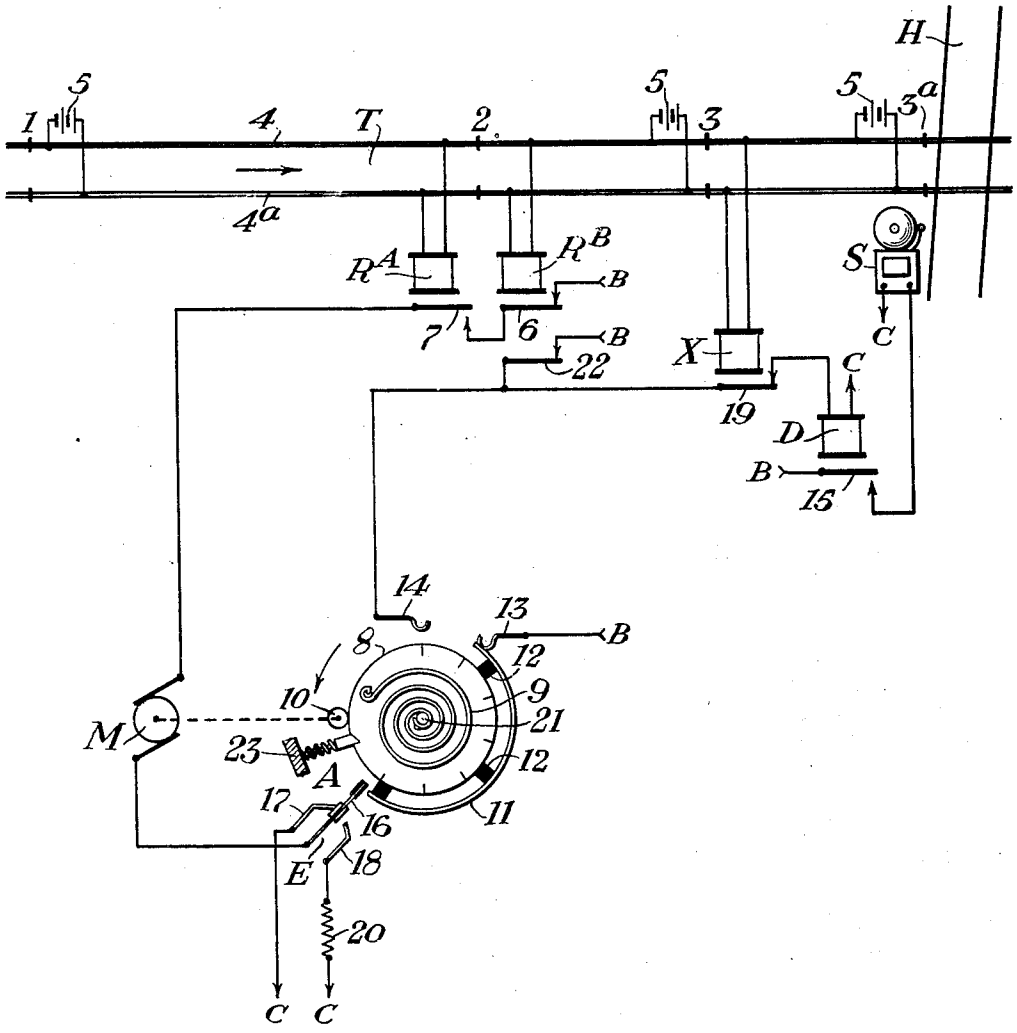
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APPARATUS FOR THE CONTROL OF HIGHWAY CROSSING SIGNALS

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INVENTOR:
J. E. Saunders,
by A. L. Vincill,
His Attorney

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APPARATUS FOR THE CONTROL OF HIGHWAY CROSSING SIGNALS

John E. Saunders, Maplewood, N. J., assignor to The Union Switch & Signal Company, Swissvale, Pa., a corporation of Pennsylvania

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My invention relates to apparatus for the control of highway crossing signals, and has for an object the provision of means controlled by a train approaching a highway for starting the operation of the signal at substantially the same interval of time before the train reaches the highway regardless of the speed of the train.

