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RAILWAY TRAFFIC CONTROLLING APPARATUS

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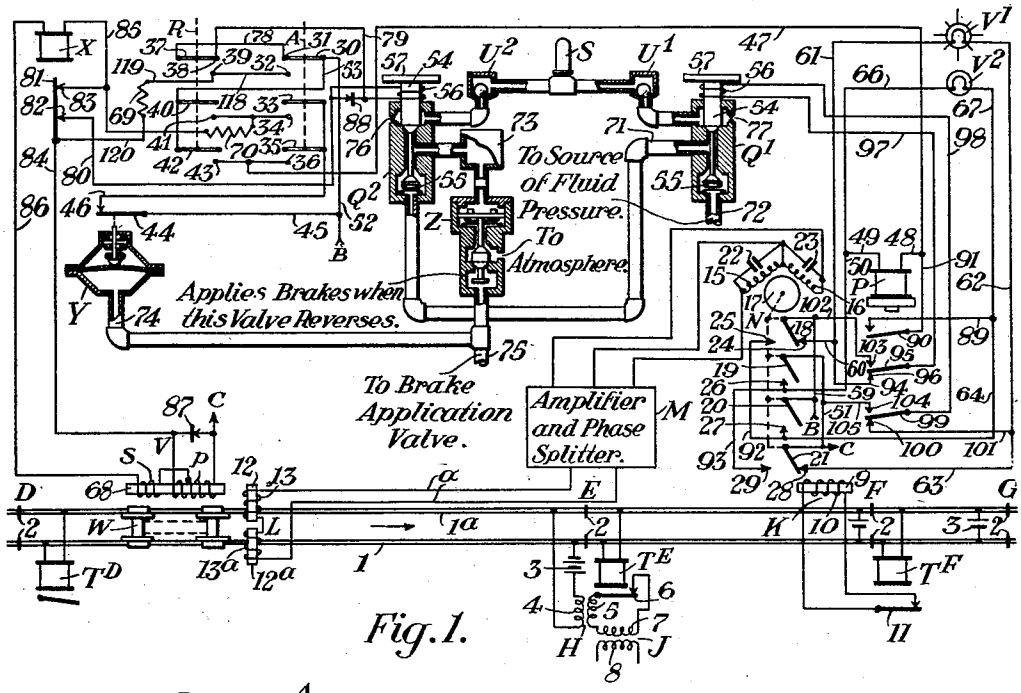


Fig. 1.

