

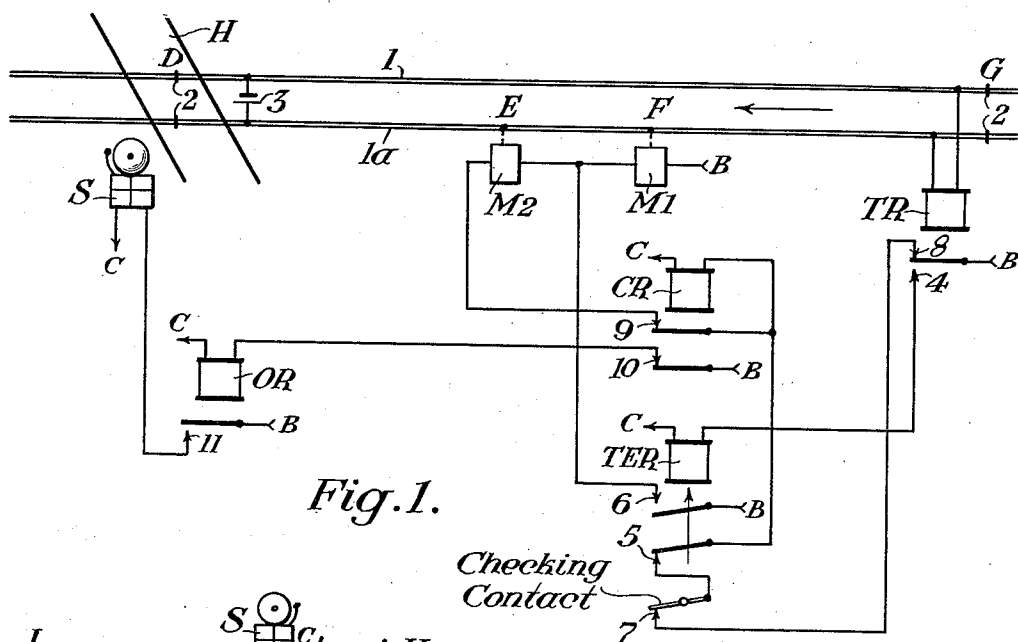
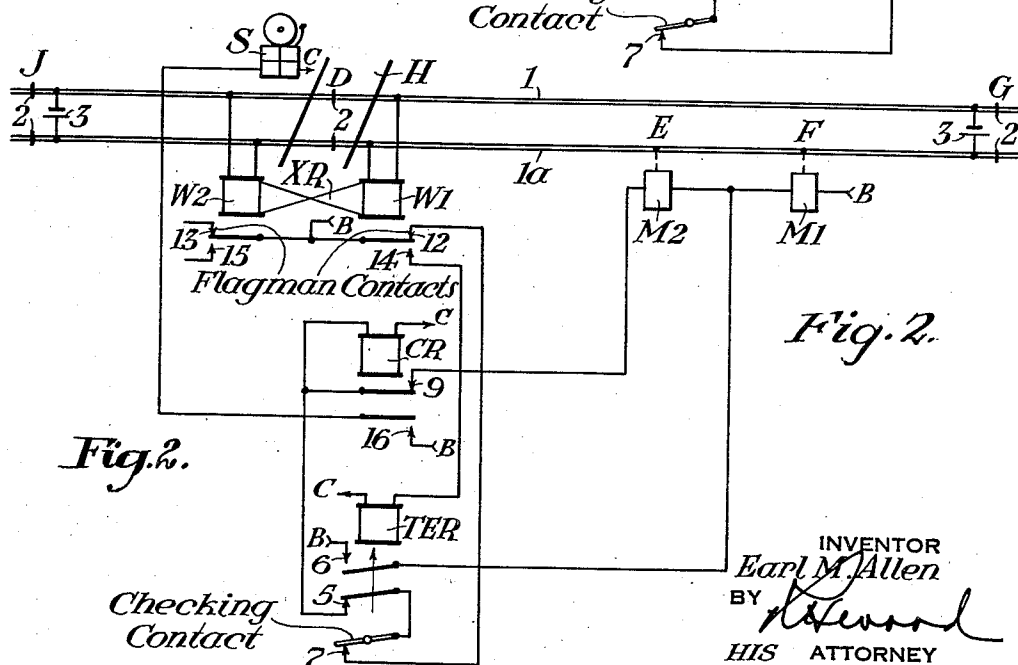
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APPARATUS FOR THE CONTROL OF HIGHWAY CROSSING SIGNALS

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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 has for an object the provision of novel and improved means governed by a train approaching the intersection for starting the operation of the signal in accordance with the speed of the train. Other objects and advantages of my invention will appear as the specification progresses.

