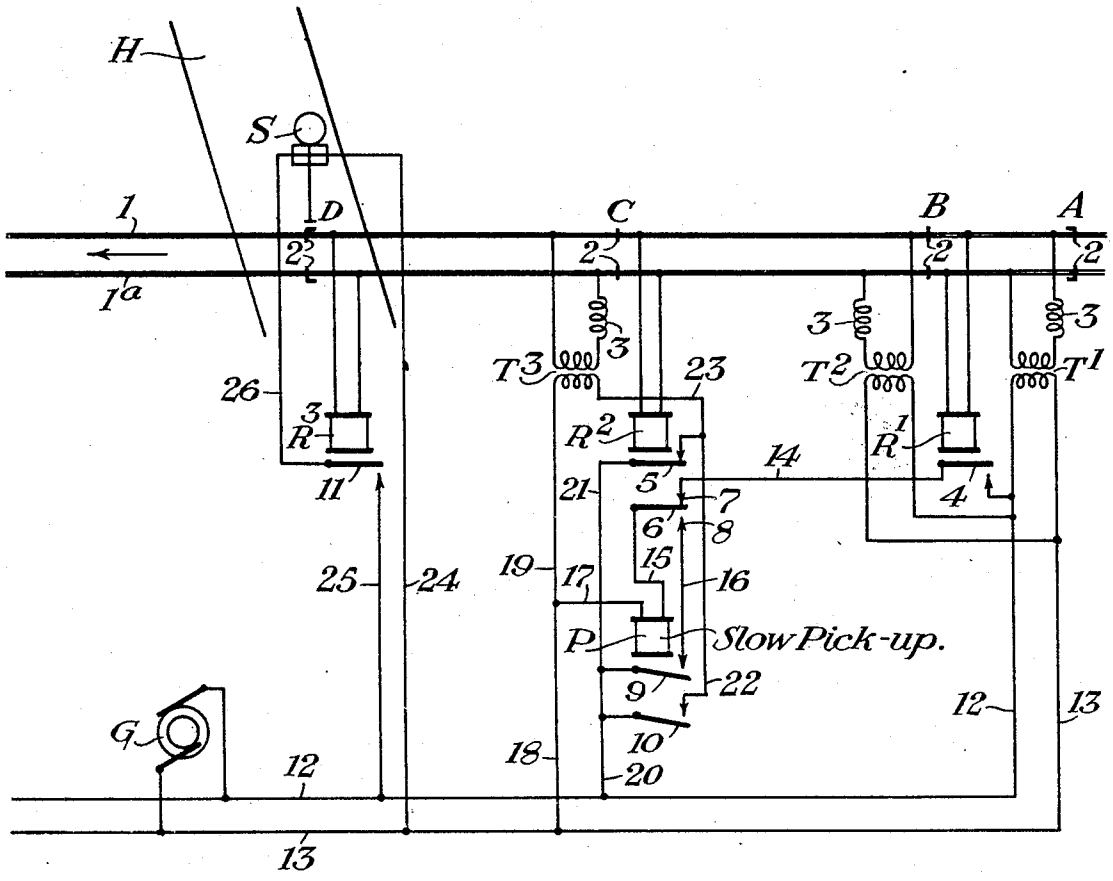
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CONTROLLING APPARATUS FOR HIGHWAY CROSSING SIGNALS

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CONTROLLING APPARATUS FOR HIGHWAY CROSSING SIGNALS

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My invention relates to controlling apparatus for highway crossing signals, that is, to means for the control of signals which are placed at intersections of railways and highways for the purpose of warning users of the highway when a train is approaching.

One feature of my invention is the provision of means for starting the operation of the signal at one point or another depending on the speed of a train approaching the signal.

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

The accompanying drawing is a diagrammatic view illustrating one form of apparatus embodying my invention as applied to a crossing bell.

Referring to the drawing, the reference characters 1 and 1^a designate the track rails of a stretch of railway track along which traffic normally moves in the direction indicated by the arrow. This track is intersected by a highway H. Insulated joints 2 divide the track rails 1 and 1^a into three insulated track sections A—B, B—C, and C—D, the end D of section C—D being located at or near the highway crossing H. A signal S, of the crossing bell type, is placed adjacent to the highway.

