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RAILWAY TRAFFIC CONTROLLING APPARATUS

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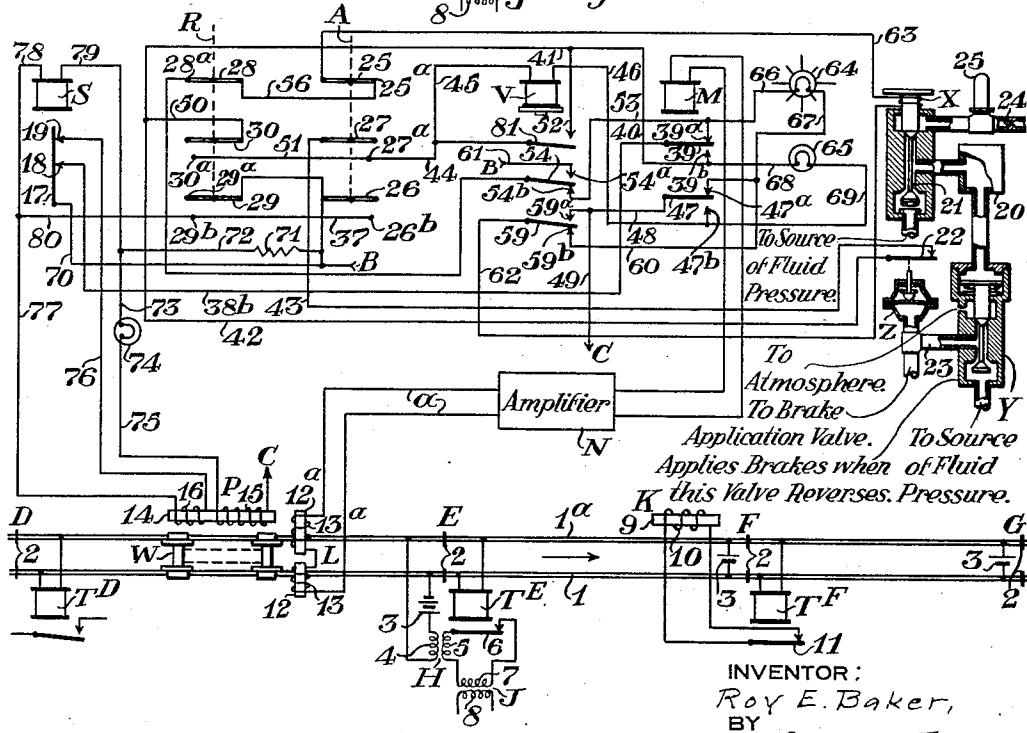
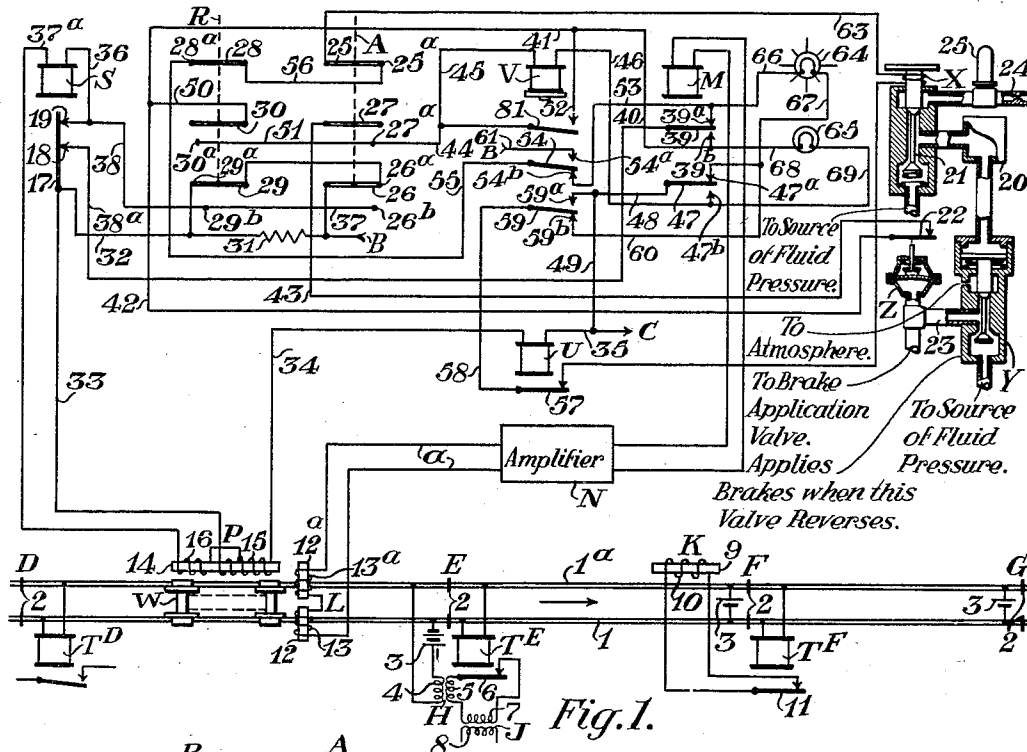


Fig. 2.

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RAILWAY TRAFFIC CONTROLLING APPARATUS

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My invention relates to railway traffic controlling apparatus, and particularly to automatic train control systems of the intermittent inductive and continuous inductive types. More particularly, my invention relates to the train carried portion of such systems.

One object of my invention is to provide train carried apparatus having a minimum number of constituent parts so arranged that the train may be operated in territory provided with either intermittent or continuous train control apparatus.

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

In the accompanying drawing, Fig. 1 is a view, partly diagrammatic and partly cross sectioned, illustrating one form of railway traffic controlling apparatus embodying my invention. Fig. 2 is a similar view showing a modified form of the apparatus illustrated in Fig. 1, and also embodying my invention.

Similar reference characters refer to similar parts in both views.

