March 31, 1925. 1,531,574

A. L. RUTHVEN

SIMPLEX TRAIN CONTROL

Filed June 26, 1922 2 Sheets-Sheet 1

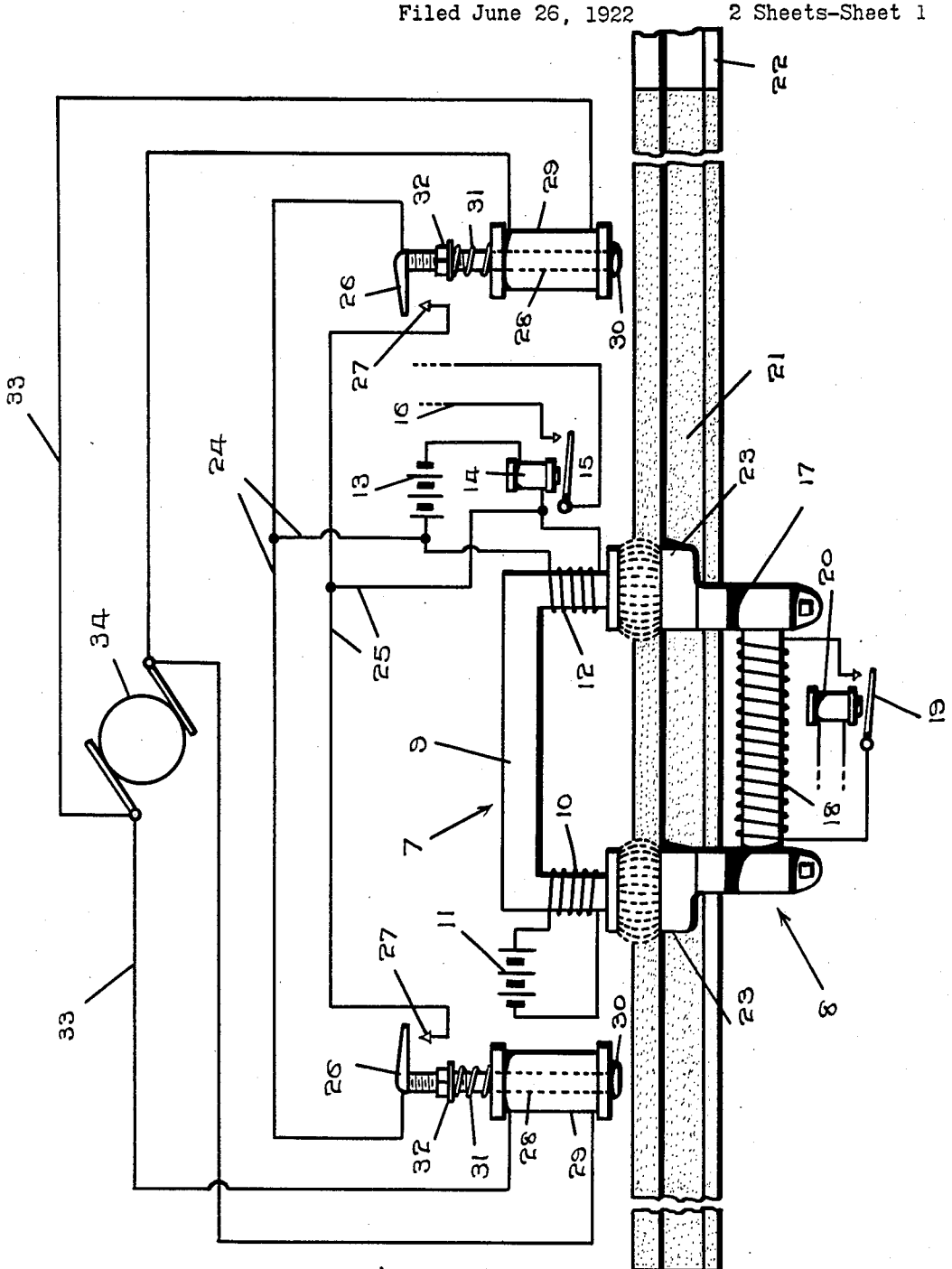


FIG. 1.

