June 30, 1931. R. R. KEMMERER 1,812,154

RAILWAY TRAFFIC CONTROLLING APPARATUS

Filed July 19, 1928 2 Sheets-Sheet 1

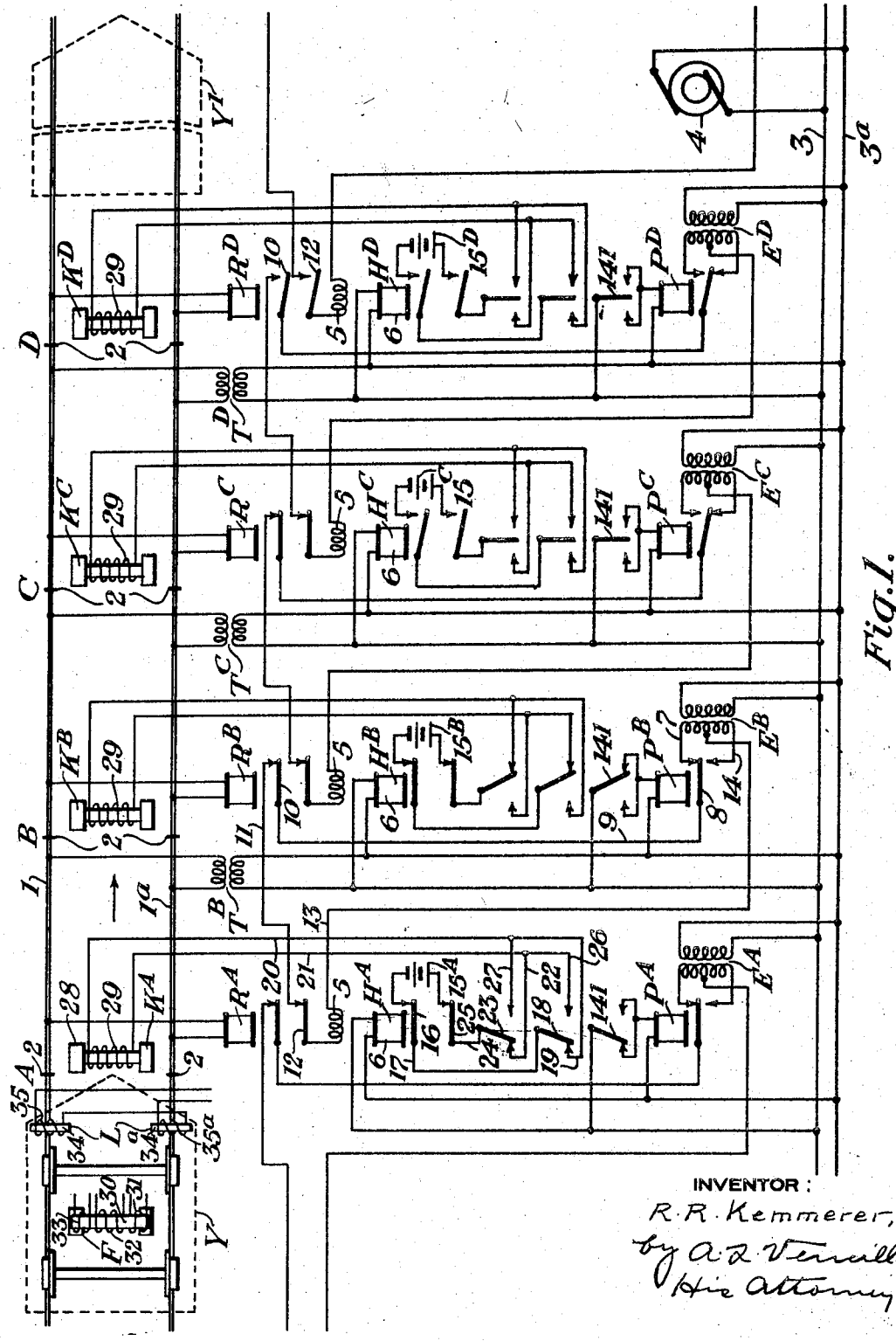


Fig. 1.

