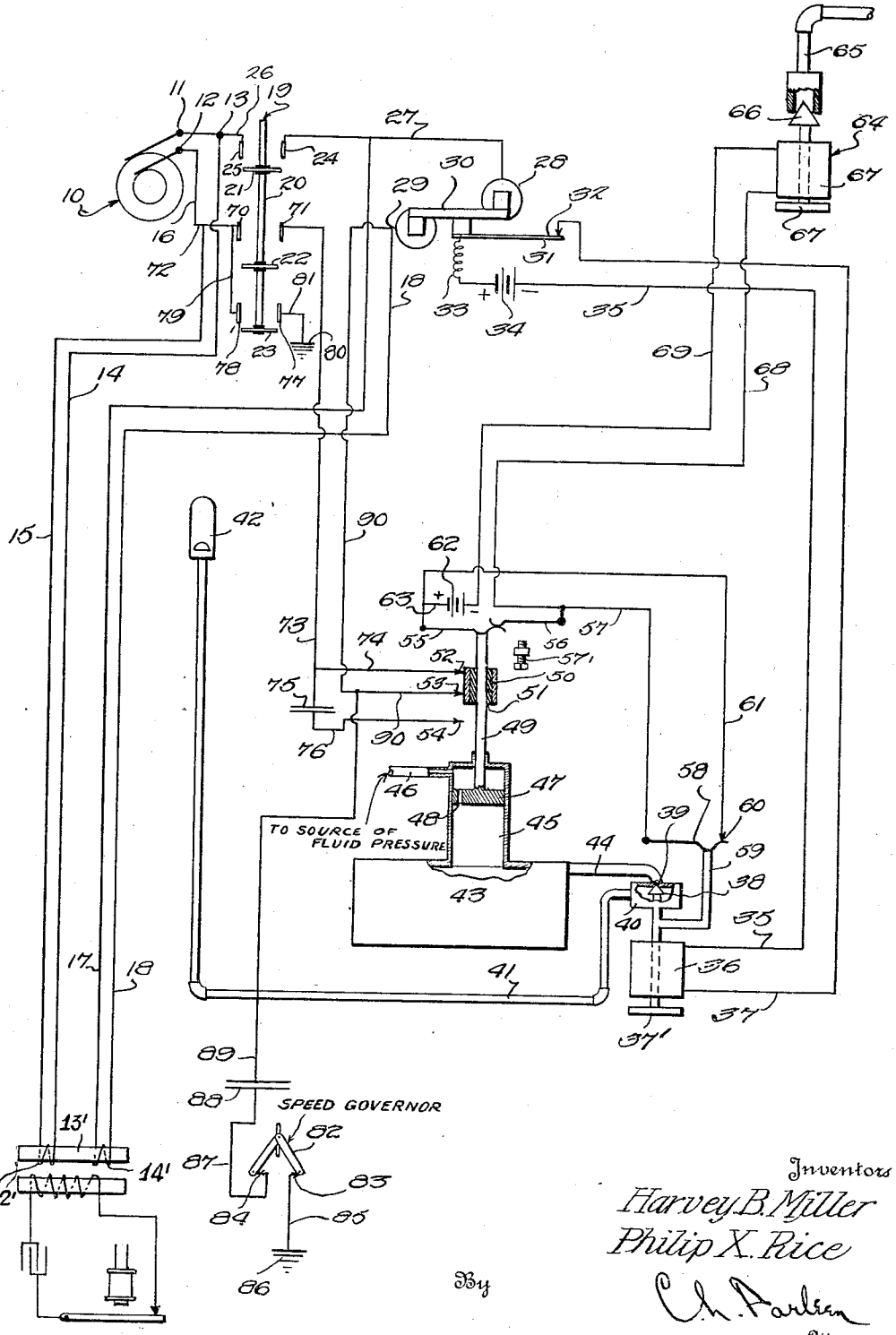
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TRAIN CONTROL SYSTEM

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TRAIN CONTROL SYSTEM

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This invention relates to train control systems of the intermittent induction type, as disclosed in the copending applications of Philip X. Rice, Serial Numbers 106,478, filed May 3rd, 1926, and 714,962, filed May 21st, 1924.