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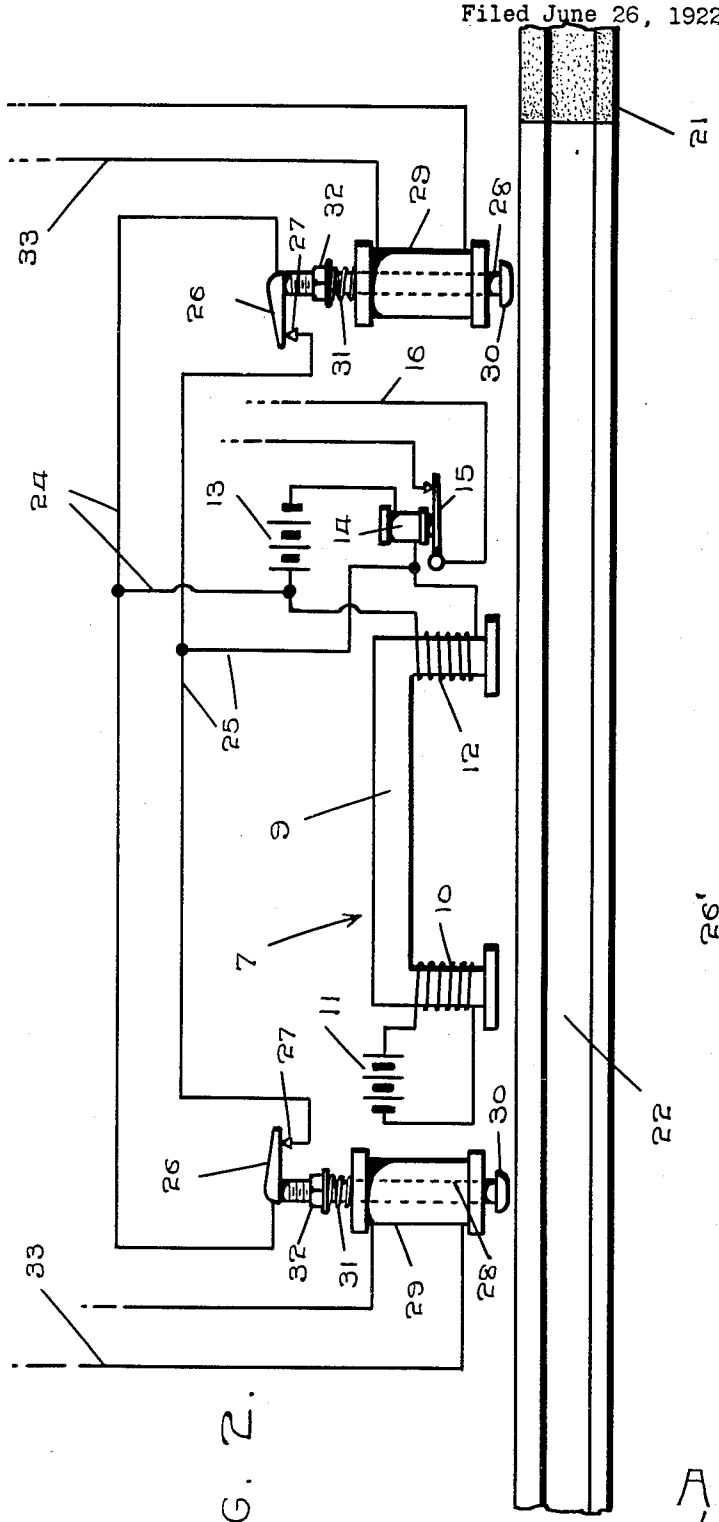


FIG. 2.

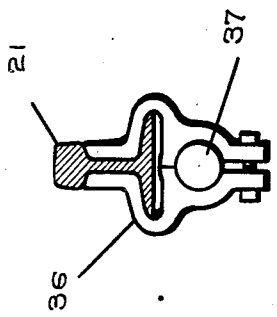


FIG. 4.

