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TRAIN CONTROL SYSTEM

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This invention relates to train control systems, and has special reference to the provision of an improved train control system of the induction type.

A prime object of my present invention relates to the provision of a train control system of the induction type embodying cooperating vehicle carried and roadside inductors in which an activating condition may be produced in the vehicle carried inductor to effect some active operation of the train control apparatus by the movement or positioning of said vehicle carried inductor relatively to a roadside inductor which embodies circuit control means devoid of an energy source.

In prior induction train control systems of which I am aware, an activating operation of the vehicle carried circuits was produced by the transmission of some energizing influence from the roadside inductor to the vehicle carried inductor obtained by energizing the roadside inductor either directly by means of a source of energy located on the roadside or indirectly by locating the source of energy on the moving vehicle and reflexing or retransferring said energy through cooperating vehicle carried and roadside inductors from the vehicle to and through the roadside inductors and back to the vehicle apparatus. By my present invention I propose to eliminate the principal objections to these systems of prior design; which objections have their origin either in the necessity of using roadside energy for the roadside inductors or in the necessity of using a multiplicity of inductors for reflexing energy where the energy source is located on the vehicle.

A corollary prime object of my present invention relates to the provision of an improved induction train control system in which a single roadside inductor may be employed and selectively operated to produce in a vehicle carried inductor means a number of operations corresponding to the conditions of the roadside, which operations comprise the production of a condition in the vehicle carried inductor means to produce a tripping or train control stopping operation in the train control apparatus or/and a condition in the vehicle carried inductor means to permit a passive state in the vehicle carried apparatus, that is, to permit the vehicle to pass a roadside controlling station without any modifying operation being produced in the vehicle carried apparatus, combined with a third condition producible in the vehicle carried inductor means for effecting some other operation therein in response, for example, to a "clear" or "caution" roadside condition. A further prime object of my present invention relates to the provision of an induction system of this character in which the third condition may be employed for resetting the vehicle

carried apparatus, and in which the "clear" or "caution" operating conditions in the vehicle carried apparatus may be produced by means of a roadside inductor devoid of a source of energy, the results attained being therefore capable of being produced with the use of a single inductor controlled by circuit means without using or employing a roadside energy source for the inductors.

Other principal objects of my invention will become evident as the description proceeds, and to the accomplishment of the foregoing and such other objects as will hereinafter appear, my invention consists in the elements and their relation one to the other in circuit combinations as hereinafter more particularly described and sought to be defined in the claims; reference being had to the accompanying drawings which show the preferred embodiment of my invention, and in which:

Fig. 1 is a wiring diagrammatic view of cooperating vehicle carried and roadside inductive apparatus embodying the principles of my invention.

Fig. 2 is a wiring diagrammatic view showing a modified form thereof, and

Fig. 3 is a view of a graph showing the operating characteristics and exemplifying the underlying principles of the system of my invention.

Referring now more in detail to the drawings and having reference first to Fig. 1 thereof, I show my invention applied to a train control system having a vehicle carried inductor means of the type disclosed in the copending application of A. G. Shaver, Serial No. 506,595, filed Oct. 10, 1921, now matured into U. S. Patent No. 1,738,736 granted Dec. 10, 1929, which comprises inductively coupled coils consisting of a primary coil P and a secondary coil S inductively coupled thereto for the transmission of flux from the primary to the secondary coil, the said primary coil being arranged in a primary circuit *a* designated by the legend "Primary" in Fig. 1, which circuit is connected to the mains 10 and 11 of an alternating current source of energy such as the generator G, and the said secondary coil being arranged in a secondary circuit *b* also designated in the drawings by the legend "Secondary." Both primary and secondary coils P and S are preferably wound on cores 12 and 13 which are preferably laminated and the primary P is preferably provided with a section 14 coiled over the secondary coil S in opposite sense thereto so as to act in bucking or opposing relation thereto for the purpose of neutralizing the flux under certain conditions, as described and claimed in the patent to A. G. Shaver No. 1,521,332 of Dec. 30, 1924.

