to thereby insure that the relay contacts will remain released, while its contact 22 interrupts the circuit of relay XR to cause operation of the crossing signal S.

As the second train proceeds through the track stretch the equipment operates as previously explained to continue operation of the crossing signal until the train vacates section 2T.

From the foregoing it will be seen that this invention provides improved means to control the supply of energy to the relay XS in such manner as to insure that this relay will not prevent operation of the crossing signals when a second train approaches the crossing.

In Fig. 2 of the drawing there is shown a modified means which I may employ to control the stick relay XS. Except as hereinafter pointed out in detail the modification shown in Fig. 2 is the same in construction and operation as the modification shown in Fig. 1.

The equipment is shown in the condition which it assumes when the track stretch is vacant. At this time the track relays are picked up and their contacts establish a circuit to supply energy to the relay XR, while relay XS is released.

When a train moving from left to right enters section 1T track relay 1TR releases and its contact 10 interrupts the circuit of relay XR to initiate operation of the crossing signal, while when the train enters section 2T track relay 2TR releases and additionally interrupts the circuit of relay XR. On release of relay 2TR its contact 25 completes a pick-up circuit for relay XS which is traced from terminal B of a source through back contact 25 of relay 2TR, front contact 26 of relay 3TR, winding of relay XS, and back contact 24 of relay 1TR to terminal C. At this time the contacts of relay XS pick up but the circuit of relay XR continues to be interrupted by contact 12 of relay 2TR.

When the train advances into section 3T track relay 3TR releases and its contact 26 interrupts the circuit just traced for relay XS and the contacts of this relay release. When the train vacates section 1T track relay 1TR picks up and completes a circuit to energize relay XS. This circuit is traced from terminal B through back contact 25 of relay 2TR, front contact 24 of relay 1TR, winding of relay XS, and back contact 26 of relay 3TR. The contacts of relay XS therefore pick up and its contact 27 establishes a stick circuit to keep the relay energized after the train vacates section 2T and track relay 2TR picks up. When the train vacates section 2T track relay 2TR picks up and energy is supplied to relay XR over the circuit which includes front contact 22 of relay XS and front contact 12 of relay 2TR. The relay XR therefore picks up and discontinues operation of the crossing signal.

When the train vacates section 3T track relay 3TR picks up and its contact 26 interrupts the circuit of relay XS so that it releases, while contact 11 of relay 3TR completes the circuit of relay XR so that relay XR remains energized and prevents operation of the crossing signal after relay XS releases.

If before the first train vacates section 3T a second or following train enters section 1T the track relay 1TR will release and interrupt the stick circuit for relay XS so that it will release and de-energize relay XR to thereby cause the crossing signal to operate to warn users of the highway of the approach of the second train.

If the second train enters section 1T at substantially the same instant that the first train vacates section 3T energy will be supplied to relay XS over the circuit which includes front contact 27 of relay XS, front contact 26 of relay 3TR, winding of relay XS, and back contact 24 of relay

1TR. The energy supplied over this circuit flows through the winding of relay XS in the direction opposite to the energy supplied to relay XS when relay **1TR** is picked up and relay **3TR** is released. Accordingly relay XS is certain to release so that its contact **27** interrupts the circuit just traced to thereby prevent picking up of the relay, while its contact **22** interrupts the supply of energy to relay XR and thus causes operation of the crossing signal.

The equipment operates in a similar manner on movement of a train through the track stretch from right to left. When such a train enters section **3T** track relay **3TR** releases and releases relay XR to thereby initiate operation of the crossing signal. When the train enters section **2T** track relay **2TR** releases and additionally interrupts the circuit of relay XR. At this time relay XS picks up but as soon as the train enters section **1T** the circuit of relay XS is interrupted and relay XS releases. When the train vacates section **3T** relay XS is picked up by current supplied over terminal B through back contact **25** of relay **2TR**, front contact **26** of relay **3TR**, winding of relay XS, and back contact **24** of relay **1TR** to terminal C. On picking up of relay XS its contact **27** establishes a stick circuit to keep the relay energized after picking up of relay **2TR**, while when the train vacates section **2T** energy is supplied to relay XR over front contact **22** of relay XS and front contact **12** of relay **2TR** so that operation of the crossing signal is discontinued.

If a second or following train enters section **3T** before the first train has vacated section **1T** contact **26** of relay **3TR** will interrupt the circuit traced above for energizing relay XS and this relay will release and interrupt the circuit of relay XR and thus cause the crossing signal to operate to warn of the approach of the second or following train.

The system shown in Fig. 2 also operates to insure release of relay XS if a second train enters section **3T** substantially at the same instant that the first train vacates section **1T**. When section **1T** is vacated and section **3T** is occupied energy may be supplied to relay XS over the circuit which is traced from terminal B through front contact **27** of relay XS, front contact **24** of relay **1TR**, winding of relay XS, and back contact **26** of relay **3TR** to terminal C. The energy supplied over this circuit flows through the relay XS in the direction opposite to that of the energy supplied to the relay when section **1T** is occupied and section **3T** is vacant. Accordingly the relay is certain to release and initiate operation of the crossing signal to warn of the approach of the second train.