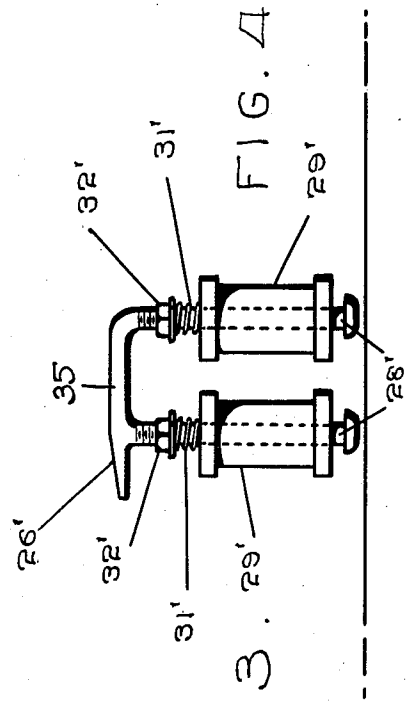


FIG. 3.

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Patented Mar. 31, 1925. 1,531,574

UNITED STATES PATENT OFFICE.

ALFRED L. RUTHVEN, OF ROCHESTER, NEW YORK.

SIMPLEX TRAIN CONTROL.

Application filed June 26, 1922. Serial No. 571,064.

To all whom it may concern:

Be it known that I, ALFRED L. RUTHVEN, a citizen of United States, residing at Rochester, in the county of Monroe and State of New York, have invented certain new and useful Improvements in Simplex Train Controls, of which the following is a specification, reference being had therein to the accompanying drawing.

The present invention relates to apparatus for transmitting impulses from a track or road-bed to a moving train or vehicle for the purpose of controlling the vehicle, and an object of the invention is the provision of such apparatus using the induction principle wherein the inductor on the road-bed or track, instead of being spaced from the rails of the track so as to involve clearance problems and other difficulties, is associated directly with one rail of the track, thereby eliminating all clearance problems and objectionable obstructions on the roadway, the receiver on the vehicle being capable of moving directly over the rail so as to be protected by the wheels of the vehicle and not apt to be knocked off or damaged by obstructions on the road-bed or adjacent to the track.

By the provision of a non-magnetic section in a rail of the track at the controlling station, the inductor may be associated directly with and supported from said non-magnetic rail section, and the receiver on the vehicle can move directly over the rail, instead of at one side thereof, and clearance problems and track obstructions are thus not only avoided, but the non-magnetic section of rail is utilized for bringing the inductive devices into action at the controlling station only, so as to avoid false operations of the vehicle equipment in passing over iron and steel bridges, crossings or other magnetic objects, which has been a serious difficulty with induction train control devices.

With the foregoing and other objects in view, which will be apparent as the description proceeds, the invention resides in the construction and arrangement of parts, as hereinafter described and claimed, it being understood that changes can be made within the scope of what is claimed, without departing from the spirit of the invention.

The invention is illustrated in the accompanying drawings, wherein—

Figure 1 is a diagrammatical view of the apparatus with the vehicle at a controlling station or point of the track.

Fig. 2 is a diagrammatical view of the vehicle equipment, portions being omitted, showing the same as when passing between the controlling stations.

Fig. 3 is an elevation of a modified form of rail-responsive magnet.

Fig. 4 is an end view of the inductor, showing the rail in section.

The apparatus embodies a vehicle carried receiver 7 to move, in inductive relation, past an inductor 8 on the track. The receiver 7 includes a core 9 of magnetic material whose end portions or legs are directed downwardly, as shown, and a winding or coil 10 is disposed on one leg or end portion of the core and is connected in circuit with the battery 11 or other source of electrical energy. A second coil or winding 12 is disposed on the other leg or end portion of the core and is connected in circuit with the battery 13 or other source of electrical current and an electromagnet or relay 14. The magnet 14 being energized by the battery 13 in the circuit of the coil 12 will attract an armature switch 15 to close a circuit 16 which controls the vehicle or such means (not shown) which will retard or stop the vehicle when the switch 15 is opened. The inductor 8 includes a magnetic core 17 on the intermediate or yoke portion of which is disposed the coke coil or winding 18 disposed in the circuit with the switch 19 controlled by an electromagnet or relay 20, which may form a part of the automatic block signal system.

