Sept. 22, 1931. W. K. HOWE 1,824,145

TRAIN CONTROL

Filed Sept. 11, 1924

FIG. 1.

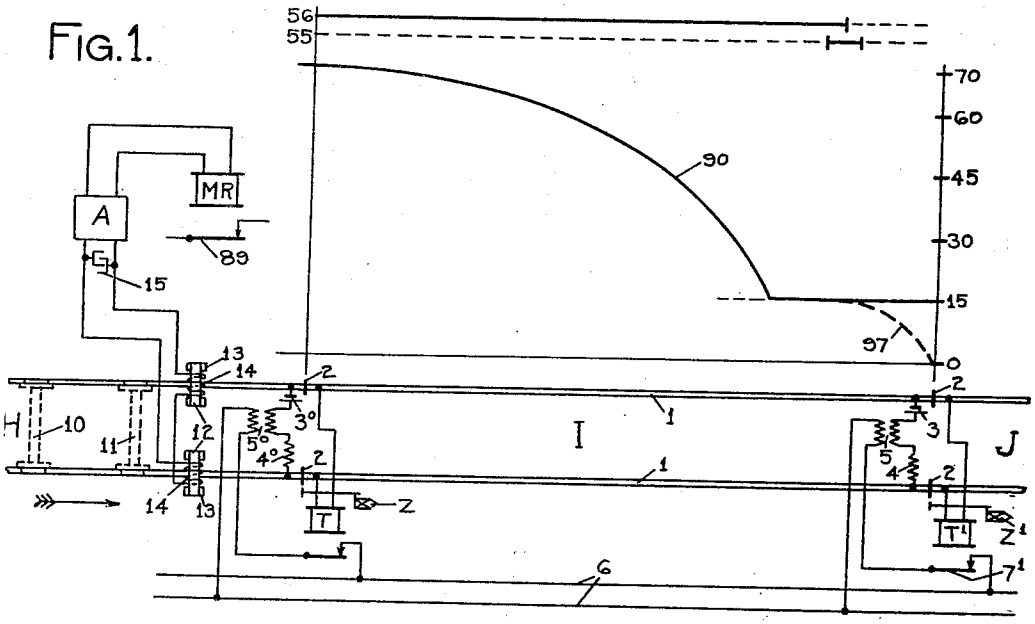
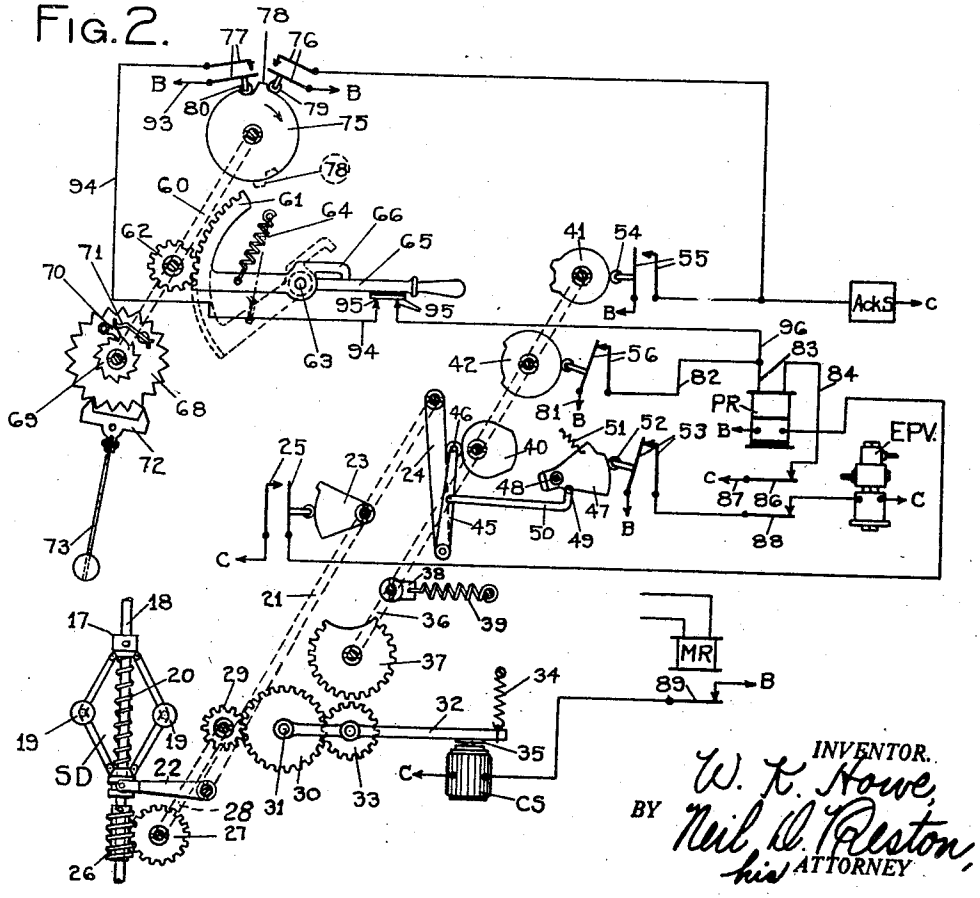


