

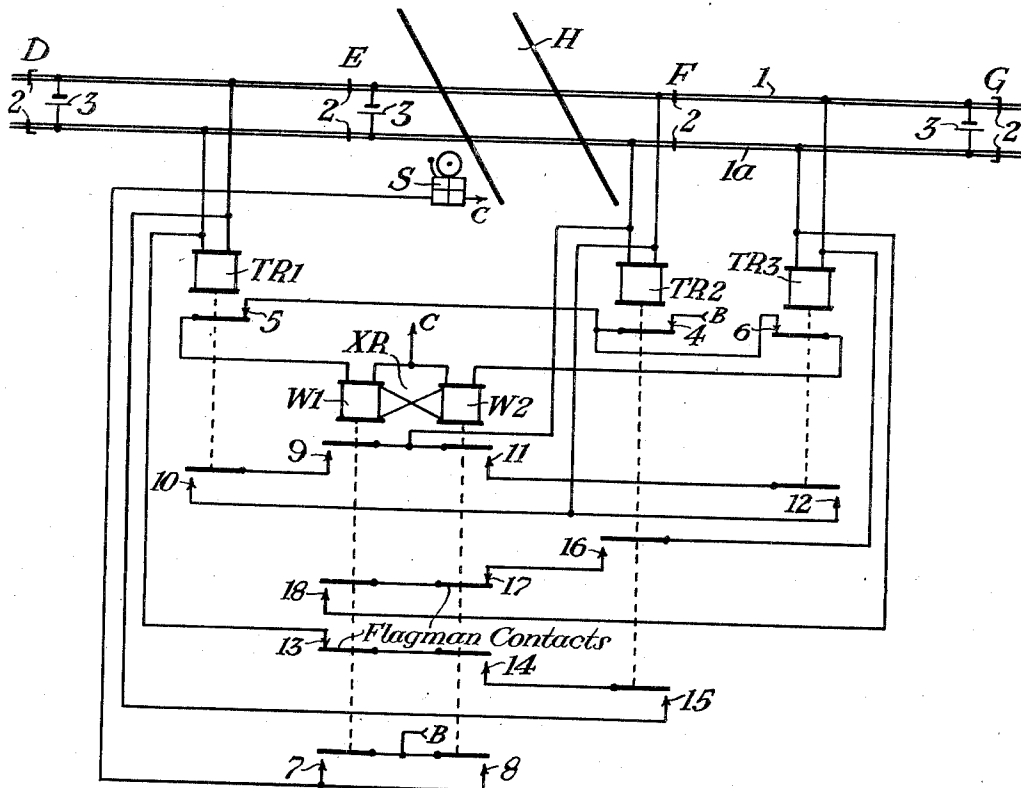
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APPARATUS FOR THE CONTROL OF HIGHWAY CROSSING SIGNALS

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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 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.

An object of my invention is the provision, in apparatus of the character described, of novel and improved means for operating highway crossing signals until trains completely clear the intersection. Other objects and advantages of my invention will appear as the specification progresses.

My invention relates to improvements in apparatus for controlling highway crossing signals of the type described and claimed in an application for Letters Patent Serial No. 220,693 filed on July 22, 1938, by Paul H. Crago.

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 showing a preferred form of apparatus embodying my invention.

Referring to the drawing, the reference characters 1 and 1a designate the track rails of a stretch of railway track over which traffic moves in both directions. Rails 1 and 1a are divided by means of the usual insulated track joints 2 into relatively long operating sections D—E and F—G which are separated from each other by a relatively short positive operating section E—F. Section E—F is intersected by a highway H; and located adjacent the intersection is a highway crossing signal S, which may be any one of the well-known forms but which, as here shown, is an audible signal in the form of an electric bell. Sections D—E and F—G usually will be of such length that an adequate warning period for highway users of the approach of a train to the highway is provided. Section E—F usually will be of such length as to completely include the highway intersection.

Sections D—E, E—F and F—G are provided with track circuits comprising in each instance a suitable source of current, such as track battery 3, connected across the track rails at one end of the section and a track relay, designated by the reference characters TR1, TR2 or TR3, respectively, connected across the track rails at the other end.