In the systems shown in the copending applications above identified, there is disclosed a pair of magnetizable train carried cores provided with primary and secondary windings, the primary winding being connected to a source of alternating current whereby the flow of magnetic flux between the cores is adapted to induce a current in the secondary core and coil, the current in the secondary being utilized for maintaining an electro-pneumatic valve in closed position. The apparatus is associated with and adapted to be influenced by track-side inductors whereby the flow of magnetic flux may be interrupted or reduced in such a manner as to reduce the alternating current in the secondary circuit, and thus permit the electro-pneumatic valve to open, this valve having a normal bias to open position. Considerable force is necessary to maintain the electro-pneumatic valve in closed position, and consequently considerable secondary current is required for this work.

In the system disclosed in copending application Serial No. 106,478, above referred to, there is disclosed means whereby the engineer, by manual operation of a switch, may forestall the operation of the apparatus, provided the switch referred to is closed before the train carried device passes over an open circuited track inductor. The manually controlled switch is adapted to supply current directly from the source of alternating current to the electro-pneumatic valve, whereby the latter will be retained in closed position when the train device passes over an open circuited track-side inductor which normally would effect a sufficient reduction in the secondary current to permit the electro-pneumatic valve to open.

An important object of the present invention is to provide a system of the character generally outlined above wherein a second source of current is employed for maintaining the electro-pneumatic valve in closed position, the current from the secondary coil of the train shoe being utilized merely for closing a relay to complete the circuit from the second current source to the electro-pneumatic valve, whereby considerable economy in the consumption of current is effected inasmuch as a weaker current in the secondary circuit may be utilized.

A further object of the invention is to provide a system of the character just mentioned wherein the reduction of the current necessary in the secondary circuit is adapted to render the system more sensitive thus permitting the primary and secondary cores or shoes to be arranged a substantial distance above the track-side inductor to be influenced thereby.

A further object of the invention is to provide a train control system provided with means of the character previously referred to whereby the engineer may forestall the opening of the electro-pneumatic valve when passing over an open circuited inductor, and wherein the engineer is further permitted to "after-stall" the operation of the valve provided he takes suitable action within a limited time after the locomotive passes over an open circuited inductor.

A further object is to provide a forestalling device including a circuit having a portion associated with and adapted to be controlled by a time device whereby the engineer may close a suitable switch to directly connect the source of alternating current to a relay to maintain the electro-pneumatic valve in closed position, the time device being adapted to prevent the closing of the circuit referred to after a given interval of time.

A further object is to provide a train control system wherein audible warning is given to the engineer when passing over an open circuited inductor whereby he may, if he so desires, prevent the operation of the system by closing a suitable switch within a given length of time after the locomotive passes over the inductor.

A further object is to provide means associated with a train control system of the character above mentioned whereby resetting

of the electro-pneumatic valve may be effected after the speed of the train has been reduced to a predetermined limit.

Other objects and advantages of the invention will be apparent during the course of the following description.

In the drawing, the single figure is a diagrammatic representation of the train carried circuit.

Referring to the drawing, the numeral 10 designates a suitable alternator having take-off terminals 11 and 12. The terminal 11 is connected to a second terminal 13, and a wire 14 is connected to one end of the primary coil 12′ of the shoe 13′. The other end of the primary coil is connected to the terminal 12 through wires 15 and 16. The shoe also employs a secondary coil 14′ connected to leads 17 and 18. The shoe employed may be of any suitable type, such as the types shown in the copending applications above referred to, and need not be described in detail.

The numeral 19 designates a manually controlled switch as a whole which is normally movable downwardly by gravity to open position, as will become apparent. The switch 19 includes a stem 20 to which are connected switch arms 21, 22 and 23, the switch arms being suitably insulated from the stem. Contacts 24 and 25 are arranged on opposite sides of the arm 21 and are adapted to contact therewith. A wire 26 is connected to the contact 25, while a wire 27 is connected between the contact 24 and one end of the coils of a relay 28. As shown, the wire 17, connected to the secondary coil of the shoe, is connected to the wire 27, while the wire 18 is connected to the opposite end of the coils of the relay as at 29.

The relay is provided with an armature 30 provided with means (not shown) whereby it has a normal bias to open position. The armature is provided with a switch arm 31 which normally contacts with a stationary contact 32. The arm 31 is connected by a wire 33 with one side of a suitable source of current 34. From the opposite side of the source 34, a wire 35 leads to a solenoid 36, the lead 37 from the opposite side of the solenoid being connected to the stationary contact 32.