Current is supplied to the entrance end of each of the track sections A—B, B—C, and C—D, by transformers T^1, T^2, and T^3, respectively, through the usual impedance device 3. The primary windings of transformers T^1, T^2, and T^3 are supplied with alternating current over line wires 12 and 13 from a generator G. Relays R^1, R^2, and R^3, respectively, are connected across the rails at the exit ends of sections A—B, B—C, and C—D.

The supply of current to the primary winding of transformer T^3 is so controlled by track relay R^2 and an auxiliary slow pick-up stick relay P as to be interrupted when a train moving faster than a given speed passes point B, or to continue uninterrupted until a train moving at a lower speed passes point C. Relay P is provided with a pick-up circuit which is from generator G, over line wire 12, contact 4, wire 14, contact 7—6 of relay R^2, wire 15, winding of relay P, and wires 17, 18, and 13 to generator G. A stick circuit for relay P is from generator G over line wire 12, through wire 20, contact 9 of relay P, wire 16, back contact 8—6 of relay R^2, wire 15, winding of relay P and wires 17, 18, and 13 to generator G. A control circuit for transformer T^3 is from generator G, over line wire 12, wire 20, contact 10 of relay P, wires 22 and 23, primary winding of transformer T^3, and wires 19, 18, and 13 to generator G. The portion of this circuit through contact 10 and wire 22 is in multiple with a path through wire 21 and contact 5 of relay R^2.

As shown in the drawing, all of the parts of the apparatus occupy the positions corresponding to the normal or unoccupied condition of the sections A—B, B—C, and C—D.

In describing the operation of the apparatus I will first assume that a train moving from right to left, enters the stretch of track shown in the drawing. When the train enters section A—B, relay R^1 becomes de-energized, thereupon closing its contact 4 and completing the pick-up circuit for relay P. I will further assume that the train moves so rapidly through section A—B that relay P, because of its slow pick-up characteristic, does not have time to close its front contacts before the train enters section B—C and that relay P hence remains de-energized as the train moves through section B—C. Therefore, the branch path of the primary circuit of transformer T^3 continues open at contact 10 of relay P and the main path is opened at contact 5 of relay R^2 when the train de-energizes relay R^2, thus causing the primary winding of transformer T^3 to become de-energized. In turn, relay R^3 becomes de-energized because the primary circuit of transformer T^3 is de-energized. The back contact of relay R^3 then closes the operating circuit of bell S from generator G, over line wire 12, wire 25, contact 11 of relay R^3, wire 26, bell S, and wires 24 and 13 to generator G, causing the bell to ring while the train is moving through sections B—C and C—D.

As the train moves out of section B—C, relay R^2, by its contact 5, closes the primary circuit of transformer T^3 which again energizes relay R^3 when the train leaves section C—D. Relay R^3, upon opening its back contact 11, breaks the operating circuit of bell S which then stops ringing.

I will now assume that a train moves so slowly through section A—B that relay P closes its front contacts before the train de-energizes relay R^2, so that relay P then continues energized by current flowing in its stick circuit as the train moves through section B—C. While relay P is energized, the primary circuit of transformer T^3 is completed through contact 10 of relay P, and relay R^3 continues energized and the bell S will not ring until the train enters section C—D and de-energizes relay R^3. Bell S will then continue to ring until the train leaves section C—D.

From the foregoing description it is clear that if a train moves faster than a certain rate of

speed through section A—B, bell S will ring from the time the train enters section B—C, until it leaves section C—D. It is also clear that if a train moves at lower speeds through section A—B, bell S will ring only from the time the train enters section C—D, until it leaves section C—D.

Although I have herein shown and described only one form of signaling 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, three successive sections of railway track, a highway intersecting said track adjacent the isolated end of the third section, a track circuit including a track relay for each section, an auxiliary slow pick-up stick relay, a pick-up circuit for said auxiliary relay including a source of current and a back contact of the track relay for the first track section as well as a front contact of the track relay for the second section, a stick circuit for said auxiliary relay including a source of current and a back contact of the track relay for the second track section as well as a front contact of the auxiliary relay, a control circuit for the source of current for the third track section including a source of current and a front contact of the track relay for the second track section, a second control circuit for the source of current for the third section including a source of current and a front contact of the auxiliary relay, a highway crossing signal, and an operating circuit for said signal including a source of current and a back contact of the track relay for the third section.

