Feb. 16, 1932. B. R. PADMORE 1,845,175

RAILWAY SWITCH CONTROLLING APPARATUS

Filed Aug. 21, 1923 2 Sheets-Sheet 1

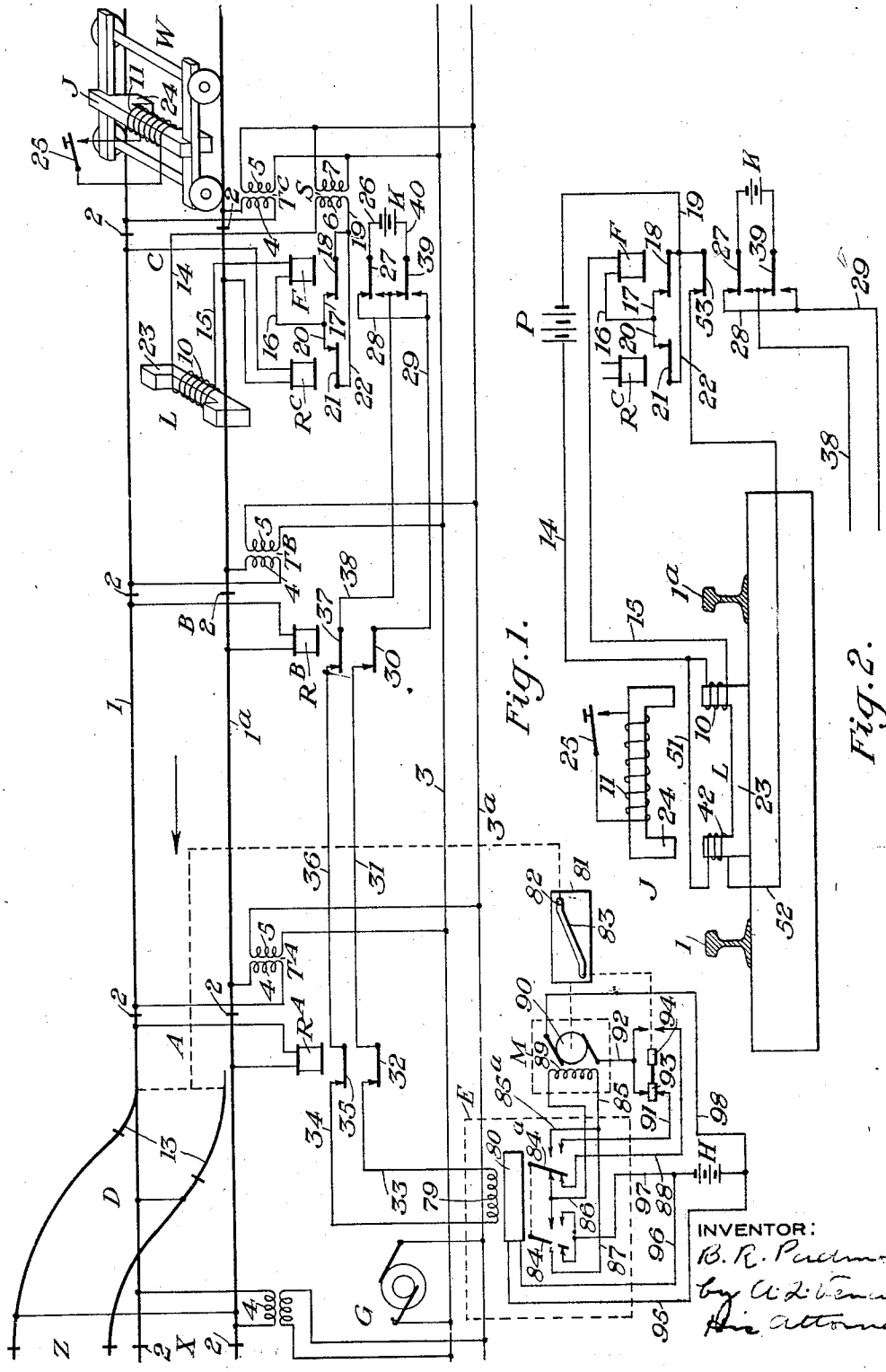

Fig. 1.

Fig. 2.

INVENTOR:
B. R. Padmore
by A. L. Terrill
his attorney.

