Oct. 25, 1932. L. E. SPRAY 1,884,329

HIGHWAY CROSSING PROTECTION

Filed May 16, 1931

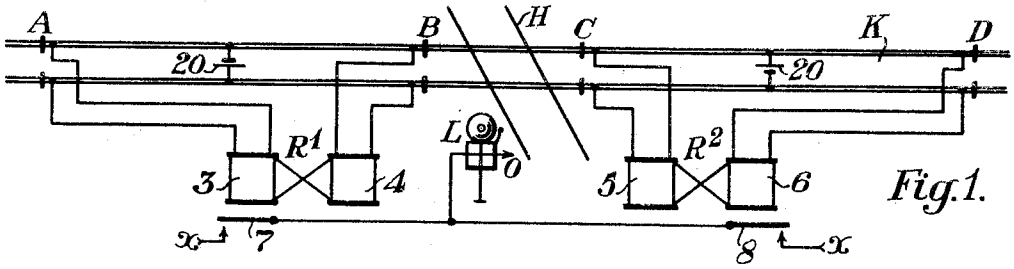


Fig. 1.

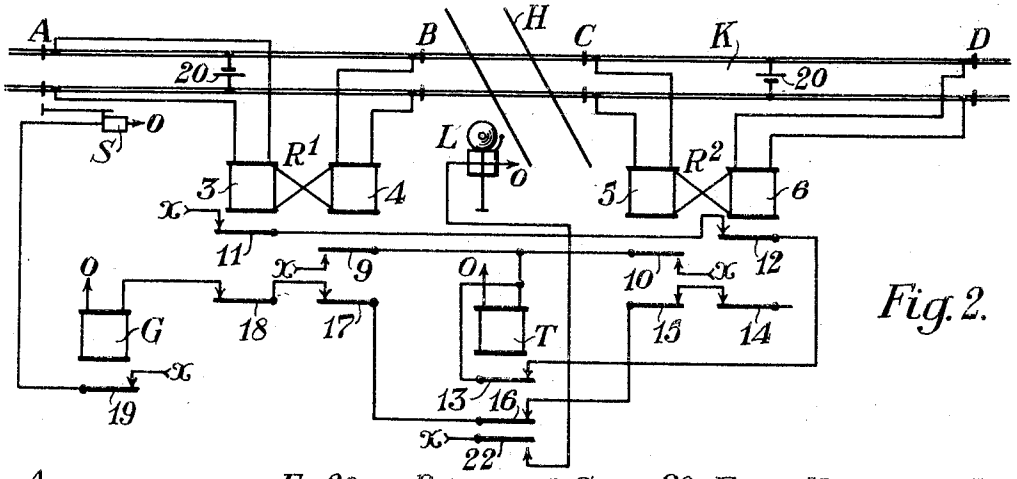


Fig. 2.

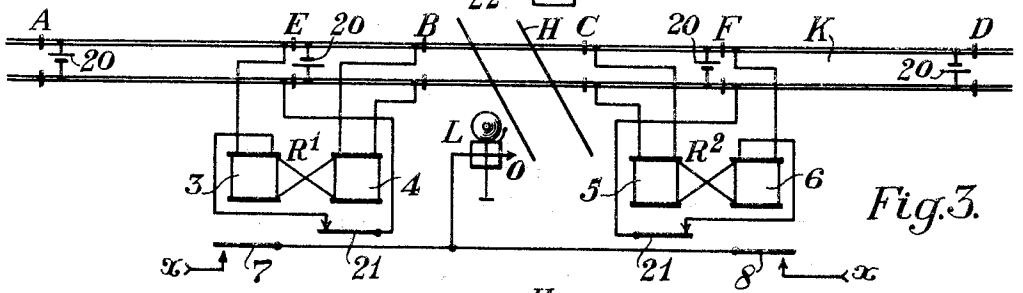


Fig. 3.