It will be apparent that the relay 28 is adapted to be normally energized by current induced in the secondary coil of the shoe, whereby current is normally supplied from the source 34 to the solenoid 36 to maintain the latter energized. The solenoid is provided with a movable core 37′ having a valve 38 arranged at its upper end. This valve is adapted to normally close an opening 39 in a chamber 40.

As shown, a pipe 41 is connected between the chamber 40 and a whistle or other audible signal 42, whereby the signal will be operated when fluid pressure is supplied to the chamber 40 in a manner to be described.

Fluid pressure is adapted to be supplied to the chamber 40 through opening 39 from a reservoir 43, through a pipe 44. A cylinder 45 is arranged over the reservoir 43 and is in constant communication therewith. A pipe 46 is connected at one end with the upper end of the cylinder 45, the opposite end of the pipe 46 being connected to a suitable source of fluid pressure supply. A piston 47 is arranged to reciprocate in the cylinder 45 between the pipe 46 and the reservoir 43. The piston 47 is provided with a leakage port 48 affording restricted communication between the opposite ends of the cylinder 45 for a purpose to be described. The piston 47 is mounted upon the lower end of a piston rod 49 the upper end of which projects through the upper end of the cylinder and a substantial distance therebeyond. A preferably cylindrical contact 50 is carried by the piston rod and is insulated therefrom as at 51. The contact 50 is adapted to establish electrical communication either between a contact 52 and a contact 53, or between the latter contact and a third contact 54.

The upper end of the piston rod 49 is adapted to control a swinging switch arm 55, the latter being movable downwardly by gravity and normally supported by the upper end of the piston rod. The arm 55 contacts with a movable contact 56 connected to a lead wire 57 and an adjustable set screw 57′ is adapted to limit the downward movement of the contact 56. The opposite end of the wire 57 is connected to a swinging switch arm 58 which is supported upon the upper end of an extension 59 which may be formed integral with the core 37′. The arm 58 normally establishes electrical connection with a contact 60 connected to one end of a wire 61. One side of the source of current 62 is connected to the wire 61 through a lead wire 63, the wire 61 also being connected to the swinging arm 55 as shown.

In the drawing we have diagrammatically shown an electro-pneumatic valve 64. This valve includes a pipe 65 normally closed by a valve 66 carried by the upper end of an armature 67. The valve is normally maintained in closed position by a solenoid 67. The valve 64 is adapted to control the air brake system according to the usual practice. The solenoid 67 is provided with a lead wire 68, the opposite end of this wire being connected to the wire 57. The opposite end of the solenoid winding is connected by a wire 69 to the opposite side of the source of current 62.

Contacts 70 and 71 are associated with the arm 22 of the switch 19. A wire 72 connects the contact 70 with the wires 15 and 16, while the contact 71 is connected through

wires 73 and 74, with the contact 52. The wire 73 is also connected to a suitable condenser 75, the opposite side of which is connected to the contact 54 through a wire 76. Contacts 77 and 78 are associated with the arm 23 and are adapted to contact therewith. A wire 79 connects the contact 78 with the wire 72, while the contact 77 is grounded as at 80 through a wire 81.

Means are provided whereby the valve 64 may be reset after the solenoid 67 has been deenergized. This means includes a speed governor 82, the arms of which are adapted to contact with stationary contacts 83 and 84. A wire 85 connects the contact 83 to a ground 86. The other contact 84, is connected by a wire 87 to one side of a condenser 88 of suitable capacity, the opposite end of this condenser being connected by a lead wire 89 to a wire 90. The latter wire is connected at one end to the contact 53 and the opposite end of the wire 90 is connected to the wire 18 and relay coils 28.