FIG. 2.



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TRAIN CONTROL

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This invention relates to automatic train control systems for railroads, and more particularly to the provision of means requiring the engineer to take appropriate action, conveniently termed acknowledgement, upon the approach of his train to a stop signal or entrance to a danger or occupied block, and also thereafter at repeated intervals of time so long as the train is traveling under a stop signal or in such danger or occupied block, otherwise the brakes of the train are automatically applied and the train brought to a stop, or some other suitable penalty enforced.

Other objects, purposes and characteristics features of the present invention will appear as the description thereof progresses.

In describing the invention in detail reference will be made to the accompanying drawings in which:—

Fig. 1 shows a portion of a typical automatic wayside signal system having train control apparatus superimposed thereon, together with a vehicle shown conventionally having suitable inductive influence receiving apparatus carried thereby; and

Fig. 2 shows conventionally and in a diagrammatic manner the car-carried apparatus of the invention.

The present invention, which relates primarily to the acknowledgment of stop or danger signals, is applicable to train control systems of either the intermittent inductive type or the continuous inductive type. This invention for convenience, however, has been shown applied to a simple form of a train control system of the continuous inductive type, namely a two-position system in which a two-position main control relay is used.

Referring to Fig. 1 of the drawings, the reference characters 1 designate the track rails, which are divided by insulating joints 2 into blocks in the usual way, the block I and the adjacent ends of two other blocks H and J being shown. Since the various blocks are assumed to be equipped the same, like parts of each block are designated by like reference characters having distinctive exponents. Using the reference characters for the block I, each of these blocks is provided with the usual normally closed track circuit including a battery 3, which is connected in series with the usual limiting resistance 4. A track relay T responsive to direct current is bridged across the block at the entrance end thereof.

The train control system illustrated may be used either with or without wayside signals; and since such signals may be of any suitable type, semaphore signals Z have been shown conventionally without illustrating their well known operating mechanism and control circuits. Although in the car-carried apparatus hereinafter described no cab signals have been shown, such cab signals may be applied in the usual way, when desired, and especially if no wayside signals are employed.

Alternating current is superimposed on the direct current in the usual track circuit and flows down one rail and back through the other, only when traffic conditions ahead are clear. In the particular arrangement shown, a transformer 5, having its secondary winding connected in series with the track battery 3, is energized under clear traffic conditions by current derived from a transmission line 6 through a circuit including the front contact 7^1 of the relay T^1 of the block J next in advance.

On the locomotive or other vehicle, illustrated by the wheels and axles 10 and 11, are two car elements or receivers in front, each comprising a core of laminated magnetic material 12, terminating in enlarged pole pieces 13 and provided with a winding 14. These windings 14 are connected in series in such a manner that voltages induced therein due to current flowing down one rail and back through the other are cumulative. These coils 14 are preferably tuned to resonance for the particular frequency of the alternating current used along the trackway by a condenser 15 of the proper capacity, so that the potential across this condenser 15 is comparatively high. The voltage across the condenser 15 supplies the input side of an amplifying device A, which includes suitable sources of energy and one or

more amplifying tubes or audions well known in the art of continuous inductive train control and radio telephony. The output leads of this amplifying device A are connected to a main relay MR, which is adapted to control the train in accordance with traffic conditions ahead, manifested by the presence or absence of alternating current flowing in the track circuit directly ahead of the train equipped with this apparatus.

