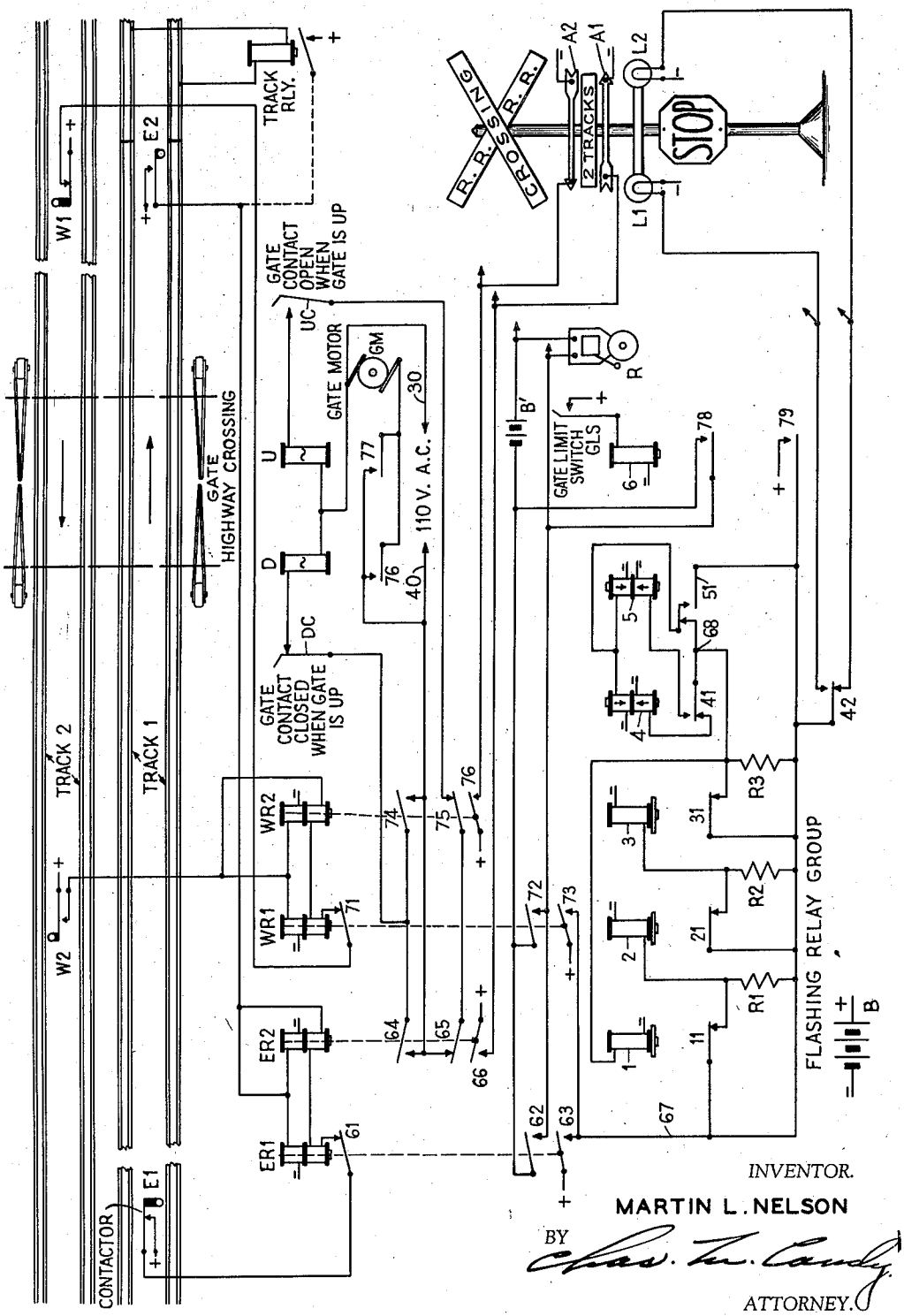
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HIGHWAY CROSSING SIGNALING SYSTEM

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HIGHWAY CROSSING SIGNALING SYSTEM

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This invention relates in general to railway signaling systems but more particularly to highway crossing signaling systems for operating signals at a highway crossing to warn motorists of approaching trains.

The main object of the present invention is the provision of a simple and reliable relay arrangement for controlling the flashing of lamps at a highway crossing to designate the approach of one or more trains.

A feature of the invention relates to the provision of arrows which when illuminated by approaching trains indicate whether one or more trains are approaching the crossing by indicating the direction such trains are travelling, or if desired the direction from which the train is approaching the crossing.