2. In combination, three successive sections of railway track, a highway intersecting said track adjacent the isolated end of the third section, a track circuit including a track relay for each section, an auxiliary slow pick-up stick relay, means including the track relay of the first track section for energizing said auxiliary relay, means including the track relay of the second section for continuing the energization of said auxiliary relay, a highway crossing signal, and means controlled by the auxiliary relay and by the track relay for the third section for controlling the operation of said signal.

3. In combination, three successive sections of railway track, a highway intersecting said track adjacent the isolated end of the third section, a track circuit including a track relay for each section, an auxiliary slow pick-up stick relay, means including the track relays of the first and second track sections for controlling said auxiliary relay, means including the auxiliary relay and the track relay of the second track section for controlling the source of current for the third track section, a highway crossing signal, and means including the track relay of the third section for controlling said signal.

4. In combination, three successive sections of railway track, a highway intersecting said track adjacent the isolated end of the third section, a track circuit including a track relay for each section, a slow pick-up stick relay controlled by the track relays for the first and second sections, a highway crossing signal, means for controlling said signal by the track relays of the second and third track sections, and means including said stick relay for removing said signal from control by the track relay for the second section.

5. In combination, three successive sections of railway track, a highway intersecting said track adjacent the isolated end of the third section, a track circuit including a track relay for each section, a traffic-controlled auxiliary slow pick-up stick relay, a highway crossing signal, means including the track relays of the second and third track sections for causing the signal to operate while a train occupies either of these two sections, and means including the auxiliary relay and the track relay for the first track section for delaying the operation of said signal until a slow-moving train enters the third section.

6. In combination, three successive sections of railway track, a highway intersecting said track adjacent the isolated end of the third section, a track circuit including a track relay for each section, a traffic-controlled auxiliary slow pick-up stick relay, a highway crossing signal, means controlled by the track relays of the second and third sections for causing said signal to operate while a train occupies either the second or the third section after moving at a high rate of speed through the first section, and means controlled by said auxiliary relay and the track relays of the first and third sections for causing said signal to operate only while a train occupies the third section after moving at lower rates of speed through the first section.

7. In combination, a stretch of railway track intersected by a highway, a highway crossing signal located at the point of intersection, means controlled by trains approaching said highway for causing operation of said signal, and means responsive to the speed of a train approaching said highway for causing the operation of said signal to begin when the train reaches one point or another.

8. In combination, a stretch of railway track intersected by a highway, a highway crossing signal located at the point of intersection, means for starting the operation of said signal when a slow moving train reaches a point relatively close to the signal, and means for starting the operation of said signal when a fast moving train reaches a point relatively far from the signal.

9. In combination, a stretch of railway track intersected by a highway, a highway crossing signal located at the point of intersection, means controlled by trains approaching said highway for causing operation of said signal, and means for causing the operation of said signal to begin when a train reaches one point or another in approaching the signal according as the speed of the train is above or below a given value.

10. In combination, two successive sections of railway track, a track circuit for each section each containing a track relay, a slow-acting relay, a pick-up circuit for said slow-acting relay including a back contact of one said track relay and a front contact of the other said track relay, a signal, and a control circuit for said signal governed by said slow-acting relay for at times delaying the starting of said signal after said pickup circuit is closed.

11. In combination, two successive sections of railway track, a track circuit for each section each containing a track relay, a slow-acting relay, a pick-up circuit for said slow-acting relay including a back contact of one said track relay and a front contact of the other said track relay, a stick circuit for said slow-acting relay con-

trolled by one of said track relays, a signal, and means controlled by said slow-acting relay for governing said signal.

12. In combination, a stretch of railway track intersected by a highway, a highway crossing signal located at the point of intersection, starting means for setting said signal into operation when a train approaching said intersection reaches one point in said stretch, and means responsive to the speed of the train approaching such one point for at times delaying the operation of said starting means.