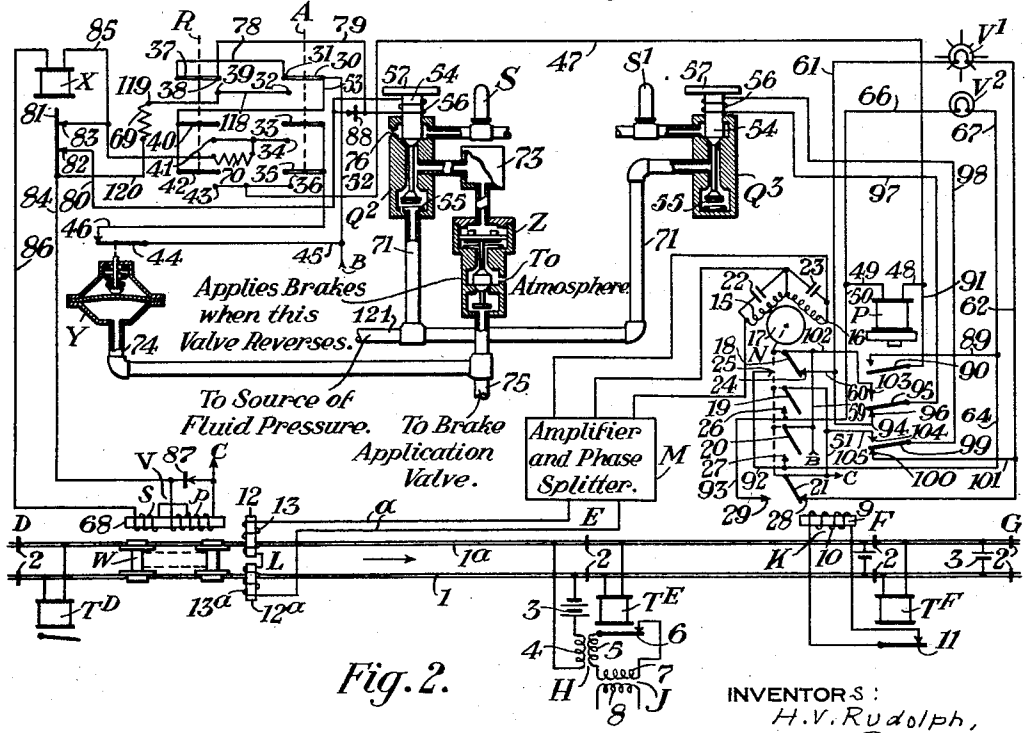


Fig. 2.

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RAILWAY TRAFFIC CONTROLLING APPARATUS

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

One object of our invention is to provide train-carried apparatus which may be used in an intermittent inductive train control system or with a continuous inductive train control system in such manner that the same brake applying apparatus may be utilized for both systems.

Another object of our invention is to provide train-carried apparatus in which the same acknowledging and resetting devices may be used for both systems.

Other objects of our invention will appear as the description proceeds.

We will describe two forms of railway traffic controlling apparatus embodying our invention, and will then point out the novel features thereof in claims.

In the accompanying drawings, Fig. 1 is a view, partly diagrammatic and partly cross-sectioned, illustrating one form of railway traffic controlling apparatus embodying our invention. Fig. 2 is a similar view showing a modified form of the apparatus illustrated in Fig. 1, and also embodying our 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 having 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 this winding will be short-circuited when section F—G is unoccupied and open-circuited 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 thus induced in the receiving circuit *a* are utilized to control the supply of current to the two stator windings 15 and 16 of an induction motor relay N, suitable amplifying and phase splitting apparatus M

being interposed between the receiving circuit and the relay windings. The amplifying and phase splitting apparatus M may have any suitable form and may, for example, be similar to that shown and described in Letters Patent of the United States, No. 1,566,331, granted on Dec. 22nd, 1925, to L. V. Lewis, for Railway traffic controlling apparatus. A condenser 22 is connected across the winding 15 of relay N in the usual manner to tune the circuit including this winding to resonance at the frequency of the train controlling current supplied to the rails, and a condenser 23 is likewise connected across the winding 16 for a similar purpose.

Relay N also comprises a rotor 17, which controls four contact fingers 18, 19, 20 and 21, these fingers being normally biased to occupy vertical or neutral positions when the relay is deenergized. The amplifier and phase splitter M is so constructed, and the parts are so arranged that, under normal conditions, when current is being supplied to the receiving circuit *a* by the receiver L, the windings 15 and 16 will be supplied with currents of such a magnitude and instantaneous polarity that the contact fingers 18, 19, 20 and 21 will be swung toward the right, thereby closing the normal contacts of the relay.

The train-carried apparatus further includes an acknowledging switch A and a reset switch R which, together with the relay N, control an acknowledging relay P having slow release characteristics. As here shown, the acknowledging switch A comprises a normally closed contact 30—31, and three normally open contacts 30—32, 33—34 and 35—36. Similarly, the reset switch R comprises a normally closed contact 37—38, and three normally open contacts 37—39, 40—41 and 42—43. The reset switch R will usually be located in such a position on the train that it is inaccessible to the engineman while the train is in motion.

Relay P is provided with an acknowledging circuit which passes from terminal B of a suitable source of current not shown in the drawings through wire 45, normally closed contact 44 of a pneumatic relay Y, wire 46, normally open contact 35—36 of reset switch A, wires 47 and 48, winding of relay P, wires 49 and 50, neutral contact 19—26 of relay N, and wire 51 to the other terminal C of the source. Relay P is also provided with a reset circuit which passes from terminal B through wires 52 and 53, normally open contact 42—43 of reset switch R, wires 47 and 48, winding of relay P, wires 49 and 50, neutral contact 19—26 of relay N, and wire 51 to terminal C. Relay P is further provided with a stick circuit which passes from terminal B through neutral contact 20—27 of relay N, wires 64 and 89, front contact 90 of relay P, wires 91 and 48, winding of relay P, wires 49 and 50, neutral contact 19—26 of relay N, and wire 51 to terminal C.