The operation of the system is as follows: Current is supplied to the primary coil 12′ of the shoe through wires 14 and 15 from the alternator 10. The arrangement of the core of the shoe, as previously explained, is such that magnetic flux threads the secondary portion of the core from the primary portion, thus inducing a current in the secondary winding 14′. This induced current flows through wires 17 and 27 to the relay 28 and thence back to the secondary winding through leads 29 and 18. The induced current may be relatively weak, but will have sufficient strength to retain the armature 30 in closed position whereby the switch arm 31 will be electrically connected to the contact 32. Current will then flow from the source 34, through wire 33 and switch arm 31 to contact 32, thence through wire 37 to the winding of the solenoid 36, and thence back to the source of current 34 through wire 35. Thus it will be apparent that the solenoid 36 normally will be energized to retain its core in upper position to hold the valve 38 in closed position, thus preventing the passage of pressure fluid from the reservoir 43 to the chamber 40. When escape of fluid from the reservoir 43 is prevented, the port 48 serves to establish equal pressures on opposite sides of the piston 47 in the cylinder 45. Since the effective area of the lower face of the piston is greater than that of the upper face, it will be apparent that the piston 47 normally will be moved upwardly to the position shown, whereby electrical connection will be established across the contacts 52 and 53 by means of the contact 50. With the parts in the position shown, it will be apparent that current will flow from the source 62 through wire 63, and through either wire 61 or switch arm 55. Both the latter elements are normally electrically connected to the wire 68, and thus current will be supplied to the solenoid 67, current returning from the solenoid to the source 62 through wire 69. Thus the valve 66 will be maintained closed and the braking system of the vehicle will remain inoperative permitting the vehicle to proceed.

If the vehicle passes over a track inductor the coil of which is in a closed circuit, the passage of magnetic flux between the primary and secondary cores will not be interrupted, and accordingly the relay coils 28 will not be affected but will maintain the arm 31 in closed position. If the inductor coil is in an open circuit, due to danger traffic conditions in the next track block, the passage of magnetic flux previously referred to will be interrupted or reduced thus affecting the relay 28 and permitting the armature thereof to open. This action obviously breaks the electrical connection between switch arm 31 and contact 32 and hence the solenoid 36 will be deenergized, permitting its armature to drop. The valve 38 then will be opened permitting the escape of pressure fluid from the reservoir 43 to the chamber 40, and the signal 42 will be sounded. This action further decreases the pressure in the lower end of cylinder 45 and since this pressure decrease takes place slightly faster than the pressure can be built up through the escape of fluid through the port 48, it will be apparent that the piston 47 will slowly drop. Movement of the piston downwardly permits the movable contact 56 to move downwardly until its movement is arrested by the set screw 57′, whereupon further downward movement of the piston breaks the electrical connection between the switch arm 55 and contact 56. Since the switch arm 58 will have been disconnected from the contact 60 upon the previously described deenergization of the solenoid 36, no current will be supplied from the source 62, to the solenoid 67, and hence the valve 66 will open thus setting the brakes of the vehicle and causing it to stop.

Means are provided whereby the engineer may forestall the operation of the valve 66 before the vehicle passes over a track inductor. By lifting the switch 19, the arms 21 and 22 may be caused to establish connection with their respective contacts. Current will then be supplied from terminal 11, through wire 26, contact 25, arm 21 and contact 24, and thence through wire 27 to coils 28. From the relay 28 current flows through wire 90 to contact 53, across contact 50 to contact 52, and thence back to the other terminal of the alternator through wire 73, contact 71, arm 22, contact 70 and wires 16 and 72. Thus it will be apparent that current will be supplied directly to the coils 28 from the alternator whereby a decrease in current in the secondary core of the shoe when passing over an open circuited inductor will not affect the

coils 28 and the circuits supplied with current from the sources 34 and 62 will remain closed and the vehicle is permitted to proceed.

Under some conditions, as during foggy weather, it is difficult for the engineer to see the visible block signal before the shoe passes over the inductor, and accordingly we provide means whereby the engineer may "after-stall" the operation of the electropneumatic valve, provided he takes proper steps within a limited time after the vehicle has passed over the inductor. As previously stated, a sufficient reduction in current to permit the armature 30 to open causes the circuit of the source 34 to be opened thus deenergizing the solenoid 36. This action causes the two results previously referred to, namely the sounding of the signal 42 and the slow lowering of the piston 47. Downward movement of the piston causes the contact 50 to bridge across the contacts 53 and 54 before the connection is broken between contacts 55 and 56. If the engineer desires to prevent the application of the brakes, he necessarily must take the proper steps before the contact 50 passes downwardly beyond the contact 53. Under such conditions upward movement of the switch 19 closes a circuit from the alternator substantially in the manner previously described in connection with the forestalling of the operation of the pneumatic valve. Instead of current passing from the contact 53 to the contact 52, however, it will pass to the contact 54, and thence through wire 76 and condenser 75, to wire 73 from which the current returns to the alternator in the manner previously described. It will be obvious that the windings of the relay 28 possess substantial inductive reactance, and accordingly the current from the alternator is not sufficient to reset the armature 30 unless this inductive reactance is neutralized. Accordingly we provide the condenser 75 in circuit with the coils 28, and the capacity reactance of the condenser 75 is sufficient to overcome the inductive reactance of the relay windings whereby the latter may be sufficiently energized to attract its armature and close the circuit of the source 34. When the relay 28 is thus energized, the circuit will be closed between the source 34 and solenoid 36 whereby the armature of the latter will be moved upwardly to close the valve 38. This action prevents further escape of fluid from the reservoir 43 and permits a balanced pressure to be reestablished in the cylinder 45 whereupon the piston 47 will move upwardly to normal position without having broken the connection between contacts 55 and 56. Thus it will be apparent that the brakes will be prevented from acting and the vehicle may proceed.