Referring first to Fig. 1, the reference characters 1 and 1^a designate the track rails of a stretch of railway track over which traffic normally moves in the direction indicated by the arrow. These track rails are divided, by means of insulated joints 2, into a plurality of track sections, only three of which D—E, E—F and F—G are illustrated in the drawing. Each track section is provided with the usual track circuit comprising a suitable source of current, here shown as a track battery 3, connected across the rails adjacent the exit end of the section, and a track relay, designated by the reference character T with an exponent corresponding to the location, connected across the rails adjacent the entrance end of the section.

The rails of section D—E are also supplied with alternating train controlling current under the control of traffic conditions in advance of the section. As here shown, this latter current is furnished by interposing between the track battery 3, and one rail 1^a of the section, the secondary 4 of a transformer H, the primary 5 of which is at times supplied with alternating train controlling current

from the secondary 7 of a transformer J. The primary 8 of transformer J is constantly connected with a source of alternating current which is not shown in the drawing. The circuit for primary 5 of transformer H includes a front contact 6 of track relay T^E, and it will be apparent, therefore, that alternating train controlling current is supplied to the rails of section D—E when section E—F is unoccupied, but not when this section is occupied.

Located adjacent the entrance end of section F—G is a trackway inductor K of the usual form commonly employed in intermittent inductive train control systems, and comprising a magnetizable core 9 provided with a winding 10. As here shown, the circuit for winding 10 is controlled by a front contact 11 of track relay T^F, so that the circuit for this winding will be closed when section F—G is unoccupied, and opened when this section is occupied.

As shown in the drawing, section D—E is occupied by a train W. Located in advance of the forward axle of this train is a receiver L of the usual form commonly employed in train control systems of the continuous inductive type, and comprising two magnetizable cores 12 and 12^a disposed in inductive relation with the track rails 1 and 1^a, respectively, and provided with windings 13 and 13^a. The windings 13 and 13^a are included in a receiving circuit *a*, these windings being connected in series in this circuit in such manner that the potentials created in these windings by alternating current flowing in opposite directions in the two track rails, are additive.

The currents induced in the receiving circuit *a* are utilized to control the supply of current to a relay M, suitable amplifying apparatus N preferably being interposed between the receiving circuit and the relay windings as illustrated in the drawing.

The train carried apparatus also includes a second receiver P of the usual form commonly employed in train control systems of the intermittent inductive type, and comprising a magnetizable core 14 provided with a primary winding 15 and a secondary winding 16. The receiver P is so located as to

register with the trackway inductor K in the usual and well known manner. The train carried apparatus further includes a polarized relay S of the usual type commonly employed in intermittent inductive train control systems, a checking relay U, a slow releasing acknowledging relay V, and a brake magnet X. The brake magnet X controls the brakes in such manner that an automatic brake application occurs at the expiration of a given interval of time following the deenergization of magnet X. Associated with the brake controlling apparatus is a pneumatic relay Z which controls a contact 22 in such a manner that this contact is normally closed but becomes opened upon the initiation of an automatic application of the brakes.

When magnet X is energized, it connects a timing reservoir 20 with a suitable source of fluid pressure not shown in the drawing through the medium of a valve 21. Reservoir 20 is connected with a relay valve Y so that, when this reservoir is charged, the valve is depressed, and pneumatic relay Z is connected by a pipe 23 with a source of fluid pressure; contact 22 is then closed. Pipe 23 is also connected to apparatus (not shown) which causes an automatic application of the brakes when this pipe is opened to atmosphere. When magnet X becomes deenergized, timing reservoir 20 will be opened to atmosphere through a restricted orifice 24, and also through a whistle 25 which gives an audible indication to the engineman. After a given interval of time, such as six seconds, valve Y will reverse, thereby venting pipe 23 to atmosphere, and this will cause an automatic application of the brakes, and will also cause contact 22 of relay Z to open.

The train carried apparatus further includes an acknowledging switch A and a reset switch R. As here shown, the acknowledging switch A comprises two normally closed contacts 25—25^a and 26—26^a, and two normally open contacts 26—26^b and 27—27^a. Similarly, the reset switch R comprises two normally closed contacts 28—28^a and 29—29^a, and two normally open contacts 30—30^a and 29—29^b. The reset switch R will usually be located on the train in such a position that it is inaccessible to the engineman while the train is in motion. The train carried apparatus also includes a resistance element 31, the function of which will be made clear hereinafter.

The main circuit for the primary winding 15 of the receiver P passes from terminal B of a suitable source of direct current not shown in the drawing, through normally closed contact 26—26^a of acknowledging switch A, normally closed contact 29—29^a of reset switch R, wires 32 and 33, primary winding 15, wire 34, winding of checking relay U, and wire 35, to the other terminal C of the source. The normal circuit for the sec-

ondary winding 16 of the receiver P is from terminal B through normally closed contact 26—26^a of acknowledging switch A, normally closed contact 29—29^a of reset switch R, wire 32, normal contact 17—19 of relay S, wire 36, winding of relay S, wire 37^a, secondary winding 16 to an intermediate point in the primary winding 15, and thence through the right hand portion of this winding, wire 34, the winding of relay U, and wire 35 to terminal C.

Acknowledging relay V is provided with an acknowledging circuit which passes from terminal B through normally open contact 26—26^b of acknowledging switch A, wires 37 and 38, normal contact 19—17—18 of relay S, wire 38^a, back contact 39—39^b of relay M, wires 40, 41 and 42, contact 22 of pneumatic relay Z, wire 43, normally open contact 27—27^a of acknowledging switch A, wires 44 and 45, winding of relay V, wire 46, back contact 47—47^b of relay M, and wires 48 and 49 to terminal C. Relay V is also provided with a reset circuit which passes from terminal B through normally closed contact 26—26^a of acknowledging switch A, normally open contact 29—29^b of reset switch R, wire 38, normal contact 19—17—18 of relay S, wire 38^a, back contact 39—39^b of relay M, wires 40, 41 and 50, normally open contact 30—30^a of reset switch R, wires 51, 44 and 45, winding of relay V, wire 46, back contact 47—47^b of relay M, and wires 48 and 49 to terminal C. Relay V is further provided with a stick circuit which passes from terminal B through normally closed contact 26—26^a of acknowledging switch A, normally closed contact 29—29^a of reset switch R, wire 32, normal contact 17—18 of relay S, wire 38^a, back contact 39—39^b of relay M, wires 40 and 52, front contact 81 of relay V, wire 45, winding of relay V, wire 46, back contact 47—47^b of relay M, and wires 48 and 49 to terminal C.