The relay N and the relay P jointly control a brake controlling magnet valve Q^1 comprising a valve stem 54 biased to an upper position by a spring 55, and provided with a winding 56 and an armature 57. The magnet valve Q^1 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 valve Q^1. The magnet valve Q^1 also controls an indicating device here shown as a whistle S, a check valve U^1 being interposed between the whistle and the valve for reasons which will be made clear as the description proceeds.

Magnet valve Q^1 is provided with a circuit, which is closed when relay N is energized in the normal direction and relay P is deenergized, and which passes from terminal B through wire 59, normal contact 18—24 of relay N, wires 60 and 94, back contact 95—96 of relay P, wire 97, winding 56 of magnet valve Q^1, wire 98, back contact 99—100 of relay P, wires 101 and 63, and normal contact 21—28 of relay N to terminal C. Magnet valve Q^1 is also provided with a circuit which is closed when relay P is energized, and which passes from terminal B through wires 59 and 102, front contact 95—103 of relay P, wire 97, winding 56 of magnet valve Q^1, wire 98, front contact 99—104 of relay P, and wires 105 and 51 back to terminal C.

The relay N in addition to controlling the magnet valve Q^1 and the relay P, also controls two indicating devices here shown as electric lamps V^1 and V^2 which, when illuminated, indicate proceed and stop, respectively. Lamp V^1 is provided with a circuit which passes from terminal B through wire 59, normal contact 18—24 of relay N, wires 60 and 61, the filament of lamp V^1, wires 62 and 63, and normal contact 21—28 of relay N back to terminal C. Lamp V^2 is provided with a circuit which passes from terminal B through neutral contact 20—27 of relay N, wires 64 and 67, the filament of lamp V^2, wires 66 and 50, neutral contact 19—26 of relay N, and wire 51 back to battery C. Lamp V^2 is also provided with a circuit which passes from terminal B through wire 59, reverse contact 18—25 of relay N, wires 92, 64 and 67, the filament of lamp V^2, wires 66, 50 and 93, and contact 21—29 of relay N, back to battery C.

The train-carried apparatus thus far described corresponds to that commonly employed in train control systems of the continuous inductive type. In addition, the train-carried apparatus includes a second receiver V of the usual form commonly employed in train control systems of the intermittent inductive type, and comprising a magnetizable

core 68 provided with a primary winding p and a secondary s. The receiver V is so located as to register with the trackway inductor K previously described in the usual and well known manner.

The train-carried apparatus further includes a relay X of the usual type commonly employed in intermittent inductive train control systems, and a second brake controlling magnet valve Q^2 which is exactly like the valve Q^1, and which is also arranged to initiate an automatic application of the brakes at the expiration of a given interval of time following the deenergization of this latter magnet valve.

As shown in Fig. 1, when magnet valve Q^2 is energized, it connects a timing reservoir 73 with a pipe 71 which, in turn, is connected with a pipe 72 through the valve Q^1 when valve Q^1 is energized. The pipe 72 is constantly connected with a suitable source of fluid pressure not shown in the drawing. The reservoir 73 is connected with a relay valve Z, so that when this reservoir is charged, the valve is depressed, and a pipe 75, which is connected to apparatus (not shown) for causing an automatic application of the brakes when this pipe is opened to atmosphere, is then disconnected from atmosphere. Pipe 75 is also connected with the pneumatic relay Y referred to hereinbefore by means of a pipe 74, and when the pipe 75 is disconnected from atmosphere, contact 44 is closed as shown in the drawing. If magnet valve Q^2 becomes deenergized when magnet valve Q^1 is energized, timing reservoir 73 will be opened to atmosphere through a restricted orifice 76 in valve Q^2, and also through a check valve U^2 and the whistle S, which under these conditions gives an audible indication to the engineman that the timing reservoir is being exhausted. It will be noted that when the whistle S is connected with the reservoir 73 in this manner, the check valve U^1 prevents the escape of fluid through the restricted orifice 77 in valve Q^1. After an interval of time, such as six seconds, valve Z will reverse, thereby venting pipe 75 to atmosphere, and this will cause an automatic application of the brakes, and will also cause contact 44 of pneumatic relay Y to open. If valve Q^1 becomes deenergized when valve Q^2 is energized, reservoir 73 will then be connected with atmosphere through valve Q^2, pipe 71, valve Q^1, and restricted orifice 77, as well as through valve Q^2, pipe 71, valve Q^1, check valve U^1 and whistle S. Under these conditions, after an interval of say six seconds, valve Z will again reverse to cause an automatic application of the brakes, and the opening of contact 44. It will be noted that when whistle S is connected with reservoir 73 through valve Q^1, the check valve U^2 prevents the escape of fluid through the restricted orifice 76 of valve Q^2.

