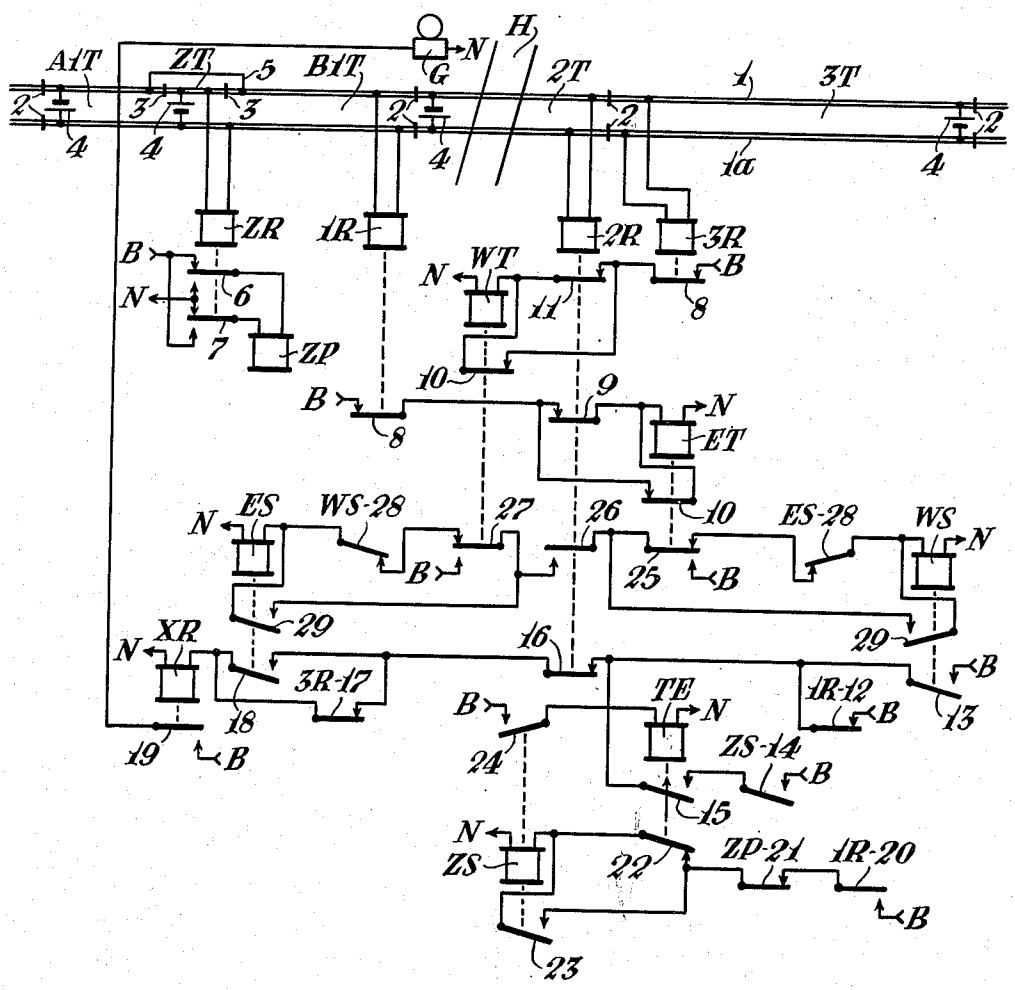
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APPARATUS FOR CONTROLLING HIGHWAY CROSSING SIGNALS

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APPARATUS FOR CONTROLLING HIGHWAY CROSSING SIGNALS

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My invention relates to apparatus for controlling highway crossing signals, and particularly to apparatus for interrupting the operation of a highway crossing signal when a train stops on a control track section for the highway crossing signal, and for then again starting operation of the signal when the train resumes its movement toward the highway crossing.

In order to avoid unnecessarily delaying the users of a highway at the intersection of a railway with the highway, it is important that the operation of a highway crossing signal shall be interrupted if a train stops on a control track section for the highway crossing signal. It is also very desirable to prevent useless operation of a highway crossing signal in order to maintain the respect of users of a highway for the indication given by a highway crossing signal. If a highway crossing signal is operated when it should not be operated, users of a highway may become accustomed to disregarding its indication, and may then sometimes be mistaken and disregard its indication when such action is dangerous.

One feature of my invention is the provision of means for interrupting the operation of a highway crossing signal if a train approaching a highway crossing stops on a control track section for the signal.