The reference character XR designates an interlocking relay which may be of any suitable type such as, for example, the relay shown in United States Letters Patent No. 1,799,629 granted

to W. K. Lockhart and T. J. O'Meara on April 7, 1931. This type of relay is well-known and is characterized by the fact that when the left-hand winding W1 is deenergized, the downward movement of the armature associated therewith operates a mechanical locking device which keeps the armature associated with the right-hand winding W2 "locked up" in approximately its mid position, so that a subsequent deenergization of winding W2 while winding W1 is still deenergized cannot close back contacts 8, 11 and 14. Similarly, if right-hand winding W2 is first to become deenergized, then back contacts 7, 9 and 18 are prevented from closing when left-hand winding W1 becomes deenergized during the interval that winding W2 is still deenergized. Relay XR is also provided with front contacts 13 and 17 associated with windings W1 and W2, respectively, which have what I shall term "flagman" adjustment. That is to say, these contacts remain closed when the associated armature is in its "locked-up" position. Winding W1 of relay XR is energized over a circuit passing from one terminal B of a suitable source of current, such as a battery not shown, through front contact 4 of relay TR2, front contact 5 of relay TR1 and winding W1 of relay XR to the other terminal C of the source of current. Winding W2 is energized over a circuit passing from terminal B through front contact 4 of relay TR2, front contact 6 of relay TR3 and winding W2 of relay XR to terminal C. It can be seen that winding W1 or W2, as the case may be, will be deenergized when its associated track relay TR1 or TR3 is released, and that both windings W1 and W2 will be deenergized when relay TR2 is released.

Relay XR, as will be pointed out in detail hereinafter, functions as a directional operating means for signal S, providing operation of the highway crossing signal S when a train approaches the intersection and preventing operation of the signal when the train recedes from the intersection. Signal S is provided with an operating circuit passing from terminal B through back contact 1 of winding W1 or back contact 8 of winding W2, and the winding of signal S to terminal C. Relay XR also cooperates, in a manner to be pointed out in detail hereinafter, with track relay TR1 or TR3 associated with the track section first entered by a train approaching the intersection, for releasing relay TR2 and the other track relay TR1 or TR3, as the case may be, associated with the track section on the receding side of the intersection.

The apparatus is in its normal condition, as shown in the drawing, when sections D—E, E—F and F—G are unoccupied. In this condition of the apparatus, track relays TR1, TR2 and TR3 are energized, windings W1 and W2 of relay XR are likewise energized, and 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 establishes a train shunt in that section so that relay TR1 releases. The release of relay TR1 opens front contact 5 and closes back contact 10, the opening of front contact 5 opening the circuit for winding W1 so that W1 releases to establish at its back contact 7 the energizing circuit for signal S. Signal S now becomes energized and exhibits its warning to highway users of the approach of the train to the intersection. Winding W1 in releasing also closes its back contacts 9 and 18. Back contact 9 of winding W1 is interposed in a shunt path (which may be traced from the left-hand terminal of relay TR2 through back contact 9 of winding W1 and back contact 10 of relay TR1 to the right-hand terminal of relay TR2) provided around the winding of relay TR2, whereupon that relay releases. The release of relay TR2 opens front contact 4 to open the energizing circuits for both windings W1 and W2 with the result that winding W2 releases to its "locked-up" position. Relay TR2 also closes its back contact 16 whereupon a shunt path, which may be traced from the right-hand terminal of relay TR3 through back contact 16 of relay TR2, front "flagman" contact 17 of winding W2 (which contact is held closed by virtue of the interlocking mechanism of relay XR), and back contact 18 of winding W1 to the left-hand terminal of relay TR3, is completed with the result that the winding of relay TR3 is shunted so that relay TR3 also releases and opens its front contact 6 interposed in the energizing circuit for winding W2. It is readily apparent from the foregoing that when an eastbound train enters section D—E, relay TR1 releases to effect the release of winding W1 and thereby initiate the operation of signal S. The release of relay TR1 and winding W1 establishes a shunt path around the winding of relay TR2, whereupon that relay releases to open the circuit for winding W2 so that winding W2 is released to its "locked-up" position, and relay TR2 also cooperates with winding W1 to establish a shunt path around the winding of relay TR3 whereby that relay also is released. It follows, therefore, that when an eastbound train enters section D—E, relay TR1 and winding W1 are released to initiate the operation of signal S and to effect the release of relays TR2, TR3 and winding W2.

When the train enters track section E—F, the wheels and axles of the train shunt the track rails of that section, but this action serves no useful purpose at this time since, as was pointed out heretofore, track relay TR2 is released by the entrance of the train upon section D—E.

When the train vacates section D—E, relay TR1 picks up to close front contact 5 and to open back contact 10. Front contact 5 now prepares the circuit for winding W1, but that winding is retained released since its energizing circuit is open at front contact 4 of relay TR2. Back contact 10 of relay TR1 opens the shunt path provided around the winding of relay TR2, that relay being retained released by the shunt provided across rails 1 and 1a of section E—F by the wheels and axles of the train. The reason for

providing a shunt path, governed by relay TR1, around the winding of relay TR2 will now become apparent, since this shunt path effects the release of relay TR2 prior to the train entering section E—F. It is readily apparent, therefore, that since relay TR2 is released prior to the entrance of the train on section E—F, the train need not create the low resistance shunt to the rails of section E—F necessary to effect the release of track relay TR2, but need create only sufficient shunting to prevent the pick-up of that relay.