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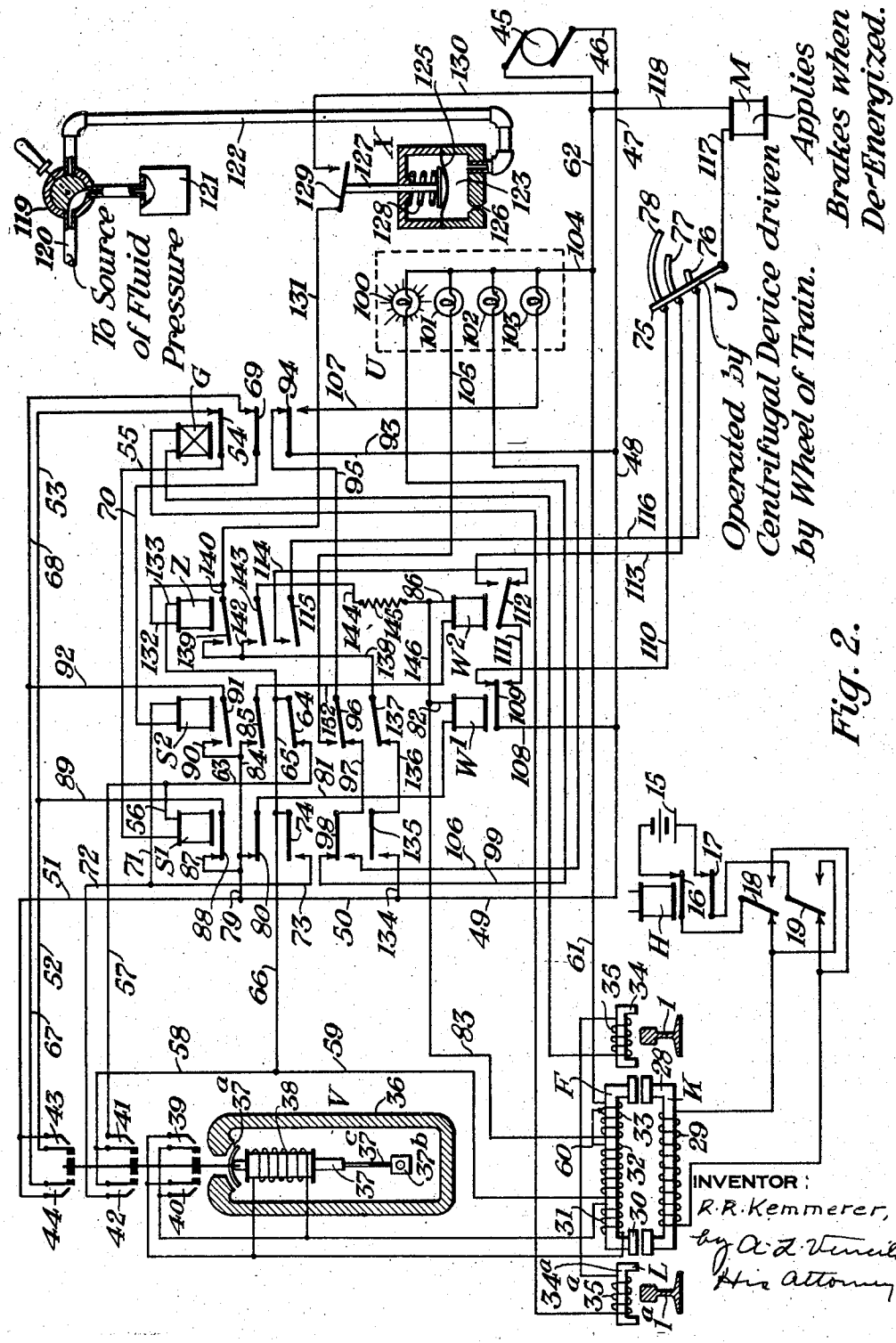


Fig. 2.

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UNITED STATES PATENT OFFICE

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RAILWAY TRAFFIC CONTROLLING APPARATUS

Application filed July 19, 1928. Serial No. 293,948.

My invention relates to railway traffic controlling apparatus, and particularly to apparatus of the type comprising train carried governing means controlled in accordance with traffic conditions in the trackway. More particularly my present invention relates to apparatus of the type in which current is at times supplied to the track rails for the control of the train governing means, and in which the apparatus on the train is also controlled at times by means of devices located at intervals along the trackway and controlled in accordance with traffic conditions.

I will describe one form of railway traffic controlling apparatus embodying my invention, and will then point out the novel features thereof in claims.

In the accompanying drawings Fig. 1 is a diagrammatic view showing one form of trackway apparatus embodying my invention. Fig. 2 is a view, partly diagrammatic, showing one form of train carried governing means suitable for co-operation with the trackway apparatus illustrated in Fig. 1 and also embodying my invention.

Similar reference characters refer to similar parts in each of the views.

Referring first to Fig. 1, the reference characters 1 and 1ª designate the track rails of a stretch of railway track over which traffic normally moves in the direction indicated by the arrow.

