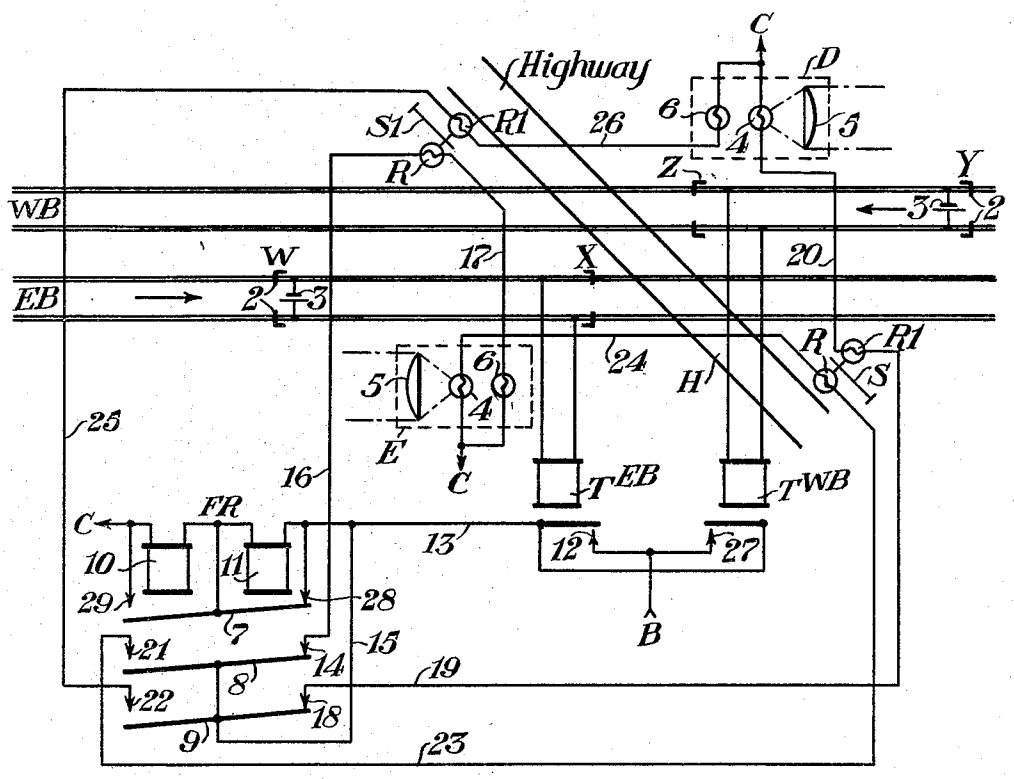
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APPARATUS FOR THE CONTROL OF HIGHWAY CROSSING SIGNALS

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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 indicating to an approaching train the operating condition of the highway crossing signals.

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

In the accompanying drawing there is disclosed diagrammatically one form of apparatus embodying my invention as applied to the highway crossing signals at the intersection of a highway with a double track railway.

In the drawing the tracks EB and WB are the two tracks of a double track railway on which traffic normally moves in the direction indicated by arrows. A highway designated by the reference character H intersects the two tracks of the railway at grade. At the intersection there are located two highway crossing signals S and S1. As is common practice the signal S will be set to be exhibited to highway traffic approaching the intersection from one direction and signal S1 set to be exhibited to traffic approaching from the opposite direction on the highway. While the signals S and S1 may take different forms, they are here shown as standard flashing light signals where two horizontal lamps R and R1, each adapted to display a red light, are alternately flashed at the rate of thirty to thirty-five times per minute in response to the approach of a train, to present the appearance of a horizontally swinging red light.

By means of the usual insulated rail joints 2 the tracks EB and WB are each arranged with a track section designated as W—X and Y—Z, respectively. Each track section is so located that a train approaching the highway, when traveling in the normal direction of traffic for that particular track, will traverse the track section just before it traverses the highway. Each track section is provided with a track circuit consisting of a source of energy such as a battery 3 connected across the traffic rails at one end of the section and a track relay T with an exponent corresponding to the track connected across the traffic rails at the opposite end of the section.