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. Fig. 2 is a diagrammatic view showing a modified form of the apparatus of Fig. 1, and also embodying my invention.

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

Referring to Fig. 1, the reference characters 1 and 1a designate the track rails of a stretch of railway over which traffic normally moves in a direction indicated by an arrow, and which is intersected at grade by a highway H. A highway crossing signal S is located at the intersection. Signal S may be any one of the usual and well-known forms of highway crossing signals, and as here shown is an audible signal in the form of an electric bell.

The track rails 1 and 1a are divided by means of the usual insulated track joints 2 to form a single track section D—G which is provided with a track circuit comprising 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 TR connected across the rails at the other end. Track section D—G is preferably arranged for its exit end D to be adjacent highway H.

Two track instruments M1 and M2 are located at selected points spaced apart along the single track section D—G. These track instruments are preferably alike, and are preferably of the type having a normally closed contact which is operated to an open position in response to actuation by a passing train. A preferred form that track instruments M1 and M2 may take is that covered in United States Letters Patent No. 1,834,077, issued on December 1, 1931, to A. J. Sorensen.

Track instrument M2 is located at a location E, which location is a distance from highway H sufficient to provide a predetermined minimum operating period, at least, for signal S prior to the arrival of a train at the intersection when the train is operating at a speed not exceeding a cer-

tain prescribed speed, operation of the signal being initiated when the train reaches location E. In order to more clearly understand the apparatus embodying my invention, I shall assume location E is located in the rear of highway H a distance sufficient to provide 15 seconds operation of the signal S prior to the arrival of a train at the intersection when a train is moving at a speed of slightly less than 60 miles per hour, the operation of the signal being, as stated above, initiated when the train reaches location E. Hence, under these conditions, the distance D—E is substantially 1300 feet in length, since a train traveling at a speed of, say, 59 miles per hour will advance approximately 1300 feet in 15 seconds.

Track instrument M1 is located at a location F in the rear of location E. Location F is a distance from highway H sufficient to provide a predetermined period of operation of signal S prior to arrival of a train at the intersection when the train is operating at the maximum speed for all trains, operation of signal S being initiated when the train reaches location F. In order to agree with the train speeds assumed above, I shall assume a maximum operating speed of all trains to be 80 miles per hour, and that the predetermined operating period for signal S for such maximum speed is preferably 15 seconds. Hence, under these conditions, distance D—F is approximately 1760 feet in length, since a train operating at 80 miles per hour will advance approximately 1760 feet in 15 seconds.

A normally deenergized time element device, designated by the reference character TER, is provided to determine the speed of trains approaching the intersection and to permit track instrument M1 to operate signal S when a train is traveling at a speed above the previously assumed prescribed speed of 60 miles per hour, and to delay the starting of the operation of signal S until the train reaches track instrument M2 when the train is traveling at a speed less than such prescribed speed. As here shown, the time element device TER is a direct current slow pick-up relay which is provided with an energizing circuit passing from terminal B of a suitable source of current, such as a battery not shown, through back contact 4 of track relay TR and the winding of relay TER to terminal C of the source of current.

The pick-up period for relay TER may be any desired interval. However, as hereinbefore mentioned, since track instrument M1 initiates the operation of signal S for a train operating at a speed exceeding 60 miles per hour, relay TER cannot have a pick-up period shorter than the time re-

quired for a train to traverse the distance F—G, or the distance a train travels on section D—G prior to arriving at location F. In order to more clearly understand the apparatus embodying my invention, I shall assume that distance F—G is substantially 2600 feet in length, so that a train operating at the prescribed speed of 60 miles per hour requires approximately 30 seconds to traverse the distance. It follows that the pick-up period for relay TER will be 30 seconds. Relay TER is provided with a front contact 6 and a back contact 5, which contacts close and open, respectively, at the expiration of the delay period of the relay. A checking contact 7 which opens immediately upon energization of relay TER is also provided. Back contact 5 and checking contact 7 close, and front contact 6 opens, immediately upon de-energization of relay TER.

The reference character CR designates a normally energized control relay provided with a pick-up circuit which may be traced from terminal B through front contact 8 of relay TR, checking contact 7 of relay TER, back contact 5 of relay TER, and the winding of relay CR to terminal C; and with a stick circuit having two branch paths, one path of which may be traced from terminal B through track instrument M1, track instrument M2, front contact 9 of relay CR and the winding of relay CR to terminal C; and the other path of which may be traced from terminal B through front contact 6 of relay TER, track instrument M2, front contact 9 of relay CR and the winding of relay CR to terminal C.

The reference character OR designates a normally energized operating relay which is energized by virtue of a simple circuit including front contact 10 of relay CR.