The above and other objects of the invention will be apparent from the following specification when read in connection with the accompanying drawing.

In the drawing two railroad tracks, track 1 and track 2 for east-bound and west-bound traffic, are shown. A highway crossing crosses the tracks as indicated near the center of the drawing and such crossing is protected by gates. Crossing signals, such as shown in the lower right-hand corner of the drawing, are also provided at the crossing to warn motorists of approaching trains. The crossing signal comprises the lamps L1 and L2 adapted to be alternately flashed, arrows A1 and A2 also adapted to be illuminated to indicate the direction of travel of the approaching train or trains and other conventional railroad crossing signs. The arrows A1 and A2 may be either neon tube lamps or may be a series of lamps for illuminating the arrows shown.

Along the inside of one of the rails of each track are placed contactors, such as E1, E2, W1, and W2, for controlling the circuits of relays ER1, ER2, and WR1 and WR2. These contactors may be substantially of the same design and operation as disclosed in the application of H. F. Obergfell and G. W. Eickenberg, Serial No. 639,558, filed October 26, 1932, wherein the plunger is operated by the train wheels to cause the operation of the circuit controlling contacts in the associated housing. Contactor E1 is placed along east-bound track 1 on the left-hand side of the crossing at a predetermined distance from the crossing, while contactor E2 is placed along track 1 on the right-hand side a short distance from the crossing. Contactors W1 and W2 are similarly placed for west-bound track 2. If desired, different sections of the tracks may be insulated and instead of using contactors, track relays may be used. For example, the track relay shown to the right in the drawing may be substituted for contactor E2. The circuits of relays ER1 and ER2 are controlled by contactors E1 and E2 and the circuits of relays WR1 and WR2 are controlled by contactors W1 and W2. Relays D and U are alternating current relays for controlling the operation of the gate motor GM. Contacts DC are contacts controlled by the gate and are normally closed when the gate is up. Contacts UC are contacts controlled by the gate and are normally open when the gate is up. Contacts DC control the circuit of A. C. relay D and contacts UC control the circuit of A. C. relay U. The contacts DC open when the gates are lowered to a predetermined position and do not again close until the gates are raised to a predetermined position. Contacts UC close when the gates are lowered to a predetermined position and do not again open until the gates are raised to a predetermined position. A gate-limit switch GLS is normally open when the gates are in their normal raised positions and close as soon as the gates are moved therefrom. A bell R is associated with the crossing to sound an audible alarm to warn motorists. Relays D and U and the gate motor GM are operated from the 110-volt A. C. source indicated on the drawing. The various other relays shown are operated from the source B while the bell R is operated from the source B'.

Relays 1, 2, and 3 are retarded relays which operate in a definite sequence after being initially operated to control the two differential relays 4 and 5 which in turn control the flashing of lamps L1 and L2.

All of the circuits are shown at normal position with relays ER1, ER2, WR1 and WR2 energized over their stick circuits. The circuit over which relays ER1 and ER2 are energized may be traced as follows:—from positive pole of source B, contactor springs E1, armature 61, through the lower windings of relays ER1 and ER2 in series, and through the upper windings of relays ER1 and ER2 in multiple to the negative pole of source B. Relays WR1 and WR2 are energized over the following circuit: from positive pole of source B, contactor springs W1, armature 71, through the lower windings of relays WR1 and WR2 in series, and through the upper windings of relays WR1 and WR2 in multiple to the negative pole of source B.

In order to describe the circuit operations, it will be assumed that the wheels of an east-bound