If the vehicle travels over the inductor without having the operation of the pneumatic valve "forestalled" or "after-stalled" it will be apparent that the brakes will be applied due to the breaking of the circuits to the solenoid 64 and the consequent release of air from the brake pipes. The contact 50 thus will move downwardly beyond the contact 53 and the circuit through contacts 55 and 56 will be broken, thus making it impossible for the engineer to reset the solenoid 67 by operating the switch 19. Under such conditions, it is necessary for the engineer to wait until the vehicle has reached a minimum or zero speed whereby the contacts 83 and 84 will be connected to each other. At this time, as previously stated, the piston 47 will have moved downwardly a sufficient distance to open the circuit between contacts 55 and 56 and accordingly the brakes will be set. As shown in the drawing, the arms 21 and 23 are adapted to establish connection with their respective contacts before the circuit may be established across the contacts 70 and 71. When the vehicle has been brought to a minimum or zero speed, the engineer may lift the switch 19 to close the circuit between the contacts 77 and 78. Under such conditions, current will be supplied from the alternator to the wire 90, in the manner previously described, and this current flows to wire 89, and thence to the condenser 88 to wire 87 and contact 84. The current then flows through the governor arms 82 and wire 85, to ground 86 and ground 80. Current is returned to the alternator through wire 81, contact 77, arm 23, contact 78, and wires 79 and 16. The reset condenser 88 is of substantially the same capacity as the condenser 75, being adapted to neutralize the inductive reactance of the relay 28. Thus it will be apparent that it will be impossible for the engineer to reset the valve 66 through the circuit just described until the train has been brought to a minimum or zero speed. It will be apparent that an appreciable length of time is required for the piston 47 to move downwardly to break the connection between contacts 55 and 56, and similarly it requires a considerable interval of time to close the circuit between these members when the reset mechanism is operated. The switch 58 is provided in order that the solenoid 64 may be quickly energized when the reset switch is closed without waiting for the piston 47 to move upwardly to close the circuit between the contacts 55 and 56.

In operation we prefer to arrange the cylinder 45 and associated elements in such a manner that it requires approximately three seconds for the contact 50 to pass downwardly beyond the contact 53, this interval of time being given to permit the engineer to "after-stall" the operation of the relay if he so desires.

From the foregoing it will be apparent that relatively slight currents are sufficient to operate the valve magnet 28, and accordingly

the system possesses an increased degree of sensitivity since relatively smaller current reductions are necessary in the secondary coil to permit the armature 30 to open. This increased sensitivity results in economy in the use of the alternating current, and also permits the shoes to be arranged at a greater height above the inductor.

It is to be understood that the form of our invention herewith shown and described is to be taken as a preferred example of the same and that various changes in the shape, size and arrangement of parts may be resorted to without departing from the spirit of the invention or the scope of the subjoined claims.

We claim:

1. In a train control system, a source of current, electrically operated means normally energized to maintain it in operative position to permit the vehicle to proceed, circuits associated with said source of current and adapted to be influenced under certain track conditions to cause deenergization of said electrically operated means to influence the speed of the vehicle, at least one of said circuits normally being inductively reactive, said source normally being ineffective for rendering said electrically operated means operative after it has been deenergized, an auxiliary circuit adapted to cause the energization of said electrically operated means by said source independently of track conditions and including capacity reactance adapted to neutralize the inductive reactance of one of said first named circuits, and time controlled means for breaking said auxiliary circuit.

2. In a train control system, a source of current, electrically operated means normally energized to maintain it in operative position to permit the vehicle to proceed, circuits associated with said source of current and adapted to be influenced under certain track conditions to cause deenergization of said electrically operated means to influence the speed of the vehicle, at least one of said circuits being inductively reactive, said source being normally ineffective for rendering said electrically operated means operative after it has been deenergized, a reset circuit including sufficient capacity reactance to neutralize the inductive reactance of one of said first mentioned circuits, and speed responsive means adapted to complete said reset circuit when the speed of the vehicle is reduced to a certain point to cause energization of said electrically operated means.