Located adjacent the intersection are two railway signals or indicators designated by the reference characters D and E. The signal D is set to be displayed to a train approaching the highway H in the normal direction of traffic on track WB and signal E is set to be displayed to a train approaching the intersection on the track EB. These railway signals may take different forms but a preferred form is that of the commonly used light signal such for example as described in the United States Letters Patent 1,453,535 to W. B. Wells on light signals, wherein a single operating unit is provided with two lamps, one set to cause the display of a bright light and the other lamp set to cause the display of a dim light. The lamp 4 of each railway signal D and E is located directly at the focal point of the lens system indicated by the reference character 5, while the lamp 6 of each signal is located somewhat back of the focal point of the lens system. It follows that when lamp 4 of either signal D or E is lighted that signal will display a bright indication while when lamp 6 is lighted the signal will display a relatively dim indication. The lens system 5 may be such that the signal displayed is a pure white light or it may contain a colored lens so that the signal displayed is of some convenient color, preferably of course of a color different from that commonly used in the usual railway automatic signal system.

The operation of the railway signals D and E as well as of the highway crossing signals S and S1 is governed by a flasher relay FR. The flasher relay FR may take different forms but a preferred form is that described and claimed in the United States Letters Patent Reissue No. 17,252 to C. S. Snavely and W. B. Wells on electric rays. It is deemed sufficient for this description to point out that the armatures 7, 8, and 9 are each pivoted at the center and adapted to be attracted by either winding 10 or 11 and are normally biased by means not shown to the position shown in the drawing when both windings 10 and 11 are deenergized. In the normal position of relay

FR the winding 11 is short-circuited by a connection closed at the front contact 28 of armature 7 as will be readily understood by an inspection of the drawing. When current is applied to the two windings 10 and 11 in series in a manner to be later described the winding 11 will not at first be energized due to the short circuit and thus armatures 7, 8, and 9 will be swung in a clockwise direction by the attraction created by the energizing of winding 10. As the armatures swing in a clockwise direction they engage respective right-hand contacts and winding 10 becomes short-circuited by a connection completed at the left-hand front contact 29 of armature 7 while the short-circuit on winding 11 is removed by the opening of the contact 28. Winding 11 now becomes energized and winding 10 deenergized with the result that the armatures are caused to swing in a counter-clockwise direction back to the position shown in the drawing where winding 11 is short-circuited and the short circuit of winding 10 removed. The above cycle of operation will then be repeated all over again. The proportioning of the parts of the relay FR are such that the armatures will make a complete cycle of operation in substantially two seconds.

With both track sections W—X and Y—Z unoccupied both track relays T^{EB} and T^{WB} are energized and the flasher relay FR is inactive. A train approaching the intersection on the track EB will enter the section W—X and shunt the track relay T^{EB}. The deenergizing of relay T^{EB} causes current to be supplied from the positive terminal B of any convenient source of current not shown through the back contact 12, wire 13 and the windings 11 and 10 of flasher relay FR and thence to the negative terminal C of the source of current. Due to the short-circuiting of the winding 11 described above the relay FR is set into operation and will continue to be thus operated in the manner previously pointed out as long as the train occupies the section W—X and track relay T^{EB} is deenergized. During the interval the armature 8 engages the right-hand contact 14 current flows from the terminal B of the current source through back contact 12 of relay T^{EB}, wires 13 and 15, armature 8, contact 14, wire 16, lamp R of highway crossing signal S1, wire 17, lamp 6 of the railway signal E and to the opposite terminal C of the current source. At the same time current is also supplied to a circuit branching from the wire 15 through armature 9, contact 18, wire 19, lamp R1 of highway signal S, wire 20, lamp 4 of railway signal D, and to the negative terminal C of the current source. During the interval the armatures 8 and 9 are in engagement with the left-hand contacts 21 and 22, respectively, current flows from the terminal B through the back contact 12 and wires 13 and 15 as before, and then by either of two parallel paths to the negative terminal C. One path includes armature 8, contact 21, wire 23, lamp R of highway signal S, wire 24, lamp 4 of railway signal E, and to the negative terminal C. The other path includes armature 9, contact 22, wire 25, lamp R1 of highway signal S1, wire 26, lamp 6 of railway signal D, and to the negative terminal C. It is clear, therefore, that during the entire time the train occupies the section W—X the flasher relay FR is operated causing its armatures 8 and 9 to make a complete cycle of operation substantially every two seconds. This operation of armatures 8 and 9 back and forth causes the lamps R and R1 of each highway signal to be alternately illuminated with the result that the signals S and S1 have the appearance of a swinging red light to traffic approaching the intersection on the highway. Due to the fact that lamps 6 and 4 of railway signal E are in series with the lamp R of signal S1 and lamp R of signal S, respectively, the railway signal E will be flashed alternately bright and dim to the approaching train. The alternate bright and dim display of signal E is an indication to the operator of the train approaching the intersection on the track EB that the highway signals S and S1 are being alternately flashed, that is, there is being effected the normal condition for the highway protection. In the event lamp R of signal S1 is burned out or the circuit to this lamp in some manner incomplete so that the signal S1 provides only a partial protection by the flashing of lamp R1 alone to warn the highway traffic, the lamp 6 in series with the lamp R of S1 will remain dark causing thereby signal E to be alternately bright and dark. Again, if there is a failure of the lamp R of signal S or of the circuit therefor so that signal S provides only partial protection by the flashing of lamp R1 alone to warn the highway traffic, the lamp 4 of signal E remains dark and the signal E will be alternately dim and dark. The display of signal E alternately bright and dark, or alternately dim and dark is an indication to the train operator that one of the highway signals is providing only partial protection. Again, in case of a loss of power by a failure of the current source so that there is no protection afforded by the highway signals S and S1, the railway signal E will also remain dark indicating to the train operator of the train on the track EB that there is a failure of the highway signals S and S1 and that no protection is being provided for the highway traffic. In the case the flasher relay fails to operate the armatures 8 and 9 will be held by the biasing element in their normal position with the result that when the track relay T^{EB} is shunted there is a steady burning of the lamps R and R1 of the highway crossing signals S and S1, respectively, and also of the

