April 26, 1932. P. H. CRAGO 1,855,705

HIGHWAY CROSSING PROTECTION

Original Filed Sept. 26, 1929

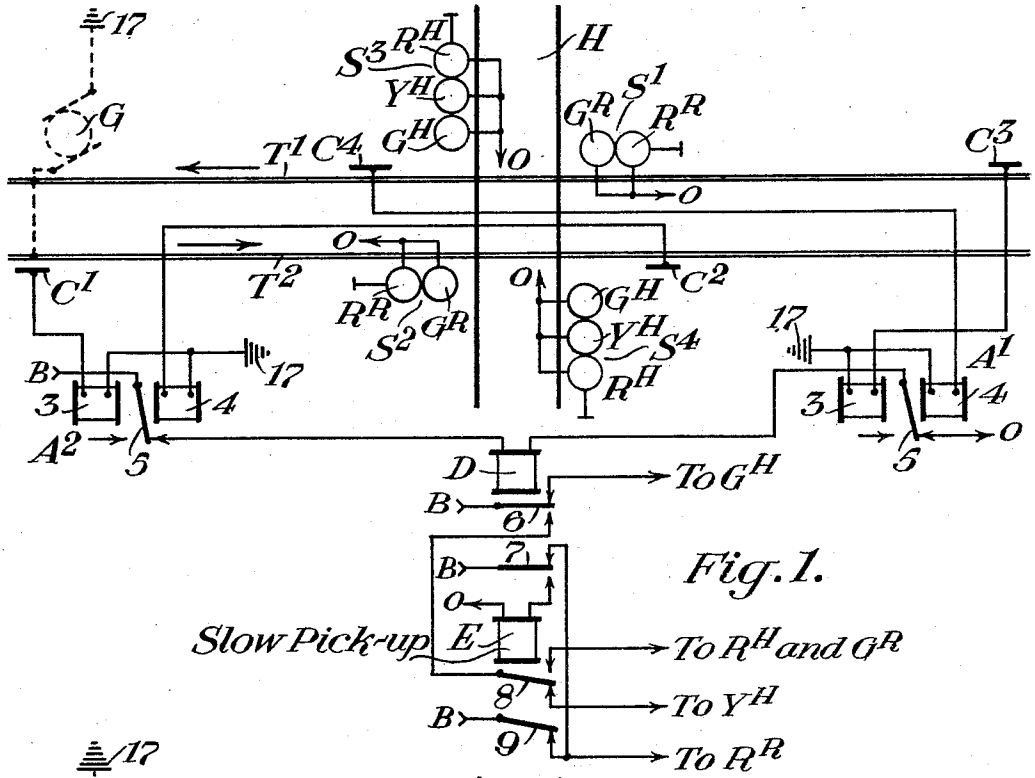

Fig. 1.