The vehicle carried coupled coil combination P—S is employed for normally energizing a ve-

hicle carried translating device such as a relay R which, as shown in Fig. 1 of the drawings, preferably is of the form of a two-element relay having a field coil r^1 and an armature coil r^2 , the said field coil r^1 being connected to the generator G by means of the conductors 10 and 11 and the said armature coil r^2 being connected directly in the secondary circuit b . The armature r^2 is provided with a movable circuit controlling member 15 for selectively operating a contact mechanism generally designated as C for in turn selectively controlling the train control circuits to be described hereinafter.

As disclosed in the aforementioned copending application of A. G. Shaver, Serial No. 506,595 of 1921, now matured into U. S. Patent No. 1,738,736 granted Dec. 10, 1929 the vehicle carried transformer combination P—S operates to normally energize the relay R by the transmission of sufficient flux from the primary P to the secondary S to effectively energize the relay coil r^2 of the relay R. When, however, the coupled coil combination P—S moves over in proximity to an inert roadside element, the flux from the primary P is diverted to and through the roadside inert element and shunted from the secondary coil S in a degree sufficient to effectively deenergize the relay R. When the relay R is energized under the first or normal condition of the inductively coupled coils P and S, the circuit controlling member 15 thereof assumes a normal position, such as shown in full lines in Fig. 1 of the drawings, which position is indicated as x , and when the relay is effectively deenergized by the shunting of the secondary, the circuit controlling member 15 of the relay moves to a neutral position such as indicated by the dotted line position y . In the operation of this system it is also known that when the roadside inert element is provided with an energyless circuit, the said circuit may be closed to permit the vehicle carried inductor means to pass the roadside inductor (on closed circuit) without any substantial diversion or shunting of the flux from the secondary S and hence without modifying the operation of the relay R, the circuit controlling member 15 thereof being maintained in the normal or full-line position x . By this means it is possible to control the roadside inductor either to produce an effective deenergization of the vehicle carried translating device or relay to trip the vehicle carried apparatus, or to permit the vehicle carried apparatus to pass the roadside station unaffected so as to prevent or inhibit the tripping operation from taking place.

I have discovered that in a system of this character, another activating influence can be produced in the vehicle carried conductors and apparatus by the employment of a roadside circuit devoid of any energy source. More particularly, I have empirically found that by employing an inert or energyless roadside circuit of given characteristics, a torque may be produced in the relay R which is substantially greater than the normal torque thereof due to the normal transmission of flux from the primary coil P to the secondary coil S. This increase of torque in the relay R may be employed for producing a third condition or positioning thereof, which third condition may be utilized either for effecting the production of another indication in the vehicle carried apparatus, such as an indication in response to a "caution" roadside condition, or for effecting a resetting operation of the tripped vehicle carried apparatus.

These results I have found capable of being accomplished by the use of a tuned or resonant inert roadside circuit controlling the roadside inductor, and to these ends my invention contemplates the provision of a track or roadside inductor means T embodying an inductor track coil t wound on a core 16 which preferably is laminated, the said coil t being controlled by a circuit d devoid of an energy source, which circuit is tuned or made resonant by means of a condenser K connected in series with the track coil t . The said circuit is also provided with a switch member 17 movable into the "clear", "caution" and "danger" positions shown in Fig. 1 of the drawings by being connected to a semaphore signalling apparatus 18 or equivalent means associated with the insulated track sections or blocks 19 and 20 of a block signalling system. When the vehicle carried inductor combination P—S is positioned or moves over the track inductor T when the tuned or resonant circuit d is closed, an increase over the normal torque of the relay R is produced which is utilized to move the circuit controlling member 15 of the relay to a third position z indicated in dotted lines in Fig. 1 of the drawings. This increase of torque I believe is due to an increase in the driving E. M. F. in the secondary coil S, such increase in driving E. M. F. being in turn due to a strong counter magneto-motive force set up by the tuned track inductor which opposes the poles of the primary inductor P and hence constrains or forces a part of the flux of the primary P away from the roadside inductor and consequently confines the magnetic field of the vehicle carried inductor more closely to its own vicinity and thereby tends to increase the flux through the secondary winding. When the roadside inductor circuit d is opened, as under "caution" or "danger" track conditions, the inert core 16 of the track inductor T diverts or shunts the flux from the secondary S as heretofore described, and therefore it will be seen that the roadside circuit d is operative to selectively diminish or increase the flux transmission from the primary coil P to the secondary coil S of the vehicle carried inductor means, the opening of the track circuit d causing a shunting or diversion of flux from the secondary, while the closing of said tuned circuit d causes a concentration or increase of flux through the secondary S, such increase operating the relay R to its third position z .