Feb. 16, 1932. B. R. PADMORE 1,845,175

RAILWAY SWITCH CONTROLLING APPARATUS

Filed Aug. 21, 1923 2 Sheets-Sheet 2

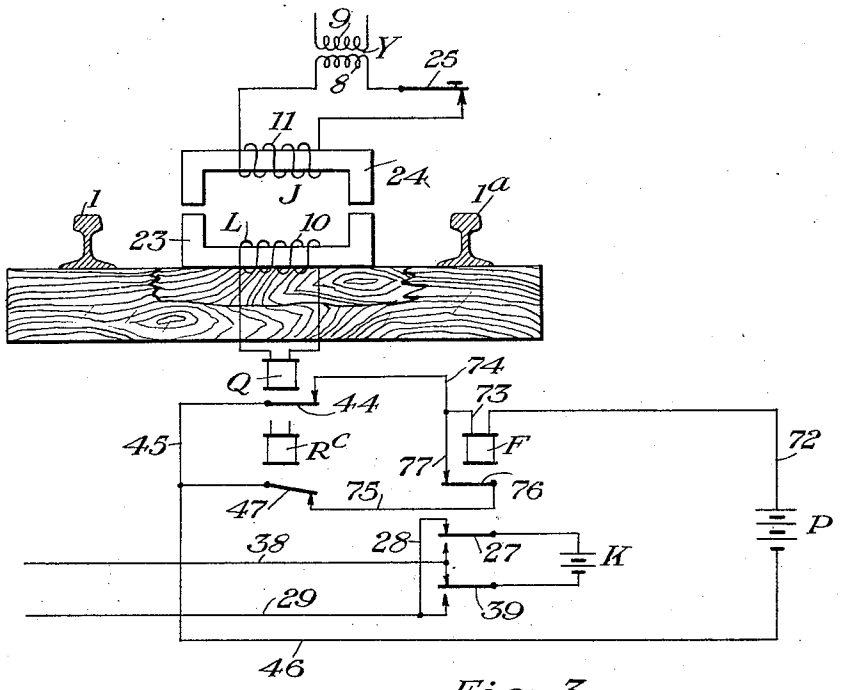

Fig. 3.

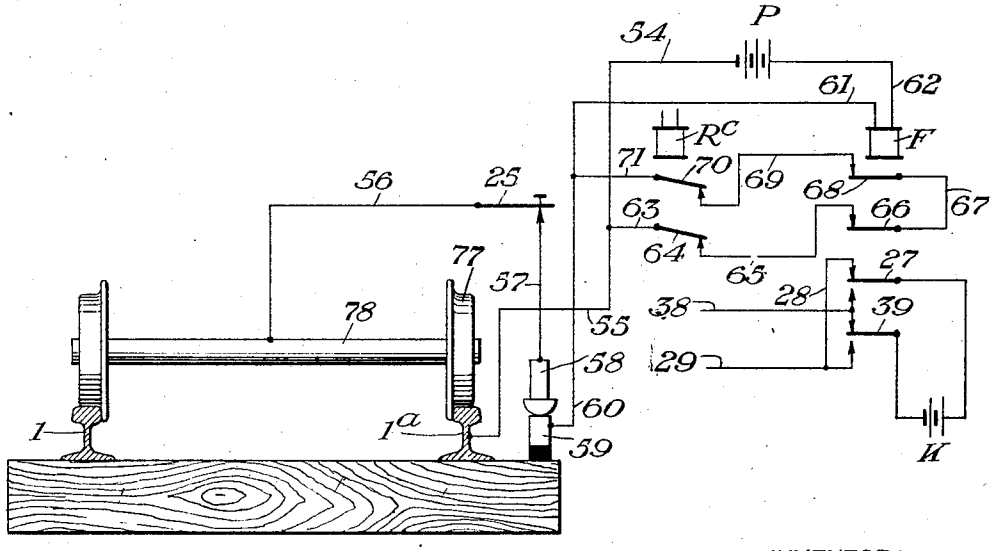

Fig. 4.