13. In combination, a stretch of railway track intersected by a highway, a highway crossing signal located at the point of intersection, starting means for setting said signal into operation when a train approaching said intersection reaches one point in said stretch, and means responsive to the speed of the train approaching such one point for at times delaying the operation of said starting means until the train reaches a second point located between such one point and the intersection.

14. In a signaling system for highway crossings on railroads, the combination with a signal at the crossing, starting means actuated by an approaching train for setting said signal into operation, and means responsive to the speed of said train for determining the distance in rear of the signal at which the starting means is actuated.

15. In a signaling system for highway crossings on railroads, the combination, with a signal at the crossing, of mechanism responsive to the speed of a train and its location with respect to said crossing, and means for actuating said signal when an approaching train reaches a point in rear of the signal determined by said mechanism.

16. In a signaling system for highway crossings on railroads, the combination with a signal at the crossing, of mechanism responsive to the speed of a train, and means for actuating said signal when an approaching train reaches a point in rear of the signal determined by said mechanism.

17. In combination, a stretch of railway track intersected by a highway, a highway crossing signal located at the point of intersection, means normally tending to set said signal into operation when a train approaching said intersection reaches one point in said stretch and to continue the operation of the signal until the train reaches the highway, and means responsive to the speed of the train approaching such one point for at times delaying the setting of said signal into operation.

18. In a signaling system for highway crossings on railroads, the combination with a signal at the crossing, means actuated by an aproaching train for setting said signal into operation and for continuing the operation of the signal until the train reaches the crossing, and means responsive to the speed of said train for determining the distance in the rear of the signal at which the signal is set into operation.

19. In a railway signal system, the combination, a railway track, a pair of adjacent track circuits, each having a track relay, said track circuits formed by the rails of said track, a signal device for giving a signal on the aproach of a train located on the trackway and a timing device operating said signal device in co-operation with one of said track relays in the deenergized position and said timing device operated by the other track relay in the deenergized position to determine the starting of the signal after the train enters the track circuit controlling said cooperating relay.

20. In a railway crossing signal, the combination, a first track circuit of a predetermined length, a second track circuit, said track circuits formed by the rails of the track, a signal device on the trackway, a timing device in co-operation with said second track circuit controlling the operation of said signal device, and means for operating said timing device in accordance with the time a train occupies the first track circuit for determining the starting of operation of said signal device after the train enters said second track circuit.

21. In a railway signal system, the combination, a railway track divided into sections by a first and a second track circuit, each having track relays, each track relay being normally energized and being deenergized by the presence of a train in the respective sections, said first track circuit being of a predetermined length, a signal device located on the trackway, a circuit for said device, means controlled by the relay of said second track circuit as long as this circuit is occupied by a train for establishing the circuit of said signal device and a timing device operated by the track relay of said first track circuit, said timing device establishing the circuit of said signal device in cooperation with said means, whereby the time of operation of said signal device is controlled by the speed of the train on said first track circuit.

22. In a railway signal system, the combination, a railway track divided into sections by a first and a second track circuit, each having track relays, each track relay being normally energized and being deenergized by the presence of a train in the respective sections, said first track circuit being of a predetermined length, a signal device located on the trackway, a timing device operated by the track relay of said first track circuit, and means controlled jointly by said timing device and by the track relay of said second track circuit for initiating the operation of said signal device and serving thereafter to maintain said signal device in operation as long as the track relay of said second track circuit is deenergized.

23. A method of crossing protection control including the automatic classification of oncoming trains into a plurality of speed classes and the automatic selection of the time of operation of a protecting device to permit trains of lower speed class to approach closer to the device before it is operated than trains of higher speed class.

24. A method of crossing protection control including automatically measuring the time required for an oncoming train to traverse a given distance, and automatically selecting the time of operation of a crossing protection device in accordance with the time measurement to postpone the said operation for a longer time after the time measurement for a slow speed train than for a higher speed train.

25. A method of crossing protection control including the automatic classification of oncoming trains into a plurality of speed classes, and the automatic operation of a protection device when a train reaches a different predetermined distance from the crossing for each speed class, the distance being less for a lower speed class than for a higher speed class.