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 showing one form of apparatus embodying my invention.

Referring to the drawing, the reference characters 4 and 4^a designate the track rails of a railway track T along which traffic normally moves in the direction indicated by the arrow. The track T is intersected by a highway H, and the intersection is provided with a highway crossing signal S, which, as here shown, is in the form of an electric bell.

The track rails 4 and 4^a are divided by the usual insulated joints to form two track sections 1—2 and 2—3, which sections are traversed successively by a train approaching the highway H. Each section is provided with a track circuit comprising a track battery 5 and a track relay R. As shown in the drawing, a third track section—3—3^a is located between section 2—3 and the highway H, but, as will appear hereinafter, this section is not essential for the operation of a system embodying my invention.

The highway crossing signal S is controlled jointly by track relays R^A and R^B, and a time measuring device which is designated as a whole by the reference character A.

The time measuring device A comprises a fixed shaft 21, on which a member 8 is mounted to rotate freely. This member 8 is biased by a spiral spring 9 to an initial position, which is the position wherein it is shown in the drawing, but the member 8 is at times moved in counter-clockwise direction against the biasing force of the spring 9 by an electric motor M. As here shown, the motor M operates a wheel 10 which is in frictional engagement with the member 8, although any other suitable mechanism for driving the member 8 by the motor M may be used. During the return movement of member 8 to its initial position after the motor becomes deenergized, the member must drive the motor, and so this return movement is restrained to take place at substantially the same speed as that at which the member is moved away from initial position by the motor. The initial position of member 8 is determined by a spring latch 23. Mounted on the periphery of the member 8 is a circuit controller segment 11, which, as here shown, is attached to the member 8 by insulating studs 12. This segment coacts with two fixed contact members 13 and 14. Associated with the member 8 is a circuit controller E comprising a normally closed contact 16—17 and a normally open contact 16—18. When the member 8 is rotated in counter-clockwise direction to what I will term its "ultimate" position, the end of the contact segment 11 will engage contact 16 of the circuit controller E and will thereby open the normally closed contact 16—17 and close the normally open contact 16—18.

The motor M is provided with a circuit which passes from terminal B of a suitable source of current, through front contact 6 of track relay R^B, back contact 7 of track relay R^A, the motor M, and normally closed contact 16—17 of the circuit controller E to terminal C of the same source of current.

The crossing signal S is controlled by a relay D, the circuit for the signal S being from terminal B, through back contact 15 of relay D, and the operating mechanism of the signal S to terminal C. Relay D is normally energized, so that signal S is normally silent but will operate when the relay D becomes deenergized.

The relay D is provided with a circuit which passes from terminal B, through front contact 22 of track relay R^B, front contact 19 of an auxiliary track relay X, and the winding of relay D to terminal C. For present purposes I will assume that auxiliary relay X is not included in the apparatus. The circuit for relay D is provided with a branch around contact 22 of relay R^B, which branch includes contact 13—11—14 of the time measuring device A.

The operation of the apparatus is as follows: When a train moving toward the right enters track section 1—2, it will deenergize track relay R^A, thereby completing the circuit for motor M, with the result that member 8 of the time measuring device A will begin to rotate in counter-clockwise direction. If this train is moving at maximum speed, contact segment 11 will engage contact member 14 at the instant that the train enters section 2—3. The opening of track relay R^B will open the circuit for motor M, and will also open at contact 22 the circuit for relay D. Member 8 will immediately begin to return to its initial position, with the result that relay D will immediately become deenergized, so that signal S will start to operate. If the train is mov-

ing at a lower speed, contact segment 11 will move beyond the point at which it engages contact member 14 by the time the train enters section 2—3, so that when the train enters this section the opening of contact 22 of track relay R^B will not deenergize relay D because the circuit for this relay will still be closed at contact 13—11—14 of device A. The member 8 will then begin its return movement toward its initial position, and when this member reaches such point that contact segment 11 becomes disengaged from contact member 14, the circuit for relay D will be opened, with the result that the signal S will begin to operate. As stated hereinbefore, the member 8 is restrained to return toward its initial position at substantially the same rate of speed as the rate at which it is moved away from this position by the motor M. It follows that the lower the speed of the train, the longer will it take member 8 to return to the position at which contact 11—14 opens after the train passes point 2, and the parts may be so proportioned that this contact will open at substantially the same interval of time before the train reaches the highway H regardless of the speed of the train.