Another feature of my invention is the provision of means for again starting the operation of a highway crossing signal when a train resumes its movement toward a highway crossing after having stopped on a control track section for the highway crossing signal.

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 one form of apparatus embodying my invention, in which a railway track which intersects a highway is divided to form a crossing section at the highway, and two approach control sections one adjacent each end of the crossing section; in which one rail of an intermediate portion of a given one of the approach sections is divided to form an intermediate section; in which operation of a highway crossing signal is started when a train approaches the intersection over either of the approach control sections; in which operation of the crossing signal is interrupted if a train approaching the intersection stops on the given approach control section; and in which operation of the highway crossing signal is then resumed when the train moves over the intermediate section.

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Similar reference characters refer to similar parts in the drawing.

In the drawing, the contacts operated by the various relays are identified by numbers, each such number having a distinguishing prefix from which it is separated by a dash when the associated contact is shown apart from the relay by which it is operated. The prefix for each of these contact numbers comprises the reference character for the respective relay by which the associated contact is operated. For example, contact IR–20, shown in the lower right-hand portion of the drawing in the circuits for relay ZS, is identified by the number 20 separated by a dash from the prefix IR which is the reference character for relay IR by which this contact is operated.

Referring further to the drawing, a stretch of railway track is shown intersected by a highway H. A highway crossing signal, which may be of the flashing light type or of any other suitable design, but which, in order to simplify the drawing, is shown as a bell G, is located adjacent the intersection of the railway track and the highway H.

Rails 1 and 1a of the railway track are divided by insulated joints 2 to form a crossing section 2T and two approach control sections, one adjacent each end of the crossing section. A given one of the approach control sections has two portions, one of which is designated AIT and the other of which is designated BIT. The other approach control section is designated 3T An intermediate portion of the given approach control section is divided by insulated joints 3 to form an intermediate section ZT, which is shorter than the distance between the trucks of a car, between portions AIT and BIT. The intermediate section ZT has one rail in common with portions AIT and BIT of the given approach section. Portions AIT and BIT are connected with each other around section ZT by a jumper 5.

Each of the track sections is provided with a track circuit including a relay, designated by the reference character R with a distinguishing prefix, connected across the rails adjacent one end of the section, and a suitable source of current, such as a battery 4, connected across the rails adjacent the opposite end of the section.

A repeater relay, designated by the reference character ZP, is controlled, by pole changing contacts 6 and 7 of relay ZR for the intermediate section, to be energized by current of normal polarity when relay ZR is energized, and to be energized by current of reverse polarity when relay ZR is deenergized.

An eastbound control stick relay ET has a pickup and a stick circuit, both of which are controlled by a front contact 8 of relay 1R, and the pickup circuit is also controlled by a front contact 8 of relay 2R. A westbound control stick relay WT is similarly controlled by relays 3R and 2R.

An eastbound direction stick relay, designated by the reference character ES, is controlled by relays ET and 2R to become energized when an eastbound train enters section 2T, and is then controlled to remain energized while the train moves through section 3T. A westbound direction stick relay, designated by the reference character WS, is similarly controlled by relays WT and 2R to become energized when a westbound train enters section 2T, and is controlled to remain energized while the westbound train moves through the given track section comprising portions A1T and B1T.

A timing stick relay, designated by the reference character ZS, is controlled to become energized when a train enters the given control section comprising portions A1T and B1T. A time element device TE is controlled by a front contact 24 of relay ZS.

A signal control relay, designated by the reference character XR, is normally energized by a circuit which includes front contacts 1R–12 and 3R–17 of the track relays for the two approach control sections and contact 16 of the track relay 2R for the crossing section. Relay XR has also a second energizing circuit including front contact ZS–14 of relay ZS, and contact 15 of time element device TE which becomes closed when time element device TE has been energized a measured period of time. Relay XR is also controlled by front contacts 18 and 13 of relays ES and WS, respectively, to be energized when a train is receding from the intersection of the railway and the highway through the given approach control section or through section 3T. Highway crossing signal G is controlled by a back contact 19 of relay XR.

Having described, in general, the arrangement and the control of the apparatus shown by the accompanying drawing, I shall now describe in detail its operation.

As shown in the drawing, all parts of the apparatus are in the normal condition, that is, each of the track sections is unoccupied and, therefore, track relays ZR, 1R, 2R, and 3R are energized; relay ZP is energized by current of normal polarity; relays ET, WT, and XR are energized; and relays ES, WS, and ZS, time element device TE, and crossing signal G are deenergized.