The train-carried apparatus also includes a resistor 69, the resistance value of which is substantially the same as that of the winding of the valve magnet Q^2. Another resistance element 70 is provided for a purpose which will appear hereinafter.

The main circuit for the primary winding p of the receiver V passes from terminal B through wire 52, normally closed contact 30—31 of the acknowledging switch A, wire 78, normally closed contact 37—38 of the reset switch R, wire 79, winding 56 of magnet valve Q^2, wire 80, normal contact 81—82 of relay X, wire 84, and primary winding p to terminal C. The normal circuit for the secondary winding s is from terminal B through wire 52, normally closed contact 30—31 of acknowledging switch A, wire 78, normally closed contact 37—38 of reset switch R, wire 79, winding 56 of magnet valve Q^2, wire 80, normal contact 82—81—82 of relay X, wire 85, winding of relay X, wire 86, secondary winding s to an intermediate point in the primary winding p, and then through the right hand portion of this winding to terminal C. A spark arresting device 87, here shown as a rectifier, is connected across primary winding p, and a similar device 88 is connected across the winding 56 of magnet valve Q^2.

The operation of the entire apparatus is as follows: As shown in the drawings, 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 N is energized in its normal direction. The circuit for lamp V^1 is therefore closed, and this lamp is lighted, thus giving a visible indication to the engineman that traffic conditions in advance are safe. Acknowledging relay P is deenergized, and the circuit previously traced for magnet valve Q^1 is therefore closed at back contacts 95—96 and 99—100 of relay P, and at normal contacts 18—24 and 21—28 of relay N. Magnet valve Q^1 is therefore energized, so that pipe 71 is connected with the source of fluid pressure. Relay X is energized by virtue of the normal circuit previously traced for the secondary s of receiver V which is closed at contact 82—81—83 of relay X, and since magnet valve Q^2 is included in this circuit, this magnet valve is likewise energized. The timing reservoir 73 is therefore charged with fluid pressure, and the relay valve Z occupies its lower position in which pipe 75 is blanked. Contact 44 of pneumatic relay Y is closed. It follows that as long as 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.

We will now assume that the supply of train controlling current to the receiver L is cut off due, for example, either to the pres-

ence of a train in section D—E in advance of the train W, or to a train in section E—F which causes track relay T^E to become deenergized. Under these conditions, relay N becomes deenergized, thereby opening its normal contacts 18—24 and 21—28, and closing its neutral contacts 19—26 and 20—27. The opening of normal contacts 18—24 and 21—28 of relay N interrupts both the circuit for lamp V^1 and the circuit for magnet valve Q^1. The lamp V^1 therefore becomes extinguished, and the valve Q^1 becomes deenergized. The closing of neutral contacts 19—26 and 20—27 of relay N completes the circuit previously traced for the lamp V^2, and this lamp becomes lighted to indicate that traffic conditions in advance are dangerous. The deenergization of magnet valve Q^1 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 time interval. Assuming he does this, the acknowledging circuit previously traced for acknowledging relay P will then be closed at normally open contact 35—36 of acknowledging switch A, and acknowledging relay P will therefore become energized. When relay P is energized, the circuit previously traced for magnet valve Q^1 is closed at front contacts 95—103 and 99—104 of relay P, and magnet valve Q^1 again becomes energized, so that reservoir 73 is again connected with the source of fluid pressure. Furthermore, when relay P becomes energized, it closes its stick circuit at its front contact 90. It follows that after the acknowledging switch has been operated under these conditions, it may immediately be returned to its normal position, and relay P will remain energized, so that valve Q^1, after being reenergized, will subsequently remain energized, and 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 N will again become energized and close its normal contacts, thereby deenergizing relay P, and restoring the parts to the conditions in which they are illustrated in the drawings.

