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INDUCTION TRAIN CONTROL SYSTEM FOR CURVE PROTECTION

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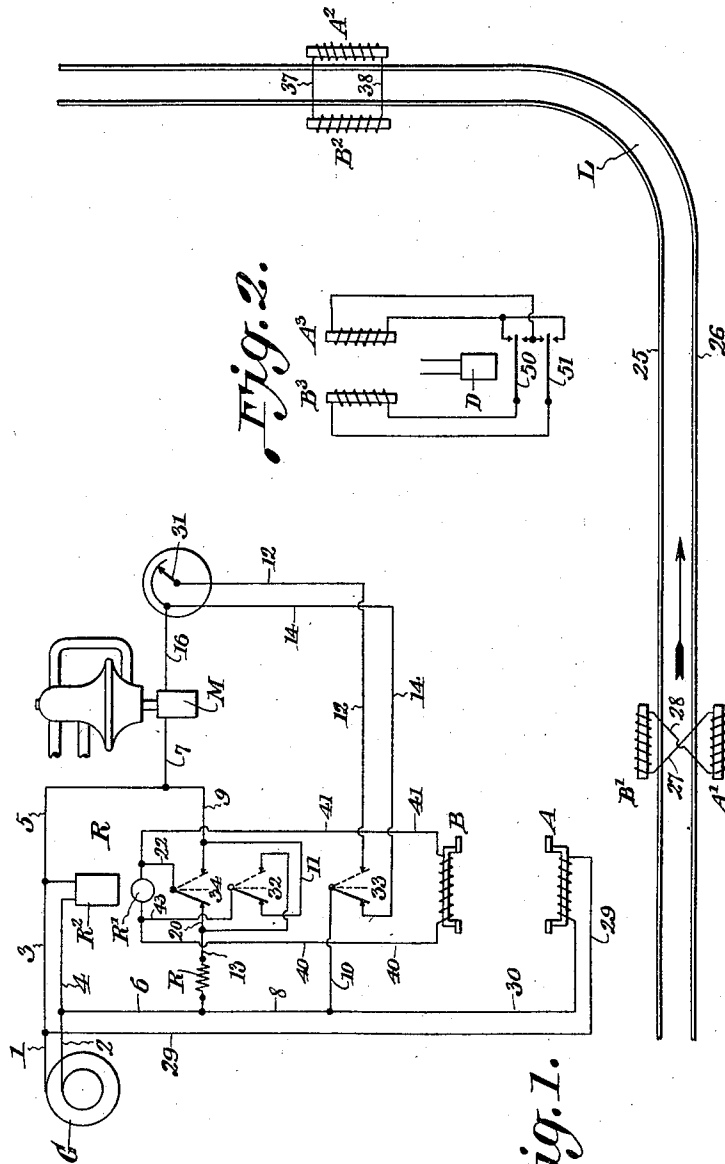
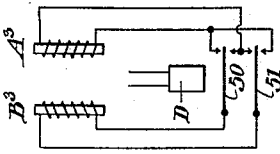


Fig. 1.

Fig. 2.



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INDUCTION TRAIN-CONTROL SYSTEM FOR CURVE PROTECTION

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This invention relates to improvements in train controlling systems, and more particularly to an induction system for controlling the speed of trains at curves, and other "slow" track points and has special reference to the provision of an inductive train controlling system in which the train control means is influenced by the cooperation of train and track inductoriums controlled from a vehicle source of energy.

A principal object of the invention comprehends the provision of an induction system in which the train carried apparatus will upon a train approaching a curve be controlled by a roadside apparatus to reduce the speed of the train if the latter exceeds a permissive speed, and then after the train has rounded the curve, will be controlled by a second roadside apparatus to restore the train apparatus to normal conditions, permitting the same to proceed at normal or unlimited speeds.

To the accomplishment of the foregoing and such other objects as may hereinafter appear, my invention consists in the elements and their relation one to the other, as hereinafter particularly described and sought to be defined in the claims, reference being had to the accompanying drawing which shows a preferred embodiment of my invention, and in which:—

Fig. 1 is a diagrammatic view showing the complete apparatus, and

Fig. 2 is a view indicating the manner in which the road side inductoriums may be connected through a pole changing switch or relay.