The inductor and receiver as above described are well known and recognized in the prior art, and no claim to them per se is made. The cooperation of the inductor and receiver is also well known, but briefly described is as follows: The magnetic flux created in the core 9 and between the terminals or pole faces thereof, is greater than the opposing flux created by the coil 12, but the tendency for the magnetic flux flowing in the coil 10 to induce a current in the coil 12 and its circuit opposing the battery 13 is not felt by the magnet 14 when the receiver

is inactive or away from a magnetic object between the terminals of the core 9. Considering the operation of the inductor and receiver, without reference to the remainder of the apparatus, not yet described, current from the battery 13 flows through the magnet 14 and coil 12 and the magnet 14 is energized to keep the switch 15 closed. When the receiver passes over the inductor, with the switch 19 open, the magnetic flux of the receiver, instead of following the air gap between the ends of the core 9, will pass through the core 17 of the inductor (the choke coil 18 being inactive), thereby causing a large change of magnetic flux within the coil 12, which will result in a sufficient reduction in the current flowing through the magnet 14 to release the switch 15 and open the circuit 16. Ordinarily, when the receiver is away from the inductor, the flow of current through the magnet 14 is steady, but when the receiver passes over the inductor with the switch 19 open, the change in induction in the receiver will result in the magnetic flux created by the coils 10 and 12 being so changed as to influence the magnet 14 in releasing the switch 15. This change in magnetic flux is due to the fact that when the core 9 registers with the core 17, the magnetic flux created by the coil 10 has a freer path through the core 17 than through the air, and the sudden flow of the flux from the coil 10 through the cores 9 and 17, will induce current in the coil 12 opposing the battery 13, whereby the current flowing in the magnet 14 is reduced sufficiently to release the switch 15. However, when the switch 19 is closed to connect the choke coil 18 in a completed circuit, a choking effect is obtained when the receiver passes over the inductor, to offset the tendency for the magnetic flux to be changed as when passing over the inductor with the switch 19 open. Consequently, when said switch is closed, the choking action of the coil 18 impedes the flow of magnetic flux through the core of the inductor, whereby the current flowing through the coil 12 and magnet 14 is not disturbed sufficiently to release the switch 15, thereby keeping said switch closed when passing the controlling station.

Such an inductive device has been suggested and used by being located at one side of the track, involving the objectionable clearance problems, an obstruction on the road-bed or track which is undesirable, and a device suspended from the vehicle which is apt to be knocked off or damaged by obstructions on the road-bed or track. Furthermore, if the receiver is not rendered inactive when passing between controlling stations, the magnet 14 is apt to be deenergized sufficiently, in passing over iron and steel bridges and other magnetic objects, for releasing the switch 15 when not so intended, thus producing an undesirable stopping of the vehicle.

The present invention involves an arrangement for avoiding the above-mentioned objections, by the use of a section 21 of non-magnetic material in one traffic rail 22 of the track at each controlling station where one of the inductors is located. By using such non-magnetic rail section several decided advantages are obtained. In the first place, the inductor can be assembled or associated directly with the rail, instead of being spaced from the rail, thus dispensing at once with an undesirable obstruction on the track and clearance problems. The inductor can be supported or suspended from the non-magnetic rail section 21 with the choke coil under the rail and the pole or terminal portions 23 of the core 17 disposed at the sides of the rail section directly under the tread or head of the rail. The inductor can thus be conveniently assembled with and supported from the non-magnetic rail section, underneath same, so as to be out of the way and protected from damage or injury. This arrangement of the inductor also enables the receiver to be disposed directly over the rail, instead of at one side of the track, and several advantages are thus obtained. Thus, the receiver can be located between wheels of the vehicle to be protected and shielded thereby, so that the receiver is not apt to strike obstructions on the track, as would be the case if the receiver were suspended from the vehicle at a distance from the rail. Again, the receiver may be supported closely adjacent to the rail, thereby providing a definite spaced relation of the receiver with reference to the inductor, to obtain uniform action in the coil 12 and circuit thereof when passing the inductors. The location of the inductor under or adjacent to the rail is therefore of considerable advantage; the location of the receiver directly over the rail is also of advantage; and the use of the non-magnetic rail section is of still further advantage in enabling the receiver to be active only when passing a controlling station so as not to be affected when passing over iron and steel bridges and other magnetic objects between controlling stations, as will presently appear.

