

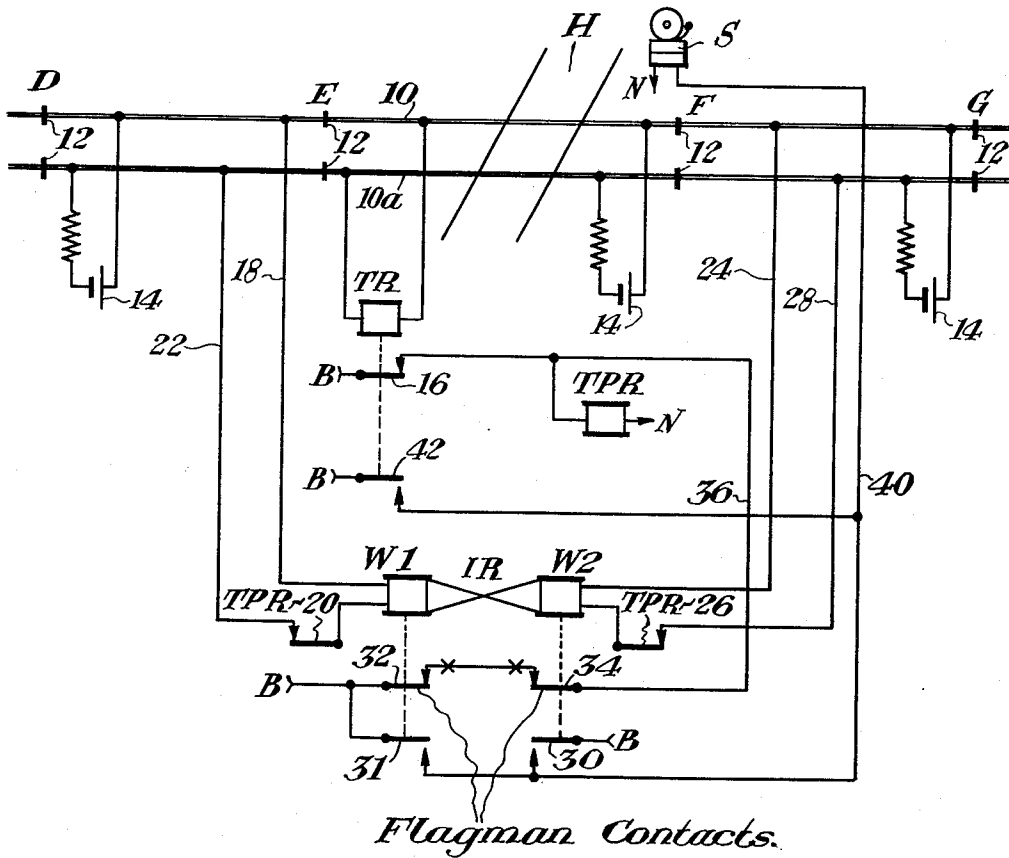
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APPARATUS FOR THE CONTROL OF HIGHWAY CROSSING SIGNALS

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**APPARATUS FOR THE CONTROL OF HIGHWAY CROSSING SIGNALS**

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My invention relates to apparatus for the control of highway crossing signals, and particularly to novel and improved apparatus for controlling the operation of a highway crossing signal located at the intersection of a highway and a railway track over which trains pass in both directions.

In highway crossing signal systems of the type employed for a stretch of track over which traffic moves in both directions, directional control means are employed to cause operation of the crossing signal whenever a train approaches the crossing in either direction, and to prevent operation when the train recedes from the crossing. The directional control means operates to permit a resumption of the flow of vehicles and pedestrian traffic over the highway crossing a short time after the rear end of the train has vacated the crossing. Normally, it is the practice to employ at the crossing a short track circuit usually referred to as an island track circuit and two approach track circuits one on each approach side of the crossing. The approach track circuits are normally of a length sufficient to provide adequate warning whenever either approach section becomes occupied by a train. When the train occupies the island track section at the crossing, the warning is continued.

While I am aware that it has been proposed heretofore to provide signal protection at the intersection of a highway with a railway track over which trains operate in both directions, an object of my present invention is to provide a novel and improved highway crossing signal control system of the class described.

Other objects and advantages of my invention will appear as the specification progresses.

In practicing my invention, the above-mentioned objects of my invention are attained by providing two approach track sections separated from each other by a crossing or "island" track section. Each approach track section has connected thereto one winding of an interlocking relay which serves as the track relay for that section. The windings of the interlocking relay are controlled by train movements in the respective approach sections, and by a relay serving as a repeater of a track relay connected to the "island" track section.