lamp 6 of the signal E. The display of a steady burning light by the signal E is an indication to the train on track EB that the normal operation of the highway signals is not being obtained but that the signals S and S1 are each displaying but a single steady red light.

It will be noted that while the train on track EB occupies the section W—X, the railway signal D is displayed in the same manner as described above for the signal E due to the fact that the lamp 6 of signal D is in series with the lamp R1 of signal S1 and the lamp 4 of signal D is in series with the lamp R1 of signal S. It follows that both signals D and E display different indications that correspond to the different operating conditions of the highway signals S and S1.

In the event a train approaches the intersection on the track WB the shunting of the track relay T^{WB} as the train enters the section Y—Z completes the connection to the positive terminal B of the current source at the back contact 27 in the same manner as the shunting of the track relay T^{EB} completes the connection at the back contact 12. Thus, the flasher relay FR and the operating circuits for the signals are supplied with current and will operate in response to a train approaching the intersection on the track WB in the same maner just described for a train on track EB.

To sum up, therefore, an alternate bright and dim display of the signals D and E is an indication that the highway signals S and S1 are flashing as a proper danger warning to highway traffic. An alternate bright and dark or dim and dark display of either signal D or E indicates that only partial warning is being provided by at least one of the highway signals with the possibility that no warning is being given. A dark railway signal is an indication that no warning is being provided for the highway traffic and the steady display of a railway signal indicates that there is a steady red light warning by the highway signals but not the normal appearance of a swinging red light.

Apparatus such as here shown and described provides the operator of a train approaching the highway crossing with complete information as to the protection being provided for the highway traffic with but very little additional expense over that required for the usual highway crossing signals, the additional apparatus required being a single operating unit of a light signal for each railway track. While I have shown my invention applied to a highway crossing a double track railway on which traffic normally moves in but one direction on each track, it will be apparent that it can equally as well be applied to a single track railway with signal D governing traffic in one direction and signal E governing traffic in the opposite direction. Furthermore, my invention can readily be applied to a multiple track road with a railway signal for each track by the mere duplication of parts already described. The form of apparatus here shown will serve to illustrate the manner whereby I propose to supply at very little extra cost apparatus that will indicate to the operator of a train approaching a highway crossing full information as to the operating condition of the highway crossing signal apparatus in order that he may take any necessary precautions in approaching the highway in case there is a failure of the normal display of the highway signals.

