No. 892,677. PATENTED JULY 7, 1908.

E. T. MUNGER.

SAFETY APPLIANCE FOR ELECTRIC RAILWAY TRAINS.

APPLICATION FILED DEC. 2, 1907.

2 SHEETS—SHEET 1.

Fig. 1

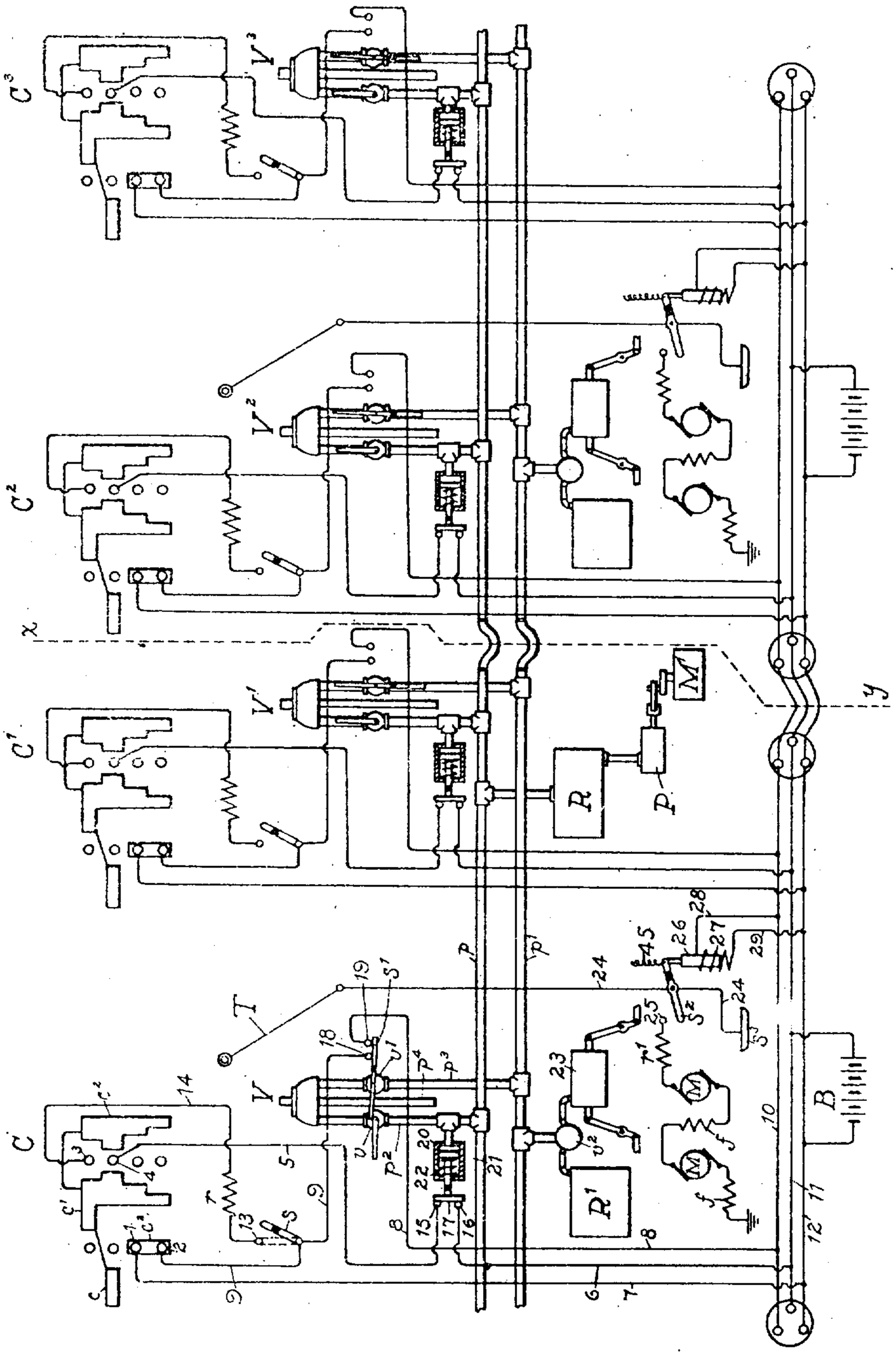

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Fig 4.

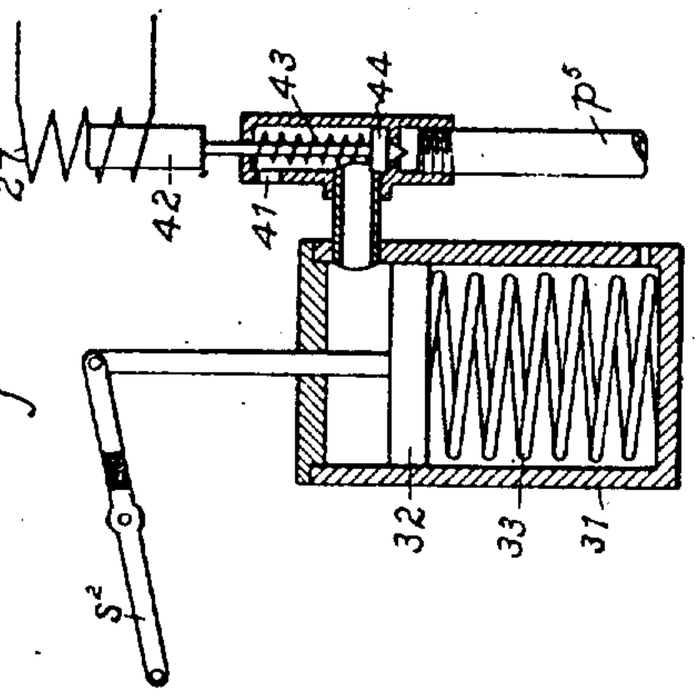


Fig 5.