train in approaching the crossing operate contactor E1 thereby opening the stick circuit of relays ER1 and ER2 which accordingly deenergize. At armature 61 the previously traced stick circuit is opened to prevent the reenergization of relays ER1 and ER2 from contactor E1; armature 62 completes a circuit for operating the audible bell R, and armature 63 connects positive pole of source B to conductor 67 to complete circuits for relays 1, 2, 3, 4, and 5. At armature 64 relay ER2 completes a circuit for A. C. relay D, at armature 65 opens a point in the circuit for A. C. relay U, and at armature 66 completes a circuit for illuminating the arrow A1. The circuit for operating the audible bell R may be traced from the negative pole of battery B', armature 62, and through the bell R to the positive pole of battery B'. The energizing circuit for relay 1 may be traced from positive pole of source B, armature 63, conductor 67, armature 31, and through the winding of relay 1 to negative pole of source B, the circuit for relay 2 extends from conductor 67 by way of armature 11 through the winding of relay 2 to the negative pole of source B and the circuit for relay 3 extends from conductor 67 by way of armature 21 through the winding of relay 3 to negative pole of source B. Since relays 1, 2, and 3 are retarded the same do not immediately energize. At this time a circuit may also be traced for differential relays 4 and 5 as follows:—from positive pole of source B, armature 63, conductor 67, armature 31 to point 68 where the circuit divides, one branch extending by way of armature 41 and resting contact and through the lower winding of relay 4 to negative pole of source B, the other branch extending from point 68 by way of normally closed spring contacts controlled by armature 51 and through the upper windings of differential relays 4 and 5 in multiple to negative pole of source B. Relay 4, being differential, and having both its windings energized does not energize at this time, but differential relay 5, since only its upper winding alone is energized at this time, operates armature 51. Armature 63 also closes a circuit for illuminating lamp L2 as follows:—from positive pole of source B, armature 63, conductor 67, armature 42 and resting contact, and through the filament of lamp L2 to negative pole of source B. The circuit for illuminating arrow A1 may be traced from positive pole of source B, armature 66, and through the lamps (not shown) in A1, or through the neon tube as the case may be to negative pole of source B. The arrow may point in the direction the train is travelling, or, if desired, may point in the direction the train is approaching the crossing.

The circuit for energizing A. C. relay D may be traced from one terminal of the 110-volt A. C. source, conductor 40, armature 64, springs DC, winding of A. C. relay D by way of conductor 30 to the other terminal of the 110-volt A. C. source. At armature 76 relay D completes the circuit for the gate motor GM as follows:—from the A. C. source, conductor 40, armature 76, through the motor GM, and conductor 30 to the A. C. source. The gate motor operates over this circuit and lowers the gates across the crossing. When the gates reach a predetermined position springs DC open the circuit to relay D and springs UC close to prepare a circuit for relay U. Relay D at armature 76 opens the gate motor circuit and the gates remain in their lowered position until relay U is later energized.

The gate switch GLS closes when the gates are lowered and completes an obvious circuit for relay 6. Relay 6 at armature 78 closes a shunt around contacts 62 to maintain the circuit to bell R closed and at armature 79 connects positive pole of source B to conductor 67 in order to maintain the operation of the flashing relay group and the flashing of lamps L1 and L2.

As soon as relay ER1 deenergizes said relay at armature 63 completes the previously traced circuits for relays 1, 2, 3, 4, and 5 but relay 5 is the first to operate since relays 1, 2, and 3 are retarded and differential relay 4 has both its windings energized. Relay 5 at armature 51 opens the original circuit through the upper windings of relays 4 and 5 and substitutes a new circuit for these upper windings from conductor 67 by way of the working contact of armature 51 before the original circuit is opened at the normally closed contacts of this armature.

Any one of the three retarded relays 1, 2, or 3, may operate first but after once started in operation these relays operate in a definite sequence as long as the positive pole of source B is connected to conductor 67. This sequence will be apparent from the following description. For this purpose, it will be assumed that relay 1 is the first to operate and said relay at armature 11 opens the circuit to relay 2 to prevent its operation. The resistances R1, R2, and R3 are sufficiently high to prevent the operation of relays 1, 2, and 3, respectively, and are provided to prevent the burning and arcing at contacts 11, 21, and 31 as well as to reduce radio interference.

Since the circuit to relay 2 is opened then relay 3 is the next retarded relay to operate. At armature 31 relay 3 opens the circuit of relay 1 and also opens the circuit through the lower winding of differential relay 4 to cause its operation since the latter relay is now energized over its upper winding alone. At armature 42 and resting contact relay 4 opens the circuit to lamp L2 and at the working contact of armature 42 connects the circuit of lamp L1 to conductor 67 to illuminate the same. At armature 41 and resting contact relay 4 opens a further point in the circuit to the lower winding of relay 4 and at the working contact of armature 41 prepares the circuit to the lower winding of differential relay 5.

Relay 1 deenergizes shortly after its circuit is opened at armature 31 and at armature 11 reestablishes the circuit for relay 2. Relay 2 operates after an interval over its previously traced circuit and at armature 21 opens the circuit of relay 3 which accordingly deenergizes. At armature 31 relay 3 again completes the circuit for relay 1 and also completes a circuit from conductor 67 by way of armature 41 and working contact through the lower winding of differential relay 5. Differential relay 5 now has both its windings energized with the result that said relay accordingly deenergizes. At armature 51 relay 5 closes its normally closed contacts before disconnecting armature 51 from its working contact thereby maintaining the circuit through the upper windings of differential relays 4 and 5 by way of armature 31.