Referring now to Fig. 2, this relay MR controls suitable speed restricting apparatus of the well known cam and governor type, which is adapted to gradually restrict the speed of the train in accordance with its progress along the trackway under adverse traffic conditions ahead. In the particular arrangement shown, this speed restricting cam and governor mechanism includes a centrifugal speed responsive device or centrifuge SD of the well known fly-ball type in which a grooved collar 17 moves downwardly on a shaft 18, driven from the wheels of the vehicle in any suitable manner, as the speed of the vehicle increases, by reason of the fly balls 19 acting by centrifugal force upon this sleeve against the opposing force of a spring 20. To a speed shaft 21 is pinned a bifurcated arm 22 which has pins extending inwardly on its bifurcated end and engaging the groove in the collar 17, so that this shaft 21 is rocked to a position depending on the speed of the train. To the speed shaft 21 are also fixedly secured a speed sector 23 and a speed arm 24. The speed sector 23 is of such construction that it closes the contacts 25 when the speed is practically zero.

The shaft 18 has fixed thereto a worm 26 which operatively engages a worm wheel 27, pinned on a rotatable shaft 28, so as to cause rotation of this shaft 28 in accordance with the progress of the train along the track. This shaft 28 has secured thereon a pinion 29, operatively engaging a gear 30 pivotally supported on a stationary pin 31. This pin 31 also pivotally supports the bifurcated end of an arm 32; and in the bifurcation of this arm is pivotally supported a gear 33 continuously meshing with the gear 30. This arm 32 is biased upwardly by a spring 34, but is normally held in its lower position (as illustrated) by a cam starter magnet CS acting to attract an armature 35 fastened to the arm 32. Directly above the gear 33 and pinned to a cam shaft 36, is a mutilated gear 37. This cam shaft 36 is held in a normal position, that is, the position in which the mutilated portion of the gear 37 is diametrically opposite to the gear 30, by an arm 38 pinned to this shaft and a tension spring 39. On this cam shaft 36 are fixedly secured permissive speed cam 40, an acknowledging signal cam 41, and an acknowledging cam 42, in any suitable manner, by cross pins.

To the lower and free end of the speed arm 24 is pivotally secured the lower end of a floating lever 45, the other end of which has pivotally secured thereto a roller 46 bearing against the cam surface of the permissive speed cam 40. Adjacent to this cam 40 and on a pin 48 is pivotally supported a sector 47 having an eccentrically located pin 49. In order to cause the sector 47 to move in accordance with the speed of the train as compared with the speed set up by the permissive speed cam 40, it is only necessary to cause movement of an intermediate point on the floating lever 45. This has been accomplished by a link 50 connected from an intermediate point on the floating lever 45 to the eccentric pin 49 on the sector 47. This sector 47 is biased in a clockwise direction by a spring 51, so that the roller 46 is always urged against the permissive speed cam 40, whereby the sector 47 assumes a position depending on both the position of the cam 40 and the actual speed of the train. The sector 47 is provided with a cutaway portion into which the roller 52 will ride when the speed of the train is in excess of the permissive speed set up by the speed cam 40, whereby the contacts 53 are opened.

The acknowledging signal cam 41 is of such a shape that the contacts 55 are closed through the medium of the roller 54 when the cam 40 has restricted the speed to its ultimate minimum and when this cam has almost reached its final run down position. The acknowledging cam 42, on the other hand, opens the contacts 56 just a short distance of movement of the train after the contacts 55 have been closed.

As heretofore stated, the present invention contemplates that the engineer is required to operate an acknowledging device at repeated intervals while running under a stop signal, these intervals being determined by a timing device. In the arrangement shown, this timing device comprises a shaft 60 horizontally pivotally supported in any suitable manner, which is biased into its normal position (as shown), by a gear sector 61 engaging a pinion 62 fixed on this shaft 60, the sector 61 being pivotally supported on a pin 63 and being biased in a clockwise direction by a tension spring 64. This sector 61 is adapted to be moved to its other position (shown dotted) by a lever 65, which is also pivotally secured on the pin 63, and which is disposed to engage a lug 66 projecting back from the gear sector 61.

Free on the shaft 60 is an escapement wheel 68, which is adapted to be driven in one direction by the shaft 60 through the ratchet mechanism comprising, a ratchet wheel 69, a dog or pawl 70 and a spring 71. This escapement wheel 68, is driven in a

counter-clockwise direction, is retarded by the pivotally supported pallet 72 having a weighted spring arm 73 or pendulum projecting therefrom. The shaft 60 also has pinned thereto a cam 75, which, in combination with spring contacts 76 and 77, is adapted to close and open certain circuits when this cam assumes predetermined positions.