We 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 will result in normally closed contact 44 of pneumatic relay Y being opened, so that relay P cannot be energized by closing 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 reset switch R is reversed, the reset circuit for acknowledging relay P becomes closed at normally open contact 42—43 of reset switch R, and relay P therefore becomes energized and completes its stick circuit. Magnet valve Q^1 then again becomes energized, and the brakes can be released. Relay P will now remain energized until train controlling current is again supplied to receiver L to energize relay N in its normal direction, at which time relay P will become deenergized and lamp V^1 will become lighted. The parts will then be restored to the conditions in which they are illustrated in the drawings.

It should be pointed out that if relay N becomes energized in the reverse direction for any reason so that its contacts are swung to the left, the circuit for lamp V^2 including reverse contacts 18—25 and 21—29 of relay N will become closed, and this lamp will become lighted thereby giving a stop indication on the train. Furthermore, all circuits for valve Q^1 will then be open, so that valve Q^1 will become deenergized. If the engineman operates the acknowledging switch A under these conditions before an automatic application of the brakes occurs, relay P will become energized by virtue of a branch for the acknowledging circuit previously traced for this relay, which branch passes from wire 50 through wire 93, and reverse contact 21—29 of relay N to terminal C. When relay P becomes energized, it completes a stick circuit which passes from terminal B through wire 59, reverse contact 18—25 of relay N, wires 92, 64 and 89, front contact 90 of relay P, wires 91 and 48, winding of relay P, wires 49, 50 and 93, and reverse contact 21—29 of relay N to terminal C. Relay P will therefore remain energized even though acknowledging switch A is immediately returned to its normal position, and it will be apparent, therefore, that valve Q^1 will again become energized and prevent an automatic application of the brakes so that the train can proceed. If lamp V^2 continues to be lighted for any considerable length of time, however, the engineman will then know that the apparatus is not functioning in the normal manner.

If the engineman does not operate switch A under the conditions just stated before an automatic application of the brakes occurs, he will have to operate reset switch R. If he does this, relay P will then become energized by virtue of a branch for the acknowledging circuit which is the same as the branch just traced for the reset circuit. If relay P is energized in this manner, it will then remain energized until relay N is again energized in its normal direction. This arrangement insures that improper operation of the apparatus will be detected.

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,

and unless the engineman demonstrates his cognizance of the fact that he is leaving continuous territory by reversing the acknowledging switch A, an automatic application of the brakes will occur in the manner previously described. He will then have to wait until the train has come to a standstill and operate the reset switch R before the train can again proceed. When the acknowledging switch A is reversed under the above conditions, or the reset switch R is operated, relay P will become energized and will subsequently remain energized by virtue of its stick circuit previously traced, until the receiver L is again supplied with train controlling current due to the train having again entered continuous control territory. As long as the train is out of continuous control territory, relay N will be deenergized and lamp V^2 will be lighted.

We will now assume that with relay P held in its energized condition by virtue of its stick circuit, and with the rest of the train-carried apparatus in the condition shown in the drawings, the train passes 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 V will be considerably reduced, and so the flux traversing the receiver core 68 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 electromotive force in the secondary winding *s*, and the voltage of one of these alternations will neutralize or reverse the current through the winding of relay X, thereby causing the latter relay to open its contacts. This will deenergize the primary winding *p* and the magnet valve Q^2, and will, of course, open the stick circuit for relay X. The deenergization of magnet valve Q^2 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 action will be the same as before, except that the voltage induced in the receiver secondary *s* will be very much lower and will not be sufficient to deenergize relay X. It follows that an automatic application of the brakes will not occur.

We will now assume that the circuit for the trackway inductor winding 10 is open, that the train-carried receiver V passes over the inductor, and that the engineman reverses the acknowledging switch A just before the receiver registers with the inductor.

An acknowledging circuit will then be closed, which circuit passes from terminal B through wire 45, normally closed contact 44 of pneumatic relay Y, wire 46, normally open contact 33—34 of acknowledging switch A, resistance element 70, wire 85, winding of relay X, wire 86, secondary winding *s*, and the right hand portion of primary winding *p* to terminal C.

A branch circuit is also closed, which circuit passes from terminal B through wire 52, normally open contact 30—32 of acknowledging switch A, wires 118 and 119, substitute resistor element 69, wire 84, primary winding *p* to terminal C.