In Fig. 3 of the drawings, I have shown a graph which depicts these characteristic operations of the vehicle carried and roadside inductors. In this graph the ordinates represent the torque effective on the relay R, while the abscissae represent the movement of the vehicle inductor means over the track inductor, the latter being shown on the graph. Normally a torque is produced in the relay R represented by the curve XX corresponding to the position x of the relay armature r^2 . Under "danger" roadside conditions when the tuned circuit d is opened to produce the deenergization of the relay R, the torque curve drops and is represented by the curve XOYOX when the train-carried and track inductoria are in co-operative relation. When, however, the vehicle inductor cooperates with the track inductor on closed tuned circuit, the torque of the relay increases as shown by the curve XZX. This phenomenon may be contrasted with that produced by an untuned track circuit, for with the use of an untuned track circuit the torque of the relay slightly decreases when the untuned track cir-

cuit is closed as represented by the dotted line curve M in the graph.

It will now be apparent that the three operating conditions of the relay R may be employed for producing different operations in train control circuits, and I show the invention applied to a system in which two active operations may be produced for tripping or resetting the vehicle carried circuits and a third operation may be produced in which the vehicle carried circuits may pass the control circuits without changing or affecting the ultimate operation of the vehicle carried circuits, which third operation may therefore be described as an inactive or passive operation.

The controlled vehicle carried circuit comprises a relay 21 having a stick contact 22 arranged in an energizing circuit normally closed by the x position of the armature 15 of the relay R, which circuit may be traced from the D. C. energy source 23, conductor 24, contacts 25 normally closed by the element 15 of relay R, conductor 26, relay coil 21, conductor 27, stick contact 22 and conductor 28 back to the energy source 23. Under normal conditions this circuit is maintained in a closed or stick condition for energizing other vehicle carried apparatus.

When, as under "danger" roadside conditions, the relay R is effectively deenergized to move its contact controlling member 15 to the position y , the stick circuit to the relay 21 is opened and is maintained open due to the opening of the contact 22 although the relay R is returned to its position x after the vehicle inductor passes the roadside inductor.

Now under "clear" roadside conditions after the vehicle apparatus has been tripped, the cooperation between the vehicle carried and tuned roadside inductor circuit actuates the relay R to its position z for closing a second pair of contacts 29 which operates to reenergize the relay 21 by means of a circuit comprising the battery 23, conductor 24, the closed contacts 25, conductor 26, relay coil 21, conductor 30, closed contacts 29 and conductor 30' back to the energy source 23; and the relay 21 will therefore be energized to close its stick contact 22 for resetting the vehicle carried apparatus. After the vehicle inductor means passes the tuned roadside inductor, the relay R returns to its normal position x to open the contacts 29, but the control relay 21 is maintained in persisting energized condition due to the closing of its stick contact 22. The vehicle circuits will therefore be reenergized and will be maintained in reset condition until the next roadside station is reached.

For producing an increased efficiency in the relay R to make effective the increased torque thereof, I have found that the phases between the currents in the elements of the relay R should be predetermined, and I have discovered that the desired phase relationship may be obtained by the provision of a condenser 31 shunted by a resistance 32 both arranged in series with the field coil r' of the relay R. I have found that where the frequency employed is 60 cycles, the resistor 32 should have a resistance of about 80 ohms, while the condenser 30 should have a capacitance of about 62 microfarads. With these constants I have found that the tuned circuit d may be employed to produce a substantially maximum increase in the torque of the relay R.

Referring now to Fig. 2 of the drawings, I show a modified form of my invention in which the relay R' is made to comprise two armatures in

lieu of one, an armature coil r^3 being provided for controlling a contact 33 and a second armature coil r^4 being provided for controlling a second contact 34. The contact 33 of Fig. 2 corresponds to the contacts 25 of Fig. 1 and the contact 34 of Fig. 2 corresponds with the contacts 29 of Fig. 1, while the remaining parts of the vehicle carried inductor and train control apparatus shown in Fig. 2 are similar to that shown in Fig. 1 and are designated by corresponding reference characters.