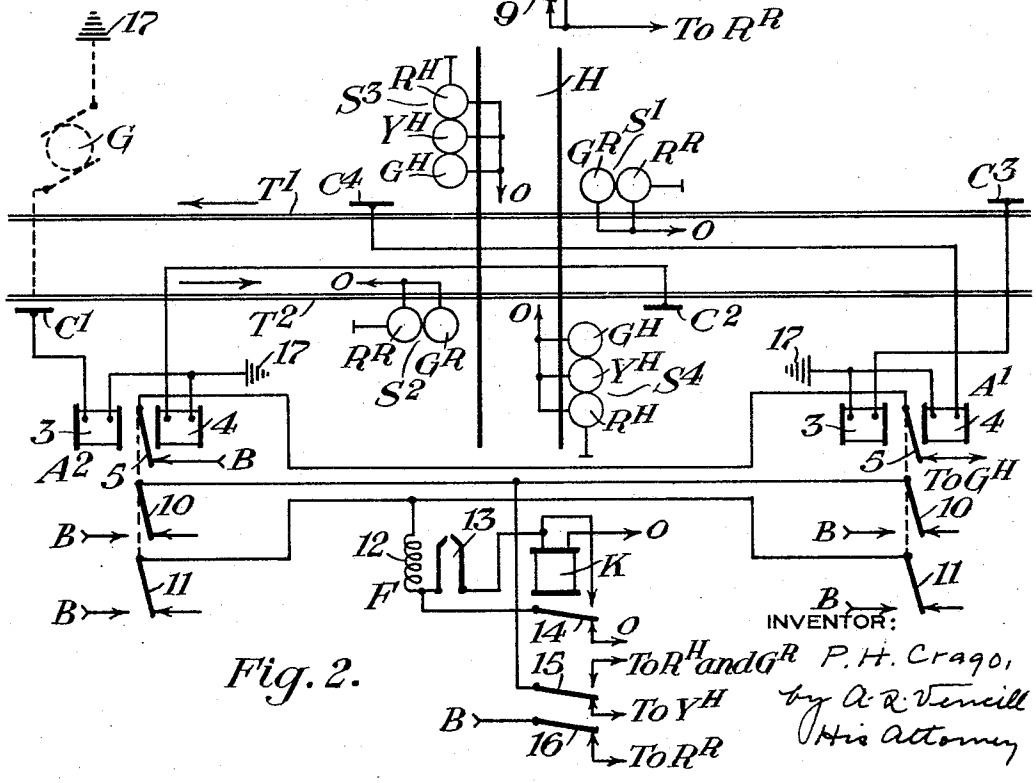

Fig. 2.

INVENTOR:
P. H. Crago,
by A. R. Vencill
His Attorney

Patented Apr. 26, 1932 1,855,705

UNITED STATES PATENT OFFICE

PAUL H. CRAGO, OF WILKINSBURG, PENNSYLVANIA, ASSIGNOR TO THE UNION SWITCH & SIGNAL COMPANY, OF SWISSVALE, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA

HIGHWAY CROSSING PROTECTION

Application filed September 26, 1929, Serial No. 395,327. Renewed May 2, 1931.

My invention relates to apparatus for protecting the intersections of highways and railways, and has for an object the provision of novel and improved means for controlling railway signals and highway signals associated with such intersections.

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

In the accompanying drawings, Fig. 1 is a diagrammatic view showing one form of apparatus embodying my invention. Fig. 2 is a diagrammatic view showing a modification of a portion of the apparatus shown in Fig. 1 and also embodying my invention.

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

Referring first to Fig. 1, the reference characters T^1 and T^2 designate the trolley wires of a double track electric railway, which railway is intersected by a highway H. The highway is provided with signals S^3 and S^4, each of which comprises a proceed lamp G^H, a preliminary warning lamp Y^H, and a final warning lamp R^H. Each track of the electric railway is likewise provided with a signal S^1 or S^2, for governing trains approaching the highway, each of which signals comprises a proceed lamp G^R and a stop lamp R^R.

The signals are controlled by two "last position" relays A^1 and A^2 associated with the two trolley wires T^1 and T^2, respectively. Each of these relays comprises a normal winding 4 and a reverse winding 3, as well as an armature 5 movable to a normal or a reverse position according as the normal or the reverse winding is energized. Each of these relays is so designed that the armature remains in the position to which it was last moved after the winding which moved it there becomes de-energized. A main relay D is controlled by the last position relays A^1 and A^2, and a slow pick-up relay E is controlled by the main relay D.

The two windings of the last position relay A^2 are controlled by two trolley contactors C^1 and C^2 respectively, associated with trolley wire T^2, the former of which is located in advance of the highway H, and the latter of which is located close to the highway. One terminal of winding 3 is connected with the contactor C^1, and one terminal of winding 4 is connected with the contactor C^2. The remaining terminals of these windings are connected with the ground at 17. The two trolley wires T^1 and T^2 are, of course, connected with one terminal of a generator G, the other terminal of which is connected with the ground 17. It follows that when a car passes along the track corresponding to trolley wire T^2, winding 3 of relay A^2 will be energized momentarily when the car passes contactor C^1, and the other winding 4 will be energized momentarily when the car passes contactor C^2. The windings 3 and 4 of relay A^1 are controlled in a similar manner by contactors C^3 and C^4 associated with trolley wire T^1.