It follows that under the condition specified, the relay X will remain energized, so that if the engineman returns the acknowledging switch to its normal position before an automatic brake application occurs due to the deenergization of magnet valve Q^2, the brake application will be forestalled and the train may proceed. The purpose of the substitute resistance element 69 is to provide the acknowledging circuit just traced with the equivalent of the winding 56 of the magnet valve Q^2, thereby avoiding any disturbance in the circuits for the primary and secondary windings of the receiver V due to the fact that the winding 56 of the magnet valve Q^2 is taken out of the circuits for the primary and secondary windings during the acknowledging process.

We 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 V with an open-circuited inductor K. The brake application will result in normally closed contact 44 of pneumatic relay Y being opened so that relay X cannot 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 circuit: From terminal B through wires 52 and 53, normally open contact 40—41 of reset switch A, resistance element 70, wire 85, winding of relay X, wire 86, secondary winding *s*, and the right-hand portion of primary winding *p* to terminal C. This will energize relay X, so that when the reset switch R is restored to its normal position, the magnet valve Q^2 will again become energized and the brakes can be released. The parts will then be restored to the conditions in which they were before the automatic application of the brakes occurred with the result that the train may proceed.

It will be noted that when the acknowledging switch A is reversed, the circuit for the magnet valve Q^2 becomes opened, so that if this switch is reversed and left in the reverse position for more than the time required for the brake applying apparatus to function, 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.

One advantage of the apparatus shown in Fig. 1 is that the same brake applying apparatus is utilized for both systems with the result that the amount of brake applying equipment required for the combined system is reduced to a minimum. Another advantage of the apparatus shown in Fig. 1 is that the same resetting and acknowledging switches are utilized for both systems. This likewise results in a reduction of the number of parts required when it is desired to equip a train with a combined system of the type described.

Referring now to Fig. 2, as here shown, the pipe 71, instead of being connected with the source of fluid pressure through the valve Q^1 and the pipe 72 as shown in Fig. 1, is connected with the source of fluid pressure through a pipe 121. Furthermore, as here shown, the valve Q^1 has been replaced by a valve Q^3 which is similar to the valve Q^1, but which is arranged when deenergized to connect a whistle S^1 with the pipe 71. The electrical circuits for the valve Q^3 are exactly the same as the circuits for the valve Q^1 described in Fig. 1, and the remainder of the apparatus is similar to that shown in Fig. 1.

The operation of the apparatus shown in Fig. 2 is substantially the same as that shown in Fig. 1 with the exception that when valve Q^3 becomes deenergized, it does not initiate an automatic application of the brakes, but merely causes whistle S^1 to blow. After whistle S^1 has started to blow, it will continue to blow until the engineman operates the acknowledging switch A to energize acknowledging relay P and hence reenergize valve Q^3.

In conclusion, it should be pointed out that we have provided train-carried apparatus comprising a minimum number of parts for cooperating either with trackway circuit provided in continuous train control territory such as illustrated in connection with section D—E, or with trackway inductors similar to inductor K, which are located at intervals along a stretch of intermittent control territory. By this arrangement, a train provided with apparatus embodying our invention may be operated over either continuous or intermittent territory with full protection and without manual interference with or adjustment of the train-carried apparatus.

Although we have herein shown and described only two forms of railway traffic controlling apparatus embodying our 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 our invention.

Having thus described our invention, what we claim is:

1. Railway traffic controlling apparatus comprising two normally energized train-carried windings, means on the train cooperating with devices located at intervals along the trackway for at times deenergizing one of said windings, means on the train controlled by currents in the trackway for at other times deenergizing the other winding, single means controlled by both said windings for initiating an automatic application of the brakes on the train when either of said magnets has been deenergized for a given interval of time, and single manually operable means on the train effective during said interval of time for reenergizing the deenergized winding to prevent an automatic application of the brakes.

2. Railway traffic controlling apparatus comprising two normally energized train-carried windings, means on the train cooperating with devices located at intervals along the trackway for at times deenergizing one of said windings, means on the train controlled by currents in the trackway for at other times deenergizing the other winding, single means controlled by both said windings for initiating an automatic application of the brakes on the train when either of said magnets 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, and single manually operable means including said contact for reenergizing either winding after such winding has become deenergized.