INVENTOR:
B. R. Padmore,
by A. L. Vencill
His Attorney

Patented Feb. 16, 1932 1,845,175

UNITED STATES PATENT OFFICE

BERTRAM R. PADMORE, OF BLAWNOX, PENNSYLVANIA, ASSIGNOR TO THE UNION SWITCH & SIGNAL COMPANY, OF SWISSVALE, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA

RAILWAY SWITCH CONTROLLING APPARATUS

Application filed August 21, 1923. Serial No. 658,540.

My invention relates to railway switch controlling apparatus, and particularly to apparatus of the type comprising means located on a vehicle and arranged to co-operate with means located in the trackway for operating a railway switch.

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

In the accompanying drawings, Fig. 1 is a view, partly diagrammatic, showing one form and arrangement of railway switch controlling apparatus embodying my invention. Figs. 2, 3 and 4 are views showing various modifications of the apparatus illustrated in Fig. 1 and also embodying my invention.

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

Referring first to Fig. 1, the reference characters 1 and 1ª designate the track rails of a railroad over which traffic normally moves in the direction of the arrow. These rails are divided, by means of insulated joints 2, into successive track sections X—A, A—B, B—C, etc. Each such section is provided with a source of track circuit current here shown as a secondary winding 4 of a track transformer designated by the reference character T with an exponent corresponding to the location, which secondary winding is connected across the rails adjacent the exit end of the section. The primary 5 of each such track transformer T is constantly supplied with alternating current from a suitable source of energy, such as a generator G, over line wires 3 and 3ª. Each section is also provided with a track relay designated by the reference character R with an exponent corresponding to the location and connected across the rails adjacent the entrance end of the section.

Section X—A is provided with a switch 13 for allowing traffic to proceed onto track D or to continue on the main track through section X—A, depending on the position of the switch. The switch 13 is operated by a motor device M which is responsive to reversals in the polarity of the current with which it is supplied to move switch 13 into one or the other of its extreme positions. It will be noted that the switch is operated by a motion plate 81 containing a slot 83 coacting with a roller 82 which is operatively connected with the movable points of the switch. This particular type of operating device is chosen merely for purposes of illustration, however, and is only one of several types of equivalent devices which may be employed to accomplish the same result. The motion plate 81 is shifted or reciprocated by a motor M having an armature 90 and a field winding 89. This motor is controlled by a circuit controller E comprising two windings 79 and 80 and a pair of contact fingers 84 and 84ª. The motor is further controlled by two contacts 93 and 94 which are operatively connected with motion plate 81 and are so arranged that contact 93 is closed when switch 13 is normal, that is, set for traffic to continue through the main track, and contact 94 is closed when switch 13 is reversed. Winding 80 is constantly supplied with current from some suitable source as a battery H over wires 95 and 96, while winding 79 is supplied with current of one relative polarity or the other by means of wires 33 and 34 as will appear hereinafter. As shown in the drawings, the switch is normal; when the switch is to be closed the polarity of the current supplied to wires 33 and 34 is reversed, so that contact fingers 84 and 84ª are reversed. Current is then supplied to motor M from battery H, through wire 97, contact 84, wire 88, field winding 89, wire 85, contact 84ª, wire 91, contact 93, wire 92, armature 90, and wire 98 back to battery H. When the switch reaches its full reversed position, contact 93 opens, thereby opening the circuit just traced and so de-energizing motor M. Contact 94 closes at the same time. When the switch 13 is to be returned to normal, the relative polarity of the current supplied to winding 79 is again versed, so that contact fingers 84 and 84ª are restored to the positions in which they are shown in the drawings. Current then flows from battery H, through wire 97, contact 84, wires 87 and 85, field winding 89 of motor M, wire 86, contact 84ª, wire 88, contact 94, wire 92, armature 90 and wire 98 back to battery H. As soon as the motion of switch 13 is completed, contact 94 opens and contact 93

closes, so that the parts are restored to the positions in which they are shown in the drawings.

The portion of track D to the right of the fouling point 2 is included in the track circuit for the section to the left of point A in the usual and well known manner.

Located in the trackway adjacent the entrance end of section B—C is an inductor device L comprising a U-shaped member 23 of paramagnetic material having a winding 10 thereon. The winding 10 is provided with a circuit which starts with secondary 6 of a transformer S (the primary of which is constantly supplied with alternating current over line wires 3 and 3^a from generator G) and passes through wire 14, winding 10 of inductor device L, wire 15, auxiliary relay F, wires 16 and 20, front contact 21 of track relay R^C, and wires 22 and 19 back to secondary 6 of transformer S. This circuit is closed only when relay R^C is energized, under which condition alternating current from transformer S traverses the winding 10 and the winding of relay F. The circuit for winding 10 is provided with a branch around relay contact 21, which branch comprises wire 17 and contact 18 of relay F. This branch is of course closed only when relay F is energized.