The operation of the apparatus shown in Fig. 1 is as follows: Relay D is normally energized by virtue of a circuit which passes from terminal B of a suitable source of current, through contact 5 of relay A^2 in the normal position, winding of relay D, contact 5 of relay A^1 in normal position, to terminal O of the same source of current. Relay E is then de-energized, because its circuit is open at the back point of contact 7 of relay D. The proceed lamps G^H of the highway signals are then lighted by virtue of a circuit which passes from terminal B, through front point of contact 6 of relay D, then through the lamps G^H to terminal O. The stop lamp R^R of each railway signal is lighted by virtue of a circuit which passes from terminal B, through the front point of contact 7 of relay D and the lamps R^R to terminal O. This circuit is provided with a branch around contact 7 of relay D, which branch includes back contact 9 of relay E. The remaining lamps of all of the signals are extinguished.

I will now assume that a car passes along the track corresponding to trolley wire T^2, and that it is moving in the direction indicated by the arrow applied to this wire. When this car passes contactor C^1, it will energize winding 3 of relay A^2, whereupon contact 5 of this relay will be swung to its reverse position, thereby de-energizing relay D. This will close the circuit for relay E

at the back point of contact 7, but relay E will not close until the expiration of a given interval of time. The opening of relay D will open at the front point of contact 6, the circuit for the proceed lamps G^H of the highway signals, so that these lamps become extinguished. The warning lamps Y^H will immediately become lighted by virtue of a circuit which passes from terminal B, through back point of contact 6 of relay D, back point of contact 8 of relay E, and the lamps Y^H to terminal O. The stop lamps R^R of the railway signals will remain lighted because of the auxiliary circuit for these lamps through contact 9 of relay E. After the expiration of the aforesaid given interval of time, relay E will close, thereby opening at back contact 9 the circuit for the stop lamps R^R of the railway signals, whereupon these lamps will become extinguished. The proceed lamps G^R of the railway signals will immediately become lighted because of a circuit which passes from terminal B, through the back point of contact 6 of relay D, front point of contact 8 of relay D, and the proceed lamps G^R to terminal O. This circuit also includes the final warning lamps R^H of the highway signals, so that these lamps will likewise become lighted, it being understood that the preliminary warning lamps Y^H will become extinguished because the circuit for these lamps will be opened at the back point of contact 8. It follows that unless the car consumes a given interval of time in passing from the contactor C^1 to the signal S^2, the car will receive a stop indication at this signal. In other words, the car is not permitted to cross the highway H unless its speed is below a given limit. Immediately after crossing the highway H, the car will encounter the contactor C^2, and so will momentarily energize winding 4 of relay A^2, thereby restoring contact 5 of this relay to its normal position. This will again energize relay D, which will in turn de-energize relay E, so that all parts of the apparatus will be restored to the conditions in which they are shown in the drawings.

If a car approaches the highway on the track corresponding to trolley wire T^1, the operation will be the same as before, except that the circuit for relay D will be open at contact 5 of relay A^1.

Referring now to Fig. 2, the apparatus for the control of the last position relays A^1 and A^2 is the same as the corresponding apparatus in Fig. 1, and the arrangement of the signals is likewise the same as in Fig. 1. The means for controlling these signals, however, involves a normally de-energized thermal relay F and a normally de-energized stick relay K. Assuming that relays A^1 and A^2 are both in their normal positions, as shown in the drawings, the proceed lamps G^H of the highway signals are lighted by virtue of a circuit which passes from terminal B, through normal contact 5 of relay A^2, normal contact 5 of relay A^1 and the lamps G^H to terminal O. The stop lamps R^R of the railway signals are lighted by virtue of a circuit which includes back contact 16 of relay K. The other lamps are all extinguished.