3. Railway traffic controlling apparatus comprising two normally energized train-carried windings, means on the train cooperating with devices located at intervals along the trackway for at times deenergizing one of said windings, means on the train controlled by currents in the trackway for at other times deenergizing the other winding, single means controlled by both said windings for initiating an automatic application of the brakes on the train when either of said windings 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, and means on the train controlled by said acknowledging switch and by said contact for reenergizing either winding after such winding has become deenergized.

4. Railway traffic controlling apparatus comprising two normally energized train-carried windings, means on the train cooperating with devices located at intervals along the trackway for at times deenergizing one of said windings, means on the train controlled by currents in the trackway for at

other times deenergizing the other winding, single means controlled by both said windings for initiating an automatic application of the brakes on the train when either of said windings 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, means on the train controlled by said acknowledging switch and by said normally closed contact for at times reenergizing either winding after such winding has become deenergized, and other means on the train for at other times energizing either winding after such winding has become deenergized.

5. Railway traffic controlling apparatus comprising two normally energized train-carried windings, means on the train cooperating with devices located at intervals along the trackway for at times deenergizing one of said windings, means on the train controlled by currents in the trackway for at other times deenergizing the other winding, single means controlled by both said windings for initiating an automatic application of the brakes on the train when either of said windings 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, means on the train controlled by said acknowledging switch and by said normally closed contact for at times reenergizing either winding after such winding has become deenergized, a reset switch on the train, and means controlled by said reset switch for at other times energizing either winding after such winding has become deenergized.

6. Railway traffic controlling apparatus comprising two normally energized train-carried magnet valves, means on the train cooperating with devices located at intervals along the trackway for at times deenergizing one of said magnet valves, means on the train controlled by current in the track rails for at other times deenergizing the other magnet valve, means controlled by said one magnet valve for initiating an automatic application of the brakes on the train after said one magnet valve has been deenergized for a given interval of time, means controlled by said other magnet valve for giving an audible signal on the train when said other magnet valve becomes deenergized, a reset switch on the train, and means controlled by said reset switch for at times energizing either of said magnet valves after such magnet valve has become deenergized.

7. Railway traffic controlling apparatus comprising two normally energized train-carried magnet valves, means on the train arranged for magnetic coaction with a trackway inductor for at times deenergizing one of said magnet valves, means on the train controlled by currents in the track rails for at other times deenergizing the other magnet valve, means controlled by said one magnet valve for initiating an automatic application of the brakes on the train when said one magnet valve has been deenergized for a given interval of time, means controlled by said other magnet valve for giving an audible signal on the train when said other magnet valve 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, means controlled by said acknowledging switch for reenergizing said other magnet valve after said other magnet valve has become deenergized, and means controlled by said acknowledging switch and said normally closed contact for at times reenergizing said one magnet valve when said one magnet valve has become deenergized.

8. Railway traffic controlling apparatus comprising a train-carried magnetizable receiver core arranged for magnetic coaction with a trackway inductor and provided with a primary and a secondary winding, a first train-carried relay, a train-carried magnet valve, a normally closed circuit including said primary winding and the winding of said magnet valve as well as a front contact of said relay, a second normally closed circuit including said secondary winding and the winding of said magnet valve as well as the winding and a front contact of said relay, means controlled by said magnet valve for initiating an automatic brake application on the train after said first magnet valve has been deenergized for a given interval of time, an acknowledging switch on the train, means controlled by said acknowledging switch effective for reenergizing said first relay if and only if said switch is operated during said interval of time, a second train-carried relay, means controlled by currents in the track rails for controlling said second relay, a train-carried acknowledging relay, a pick-up circuit for said acknowledging relay controlled by said second relay and by said acknowledging switch, a stick circuit for said acknowledging relay controlled by said second relay, and indication means on the train controlled by said acknowledging relay and by said second relay.