For example, track section 1—2 may be made 1760 feet in length, and the device A may be so proportioned that when a train moving at 60 miles an hour passes through this section, contact 11—14 will close at the instant that the train passes point 2. Point 2 may be located 1760 feet from the highway H, this being the distance covered in 20 seconds by a train traveling at 60 miles an hour. It follows that signal S will begin to operate 20 seconds before such train reaches the highway H. If the train is traveling at 12 miles per hour it will consume 100 seconds in passing through track section 1—2. Contact 11—14 will then remain closed for 80 seconds after the train passes point 2, with the result that signal S will begin to operate 20 seconds before the train reaches the highway H. Similarly, for all intermediate speeds the signal will begin to operate at the same interval of time before the train passes the highway.

It is, of course, possible that a train will consume more than 100 seconds in passing through section 1—2, in which event member 8 of the time measuring device A would be moved beyond its "ultimate" position. To avoid this I provide that the circuit controller E will be reversed at the expiration of 100 seconds, and when this circuit controller reverses it will insert a resistance 20 in the circuit of motor M, with the result that the motor M will then be energized sufficiently to hold member 8 in its ultimate position, but will not be energized sufficiently to move the member beyond this position.

As shown in the drawing, the auxiliary track section 3—3^a is provided with an auxiliary track relay X, the front contact 19 of which is included in the circuit for relay D. The reason for this is to insure operation of the crossing signal S in the event of failure of the time measuring device A or of track relay R^A or R^B. In other words, if the apparatus for normally setting the signal into operation should fail, the signal will be started when a train enters section 3—3^a, because the circuit for relay D will then be opened at contact 19 of relay X.

If section 3—3^a is made 528 feet in length, a train traveling at 12 miles per hour will set the signal S into operation more than 20 seconds before the train reaches the highway, but for trains traveling at speeds above 18 miles per hour the 20 second interval will still obtain.

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, a highway crossing signal located at the intersection, and means for starting the operation of said signal at substantially the same interval of time before a train reaches the intersection regardless of the speed of the train.

2. In combination, a stretch of railway track intersected by a highway, a highway crossing signal located at the intersection, a motor operated time measuring device set into operation when a train approaches the intersection, and means controlled by said device for starting the operation of said signal at substantially the same interval of time before a train reaches the intersection regardless of the speed of the train.

3. In combination, a stretch of railway track intersected by a highway, a highway crossing signal located at the intersection, a time measuring device comprising a member biased to one position and a motor for moving it in the opposite direction against its biasing force, and means controlled by said device for starting the operation of said signal at substantially the same interval of time before a train reaches the intersection regardless of the speed of the train.

4. In combination, a stretch of railway track intersected by a highway, a highway crossing signal located at the intersection, a time measuring device comprising a member biased to an initial position and a motor for moving it away from such position at a fixed rate of speed, said member being restrained to return to its initial position at substantially the same rate of speed when the motor becomes deenergized, means operating when a train approaches said highway to energize said motor when the train passes one fixed point and to deenergize the motor when the train passes a second fixed point, and means for setting said signal into operation when said member reaches a given position during its return to its initial position.

5. 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, a track circuit including a track relay for each section, a controlling circuit for said signal including a front contact of the relay for the section closer to the highway, a time measuring device comprising a member biased to an initial position and a motor for moving it away from such position at a fixed rate of speed, said member being restrained to return to its initial position at substantially the same rate of speed when the motor becomes deenergized, a circuit for said motor including a front contact of the relay for the section closer to the highway and a back contact of the other relay, a normally open circuit controller, means for closing said circuit controller when said member reaches a given point in its movement away from its initial position and for keeping it closed until the member reaches the same point during its return move-

ment, said point being the point reached by said member when a train moving at maximum speed reaches the second track section, and a shunt for said signal controlling circuit around said relay contact and including said circuit controller.