Referring now more in detail to the drawings, and more particularly to Fig. 1 thereof, the train control system comprises train carried mechanism including the train inductoriums A and B which are adapted to be brought into cooperation with spaced sets of track inductoriums A' and B' and A² and B², the inductorium set A'—B' being located at the entrant end of a curve L of the tracks 25 and 26 and the inductorium set A²—B² being located at the exit end of the said curve, the former set being operative for impressing speed restrictive conditions on the train, and

the latter set being operative for restoring unlimited speed conditions upon the train.

The train inductorium A is a transmitting inductorium and is normally energized from a vehicle carried source of energy, preferably an alternating current source of energy G, by the circuit including the said source of energy G, conductors 1, 29, the coil of the inductorium A, and conductors 30, 6 and 2. The train inductorium B is an impulse receiving inductorium and is connected to influence a two-element relay R of the three-position type, having the two elements R' and R², the element R' being connected in circuit with the inductorium B by means of the conductors 40 and 41 and the element R² being normally energized from the train source of energy G and connected thereto by means of the conductors 1, 3, 4 and 2.

The track inductorium A' is an impulse receiving inductorium which is adapted to cooperate with the train transmitting inductorium A, and the track inductorium B' is an impulse transmitting inductorium which in turn is adapted to cooperate with the train receiving inductorium B in the movement of the vehicle, the inductorium B' being electrically connected to the inductorium A' by means of the conductors 27 and 28 in such a manner as clearly shown in the drawings that an impulse received by the inductorium A' and transmitted to the inductorium B' for transmission to the companion train inductorium B will energize the element R' of the relay R with current opposite in phase to the current with which the element R² of the relay R is normally energized by the generator G.

The track inductorium A² is also an impulse receiving inductorium, and is connected to the track inductorium B² which is an impulse transmitting inductorium by means of the conductors 37 and 38, the connection between these track inductoriums being such that an impulse received by the inductorium A² from the train transmitting inductorium A in the movement of the vehicle will be transmitted to the inductorium B² and thence to the train receiving inductorium B so as to energize the element R' of the relay R with

a current in phase with that of the current in the relay R^2 .

The relay R as heretofore referred to is a three-position relay controlling the positions of the contacts 32, 33 and 34, the arrangement being such that when the element R' is energized by a substantially in phase current the contacts will be moved to their full line position as shown in the drawings, and when the said element R' is energized by an opposite phase current, the contacts 32 to 34 are actuated to assume the inclined dotted position shown in Fig. 1. With this construction, it will therefore be apparent that when the train inductoriums move over the inductorium set $A'-B'$, that the contacts 32, 33 and 34 will be moved to assume the inclined dotted line position; while when the train inductoriums A and B move over the succeeding inductorium set A^2-B^2 , the contacts 32, 33 and 34 will be returned to their normal full line position shown in the figure.

Under normal conditions the contacts 32, 33 and 34 are maintained in their normal full line position by means of train circuit comprising the generator G , conductors 2 and 6, resistance R , conductors 13 and 20, contact 34 in full line position, conductor 22, relay element R' , conductor 43, contact 32 in full line position, and conductors 11, 9, 5, 3 and 1. The resistance R is adjusted to give sufficient current to the relay element R' to permit the same to operate properly.

Under these normal conditions with the contact 33 maintained by energization of the relay R in the full line position, the train is permitted to proceed at normal or unlimited speed. To this end there is provided the train control means comprising an electromagnet M which controls an air valve, the said electromagnet being normally energized by a circuit including the generator G , conductors 1, 3, 5 and 7, the coil of the electromagnet M , conductors 16 and 14, contact 33 of relay R in full line position, and conductors 10, 8, 6 and 2.