The track circuit for the given approach control section, including relay 1R, passes from a battery 4, through rail 1 of portion A1T of the given approach control section, jumper wire 5 connected around the intermediate section ZT, rail 1 of portion B1T, winding of relay 1R, and rail 1a of portions B1T and A1T, back to battery 4. Relay ZP is energized by current of normal polarity passing from terminal B of a suitable source of current, not shown in the drawing, through the front point of contact 6 of relay ZR, winding of relay ZP, and the front point of contact 7 of relay ZR, to terminal N of the same source of current.

A pickup circuit for relay ET is closed, passing from terminal B, through contacts 8 and 9 of relays 1R and 2R, respectively, and the winding of relay ET to terminal N. A stick circuit for relay ET is also closed which is the same as the pickup circuit just traced except that it includes contact 10 of relay ET instead of contact 9 of relay 2R. Relay WT is energized by a pickup and a stick circuit which are similar to the pickup and stick circuits just traced for relay ET.

Relay XR is energized by a circuit passing from terminal B, through contact 1R–12, contact 16 of relay 2R, contact 3R–17, and the winding of relay XR to terminal N.

I shall assume that, with apparatus embodying my invention, a train moving from left to right as shown in the accompanying drawing, which I shall assume is the eastbound direction, enters portion A1T of the given approach control section, causing relay 1R to become deenergized. Relay ET, therefore, in turn becomes deenergized because contact 8 of relay 1R becomes opened. Also, with relay 1R deenergized, the circuit previously traced for relay XR is open at contact 1R–12, causing relay XR to become deenergized. Relay XR, upon becoming deenergized, starts the operation of crossing signal G by a circuit passing from terminal B, through contact 19 of relay XR, and crossing signal G to terminal N.

With relay 1R deenergized, a pickup circuit is completed for relay ZS, this circuit passing from terminal B, through contacts 1R–20 and ZP–21, contact 22 of time element device TE, and the winding of relay ZS to terminal N. Relay ZS, upon becoming energized by its pickup circuit, completes its stick circuit which is the same as the pickup circuit just traced except that it includes contact 23 of relay ZS instead of contact 22 of time element device TE.

Relay ZS, upon becoming energized, completes a circuit for energizing time element device TE, this circuit passing from terminal B, through contact 24 of relay ZS, and the control element of time element device TE to terminal N. Time element device TE, after becoming energized, opens its contact 22 in the pickup circuit traced for relay ZS which, however, then remains energized by its stick circuit previously described. Time element device TE does not close its contact 15 until the lapse of a measured period of time after time element device TE has become energized.

I shall assume further that the eastbound train, after entering portion A1T of the given approach control section, proceeds at a speed such that time element device TE does not close its contact 15 before the train enters section ZT, deenergizing relay ZR. When relay ZR becomes deenergized, relay ZP is deenergized for a brief period between the opening of contacts 6 and 7 of relay ZR at their front points, and the closing of these contacts at their back points. When contacts 6 and 7 become closed at their back points, relay ZP becomes energized by current of reverse polarity in a circuit which is the same as the circuit previously traced for this relay except that it includes the back points of contacts 6 and 7 instead of the front points of these contacts. On account of relay ZP being deenergized, and then being energized in the reverse direction, contact ZP–21 of relay ZP in the circuit for relay ZS becomes momentarily opened, causing relay ZS to become deenergized. Time element device TE is therefore also deenergized because of the opening of contact 24 of relay ZS. Relay ZS cannot become energized again until contact 22 of time element device TE becomes closed. Relay ZS,

upon again becoming energized, completes the circuit previously traced for time element device TE for starting the operation of time element device TE again.

Since section ZT is shorter than the distance between trucks of a car, relay ZR will again become energized while section ZT is between the front trucks of the car and the rear trucks of the car. It follows that while a train is moving over section ZT, relay ZP is repeatedly energized alternately by current of normal and reverse polarity.

I shall also assume further that the train enters section 2T before time element device TE closes its front contact 15 after the train leaves section ZT. Relay XR, therefore, remains deenergized while the eastbound train is moving through the given approach control section comprising portions A1T and B1T. Relay XR remains deenergized while the train occupies section 2T, because contact 16 of relay 2R is then open in the control circuits for relay XR.