The use and operation of the system embodying my invention and the numerous advantages thereof will in the main be apparent from the above detailed description thereof. It will be further apparent that while I have shown and described my invention in the preferred forms, many changes and modifications may be made in the structure disclosed without departing from the spirit of the invention, defined in the following claims.

I claim:

1. In combination, vehicle carried apparatus including a source of energy, a vehicle carried inductor means including inductively coupled coils operable through said source of energy for producing either of two operating conditions in said apparatus, one operating condition being effected upon a reduction of the normal transmission of energy between the inductively coupled coils; and a single roadside inductor cooperating with said vehicle carried inductor means, said roadside inductor embodying a circuit devoid of an energy source and operative when closed for influencing the vehicle carried coupled inductor coils to produce the other of said two operating conditions in the vehicle carried apparatus.

2. In combination, vehicle carried apparatus including a source of energy, a vehicle carried inductor means including inductively coupled coils operable through said source of energy for producing either of two operating conditions in said apparatus, one operating condition being effected upon a reduction of the normal transmission of energy between the inductively coupled coils; and a roadside inductor cooperating with said vehicle carried inductor means, said roadside inductor embodying a resonant or tuned circuit devoid of an energy source and operative when closed for influencing the vehicle carried inductor means to produce the other of said two operating conditions in the vehicle carried apparatus.

3. In combination, vehicle carried apparatus, a vehicle carried inductor means operable for producing either of two operating conditions in said apparatus and including an inductor circuit which is effectively deenergized in producing one of said operating conditions; and a single roadside inductor cooperating with said vehicle carried inductor means, said roadside inductor embodying a circuit devoid of an energy source and operative when selectively opened and closed for influencing the vehicle carried inductor means to produce respectively either one or the other of said two operating conditions in the vehicle carried apparatus.

4. In combination, vehicle carried apparatus including an A. C. source of energy, a vehicle carried inductor means including inductively coupled coils energized from said energy source and operable for producing either of two operating conditions in said apparatus; and a single roadside inductor cooperating with said vehicle carried inductor means, said roadside inductor embodying a circuit devoid of an energy source and operative when selectively opened and closed for in-

fluencing the vehicle carried inductor means to respectively decrease and increase the energy transmission between the vehicle coupled coils and to thereby produce respectively either one or the other of said two operating conditions in the vehicle carried apparatus.

5. In combination, vehicle carried apparatus, a vehicle carried inductor means including inductively coupled coils operable for producing either of two different operations in said apparatus, one operation being effected upon a reduction of the normal energy transmission between the inductively coupled coils; and a single roadside inductor cooperating with said vehicle carried inductor means, said roadside inductor embodying a circuit devoid of an energy source, said roadside inductor being operative on open circuit for influencing the vehicle carried inductor means to produce said one of said two operations in said apparatus and operative on closed circuit for influencing the vehicle carried inductor means either to produce the other of said two operations in said apparatus or to permit the first of said operations thereof to remain unaffected.

6. In combination, vehicle carried apparatus including an A. C. source of energy, a vehicle carried inductor means including inductively coupled coils energizable through said source of energy and operable for producing either of two different operations in said apparatus, one operation being effected upon a reduction of the normal energy transmission between the inductively coupled coils; and a single roadside inductor cooperating with said vehicle carried inductor means, said roadside inductor embodying a circuit devoid of an energy source, said roadside inductor being operative on open circuit for influencing the vehicle carried inductor means to produce said one of said two operations in said apparatus and operative on closed circuit for influencing the vehicle carried inductor means either to produce the other said two operations in said apparatus or to permit the first of said operations thereof to remain unaffected.

7. In combination, vehicle carried apparatus including an A. C. source of energy, a vehicle carried inductor means energizable through said source of energy and operable for producing either of two different operations in said apparatus; and a roadside inductor cooperating with said vehicle carried inductor means, said roadside inductor embodying a tuned or resonant circuit devoid of an energy source, said roadside inductor being operative on open circuit for influencing the vehicle carried inductor means to produce one of said two operations in said apparatus and operative on closed circuit for influencing the vehicle carried inductor means either to produce the other of said two operations in said apparatus or to permit the first of said operations thereof to remain unaffected.