Magnet X is provided with a circuit which passes from terminal B through normally closed contact 26—26^a of acknowledging switch A, normally closed contact 29—29^a of reset switch R, wire 32, normal contact 17—18 of relay S, wire 38^a, front contact 39—39^a of relay M, wire 53, back contact 54—54^b of relay V, wire 55, normally closed contact 28—28^a of reset switch R, wire 56, normally closed contact 25—25^a of acknowledging switch A, wire 63, winding of magnet X, front contact 57 of relay U, wire 58, back contact 59—59^b of relay V, wire 60, front contact 47—47^a of relay M, and wires 48 and 49 to terminal C. Magnet X is also provided with a circuit which passes from terminal B through wire 61, front contact 54—54^a of relay V, wire 55, normally closed contact 28—28^a of reset switch R, wire 56, normally closed contact 25—25^a of acknowledging switch A, wire 63, winding of

magnet X, front contact 57 of checking relay U, wire 58, front contact 59—59^a of relay V, and wire 49 to terminal C.

The train carried apparatus also comprises two indicating devices here shown as electric lamps 64 and 65 which indicate proceed and stop, respectively, when illuminated. Lamp 64 is provided with a circuit which passes from terminal B through normally closed contact 26—26^a of acknowledging switch A, normally closed contact 29—29^a of reset switch R, wire 32, normal contact 17—18 of relay S, wire 38^a, front contact 39—39^a of relay M, wire 66, filament of lamp 64, wire 67, front contact 47—47^a of relay M, and wires 48 and 49 to terminal C. Lamp 65 is provided with a circuit which passes from terminal B through normally closed contact 26—26^a of acknowledging switch A, normally closed contact 29—29^a of reset switch R, wire 32, normal contact 17—18 of relay S, wire 38^a, back contact 39—39^b of relay M, wire 68, filament of lamp 65, wire 69, back contact 47—47^b of relay M, and wires 48 and 49 to terminal C.

The operation of the entire apparatus is as follows: As shown in the drawing, section E—F is unoccupied, and train controlling current is therefore supplied to the track rails 1 and 1^a of section D—E, so that relay M is energized. Acknowledging relay V is deenergized. Relay S is energized by virtue of the normal circuit previously traced for the secondary 16 of receiver P which circuit is closed at normal contact 17—19 of relay S. Relay U is energized by virtue of the main circuit previously traced for the primary 15 of receiver P. Since relays M, S and U are all energized and relay V is deenergized, magnet X is energized. The timing reservoir 20 is therefore charged with fluid pressure, and the relay valve Y occupies its lower position in which pipe 23 is connected with the source of fluid pressure. Contact 22 of pneumatic relay Z is closed. It follows that as long as that part of section D—E in advance of the train W, and section E—F are unoccupied, the train W may proceed through the remainder of section D—E without incurring an automatic application of the brakes.

I will now assume that the supply of train controlling current to the receiver L is cut off, due, for example, either to the presence of a train in section D—E between the train W and the exit end of the section, or to a train in section E—F which causes track relay T² to become deenergized. Under these conditions relay M becomes deenergized, thereby opening its front contacts 39—39^a and 47—47^a and closing its back contacts 39—39^b and 47—47^b. The opening of front contacts 39—39^a and 47—47^a of relay M interrupts both the circuit for the proceed lamp 64 and the circuit for magnet X, so that

the lamp 64 becomes extinguished and the magnet becomes deenergized. The closing of back contacts 39—39^b and 47—47^b of relay M completes the circuit previously traced for the stop lamp 65, and this lamp becomes lighted to indicate that traffic conditions in advance are dangerous. The deenergization of magnet X will, after the predetermined time interval, result in an automatic application of the brakes unless the engineman is alert and reverses the acknowledging switch A before the expiration of the predetermined time interval. Assuming he does this, the acknowledging circuit previously traced for acknowledging relay V will then be closed, and acknowledging relay V will therefore become energized. When relay V becomes energized, the circuit previously traced for magnet X is closed at front contacts 54—54^a and 59—59^a of this relay, and magnet X, therefore, again becomes energized, so that reservoir 20 is again connected with the source of fluid pressure. Furthermore, after relay V has become energized, and the acknowledging switch A has been returned to its normal position, the stick circuit for relay V is closed, and relay V therefore remains energized, it being understood, of course, that relay V is sufficiently slow-releasing so that it will not open its front contacts while the switch A is being restored to its normal position. It follows that when magnet X has been reenergized in this manner, it will, subsequently remain energized, and will prevent an automatic application of the brakes. The parts will then remain in these latter conditions until train controlling current is again supplied to the receiver L at which time relay M will become energized, thereby deenergizing relay V, and, hence, restoring the parts to the conditions in which they are illustrated in the drawing.

I will now assume that the engineman was not alert and did not reverse the acknowledging switch A prior to the automatic application of the brakes due to the supply of train controlling current to the receiver L being cut off. The brake application results in normally closed contact 22 of pneumatic relay Z being opened, so that relay V cannot be energized by reversing the acknowledging switch A. The engineman must therefore reverse the reset switch R, which cannot be done until the train has come to a full stop. When he does this, the reset circuit for acknowledging relay V becomes completed, and relay V therefore becomes energized so that, if the reset switch is now returned to its normal position, relay V will remain energized by virtue of its stick circuit. When relay V is energized, magnet X becomes energized, and the brakes can be released. If relay M now again becomes energized, relay V will become deenergized. Furthermore, when relay M becomes energized, lamp 65 will become ex-

tinguished and lamp 64 will become lighted. The parts will then be restored to their normal conditions in which they are illustrated in the drawing.