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

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

Referring to the drawing, the reference characters 10 and 10a designate the track rails of a stretch of railway track over which traffic moves in both directions, and which is intersected by a highway H. Located adjacent the intersection is a highway crossing signal S, which may be of any suitable type, but which is shown herein as an audible signal in the form of an electric bell. The track rails 10 and 10a are divided by means of the usual insulated rail joints 12 into relatively long sections D—E and F—G separated from each other by a relatively short section E—F. Sections D—E and F—G will generally be of such lengths as to provide users of the highway at the crossing with an adequate warning period upon the entrance of a train into the section. Section E—F will generally be of such length as to completely include the intersection.

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Section E—F is provided with a track circuit comprising a suitable source of current, such as a track battery 14, connected across the rails at one end of the section, and a track relay designated by the reference character TR, connected across the section at the other end. Relay TR is provided with a front contact 16 for controlling the operation of a repeater relay TPR having a first energizing circuit which may extend from positive terminal B of a suitable source of current such as a battery, not shown, over front contact 16 of relay TR, and through the winding of relay TPR to terminal N of the battery.

Section D—E is provided with a track circuit which may be traced from one terminal of track battery 14 of section D—E, through rail 10, wire 18, the winding W1 of an interlocking relay IR to be described, front contact 20 of relay TPR, wire 22, and rail 10a to the other terminal of battery 14.

Section F—G is provided with a track circuit which may extend from one terminal of track battery 14 of section F—G, through rail 10, wire 24, winding W2 of relay IR, front contact 26 of relay TPR, wire 28, and rail 10a to the other terminal of battery 14.

The interlocking relay IR, previously referred to, may be of any suitable type, such as, for example, the relay covered by Letters Patent of the United States, No. 1,799,629, granted to William K. Lockhart and Thomas J. O'Meara on April 7, 1931, for Interlocking Relays, and assigned to the assignee of the present application. This type of relay is well known and is characterized by the fact that when the left-hand winding W1 becomes deenergized, the downward movement of the armature associated with winding W1 operates a mechanical locking detent which prevents the armature associated with the right-hand winding W2 from dropping to its full released position; that is, the armature associated with winding W2 will be kept "locked up" in approximately its mid position, so that when winding W2 subsequently becomes deenergized during the time winding W1 is still deenergized, back contact 30 remains open. Similarly, if the right-hand winding W2 is the first to become deenergized, then back contact 31 of winding W1 is prevented from closing when winding W1 becomes deenergized during the interval that winding W2 remains deenergized. Relay IR is also provided with front contacts 32 and 34 associated with windings W1 and W2, respectively, which have what I shall term "flagman" adjustments. That is to say, each "flagman" contact remains closed when its associated armature is in its "locked up" position. However, each winding W1 and W2 when deenergized before the subsequent deenergization of the other winding operates to release all of its associated front and back contacts.

As will be explained hereinafter, the interlocking relay IR functions as directional means for preventing the operation of crossing signal S by winding W1 or W2 when section D—E or F—G becomes occupied by a train receding from the intersection.

Relay TPR is provided with a second energizing circuit which may extend from terminal B of the battery, through "flagman" contacts 32 and 34, respectively, of winding W1 and W2, wire 36, and the winding of relay TPR to terminal N of the battery.

Signal S is energized over a circuit passing from terminal B of the battery through three branch paths to wire 40, the operating element of signal S and to terminal N of the battery; the first path including contact 31 of winding W1 of relay IR, the second path including back contact 42 of track relay TR, and the third path including contact 30 of winding W2.

The apparatus, as shown in the accompanying drawing, is in its normal position when sections D—E, E—F, and F—G are unoccupied. In this condition, track relay TR

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is energized, repeater relay TPR is energized over both of its above-traced energizing circuits, and windings W1 and W2 of relay IR are energized. Signal S is deenergized.

I shall now assume that an eastbound train, that is, a train moving from left to right in the drawing, enters section D—E and shunts winding W1 of relay IR. Winding W1, therefore, becomes deenergized and releases contact 31 and "flagman" contact 32 to full released positions, thereby, respectively, establishing the above-traced first branch path for energizing the operating element of signal S, and interrupting the second named energizing circuit for repeater relay TPR. Signal S now becomes energized and exhibits its warning of the approach of the train to highway users.

When the train enters section E—F, relay TR is shunted and becomes deenergized to open front contact 16 and close back contact 42, the closing of contact 42 completing the above-traced second branch path for energizing the operating element of signal S, thereby causing signal S to continue to operate. The opening of contact 16 interrupts the first named energizing circuit for relay TPR. Consequently, relay TPR becomes deenergized. When this happens, contacts 20 and 26 of relay TPR both open. The opening of contact 20 of relay TPR at this time serves no useful purpose since winding W1 remains shunted by the portion of the train occupying section D—E. However, the opening of contact 26 of relay TPR interrupts the energizing circuit for winding W2 of relay IR so that winding W2 becomes deenergized and releases its contact 30 to its "locked up" position. It is to be noted that to complete the energizing circuit for winding W1, relay TPR must become energized and section D—E must again be unoccupied.