26. A method of crossing protection control including automatically measuring the time required for an oncoming train to traverse a given distance, and automatically setting a protection device into operation when the train has approached within a predetermined distance of the crossing, the length of the predetermined distance being automatically dependent upon the time measurement so as to permit a slow speed train to approach nearer to the crossing than a high speed train before the device is set into operation.

27. A crossing protection system including means for controlling a crossing protection device, a pair of train operated devices successively actuable by a train approaching the crossing, a connection between said controlling means and the first of said train operated devices to be actuated by a train approaching the crossing, said connection normally operating to set the protection device into operation upon actuation of said first device by a train, train operated timing mechanism for measuring the speed of an approaching train, means controlled by said timing mechanism for rendering the said connection inoperable if the train approaches at less than a predetermined speed, and a connection between said controlling means and the second of said train operated devices, said connection operating to set the protection device into operation upon actuation of said second device by a train if the protection device has not been previously set into operation.

28. A crossing protection system including means for controlling a crossing protection device, a pair of train operated devices successively actuatable by a train approaching the crossing, connections between each of said train operated devices and said controlling means, normally operable to set the protection device into operation upon actuation of said devices by a train, a timing device associated with the connection between said controlling means and the first of said train operated devices to be reached by an oncoming train, said timing device being adapted to render said connection inoperative at the end of a predetermined time interval after actuation of said timing device, and train operated means for actuating said timing device when a train has approached within a predetermined distance of said first train operated device.

29. A crossing protection system including three train operated devices successively actuatable by a train approaching the crossing, a timing device, connections between the timing device and the first of said train operated devices to be reached by an oncoming train, said connections initiating the action of said timing device when said first train operated device is actuated by a train, a crossing protection device provided with controlling means, a connection between the second of said train operated devices and said controlling means, said connection normally operating to set the protection device into operation when said second train operated device is actuated by an oncoming train, means controlled by said timing device for rendering said last mentioned connection inoperative at a predetermined time interval after the initiation of the operation of said timing device, and a connection between the third of said train operated devices and said controlling means, said connection operating to set the protection device into operation upon actuation of said third device by a train unless the protection device has previously been set into operation.

30. A crossing protection system including a railroad track having at least three insulated track circuit blocks at progressively increasing distances from a crossing, a track relay associated with each block, each relay being actuated by the entrance of a train into its associated block, a crossing protection device, an electrical circuit for controlling said device, means for conditioning said circuit for the operation of the device, said means being normally operated upon the actuation of the second track relay to be actuated by a train approaching the crossing, a timing device connected to the first track relay to be actuated by a train approaching the crossing, the action of said timing device being initiated by the actuation of said first relay and said timing device being connected to said circuit conditioning means to render the same inoperative at the end of a predetermined time after the actuation of said timing device, and a second conditioning means for said crossing protection circuit operated by the third track relay to be actuated by a train approaching the crossing.

31. A crossing protection control system including mechanism for initiating the operation of a protection device, a pair of train operated devices successively actuatable by a train approaching the crossing, a connection between said mechanism and the first of said train operated devices to be actuated by a train approaching the crossing, said connection normally operating to initiate the operation of said protection device upon actuation of said first device by a train, train operated timing mechanism for measuring the speed of an approaching train, means controlled by said timing mechanism for rendering the said connection inoperable if the train approaches at less than a predetermined speed, and a connection between said mechanism and the second of said train operated devices, said connection serving to initiate the operation of the protection device upon actuation of said second device by a train if the operation of the protection device has not previously been initiated.

32. A crossing protection control system including mechanism for initiating the operation of a crossing protection device, a pair of train operated devices successively actuatable by a train approaching the crossing, connections between each of said train operated devices and said mechanism, said connections normally operating to initiate the operation of the protection device upon actuation of said devices by a train, a timing device associated with the connection between said mechanism and the first of said train operated devices to be reached by an oncoming train, said timing device being adapted to render said connection inoperative at the end of a predetermined time interval after actuation of said timing device, and train operated means for actuating said timing device when a train has approached within a predetermined distance of said first train operated device.