Referring to the operation of this time element, or time controlled device, it will be noted that if the engineer raises the handle 65, he will rock the gear sector 61 in a counter-clockwise direction to the dotted position, and in turn operate the cam 75 and the ratchet wheel 69 in a clockwise direction. If the engineer then returns the handle 65 to the normal position, as is necessary to complete a certain circuit as pointed out hereinafter, the gear sector 61 and the cam 75 are moved by the spring 64 away from the dotted position shown, the movement being retarded by the escapement wheel 68 and pallet 72. If this gradual counter-clockwise rotation of shaft 60 continues, the projection 78 first strikes the roller 79, thereby closing contacts 76, and shortly thereafter the roller 80 rides into the notch, thereby opening the contacts 77.

Any suitable means may be employed with this invention to act upon the usual air-brake system and produce an automatic application of the brakes. For the purpose of this case, it is assumed that such automatic brake control apparatus will be governed by an electro-pneumatic valve; and to make clear the manner of automatic control of the brakes in accordance with this invention, a conventional form of electro-pneumatic valve EPV has been shown with its control circuits.

The car apparatus also includes a penalty relay PR of any suitable construction with two separate windings which is, however, made slow acting by the adoption of any of the well known expedients, such as copper rings on its cores, so that this relay does not actually open its contacts until after the lapse of a short interval of time following de-energization of its windings.

For the guidance of the engineer, an acknowledging signal, preferably an audible signal, is automatically given in time to permit the engineer to acknowledge before the brakes are automatically applied. Various forms of signal devices are suitable for this purpose, and an acknowledging signal Ack. S has been shown diagrammatically.

Operation

Normally while the train is traveling under a clear signal, the main relay MR is energized as a result of the amplified influence received from the flow of alternating current in the track rails. With the relay MR energized, a cam starter magnet CS is also energized by a circuit through a front contact 89 of said relay MR, this circuit being readily traced in the drawing. The penalty relay PR is normally energized by a stick circuit as follows:—Beginning at one terminal of a suitable battery or other source of energy, indicated by the letter B, wire 81, contacts 56, wires 82 and 83, relay PR, wire 84, front contact 86 of the relay PR, and wire 87 to the other terminal of said source, indicated by the letter C. The electro-magnetic valve EPV, which acts to apply the brakes when de-energized, is normally maintained energized by a circuit readily traced in the drawing, including the speed-distance contacts 53 and a front contact 88 of the penalty relay PR.

Under clear traffic conditions a maximum normal running speed limit is enforced. Referring to Fig. 2, it will be evident that, after the running speed of the train exceeds a certain value (assumed to be about 60 miles per hour), the lower end of the floating lever 45 is moved so far to the left, with the cam 40 in its initial position, as to rock the sector 47 downward for enough to open the contacts 53 and deenergize the valve EPV, thereby applying the brakes. As soon as the running speed of the train has been brought below the maximum speed limit, the contacts 53 re-close, the valve EPV is again energized, and the engineer may release the brakes.

When the train enters a caution block, that is, a block in the rear of one occupied by another train, the main relay MR is de-energized, because the alternating current is cut off from the track rails in this caution block; and the cam starter magnet CS is in turn de-energized, thereby bringing gears 33 and 37 into mesh and connecting the cam shaft 36 to the wheels of the train so that said shaft is gradually moved in accordance with the distance travelled. As the cam 40 is thus gradually turned, it sets up progressively lower permissive speed limits (see curve 90 in Fig. 1) until a predetermined minimum speed limit (assumed to be 15 miles per hour) is set up, this minimum speed limit corresponding to the maximum radius of the cam 40. As the train advances still further, the gear 33 rotates idly in the mutilated portion of the gear 37, holding the cam 40 in its ultimate position and maintaining the minimum speed limit. If the train at any time exceeds the permissive speed limits prescribed by the position of the cam 40, the contacts 53 open and de-energize the valve EPV to automatically apply the brakes. This brake application is maintained until the speed has been reduced below the existing permissive speed limit, whereupon the valve EPV is re-energized, and the engineer may release the brakes.

At a predetermined distance from the exit end of the caution block, the cam shaft 36 is turned to the point where one of the projections on the acknowledging signal cam 41 engages the roller 54 and acts to close the contacts 55. The point at which the contacts 55 close is indicated in Fig. 1 by a change in the line 55 from a broken line (contacts open) to a solid line (contacts closed). The closing of the contacts 55 energizes the acknowledging signal Ack. S by a circuit readily seen on the drawings, sounding this acknowledging signal as a warning to the engineer that it is necessary for him to operate the acknowledging device. The contacts 55 open after a short distance of travel (see Fig. 1) and discontinue the sounding of the acknowledging signal.