Assuming now that a car passes contactor C^1, relay A^2 will be reversed, thereby opening at contact 5 of this relay the circuit for the proceed lamps G^H of the highway signals. The preliminary warning lamps Y^H will be lighted by virtue of a circuit which passes from terminal B, through reverse contact 10 of relay A^2, back contact 15 of relay K, and the lamps Y^H to terminal O. The operating winding 12 of the thermal relay F will become energized by a circuit which passes from terminal B, through contact 11 of relay A^2 in the reverse position, winding 12 and the back contact 14 of relay K to terminal O. After the lapse of a given interval of time, contact 13 of relay F will close, thereby closing a pick-up circuit for relay K, which circuit is from terminal B, through contact 11 in the reverse position, winding 12 and contact 13 of relay F, and the winding of relay K to terminal O. Relay K will then remain energized by virtue of a stick circuit, which passes from terminal B, through contact 11 in the reverse position, winding 12, front point of contact 14 and the winding of relay K to terminal O. The current flowing in this circuit is insufficient to keep contact 13 of relay F closed. When relay K becomes energized, the circuit for the preliminary warning lamps Y^H will be opened at the back point of contact 15, and the circuit for the stop lamps R^R will be opened at back contact 16. The circuit for the final warning lamps R^H, and for the proceed lamps G^R, will be closed at the front point of contact 15 of relay K. When the car passes contactor C^2, relay A^2 will be restored to its normal position, so that the stick circuit for relay K will be opened at contact 11, with the result that the parts of the apparatus will be restored to the positions in which they are shown in the drawings.

When a car approaches the highway on the track corresponding to trolley wire T^1, the operation of the apparatus will be the same as before, except that the circuits will be controlled by the contacts of relay A^1 instead of by the contacts of relay A^2.

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 railway intersected by

a highway, a last-position relay having a normal and a reverse winding as well as an armature movable to normal or reverse position according as the normal or the reverse winding is energized and remaining in the position to which it was last moved after the winding which moved it there becomes de-energized, means for energizing the reverse winding when a train approaches said highway and for energizing the normal winding when such train passes the highway, a main relay, a circuit for said main relay controlled by a normal contact of said last position relay, a slow pick-up relay, a circuit for said slow pick-up relay controlled by a back contact of said main relay, and signals for said railway and said highway controlled jointly by said main and slow pick-up relays.

2. In combination, a railway intersected by a highway, a last-position relay having a normal and a reverse winding as well as an armature movable to normal or reverse position according as the normal or the reverse winding is energized and remaining in the position to which it was last moved after the winding which moved it there becomes de-energized means for energizing the reverse winding when a train approaches said highway and for energizing the normal winding when such train passes the highway, a main relay, a circuit for said main relay controlled by a normal contact of said last-position relay, a slow pick-up relay, a circuit for said slow pick-up relay controlled by a back contact of said main relay, a signal comprising a green and a red lamp for said highway, a signal comprising a green and a red lamp for said railway, a circuit for the green highway lamp including a front contact of said main relay, a circuit for the red railway lamp including a back contact of said slow pick-up relay, and a circuit for said red highway lamp and said green railway lamp including a front contact of said slow pick-up relay and a back contact of said main relay.

3. In combination, a railway intersected by a highway, a last-position relay having a normal and a reverse winding as well as an armature movable to normal or reverse position according as the normal or the reverse winding is energized and remaining in the position to which it was last moved after the winding which moved it there becomes de-energized, means for energizing the reverse winding when a train approaches said highway and for energizing the normal winding when such train passes the highway, a main relay, a circuit for said main relay controlled by a normal contact of said last-position relay, a slow pick-up relay, a circuit for said slow pick-up relay controlled by a back contact of said main relay, a signal for said highway comprising a red and a yellow and a green lamp, a signal for said railway comprising a green and a red lamp, a circuit for the green highway lamp including a front contact of said main relay, a circuit for the red railway lamp including a back contact of said slow pick-up relay, a circuit for said red highway lamp and said green railway lamp including a front contact of said slow pick-up relay and a back contact of said main relay, and a circuit for said yellow highway lamp including a back contact of said slow pick-up relay and a back contact of said main relay.