33. A crossing protection control system including three train operated devices successively actuatable by a train approaching the crossing, a timing device, connections between the timing device and the first of said train operated devices to be reached by an oncoming train, said connections initiating the action of said timing device when said first train operated device is actuated by a train, mechanism for initiating the operation of a crossing protection device, a con-

nection between the second of said train operated devices and said mechanism, said connection normally operating to initiate the operation of the protection device when said second train operated device is actuated by an oncoming train, means controlled by said timing device for rendering said last mentioned connection inoperative at a predetermined time interval after initiation of the operation of said timing device, and a connection between the third of said train operated devices and said mechanism, said connection operating to initiate the operation of said protection device upon actuation of said third device by a train unless said protection device has previously been set into operation.

34. A crossing protection control system including a railroad track having at least three insulated track circuit blocks at progressively increasing distances from a crossing, a track relay associated with each block, each relay being actuated by the entrance of a train into its associated block, mechanism for initiating the operation of a crossing protection device, an electrical circuit for actuating the said mechanism, means for conditioning said circuit to initiate the operation of the protection device, said means being normally operated upon the actuation of the second track relay to be actuated by a train approaching the crossing, a timing device connected to the first track relay to be actuated by a train approaching the crossing, the action of said device being initiated by the actuation of said first relay and said device being connected to said circuit conditioning means to render the same inoperative at the end of a predetermined time after the actuation of said device, and a second conditioning means for said initiating circuit operated by the third relay to be actuated by a train approaching the crossing.

35. A crossing protection control system including mechanism for operating a crossing protection device, a pair of train operated devices successively actuatable by a train approaching the crossing, train operated timing mechanism for measuring the speed of an oncoming train, and connections between said mechanism, said train operated devices and said timing mechanism, said connections operating to initiate the operation of said mechanism when the first or second train operated device is actuated by a train depending upon whether the speed of the train as measured by said timing mechanism is greater or less than a predetermined speed.

36. A crossing protection control system including mechanism for initiating the operation of a crossing protection device, a pair of train operated devices successively actuatable by a train approaching the crossing, train operating timing mechanism for measuring the speed of an oncoming train, and connections between said initiating mechanism, said train operated devices and said timing mechanism, said connections operating to initiate the operation of the protection device when the first or second train operated device is actuated by a train depending upon whether the speed of the train as measured by said timing mechanism is greater or less than a predetermined speed.

37. A crossing protection control system including electrically operated mechanism for initiating the operation of a crossing protection device, a pair of train operated electrical devices successively actuatable by a train approaching the crossing, train operated timing mechanism for measuring the speed of an oncoming train, and electrical connections between said initiating mechanism, said train operated devices and said timing mechanism, said connections operating to initiate the operation of the protection device when the first or second train operated device is actuated by a train depending upon whether the speed of the train as measured by said timing mechanism is greater or less than a predetermined speed.

38. In combination, a stretch of railway track intersected by a highway, a highway crossing signal located at the intersection, means for measuring the time required for a train approaching the intersection to traverse a given distance, and means controlled by said time measuring means for setting said signal into operation.

39. In combination, a stretch of railway track intersected by a highway, a highway crossing signal located at the intersection, said track being divided to form two sections on one side of the highway, means for measuring the time required for a train approaching the highway to traverse the section more remote from the highway, a track circuit including a track relay for the other section, and means controlled jointly by said time measuring means and said track relay for setting said signal into operation.

40. In combination, two successive sections of railway track, a track circuit for each section each containing a track relay, a slow-acting relay, a pick-up circuit for said slow-acting relay including a back contact of one said track relay and a front contact of the other said track relay, a signal, and a control circuit for said signal including in parallel a front contact of said other track relay and a front contact of said slow-acting relay.

41. In combination, two successive sections of railway track, a track circuit for each section each containing a track relay, a slow-acting relay, a pick-up circuit for said slow-acting relay including a back contact of one said track relay and a front contact of the other said track relay, a signal, and a control circuit for said signal governed by said slow-acting relay for delaying the starting of said signal provided only said slow-acting relay consumes its time interval before said other track relay is deenergized.

42. In a signaling system for highway crossings on railroads, the combination with a signal at the crossing, of a starting device for the signal, mechanism responsive to the speed of a train, and means for operating said starting device when an approaching train reaches a point in rear of the signal determined by said mechanism in accordance with the speed of such approaching train.

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