Upon sounding of the acknowledging signal Ack. S, the engineer is supposed to raise the handle 65, moving the sector 61 down and tensioning the spring 64, and then return the handle 65 to the normal position to close the contacts 95. During this downward movement of the sector 61, shaft 60 and the cam 75 are turned clockwise from the position shown until the projection 78 and adjacent notch on the cam 75 are in the position indicated by the dotted lines projection 78, during this movement, momentarily closing contacts 76 to energize Ack. S through a circuit which is obvious from the drawings, this energization however having no useful function at this time. The roller 80 now engages the outer edge of the cam 75 and closes the contacts 77, thereby establishing an auxiliary stick circuit for the penalty relay PR which may be traced as follows:—Beginning at B, wire 93, contacts 77, wire 94, contacts 95, wires 96 and 83, relay PR, wire 84, front contact 86 of the relay PR, and wire 87 to C. It will be observed that the engineer must restore the handle 65 to the normal position in order to complete the auxiliary stick circuit for the penalty relay PR. Consequently, he cannot retain the contacts 77 closed by fastening the handle 65 in the raised position. In other words, after each movement of the handle 65 to wind up the time element device, this handle must be returned to the normal position, permitting the shaft 60 to be brought back gradually to its initial position under the influence of the spring 64 and open the contact 77.

Shortly after the contacts 55 are closed to sound the acknowledging signal, the contacts 56 are automatically opened by the cam 42, as indicated by the broken and solid line 56 in Fig. 1. The opening of these contacts 56 interrupts the normally closed stick circuit for the penalty relay PR, tending to cause de-energization of this relay and cause an automatic brake application. Since the engineer is assumed to have been vigilant and operated the acknowledging device, the penalty relay PR is maintained by its auxiliary stick circuit above pointed out. The contacts 56 remain open so long as the danger conditions continue, so that the contacts 77 must be kept closed by the engineer, by repeated manipulations of the acknowledging device, attention being called to the necessity for repeating operation of the acknowledging device by the energization of Ack. S by projection 78 closing contacts 76 on the return movement of cam 75, just before the cam reaches its shown position, in order to avoid deenergization of the penalty relay PR and an automatic brake application.

If the engineer fails to operate the acknowledging device in time, the penalty relay PR is de-energized a short time after the opening of the contacts 56, and the brakes are applied. The penalty relay PR, once de-energized by the opening of its stick circuit, cannot again be energized until the train is brought to a stop, whereupon the zero speed contacts 25 close an energizing circuit, readily traced on the drawing, through the lower winding of the penalty relay PR, so that its armature is attracted to close its front contact and re-establish a stick circuit through either the contacts 56 or 77. If the engineer fails to acknowledge, therefore, the train must be brought to a stop before the brakes can be released, this constituting the penalty for failure to acknowledge.

The point at which the contacts 56 open and cause an automatic brake application, unless the engineer forestalls such application by acknowledgment, is preferably braking distance for the selected minimum speed from the exit end of the block, so that such brake application for failure to acknowledge will bring the train to a stop before reaching the end of the block, as indicated by the curve 97 in Fig. 1. Since the point in the length of the block at which the contacts 56 open is a fixed distance from the point where the cam shaft 36 is set into operation, it will be evident that it is necessary, in order to have the contacts 56 open at the right point, to de-energize the car relay MR and start the cam shaft 36 in each block at a predetermined distance from the exit end of that block. In practice the length of the several blocks on the railroad frequently differ and may be either shorter or longer than this fixed run-down distance, so that it may be necessary to employ cut sections or other recognized expedients to bring about de-energization of the main relay MR at the right point with respect to the exit end of each block, in order to bring the acknowledging point at the proper place, assuming that it is desired to have the point of acknowledgment braking dis-

tance for the minimum speed from the exit end of the block.

As the train advances from a caution block into a danger or occupied block, the main relay MR remains de-energized, since the alternating current, if applied to the rails of that block, is shunted by the train ahead, depriving the following train of such current. The minimum speed limit is, therefore, maintained throughout the danger or occupied block. As the train advances from the acknowledging point near the end of the caution block, the shaft 60 is being gradually returned by the spring 64 at a rate determined by the pallet 72 and escapement wheel 68; and after the lapse of a predetermined interval of time, say 40 or 50 seconds, the cam 75 while turning counter-clockwise reaches the point where the projection 78 engages the roller 79 and closes the contacts 76 to sound the acknowledging signal Ack. S. The engineer must now raise the handle 65 again, otherwise the cam 75 continues its counter-clockwise movement and opens the contacts 77, whereupon the penalty relay PR is de-energized, since the contacts 56 are still open. When the engineer raises the handle 65, the contacts 95 are opened, but the penalty relay PR is made slow acting enough to afford sufficient time to raise the handle 65 and return it to the normal position before the front contact 86 of this relay actually opens.