As shown in the drawings the section to the right of point C is occupied by a vehicle designated in general by the reference character W. This vehicle is provided with an inductor device J comprising an inverted U-shaped member 24 of paramagnetic material carrying a winding 11 the terminals of which may be connected together by means of a manually operable switch 25. The device J is so proportioned and so located with respect to the vehicle upon which it is mounted that as the vehicle passes device L located in the trackway, device J is moved into inductive relation with device L so that the varying flux caused by the alternating current in winding 10 traverses member 24. If contact 25 is closed when devices J and L are in registry, the reluctance of the magnetic circuit for winding 10 will not be materially affected, and so the reactance of this winding will not be materially varied, with the result that relay F will remain closed. If, however, contact 25 is open when the two devices register, the reluctance of the magnetic circuit for winding 10 will be materially decreased, so that the reactance of this winding will be materially increased, and this will decrease the current in winding 10 and the relay F below the value required to keep the relay closed. Relay F will then open.

Winding 79 of circuit controller E is governed by track relays R^A and R^B, and also by relay F, the contacts 27 and 39 of which constitute a pole-changer to reverse the polarity of the current in winding 79 when relay F is deenergized. The circuit for winding 79 is from battery K through wire 26, front contact 27 of relay F, wires 28 and 29, front contact 30 of track relay R^B, wire 31, front contact 32 of track relay R^A, wire 33, winding 79 of circuit controller E, wire 34, front contact 35 of track relay R^A, wire 36, front contact 37 of track relay R^B, wire 38, front contact 39 of relay F and wire 40 back to battery K. When relay F is de-energized, the circuit is from battery K through wire 26, back contact 27 of relay F, wire 38, thence as before through winding 79 of circuit controller E and through wire 29, back contact 39 of relay F, and wire 40 to battery K. It is therefore clear that the winding 79 of circuit controller E is supplied with current of one relative polarity or the other, assuming relays R^A and R^B to be energized, depending upon whether relay F is energized or de-energized.

As shown in the drawings, sections X—A, A—B and B—C are all unoccupied, track relays R^A, R^B and R^C are all energized, relay F is energized, and winding 79 of circuit controller E is supplied with current of what I shall term "normal relative polarity" so that switch 13 is in such position as to allow traffic to continue past this switch along rails 1 and 1^a. I will now assume that vehicle W enters section B—C. Relay R^C is immediately de-energized but relay F is still energized over its own front contact. If contact 25 is closed, no change will occur as device J passes device L. As the vehicle enters section A—B, relay R^B is de-energized, and as the vehicle enters section X—A, relay R^A becomes de-energized. Each of these track relays opens the circuit for winding 79, and so it is impossible for motor device M to be reversed and hence impossible to operate switch 13 while the vehicle is between points B and X.

If the engineman wishes to reverse the switch 13 he will see that contact 25 is open while device J is passing over device L. As a result, the decreased current through relay F allows this relay to become de-energized, thus supplying current of reverse polarity to winding 79 which thereupon causes reversal of switch 13 to set up the route into track D. As the vehicle leaves section B—C, the energization of relay R^C causes relay F to pick-up but this is not effective to restore switch 13 since the circuit for winding 79 is open at front contacts 30 and 37 of relay R^B. For a similar reason the switch cannot be restored while the vehicle is in section Z—A. As the vehicle passes the fouling point Z of track D, however, the resulting energization of track relay R^A completes the normal circuit for winding 79 which automatically restores the switch 13 to its normal position.

The same results may be obtained by means of the apparatus shown in Fig. 2. In the form of apparatus here illustrated, the vehicle carried device J is the same as before.