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 intersected by a highway, two normally inactive highway crossing signals each including an electric light and said signals set to govern highway traffic approaching the intersection in opposite directions, a railway signal having two electric lights each adapted to display a distinctive indication, a first circuit including one light of the railway signal and the light of one of said highway signals in series, a second circuit including the other light of the railway signal and the light of the other highway signal in series, and means responsive to a train approaching the intersection adapted to alternately close periodically the said first and second circuits for causing the flashing of said highway signals to warn highway traffic and to alternately flash the two lights of said railway signal as an indication to the approaching train that proper highway warning is being given.

2. In combination, a stretch of railway track intersected by a highway, two normally inactive flasher light signals each including a lamp and said signals set to govern highway traffic approaching the intersection in opposite directions, a railway light signal having one lamp in series with the lamp of one highway signal and a second lamp in series with the lamp of the other highway signal and said railway signal set to govern railway traffic approaching the intersection, means responsive to a train approaching the intersection to set into operation the alternate flashing of the two lamps of said highway signal and the alternate flashing of the two lamps of the railway signal to indicate to the approaching train the flashing of each highway signal.

3. In combination, a stretch of railway track intersected by a highway, two normally inactive flasher light signals each includ-

ing a lamp and said signals set to govern highway traffic approaching the intersection in opposite directions, a railway signal having one lamp in series with the lamp of one highway signal and a second lamp in series with the lamp of the other highway signal and said railway signals set to govern traffic approaching the intersection, a track circuit for said railway track, a flasher relay normally inactive, means controlled by the track circuit for setting into operation the flasher relay as a train approaches the intersection, and circuit means controlled jointly by the flasher relay and the track circuit for causing alternate flashing of the two lamps of said highway signals and thereby alternately flash the two lamps of the railway signal to indicate to the approaching train the flashing of each highway signal.

4. In combination, a stretch of railway track intersected by a highway, two normally inactive highway flasher light signals each including a lamp and said signals set to govern highway traffic approaching the intersection in opposite directions, a railway signal having a lamp adapted to display a brilliant indication connected in series with the lamp of one highway signal and a second lamp adapted to display a dim indication connected in series with the lamp of the other highway signal and said railway signal set to govern railway traffic approaching the intersection, and circuit means responsive to a train approaching the intersection for causing the alternate flashing of the two lamps of said highway signals and thereby cause the two lamps of the railway signal to be alternately in circuit to display an alternate brilliant and dim signal to the approaching train when both highway signals are normally operated and to display an alternate brilliant and dark signal or an alternate dim and dark signal when only one highway signal is operated and to display no signal when neither highway signal is operated.

5. In combination, a railway intersected by a highway, two normally inactive highway signals each including two lamps and said signals set to govern highway traffic approaching the intersection in opposite directions, two normally inactive railway signals each including two lamps and said signals set to govern railway traffic approaching the intersection in opposite directions, circuit means for illuminating the lamps of said signals arranged that each railway signal has one lamp connected in series with a lamp of one highway signal and its other lamp connected in series with a lamp of the other highway signal, and a flasher relay rendered active by a train approaching the intersection from either direction to so energize the circuit means as to cause the alternate flashing of the two lamps of each of said highway and railway signals.

6. In combination, a railway intersected by a highway, two normally inactive highway signals each including two lamps, two railway signals each having a lamp adapted to display a bright indication connected in series with a lamp of one of the highway signals and a second lamp adapted to display a dim indication connected in series with a lamp of the other highway signal, circuit means responsive to a train approaching the intersection for causing the alternate flashing of the two lamps of each highway signal and thus cause each railway signal to alternately display a bright and dim indication to indicate the flashing of said highway signals.

7. In combination, a stretch of railway track intersected by a highway, two normally inactive highway crossing signals each including a lamp and said signals set to warn highway traffic approaching the intersection in opposite directions, a railway signal comprising a single operating unit having two lamps one adapted to cause said unit to display one indication and the other adapted to cause said unit to display a second and different indication and said railway signal set to be exhibited to railway traffic approaching the intersection, track circuit means for rendering the highway signals active upon the approach of a train by alternately flashing the lamps of said highway signals, and means responsive to the flashing of one highway signal to cause one lamp of said railway signal unit to display its indication and responsive to the flashing of the lamp of the other highway signal to cause the other lamp of the railway signal unit to display its indication and thereby alternately display the two indications of the railway signal to indicate the flashing of both highway signals.

In testimony whereof I affix my signature.

PAUL H. CRAGO.