When the train inductoriums A and B are moved over the track inductorium set $A'-B'$, the train controlling means is operated to produce speed restrictive effects, this being produced by motion of the relay contacts 32 to 34 to their right-hand or dotted line position shown in the figure. This is accomplished as the result of the energization of the vehicle carried inductoriums B from the vehicle carried inductor A through the roadside inductorium means $A'-B'$, the energization of the inductorium B being such as to produce a current in the relay element R' opposed to the normal energizing current therein. The resistance R in the relay circuit is also provided for normally reducing the value of the current in the relay element R' , the value of the current being such as to be sufficient for holding the relay

contacts but insufficient for moving them into any of their active positions. It will thus be seen that when the vehicle carried and roadside inductoriums cooperate, the first effect produced will be the production of opposing currents in the relay element R' , this resulting in the relay contacts moving to the inactive position; after this first effect, the relay element R' is energized from the inductorium B only and the contacts will therefore be moved to the right-hand or dotted line position shown in the figure. Thus with the contact 33 moved to dotted line position, electromagnet M is placed in series with a speed controller and is controlled by the latter in the circuit including the generator G , conductors 1, 3, 5 and 7, electromagnet M , conductor 16, make and break speed controller contact 31, conductor 12, contact 33 in the dotted line position, and the conductors 10, 8, 6 and 2. The contact 31 of the speed controller is adjustable to open at any predetermined speed and remain opened at or above the predetermined speed, and to close and remain closed when the speed is below the predetermined limit. With this construction it will be seen that with the apparatus on the locomotive under the control of the speed controller in rounding a curve, if the speed of the train is above the predetermined limit the contact 31 will be opened, the electromagnet M deenergized and the air brakes of the train applied through the operation of the valve; but when the speed of the train is below the predetermined limit the contact 31 is closed and no speed control effect will be produced.

When the relay contacts 32 to 34 are moved to their dotted line position, these contacts will be maintained in such position until again actuated by the inductorium set A^2-B^2 , the contacts being maintained in a stick circuit including the generator G , conductors 1, 3, 5 and 9, contact 34 in dotted line position, conductor 22, relay element R' , conductor 43, contact 32 in dotted line position, and conductor 13, resistance R , and conductors 6 and 2, the current through R' maintained by the stick circuit being opposite in phase to that delivered to the element R^2 .

Fig. 2 indicates an arrangement in which the roadside inductoriums are operated automatically, as through a control relay D and the relay contacts 50 and 51, the latter acting as a pole changer to change circuit connections between the inductoriums A^3 and B^3 . When relay D is energized, armature contacts 50 and 51 are attracted to connect the inductoriums A^3 and B^3 so that current of one phase may be transmitted from one inductorium to the other, and when the relay D is deenergized, the contacts 50 and 51 are released, changing the circuit connections to transmit current of an opposite phase from one inductorium to the other.

The operation of my train control system will in the main be apparent from the above detailed description thereof. Under normal conditions the electromagnet M is normally energized to permit unlimited or proceed conditions on the train. When the train approaches a curve L, the train inductorium set A—B will move over the track inductorium set A'—B' and an impulse will be transmitted to the train receiving inductorium B for energizing the relay element R' with a current opposite in phase to the current in the element R², with the result that the relay contacts will be moved to connect the electromagnet M in circuit with speed controller contact 31. If the train is approaching the curve at a speed exceeding the permissive speed, the contact 31 will be opened and the electromagnet M deenergized to set the brakes. If, however, the train will be approaching the curve L at a speed below the permissive speed, then the contact 31 will remain closed and the electromagnet M will remain energized to permit the train to proceed without application of the brakes. After the train has rounded the curve, the train inductoriums A and B will move into cooperation with the track inductoriums A² and B², and the latter will operate in conjunction with the former to transmit an impulse to the train receiving inductorium B to energize the relay element R' with a current in phase with the current in the element R², and the electromagnet M will thereby be placed in an energizing circuit which permits unlimited speed conditions.

While I have shown my device in the preferred form, it will be apparent that many changes and modifications may be made in the structure disclosed, without departing from the spirit of the invention, defined in the following claims:—

What I claim as new is:

1. In a vehicle control system, vehicle control mechanism, roadside means located at the entrant end of a curve for producing a control condition in said mechanism and means for modifying such condition including a roadside magnetic device located at the exit end of the curve, a vehicle magnetic means cooperating therewith in the movement of the vehicle, and a vehicle carried source of energy for energizing the said vehicle magnetic means by way of the roadside magnetic device.