In order to render the control of the magnet 14 from the coil 12 ineffective when passing between controlling stations, with the receiver 7 over the magnetic portion of the rail 22, and to bring the magnet 14 under control only when passing a controlling station, conductors or wires 24 and 25 are connected to the portions of the circuit of the magnet 14 between the coil 12 and the battery 13 and magnet 14, for shunting the coil 12 and keeping the magnet 14 energized without regard to conditions of magnetic flux with reference to the coil 12.

The conductor 24 is connected to switches 26 and the conductor 25 is connected to contacts 27 against which the switches normally engage when travelling between controlling stations, whereby a shunt is closed so that current from the battery 13 through the shunt keeps the magnet 14 energized irrespective of changes in magnetic flux in the core 9 or coil 12. As a means for keeping the switches 26 closed when travelling between controlling stations, and to open said switches when passing a controlling station, rail responsive means are employed to be controlled by the magnetic and non-magnetic portions of the rail. Thus, the switches are carried, as shown, by the upper ends of slidable vertical cores 28 of solenoids 29, and said cores have pole faces or heads 30 at their lower ends located close above the rail. Coiled wire springs 31 surround the cores and are confined between the solenoids 29 and adjusting nuts 32 threaded on the cores above the solenoids, for raising the cores and opening the switches 26 when the magnetic attraction of the cores 28 to the rail is lost. The heads 30 in contacting with the lower ends of the solenoids will provide stops for limiting the upward movement of the cores, and other means than the springs 31 can be used for raising the cores, as will be apparent to those skilled in the art. The solenoids or electromagnetic devices 29 are connected in the circuits 33 with the electrical generator 34 or other source of electrical energy, for keeping said solenoids energized at all times. When the vehicle is travelling between controlling stations, the magnetic flux in the cores 28 created by the windings of the solenoids 29 will attract said cores to the magnetic portion of the rail, thereby holding the switches 26 closed against the tension of the springs 31 or other switch-opening means. However, when passing a controlling station, the solenoids 29 in moving over the non-magnetic rail section 21 will result in the magnetic attraction of the cores 28 to the rail being lost, so that the springs or means 31 will assert themselves and lift the cores 28 for opening the switches 26. In this way, the shunt of the circuit of the magnet 14 is opened, when passing a controlling station, so that the control of the magnet 14 is now had from the coil 12.

The two rail-responsive devices are used in order that they may pass over non-magnetic crossings, switch points, and the like, without both switches 26 being opened simultaneously excepting when passing over a non-magnetic rail section 21. The vehicle equipment can thus pass over non-magnetic crossings, switch points, and the like, and even though one of the cores 28 is released for a moment to open the corresponding switch 26, both of the switches 26 must be opened simultaneously, as when passing over the non-magnetic rail section 21, in order to completely open the shunt. Such rail responsive devices are so arranged that both of them will not simultaneously pass over non-magnetic portions of the rail excepting when passing over the rail sections 21, thereby keeping the shunt closed even when passing over other non-magnetic portions of the rail at crossings, switches, and the like.

The operation of the apparatus is as follows: When the vehicle is passing through a block between controlling stations, the cores 28 are attracted down to the magnetic portion of the rail, thereby closing the switches 26 and the shunt of the circuit of the magnet 14 whereby said magnet is kept energized regardless of magnetic induction in the coil 12. In other words, the coil 12 is shunted out of control of the magnet when the vehicle is travelling between controlling stations, so that even though the receiver is passing over the magnetic portion of the rail, crossings, switches, iron and steel bridges, or other magnetic objects, the magnet 14 remains unaffected and keeps the switch 15 closed. Even though either one of the cores 28 is momentarily released in passing over a non-magnetic crossing, switch point, or the like, the shunt is kept closed by the other switch 26. When the vehicle passes the controlling station, the solenoids 29 passing over the non-magnetic rail section 21, will result in the cores 28 being released from the rail and the switches 26 opened. The magnet 14 is then under control by the coil 12, and if the switch 19 is open, as seen in Fig. 1, with the receiver 7 passing over the inductor 8, the magnetic flux flowing through the core 17 will result in the magnet 14 being influenced from the coil 12 to release the switch 15, whereby the opened switch 19 is signaled to the vehicle equipment by the opening of the switch 15, producing danger or vehicle retarding conditions through the translating devices (not shown) in the circuit 16. However, if the magnet 20 is energized and the switch 19 closed, the choking effect of the coil 18 will sufficiently offset the change in magnetic flux, when the receiver passes over the inductor, to keep the magnet 14 from releasing the switch 15, thereby maintaining clear conditions. As soon as the vehicle leaves the controlling station, the reattraction of one or both cores 28 to the magnetic portion of the rail will close the shunt thereby taking the control of the magnet 14 away from the coil 12 again until the next controlling station is reached.