When the train enters section 2T, relay ES becomes energized by its pickup circuit passing from terminal B, through the back point of contact 25 of relay ET, contact 26 of relay 2R, front point of contact 27 of relay WT, contact WS–28, and the winding of relay ES to terminal N. Relay ES, upon becoming energized, completes its stick circuit passing from terminal B, through the back point of contact 25 of relay ET, contact 26 of relay 2R, contact 29 of relay ES, and the winding of relay ES to terminal N.

When the train enters section 3T, relay 3R becomes deenergized, and its contact 8 opens the circuits previously described for relay WT, causing relay WT to become deenergized. A second stick circuit for relay ES is thereby completed, passing from terminal B, through the back point of contact 27 of relay WT, contact 29 of relay ES, and the winding of relay ES to terminal N. Although the pickup circuit previously traced for relay ES is opened at the front point of contact 27 of relay WT, relay ES remains energized by its first stick circuit while contact 27 of relay WT is open between its front and back points.

When the train leaves portion B1T of the given approach section, relay 1R becomes energized, and opens the pickup and stick circuits for relay ZS, causing relay ZS to become deenergized. Time element device TE in turn becomes deenergized because of the opening of contact 24 of relay ZS.

When the train leaves section 2T, relay ET again becomes energized by its pickup circuit previously traced. Relay ES, however, remains energized by its second stick circuit traced through the back point of contact 27 of relay WT. Relay XR now becomes energized by a second circuit, passing from terminal B, through contact 1R–12, contact 16 of relay 2R, contact 18 of relay ES, and the winding of relay XR to terminal N. Relay XR, upon becoming energized, opens its contact 19, thereby deenergizing signal G.

When the train leaves section 3T, the circuit first traced for relay XR again becomes closed. Also, when the train leaves section 3T, relay WT again becomes energized by its pickup circuit previously described. Relay WT, upon becoming energized, opens its contact 27 at the back point, thereby deenergizing relay ES.

I shall next assume that, with all parts of the apparatus again in the normal condition, an eastbound train enters portion A1T of the given approach control section and stops on portion A1T, deenergizing relay XR, which, in turn, causes operation of signal G to be started. Relay ZS becomes energized, as previously described, causing time element device TE also to be energized. Upon the lapse of a measured period of time, device TE closes its front contact 15, thereby completing a third circuit for energizing relay XR, this circuit passing from terminal B, through contact ZS–14, contact 15 of time element device TE, contact 16 of relay 2R, contact 3R–17, and the winding of relay XR, to terminal N. Relay XR, upon thus becoming energized, opens its contact 19, and thereby interrupts the operation of signal G.

When the train resumes its movement toward highway H, relay ZP becomes repeatedly energized alternately by current of normal and reverse polarity, while the train moves over section ZT, as previously described, causing relay ZS to become deenergized, which, in turn, deenergizes time element device TE. Relay XR is thus deenergized because of the opening of contact 15 of time element device TE, and therefore the operation of signal G is started again by the closing of contact 19 of relay XR. The operation of the apparatus as the train now proceeds over portion B1T of the given approach control section, and over sections 2T and 3T is as previously described.

If, instead of stopping on approach section portion A1T, the train proceeds onto section ZT, relay ZS will become deenergized, causing time element device TE to be deenergized, as previously described. If the train stops with a pair of wheels on section ZT, relay ZP will be constantly energized by current of reverse polarity, so that, when back contact 22 of time element device TE becomes closed, relay ZS will become energized by its pickup and stick circuits previously traced. Time element device TE will then become energized because of the closing of contact 24 of relay ZS. Upon the lapse of a measured period of time, device TE will close its contact 15, causing relay XR to be energized, as previously described, which in turn interrupts the operation of signal G, as also previously described.

I shall now assume that all parts of the apparatus are again in the normal condition, and that a westbound train enters section 3T. Contact 8 of relay 3R, therefore, becomes opened, causing relay WT to become deenergized. With relay 3R deenergized, contact 3R–17 opens the circuit first traced for relay XR, causing relay XR to become deenergized. With relay XR deenergized, the operation of signal G is begun because of the closing of contact 19 of relay XR.

When the train enters section 2T, relay WS becomes energized by its pickup circuit passing from terminal B, through the back point of contact 27 of relay WT, contact 26 of relay 2R, front point of contact 25 of relay ET, contact ES–28, and the winding of relay WS to terminal N. Relay WS, upon becoming energized, completes a stick circuit which is the same as the pickup circuit just traced except that it includes contact 29 of relay WS instead of contact ES–28 and the front point of contact 25 of relay ET.