8. An induction train control system comprising vehicle carried apparatus, a vehicle carried inductor means including an energy transmitting element and an energy receiving element coupled together and operative for tripping and resetting the vehicle carried apparatus, the tripping being effected upon a reduction of transmission of energy between the coupled elements, and roadside inductor means cooperating with the vehicle carried inductor means and comprising an inductor element cooperable inductively with the vehicle carried coupled elements and circuit means devoid of any energy source governing said inductor element for selectively producing there-

in tripping and resetting indications to selectively effect tripping and resetting operations of the vehicle carried inductor means.

9. An induction train control system comprising a controlling relay, a vehicle carried inductor means including an energy transmitting element and an energy receiving element coupled together, said energy receiving element being connected to said controlling relay and said elements being operative for tripping and resetting the controlling relay, the tripping being effected by substantially deenergizing said relay, and roadside inductor means cooperating with the vehicle carried inductor means and comprising a single inductor element cooperable inductively with the vehicle carried coupled elements and circuit means devoid of an energy source governing said single inductor element for selectively producing therein tripping and resetting indications to selectively effect tripping and resetting operations of the vehicle carried inductor means.

10. An induction train control system comprising vehicle carried apparatus, a vehicle carried inductor means including an energy transmitting element and an energy receiving element coupled together and operative for tripping and resetting the vehicle apparatus, a roadside inductor means cooperating with the vehicle carried inductor means and comprising a single inductor element cooperable inductively with the vehicle carried coupled elements and capable when in effectively open circuit of reducing the transmission of energy from said energy transmitting element to said energy receiving element to produce a tripping operation in said vehicle carried apparatus, and circuit means devoid of an energy source governing the said inductor element for producing therein a resetting indication transmittable to for effecting a resetting operation of said vehicle carried inductor means.

11. An induction train control system comprising a governing relay, a vehicle carried inductor means including an energy transmitting element and an energy receiving element coupled together, said energy receiving element being connected to said controlling relay and said elements being operative for tripping and resetting the said relay, a roadside inductor means cooperating with the vehicle carried inductor means and comprising an inductor element cooperable inductively with the vehicle carried coupled elements and capable when in effectively open circuit of influencing said vehicle carried inductor means to produce a tripping deenergization of said relay, and circuit means devoid of an energy source governing the said roadside inductor element for producing therein a condition transmittable to said vehicle carried inductor means for effecting a resetting operation of said relay.

12. In combination, vehicle carried apparatus including an A. C. source of energy, a vehicle carried inductor means comprising inductively coupled coils, the primary coil of which is connected to said A. C. source and the secondary coil of which is connected to said apparatus, and roadside inductor means cooperating with said vehicle carried inductor means, said roadside inductor means embodying a coil and a circuit devoid of an energy source, said roadside circuit being operative to selectively diminish or increase the normal energy transmission from the primary coil to the secondary coil of the vehicle carried inductor means to effect either of a plurality of operations in said vehicle carried apparatus.

13. In combination, vehicle carried apparatus

including an A. C. source of energy, a vehicle carried inductor means comprising inductively coupled coils, the primary coil of which is connected to said A. C. source and the secondary coil of which is connected to said apparatus, and roadside inductor means cooperating with said vehicle carried inductor means, and operative to selectively diminish or increase the normal energy transmission from the primary coil to the secondary coil of the vehicle carried inductor means.

14. In combination, vehicle carried apparatus including an A. C. source of energy, a vehicle carried inductor means comprising inductively coupled coils, the primary coil of which is connected to said A. C. source, and roadside inductor means cooperating with said vehicle carried inductor means, and operative to selectively diminish or increase the normal energy transmission from the primary coil to the secondary coil of the vehicle carried inductor means.

15. In combination, vehicle carried apparatus including an A. C. source of energy, a vehicle carried inductor means comprising inductively coupled coils, the primary coil of which is connected to said A. C. source and the secondary coil of which is connected to said apparatus, and roadside inductor means cooperating with said vehicle carried inductor means and operative to selectively diminish or increase the normal energy transmission from the primary coil to the secondary coil of the vehicle carried inductor means to effect either a tripping or resetting operation respectively in said vehicle carried apparatus.

16. In combination, vehicle carried apparatus including an A. C. source of energy, a vehicle carried inductor means comprising inductively coupled coils, the primary coil of which is connected to said A. C. source and the secondary coil of which is connected to said apparatus, and roadside inductor means cooperating with said vehicle carried inductor means, said roadside inductor means embodying a single coil and a circuit devoid of an energy source, said roadside circuit being operative when open and closed to respectively diminish and increase the normal energy transmission from the primary coil to the secondary coil of the vehicle carried inductor means.