Signal S is provided with a simple operating circuit including back contact 11 of relay OR.

In the normal condition of the apparatus as shown in the drawing, track section D—G is unoccupied; relays TR, CR and OR are energized; and time element device TER and signal S are deenergized.

In explaining the operation of the apparatus embodying my invention, I shall first assume a train approaches highway H, in the direction of normal traffic, at a speed of 70 miles an hour, that is, above the assumed prescribed speed of 60 miles per hour. When the train enters track section D—G, relay TR releases to open front contact 8 and thereby open the pick-up circuit for relay CR, and to close back contact 4 to complete the energizing circuit for relay TER. Since a train traveling at 70 miles per hour advances 2600 feet in approximately 26 seconds, the train will reach location F and actuate track instrument M1 prior to relay TER picking up at the end of its 30 second pick-up period. The actuation of track instrument M1 interrupts the stick circuit for relay CR so that relay CR becomes released to open front contacts 9 and 10, the latter contact opening the energizing circuit for relay OR and thereby permitting relay OR to close back contact 11 to initiate the operation of signal S. Since the stick circuit for relay CR is open at front contact 9, the closing of front contact 8 of relay TER at the expiration of the slow pick-up period for relay TER, and the actuation of track instrument M2 when the train reaches location E, does not affect the operation of the signal for a train operating above the prescribed speed of 60 miles an hour.

When the train vacates track section D—G and clears the highway, relay TR becomes reenergized, relay TER becomes deenergized, and the pick-up

circuit for relay CR is again completed so that relay CR picks up to reenergize relay OR, relay OR picking up and stopping the operation of signal S. It should be noted that the pick-up circuit for relay CR cannot be completed unless contacts 5 and 7 of relay TER are closed. It is to be seen, therefore, that these contacts serve to check the normal position of relay TER.

I shall now assume that a train approaches highway H in the direction of normal traffic at a speed of 50 miles per hour, that is, it is operating below the prescribed speed of 60 miles per hour. The entrance of the train on section D—G releases track relay TR, thereby opening the pick-up circuit for relay CR and closing the energizing circuit for relay TER. Since the train operating at 50 miles per hour requires approximately 36 seconds to traverse the distance F—G, relay TER will pick up at the end of its 30 seconds pick-up period and close front contact 6 prior to the train arriving at location F. When the train reaches location F and actuates track instrument M1, relay CR is held energized by virtue of its stick circuit including front contact 6 of relay TER and track instrument M2. Then, when the train reaches track instrument M2, the actuation of that instrument interrupts the stick circuit for relay CR so that relay CR releases to interrupt the energizing circuit for relay OR, which then releases and initiates the operation of signal S.

When the train clears the highway and vacates track section D—G, relay TR picks up, relay TER releases, and relays CR and OR pick up to terminate the operation of signal S.

While herein described, specific values have been assumed for distances D—E, E—F and F—G, and for the pick-up period for time element device TER, it is to be understood that such values are for the purpose of illustration only and the apparatus can be proportioned and adjusted, within limits, of course, to best suit the specific conditions of the location at which the apparatus is installed.

In Fig. 2, the apparatus of Fig. 1 is modified to provide directional control of the highway crossing signal, whereby a train operating in either direction over the track rails 1 and 1a will operate the signal when approaching the intersection.

Referring to Fig. 2, the apparatus of Fig. 1 is modified by substituting one winding W1 of an interlocking relay XR for the track relay TR of Fig. 1, the other winding W2 of relay XR being connected across the track rails 1 and 1a of a track section D—J, which is provided on the opposite side of the intersection from section D—E by insulating the track rails 1 and 1a in the usual manner. The section D—J is provided with a track circuit comprising a track battery 3 connected across the rails 1 and 1a at one end of the section, winding W2 being connected across the rails 1 and 1a at the other end of the section.

The interlocking relay XR may be of any suitable type, such as, for example, that type covered by 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 right-hand winding W1 is deenergized, the downward movement of the armature associated therewith to its full-released position operates a mechanical locking device which keeps the armature associated with the left-hand winding W2 "locked up" in approximately its mid-position, with the result that the deenergization of winding W2 prior to the reenergization of winding W1 is in-

effective to release the armature of winding W2 to its full-released position. Similarly, if the left-hand winding W2 is first to be deenergized, the subsequent deenergization of winding W1 is ineffective to release its armature to the full-released position, the armature being retained in a "locked up" position. Relay XR is provided with front "flagman" contacts 12 and 13, associated with windings W1 and W2, respectively, each characterized by the fact that the contact is opened only when its associated armature is released to its full-released position, the contact being held closed in the "locked up" as well as in the picked-up position of the armature. Back contacts 14 and 15, associated with windings W1 and W2, respectively, are each characterized by the fact that the contact is closed only in the full-released position of its associated armature.