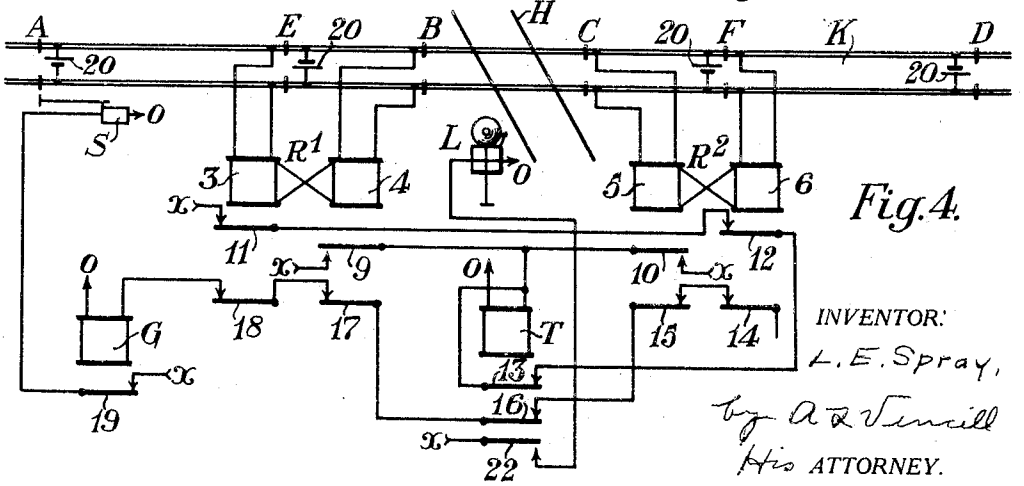


Fig. 4.

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UNITED STATES PATENT OFFICE

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HIGHWAY CROSSING PROTECTION

Application filed May 16, 1931. Serial No. 537,907.

My invention relates to apparatus for the control of highway crossing signals, and has for an object the provision of systems for the automatic control of crossing signals in locations where the usual track circuits must be spaced at the highway due to an electric railway or some other cause.

I will describe several forms of apparatus embodying my invention, and will 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. Fig. 2 is a view showing a modification of a portion of the apparatus shown in Fig. 1 and also embodying my invention. Fig. 3 is a diagrammatic view showing another form of apparatus embodying my invention. Fig. 4 is a view showing a modification of a portion of the apparatus shown in Fig. 2 and also embodying my invention.

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

Referring first to Fig. 1, the reference character K designates a railway track along which traffic moves in both directions, and which track is intersected by a highway H. The track K is divided by the usual insulated joints to form two track sections A—B and C—D, located on opposite sides of the highway and spaced by the distance B—C, due to some cause such as an electric railway running in the same general direction as the highway.

Section A—B is provided with a track circuit comprising a battery 20 connected across the rails adjacent the middle of the section, and an interlocking relay R^1 having one magnet 3 connected across the rails at the end remote from the highway and another magnet 4 connected across the rails at the end adjacent the highway. Section C—D is provided with a similar track circuit including an interlocking relay R^2 having two magnets 5 and 6.

A signal L, which, as here shown, is an electric bell, is located adjacent the intersection of the highway H and the track K, and is provided with a circuit which includes a back contact 7 associated with relay magnet 3 and a back contact 8 associated with relay magnet 6. These two contacts are included in multiple in the circuit for the bell L, and this circuit is provided with a source of current, the terminals of which are designated *x* and *o*. It follows that when either back contact 7 or 8 is closed, the bell will ring, whereas the bell will be silent when both of these contacts are open.

The operation of the apparatus shown in Fig. 1 is as follows: When a train moving toward the right enters section A—B, magnet 3 will release, so that back contact 7 will close and the bell will start to ring. As the train proceeds through section A—B, magnet 4 will become deenergized, but the current supplied to magnet 3 will not be of sufficient magnitude to open contact 7 until the rear end of the train passes point B. When the train enters section C—D, it will first deenergize magnet 5 of relay R^2 and will subsequently deenergize magnet 6 of this relay, but owing to the interlocking characteristics of relay R^2, contact 8 will not close when the magnets are deenergized in this sequence. It follows that the operation of the bell L will stop when the rear end of the train passes point B, so that the train will not cause operation of the bell while it is receding from the highway.

The operation of the apparatus during the passage of a train moving in an opposite direction will be apparent from the foregoing without detailed explanation.

Referring now to Fig. 2, the track circuits illustrated in this view are the same as those in Fig. 1, but the apparatus for controlling the signal L is different. In Fig. 2, the signal L is controlled by a relay T having two pick-up circuits. One of these circuits includes a back contact 9 associated with magnet 4 of relay R^1, and the other circuit includes a back contact 10 associated with magnet 5 of relay R^2. Relay T is also provided with a stick circuit which passes from terminal *x*, through front contact 11 associated with magnet 3, front contact 12 associated with magnet 6, front contact 13 of relay T, and the winding of this relay

to terminal *o*. Contact 11 is of the well known "flagman" type; that is to say, when magnets 3 and 4 are deenergized in the sequence named, contact 11 will open and will remain open until magnet 3 again becomes energized; but when these magnets are deenergized in the reverse sequence, contact 11 remains closed. Contact 12 is controlled in a similar manner by relay R^2.