From the foregoing it will be evident that the engineer is required to operate the handle 65, while traveling in the danger or occupied block, at repeated intervals of time, and if he fails to make this recurrent acknowledgement, the train is brought to a stop. The time interval for which the acknowledging device is adjusted is preferably selected to correspond approximately to the time taken by a train traveling at minimum speed to travel the normal length of a block, but this is optional, and the time interval may be as short or as long as preferred.

Whenever a block in which the train is running changes to a clear block, the relay MR is re-energized and the parts of the car equipment are automatically returned to the normal position. Until this occurs, and so long as the train is running with the relay MR de-energized, after having passed through one caution block, the engineer is required to acknowledge repeatedly within less than a set interval of time after the last acknowledgement. With other forms of control, such as intermittent or 3-position continuous inductive, the need for recurrent acknowledgement at successive time intervals ceases as soon as the block changes from danger to caution. The particular embodiment of the invention shown, requiring the engineer to make successive acknowledgement after the first caution block until in a clear block, may be said to have the advantage of discouraging the engineer from running under caution signals.

If the train should stop after passing the acknowledging point in a caution block, or while in a danger block, the zero speed contacts 25 close and maintain the lower winding of the penalty relay PR energized, so that the engineer is not obliged to operate the handle 65 repeatedly so long as the train is not moving. Thus, when the engineer stops his train at a stop signal and waits for that signal to change to caution or to proceed, he is relieved from the necessity of operating the acknowledging contactor at repeated time intervals; whereas so long as he continues to advance in a danger block, he is required to acknowledge at recurrent intervals of time.

In practice, the device EPV controls the brakes of the train in such a manner that the brakes are not released without manual cooperation, even though the device EPV is re-energized. This precaution is taken so that, if the engineer should become incapacitated, or for other reasons be unable to perform his duties, and the train be brought to a stop by failure to acknowledge, the brakes will not be automatically released even though the speed contacts 25 are closed, and the penalty relay PR and the device EPV are re-energized.

An automatic train control system has thus been devised in which the engineer is required to operate a suitable manually operable acknowledging device a distance in the rear of the first danger signal, and if he fails to make such an acknowledging act, the train is brought to a stop before it reaches the danger signal, and in which the engineer is required to manifest such vigilance at repeated time intervals thereafter so long as the train is moving under a stop signal in danger territory.

Although the present invention has been rather specifically illustrated, this has been done for the purpose of facilitating the disclosure of the invention, rather than for the purpose of illustrating the preferred form of the invention to be used in practice, or indicating the scope of the invention. For instance, any other suitable time element device may be used instead of the clockwork mechanism illustrated; and various other changes and modifications may be made to adapt the invention to the particular car-carried mechanism in connection with which it is to be used, without departing from the scope of the invention, or the idea of means underlying the same.

What is claimed as new and desired to be secured by Letters Patent is:—

1. In an automatic train control system, vehicle-carried brake control apparatus comprising a permissive speed means initiated

in response to change in control influences corresponding to unfavorable traffic conditions ahead, said permissive speed means acting to impose increasingly restrictive speed limits followed by a minimum speed limit as the vehicle proceeds under said conditions, means for bringing the vehicle to a stop after said minimum speed limit has been imposed, and manually operable means for preventing such stop if operated at successive intervals while said minimum speed limit is in effect.

2. In an automatic train control system, vehicle-carried brake control apparatus including a permissive speed device active when initiated to impose increasingly restrictive speed limits on the vehicle, and to finally impose a minimum speed limit, means acting to effect an automatic stop after a given distance of vehicle travel from the point at which said minimum speed limit was set up, and a manually operable device and associated means for preventing said automatic stop if said manually operable device is operated just before reaching such point and at given intervals while the vehicle is proceeding at said minimum speed.