9. Railway traffic controlling apparatus comprising a train-carried receiver core arranged for magnetic coaction with a trackway inductor and provided with a primary and a secondary winding, a first train-carried relay, two train-carried magnet valves, a normally closed circuit including said primary winding and the winding of one of said magnet valves as well as a front contact of said first relay, a second normally closed circuit including said secondary winding and

the winding of said one magnet valve as well as the winding and a front contact of said first relay, a second train-carried relay provided with neutral and reverse contacts, means controlled by currents in the track rails for controlling said second relay, an acknowledging relay, a stick circuit for said acknowledging relay including its winding and its own front contact as well as a neutral contact of said second relay; a third normally closed circuit including the winding of the other magnet valve, a back contact of said acknowledging relay, and a normal contact of said second relay; single means controlled by both said magnet valves for initiating an automatic application of the brakes on the train when either of said magnet valves has been deenergized for a given interval of time, an acknowledging switch on the train, and means controlled by said acknowledging switch and effective only during said interval of time for reenergizing either said first relay or said acknowledging relay after such relay has been deenergized.

10. Railway traffic controlling apparatus comprising a train-carried magnetizable receiver core arranged for magnetic coaction with a trackway inductor and provided with a primary and a secondary winding, a first train-carried relay, two magnet valves on the train, single means controlled by both said magnet valves for initiating an automatic application of the brakes on the train when either of said magnet valves has been deenergized for a given interval of time, an acknowledging switch and a reset switch on the train, each having normally closed and normally open contacts, a source of current on the train, a pneumatic relay provided with a normally closed contact which becomes opened upon an automatic application of the brakes; a normal circuit for said primary winding extending from one terminal of said source through a normally closed acknowledging switch contact, a normally closed reset switch contact, the winding of one of said magnet valves, a first contact of said first relay, and the primary winding to the other terminal of said source; a normal circuit for said secondary winding extending from said one terminal of said source through said normally closed acknowledging switch contact, said normally closed reset switch contact, the winding of said one magnet valve, said first contact of said first relay, a second contact of said first relay, the winding of said first relay, the secondary winding, and a portion of said primary winding to the other terminal of said source; a first acknowledging circuit extending from said one terminal of the source through the normally closed contact of said pneumatic relay, a first normally open acknowledging switch contact, a first resistance, the winding of said one relay, said secondary winding, and the said portion of the primary winding to the other terminal of said source; a second acknowledging circuit extending from said one terminal of the source through a second normally open acknowledging switch contact, a second resistance, and said secondary winding to the other terminal of the source, said second acknowledging circuit having a branch which extends from said second normally open acknowledging switch contact through said second resistance, said first contact of said first relay, said second contact of said first relay, the winding of said first relay, and said secondary winding to the said portion of said primary winding; a first reset circuit which extends from said one terminal of the source through a first normally open reset switch contact, said first resistance, the winding of said first relay, the secondary winding, and the said portion of the primary winding to the other terminal of said source; said first reset circuit having a branch which extends from said one terminal of the source through said normally closed acknowledging switch contact, a second normally open reset switch contact, said second resistance, and said primary winding to the other terminal of said source; a second train-carried relay provided with neutral and normal contacts, means on the train controlled by currents in the track rails for controlling said second relay, a stop and a proceed lamp on the train, means controlled by normal contacts of said second relay for energizing said proceed lamp, means controlled by neutral contacts of said second relay for energizing said caution lamp, an acknowledging relay on the train; a third acknowledging circuit which extends from said one terminal of said source through the normally closed contact of said pneumatic relay, a third normally open contact of said acknowledging switch, the winding of said acknowledging relay, and a neutral contact of said second relay to the other terminal of said source; a second reset circuit which passes from said one terminal of said source through a third normally open contact of said reset switch, the winding of said acknowledging relay, and a neutral contact of said second relay to the other terminal of said source; and a stick circuit for said acknowledging relay which extends from said one terminal of said source through a neutral 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.

11. Railway traffic controlling apparatus comprising two normally energized train-carried windings, means on the train cooperating with devices located at intervals along the trackway for at times deenergizing one of said windings; means on the train controlled by currents in the trackway for at other times deenergizing the other winding, a timing res-

ervoir on the train, means controlled by both of said magnet valves for exhausting said timing reservoir to atmosphere at the expiration of a predetermined time interval after either of said magnet valves becomes deenergized, a whistle connected with said timing reservoir by means of said valves when either of said valves is deenergized, two check valves one located between said whistle and each of said valves, and a relay valve responsive to the pressure in said timing reservoir and arranged to initiate an automatic application of the brake on the train when the pressure in said timing reservoir has decreased below a predetermined value.

In testimony whereof we affix our signatures.

HAROLD V. RUDOLPH.
HAROLD W. BRYAN.