3. In a train control system, a source of alternating current, train controlling means including electro-magnetic means normally energized from said source to permit the vehicle to proceed, a circuit influenced by track conditions and adapted to control said electro-magnetic means whereby the latter becomes deenergized to apply the brakes of the vehicle under certain track conditions, said source being normally ineffective for operating said electro-magnetic means after it has become deenergized, an auxiliary circuit, tuned to the frequency of said source, for operating said electro-magnetic means after its deenergization, a manually controlled switch in said auxiliary circuit, a second switch adapted to complete said auxiliary circuit when said manually controlled switch is closed, and time controlled means for said second named switch including a pressure chamber adapted to be influenced by track conditions to release pressure therefrom under certain track conditions whereby said second named switch will be rendered operable to open said auxiliary circuit after an interval of time.

4. In a train control system, a source of alternating current, train controlling means including electro-magnetic means normally energized from said source to permit the vehicle to proceed, a circuit influenced by track conditions and adapted to control said electro-magnetic means whereby the latter becomes deenergized to apply the brakes to the vehicle under certain track conditions, said source being normally ineffective for causing operation of said electro-magnetic means after it has become deenergized, an auxiliary circuit, tuned to the frequency of said source, for operating said electro-magnetic means after its deenergization, a manually controlled switch in said auxiliary circuit, a control switch adapted to complete said auxiliary circuit when said manually controlled switch is closed, a piston connected to said control switch, a pressure chamber in which said piston is arranged, and means for releasing pressure from said chamber under certain track conditions whereby it will be rendered operable to open said auxiliary circuit after an interval of time.

5. In a train control system, a source of alternating current, train controlling means including electro-magnetic means normally energized from said source to permit the vehicle to proceed, a circuit influenced by track conditions and adapted to control said electro-magnetic means whereby the latter becomes deenergized to apply the brakes of the vehicle under certain track conditions, said source being ineffective for operating said electro-magnetic means after it has become deenergized, an auxiliary circuit, tuned to the frequency of said source, for operating said electro-magnetic means after its deenergization, a manually controlled switch in said auxiliary circuit, a control switch adapted to complete said auxiliary circuit when said manually controlled switch is closed, a piston connected to said switch, a pressure chamber in which said piston is arranged, means for releasing pressure from said chamber

under certain traffic conditions whereby it will be rendered operable to open said auxiliary circuit after an interval of time, and a signal operable upon release of pressure from said chamber.

6. In a train control system, a source of current, train controlling means including electro-magnetic means normally energized to permit the vehicle to proceed, a circuit influenced by track conditions and adapted to control said electro-magnetic means whereby the latter will become deenergized to apply the brakes of the vehicle under certain track conditions, said current source being ineffective for operating said electro-magnetic means after it has become deenergized, an auxiliary circuit adapted to render current from said source effective for operating said electro-magnetic means, a manually controlled switch for said auxiliary circuit, a control switch adapted to complete said auxiliary circuit when said manually controlled switch is closed, a piston connected to said control switch, said piston being provided with a port extending therethrough, a cylinder in which said piston is adapted to reciprocate, a source of fluid pressure supply communicating with one end of said cylinder, and means for permitting the escape of fluid pressure from the opposite end of said cylinder under certain track conditions whereby said control switch will be rendered operable to open said auxiliary circuit after an interval of time.

7. In a train control system, a primary circuit and a secondary circuit adapted to be inductively coupled, a source of alternating current for said primary circuit, a relay connected in said secondary circuit and having a normal bias to open position, said relay being normally energized by induced current in said secondary circuit and adapted to be deenergized under certain track conditions to permit it to open, electro-pneumatic train control means, a source of current for said train control means, a switch connecting said second source to said train control means and adapted to be opened upon deenergization of said relay, and a time controlled switch operable to connect said source of alternating current directly to said relay.

8. In a train control system, a primary circuit and a secondary circuit adapted to be inductively coupled, a source of alternating current for said primary circuit, a relay connected in said secondary circuit and having a normal bias to open position, said relay normally being energized by induced current in said secondary circuit and adapted to be deenergized under certain track conditions to permit it to open, electrically operated train control means, a source of current for said train control means, a switch normally connecting said second source to said train control means, pneumatically operated means normally retaining said switch in closed position, and means controlled by the deenergization of said relay for rendering said pneumatically operated means inoperative.