6. In combination, a stretch of railway track intersected by a highway, a highway crossing signal located at the intersection, and means responsive to the speed of a train approaching a fixed point in the rear of the highway for setting said signal into operation at the expiration of a variable time interval after the train reaches such point, said interval varying inversely as the speed of the train.

7. In combination, a stretch of railway track intersected by a highway, a highway crossing signal located at the intersection, and means responsive to the time required for a train approaching the highway to traverse a given distance in the rear of a fixed point for setting said signal into operation at the expiration of a variable time interval after the train reaches such point, said interval varying in proportion to the time required for the train to traverse such given distance.

8. 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 said highway to traverse a given distance, and means controlled by said time measuring means for setting said signal into operation at the expiration of a variable time interval after the train passes a fixed point.

9. In combination, a stretch of railway track intersected by a highway, a highway crossing signal located at the intersection, a time measuring device comprising a member biased to an initial position and a motor for moving it away from such position at a fixed rate of speed, said member being restrained to return to its initial position at substantially the same rate of speed when the motor becomes deenergized, means operating when a train approaches the highway to initiate the supply of normal operating current to said motor when the train passes one fixed point and to deenergize the motor when the train passes a second fixed point, means controlled by said device for reducing the amount of current supplied to said motor if a train consumes more than a given time between said two points, and means for setting said signal into operation when said member reaches a given position during its return to its initial position.

10. In combination, a stretch of railway track intersected by a highway, a highway crossing signal located at the intersection, a motor operated time measuring device set into operation when a train approaches the intersection, means controlled by said device for starting the operation of said signal at substantially the same interval of time before the train reaches the intersection regardless of the speed of the train, and auxiliary means for setting said signal into operation when a train approaching the intersection passes a given point.

11. 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 starting the operation of said signal at substantially the same interval of time before a train reaches the intersection regardless of the speed of the train.

12. In combination, a stretch of railway track intersected by a highway, a highway crossing signal located at the intersection, means for determining how much time a train approaching the intersection consumes in traversing a given distance, and means controlled by said time determining means for setting said signal into operation.

13. 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, and means controlled by said time measuring means for setting said signal into operation at the expiration of a variable interval of time after the train enters the other section.

14. 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 determining how much time a train approaching the highway consumes in traversing 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 determining means and said track relay for setting said signal into operation.

15. 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, a track circuit including a track relay for each section, a time measuring device set into operation when a train approaching the highway releases the track relay for the section more remote from the highway, and means controlled jointly by said device and the track relay for the other section for setting said signal into operation at the expiration of a variable interval of time after the train enters such other section.

16. In a signalling system for highway crossings on railroads, the combination with a signal at the crossing, of means for actuating said signal at a substantially uniform predetermined time prior to the arrival of each train at the crossing regardless of the speed of the train.

17. In a signalling system for highway crossings on railroads, the combination with a signal at the crossing, of time-responsive means automatically operated during the time interval taken by an approaching train to travel a predetermined distance for causing said signal to be actuated at substantially a predetermined time prior to the arrival of each train at the crossing regardless of the speed of that train.

18. In a signalling system for highway crossings on railroads, the combination with a signal at the crossing, of means tending to actuate said signal when an approaching train passes a predetermined control point distant from the crossing, and means responsive to the speed of such approaching train for delaying actuation of said signal until said train has reached a point substantially a fixed time interval for its speed from the crossing.

19. In a signalling system for highway crossings on railroads, the combination with a signal at the crossing, a timing mechanism having an initial condition and displaced automatically from the initial condition in accordance with the time

taken by an approaching train to travel between two fixed points remote from the crossing, said timing mechanism being automatically restored to its initial condition in accordance with the lapse of time after said train has passed the point nearest the crossing, and circuit-controlling means actuated at an intermediate point in the operation of said timing mechanism for governing said signal, whereby said signal is actuated to give warning of an approaching train at a substantially uniform predetermined time prior to the arrival of the train at the crossing irrespective of its speed.