When the train vacates section EF, and completely clears highway H, relay TR picks up over its energizing circuit to close front contact 16 and to open back contact 42. The opening of back contact 42 of relay TR opens the second branch path in the energizing circuit for signal S, and the closing of front contact 16 completes the previously mentioned first energizing circuit for relay TPR so that relay TPR becomes energized. Front contacts 20 and 26 of relay TPR now close. The closing of contact 20 of relay TPR completes the previously traced circuit for winding W1 so that winding W1 becomes energized. Front "flagman" contact 32 of winding W1 now closes and back contact 31 opens. The closing of contact 32 of winding W1 completes the second named energizing circuit for relay TPR whereas the opening of back contact 31 opens the first branch path in the circuit for energizing signal S. Since contact 30 of winding W2 is "locked up" to keep open the third branch path for operating signal S, signal S now becomes deenergized and ceases to display its warning. Although contact 26 of relay TPR is now closed, winding W2 remains deenergized since section F—G is occupied as the train recedes from the intersection.

When the train vacates section F—G, winding W2 becomes energized, and the apparatus is returned to its normal condition.

The operation of the apparatus for a west-bound train is substantially similar to the operation just described for an eastbound train as will be readily apparent from an inspection of the drawing, and further description is believed unnecessary.

It should be noted that when one winding of the interlocking relay becomes deenergized to release its contacts to their full released position to complete a circuit for operating signal S, and, during the interval section E—F is occupied, relay TPR becomes deenergized and operates to prevent that winding of the interlocking relay from subsequently becoming energized. Simultaneously, relay TPR will operate to deenergize the other winding of the interlocking relay, thereby allowing the directional feature of the interlocking relay to be established. That is, when track section D—E is occupied by an eastbound train, winding W1 becomes deenergized and the contacts

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controlled by winding W1 release to their full released position. During the subsequent presence of the train in track section E—F, contact 20 controlled by relay TPR releases to prevent winding W1 from again becoming energized until the time that the train vacates track section E—F, so that the armature controlled by winding W2 is released to its "locked up" position prior to the armature controlled by winding W1 being picked up. Hence, the directional feature of the apparatus for trains moving in either direction over the crossing is insured.

It should further be pointed out that when the rails are accidentally shunted by a crawler type tractor or similar vehicle using the highway and moving over the crossing, relay TR will become deenergized. The closing of back contact 42 of relay TR will complete the second branch path for energizing signal S, thereby causing the signal to operate. The opening of front contact 16 of relay TR will open the above-traced first energizing circuit for relay TPR. However, relay TPR will be retained energized over its second pickup circuit including the series-connected "flagman" contacts controlled by windings W1 and W2 of interlocking relay IR. With relay TPR energized, and relay TR accidentally shunted and its contact 16 released, windings W1 and W2 will remain energized over their respective pickup circuits including contacts 20 and 26 of relay TPR. The simultaneous release of the armature controlled by windings W1 and W2, which might cause one side of interlocking relay IR to be "locked up" and thereby cause the approach section on that side to be insensitive to a train entering that approach section, is thus prevented. Thus, notwithstanding the presence of the vehicle in section E—F which bridges the rails, windings W1 and W2 of relay IR remain energized and in condition for detecting the presence of a train entering either section D—E or F—G. A train then entering either approach section prior to the time the tractor ceases to shunt the rails, will, depending upon the direction of traffic, cause either the first or second branch path for signal S which is already operating to be completed and will continue the operation of signal S to cause ample warning to be given to users of the highway. Subsequent to the time the tractor vacates the rails, a train entering section D—E or F—G in the direction of the crossing will cause operation of the signal in the manner described hereinabove so that sufficient time for warning the highway traffic is afforded. In all cases wherein a branch path for energizing signal S is completed, whether caused by unauthorized or accidental shunting of the rails by the crawler-type vehicle or by a train, users of the highway will reasonably assume that a train is near or approaching the crossing and will be warned not to pass over the track.

It should particularly be pointed out that as one advantage of my invention, relays TR and TPR embodied herein may be of the type known in the art as two-point relays, that is, a relay adapted for controlling only two contacts. Two-point relays are normally small in overall size, and the use of such relays as contemplated would reduce the space necessary for housing the relays, and thereby provide an arrangement which is relatively inexpensive. The use of a two-point relay for relay TR is also favorable to fast shunting time which is desirable on any "island" track circuit.