The operation of the apparatus shown in Fig. 2, in so far as the crossing signal L is concerned, is as follows: When a train moving toward the right enters section A—B, it will first deenergize magnet 3, thereby opening contact 11 so that relay T will release. Signal L will then start to operate by virtue of a circuit which includes a back contact 22 of relay T. As the train proceeds into section A—B, magnet 4 will become deenergized, but contact 9 will not close because of the interlocking characteristic of relay R^1. It follows that relay T will remain deenergized. When the front end of the train enters section C—D, it will deenergize magnet 5, so that contact 10 will close and will cause relay T to become energized. As the train proceeds through section C—D, contact 12 will remain closed, so that when magnet 5 again becomes energized, relay T will remain closed due to its stick circuit. It follows that the signal L will stop operating as soon as the front end of the train enters section C—D.

The operation of the apparatus during the passage of a train moving in the other direction will be obvious from the foregoing without explanation.

The reference character S designates a railway signal governing traffic moving toward the right through sections A—B and C—D. This signal is controlled by a front contact 19 of a relay G. The circuit for relay G includes contacts 14 and 15 associated with relay R^2, contacts 17 and 18 associated with relay R^1, and a contact 16 of relay T. It follows that signal S will indicate "stop" while a train occupies any part of the track between points A and D.

Referring now to Fig. 3, in the form illustrated in this view, section A—B is divided to form two subsections A—E and E—B; and section C—D is similarly divided to form two subsections C—F and F—D. Each subsection is provided with a track battery 20. Magnet 4 of relay R^1 is connected across the rails of subsection E—B, and magnet 3 of this relay is connected across the rails of subsection A—E through a front contact 21 associated with magnet 4. The magnets of relay R^2 are connected with the two subsections C—F and F—D in a similar manner. The control of the signal L by relays R^1 and R^2 is the same as in Fig. 1.

When a train moving toward the right enters subsection A—E, it will deenergize magnet 3, thereby setting the signal L into operation. When this train enters subsection E—B, it will deenergize magnet 4, thereby opening at contact 21 the circuit for magnet 3, so that contact 7 will remain closed until the rear end of the train passes point B. When the train enters subsection C—F, it will deenergize magnet 5, and this will in turn deenergize magnet 6, but contact 8 will remain open because of the interlocking characteristic of relay R^2. It follows that the operation of signal L will stop when the rear end of the train passes point B, and that while the train is receding from the highway H, it will not cause operation of this signal. The operation during the passage of a train moving toward the left will be obvious from the foregoing without explanation.

Referring now to Fig. 4, the track circuit apparatus is the same as that shown in Fig. 3, except that the circuit for magnet 3 of relay R^1 does not include a front contact associated with magnet 4, and the circuit for magnet 6 of relay R^2 does not include a contact associated with magnet 5. The circuits for the control of the highway crossing signal L and the railway signal S are the same as the circuits shown in Fig. 2, and so the operation of the apparatus in Fig. 4 will be obvious from the foregoing description of Fig. 2.

Although I have herein shown and described only four forms 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 railway track intersected by a highway, said track being divided to form two sections one on each side of the highway, an interlocking relay associated with each of said sections, and a highway crossing signal located at said intersection and controlled jointly by said two relays.

2. In combination, a railway track intersected by a highway, said track being divided to form two sections one on each side of the highway, a track circuit for each section including a source of current connected across the rails adjacent the middle of the section and an interlocking relay the first magnet of which is connected across the rails at the end adjacent the highway and the second magnet of which is connected across the rails at the end remote from the highway, and a highway crossing signal located at said intersection and controlled jointly by said two relays.

3. In combination, a railway track intersected by a highway, said track being divided to form two sections one on each side of the highway, a track circuit for each section including a source of current connected across the rails adjacent the middle of the section

and an interlocking relay the first magnet of which is connected across the rails at the end adjacent the highway and the second magnet of which is connected across the rails at the end remote from the highway, a highway crossing signal located at said intersection, and a circuit for said signal including in multiple a back contact associated with the second magnet of one relay and a back contact associated with the second magnet of the other relay.