20. In a signalling system for highway crossings on railroads, the combination with a signal at the crossing, of means tending to actuate said signal when an approaching train passes a predetermined control point distant from the crossing, and automatic means operated during the time taken for an approaching train to travel a predetermined distance in the rear of said control point for delaying the actuation of said signal for a time interval varying with the speed of the approaching train.

21. In a signalling system for highway crossings on railroads, the combination with a signal at the crossing, a timing mechanism including a member movable in opposite directions at predetermined rates from and toward an initial position, contacts actuated by said member during a predetermined portion of its movement near said initial position, means for moving said member away from its initial position during the time taken by an approaching train to travel a predetermined distance remote from the crossing, a circuit controller actuated by an approaching train at a predetermined point distant from the crossing, and means including said contacts and said circuit controller for governing said signal.

22. In a signalling system for highway crossings on railroads, the combination with a signal at the crossing, of means tending to actuate said signal when an approaching train passes a predetermined control point distant from the crossing, timing mechanism biased to an initial position and operated from that position at a predetermined rate during the time taken by an approaching train to travel a predetermined distance in the rear of said control point, and means for delaying the actuation of said signal by said first mentioned means while said timing mechanism is displaced from its initial position more than a predetermined amount.

23. In a signalling system for highway crossings on railroads, the combination with a signal at the crossing, of a track circuit extending for a predetermined distance from said crossing including a track relay, a second track circuit in the rear of said first mentioned track circuit, timing mechanism biased to an initial position and changed automatically from that position at a predetermined rate during the time taken by an approaching train to travel over a distance corresponding with the length of said second track circuit, said timing mechanism automatically returning to its initial condition at a predetermined rate, circuit controlling means operated by said timing mechanism to one position during the change thereof to a predetermined amount near said initial position, and means controlled by the track relay of the first track section and by said circuit controlling means for controlling said signal.

24. In a signalling system for highway crossings on railroads, the combination with a signal at the crossing, a timing mechanism wound up from an initial position at a predetermined rate during the time taken by an approaching train to travel a predetermined distance remote from the crossing, said timing mechanism automatically returning to said initial position at a predetermined rate and actuating circuit controlling means at a time interval prior to reaching said initial position, and a circuit governed by said circuit controlling means for controlling said signal.

25. In a signalling system for highway crossings on railroads, the combination with a signal at the crossing, of means tending to actuate said signal when an approaching train passes a predetermined control point distant from the crossing, and speed responsive means for delaying the actuation of said signal for a time interval varying with the speed of the approaching train.

26. In a railway signal system, the combination, a railway track, a pair of track circuits each having a track relay formed by the rails of said track, a signal device located on the trackway, means for operating said signal device by deenergizing one of said track relays and means for controlling the duration of said operation by the time the same train occupies in passing over the other track circuit.

27. In a railway signal system, the combination, a railway track, a pair of adjacent track circuits each having a track relay formed by the rails of said track, a signal device located on the trackway, means for operating said signal device by deenergizing one of said track relays, and means for determining the duration of said operation by the movement of the same train over the adjacent track circuit.

28. In a railway signal system, the combination, a railway track, divided into sections by track circuits each having a track relay and having trains passing thereover at different speeds, a signal device located on the trackway, a timing device controlling said signal and means controlling said timing device by deenergizing said track relays whereby said signal device is operated for substantially the same interval of time for each train without regard to the speed of the train.

29. In a railway system, the combination, a railway track having trains passing thereover at different speeds, a track circuit of a predetermined length and a second track circuit formed by the rails of said track having a track relay, a signal device located on the trackway, a timing device controlling said signal device, said track relay in the deenergized position operating to establish the circuit of said signal device, and means controlling said timing device by said track circuit whereby said signal device is operated for substantially the same interval of time for each train without regard to the speed of the trains.

30. In a railway signal system, the combination, a railway track divided into sections by track circuits, a signal device located on the trackway, a timing device controlling said signal and when in the normal position establishing the circuit of said signal, means controlled by said track circuits for moving said timing device away from and towards the controlling position, and means for automatically varying the time of operation of said timing device.

JOHN E. SAUNDERS.