The trackway device L, however, is provided with two windings, one of which 10, is provided with a circuit similar to that provided for winding 10 of device L of Fig. 1 with the single exception that in Fig. 2 a source of direct current, as a battery P, is substituted for secondary 6 of transformer S of Fig. 1. In addition to winding 10, a second winding 42 is provided on element 23 of inductor device L, the circuit for which winding is from battery P, through wire 14, winding 42, wire 52, front contact 53 of relay F, and wire 19 to battery P. The switch operating apparatus has been omitted from this figure, but it is understood that it is controlled by contacts 27 and 39 of relay F exactly as in Fig. 1.

As inductor device J passes over device L, if contact 25 is open, the flux through the magnetic element 23 will be suddenly changed. As a result, an electromotive force will be induced in the winding 42, which will be applied to the terminals of the battery P. The parts are so disposed and proportioned that this induced electromotive force is opposite in direction to that applied to the circuit by battery P. As a result these two electromotive forces counteract each other and relay F becomes de-energized. If contact 25 is closed as the device J passes device L, the effect of the winding 11 is to oppose the passage of magnetic flux through element 24 and the flux then linking winding 42 will not induce a sufficiently high voltage in this winding to de-energize relay F.

Referring now to Fig. 3, the vehicle carried inductor device J is provided with a circuit including a winding 11, contact 25 and the secondary winding 8 of a transformer Y having a primary winding 9 constantly supplied with alternating energy from some suitable source, not shown in the drawings. The trackway inductor device L has a winding 10 whose terminals are connected with a relay Q. It is plain that as device J passes over device L, an electro-motive force will be induced in winding 10 if contact 25 is closed, but no such electro-motive force will be induced in this winding if contact 25 is open. The electro-motive force so generated causes relay Q to become momentarily energized, thereby closing a circuit for relay F which passes from battery P through wire 42, winding of relay F, wires 73 and 74, front contact 44 of relay Q, and wires 45 and 46, back to battery P. It will thus be seen that with the apparatus shown in Fig. 3 a vehicle entering the section B—C with contact 25 closed will de-energize relay R^c and momentarily energize relay F. This relay F is subsequently maintained in its energized condition by a stick circuit which passes from battery P, through wire 72, winding of relay F, wires 73 and 77, front contact 76 of relay F, wire 75, back contact 47 of track relay R^c, and wire 46 back to battery P. The relay F controls, by its contacts 27 and 39, the polarity of the current supplied to device M in a manner similar to that shown in Fig. 1 with the exception that the relay F is in Fig. 3 normally de-energized and therefore is operative to reverse switch 13 only when energized, whereas in Figs. 1 and 2 the switch 13 is reversed when relay F is de-energized. In Fig. 3, if contact 25 is not closed when device J passes device L, no energization of relay F results and consequently the switch 13 is not reversed.

In the apparatus illustrated in Fig. 4, the reference character 59 designates a contact rail or ramp located along the trackway adjacent the entrance end of section B—C and adapted to engage a contact shoe 58 carried on the vehicle. If, when shoe 58 is in contact with ramp 59, contact 25 is closed, current flows from battery P, through wires 54 and 55, rail 1^a of section B—C, the wheel 77 and axle 78 of the vehicle, wire 56, contact 25, wire 57, shoe 58, ramp 59, wires 60 and 61, winding of relay F, and wire 62 back to battery P, thus energizing relay F. Since relay R^c is already de-energized by the presence of the vehicle in section B—C, relay F is subsequently retained in its energized condition by current which flows from battery P, through wires 54 and 63, back contact 64 of track relay R^c, wire 65, front contact 66 of relay F, wire 67, front contact 68 of relay F, wire 69, back contact 7 of track relay R^c, wires 71 and 61, winding of relay F and wire 62 back to battery P. The motor device M is controlled over wires 38 and 29 in the same manner as in Fig. 3.

It should be particularly pointed out that the apparatus herein shown and described allows an engineman to operate a switch in advance of the vehicle without leaving his cab, and prevents further operation of this switch till the vehicle has passed the switch after which the switch is automatically returned to its normal conditions.

Although I have herein shown and described only a few forms of 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 switch controlling apparatus comprising a stretch of track provided with a switch, means located in the trackway and co-operating with apparatus located upon a vehicle to operate said switch, and means including a track rail circuit for preventing subsequent operation of said switch while said vehicle is between said trackway means and the switch.

2. In combination, a stretch of railway

track containing a switch, a track relay for said stretch, an auxiliary relay for controlling said switch, and means including vehicle carried means and said track relay for actuating said auxiliary relay.