4. In combination, a railway intersected by a highway, a last-position relay having a normal and a reverse winding as well as an armature movable to normal or reverse position according as the normal or the reverse winding is energized and remaining in the position to which it was last moved after the winding which moved it there becomes de-energized, a circuit for said reverse winding including a trolley contactor located in advance of said highway, a circuit for aid normal winding including a second trolley contactor located adjacent the highway, a main relay, a circuit for said main relay controlled by a normal contact of said last-position relay, a slow pick-up relay, a circuit for said slow pick-up relay controlled by a back contact of said main relay, and signals for said railway and said highway controlled jointly by said main and slow pick-up relays.

5. In combination, a railway intersected by a highway, a last-position relay having a normal and a reverse winding as well as an armature movable to normal or reverse position according as the normal or the reverse winding is energized and remaining in the position to which it was last moved after the winding which moved it there becomes de-energized, a circuit for said reverse winding including a trolley contactor located in advance of said highway, a circuit for said normal winding including a second trolley contactor located adjacent the highway, a main relay, a circuit for said main relay controlled by a normal contact of said last-position relay, a slow pick-up relay, a circuit for said slow pick-up relay controlled by a back contact of said main relay, a signal comprising a green and a red lamp for said highway, a signal comprising a green and a red lamp for said railway, a circuit for the green highway lamp including a front contact of said main relay, a circuit for the red railway lamp including a back contact of said slow pick-up relay, and a circuit for said red highway lamp and said green railway lamp including a front contact of said slow pick-up relay and a back contact of said main relay.

6. In combination, a railway intersected by a highway, a normally energized main relay, means for de-energizing said relay when a train approaches the highway, a slow pick-up relay controlled by a back contact of said

main relay, a signal comprising a green and a red lamp for said highway, a signal comprising a green and a red lamp for said railway, a circuit for the green highway lamp including a front contact of said main relay, a circuit for the red railway lamp including a back contact of said slow pick-up relay, and a circuit for said red highway lamp and said green railway lamp including a front contact of said slow pick-up relay and a back contact of said main relay.

7. In combination, a railway intersected by a highway, a normally energized main relay, means for de-energizing said relay when a train approaches the highway, a slow pick-up relay controlled by a back contact of said main relay, a signal for said highway comprising a red and a yellow and a green lamp, a signal for said railway comprising a green and a red lamp, a circuit for the green highway lamp including a front contact of said main relay, a circuit for the red railway lamp including a back contact of said slow pick-up relay, a circuit for said red highway lamp and said green railway lamp including a front contact of said slow pick-up relay and a back contact of said main relay, and a circuit for said yellow highway lamp including a back contact of said slow pick-up relay and a back contact of said main relay.

8. In combination, a railway intersected by a highway, a relay comprising two windings, means for energizing the first winding when a train approaches said highway and for energizing the second winding when such train passes the highway, a signal for said railway comprising a green lamp and a red lamp, a signal for said highway comprising a green lamp and a red lamp, means controlled by said relay and effective after said second winding has been energized and until said first winding subsequently becomes energized for lighting the green highway lamp and the red railway lamp, means effective when said first winding subsequently becomes energized for extinguishing the green highway lamp, and means effective upon the expiration of a predetermined time interval after said first winding becomes energized for extinguishing the red railway lamp and for lighting the green railway lamp and the red highway lamp.

9. In combination, a railway intersected by a highway, a relay comprising two windings, means for energizing the first winding when a train approaches said highway and for energizing the second winding when such train passes the highway, a signal located near the highway for controlling trains approaching the highway and a signal located near the railway for controlling traffic approaching the railway, means controlled by said relay and effective after said second winding has been energized and until said first winding subsequently becomes energized for causing the railway signal to give a stop indication and the highway signal to give a proceed indication, means operating when said first winding subsequently becomes energized for causing the highway signal to give a warning indication, and means operating after the lapse of a given time thereafter to cause the indication given by said railway signal to change from stop to proceed.

10. In combination, a railway intersected by a highway, a relay comprising two windings, means for energizing the first winding when a train approaches said highway and for energizing the second winding when such train passes the highway, a signal located near the highway for controlling trains approaching the highway and another signal located near the railway for controlling traffic approaching the railway, means effective after said second winding has been energized and until said first winding subsequently becomes energized for causing the railway signal to give a stop indication and the highway signal to give a proceed indication, a slow acting device, means operating when said first winding subsequently becomes energized for causing the highway signal to give a warning indication and for setting into operation said slow acting device, and means effective when the operation of said slow acting device has been completed for changing the indication given by said railway signal from stop to proceed.