- 5 When the train passes out of "continuous" control territory, as is the case when the train leaves section D—E, the supply of current to the receiver L will, of course, be cut off so that relay M will become de-
 10 energized and, unless the engineman reverses the acknowledging switch A to energize relay V, an automatic application of the brakes will occur in the manner previously described. If the engineman does reverse
 15 the acknowledging switch A to energize relay V, however, then when the acknowledging switch is returned to its normal position, the stick circuit for relay V will be completed, and relay V will subsequently
 20 remain energized until relay M again becomes energized due to the train entering continuous control territory.

- I will now assume that with relay M de-
 25 energized, with relay V held in its energized condition by virtue of its stick circuit, and with the remainder of the train carried apparatus in the condition in which it is illustrated in the drawing, the train passes
 30 an inductor K having its winding 10 open circuited. Under these conditions, while the train is passing the inductor K, the reluctance of the magnetic circuit for the receiver P will be considerably reduced, and so the
 35 flux traversing the receiver coil 14 will rapidly increase as the receiver approaches the inductor and will decrease as the receiver recedes from the inductor. This will produce a complete cycle of two alternations of
 40 electromotive force in the secondary winding 16, and the voltage of one of these alternations will neutralize or reverse the current through the winding of relay S thereby causing this relay to open its normal con-
 45 tacts. When the contacts of relay S are opened, the stick circuit for relay V is opened, and relay V therefore becomes de-energized, and deenergizes magnet X. The deenergization of the magnet X will, after the predetermined time interval, result in an
 50 automatic application of the brakes in the manner previously described.

- If the train passes the inductor K when its winding 10 is short circuited, the magnetic coaction will be the same as before,
 55 except that the voltage induced in the receiver secondary 16 will be very much lower and will not be sufficient to deenergize relay S. It follows that an automatic application of the brakes will not occur.

- 60 I will now assume that after relay S has become deenergized due to the train having passed a trackway inductor K having its winding 10 open circuited, the engineman reverses the acknowledging switch A, before
 65 an automatic application of the brakes oc-

curs. When switch A is reversed an acknowledging circuit for relay S is completed which passes from terminal B through normally open contact 26—26^b of acknowledging switch A, wires 37, 38 and 36, winding of relay S, wire 37^a, secondary 16 of receiver P, the right hand portion of primary 15 of receiver P, wire 34, winding of relay U, and wire 35 to terminal C. This circuit is provided with a branch which passes from terminal B
 70 through resistor 31, wires 32 and 33, and the left hand portion of primary 15 of receiver P to the right hand portion of primary 15 of receiver P. Current flowing in this acknowledging circuit energizes relay S in the
 75 normal direction and relay S therefore closes its normal polar contact 19—17—18. When this contact is closed, the acknowledging circuit previously traced for acknowledging relay V is completed, and relay V becomes
 80 energized. The acknowledging switch may now be returned to its normal position, and relay V will subsequently remain energized by virtue of its stick circuit. As soon as relay V becomes energized, magnet X becomes en-
 85 ergized over the circuit previously traced for this magnet, thus preventing an automatic application of the brakes. When magnet X becomes energized, the parts are restored to the conditions in which they were before the receiver passed the inductor, and the train
 90 may proceed without stopping.

The function of the resistor 31 is to cause the current to divide in the two paths of the above circuit in such manner that relay S
 100 will be supplied with sufficient current to energize this relay. This would not happen if this resistor were not provided.

I will now assume that the engineman does not reverse the acknowledging switch A prior to an automatic application of the brakes due to coaction of the receiver P with an open circuited inductor K. The brake application will result in normally closed contact 22 of pneumatic relay X being opened so that acknowledging relay V cannot
 105 again be energized by operation of the acknowledging switch A. When the train has come to a full stop, the engineman will reverse the reset switch R thereby closing the following reset circuit; from terminal B
 110 through normally closed contact 26—26^a of acknowledging switch A, normally open contact 29—29^b of reset switch R, wires 38 and 36, winding of relay S, wire 37^a, secondary 16 of receiver P, the right hand portion of the primary 15 of receiver P, wire 34, wind-
 115 ing of relay U, and wire 35 to terminal C. This circuit is provided with a branch which passes from terminal B through resistor 31, wires 32 and 33, and the left hand portion of primary winding 15 of receiver P to the right hand portion of this winding. The current
 120 in this last-traced reset circuit will energize relay S in the normal direction, so that this
 125
 130

relay will close its normal contact. With the normal contact 19—17—18 of relay S closed and the reset switch R in its reverse position, the reset circuit previously traced for acknowledging relay V is completed at the normally open contacts 29—29^b and 30—30^a of reset switch R, and relay V therefore becomes energized. When relay V becomes energized, and reset switch R is returned to its normal position, the circuit previously traced for magnet X is then completed, and magnet X becomes energized, so that the brakes can be released. As soon as the brakes have been released, normally closed contact 22 of pneumatic relay Z becomes closed, and the parts are then restored to the conditions which they were in before the automatic application of the brakes occurred.

It will be noted that when the acknowledging switch A is reversed, both circuits for the magnet X are opened, so that, if this switch is reversed and left in the reverse position for more than a given interval of time, an automatic application of the brakes will occur. The same thing is true of the reset switch R. It follows that neither one of these switches can be tied or otherwise held in the reverse position to defeat the object of the system.

The function of the checking relay U is to open the circuit for magnet X in case a broken wire occurs in the circuit for the primary winding 15 of receiver P, thereby insuring that the dangerous condition which might exist if the receiver passed an open circuited inductor K under these conditions will be prevented.