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 with a stretch of railway track divided into an intermediate track section separating first and second approach track sections leading toward a highway intersecting said intermediate section, a track relay for said intermediate section, a repeater relay, a

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first pickup circuit for said repeater relay including a front contact of said track relay, an interlocking relay comprising first and second windings, a second pickup circuit for said repeater relay controlled by said first and second windings, a track circuit for said first approach section including said first winding of said interlocking relay and a first front contact of said repeater relay, a track circuit for said second approach section including said second winding of said interlocking relay and a second front contact of said repeater relay, a signal at said intersection, and a circuit for energizing said signal including a contact controlled by said track relay and contacts controlled separately by said first and second windings of said interlocking relay.

2. In combination, a stretch of railway track divided into first and second approach sections separated from each other by an intermediate section intersected by a highway, a track relay, a track circuit for said intermediate section including said track relay, an interlocking relay comprising first and second windings, a repeater relay, a first energizing circuit for said repeater relay including a front contact controlled by said track relay, a second energizing circuit for said repeater relay including series-connected front contacts controlled by said first and second windings, a track circuit for said first approach section including said first winding of said interlocking relay and a first front contact controlled by said repeater relay, a track circuit for said second approach section including said second winding of said interlocking relay and a second front contact controlled by said repeater relay, a signal at said intersection, and means individually controlled by said first and second windings and by said track relay for controlling said signal.

3. In combination, a stretch of railway track divided into relatively long first and second track sections separated by a relatively short third track section intersected by a highway, a signal adjacent said intersection, a normally energized track relay for said third track section, a normally energized repeater relay energized over a first circuit including a front contact controlled by said track relay, an interlocking relay comprising first and second windings, a second circuit for energizing said repeater relay including series-connected front contacts controlled by said first and second windings of said interlocking relay, a track circuit for said first track section including said first winding of said interlocking relay and a first front contact controlled by said repeater relay, a track circuit for said second track section including said second winding of said interlocking relay and a second front contact controlled by said repeater relay, and means separately controlled by said windings and by said track relay for controlling said signal.

4. In a signal system provided for a stretch of railway track divided into two approach track sections separated from each other by an intermediate section intersected by a highway, a signal adjacent said intersection, a track relay, a track circuit for said intermediate section including said track relay, a repeater relay, a first circuit for energizing said repeater relay including means controlled by said track relay, an interlocking relay comprising first and second windings, a track relay for each of said approach track sections comprising said first and second windings of said interlocking relay, a pickup circuit for said first winding of said interlocking relay including first means controlled by said repeater relay, a pickup circuit for said second winding of said interlocking relay including second means controlled by said repeater relay, a second circuit for energizing said repeater relay in-

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cluding series-connected flagman contacts controlled by said first and second windings of said interlocking relay, and means controlled by said first and second windings and by said track relay for operating said signal.

5. In combination with a stretch of railway track divided into first and second approach track sections separated by a third track section intersected by a highway, a signal at said intersection, a track circuit for said third section including a track relay, a repeater relay having a first pickup circuit including a front contact controlled by said track relay, an interlocking relay comprising first and second windings, a second pickup circuit for said repeater relay including series-connected flagman contacts controlled by said windings of said interlocking relay, said first winding of said interlocking relay connected to said first approach track section through a first contact controlled by said repeater relay, said second winding of said interlocking relay connected to said second approach track section through a second front contact controlled by said repeater relay, whereby when only said third track section is occupied said first and second windings of said interlocking relay both remain energized, and means controlled by said first and second windings of said interlocking relay and by said track relay for controlling said signal.

6. In combination, a stretch of railway track intersected by a highway and divided into three successive track sections the middle one of which separates the outer track sections and includes the intersection, a highway crossing signal at said intersection, an interlocking relay comprising first and second windings each serving as a track relay connected to one of said outer track sections, a track circuit for said middle track section including a track relay, a repeater relay having parallel pickup circuits including respectively a front contact controlled by said track relay and series-connected front contacts controlled by said first and second windings of said interlocking relay, a track circuit for each of said outer track sections including the winding of said interlocking relay connected to the outer track section and a contact controlled by said repeater relay, and means separately controlled by each of said windings and by said track relay controlling the operation of said signal.

7. In a highway crossing control system for a stretch of track divided into first, second, and third successive track sections, a highway intersecting said second track section and a signal at said intersection, circuit means for detecting the occupancy of said second track section by a railway vehicle, repeater means, a first energizing circuit for said repeater means when said second track section is unoccupied including means controlled by said circuit means, an interlocking relay having first and second windings, a track circuit for said first track section including said first winding of said interlocking relay and first means controlled by said repeater means, a track circuit for said third track section including said second winding of said interlocking relay and second means controlled by said repeater means, a second energizing circuit for said repeater means including means controlled by said first and second windings of said interlocking relay, and means controlled by said first winding, said second winding, and said train responsive means individually effective for controlling said signal.

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