4. In combination, a railway track intersected by a highway, said track being divided to form two sections one on each side of the highway, a track circuit for each section including a source of current connected across the rails adjacent the middle of the section and an interlocking relay the first magnet of which is connected across the rails at the end adjacent the highway and the second magnet of which is connected across the rails at the end remote from the highway, a signal relay, a pick-up circuit for said signal relay including in multiple a back contact associated with the first magnet of each interlocking relay, a stick circuit for said signal relay including in series a front contact associated with the second magnet of each interlocking relay, and a highway crossing signal controlled by said signal relay.

5. In combination, a railway track intersected by a highway, said track being divided to form two sections one on each side of the highway, a track circuit for each section including a source of current connected across the rails adjacent the middle of the section and an interlocking relay the first magnet of which is connected across the rails at the end adjacent the highway and the second magnet of which is connected across the rails at the end remote from the highway, a signal relay, a pick-up circuit for said signal relay including in multiple a back contact associated with the first magnet of each interlocking relay, a stick circuit for said signal relay including in series a front contact associated with the second magnet of each interlocking relay, a highway crossing signal located at said intersection and controlled by said signal relay, and a railway signal governing traffic through said two sections and controlled by each magnet of each interlocking relay and by said signal relay.

6. In combination, a railway track intersected by a highway, said track being divided to form two sections one on each side of the highway, and each section being divided to form two subsections, an interlocking relay for each section having its first magnet connected with the rails of the subsection nearer to the highway and its second magnet connected with the rails of the subsection remote from the highway through a front contact associated with the first magnet, and a highway crossing signal located at said intersection and controlled jointly by said relays.

7. In combination, a railway track intersected by a highway, said track being divided to form two sections one on each side of the highway, an interlocking relay associated with each section and arranged so that when a train approaching the highway enters the section the armature for the second magnet releases and continues to be released until the train leaves the section, but that when a train leaving the highway enters the section the armature for the first magnet releases and continues to be released until the train leaves the section, a signal relay, a pick-up circuit for said signal relay including in multiple a back contact associated with the first magnet of each interlocking relay, a stick circuit for said signal relay including in series a front contact associated with the second magnet of each interlocking relay, and a highway crossing signal controlled by said signal relay.

8. In combination, a railway track intersected by a highway, said track being divided to form two sections one on each side of the highway, an interlocking relay associated with each section and arranged so that when a train approaching the highway enters the section the armature for the second magnet releases and continues to be released until the train leaves the section but that when a train leaving the highway enters the section the armature for the first magnet releases and continues to be released until the train leaves the section, a signal relay, a pick-up circuit for said signal relay including in multiple a back contact associated with the first magnet of each interlocking relay, a stick circuit for said signal relay including in series a front contact associated with the second magnet of each interlocking relay, a highway crossing signal located at said intersection and controlled by said signal relay, and a railway signal governing traffic through said two sections and controlled by each magnet of each interlocking relay and by said signal relay.

9. In combination, a railway track intersected by a highway, said track being divided to form two sections one on each side of the highway, and each section being divided to form two subsections, an interlocking relay for each section having its first magnet connected with the rails of the subsection nearer to the highway and its second magnet connected with the rails of the other subsection; and a highway crossing signal located at said intersection and controlled jointly by said two relays.

10. In combination, a railway track intersected by a highway, said track being divided to form two sections one on each side of the highway, and each section being divided to form two subsections, an interlocking relay for each section having its first magnet con-

nected with the rails of the subsection nearer to the highway and its second magnet connected with the rails of the other subsection; a highway crossing signal located at said intersection, and a circuit for said signal including in multiple a back contact associated with the second magnet of one relay and a back contact associated with the second magnet of the other relay.

11. In combination, a railway track intersected by a highway, said track being divided to form two sections one on each side of the highway, an interlocking relay associated with each section and arranged so that when a train approaching the highway enters the section the armature for the second magnet releases and continues to be released until the train leaves the section but that when a train leaving the highway enters the section the armature for the first magnet releases and continues to be released until the train leaves the section, a highway crossing signal located at said intersection, and means for operating said signal when and only when the armature for the second magnet of either relay is released.

In testimony whereof I affix my signature.

LESTER E. SPRAY.