17. In combination, vehicle carried apparatus including an A. C. source of energy, a vehicle carried inductor means comprising inductively coupled coils, the primary coil of which is connected to said A. C. source and the secondary coil of which is connected to said apparatus, and roadside inductor means cooperating with said vehicle carried inductor means, said roadside inductor means embodying a single coil and a resonant circuit devoid of an energy source, said resonant roadside circuit being operative when open and closed to respectively diminish and increase the normal energy transmission from the primary coil to the secondary coil of the vehicle carried inductor means.

18. In combination, vehicle carried apparatus including an A. C. source of energy, a vehicle carried inductor means comprising inductively coupled coils, the primary coil of which is connected to said A. C. source and the secondary coil of which is connected to said apparatus, and roadside inductor means cooperating with said vehicle carried inductor means, said roadside inductor means embodying a single coil and a resonant circuit devoid of an energy source, said

resonant roadside circuit being operative when open and closed to respectively diminish and increase the normal energy transmission from the primary coil to the secondary coil of the vehicle carried inductor means to effect either a tripping or resetting operation respectively in said vehicle carried apparatus.

19. In combination, vehicle carried apparatus including an A. C. energy source and a relay, a vehicle carried inductor means including inductively coupled coils energized from said energy source for operating said relay; and a roadside inductor cooperating with the vehicle carried inductor means, said roadside inductor embodying a tuned or resonant circuit devoid of an energy source and operative on closed circuit for affecting the vehicle carried inductor means to produce an increase of torque in said relay.

20. In combination, vehicle carried apparatus including a relay, a vehicle carried inductor means for operating said relay; and a roadside inductor cooperating with the vehicle carried inductor means, said roadside inductor embodying a single circuit devoid of an energy source, said roadside inductor being operative on open and on closed circuit for affecting the vehicle carried inductor means to produce respectively a decrease and an increase of torque in said relay.

21. In combination, vehicle carried apparatus including an A. C. energy source and a relay, a vehicle carried inductor means including inductively coupled coils energized from said energy source for operating said relay; and a roadside inductor having a single flux path cooperating with the vehicle carried inductor means, said roadside inductor embodying a circuit devoid of an energy source, said roadside inductor being operative on open and on closed circuit for affecting the vehicle carried inductor means to produce respectively a decrease and an increase of torque in said relay.

22. In combination, vehicle carried apparatus including a relay, a vehicle carried inductor means for operating said relay; and a roadside inductor cooperating with the vehicle carried inductor means, said roadside inductor embodying a tuned or resonant circuit devoid of an energy source, said roadside inductor being operative on open and on closed circuit for affecting the vehicle carried inductor means to produce respectively a decrease and an increase of torque in said relay.

23. In combination, vehicle carried apparatus including an A. C. source of energy and a relay, vehicle carried inductively coupled coils, the primary coil of which is connected to the A. C. energy source and the secondary coil of which is connected to said relay; and a roadside inductor cooperating with the vehicle carried inductively coupled coils, said roadside inductor comprising a coil and a circuit therefor devoid of an energy source and operative when said energyless circuit is closed and opened for influencing the vehicle carried inductor coils to produce respectively an increase and decrease of the normal operative torque in said relay.

24. In combination, vehicle carried apparatus including an A. C. source of energy and a two element relay, vehicle carried inductively coupled coils, the primary coil of which is connected to the A. C. energy source and the secondary coil of which is connected to an element of said relay; the said coils being coupled so that the secondary coil is normally energized from said primary coil, and a roadside inductor cooperating with the ve-

hicle carried inductively coupled coils, said roadside inductor comprising a coil and a tuned or resonant circuit therefor devoid of an energy source and operative when said energyless circuit is closed for influencing the vehicle carried inductor coils to produce an operating torque in said relay.

25. In combination, vehicle carried apparatus including an A. C. source of energy and a two element relay, vehicle carried inductively coupled coils, the primary coil of which is connected to an element of said relay, the other element of said relay being connected to the A. C. energy source; the said coils being coupled so that the secondary coil is normally energized from said primary coil, and a roadside inductor cooperating with the vehicle carried inductively coupled coils, said roadside inductor comprising a coil and a circuit therefor devoid of an energy source and operative when said energyless circuit is closed for influencing the vehicle carried inductor coils to produce an operating torque in said relay.