9. In a train control system, a primary circuit and a secondary circuit adapted to be inductively coupled, a source of alternating current for said primary circuit, a relay connected in said secondary circuit and having a normal bias to open position, said relay normally being energized by induced current in said secondary circuit and adapted to be deenergized under certain track conditions to permit it to open, electrically operated train controlling means, a source of current for said train control means, a switch connecting said source to said train controlling means, pneumatically operated means including a fluid pressure reservoir for retaining said switch in closed position, and means controlled by the deenergization of said relay for releasing pressure from said reservoir.

10. In a train control system, a primary circuit and a secondary circuit adapted to be inductively coupled, a source of alternating current for said primary circuit, a relay connected in said secondary circuit and having a normal bias to open position, said relay normally being energized by induced current in said secondary circuit and adapted to be deenergized under certain traffic conditions to permit it to open, electrically operated train controlling means, a source of current for said train controlling means, a switch connecting said second named source to said train controlling means, pneumatically operated means including a fluid pressure reservoir for retaining said switch in closed position, means controlled by the deenergization of said relay for releasing pressure from said reservoir, and an audible signal adapted to be actuated upon the release of pressure from said reservoir.

11. In a train control system, a primary circuit and a secondary circuit adapted to be inductively coupled, a source of alternating current for said primary circuit, a relay connected in said secondary circuit and having a normal bias to open position, said relay normally being energized by induced current in said secondary circuit and adapted to be deenergized under certain track conditions to permit it to open, electro-pneumatic train control means, a source of current for said train control means, a switch connecting said second named source to said train controlling means, a piston normally adapted to retain said switch in closed position, a cylinder in which said piston is adapted to reciprocate, means for supplying fluid pressure to one end of said cylinder to retain said switch in closed position, and electrically operated means for releasing pressure from said cylinder to permit said switch to be opened upon deenergization of said relay.

12. In a train control system, a primary circuit and a secondary circuit adapted to be inductively coupled, a source of alternating current for said primary circuit, a relay connected in said secondary circuit and having a normal bias to open position, said relay normally being energized by induced current in said secondary circuit and adapted to be deenergized under certain track conditions to permit it to open, electro-pneumatic train control means, a source of current for said train control means, a switch connecting said second named source to said train control means, a piston normally adapted to retain said switch in closed position, a cylinder in which said piston is adapted to reciprocate, means for supplying fluid pressure to said cylinder to retain said switch in closed position, a valve normally adapted to prevent escape of fluid from said cylinder, and electro-magnetic means normally energized for retaining said valve in closed position, said electro-magnetic means being adapted to be deenergized upon the opening of said relay.

13. In a train control system, a primary circuit and a secondary circuit adapted to be inductively coupled, a source of alternating current for said primary circuit, a relay connected in said secondary circuit and having a normal bias to open position, said relay normally being energized by induced current in said secondary circuit and adapted to be deenergized under certain track conditions to permit it to open, electro-pneumatic train control means, a source of current for said train control means, a switch connecting said second named source to said train control means, a piston normally adapted to retain said switch in closed position, a cylinder in which said piston is adapted to reciprocate, means for supplying fluid pressure to said cylinder to retain said switch in closed position, a valve normally adapted to prevent escape of fluid from said cylinder, and electro-magnetic means normally energized for retaining said valve in closed position, said electro-magnetic means being adapted to be deenergized upon the opening of said relay, a contact movable by said piston, a forestalling circuit normally including said contact, and a manually operable switch adapted to complete said forestalling circuit, said last named circuit being adapted to be broken after a predetermined interval of time upon the release of pressure from said cylinder.

14. In a train control system, a primary circuit and a secondary circuit adapted to be inductively coupled, a source of alternating current for said primary circuit, a relay connected in said secondary circuit and having a normal bias to open position, said relay normally being energized by induced current in said secondary circuit and adapted to be deenergized under certain track conditions to permit it to open, electro-pneumatic train control means, a source of current for said train control means, a switch connecting said second named source to said train control means, a piston normally adapted to retain said switch in closed position, a cylinder in which said piston is adapted to reciprocate, means for supplying fluid pressure to said cylinder to retain said switch in closed position, a valve normally adapted to prevent escape of fluid from said cylinder, electro-magnetic means normally energized for retaining said valve in closed position, said electro-magnetic means being adapted to be deenergized upon the opening of said relay, a contact movable with said piston, a forestalling circuit normally including said contact, a manually operable switch adapted to complete said forestalling circuit, said last named circuit being adapted to be broken upon movement of said contact, an after-stalling circuit including in part said forestalling circuit, said after-stalling circuit also including said contact after the latter has moved to break said forestalling circuit, and a manually controlled switch adapted to complete said after-stalling circuit.