Referring now to Fig. 2, the apparatus here shown is similar to that shown in Fig. 1 with the exception that the checking relay U has been eliminated and certain of the circuits have been rearranged as follows: As here shown, the acknowledging circuit for acknowledging relay V passes from terminal B through wire 70, normal contact 17—18 of relays S, wire 38^b, back contact 39—39^b of relay M, wires 40, 41 and 42, contact 22 of pneumatic relay Z, wire 43, normally open contact 27—27^a of acknowledging switch A, wires 44 and 45, winding of relay V, wire 46, back contact 47—47^b of relay M, and wires 48 and 49 to terminal C. The reset circuit for acknowledging relay V passes from terminal B through wire 70, normal contact 17—18 of relay S, wire 38^b, back contact 39—39^b of relay M, wires 40, 41 and 50, normally open contact 30—30^a of reset switch R, wires 51, 44 and 45, winding of relay V, wire 46, back contact 47—47^b of relay M, and wires 48 and 49 to terminal C. The stick circuit for relay V passes from terminal B through wire 70, normal contact 17—18 of relay S, wire 38^b, back contact 39—39^b of relay M, wire 40, front contact 81 of relay V, wire 45, winding of re-

lay V, wire 46, back contact 47—47^b of relay M, and wires 48 and 49 to terminal C. The circuit for the proceed lamp 64 passes from terminal B through wire 70, normal contact 17—18 of relay S and thence as previously traced to terminal C. The circuit for the stop lamp 65 passes from terminal B through wire 70, normal contact 17—18 of relay S and thence as previously traced to terminal C. The main circuit for the primary winding 15 of receiver P passes from terminal B through resistor 71, wires 72 and 73, ballast lamp 74, wire 75, and primary winding 15 to terminal C. The circuit for the secondary winding 16 of receiver P passes from terminal B through wire 70, normal contact 17—19 of relay S, wire 76, secondary winding 16 of receiver P, wires 77 and 78, winding of relay S, wires 79 and 73, ballast lamp 74, wire 75, and primary winding 15 to terminal P:

The operation of the apparatus here shown when the train is in continuous control territory, as illustrated by section D—E, is substantially the same as that previously described in connection with Fig. 1, and will be readily understood from an inspection of the drawing without describing it in detail. When the train passes out of continuous control territory, however, as is the case when the train leaves section D—E, the supply of current to the relay M is of course cut off as previously described, and, in order that the train may proceed, the engineman must operate acknowledging switch A to complete the acknowledging circuit for acknowledging relay V. Relay V therefore picks up, and closes its stick circuit at its front contact 81, so that while the train is in intermittent control territory this relay is normally held in its energized condition. When relay M is deenergized, the circuit previously traced for the proceed lamp 64 is interrupted at front contacts 39—39^a and 47—47^a of relay M and the circuit for the stop lamp 65 is completed at back contacts 39—39^b and 47—47^b of relay M. The proceed lamp 64 is therefore extinguished and the stop lamp 65 is lighted.

I will now assume that with relays S and V energized and with relay M deenergized, the train passes an inductor K having its winding 10 open circuited. Under these conditions, while the train is passing the inductor K, a complete cycle of two alternations of electromotive force will be induced in the secondary winding 15 of receiver P in the manner described in connection with Fig. 1, and the current due to one of these alternations will neutralize or reverse the current through the winding of relay S, thereby causing this relay to open its contacts. When contact 17—18 of relay S is opened, the circuit for secondary winding 16 of receiver P is interrupted and, since relay S is included in this circuit, relay S therefore remains deenergized. Furthermore, the opening of con-

tact 17—18 of relay S interrupts the stick circuit for acknowledging relay V, and relay V also becomes deenergized. When relay V is deenergized under these conditions, the circuit for magnet X is interrupted at front contacts 54—54^a and 59—59^a of relay V so that magnet X likewise becomes deenergized. The deenergization of magnet X will, after the predetermined time interval, result in an automatic application of the brakes in the manner previously described. If the train passes the inductor K when its winding 10 is short-circuited, the magnetic coaction will be the same as before, except that the voltages induced in the receiver secondary 16 will be very much lower and will not be sufficient to deenergize relay S. It follows that an automatic application of the brakes will not occur.

I will now assume that when the relay S has become deenergized due to the receiver P passing an open circuited inductor K, the engineman reverses the acknowledging switch A before magnet X has been deenergized for a sufficient interval of time to cause an automatic application of the brakes. Under these conditions, an acknowledging circuit is completed for relay S at normally open contact 26—26^b of acknowledging switch A, which circuit passes from terminal B through normally open contact 26—26^b of acknowledging switch A, wires 37, 80 and 78, winding of relay S, wires 79 and 73, ballast lamp 74, wire 75, and primary winding 15 to terminal C. Relay S therefore becomes energized and closes its normal contacts. As soon as contact 17—18 of relay S becomes closed, the acknowledging circuit previously traced for acknowledging relay V is completed at normally open contact 27—27^a of acknowledging switch A, and acknowledging relay V therefore becomes energized and closes its stick circuit. If, now, the acknowledging switch A is returned to its normal position, the circuit previously traced for magnet X will become closed, and magnet X will therefore become energized, thus preventing an automatic application of the brakes. When magnet X becomes energized, the parts are restored to the conditions in which they were before the train passed the open circuited inductor K and the train may therefore proceed.

I will now assume that the engineman does not reverse the acknowledging switch A prior to the automatic application of the brakes due to coaction of the receiver P with an open circuited inductor K. Under these conditions, the operation of the acknowledging switch A will energize relay S in the manner previously described but due to the application of the brakes, contact 22 of pneumatic relay Z will now be open, and acknowledging relay V will therefore remain deenergized when the acknowledging switch is returned

to its normal position. It will be apparent therefore, that operation of the acknowledging switch A under these conditions will not permit the brakes to be released. As a result, when an automatic application of the brakes has been incurred the engineman will not operate the acknowledging switch A but will operate the reset switch R. When he does this, a reset circuit will be completed for relay S which is exactly the same as the pick-up circuit which was completed at contact 26—26^b of acknowledging switch A when this switch was reversed, except that this circuit includes normally closed contact 26—26^a of acknowledging switch A and normally open contact 29—29^b of reset switch R instead of contact 26—26^b of acknowledging switch A. Relay S therefore picks up, and closes its normal contacts. As soon as normal contact 17—18 of relay S becomes closed, the acknowledging circuit for relay V is completed, and relay V becomes energized and closes its stick circuit. As a result, when the reset switch R is restored to its normal position, magnet X will again become energized, and the brakes can be released. When the brakes have been released, contact 22 of pneumatic relay Z will become closed, and the parts will then be restored to the conditions in which they are illustrated in the drawing.