These rails are divided, by means of insulated joints 2, to form a plurality of successive track sections A—B, B—C, C—D, etc. Each track section is provided with a source of track circuit current which is here shown as a track transformer, designated by the reference character T with a suitable distinguishing exponent, and having a secondary connected across the rails adjacent the exit end of the section. The primary of each track transformer T is constantly supplied with alternating current from a suitable source, such as an alternator 4, over line wires 3 and 3ª. Each track section is also provided with a track relay, designated by the reference character R with an appropriate exponent, and connected across the rails adjacent the entrance end of the section. Associated with each track relay R are a polarized line relay and a repeater relay, designated by the reference characters H and P, respectively, with appropriate distinguishing exponents. Each repeater relay P is controlled by contact 141 of the corresponding line relay so that the repeater relay is energized when the line relay is energized in either direction but is de-energized when the associated line relay is de-energized, the circuits being apparent from the drawings.

One winding 6 of each line relay H is constantly supplied with alternating current from line wires 3 and 3ª. The other winding 5 of each line relay H is at times supplied with alternating current of one relative polarity or the other depending upon the condition of energization of the repeater relay P for the section next in advance. Referring particularly to relay H^A, this relay is at times supplied with energy from the secondary of a transformer E^B, located at point B, and having its primary constantly supplied with alternating current from line wires 3 and 3ª. One circuit for relay H^A may be traced from the upper terminal of the secondary of transformer E^B, over wire 7, front contact 8 of relay P^B, wire 9, front contact 10 of relay R^B, wire 11, front contact 12 of relay R^A, winding 5 of relay H^A, and wire 13 to an intermediate point on the secondary of transformer E^B. This circuit is closed only when relays R^A, R^B and P^B are all energized, under which conditions the winding 5 of relay H^A is supplied with alternating current of one relative polarity so that this relay is energized in its normal direction to swing its polar contacts to the left. When relay P^B is de-energized, current flows from the lower terminal of the secondary of transformer E^B over wire 14, back contact 8 of relay P^B, thence as before through winding 5 of relay H^A, and wire 13, back to the intermediate point of the secondary of transformer E^B. When this circuit is closed the relative polarity of the current supplied to winding 5 of relay H^A is reversed, and the relay is then energized in its reverse direction, swinging its polar contacts to the right. Each of the remaining relays H is

provided with circuits similar to those just traced for relay H^A, and the operation of these relays will be understood without further explanation.

Each track section is provided with a train controlling device, here shown as an inductor, and each designated by the reference character K with an appropriate exponent. In the form here shown, each inductor K comprises a magnetizable core 28, provided with a winding 29, and located adjacent the entrance end of the corresponding section, but this particular form and arrangement is not essential. The winding 29 of each inductor K is controlled by the associated line relay H so that the winding is at times de-energized, and is at other times supplied with direct current of one polarity or the other, depending upon traffic conditions in advance. Referring particularly to inductor K^A, when relay H^A is energized in the normal direction, current flows from a suitable source of direct current such as a battery 15^A, through front contact 16 of relay H^A, wire 17, normal contact 18 of relay H^A, wires 19 and 20, winding 29 of inductor K^A, wires 21 and 22, normal contact 23 of relay H^A, wire 24, and front contact 25 of relay H^A back to battery 15^A. The current then supplied to the inductor winding is of what I shall hereinafter term "normal" polarity. When relay H^A is energized in the reverse direction, however, current flows from battery 15^A, over front contact 16 of relay H^A, wire 17, reverse contact 18 of relay H^A, wires 26 and 21, winding 29 of inductor K^A, wires 20 and 27, reverse contact 23 of relay H^A, wire 24, and front contact 25 of relay H^A, back to battery 15^A. When this circuit is closed, the winding 29 of inductor K^A is supplied with current of the opposite polarity, and this polarity I will hereinafter term "reverse" polarity. When relay H^A is de-energized, however, both of the circuits just traced are open, and the inductor K^A is then de-energized.

As shown in the drawings, the section to the right of point D is occupied by a train indicated diagrammatically at Y^1. The rails to the left of this train are deprived of current and relay R^D is de-energized. Relay H^D is therefore de-energized because its circuit is open at front contact 12 of relay R^D, and winding 29 of inductor K^D is therefore de-energized. Furthermore, since contact 141 of relay H^D occupies its intermediate position, relay P^D is de-energized. Transformer T^D supplies alternating current to the rails of section C—D and relay R^C is energized. The circuit for relay H^C is open at front contact 10 of relay R^D, so that relay H^C and hence relay P^C are de-energized. Winding 29 of inductor K^C is therefore de-energized. In similar manner the current supplied to the rails of seceion B—C by transformer T^C energizes relay R^B. Since relays R^B and R^C are both energized, a circuit is closed for relay H^B, but relay P^C is de-energized, so that relay H^B is energized in its reverse direction, and under these conditions, winding 29 of inductor K^B is supplied with current of reverse polarity. Relay R^A is also energized and since relay P^B is energized, current is supplied to relay H^A to energize this relay in its normal direction. As a result, winding 29 of inductor K^A is supplied with current of normal polarity, and relay P^A is energized.