When the train leaves section 3T, contact 3R–17 becomes closed, but relay XR is now deenergized because contact 16 of relay 2R is open.

When the train leaves section 2T, relay XR becomes energized by a third circuit, passing from terminal B, through contact 13 of relay WS, contact 16 of relay 2R, contact 3R–17, and the winding of relay XR to terminal N. The operation of

signal G is then stopped because of the opening of contact 13 of relay XR. Relay XR will then remain energized regardless of the operation of relay ZS and time element device TE as the train proceeds through approach control section portions BIT and AIT.

I have described the operation of the apparatus for a few typical train movements. In view of the foregoing description, it is believed that the operation of the apparatus for any other possible train movement can be readily traced by referring to the accompanying drawing.

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 a control system for a highway crossing signal adjacent the intersection of a railway track with a highway, in which the railway track is divided into a crossing track section at the intersection and two approach control sections one adjacent each end of said crossing track section, and in which a direction stick relay for each direction of traffic movements is controlled to become energized when a train moves in the corresponding direction from an approach control section onto said crossing track section, the combination comprising, a timing stick relay, a time element device, means controlled by a train upon occupying one of said approach control sections for energizing said timing stick relay, means controlled by a front contact of said timing stick relay for energizing said time element device, means controlled by a train upon entering said one approach control section for starting operation of said crossing signal, means controlled by front contacts of said timing stick relay and said time element device for interrupting operation of said crossing signal, means controlled by further movement of said train toward said intersection for again starting operation of said highway crossing signal before said train enters said crossing track section, and means controlled by each of said direction stick relays for stopping operation of said crossing signal when a train leaves said crossing track section in a corresponding direction.

2. In a control system for a highway crossing signal adjacent the intersection of a railway track with a highway, in which the railway track is divided to form a crossing track section at the intersection, and in which a direction stick relay for each direction of traffic movements is controlled to become energized when a train moving in the corresponding direction enters said crossing track section, the combination comprising, a timing stick relay, a time element device, means controlled by a train approaching said intersection in a given direction for energizing said timing stick relay, means controlled by a front contact of said timing stick relay for energizing said time element device, means controlled by a train approaching said intersection in either direction for starting operation of said highway crossing signal, means controlled by said time element device and by said timing stick relay for interrupting operation of said crossing signal if a train stops when approaching said intersection in said given direction, means controlled by further movement of said train toward said intersection for again starting operation of said crossing signal before said train enters said crossing track section, and means controlled by each of said direction stick relays for stopping operation of said crossing signal when a train recedes from said intersection.

3. In a control system for a highway crossing signal adjacent the intersection of a railway track with a highway, in which a direction stick relay for each direction of traffic movements is controlled to become energized when a train moving in the corresponding direction arrives adjacent the intersection, the combination comprising, a time element device, means controlled by a train approaching said intersection in a given direction for energizing said time element device, means controlled by a train approaching said intersection in either direction for starting operation of said highway crossing signal, means controlled by said time element device after it has been energized a measured period of time for stopping operation of said crossing signal if a train moving in said given direction is in any location before arriving at a given point adjacent said intersection, means controlled by further movement of said train toward said intersection for again starting operation of said crossing signal before said train arrives at said given point adjacent said intersection, and means controlled by each of said direction stick relays for stopping operation of said crossing signal when a train recedes in the corresponding direction from said intersection.

4. In a control system for a highway crossing signal adjacent the intersection of a railway track with a highway, in which the railway track is divided into a crossing track section at the intersection and an approach control section adjacent an end of said crossing track section, the combination comprising, a time element device, means controlled by a train approaching said intersection in a given direction for starting operation of said highway crossing signal and energizing said time element device, means controlled by said time element device for interrupting operation of said crossing signal if said train stops on said approach control section before entering said crossing track section, means controlled by said train upon resuming its movement for again starting operation of said crossing signal before said train enters said crossing track section, and means controlled by said train for continuing operation of said crossing signal while said train occupies said crossing track section.