The function of the resistor 71 is to adjust the magnitude of the current supplied to the primary winding P to a valve which gives the desired flux density in the core 14 of receiver P. The function of the ballast lamp 74 is to maintain a constant current in the primary and secondary windings of receiver P in case the voltage of the source fluctuates.

Although I have herein shown and described only two forms of railway traffic controlling 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. Railway traffic controlling apparatus comprising a first train carried relay controlled by devices located at intervals along the trackway, a second train carried relay controlled by currents supplied to the track rails, a manually operable switch on the train, an acknowledging relay on the train controlled by said switch and by said first and second relays, and a single brake controlling magnet on the train controlled by said acknowledging relay and by said switch.

2. Railway traffic controlling apparatus comprising a first train carried relay, means controlled by currents supplied to the track rails for at times energizing said first relay, a second normally energized train carried re-

lay, means controlled by devices located at intervals along the trackway for at times deenergizing said second relay, a normally energized brake controlling magnet on the train effective to apply the brakes after said magnet has been deenergized for a given interval of time, means for deenergizing said magnet when either of said relays becomes deenergized, manually operable means on the train effective for reenergizing said magnet if and only if such means is operated prior to the expiration of said given interval of time, and other manually operable means for at other times reenergizing said magnet.

deenergized, a normally closed contact on the train, means for opening said contact upon an automatic application of the brakes, manually operable means on the train controlled in part by said contact for at times reenergizing said magnet, and other manually operable means for at other times reenergizing said magnet.

3. Railway traffic controlling apparatus comprising a first train carried relay which is controlled by currents supplied to the track rails and a second train carried relay which is controlled by devices located at intervals along the trackway, a brake controlling magnet on the train effective to apply the brakes after the magnet has been deenergized for a given interval of time, a normally closed contact on the train, means for opening said contact upon an automatic application of the brakes, a manually operable switch on the train, an acknowledging relay on the train controlled by said normally closed contact and by said manually operable switch as well as by said first and second relays, and a circuit for said brake magnet controlled by said manually operable switch and by said acknowledging relay.

4. Railway traffic controlling apparatus comprising a first train carried relay, means controlled by currents supplied to the track rails for at times energizing said first relay, a second normally energized train carried relay, means controlled by devices located at intervals along the trackway for at times deenergizing said second relay, a normally energized brake controlling magnet on the train effective to apply the brakes after said magnet has been deenergized for a given interval of time, means for deenergizing said magnet when either of said relays becomes deenergized, a normally closed contact on the train, means for opening said contact upon an automatic application of the brakes, and manually operable means on the train controlled in part by said contact for at times reenergizing said magnet.

5. Railway traffic controlling apparatus comprising a first train carried relay, means controlled by currents supplied to the track rails for at times energizing said first relay, a second normally energized train carried relay, means controlled by devices located at intervals along the trackway for at times deenergizing said second relay, a normally energized brake controlling magnet on the train effective to apply the brakes after said magnet has been deenergized for a given interval of time, means for deenergizing said magnet when either of said relays becomes

6. Railway traffic controlling apparatus comprising a first train carried relay, means controlled by currents supplied to the track rails for at times energizing said first relay, a second normally energized train carried relay, means controlled by devices located at intervals along the trackway for at times deenergizing said second relay, a brake controlling magnet on the train effective to apply the brakes after the magnet has been deenergized for a given interval of time, means for deenergizing said magnet when either said first or said second relay becomes deenergized, a normally closed contact on the train, means for opening said contact upon an automatic application of the brakes, an acknowledging switch on the train, a reset switch on the train, an acknowledging relay on the train, means controlled by said acknowledging switch and said normally closed contact for at times energizing said acknowledging relay when said second relay is energized and said first relay is deenergized, means controlled by said reset switch for at other times energizing said acknowledging relay when said second relay is energized and said first relay is deenergized, and a circuit for said brake magnet controlled by said acknowledging switch and said reset switch as well as by said first and second relays and said acknowledging relay.

7. Railway traffic controlling apparatus comprising a first train carried relay, means controlled by currents supplied to the track rails for at times energizing said first relay, a second normally energized train carried relay, means controlled by devices located at intervals along the trackway for at times deenergizing said second relay, a brake controlling magnet on the train effective to apply the brakes after the magnet has been deenergized for a given interval of time, a normally closed contact on the train, means for opening said contact upon an automatic application of the brakes, an acknowledging switch on the train, a reset switch on the train, an acknowledging relay on the train, means controlled by said acknowledging switch and said normally closed contact for at times energizing said acknowledging relay when said second relay is energized and said first relay is deenergized, means controlled by said reset switch for at other times energizing said acknowledging relay when said second relay is energized and said first relay is deenergized, and a circuit for said brake magnet controlled by said ac-

knowledging switch and said reset switch as well as by all of said relays.

8. Railway traffic controlling apparatus comprising a first train carried relay which is controlled by currents supplied to the track rails and a second train carried relay which is controlled by devices located at intervals along the trackway, a brake controlling magnet on the train effective to apply the brakes after the magnet has been deenergized for a given interval of time, a normally closed contact on the train, means for opening said contact upon an automatic application of the brakes, an acknowledging relay on the train controlled by said normally closed contact and said acknowledging switch as well as by said first and second relays, and a circuit for said brake magnet controlled by said acknowledging relay and said acknowledging switch.

9. Railway traffic controlling apparatus comprising a first train carried relay which is controlled by current supplied to the track rails and a second train carried relay which is controlled by devices located at intervals along the trackway, a brake controlling magnet on the train effective to apply the brakes after the magnet has been deenergized for a given interval of time, a normally closed contact on the train, means for opening said contact upon an automatic application of the brakes, an acknowledging switch on the train, an acknowledging relay on the train controlled by said normally closed contact and said acknowledging switch as well as by said first and second relays, a circuit for said brake magnet controlled by said acknowledging switch and said acknowledging relay as well as by said first relay, and indication means on the train controlled by both of said first and second relays.