Relay 1 again operates over its circuit and at armature 11 opens the circuit to relay 2 which deenergizes. At armature 21 relay 2 closes the circuit to relay 3 which accordingly operates after an interval. At armature 31 relay 3 opens the circuit to relay 1, and, since relay 4 alone is operated at this time, opens the circuits to both relays 4 and 5 with the result that relay 4 deenergizes. At armature 42 relay 4 opens the circuit to lamp L1 and closes the circuit to lamp

L2. At this time both differential relays 4 and 5 are in normal deenergized positions, relay 3 is operated and relay 1 therefore deenergizes to again start the sequential operation of relays 1, 2, and 3.

The sequence of operation continues as follows:—Relay 3 operates and deenergizes relay 1, relay 1 deenergizes and operates relay 2, relay 2 operates and deenergizes relay 3, relay 3 deenergizes and operates relay 1, relay 1 operates and deenergizes relay 2, and relay 2 deenergizes to reoperate 3 in a succeeding cycle as just described.

When relay 3 deenergizes the second time the initial circuit traced through point 68 is completed for both the upper and lower windings of relay 4 and only the upper winding of relay 5 with the result that relay 5 alone is operated as previously described. When relay 3 again energizes relay 4 is again operated as previously described, since the circuit through its lower winding is opened at armature 31. At armature 42 relay 4 extinguishes lamp L2 and illuminates lamp L1. When relay 3 again deenergizes both windings of relay 5 are energized and differential relay 5 accordingly deenergizes. When relay 3 again energizes all the circuits through relays 4 and 5 are opened with the result that relay 4 deenergizes to extinguish lamp L1 and illuminate lamp L2. Both differential relays 4 and 5 are in their normal deenergized positions and thereafter start on their next cycle of operations as just described when relay 3 deenergizes. From the foregoing it will be seen that for the first and each odd operation of relay 3 differential relay 4 is operated, that for the second and each even operation of relay 3 differential relay 4 is deenergized to flash the lamps L1 and L2.

The flashing relay group continues to operate and flash the lamps L1 and L2 until such time as the train passes over the crossing and operates contactor E2. In response to the operation of contactor E2 a circuit may be traced for energizing relays ER1 and ER2 as follows:—from positive pole of source B, contactor E2, and through the upper windings of relays ER1 and ER2 in multiple to the negative pole of source B. At armature 61 relay ER1 completes the previously traced stick circuit for relays ER1 and ER2 to maintain these relays in their normally energized positions. At armature 62 relay ER1 opens one point in the circuit to bell R which circuit is maintained at armature 78 of relay 6. At armature 63 relay ER1 disconnects one of the multiple positive pole of source B connections from conductor 67 but the relay group continues to function from the connection at armature 79. At armature 64 relay ER2 opens a further point in the circuit to A. C. relay D and at armature 66 opens the circuit to extinguish arrow A1. At armature 65 relay ER2 completes a circuit for energizing A. C. relay U as follows:—from the A. C. source, conductor 40, armature 65, armature 75, gate up-contacts UC, A. C. relay U, to the A. C. source. At armature 77 relay U completes a circuit for operating the gate motor GM as follows: from the A. C. source, conductor 40, armature 77, through the gate motor GM to conductor 39 and the A. C. source. In response to the operation of the gate motor GM the gates are raised to their normal position. Due to the raising of the gates contacts DC are closed to prepare a circuit for relay D, contacts UC are opened to open the circuit of relay U, and the gate limit switch GLS opens the circuit of relay 6. Relay U at armature 77 opens the circuit of the gate motor GM to stop the gates in their normal raised positions. Relay 6, upon deenergizing, at armature 78 opens the circuit of the bell R and at armature 79 disconnects the positive pole of source B from conductor 67 to stop the operation of the flashing relay group and the flashing of lamps L1 and L2.

West-bound trains on track 2 operate contacts W1 and W2 to control relays WR1 and WR2 in a manner identical with that described for east-bound trains on track 1 and it is therefore believed to be unnecessary to describe these circuits in detail. Armatures 71, 72, 73, 74, 75, and 76 control similar or the same circuits as controlled by armatures 61, 62, 63, 64, 65, and 66 need not be described in detail. A west-bound train operates contactor W1 in approaching the crossing and opens the stick circuit of relays WR1 and WR2 which deenergize. Relays WR1 and WR2 close circuits for lowering the gates, for illuminating arrow A2 to indicate the direction of travel, for operating the bell R and for operating the flashing relay group to flash lamps L1 and L2. After the train passes the crossing the operation of contactor W2 reenergizes relays WR1 and WR2 to cause the gates to rise and the various signals to stop in a manner similar to that described for east-bound trains.