For westbound traffic, that is, for traffic operating from right to left in Fig. 2, winding W1 cooperates with relay TER and track instruments M1 and M2 to control the control relay CR, and thereby govern signal S over back contact 16 of relay CR. For eastbound traffic, winding W2 may be employed to cooperate with a second time element relay and two track instruments provided for section D—J, to control a second control relay and thereby govern signal S over a back contact of the second control relay. The second time element relay, the second control relay, and the two track instruments for section D—J are not shown in Fig. 2 for the sake of simplicity, it being understood that the circuits controlling each element will be substantially similar to the circuits controlling the corresponding elements TER, CR, and instruments M1 and M2 of Fig. 2.

The operation of the apparatus of Fig. 2 in governing signal S is similar to the operation described in detail in connection with Fig. 1, as may readily be understood by an inspection of Fig. 2, and it is believed, therefore, that this latter operation will be apparent from the foregoing description without further detailed description, except to point out that whenever winding W1 or W2 as the case may be, is deenergized by a train receding from the intersection through its associated section, that winding is prevented from governing its associated control relay by virtue of the interlocking feature of relay XR, with the result that operation of the signal is effected over a back contact of one of the control relays only when a train approaches the intersection. It should be noted that when the train recedes from the intersection, the actuation of the track instruments associated with the track section on the receding side of the intersection does not affect the operation of signal S, since the control relay for that section is held energized over a front "flagman" contact of winding W1 or W2.

One advantage of apparatus embodying my invention is the provision of means for initiating the operation of a highway crossing signal in accordance with the speed of a train approaching the intersection, whereby a minimum operating period is assured for a fast moving train, and an undesirably long operating period is not effected by a slow moving train.

Although I have herein shown and described only two 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 stretch of railway track intersected by a highway and provided with an insulated track section to one side of said intersection, a highway crossing signal located at said intersection, a track circuit for said track section including a track relay, two track instruments located one each at spaced points along said track section, a control relay, a pick-up circuit for said control relay including a front contact of said track relay, a stick circuit for said control relay governed by each of said two track instruments, operating means controlled by said control relay for operating said signal, a normally deenergized time element device, an energizing circuit for said time element device including a back contact of said track relay, and means governed by said time element device for at times rendering the track instrument more remote from the intersection ineffective to govern said stick circuit for said control relay.

2. In combination, a section of railway track intersected by a highway and provided with a track circuit including a track relay, a highway crossing signal located at said intersection, a first track instrument located at a selected point along said section, a second track instrument located along said section intermediate said intersection and said first track instrument, a control relay, a pick-up circuit for said control relay including a front contact of said track relay, a first stick circuit for said control relay including a normally closed contact of each of said first and said second track instruments, a normally inactive time element device, means including a back contact of said track relay to render said time element device active, a second stick circuit for said control relay including a contact of said time element device closed in a predetermined time interval and also including the normally closed contact of said second track instrument, and operating means governed by said control relay for operating said signal.

3. In combination, a stretch of railway track intersected by a highway and provided with a single insulated track section located with its exit end adjacent the highway, a highway crossing signal located at said intersection, a track circuit including a track relay for said track section, a time element device having a normal position and an operated position and provided with a contact closed only in the operated position of said device, circuit means governed by said track relay for controlling said time element device from its normal position to its operated position, two track instruments located spaced apart along said section, a control relay normally energized over a stick circuit controlled by each of said two track instruments, a pick-up circuit for said control relay controlled by said track relay, circuit means governed by the contact of said time element device effective at times to render the track instrument more remote from the intersection ineffective to control the stick circuit of said control relay, and means controlled by said control relay for causing said signal to operate.

4. In combination, a stretch of railway track intersected by a highway and provided with a single insulated track section located with its exit end adjacent said highway, a highway crossing signal located at said intersection, a track circuit including a track relay for said track section, a time element device having a normal position and an operated position, said device being provided with a checking contact closed only in the normal position of said device, said device also being pro-

vided with a time contact closed only in the operated position of said device, circuit means governed by said track relay effective to control said device from its normal to its operated position, 5 two track instruments located spaced apart along said section, a control relay normally energized over a stick circuit controlled by each of said two track instruments, a pick-up circuit for said control relay controlled by said track relay and by

the checking contact of said time element device, circuit means controlled by the time contact of said element device effective at times to render the track instrument more remote from the intersection ineffective to control the stick circuit of said control relay, and means controlled by said 5 control relay for causing said signal to operate.

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