10. Railway traffic controlling apparatus comprising a first polarized train carried relay controlled by devices located at intervals along the trackway, a second train carried relay controlled by currents supplied to the track rails, an acknowledging relay on the train, an acknowledging switch on the train having normally closed and normally open contacts, a brake controlling magnet on the train effective to apply the brakes after the magnet has been deenergized for a given interval of time; a first circuit for said brake magnet including a normally closed contact of said acknowledging switch, a back contact of said acknowledging relay, a normal contact of said first relay, and a front contact of said second relay; a second circuit for said brake magnet including said normally closed contact of said acknowledging switch, and a front contact of said acknowledging relay; a pick-up circuit for said acknowledging relay including a normally open contact of said acknowledging switch, a normal contact of said first relay, and a back contact of said second relay.

and relay; and a stick circuit for said acknowledging relay including a normally closed contact of said acknowledging switch, a normal contact of said first relay, a back contact of said second relay, and a front contact of said acknowledging relay.

11. Railway traffic controlling apparatus comprising a first polarized train carried relay controlled by devices located at intervals along the trackway, a second train carried relay controlled by currents supplied to the track rails, a train carried acknowledging relay, an acknowledging switch on the train having normally closed and normally open contacts, a brake controlling magnet on the train effective to apply the brakes after the magnet has been deenergized for a given interval of time; a first circuit for said brake magnet including a normally closed contact of said acknowledging switch, a back contact of said acknowledging relay, a normal contact of said first relay, and a front contact of said second relay; a second circuit for said brake magnet including said normally closed contact of said acknowledging switch, and a front contact of said acknowledging relay, a pick-up circuit for said acknowledging relay including a normally open contact of said acknowledging switch, a contact which becomes opened upon an automatic application of the brakes, a normal contact of said first relay, and a back contact of said second relay; and a stick circuit for said acknowledging relay including a normally closed contact of said acknowledging switch, a normal contact of said first relay, a back contact of said second relay, and a front contact of said acknowledging relay.

12. Railway traffic controlling apparatus comprising a first polarized train carried relay controlled by devices located at intervals along the trackway, a second train carried relay controlled by currents supplied to the track rails, a train carried acknowledging relay, an acknowledging switch on the train having normally closed and normally open contacts, a brake controlling magnet on the train effective to apply the brakes after the magnet has been deenergized for a given interval of time; a first circuit for said brake magnet including a normally closed contact of said acknowledging switch, a normal contact of said first relay, a front contact of said second relay, and a back contact of said acknowledging relay; a second circuit for said brake magnet including a front contact of said acknowledging relay and a normally closed contact of said acknowledging switch; a pick-up circuit for said acknowledging relay including a normally open contact of said acknowledging switch, a normal contact of said first relay, and a back contact of said second relay; a stick circuit for said acknowledging relay including a normally closed contact of said acknowledging switch, a normal

contact of said first relay, a back contact of said second relay, and a front contact of said acknowledging relay, a first and a second lamp on the train, a circuit for said first lamp including a normal contact of said first relay and a back contact of said second relay, and a circuit for said second lamp including a normal contact of said first relay and a front contact of said second relay.

13. Train carried traffic governing apparatus comprising a first train carried receiver core arranged for magnetic coaction with a trackway inductor and provided with a primary and a secondary winding, a first polarized relay, an acknowledging switch having normally closed and normally open contacts, and a source of current; a main circuit for said primary winding extending from one terminal of said source through a normally closed contact of said acknowledging switch, and said primary winding to the other terminal of said source; a circuit for said secondary winding extending from one terminal of said source through a normally closed acknowledging switch contact, a normal contact of said first relay, the winding of said first relay, said secondary winding, and a portion of said primary winding to the other terminal of said source; an acknowledging circuit for said first relay extending from one terminal of the source through a normally open contact of said acknowledging switch, the winding of said first relay, said secondary winding, and said portion of said primary winding to the other terminal of said source, said acknowledging circuit being provided with a branch which passes from the one terminal of said source through a resistance and the remainder of said primary to said portion of said primary; a second relay controlled by currents supplied to the track rails, an acknowledging relay, a brake controlling magnet effective to apply the brakes after the magnet has been deenergized for a given interval of time, a normally closed contact which becomes opened upon an automatic application of the brakes, an acknowledging circuit for said acknowledging relay extending from one terminal of said source through a normally open contact of said acknowledging switch, a normal contact of said first relay, a back contact of said second relay, the winding of said acknowledging relay, and said normally closed contact which becomes opened upon an automatic application of the brakes to the other terminal of said source, a stick circuit for said acknowledging relay extending from one terminal of said source through a normally closed contact of said acknowledging switch, a normal contact of said first relay, a back contact of said second relay, and a front contact of said acknowledging relay to the other terminal of said source; a first circuit for said brake magnet extending from one terminal of said source through

a normally closed contact of said acknowledging switch, a normal contact of said first relay, a front contact of said second relay, a back contact of said acknowledging relay, and the winding of said magnet to the other terminal of said source; and a second circuit for said magnet extending from one terminal of said source through a front contact of said acknowledging relay, and the winding of said magnet to the other terminal of said source.