A train, indicated diagrammatically at Y, is provided with governing means responsive to the condition of the inductors K and also to the current supplied to the track rails by the track transformers T. Referring now also to Fig. 2, the train Y is provided with a receiver L comprising two magnetizable cores 34 and 34^a located in inductive relation with the track rails 1 and 1^a, respectively, and disposed in advance of the forward axle of the train. Core 34 is provided with a winding 35, and core 34^a is provided with a winding 35^a, the windings 35 and 35^a being connected in series in such manner that the electromotive forces induced therein by alternating currents flowing in opposite directions in the track rails at an instant are additive. The windings 35 and 35^a are connected with the winding of a relay G so that this relay is energized when the rails occupied by the train are supplied with alternating current from a source located in advance of the train. It should be noted, however, that when the train enters an occupied section, the alternating current will be shunted by the wheels and axles of the train already occupying the section, and under these conditions, relay G will be de-energized.

The train Y is also provided with a second receiver F illustrated in detail in Fig. 2 and comprising a core 30 co-operating with the cores 28 of the trackway inductors K. The receiver F is provided with three windings 31, 32 and 33 and controls a train carried relay V. This relay comprises a permanent magnet 36, and an armature 37 supported by a flexible spring 37^c pivoted at point 37^b. The armature 37 carries a winding 38 and terminates, at its upper end, in a rounded pole piece 37^a which is adjacent the poles of the magnet 36. The armature 37 may therefore be swung to one direction or the other, depending upon the polarity of the current supplied to winding 38. Winding 38 is connected directly with winding 31 of receiver F.

When the train passes an inductor K which is supplied with current of normal polarity, a complete cycle of alternating current is induced in winding 31. The parts are so proportioned that the first half cycle of this induced current swings armature 37 to the right, thereby closing contacts 39, 41 and 43. It will be noted that when contact 39 is closed, windings 38 and 31 are short-

circuited. One purpose of this arrangement is to prevent the armature 37 from being swung in the opposite direction by the second half cycle of current induced in winding 31. Another purpose of contact 39 is to retard somewhat the return of the relay V to the normal position in which it is illustrated, after passing an inductor K.

When the train passes an inductor K having its winding 29 supplied with current of reverse polarity, a complete cycle of alternating current is induced in winding 31 in the same manner as when the train passes an inductor supplied with current of normal polarity, but the first half cycle of the current now induced in winding 31 moves armature 37 to the left, closing contacts 40, 42 and 44. Contact 40 shunts windings 31 and 38, causing a slight retardation of the return of the relay, and preventing its reversal in response to the second half cycle of the current induced in winding 31.

The reference characters S^1 and S^2 designate two relays which are controlled in part by the relays V and G. If relay G is closed and relay V is operated to swing its armature to the right, a pick-up circuit is closed for relay S^1, which may be traced from a suitable source of energy, such as a generator 45, over wires 46, 47, 48, 49, 50 and 51, contact 43 of relay V, wires 52 and 53, front contact 54 of relay G, wire 55, winding of relay S^1, wires 56 and 57, contact 41 of relay V, wires 58 and 59, winding 32 of receiver F, wire 60, thence through a portion of winding 33 of receiver F, and wires 61 and 62 back to generator 45. The circuit just traced is provided with a branch, which passes from wire 56, over wire 63, back contact 64 of relay S^2, and wires 65 and 66 to wire 59. It will be seen therefore, that when relay S^2 is de-energized, a shunt is provided around contact 41 of relay V, but in any event, when relay V is energized to swing its armature to the right, the pick-up circuit just traced is closed and relay S^1 becomes energized. Of course, the contacts of relay V are closed for only a brief interval, but after the relay V returns to the normal position, in which it is illustrated in the drawings, relay S^1 is maintained in its energized condition, provided relay G is energized, by current which flows from generator 45, through wires 46, 47, 48, 49, 50, 79 and 87, front contact 88 of relay S^1, wires 89 and 53, front contact 54 of relay G, wire 55, winding of relay S^1, wires 56 and 63, back contact 64 of relay S^2, wires 65, 66 and 59, winding 32 of receiver F, wire 60, and thence through a portion of winding 33 of receiver F and wires 61 and 62 back to generator 45. When relay S^1 is energized, lamp 100 of a cab indicator, designated in general by the reference character U, is lighted by current which flows from generator 45, over wires 46, 47 and 93, front contact 94 of relay G, wire 95, back contact 96 of relay S^2, wire 97, front contact 98 of relay S^1, wire 99, lamp 100, and wires 104 and 62, back to generator 45.

The relays S^1 and S^2 are also arranged to control the brakes on the train. In the form here shown, this is accomplished by means of a magnet M which controls the usual brake applying mechanism by means not shown in the drawings. For present purposes, it is sufficient to state that when magnet M is de-energized, an automatic application of the brakes results.