15. In a train control system, electrically operated means normally energized to maintain it in operative condition to permit the vehicle to proceed, intermittently operative means actuated under certain traffic conditions to render said electrically operated means inoperative and thus to influence the speed of the vehicle, a pair of circuits associated with said electrically operated means, one of said circuits being operative when closed prior to the operation of said intermittently operative means for retaining said electrically operated means energized during such operation, the other circuit being adapted when closed within an interval of time after the operation of said means for restoring said electrically operated means to normal condition, and a common manually operable switch member for closing said circuits.

16. In a train control system, a source of current, electrically operated means normally energized from said source to maintain it in operative condition to permit the vehicle to proceed, automatic means operative under certain traffic conditions to render said electrically operated means inoperative and thus to influence the speed of the vehicle, control means operative prior to the operation of said automatic means for rendering the latter ineffective for influencing the speed of the vehicle, a second control means including in part said first named control means and operable within an interval of time after the operation of said automatic means for restoring the normal condition of said electrically operated means, and common manually operable means for both of said control means.

17. In a train control system, a source of alternating current, electrically operated means normally energized from said source to maintain it in operative condition to permit the vehicle to proceed, automatic means operable under certain traffic conditions to render said electrically operated means inoperative and thus to influence the speed of the vehicle, a circuit adapted when closed to maintain said electrically operated means energized upon operation of said automatic means but being adapted to supply insufficient current to said electrically operated means to initially operate it, a circuit adapted when closed within an interval of time after operation of said automatic means to energize said electrically operated means, said last named circuit being adapted to supply sufficient current to said electrically operated device to initially operate it, and common switch means for closing said circuits.

18. In a train control system, a source of alternating current, electrically operated means normally energized from said source to maintain it in operative condition to permit the vehicle to proceed, said means possessing a substantial degree of inductive reactance whereby current from said source is insufficient to initially operate it, automatic means operative under certain traffic conditions to render said electrically operated means inoperative and thus to influence the speed of the vehicle, a circuit adapted when closed to maintain said electrically operated means energized upon operation of said automatic means but being adapted to supply insufficient current to said electrically operated means to initially operate it, a circuit adapted when closed within an interval of time after operation of said automatic means to energize said electrically operated means, said last named circuit possessing sufficient capacity reactance to neutralize the inductive reactance of said electrically operated means whereby said last named circuit is adapted to supply sufficient current to said electrically operated means to initially operate it, and common switch means for closing said circuits.

19. In an automatic train control system, the combination of a car-carried apparatus comprising means to apply the brakes automatically, an air-pressure operated contactor having two contacting positions, and a manually operable device which, when operated, permits prevention of an automatic application of the brakes provided that the contactor is in one of its contacting positions, said manual device permitting restoration of the brakes provided the contactor is in its other contacting position.

20. In an automatic train control system for railroads, the combination of a car-carried equipment comprising brake-setting means, an air-pressure operated contactor having two contacting positions, and a manually operable device which when operated permits prevention of an automatic application of the brakes provided the brake-setting means are in their inactive position and the contactor is in one of its contacting positions, said manually operable device also permitting restoration of the brakes provided the contactor is in its other contacting position.

21. In a train control system, the combination of car-carried apparatus and trackway devices cooperating inductively in case of danger conditions ahead, the car-carried apparatus comprising brake-setting means, an air-operated piston having normally balanced pressures on opposite sides, two air-operated contacts actuated by said piston, one normally closed and the other normally open, and an acknowledging device, the acknowledging device preventing the automatic application of the brakes provided the normally closed air-operated contact has not been opened, such prevention not being possible if the pressure on one side of the piston has dropped below a predetermined amount, and permitting release of the brakes, after an automatic brake application, only if the other air-operated contact is closed.

In testimony whereof we affix our signatures.

HARVEY B. MILLER.
PHILIP X. RICE.