26. In combination, vehicle carried apparatus including an A. C. energy source and a relay, vehicle carried inductively coupled coils the primary coil of which is connected to the A. C. source and the secondary coil of which is connected to said relay; the said coils being coupled with reluctance in the magnetic path therebetween, and a cooperating roadside inductor including a coil and a circuit therefor devoid of an energy source, said roadside inductor being operative on open and closed circuit for influencing the inductively coupled coils to respectively deenergize and energize said relay.

27. In combination, vehicle carried apparatus including a source of energy and a relay means, a vehicle carried inductor including inductively coupled coils the primary of which is connected to said energy source and the secondary of which is connected to said relay means, the coupled coils normally producing a given persisting energized condition in said relay means; and a single cooperating roadside inductor including a coil and an energyless circuit therefor operative when open and closed for influencing the vehicle carried coupled coils to produce respectively either a deenergizing condition or different energizing conditions in said relay means.

28. In combination, vehicle carried apparatus including a source of energy and a three position relay means, a vehicle carried inductor including inductively coupled coils the primary of which is connected to said energy source and the secondary of which is connected to said relay means, the coupled coils normally producing a given position in said relay means; and a cooperating roadside inductor including a coil and an energyless tuned or resonant circuit therefor selectively operative to influence said vehicle carried coupled coils to produce either of the other two positions in said relay means.

29. In combination, vehicle carried apparatus including a source of energy and a relay means, a vehicle carried inductor including inductively coupled coils the primary of which is connected to said energy source and the secondary of which is connected to said relay means, the coupled coils normally producing a given condition in said relay means; and a cooperating roadside inductor including a coil and an energyless circuit therefor selectively operative to influence said vehicle carried coupled coils to produce either of two other conditions in said relay means, said relay means having a field connected to said source of energy

and having an armature connected to the secondary inductor coil.

30. In combination, vehicle carried apparatus comprising a source of energy and a relay having field and armature coils, inductor means including inductively coupled coils the primary of which is connected to said source of energy and the secondary of which is connected to the armature coil of said relay, the said coils being coupled so that the secondary is normally energized from said primary, the field coil of said relay being connected to said energy source, and means for improving the phase relationship between the currents in said relay field and armature coils, said means comprising resistance and capacitance arranged in circuit with said field coil.

31. In combination, vehicle carried apparatus including a source of energy and a relay, vehicle carried inductively coupled coils the primary of which is connected to said energy source and the secondary of which is connected to said relay, the said coils being coupled so that the secondary is normally energized from said primary, and means for determining the phase relationship between the current and voltage effective on said relay; and a single cooperating roadside inductor including an energyless tuned circuit operative when closed for affecting the vehicle carried coupled coils to produce an actuation of said relay.

32. In combination, vehicle carried apparatus including a source of energy and a two element relay, vehicle carried inductively coupled coils the primary of which is connected to said energy source and the secondary of which is connected to said relay, the said coils being coupled so that the secondary is normally energized from said primary, and means for improving the phase relationship between the currents in the elements of said relay; and a cooperating roadside inductor including an energyless tuned circuit operative when closed for affecting the vehicle carried coupled coils to produce an actuation of said relay.

33. In combination, vehicle carried apparatus including a source of energy and a relay having field and armature coils, vehicle carried inductively coupled coils the primary of which is connected to said energy source and the secondary of which is connected to the armature coil of said relay, the said coils being coupled so that the secondary is normally energized from said primary, the field coil of said relay being connected to said energy source, and means for improving the phase relationship between the currents in said relay field and armature coils; and a cooperating roadside inductor including an energyless tuned circuit operative when closed for affecting the vehicle carried coupled coils to produce an actuation of said relay.

34. A train control system comprising the following combination; a train-carried source of alternating current, an associated signal-receiving circuit, a train-carried inductor or unit for transmitting current to and receiving current from the wayside, means included in said unit whereby the direct effect of the source upon the receiving circuit is altered as compared with the effect thereon of said source when subjected to the influence of a wayside circuit, together with a wayside circuit adapted to inductively control the train-carried receiving circuit in accordance with signal indications.