3. In an automatic train control system of the type in which control influences corresponding to traffic conditions are transmitted from the trackway to a moving vehicle, car-carried apparatus comprising means initiated in response to change of influences corresponding to unfavorable traffic conditions ahead for imposing increasingly restrictive speed limits in accordance with the progress of the vehicle, and for finally imposing a constant minimum speed limit, a cab signal and means for actuating said cab signal a given distance of vehicle travel from the point at which said minimum speed limit is imposed, means for causing an automatic brake application a given interval of vehicle travel from the point at which said cab signal was actuated, and a device for temporarily preventing said automatic stop if actuated immediately after the actuation of said cab signal, said device being in part manually operable.

4. In an automatic train control system, the combination of a speed restricting device governed in accordance with traffic conditions ahead and initiated if traffic conditions ahead are dangerous and changing in accordance with the progress of the vehicle to gradually reduce the permissive speed at which the vehicle may travel without incurring an automatic brake application, means for applying the brakes regardless of the speed at which the train is travelling and effective a predetermined distance of travel after said speed restricting device has been initiated, and means for preventing said last mentioned means for applying the brakes effective if actuated at repeated intervals so long as dangerous traffic conditions ahead exist.

5. In an automatic train control system, the combination of a brake setting appliance means controlling said brake setting appliance in accordance with the vehicle speed, means requiring the engineer to manifest his vigilance upon the approach of his train to a signal at danger and thereafter at repeated intervals by actuating a manually operable device, and means for actuating said brake setting appliance to effect a brake application regardless of speed if the engineeer fails to actuate said manually operable device when required.

6. An automatic train control system comprising, a brake setting appliance, means for rendering said appliance active if the speed of the train is excessive including a permissive speed device and an actual speed device, and other means for rendering said appliance active including means effective after the train has travelled a predetermined distance in dangerous territory unless a suitable manually operable device is operated at repeated intervals of time so long as danger traffic conditions persist.

7. An automatic train control system comprising, a normally energized stick electroresponsive device which if de-energized effects an automatic brake application, two independent means for maintaining said device energized one of which is effective so long as the train is travelling in clear territory and a predetermined distance in danger territory regardless of the vehicle speed, and the other of which is effective if a suitable manually operable device is operated at repeated intervals.

8. An automatic train control system comprising, a normally energized stick device which if de-energized effects an automatic brake application, two independent means for maintaining said device energized, one of which is effective so long as the train is travelling in clear territory, and the other of which is effective if a suitable manually operable device is operated at repeated intervals and means for effecting an automatic brake application in clear territory if a predetermined maximum speed limit is exceeded.

9. In an automatic train control system, a normally energized stick device which if de-energized effects an automatic brake application, two stick circuits for maintaining said stick device energized, one of said stick circuits being maintained energized as long as the vehicle is traveling in clear territory and the other of said stick circuits being maintained energized if a suitable manually operable device is operated at predetermined time intervals, and a pick up circuit for said stick device closed by speed responsive

means only when the vehicle is substantially at a stop.

10. An automatic train control system comprising vehicle carried brake control apparatus controlled in accordance with influences received from the trackway corresponding to traffic conditions ahead and acting to impose an automatic stop at a predetermined distance of vehicle travel from a point at which influences corresponding to unfavorable traffic conditions are received, and manually operable means for substituting a minimum speed limit for said automatic stop if operated before said predetermined distance has been traversed and at predetermined intervals while said influences corresponding to unfavorable traffic conditions are being received.

11. An automatic train control system comprising a normally energized brake applying device which if de-energized effects an automatic brake application, a permissive speed device active when initiated to de-energize said brake applying device at increasingly restrictive speed limits, a normally energized stick device acting when de-energized to de-energize said brake applying device, means for maintaining said stick device energized while the vehicle is traveling in clear territory and for a predetermined distance in danger territory, and further means for maintaining said stick device energized if a manually operable device is operated at predetermined time intervals while the vehicle is traveling in said danger territory.

12. An automatic train control system comprising a normally energized brake applying device which if de-energized effects an automatic brake application, a permissive speed device for limiting the vehicle speed to a predetermined maximum value when the vehicle is traveling in clear territory, said permissive speed device being initiated, when the vehicle enters danger territory and acting when initiated to de-energize said brake applying device at increasingly restrictive speed limits, a normally energized stick device acting when de-energized to de-energize said brake applying device, means for maintaining said stick device energized while the vehicle is traveling in clear territory and for a predetermined distance in danger territory, and further means for maintaining said stick device energized if a manually operable device is operated at predetermined time intervals while the vehicle is traveling in said danger territory.

13. In an automatic train control system, the combination of a brake setting appliance, means requiring the engineer to manifest his vigilance upon the approach of his train to a signal at danger and thereafter at repeated intervals by actuating a clockwork time release device, and means for actuating said brake setting appliance to effect a brake application regardless of speed if the engineer fails to actuate said time release device when required.