3. In combination, a stretch of railway track containing a switch, a track relay for said stretch, an auxiliary relay for controlling said switch, manually controlled means on a vehicle, means controlled by said first means and by said track relay for energizing said auxiliary relay, and means for subsequently removing said track relay from the control of said auxiliary relay.

4. In combination, a stretch of railway track containing a switch, an inductor device located in the trackway, a relay for controlling said switch, means for energizing said relay, vehicle carried means adapted to co-operate with said inductor device to de-energize said relay, and means on the vehicle for preventing said co-operation.

5. In combination, a stretch of railway track containing a switch, an inductor device located in the trackway and comprising a paramagnetic core having a winding thereon, a track relay connected across the rails of said stretch, an auxiliary relay, a pick-up circuit for said auxiliary relay including said winding and a front contact of said track relay, a retaining circuit for said auxiliary relay omitting the said contact on the track relay but including a front contact on said auxiliary relay, means carried on a vehicle for at times co-operating with said inductor device to decrease the current through the winding thereon, and means controlled by such auxiliary relay for actuating said switch.

6. In combination, a first, a second, and a third section of railway track, a switch for said third section, a track relay for each said section, an inductor device located in the trackway adjacent said first section, an auxiliary relay associated with said device, means controlled by said auxiliary relay and said track relays for actuating said switch, and vehicle carried means arranged to co-operate with said device to operate said auxiliary relay.

7. In combination, a first, a second, and a third section of railway track, a switch for said third section, a track relay for each said section, an auxiliary relay located in the trackway, vehicle carried means for operating said auxiliary relay, and means controlled by said auxiliary relay and said track relays for actuating said switch.

8. In combination, a stretch of railway track provided with a switch, an inductor device located in the trackway, vehicle carried means adapted to co-operate with said device to operate said switch when the vehicle approaches said switch, and means for preventing subsequent operation of such switch till the vehicle has passed out of the stretch.

9. In combination, a section of railway track, a switch in said section, trackway means, means on a vehicle for co-operating with said trackway means to operate said switch as the vehicle approaches said switch, manually operable means for controlling such co-operation, and means including a track rail circuit for subsequently preventing operation of said switch while the vehicle is in said section.

10. In combination, a stretch of track provided with a switch, a track relay for said stretch, an auxiliary relay for controlling said switch, a trackway device for controlling said auxiliary relay, vehicle carried means for controlling said trackway device, and means controlled by said track relay for subsequently controlling said auxiliary relay.

11. In combination, a stretch of railway track containing a switch, operating mechanism for said switch responsive to the relative polarity of the energy supplied thereto, track circuits for said stretch including a track relay, trackway means controlled by said track relay for supplying said operating mechanism with energy of one relative polarity or the other, and vehicle carried means for controlling said trackway means.

12. In combination, a stretch of railway track containing a switch, capable of assuming two extreme positions, operating mechanism for moving said switch to one or the other of such extreme positions in accordance with the relative polarity of the energy supplied to such mechanism, track circuits for said stretch including a track relay, means located in the trackway and controlled by said track relay for supplying said mechanism with energy of one relative polarity or the other, and vehicle carried means for controlling said trackway means.

13. In a switching system, the combination of a trackway system including a main track and a switch leading into a diverging route, a power operated switch machine for operating said switch into either the closed or the open position, and means for controlling said switch machine comprising car carried apparatus acting on trackway means through an intervening air gap and effective to operate said switch machine to the open position if a car carried circuit is closed and trackway means including a circuit through a certain section of the track rails of said main trackway effective to prevent said operation of said switch machine to the open position if said section is occupied.

14. In a switching system for railways in combination with a trackway system including a main track and a diverging route connected thereto through a track switch, a power operated switch machine for operating said switch, a trackway circuit for controlling the operation of said switch machine and

manually controllable car carried means for inducing currents in said circuit to control the operation of said switch from a moving vehicle.

15. In a switching system, the combination of a railway track having a switch leading into a diverging route, a power operated switch machine for operating said switch to either the closed or the open position, means for controlling said switch machine effective to operate such switch to the open position if a manually operable device located on the switching locomotive is operated and a certain track section is occupied, provided a certain other track section is not occupied and effective to again close said switch when said certain other track section is again unoccupied.