Magnet M is controlled in part by a device J which is responsive to the speed of the train. The device J comprises a lever 75 which is operated by a centrifugal device driven from a wheel of the train, and is so controlled that the lever occupies the position in which it is illustrated in the drawings when the train is at rest. As the speed of the train increases, lever 75 swings to the right. Associated with the lever 75 are three fixed contact segments 76, 77 and 78. The parts are so proportioned and disposed that contacts 75—76, 75—77 and 75—78 are all closed when the train is travelling below a low speed, such for example, as 15 miles per hour. When the train exceeds this low speed, contact 75—76 opens. When the train exceeds a medium speed, such for example, as 35 miles per hour, contact 75—77 opens, and when the train exceeds a high speed, such for example, as 65 miles per hour, contact 75—78 opens.

Magnet M is also controlled by two relays W^1 and W^2 which are selectively controlled by relays S^1 and S^2. Returning now to the assumption that relay S^1 is energized as was explained hereinbefore, relay W^1 is also energized, the circuit for the latter relay passing from generator 45, over wires 46, 47, 48, 49, 50 and 79, front contact 80 of relay S^1, wire 81, winding of relay W^1, wires 82 and 83, winding 33 of receiver F, and wires 61 and 62, back to generator 45. When relay W^1 is energized its front contact is closed, and a circuit is then completed for magnet M, from generator 45, through wires 46, 47, 48 and 108, front contact 109 of relay W^1, wire 110, contact 75—78 of device J, wire 117, winding of magnet M, and wire 118, back to generator 45. It will be seen, therefore, that under these conditions, magnet M is controlled by contact 75—78 of device J, so that the brakes will be applied if the train exceeds 65 miles per hour.

I will next assume that the train passes an inductor K having its winding 29 supplied with current of reverse polarity. When this occurs (assuming that relay G is energized as usual), armature 37 of relay V is swung to the left, and a pick-up circuit is then closed for relay S^2, from generator 45, over wires 46, 47, 48, 49, 50 and 51, contact 44 of relay V, wires 67 and 68, front contact 69 of relay G, wire 70, winding of relay S^2, wires 71 and 72, contact 42 of relay V, wires 58 and 59, winding

32 of receiver F, wire 60, thence through a portion of winding 33 of receiver F, and wires 61 and 62, back to generator 45. This circuit is provided with a branch which passes from wire 71, through wire 73, back contact 74 of relay S^1, and wire 66 to terminal 59. It will be seen, therefore, that if relay S^1 is de-energized, back contact 74 of relay S^1 completes a shunt around contact 42 of relay V. In any event, however, when relay V is energized to swing its armature to the left, relay S^2 becomes energized, and current is thereafter supplied to the relay over a stick circuit which passes from generator 45, over wires 46, 47, 48, 49, 50, 79, 84 and 90, front contact 91 of relay S^2, wires 92 and 68, front contact 69 of relay G, wire 70, winding of relay S^2, wires 71 and 73, back contact 74 of relay S^1, wires 66 and 59, winding 32 of receiver F, wire 60, a portion of winding 33 of receiver F, and wires 61 and 62 back to generator 45. It should be pointed out that with relay S^2 energized, lamp 101 of cab indicator U is lighted, current flowing from generator 45, through wires 46, 47 and 93, front contact 94 of relay G, wire 95, front contact 96 of relay S^2, wire 105, lamp 101, and wires 104 and 62, back to generator 45. Furthermore, when relay S^2 is energized, relay W^2 is also energized, the circuit for the latter relay being from generator 45, through wires 46, 47, 48, 49, 50, 79 and 84, front contact 85 of relay S^2, wire 152, winding of relay W^2, wires 86, 146 and 83, winding 33 of receiver F, and wires 61 and 62 back to generator 45.

When relay W^2 is energized, the medium speed limit is imposed upon the train, magnet M being then controlled by contact 75—77 of device J. The medium speed circuit for magnet M may be traced from generator 45, through wires 46, 47, 48 and 108, back contact 109 of relay W^1, wire 111, front contact 112 of relay W^2, wire 113, contact 75—77 of device J, wire 117, winding of magnet M, and wire 118 back to generator 45. It will be plain, therefore, that when relay S^2 is energized to pick up relay W^2, the brakes will be applied on the train if the speed exceeds 35 miles per hour.