The advantages gained by the present arrangement, in addition to the elimination of contact devices or means between the track and vehicle are, first, the entire elimination

of clearance problems; second, the elimination of any objectionable obstruction on the track or road-bed by placing the track device under the rail or out of the way; third, the elimination of possible damage or injury to the vehicle carried receiver by placing it over the rail to be protected by the wheels; fourth, the association of the cooperable track and vehicle devices with a rail to obtain close, uniform cooperation thereof; and fifth, the elimination of false indications or conditions by rendering the receiver ineffective excepting at the controlling stations. The present apparatus also retains the several advantages of the inductive controlling devices, as well known, while, at the same time, eliminating some of the most serious objections thereto.

In Fig. 3 there is shown a modified form of rail responsive device or magnet, including a pair of solenoids 29′, the cores 28′ of which are connected by a yoke 35, which carries the controlling switch 26′. Each core 28′ is lifted by a spring 31′ bearing upwardly against the nut 32′ on the core. Thus, a U-shaped core member for the two coils or windings is provided, to increase the magnetic attraction to the rail by presenting the opposite poles of the core member close to the rail. One of the devices shown in Fig. 3 is used in lieu of each of the rail-responsive devices shown in Figs. 1 and 2.

In Fig. 4 there is illustrated an end view of the preferred form of construction of the core of the inductor. The end members or portions of the core are so formed as to extend around the base flange of the rail and upwardly at the opposite sides of the web, with the terminals directed upwardly under and close adjacent to the head or tread of the rail, to bring the poles of the inductor core close to the tread surface of the rail. Said end members of the core are preferably split or divided to be readily positioned at the opposite sides of the rail, and to embrace the end portions of the yoke or intermediate member 37 of the core on which the choke coil is wound thereby providing a simple and convenient assembly of the parts with one another and with the rail.

Having thus described the invention, what is claimed as new is:—

1. Vehicle controlling apparatus including an inductor on the track at each control station, a vehicle carried receiver inductively responsive to the inductor when passing a control station, controlling means controlled by said receiver, and means operable for preventing the controlling means being affected by the receiver due to stray inductive influences on the receiver when the vehicle is moving between or beyond control stations and operative to release the controlling means for control by the receiver when passing a control station.

2. Vehicle controlling apparatus including a vehicle carried receiver adapted to be affected when passing magnetic objects on the track, controlling means controlled by said receiver, an inductor on the track at each control station to affect said receiver, and means for preventing the controlling means being affected by the receiver when the vehicle is moving between or beyond control stations and operable for releasing the controlling means for control by the receiver when passing a control station.

3. Vehicle controlling apparatus including an inductor on the track, a vehicle carried receiver inductively responsive to said inductor and including a coil, an electrical device connected in circuit with said coil to be controlled by said coil, and means under normal control from the track for shunting said coil and preventing said device being controlled by the coil but released when the receiver is passing the inductor to open the shunt.

4. Vehicle controlling apparatus including an inductor on the track, a vehicle carried receiver inductively responsive to the inductor, means controlled by the receiver, a non-magnetic section in a rail of the track, and means magnetically responsive to such rail and released when passing the non-magnetic section, the lastnamed means controlling the aforesaid means to prevent the firstnamed means being controlled by the receiver excepting when the receiver is passing the inductor and the lastnamed means is passing the non-magnetic rail section.

5. Vehicle controlling apparatus including an inductor on the track, a receiver carried by the vehicle inductively responsive to the inductor, means controlled by the receiver, a non-magnetic section in a rail of the track, magnetic means carried by the vehicle responsive to the magnetic portions of the rail and adapted to be released when passing the non-magnetic rail section, and an operative connection between the magnetic means and firstnamed means to prevent the firstnamed means being controlled by the receiver excepting when the receiver is passing the inductor with the magnetic means passing the non-magnetic rail section.