When the train enters track section F—G the wheels and axles of the train shunt the rails 1 and 1a of that section, but at this time no useful purpose is served, the relay TR3 having been released in response to the release of relay TR2 and winding W1.

When the train vacates section E—F and completely clears highway H, relay TR2 picks up to close front contact 4 and to open back contact 16. The closing of front contact 4 completes the circuit for winding W1 so that winding W1 becomes energized to open back contacts 9, 18 and 7, the opening of the last-mentioned contact opening the operating circuit for signal S with the result that operation of signal S is terminated. The opening of back contact 16 of relay TR2 (and in like manner the opening of back contact 18 of winding W1 also) opens the shunt path provided around the winding of relay TR3, but that relay is retained deenergized by virtue of the train shunt in section F—G. The reason for providing the shunt path around winding of relay TR3 will now become apparent, since the release of relay TR3 resulting from the release of relay TR2 and winding W1 when the train enters section D—E, insures that the energizing circuit for winding W2 will be open when front contact 4 of relay TR2 closes to complete the energizing circuit for winding W1. It follows that loss of directional control is avoided in the event a train such as a light engine passes rapidly from section E—F to section F—G, since winding W1 cannot become reenergized prior to winding W2 becoming deenergized. It can be seen that apparatus embodying my invention establishes directional control for signal S when the train first enters the operating section D—E in approaching the intersection, and that false operation of the signal due to a loss of directional control is prevented.

When the train vacates section F—G, relay TR3 becomes energized to close front contact 6, thereby completing the energizing circuit for winding W2. The apparatus is now restored to its normal condition.

The operation of the apparatus embodying my invention for a westbound train is similar to the operation just described for an eastbound train. That is to say, the entrance of a westbound train upon section F—G shunts relay TR3 so that relay TR3 releases to open front contact 6 and thereby open the energizing circuit for winding W2, whereupon winding W2 releases to close back contact 8, thus establishing the energizing circuit for signal S. Winding W2 also closes its back contact 11 to thereby complete a shunt path around the winding of relay TR2, and which path may be traced from the left-hand terminal of relay TR2 through back contact 11 of winding W1 and back contact 12 of relay TR3 to the right-hand terminal of relay TR2. With the winding of relay TR2 shunted, relay TR2 releases to open front contact 4 and thereby open both energizing circuits for wind-

ings W1 and W2, whereupon winding W1 releases to its "locked-up" position. With relay TR2 and winding W2 both released, a shunt path which may be traced from the left-hand terminal of relay TR1 through front "flagman" contact 13 of winding W1, back contact 14 of winding W2 and back contact 15 of relay TR2 to the right-hand terminal of relay TR1, is completed with the result that relay TR1 is shunted and releases to open its front contact 5 interposed in the energizing circuit for winding W1. It follows that when a westbound train enters section F—G, relay TR3 and winding W2 are released to initiate the operation of signal S, and relays TR2 and TR1 are released so that winding W1 also releases and is engaged by the interlocking feature of relay XR.

The entrance of the westbound train on section E—F establishes the train shunt across the track rails of that section, but until such time as the train vacates section F—G and relay TR3 picks up, this train shunt serves no useful purpose since relay TR2 is held released by virtue of the shunt path established around its winding by relay TR3. When, however, relay TR3 picks up and opens its back contact 12 to remove the previously mentioned shunt path around relay TR2, that relay is held released by virtue of the train shunt in section E—F. With relay TR2 released, the energizing circuits for windings W1 and W2 are held open at its front contact 4, so that both windings of relay XR are deenergized, and the shunt path around the winding of relay TR1 is held closed. This shunt path holds relay TR1 released when the train enters section E—F and establishes the train shunt in that section, thereby insuring that when the train vacates section E—F and relay TR2 picks up, relay TR1 will have been released to open the circuit for winding W1 prior to winding W2 picking up to release the interlocking feature of relay XR and also terminate the operation of signal S. Then, when the westbound train vacates section D—E, relay TR1 picks up to complete the circuit for winding W1, whereupon that winding becomes energized to restore the apparatus to its normal condition.