14. Train carried traffic governing apparatus comprising a receiver core arranged for magnetic coaction with a trackway inductor and provided with a primary and a secondary winding, a polarized relay provided with normal contacts, an acknowledging and a reset switch each provided with normally open and normally closed contacts, and a source of current; a main circuit for said primary winding extending from said source through a normally closed contact of said acknowledging switch, a normally closed contact of said reset switch, and said primary winding to the other terminal of said source; a normal circuit for said secondary winding extending from one terminal of said source through a normally closed contact of said acknowledging switch, a normally closed contact of said reset switch, a normal contact of said polarized relay, the winding of said polarized relay, said secondary winding, and a first portion of said primary winding to the other terminal of said source; an acknowledging circuit for said polarized relay extending from one terminal of said source through a normally open contact of said acknowledging switch, the winding of said polarized relay, said secondary winding, and said first portion of said primary winding to the other terminal of said source; said acknowledging circuit being provided with a branch which passes from said one terminal of said source through a resistance element, and the remaining portion of the primary winding to said first portion of said primary winding; a reset circuit for said polarized relay extending from one terminal of said source through a normally closed contact of said acknowledging switch, a normally open contact of said reset switch, the winding of said polarized relay, said secondary winding, and said first portion of said primary winding to the other terminal of said source; said reset circuit being provided with a branch which passes from the said one terminal of said source through said resistance element, and said remaining portion of said primary winding to said first portion of said primary winding; a brake controlling magnet effective to apply the brakes after the magnet has been deenergized for a given interval of time, a pneumatic relay arranged to be operated upon an automatic application of the brakes and provided with a normally closed contact which becomes opened upon an automatic application of the brakes, a second relay

controlled by currents supplied to the track rails, an acknowledging relay; an acknowledging circuit for said acknowledging relay extending from one terminal of the source through a normally open contact of said acknowledging switch, a normal contact of said polarized relay, a back contact of said second relay, the normally closed contact of said pneumatic relay, and the winding of said acknowledging relay to the other terminal of said source; a reset circuit for said acknowledging relay extending from said one terminal of said source through a normally closed contact of said acknowledging switch, a normally open contact of said reset switch, a normal contact of said polarized relay, a back contact of said second relay, and the winding of said acknowledging relay to the other terminal of said source; a stick circuit for said acknowledging relay extending from one terminal of said source through a normally closed contact of said acknowledging switch, a normally closed contact of said reset switch, a normal contact of said polarized relay, a back contact of said second relay, a front contact of said acknowledging relay, and the winding of said acknowledging relay to the other terminal of said source; a first circuit for said brake controlling magnet extending from one terminal of said source, through a normally closed contact of said acknowledging switch, a normally closed contact of said reset switch, a normal contact of said polarized relay, a front contact of said second relay, a back contact of said acknowledging relay, and the winding of said magnet to the other terminal of said source; a second circuit for said brake magnet extending from said one terminal of said source through a front contact of said acknowledging relay, a normally closed contact of said acknowledging switch, a normally closed contact of said reset switch, and the winding of said brake magnet to the other terminal of said source; two electric lamps; a circuit for one of said lamps extending from one terminal of said source through a normally closed contact of said acknowledging switch, a normally closed contact of said reset switch, a normal contact of said polarized relay, a front contact of said second relay, and the filament of said one lamp to the other terminal of said source; and a circuit for the other of said lamps extending from one terminal of said source through a normally closed contact of said acknowledging switch, a normally closed contact of said reset switch, a normal contact of said polarized relay, a back contact of said second relay, and the filament of said second lamp to the other terminal of said source.

15. Train carried traffic governing apparatus comprising a receiver core arranged for magnetic coaction with a trackway inductor and provided with a primary and a secondary winding, a polarized relay provided with normal contacts, an acknowledging and a reset switch each provided with normally open and normally closed contacts, and a source of current; a main circuit for said primary winding extending from one terminal of said source through a resistance element, a ballast lamp, and said primary winding to the other terminal of said source; a circuit for said secondary winding extending from one terminal of said source through a normal contact of said polarized relay, said secondary winding, the winding of said polarized relay, said ballast lamp, and said primary winding to the other terminal of said source; an acknowledging circuit for said polarized relay extending from one terminal of said source through a normally open contact of said acknowledging switch, the winding of said polarized relay, said ballast lamp; and said primary winding to the other terminal of said source; a reset circuit from said polarized relay extending from one terminal of said source through a first normally open contact of said reset switch, the winding of said polarized relay, said ballast lamp; and said primary winding to the other terminal of said source; a brake controlling magnet effective to apply the brakes after the magnet has been deenergized for a given interval of time, a pneumatic relay arranged to be operated upon an automatic application of the brakes and provided with a normally closed contact which becomes opened upon an automatic application of the brakes, a second relay controlled by currents supplied to the track rails, an acknowledging relay; an acknowledging circuit for said acknowledging relay extending from one terminal of the source through a normal contact of said polarized relay, a back contact of said second relay, the normally closed contact of said pneumatic relay, a normally open contact of said acknowledging switch, and the winding of said acknowledging relay to the other terminal of said source; a reset circuit for said acknowledging relay extending from said one terminal of said source through a normally open contact of said reset switch, a normal contact of said polarized relay, a back contact of said second relay, and the winding of said acknowledging relay to the other terminal of said source; a stick circuit for said acknowledging relay extending from one terminal of said source through a normal contact of said polarized relay, a back contact of said second relay, a front contact of said acknowledging relay, and the winding of said acknowledging relay; a first circuit for said brake controlling magnet extending from one terminal of said source through a normal contact of said polarized relay, a front contact of said second relay, a back contact of said acknowledging relay, a normally closed contact of said reset switch, a normal contact of said polarized relay, a back contact of said second relay, and the filament of said one lamp to the other terminal of said source; and a circuit for the other of said lamps extending from one terminal of said source through a normally closed contact of said acknowledging switch, a normally closed contact of said reset switch, a normal contact of said polarized relay, a back contact of said second relay, and the filament of said second lamp to the other terminal of said source.

15. Train carried traffic governing apparatus comprising a receiver core arranged for magnetic coaction with a trackway inductor and provided with a primary and a secondary winding, a polarized relay provided with

ing switch, and the winding of said magnet to the other terminal of said source; a second circuit for said brake magnet extending from said one terminal of said source through
5 a front contact of said acknowledging relay, a normally closed contact of said reset switch, a normally closed contact of said acknowledging switch, and the winding of said brake magnet to the other terminal of said source;
10 two electric lamps, a circuit for one of said lamps extending from one terminal of said source through a normal contact of said polarized relay, a front contact of said second relay, and the filament of said one lamp
15 to the other terminal of said source; and a circuit for the other of said lamps extending from one terminal of said source through a normal contact of said polarized relay, a back contact of said second relay, and the
20 filament of said second lamp to the other terminal of said source.

In testimony whereof I affix my signature.

ROY E. BAKER.

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