It will be observed that the stick circuit for relay S^2 includes winding 32 of receiver F. Furthermore, when relay S^2 is energized, relay W^2 is supplied with current from generator 45 in series with winding 33 of receiver F. The current thus supplied to winding 33 creates in the core 30 of receiver F a unidirectional flux which has a steady value under normal conditions, that is, when the train is between inductors K. If, however, the receiver F, under the conditions just described, approaches a trackway inductor K having its winding 29 de-energized, the reluctance of the magnetic circuit including the receiver is materially changed. As a result of this change in relutance, the flux created in core 30 by the current in winding 33 is materially increased. An electromotive force is induced in winding 32 by the increase of this flux and this induced electromotive force creates in the circuit including winding 32 and relay S^2, a single cycle of alternating current, one-half of which opposes the current normally supplied to this relay from generator 45. The net effect of the induced electromotive force therefore is to de-energize relay S^2. The current produced in the circuit of relay S^2 when the train passes a de-energized inductor is of transitory nature but after relay S^2 has once been de-energized, it remains de-energized until its pick-up circuit is again closed. In similar manner if relay S^1 is energized, this relay will be de-energized if the train passes a de-energized inductor K, and relay S^1 will remain de-energized until the pick-up circuit for the relay is again closed. It follows that after the train has passed a de-energized inductor, relays S^1 and S^2 are both de-energized. Under these conditions, the cab indicator circuit passes from generator 45 over wires 46, 47 and 93, front contact 94 of relay G, wire 95, back contact 96 of relay S^2, wire 97, back contact 98 of relay S^1, wire 106, lamp 102 of cab indicator U, and wires 104 and 62, back to generator 45. Under these conditions also, relays W^1 and W^2 are both de-energized and both the high speed and medium speed circuits for magnet M are open and an automatic application of the brakes ensues. This automatic brake application may, however, be prevented by the engineman under certain conditions, by means of the apparatus which I will now describe.

The reference character X designates a pneumatic relay comprising a chamber 123 having one side formed by a flexible diaphragm 125. A plunger 127 is urged against the diaphragm 125 by a spring 128. Chamber 123 is constantly connected with atmosphere through a restricted orifice 126 and under normal conditions, spring 128 holds the plunger 127 in the position in which it is illustrated in the drawings, so that contact 129 is open. Communicating with chamber 123 is a pipe 122 which is at times supplied with fluid pressure under the control of a manually operable valve 119. When this valve occupies its normal position in which it is illustrated in the drawings a reservoir 121 is charged with fluid pressure through pipe 120 from a source of pressure not shown in the drawings, and pipe 122 is blanked. When the engineman reverses valve 119, however, pipe 120 is blanked and reservoir 121 is connected with pipe 122. The pressure in the reservoir is therefore supplied to chamber 123 of relay X. This pressure moves the diaphragm 125 upwardly, thereby urging plunger 127 against the bias of spring 128 and closing contact 129. The pressure in

chamber 123 gradually leaks off through the orifice 126 and after a predetermined time interval the plunger 127 returns to its initial position and opens contact 129. During the brief interval that contact 129 is closed, due to reversal of valve 119, current flows from generator 45, through wires 46 and 130, contact 129 of relay X, wires 131 and 132, winding of a relay Z, wires 133, 65, 66 and 59, winding 32 of receiver F, wire 60, a portion of winding 33 and wires 61 and 62, back to generator 45. When the engineman operates valve 119, therefore, he closes a pick-up circuit for relay Z, which causes this relay to become energized. After the relay has once picked up, it is maintained in its energized condition, by virtue of a stick circuit, which may be traced from generator 45, through wires 46, 47, 48, 49 and 134, back contact 135 of relay S^1, wire 136, back contact 137 of relay S^2, wire 138, front contact 139 of relay Z, wires 140 and 132, winding of relay Z, wires 133, 65, 66 and 59, winding 32 of receiver F, wire 60, a portion of winding 33, and wires 61 and 62 back to generator 45. It will be plain from the foregoing that although the contact of relay X is closed for only a brief interval by operation of valve 119, if this valve is operated to energize relay Z when relays S^1 and S^2 are both de-energized, relay Z is held closed after relay X returns to its normal position. When relay Z is energized, a low speed circuit is closed for magnet M from generator 45, through wires 46, 47, 48 and 108, back contact 109 of relay W^1, wire 111, back contact 112 of relay W^2, wire 114, front contact 115 of relay Z, wire 116, contact 75—76 of device J, wire 117, winding of magnet M and wire 118 back to generator 45. It will be plain, therefore, that even if relays S^1 and S^2 are de-energized, the engineman may proceed at a low speed of 15 miles per hour or less, provided he operates valve 119 to pick up relay Z.

It should be particularly noted that when relay Z is energized, winding 32 of receiver F is included in the stick circuit for this relay. But when relay Z is energized a circuit is closed for winding 33 of receiver F as follows: from generator 45, through wires 46, 47, 48, 49 and 134, back contact 135 of relay S^1, wire 136, back contact 137 of relay S^2, wires 138 and 142, front contact 143 of relay Z, wire 144, resistance 145, wires 146 and 83, winding 33 of receiver F, and wires 61 and 62 back to generator 45. It will be plain, therefore, if a train passes an inductor K having its winding 29 de-energized when relay Z is energized, the electromotive force induced in winding 32 will de-energize relay Z in the same manner as was previously described in connection with the operation of relays S^1 and S^2. It follows that upon passing each successive de-energized inductor K, the engineman must acknowledge by operating valve 119. If he does acknowledge, the train may proceed under the low speed limit, but if the engineman does not acknowledge the brakes are immediately applied.