It should be noted that the shunt paths whereby relays TR1 and TR3 are released prior to the entrance of the train on their associated track sections, each includes a back contact of relay TR2 and a back and a "flagman" contact of different windings of relay XR. It is readily apparent that when one relay TR1 or TR3 releases to effect the release of winding W1 or W2, respectively, to its full down position, the other relay TR1 or TR3, as the case may be, is also released, but that in the event relay TR2 is released while both relays TR1 and TR3 are picked up, to thereby simultaneously release both windings of relay XR to their full released position, both "flagman" contacts interposed in the shunt paths previously mentioned are opened to prevent the completion of those shunt paths. It follows that an accidental release of relay TR2 and consequent releasing of both windings of relay XR to their full released position will not result in the release of relays TR1 and TR3, so that when the conditions causing the release of relay TR2 are removed, the apparatus will be restored to its normal condition.

Although I have herein shown and described only one form of apparatus embodying my invention, it is understood that various changes and modifications may be made therein within

the scope of the appended claims without departing from the spirit and scope of my invention.

Having thus described my invention, what I claim is:

1. In combination, a stretch of railway track divided into a first section and a third section separated from each other by a second section intersected by a highway, a highway crossing signal located at such intersection, a first and a second and a third track relay for said first and said second and said third section respectively, an interlocking relay having a first winding and a second winding, operating circuit means for operating said signal governed by said first winding or said second winding and operative according as said first winding or said second winding is first deenergized, energizing circuit means for said first winding governed jointly by said first track relay and said second track relay, energizing circuit means for said second winding governed jointly by said third track relay and said second track relay, and circuit means governed by said first track relay or said third track relay and operative according as a train approaching the highway first enters said first section or said third section for providing a shunt path around said second track relay and the other one of said first and third track relays.

2. In combination, a stretch of railway track divided into a first section and a third section separated from each other by a second section intersected by a highway, a highway crossing signal located at such intersection, a first track relay for said first track section, a second track relay for said second track section, a third track relay for said third track section, operating means governed by said first or said third track relay and operative according as said first or said third section is first entered by a train approaching the intersection for operating said signal, other means governed by said first or said third track relay and operative according as said first or said third section is first entered by the train for establishing a shunt path around said second track relay and the other one of said first and said third track relays whereby the latter relays are released prior to the entrance of a train on their associated sections, and circuit means governed by said second track relay for controlling said operating means to operate the signal until the train clears the intersection.

3. In combination, a stretch of railway track divided into a first section and a third section separated from each other by a second section intersected by a highway, a highway crossing signal located at such intersection, a first track relay associated with said first section, a second track relay associated with said second section, a third track relay associated with said third section, an interlocking relay having a first winding and a second winding, operating circuit means for operating said signal governed by said first winding or said second winding, energizing circuit means for said first winding governed jointly by said first track relay and said second track relay, energizing circuit means for said second winding governed jointly by said third track relay and said second track relay, circuit means for releasing said second track relay governed by said first winding or said second winding, and circuit means for releasing said first track relay or said third track relay governed respectively by said second winding or said first winding and each including a flagman

contact of the other winding whereby the release of said second track relay while both said first and third track relays are picked up is ineffective to effect the release of said first and said third track relays.

5 4. In combination, a stretch of railway track divided into a first section and a third section separated from each other by a second section intersected by a highway, a highway crossing
10 signal located at such intersection, a first and second and third track relay for said first and second and third section respectively, an interlocking relay having a first winding and a second winding, circuit means for operating said signal governed by said first winding or said second
15 winding, circuit means for energizing said first winding governed jointly by said first and second track relays, circuit means for energizing said second winding governed jointly by said third and second track relays, circuit means for releasing said second track relay prior to the entrance of a train on its associated section governed by said first track relay together with said
20 first winding and by said third track relay together with said second winding, and circuit means for releasing said first or third track relay prior to the entrance of the train on its associated section governed by said second track relay together with said first and second windings,
25 said last mentioned circuit means including flagman contacts of said first and second windings whereby the release of said second track relay while both said first and second track relays are picked up is ineffective to effect the release of
30 said first and third track relays.
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5. In combination, a stretch of railway track divided into a first section and a third section separated from each other by a second section intersected by a highway, a highway crossing signal located at such intersection, a first and second and third track relay for said first and second and third section respectively, an interlocking relay having a first winding and a second winding, circuit means for operating said
10 signal including a back contact of said first or second winding, circuit means for energizing said first winding governed by said first and second track relays, circuit means for energizing said second winding governed by said third and second track relays, a shunt path around the winding of said second relay for effecting the release of that relay prior to the entrance of a train on its associated section and serially including back contacts of said first track relay and said first winding or back contacts of said
20 third track relay and said second winding; and shunt paths around the windings of said first and third track relays for effecting the release of said first or third track relay prior to the entrance of the train on its associated track
25 circuit, the shunt path around the winding of said first track relay serially including back contacts of said second track relay and said second winding and a flagman contact of said first winding, and the shunt path around the winding of said third track relay serially including back contacts of said second track relay and said first winding and a flagman contact of said
30 second winding.

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