6. Vehicle controlling apparatus including an inductor on the track, a vehicle carried receiver inductively responsive to said inductor and including a coil, translating means controlled by said coil, a non-magnetic section in a rail of the track, and means controlling said translating means and magnetically responsive to said rail, the lastnamed means being released when passing the non-magnetic rail section and being arranged to prevent the control of the translating means by said coil excepting when the lastnamed means is passing the non-magnetic rail section.

7. Vehicle controlling apparatus including an inductor on the track, a vehicle carried receiver inductively responsive to the inductor and having a coil, an electrical device in circuit with said coil, a non-magnetic section in the rail of the track, and means magnetically responsive to said rail for shunting said coil and preventing control of said electrical device by the coil, the last-named means being released from magnetic relation with the rail when passing the non-magnetic rail section for opening the shunt and obtaining control of said electrical device from the coil when the receiver passes the inductor.

8. Vehicle controlling apparatus including an inductor on the track, a vehicle carried receiver inductively responsive to the inductor, a non-magnetic section in a rail of the track, a plurality of devices magnetically responsive to the rail and simultaneonusly released when passing the non-magnetic rail section, and means whereby the response of one or more of said devices to the rail prevents said receiver from functioning.

9. Vehicle controlling apparatus including an inductor on the track, a vehicle carried receiver inductively responsive to the inductor, means controlled by the receiver, a non-magnetic section in a rail of the track, a plurality of devices magnetically responsive to the rail and simultaneously released when passing the non-magnetic rail section, and means arranged for preventing the control of the firstnamed means by the receiver when one or more of said devices is in magnetc response to the rail.

10. Vehicle controlling apparatus including a non-magnetic section in a rail of the track, an inductor associated with said non-magnetic rail section, a vehicle carried receiver movable over the rail and inductively responsive to the inductor, means controlled by the receiver, and means having a magnetic relation with the rail for preventing the control of said means from the receiver excepting when pasing said non-magnetic rail section.

11. Vehicle controlling apparatus including a non-megnetic section in a rail of the track, an inductor associated with said non-magnetic rail section, a vehicle carried receiver movable over the rail and inductively responsive to said inductor, said receiver including a coil, an electrical device in circuit with said coil, a shunt for said circuit to prevent control of said device, and means magnetically responsive to the rail for keeping the shunt closed but released when passing the non-magnetic section of the rail for opening the shunt.

12. Vehicle controlling apparatus including a pair of solenoids to be carried by a vehicle and moved along a rail of the track, a U-shaped core having its limbs slidable in said solenoids toward and away from the rail to complete a magnetic circuit with the rail, means for moving said core away from the rail when passing a non-magnetic section in the rail, and means controlled by the movement of said core.

13. Vehicle controlling apparatus including vehicle carried impulse receiving means, means at each control station of the track for affecting said receiving means, controlling means controlled by said receiving means, and means operable for preventing the controlling means being affected by the receiving means due to the presence of other objects or means on the track of a character to affect the receiving means when the vehicle is moving between or beyond control stations and operable to release the controlling means for control by the receiving means when passing a control station.

14. Vehicle controlling apparatus including vehicle carried impulse receiving means, means on the track at each control station for affecting said receiving means, controlling means controlled by said receiving means, vehicle-carried means having a magnetic relation with the track for preventing the controlling means being affected by the receiving means, and the track having a non-magnetic section at each control station for interrupting said magnetic relation so as to establish control of said controlling means by the receiving means when passing the control station.

15. Vehicle controlling apparatus including vehicle carried impulse receiving means, means having a cooperable relation with the track between and beyond control stations of the track to prevent the effect of the receiving means being transmitted, and means at each control station for affecting said receiving means while the secondnamed means is inactive.

16. Vehicle controlling apparatus including vehicle carried impulse receiving means, means having a magnetic relation with the track for preventing the effect of the receiving means being transmitted when the vehicle is moving between or beyond control stations of the track, a non-magnetic section in the track at each control station to interrupt said magnetic relation so that the receiving means is effective for transmitting the effect thereof, and means at each control station for affecting said receiving means.

In testimony whereof I hereunto affix my signature.

ALFRED L. RUTHVEN.