Although the equipment has been illustrated and described in connection with the control of highway crossing signals the invention is not limited to use for this purpose, but is equally applicable to other situations.

Although I have herein shown and described only two forms of railway signaling 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 over which traffic moves in both directions, said track stretch being divided into a first and a second track section which are separated by an in-

intermediate section which includes a highway intersection, each of said track sections being provided with a track circuit including a track relay, a highway crossing signal located at said intersection, a control relay effective when energized to interrupt the circuit of said signal, a circuit including front contacts of each of said track relays for supplying energy to said control relay, an auxiliary relay, a circuit including front contacts of the intermediate section track relay and of said auxiliary relay for also supplying energy to said control relay, a pick-up circuit for said auxiliary relay including a back contact of the intermediate section track relay, a stick circuit for said auxiliary relay including its own front contact, and means including contacts of the first and second section track relays for controlling the circuits of said auxiliary relay so that when the contacts of the first section track relay are picked up and the contacts of the second section track relay are released energy of one polarity is supplied to said auxiliary relay and so that when the contacts of the first section track relay are released and the contacts of the second section track relay are picked up energy of the other polarity is supplied to said auxiliary relay.

2. In combination, a stretch of railway track over which traffic moves in both directions, said track stretch being divided into a first and a second track section which are separated by an intermediate section which includes a highway intersection, each of said track sections being provided with a track circuit including a track relay, a highway crossing signal located at said intersection, a control relay effective when energized to interrupt the circuit of said signal, a circuit including front contacts of each of said track relays for supplying energy to said control relay, an auxiliary relay, a circuit including front contacts of the intermediate section track relay and of said auxiliary relay for also supplying energy to said control relay, means including a back contact of the intermediate section track relay for establishing connection from one terminal of a source to a contact of said first section track relay which is effective when released to establish connection with one terminal of the auxiliary relay winding and is effective when picked up to establish connection with the other terminal of the auxiliary relay winding providing the contacts of the second section track relay are released, means including a front contact of said auxiliary relay for also establishing connection from said one terminal of said source to said first section track relay contact, and means including another contact of the first section track relay for establishing connection from the other terminal of said source to said one terminal of the auxiliary relay winding when said contact is picked up and to the other terminal of the auxiliary relay winding when said contact is released provided the contacts of said second section track relay are picked up.

3. In combination, a stretch of railway track over which traffic moves in both directions, said track stretch being divided into a first and a second track section which are separated by an intermediate section which includes a highway intersection, each of said track sections being provided with a track circuit including a track relay, a highway crossing signal located at said intersection, a control relay effective when energized to interrupt the circuit of said signal, a circuit including front contacts of each of said track relays for supplying energy to said con-

trol relay, an auxiliary relay, a circuit including front contacts of the intermediate section track relay and of said auxiliary relay for also supplying energy to said control relay, one terminal of the winding of said auxiliary relay being connected to a contact of the first section track relay which when released establishes connection with one terminal of a source and is effective when picked up to establish connection with the other terminal of said source provided the second section track relay is released or the auxiliary relay contacts are picked up, the other terminal of the winding of said auxiliary relay being connected to a contact of the third section track relay which is effective when released to establish connection with said one terminal of said source and is effective when picked up to establish connection with said other terminal of said source provided the second section track relay is released or the auxiliary relay contacts are picked up.

4. In combination, a stretch of railway track over which traffic moves in both directions, said track stretch being divided into a first and a second track section which are separated by an intermediate section, each of said sections being provided with a track circuit including a track relay, an auxiliary relay, a pick-up circuit for said auxiliary relay which includes back contacts of the track relays of the first and intermediate sections and a front contact of the track relay of the second section and over which energy of one polarity is supplied to said auxiliary relay, another pick-up circuit for said auxiliary relay including back contacts of the track relays of the second and intermediate sections and a

front contact of the track relay of the first section and over which energy of the other polarity is supplied to said auxiliary relay, and means including a front contact of said auxiliary relay and shunting the contact of said intermediate section track relay in each of said pick-up circuits.

5. In combination, a stretch of railway track over which traffic moves in both directions, said track stretch being divided into a first and a second track section which are separated by an intermediate section, each of said sections being provided with a track circuit including a track relay, an auxiliary relay, a pick-up circuit for said auxiliary relay which includes back contacts of the track relays of the first and intermediate sections and a front contact of the track relay of the second section and over which energy of one polarity is supplied to said auxiliary relay, another pick-up circuit for said auxiliary relay including back contacts of the track relays of the second and intermediate sections and a front contact of the track relay of the first section and over which energy of the other polarity is supplied to said auxiliary relay, and means including a front contact of said auxiliary relay and shunting the contact of said intermediate section track relay in each of said pick-up circuits, a control relay, a circuit including front contacts of each of said track relays for supplying energy to said control relay, and a circuit including front contacts of said intermediate section track relay and of said auxiliary relay for also supplying energy to said control relay.

THOMAS W. TIZZARD, JR.