11. In combination, a railway intersected by a highway, a relay comprising two windings, means for energizing the first winding when a train approaches said highway and for energizing the second winding when such train passes the highway, a signal located near the highway for controlling trains approaching the highway and a signal located near the railway for controlling traffic approaching the railway, means controlled by said relay and effective after said second winding has been energized and until said first winding subsequently becomes energized for causing the railway signal to give a stop indication and the highway signal to give a proceed indication, means operating when said first winding subsequently becomes energized for causing the highway signal to give a warning indication, and means operating after the lapse of a given time thereafter to cause the indication given by said railway signal to change from stop to proceed and the indication given by said highway signal to change from warning to stop.

12. In combination, a railway intersected by a highway, a relay comprising two windings, means for energizing the first winding when a train approaches said highway and for energizing the second winding when such train passes the highway, a signal for said railway comprising a green lamp and a red lamp, a signal for the highway comprising a

green lamp and a red lamp as well as a yellow lamp, means controlled by said relay and effective after said second winding has been energized and until said first winding subsequently becomes energized for lighting the green highway lamp and the red railway lamp, means effective when said first winding subsequently becomes energized for extinguishing the green highway lamp and for lighting the yellow highway lamp, and means effective upon the expiration of a predetermined time interval after said second winding becomes energized for extinguishing the red railway lamp and the yellow highway lamp and for lighting the green railway lamp and the red highway lamp.

13. In combination, a railway intersected by a highway, a relay comprising two windings, means for energizing the first winding when a train approaches said highway and for energizing the second winding when such train passes the highway, a signal for said railway comprising a green lamp and a red lamp, a signal for the highway comprising a green lamp and a red lamp as well as a yellow lamp, means controlled by said relay and effective after said second winding has been energized and until said first winding subsequently becomes energized for lighting the green highway lamp and the red railway lamp, a slow acting device, means effective when said first winding subsequently becomes energized for extinguishing the green highway lamp and for lighting the yellow highway lamp and for setting into operation said slow acting device, and means effective when the operation of said slow acting device has been completed for extinguishing the red railway lamp and the yellow highway lamp and for lighting the green railway lamp and the red highway lamp.

14. In combination, a railway intersected by a highway, a normally deenergized slow acting thermal relay, means for energizing said relay and simultaneously giving a warning highway signal when a train approaches the highway, a second normally deenergized relay, means for energizing said second relay after said thermal relay has closed and for subsequently keeping it energized until the train passes the highway, and means for giving a stop highway signal while said second relay is energized.

15. In combination, a railway intersected by a highway, a last-position relay having a normal and a reverse winding as well as an armature movable to normal or reverse position according as the normal or the reverse winding is energized and remaining in the position to which it was last moved after the winding which moved it there becomes deenergized, means for energizing the reverse winding when a train approaches said highway and for energizing the normal winding when such train passes the highway, a signal for controlling trains approaching the highway and another signal for controlling traffic approaching the railway, means controlled by a normal contact of said last-position relay for causing said highway signal to give a proceed indication, a normally deenergized slow acting thermal relay, a third normally deenergized relay, means controlled by a reverse contact of said last-position relay and by a back contact of said third relay for causing said highway signal to give a warning indication, means controlled by a reverse contact of said last-position relay and by a back contact of said third relay for energizing the winding of said thermal relay, means controlled by a reverse contact of said last-position relay and by a contact of said thermal relay and including the winding of said thermal relay for energizing said third relay, means controlled by a reverse contact of said last-position relay and by a front contact of said third relay and including the winding of said thermal relay for subsequently maintaining said third relay energized, means controlled by a back contact of said third relay for causing said railway signal to give a stop indication, and means controlled by a reverse contact of said last-position relay and by a front contact of said third relay for causing said highway signal to give a stop indication and said railway signal to give a proceed indication.

In testimony whereof I affix my signature.

PAUL H. CRAGO.