In case both an east-bound train and a west-bound train should approach the crossing at about the same time then both the arrows A1 and A2 are illuminated to indicate that a train is approaching the crossing on each track. In this case the first train to operate its contactor lowers the gates and starts the flashing relay group while the last train to pass the crossing and operate the corresponding contactor raises the gates and stops the flashing relay group.

Having described the invention what is considered to be new and is desired to be protected by Letters Patent will be set forth in the following claims.

What is claimed is:

1. In an automatic railway highway crossing signaling system, a first contact operable by a train approaching a highway crossing, relays operated in response to said train operating said first contact for generating a plurality of electrical impulses, a pair of lamps at said crossing, other relays operated in response to said generated impulses for flashing the first of said lamps once for each odd impulse and the second of said lamps once for each even impulse, and a second contact operated by the train after passing said crossing for controlling said first relays to stop generation of said impulses and the flashing of said lamps.

2. In an automatic highway crossing signaling system, a first contact operable by a train approaching a highway crossing, gates at said crossing, means responsive to a train operating said first contact for lowering said gates, means also responsive to the train operating said first contact for generating a plurality of electrical impulses, a pair of lamps at said crossing, means controlled by said impulses for flashing the first of said lamps once for each odd impulse and the second of said lamps once for each even impulse, a gate-limit switch normally opened when said gates are in their normal raised position and closed when said gates are moved from normal position, means operated by the closure of said gate switch in response to the lowering of said gates for continuing the generation of said im-

pulses by said second means, a second contact operable by the train after passing the crossing, means responsive to the train operating said second contact for raising said gates to normal position, said last means released by said gate limit switch when the gates reach normal position for stopping further generation of impulses and the flashing of said lamps.

3. In an automatic railway highway crossing signaling system, means operated in response to a train approaching a highway crossing for generating a plurality of electrical impulses, means operated responsive to said generated impulses for regenerating impulses whose length is equal to the close and open periods of each of the first generated impulses, a first lamp at said crossing operated in response to the first and each succeeding odd regenerated impulse, and a second lamp at said crossing operated in response to the second and each succeeding even regenerated impulse.

4. In an automatic railway highway signaling system, a first contact operable by a train approaching a highway crossing, gates at said crossing, a gate motor for lowering and raising said gates, normally energized relays released in response to a train operating said first contacts in approaching said crossing, a circuit completed by the release of said relays for operating said motor to lower the gates, an audible signal at the crossing, a circuit for operating said signal completed by the release of said relays, a pair of lamps at said crossing, a group of interrupter relays for controlling said lamps, a circuit for operating said interrupter relays completed responsive to the release of said relays, means controlled by the operation of said interrupter relays for alternately flashing said lamps, a down contact normally closed by the gate in raised position and opened in response to the gate reaching a predetermined position for opening said motor circuit to stop the gates in their down positions, a second contact operable by the train passing the crossing, said relays energized in response to the operation of said second contact for opening said motor circuit, said signal circuit and said interrupter circuit, a second circuit completed in response to the energization of said relays for operating said motor to raise the gates, an up contact opened in response to the gate being raised to a predetermined point for opening said last motor circuit, a gate limit switch normally open when said gates are in their normal raised positions and closed when said gates are moved from normal position, means controlled by said gate limit switch when in closed position for completing new circuits for said signals and said group interrupter to maintain the continued operation of said signals and interrupter independent of said relays, said gate limit switch opened when the gates are raised to normal position for causing said means to open said new signal and interrupter circuits to stop said signal and flashing of said lamps.

5. In an automatic highway crossing signaling system, a contact operable by a train approaching a highway crossing, gates at said crossing, means responsive to a train operating said contact for lowering said gates, means also responsive to the train operating said contact for generating a plurality of electrical impulses, a pair of lamps at said crossing, means controlled by said generated impulses for flashing said lamps, a gate limit switch normally opened when said gates are in their normal raised position and closed when said gates are moved from normal position, and means operated by the closure of said gate switch in response to the lowering of said gates for continuing the generation of said impulses by said second means independent of the operated or non-operated condition of said contact.

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