2. In a vehicle control system, vehicle control mechanism, roadside means located at the entrant end of a curve for producing a control condition in said mechanism and means for modifying such condition including a roadside magnetic device located at the exit end of the curve, a vehicle magnetic means cooperating therewith in the movement of the vehicle, and a vehicle carried alternating current source of energy for ener-

gizing the said vehicle magnetic means by way of the roadside magnetic device.

3. In a vehicle control system, vehicle control mechanism, roadside means located at the entrant end of a curve for producing a control condition in said mechanism, and means for modifying such condition including a vehicle impulse receiver, a roadside impulse transmitter with which said receiver is cooperable located at the exit end of the curve, and a vehicle carried source of energy for energizing the transmitter and receiver, the said roadside transmitter being independent of said roadside means.

4. In a vehicle control system, vehicle control mechanism, roadside means located at the entrant end of a curve for producing a control condition in said mechanism, and means for modifying such condition including vehicle impulse transmitting and receiving inductoriums, roadside impulse receiving and transmitting inductoriums cooperable therewith, and a vehicle carried source of energy for said inductoriums.

5. In a vehicle control system, vehicle control mechanism, means for producing a control condition in said mechanism comprising a magnetic device located at the entrant end of a curve, a vehicle magnetic means cooperating therewith in the movement of the vehicle, and a vehicle carried source of energy for energizing the said magnetic means by way of the roadside magnetic device, and provisions located at the exit end of the curve for modifying such condition.

6. In a vehicle control system, vehicle control mechanism, means for producing a control condition in said mechanism comprising a magnetic device located at the entrant end of a curve, a vehicle magnetic means cooperating therewith in the movement of the vehicle, and a vehicle carried source of energy for energizing the said magnetic means by way of the roadside magnetic device, and provisions located at the exit end of the curve for modifying such condition, the said provisions also comprising a magnetic device cooperable with the said vehicle magnetic means and energized by the vehicle source of energy.

7. In a vehicle control system, vehicle control mechanism, vehicle magnetic means for influencing the same, spaced roadside magnetic elements arranged to cooperate with said magnetic means in the movement of the vehicle and constructed for reversely influencing the said magnetic means, and a vehicle carried source of energy for energizing the vehicle magnetic means by way of the roadside magnetic elements.

8. In a vehicle control system for curve protection, vehicle control mechanism, a vehicle magnetic means for influencing the same, spaced roadside magnetic elements arranged at the beginning and end of a curve, the said road-

side magnetic elements being constructed to influence the said magnetic means to impose speed restrictive and proceed effects on the said mechanism successively, and a vehicle
5 carried source of energy for energizing the said vehicle magnetic means by way of the roadside magnetic elements.

9. In a vehicle control system, vehicle control mechanism, vehicle magnetic means for
10 influencing the same, spaced roadside magnetic elements arranged to cooperate with said magnetic means in the movement of the vehicle and constructed for reversely influencing the said magnetic means, and a vehicle
15 carried alternating current source of energy for energizing the vehicle magnetic means by way of the roadside magnetic elements.

10. In a vehicle control system, vehicle control mechanism, roadside means for producing a given condition in said mechanism, and
20 means independent of traffic conditions for modifying such given condition including vehicle transmitting and receiving inductoriums, roadside receiving and transmitting inductoriums cooperable therewith, and a vehicle
25 carried source of energy for said inductoriums.

11. In a vehicle control system, vehicle control mechanism, roadside means for producing a predetermined condition in said
30 mechanism, and means independent of traffic conditions for modifying such predetermined condition including vehicle transmitting and receiving inductoriums and roadside receiving and transmitting inductoriums cooperating therewith.
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12. In a system for curve protection, the combination with two sets of roadside inductoriums, one located at the entrant end and
40 the other at the exit end of a curve, of a vehicle carried mechanism including impulse transmitting and receiving inductoriums, a source of energy for the transmitting and receiving inductoriums, a speed controller, an
45 air brake controlling means and a relay, said relay being under the control of the source of energy and adapted to be affected when one of the vehicle inductoriums passes in inductive relation with the first set of roadside inductoriums to connect the speed controller in
50 circuit with the air brake controlling means while passing the curve and to be affected when the vehicle inductoriums pass in inductive relation with the said second set of
55 roadside inductoriums.

In testimony whereof I affix my signature.
ARCHIBALD G. SHAVER.