5. In a control system for a highway crossing signal adjacent the intersection of a railway track with a highway, in which said railway track is divided to form a crossing section at the highway and an approach section adjacent said crossing section, and in which each of said track sections is provided with a track circuit including a track relay, the combination comprising, an intermediate portion of said approach section divided to form an intermediate section which is shorter than the distance between the trucks of a railway car, a track circuit including a track relay for said intermediate section, a repeater relay for said track relay for said intermediate section controlled by pole-changing contacts of the track relay to be energized by current of normal or reverse polarity according as the track relay is energized or deenergized, a time element device, a timing stick relay, a pickup and a stick circuit for said timing stick relay each of which is controlled by a back contact of the track relay

for said approach section and by a front contact of said repeater relay and said pickup circuit also controlled by a back contact of said time element device, a circuit controlled by a front contact of said timing stick relay for energizing said time element device, a signal relay, a circuit controlled by front contacts of the track relays for said approach and crossing sections for controlling said signal relay, a second circuit controlled by front contacts of said timing stick relay and of said time element device and also of the track relay for said crossing section for controlling said signal relay, and means controlled by said signal relay for controlling said crossing signal.

6. In a control system for a highway crossing signal adjacent the intersection of a railway track with a highway, in which said railway track is divided to form a control section adjacent said intersection, the combination comprising, an intermediate portion of said control section divided to form an intermediate section which is shorter than the distance between the trucks of a railway car, a track circuit for said intermediate section including a track relay, a repeater relay controlled by pole-changing contacts of said track relay to be energized by current of normal or reverse polarity according as said track relay is energized or deenergized, a front contact of said repeater relay which becomes opened for a brief period of time when the polarity of energization of said repeater relay is changed by said pole-changing contacts, a time element device, a timing stick relay, a pickup and a stick circuit for said timing stick relay each of which is controlled to be closed when said approach section is occupied by a train while said front contact of said repeater relay is closed and said pickup circuit also controlled by a back contact of said time element device, means controlled by a front contact of said timing stick relay for energizing said time element device, a signal relay, a control circuit for said signal relay which is normally energized but which is deenergized when said control section is occupied, a second control circuit for said signal relay controlled by front contacts of said timing stick relay and said time element device, and means controlled by said signal relay for controlling said crossing signal.

7. In a control system for a highway crossing signal adjacent the intersection of a railway track with a highway, in which said railway track is divided to form a control section adjacent said intersection, the combination comprising, an intermediate portion of said control section divided to form an intermediate section which is shorter than the distance between the trucks of a railway car, a time element device, means controlled by a train upon entering said control section for starting operation of said highway crossing signal and for energizing said time element device, means controlled by said time element device after being energized a measured period of time for interrupting operation of said crossing signal, means controlled by movement of said train over said intermediate section for again starting operation of said crossing signal, and other means controlled by said train upon arriving adjacent said intersection for at times starting operation of said highway crossing signal.

8. In a control system for a highway crossing signal adjacent the intersection of a railway track with a highway, in which said railway track is divided to form a control section and a crossing track section adjacent said intersection, the combination comprising, means controlled by a train upon entering said control section for starting operation of said highway crossing signal, means controlled by a train if it stops on said control section for stopping operation of said highway crossing signal, means within said control section effective when said train resumes movement for again starting operation of said highway crossing signal before said train enters said crossing track section, and means controlled by said train on said crossing track section for continuing operation of said signal.

9. In a control system for a highway crossing signal adjacent the intersection of a railway track with a highway, in which said railway track is divided to form a control section and a crossing track section adjacent said intersection, the combination comprising, means controlled by a train upon entering said control section in a given direction for starting operation of said highway crossing signal, means controlled by a train if it stops on said control section for interrupting operation of said crossing signal, means controlled by said train upon resuming its movement toward said intersection for again starting operation of said crossing signal before said train enters said crossing track section, and means controlled by said train for continuing operation of said crossing signal while said train occupies said crossing track section.

10. In a control system for a highway crossing signal adjacent the intersection of a railway track with a highway, in which the railway track is divided to form a crossing track section at the intersection, and including means controlled by a train approaching said intersection in a given direction for starting operation of said highway crossing signal, the combination comprising, time element means controlled by said train for interrupting operation of said highway crossing signal if said train stops approaching said intersection after it has started operation of said highway crossing signal, means controlled by said train upon again resuming its movement toward said intersection for again starting operation of said highway crossing signal before said train enters said crossing track section, and means controlled by said train for continuing operation of said crossing signal while said train occupies said crossing track section.

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References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,698,459	Spray	Jan. 8, 1929
1,998,175	Thompson	Apr. 16, 1935
2,346,518	Tizzard	Apr. 11, 1944
2,370,704	Allen	Mar. 6, 1945
2,379,209	Allen	June 26, 1945
2,452,868	Quinlan	Nov. 2, 1948
2,628,306	McMahon	Feb. 10, 1953