When relay G is de-energized, as when the train enters an occupied section, lamp 103 of cab indicator U is lighted, current flowing from generator 45, through wires 46, 47 and 93, back contact 94 of relay G, wire 107, lamp 103 of cab indicator U, and wires 104 and 62 back to generator 45. If the engineman operated valve 119 as he passed the de-energized inductor at the entrance of the occupied section, however, the train may still proceed under the low speed limit.

In describing the operation of the apparatus as a whole, I will assume that the train Y, provided with the apparatus shown on Fig. 2, proceeds through the stretch of track shown in Fig. 1. While this train moves through section A—B, relay G is energized and when the receiver F passes inductor K^A, relay S^1 is picked up if this relay is not already energized, because current of normal polarity is being supplied to winding 29 of inductor K^A. After the receiver F has passed the inductor K^A, relay S^1 is subsequently stuck up so that lamp 100 of cab indicator U is lighted and relay W^1 is energized to impose a high speed limit upon the train.

When the train enters section B—C, relay G is still energized, but since winding 29 of inductor K^B is supplied with current of reverse polarity relay V reverses to pick up relay S^2. The stick circuit for relay S^1 is then broken at back contact 64 of relay S^2 so that relay S^1 becomes de-energized. Relay S^2 is stuck up after receiver F passes inductor K^B and lamp 101 of cab indicator U is therefore lighted. Furthermore, relay W^1 is de-energized and relay W^2 is energized to impose a medium speed limit upon the train.

Inductor K^C is de-energized so that when the train enters section C—D, relay S^2 becomes de-energized, although relay G remains energized. As a result, lamp 102 is lighted in cab indicator U and relays W^1 and W^2 are both de-energized. Under these conditions, the brakes on the train are applied unless the engineman operates valve 119 to pick up relay Z. If valve 119 is operated, relay Z is picked up, and this relay is subsequently stuck up to impose a low speed limit upon the train by energizing magnet M over contact 75—76 of device J. When the train enters the occupied section to the right of point D, relay G becomes de-energized and lamp 103 is then lighted to indicate to the engineman that the train has entered an occupied section. Furthermore, since winding 29 of inductor K^D is de-energized, relay Z is de-energized as receiver F passes inductor K^D. The engineman is therefore forced to acknowledge inductor K^B in order to prevent an automatic application of the brakes. If

valve 119 is operated to again energize relay Z, the train may proceed under the low speed limit.

It will be observed that both the pick-up circuits and the stick circuits for relays S^1 and S^2 are carried over front contacts of relay G. It follows, therefore, that if either of these relays is energized, and a switch is thrown in advance of the train, or if for any other reason the supply of current to the rails occupied by the train is interrupted, relay G becomes de-energized and an automatic application of the brakes is incurred.

It will be manifest, therefore, that with apparatus embodying my invention, I have made it possible to produce upon the train four distinctive indications of traffic conditions in the trackway with a minimum of equipment. Furthermore, the apparatus is so constructed as to combine the simplicity of an intermittent train control system with the safety of a continuous train control system to accomplish results not readily obtainable by either.

Although I have herein shown and described only one form 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 means for supplying current to the track rails, an inductor located in the trackway and provided with a winding, means for supplying said winding with current of one polarity or the other or for de-energizing said winding in accordance with traffic conditions, and train carried governing means controlled jointly by said inductor and by the current in the track rails.

2. Railway traffic controlling apparatus comprising means for supplying current to the track rails, an inductor located in the trackway and provided with a winding, means for supplying said winding with current of one polarity or the other or for de-energizing said winding in accordance with traffic conditions, and train carried governing means controlled by the current in the track rails and responsive to the polarity of the current supplied to said winding.

3. In combination, a section of railway track, means for supplying current to the rails of said section, an inductor located in the trackway and provided with a winding, means responsive to traffic conditions for at times supplying said winding with current of one polarity or the other or for de-energizing said winding, a first train carried relay controlled by current in said rails, a second train carried relay selectively responsive to the condition of energization of said winding, and governing means on the train controlled jointly by said two relays.

4. In combination, a plurality of successive sections of railway track, means for supplying current to the rails of each section, a plurality of trackway inductors one for each section and each having a winding, means for at times supplying each such winding with current of one polarity or the other or for de-energizing said winding in accordance with traffic conditions, a first receiver on the train in inductive relation with the track rails, a second receiver on the train for cooperating with said inductors, and governing means controlled jointly by said receivers and responsive to the condition of energization of said inductors.