16. In combination, a section of railway track containing a switch, a track circuit including a track relay for said section, means controlled from a car approaching said section for operating said switch, and means for preventing operation of said switch by an approaching car if said track relay is open.

17. In combination, a section of railway track containing a switch, means controlled from a car approaching said section for operating said switch, and means for preventing operation of said switch by an approaching car if said section is occupied.

18. In combination, a section of railway track containing a switch normally set for traffic on a main track, means controlled from a car approaching said section for reversing said switch to permit the car to enter another track, and means for preventing an approaching car from reversing said switch if said section is occupied.

19. In combination, a section of railway track containing a switch normally set for traffic on a main track, means controlled from a car approaching said section for reversing said switch to permit the car to enter another track, a track circuit including a track relay for said section, and means for preventing said switch being reversed by an approaching car if said relay is de-energized.

20. In combination, a stretch of railway track provided with a switch, a track relay connected across the rails of said stretch, an auxiliary relay located in the trackway, vehicle carried means for energizing said auxiliary relay, a second auxiliary relay, means controlled by said first auxiliary relay for energizing said second auxiliary relay, means controlled by said track relay for subsequently maintaining said second auxiliary relay in its energized condition, and means controlled by said second auxiliary relay for actuating said switch.

21. In combination, a stretch of railway track provided with a switch, a track relay connected across the rails of said stretch, an auxiliary relay located in the trackway, an inductor device located in the trackway and comprising a paramagnetic core having a winding thereon the terminals of such winding being connected with said auxiliary relay, a vehicle carried inductor device arranged to cooperate with said first device to induce an electromotive force in said winding, a second auxiliary relay controlled by said track relay and said first auxiliary relay, and means controlled by said second auxiliary relay for actuating said switch.

22. In combination, a stretch of railway track provided with a switch, a track relay connected across the rails of said stretch, an auxiliary relay located in the trackway, an inductor device located in the trackway and comprising a paramagnetic core having a winding thereon the terminals of such winding being connected with said auxiliary relay, a vehicle carried inductor device comprising a paramagnetic core provided with a winding and arranged to be placed in inductive relation with said first device when the vehicle approaches said switch, a circuit for such last mentioned winding including an energy source and a manually operable circuit controller, a second auxiliary relay controlled by said track relay and said first auxiliary relay, and means controlled by said second auxiliary relay for actuating said switch.

23. In combination, a stretch of railway track comprising a switch, a trackway device comprising a paramagnetic core, a relay, a first winding on said core; an electrical circuit including said winding, said relay and a source of energy; a second winding on said core connected in parallel with said source, vehicle carried means adapted to cooperate with said device to control said relay, and means controlled by said relay for operating said switch.

24. In combination, a stretch of railway track comprising a switch, a trackway device comprising a paramagnetic core, a relay, a first winding on said core; an electrical circuit including said winding, said relay and a source of energy, a second winding on said core connected in parallel with said source, vehicle carried means arranged to cooperate with said device to produce in said second winding an electromotive force opposite in direction to that applied by said source, and means controlled by said relay for operating said switch.

25. In combination, a stretch of railway track comprising a switch, operating mechanism for said switch, a trackway device comprising a paramagnetic core, a track relay for said stretch, an auxiliary relay for said stretch, a winding on said core; an electrical circuit including said winding, said auxiliary relay, a contact operated by said track relay, and a source of energy; a contact operated by said auxiliary relay for at times

removing said track relay from the control of such circuit, a second winding on said core connected in parallel with said source, vehicle carried means arranged to cooperate with said device to produce in said second winding an electromotive force opposite in direction to that applied by said source, and means controlled by said relay for actuating said mechanism.

26. In combination, a stretch of track provided with a switch, operating mechanism for said switch, a trackway ramp, a train carried contact shoe adapted to engage said ramp, a track relay for said stretch, an auxiliary relay for said stretch; an electrical circuit including said shoe, said ramp, a manually operable contact, said auxiliary relay and an energy source; means controlled by said track relay and operative only when said auxiliary relay is de-energized for maintaining such auxiliary relay in its energized condition, and means controlled by said auxiliary relay for actuating said mechanism.

In testimony whereof I affix my signature.

BERTRAM R. PADMORE.