14. Railway traffic controlling apparatus comprising automatic mechanism carried on a train and operating under unsafe traffic conditions to apply the brakes, a slow acting device on the train including a contact and requiring periodic manual operation to keep the contact closed, and means controlled by said device for preventing an automatic brake application.

15. Railway traffic controlling apparatus comprising automatic mechanism carried on a train and operating under unsafe traffic conditions to apply the brakes, a normally open contact on the train arranged when closed to reopen after a time interval, manually operable means for closing such contact, a second contact controlled by said means, and means controlled by said normally open contact and by said second contact for preventing an automatic brake application.

16. Railway traffic controlling apparatus comprising automatic mechanism carried on a train and operating under unsafe traffic conditions to apply the brakes, a normally open contact on the train arranged when closed to reopen after a time interval, manually operable means for closing such contact, a second contact controlled by said means, and means controlled by said two contacts and by the speed of the train for preventing an automatic brake application.

17. A railway traffic controlling system comprising, mechanism on a train automatically operated under predetermined conditions of traffic and speed of the train to apply the brakes, a slow-releasing electro-responsive device effective if not de-energized for more than a limited time to maintain said mechanism inactive, a normally open circuit for energizing said device, a member biased to an extreme run down position and acting when moved from that position and released to return thereto with a uniform slow angular velocity and thereby consume a predetermined time in returning to its run down position, normally open contacts in said circuit closed throughout the movement of said member except in its run down position, a handle arranged for convenient operation by the engineer and operable to move said member from its run down position and close said normally open contacts when said handle is shifted from its normal position, and normally closed contacts also included in said circuit and closed only if said handle is in its normal position.

18. In an automatic train control system, in combination with a device for initiating a brake application when de-energized, means for maintaining said device ener-

gized if operated at predetermined time intervals comprising, a shaft biased toward a run-down position, means on said shaft for maintaining an energizing circuit for said device closed until said shaft has turned to said run-down position, and manually operable means for rewinding said shaft.

19. In an automatic train control system, in combination with a device for initiating an automatic brake application when de-energized, means for maintaining said device energized if operated at predetermined time intervals comprising a shaft having a retarding mechanism thereon, means for biasing said shaft toward a run-down position, contacts operated in accordance with the position of said shaft and acting to de-energize said device, and manually operable winding means for turning said shaft away from said run-down position.

20. In an automatic train control system, trackway means for transmitting influences continuously to a moving vehicle under favorable traffic conditions only, car-carried apparatus comprising, a device for causing an automatic brake application when de-energized, means for preventing an automatic brake application comprising a manually actuated acknowledging means and a member acting to maintain said device energized when in one position, said member being maintained in said one position so long as said influences are being received from the trackway and being otherwise so maintained by the actuation of the acknowledging means at predetermined time intervals.

21. Railway traffic controlling apparatus comprising automatic mechanism carried on a train and operating under unsafe traffic conditions to apply the brakes, control means located entirely on the train for preventing an automatic brake application if the engineer take suitable periodic action, and car-carried indicating means for indicating the time when said periodic action is first necessary.

22. Railway traffic controlling apparatus comprising automatic mechanism carried on a train and operating under unsafe traffic conditions to apply the brakes, control means located entirely on the train for preventing an automatic brake application if the engineer take suitable periodic action, and car carried indicating means for indicating the time when said periodic action is first necessary, said indicating means being controlled by said control means to indicate when each recurrent periodic action is necessary.

23. Railway traffic controlling apparatus comprising automatic mechanism carried on a train and operating under unsafe traffic conditions to apply the brakes, control means protected against misuse and located entirely on the train for preventing an automatic brake application if the engineer take suitable periodic action, and car-carried indicating means for indicating the time when said action is first necessary.

24. Railway traffic controlling apparatus comprising slow-acting automatic mechanism carried on a train and operating under unsafe traffic conditions to apply the brakes, and control means located entirely on the train for preventing an automatic brake application if the engineer take suitable periodic action.

25. Railway traffic controlling apparatus comprising slow-acting automatic mechanism carried on a train and operating under unsafe traffic conditions to apply the brakes, and control means located entirely on the train for preventing an automatic brake application if the engineer take suitable periodic action, said control means being protected against misuse by a contact controlling the automatic mechanism and operable by said control means.

In testimony whereof I affix my signature.

WINTHROP K. HOWE.