5. Railway traffic controlling apparatus comprising a train carried core having a first and a second winding, a plurality of inductors located at intervals along the trackway adjacent the path of travel of said core and each provided with a winding, means controlled by traffic conditions for at times supplying the winding of each inductor with current, a train carried relay, means controlled by said first winding and operating when said core passes an inductor having its winding supplied with current to energize said relay, means effective when said relay is energized to connect the relay with a source of energy in series with said second winding, means also effective when said relay is energized to create in said core a flux which is varied when the core passes an inductor having its winding de-energized to induce in the second winding an electromotive force that de-energizes said relay, and governing means on the train controlled by said relay.

6. Railway traffic controlling apparatus comprising means for supplying the rails with current, a first relay on the train responsive to such current in the track rails, a winding located in the trackway, means for at times supplying said winding with current of one polarity or the other in accordance with traffic conditions, a second and a third relay on the train, means effective when the train passes said winding to energize said second or said third relay depending upon the polarity of the current in said winding provided said first relay is energized, and governing means controlled by said second and third relays.

7. Railway traffic controlling apparatus comprising means for supplying the rails with current, a first relay on the train responsive to such current in the track rails, a winding located in the trackway, means for at times supplying said winding with current of one polarity or the other in accordance with traffic conditions, a second and a third relay on the train, means effective when the train passes said winding to energize a selected one

of said second or third relay depending upon the polarity of the current in said winding, means controlled by said first relay for subsequently maintaining such selected relay in its energized condition, and governing means on the train controlled by said three relays.

8. Railway traffic controlling apparatus comprising a receiver on the train comprising a first winding, a second winding located in the trackway adjacent the path of travel of said first winding, means for at times supplying said second winding with current of one polarity or the other depending upon traffic conditions, a train carried relay comprising an armature biased to an intermediate position, means receiving energy from said first winding for swinging said armature to one extreme position or the other depending upon the polarity of the current in said first winding, means effective when the armature occupies either extreme position to short circuit said first winding, and governing means selectively controlled by said armature.

9. Railway traffic controlling apparatus comprising an inductor located in the trackway and provided with a first winding, means for at times supplying said winding with current; a train carried receiver co-operating with said inductor and provided with a second, a third, and a fourth winding; a first train carried relay controlled by said second winding, a second train carried relay, a pick-up circuit for said second relay controlled by said first relay, a stick circuit for said second relay including its own front contact and said third winding, a third relay, a circuit for said third relay controlled by said second relay and including said fourth winding, and governing means controlled by said third relay.

10. In combination, a plurality of sections of railway track, means for supplying current to the rails of each section, a plurality of inductors located in the trackway and controlled in accordance with traffic conditions, a train carried relay controlled by current in the track rails, a plurality of other relays selectively controlled by said inductors in accordance with traffic conditions, and governing means on the train controlled by all said relays and responsive to the speed of the train.

11. In combination, a stretch of railway track divided into a plurality of successive track sections, means for supplying alternating current to the rails adjacent the exit end of each section, an inductor for each section and each comprising a winding, means for at times supplying each such winding with direct current of one polarity or the other or for de-energizing the winding depending upon traffic conditions, and train carried governing means responsive to such alternating current and to the condition of energization of said windings.

12. In combination, a plurality of successive sections of railway track, means for supplying alternating current to the rails of each section, a track relay for each section, an inductor located adjacent the entrance end of each section, means for controlling each inductor in accordance with traffic conditions, train carried governing means arranged to impose a speed limit upon the train as the train passes each inductor depending upon the condition of such inductor, and means controlled by the current in the track rails for maintaining said speed limit effective until the train passes the next inductor.

13. In combination a plurality of successive sections of railway track, means for supplying alternating current to the rails of each section, a track relay for each section, a line relay for each section controlled by the corresponding track relay and by the track relay for the section next in advance, a plurality of inductors one located adjacent the entrance end of each section and each comprising a winding, means controlled by each line relay for supplying the associated winding with current of one polarity or the other or for de-energizing such winding depending upon the condition of such line relay, and train carried governing means controlled jointly by said inductors and by the current in the track rails.

14. Railway traffic controlling apparatus comprising means for supplying current to the track rails, an inductor located in the trackway and provided with a winding, means for supplying said winding with direct current of one polarity or the other in accordance with traffic conditions, and train carried governing means controlled jointly by said inductor and by the current in the track rails.

15. Railway traffic controlling apparatus comprising means for supplying current to the track rails, an inductor located in the trackway and provided with a winding, means for supplying said winding with direct current of one polarity or the other in accordance with traffic conditions, and train carried governing means controlled by the current in the track rails and responsive to the polarity of the current supplied to said winding.

In testimony whereof I affix my signature.

RALPH R. KEMMERER.