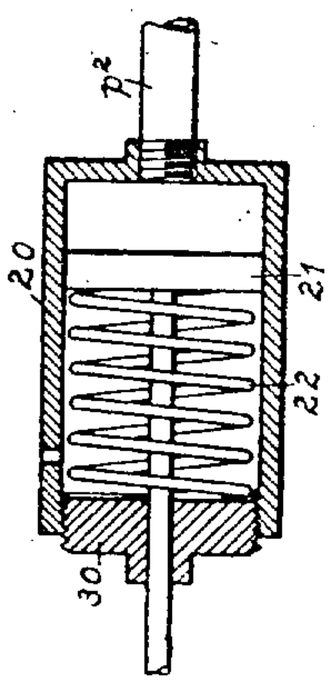


Fig 2.

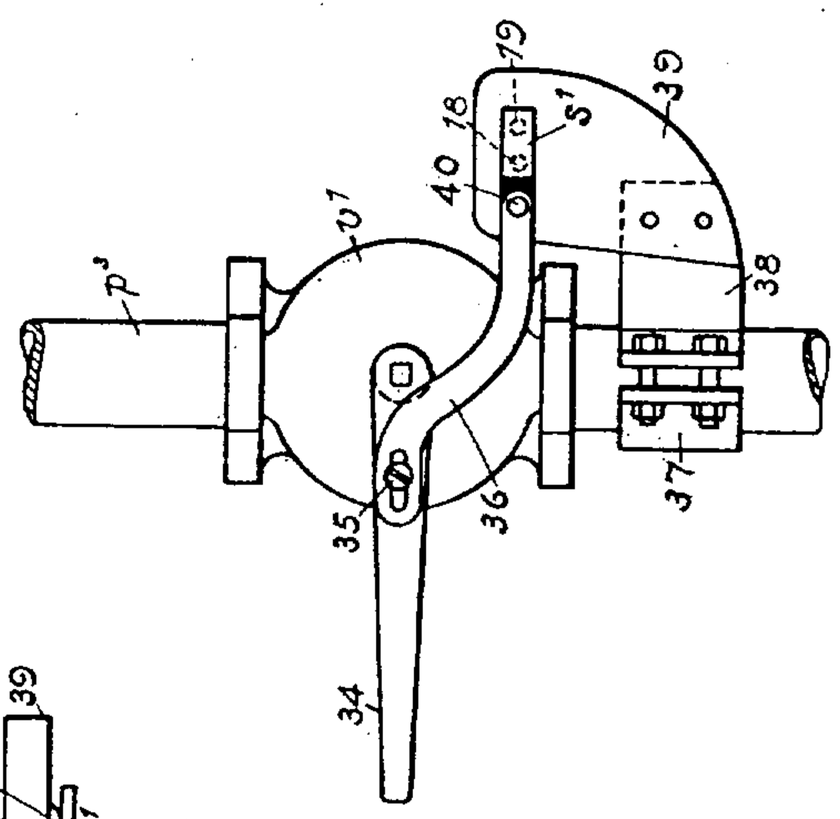
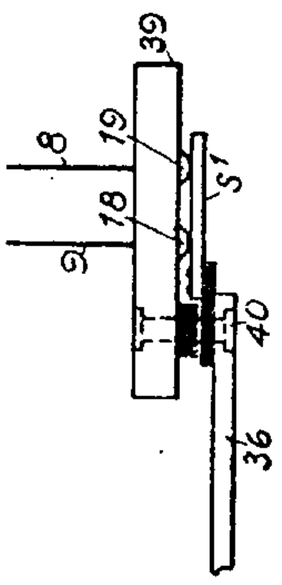


Fig 3.



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EDWIN T. MUNGER, OF CHICAGO, ILLINOIS.

SAFETY APPLIANCE FOR ELECTRIC-RAILWAY TRAINS.

No. 892,677. Specification of Letters Patent. Patented July 7, 1908.

Application filed December 2, 1907. Serial No. 404,793.

To all whom it may concern:

Be it known that I, EDWIN T. MUNGER, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Safety Appliances for Electric-Railway Trains, (Case 1,) of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to safety appliances for electric railway trains and is particularly applicable in connection with the mechanism for controlling the operation of such trains when it involves the use of a power brake system, as well as an electric motor or motors for driving the train.

Generally stated my invention provides interlocking safety devices on such electrically driven cars or trains for preventing accidents resulting from the brakes or brake-controlling mechanism being in a condition such as to prevent the motorman or driver from controlling the brakes in proper manner.

My invention may be applied, for example, to electric railway trains which are equipped with air brake systems. In such equipments it is customary to provide at each end of each car not only a controller by means of which the motors may be controlled, but also a device for controlling the application of the air brakes. In order that the brakes may be effectively applied due to a control exercised from any one of these locations in a train, it is essential that the brake-controlling devices at the other points be in a certain operative position or condition. Serious accidents have resulted from the failure to put such brake-controlling devices in proper running conditions before starting the motors and thus putting the train in motion. If, for example, as is frequently the case, a train has been running in one direction with the motorman standing at the forward end of the head car and he reaches the end of the line, he will take his position at the extreme opposite end of the train in order to commence the return trip. If, under such conditions, the motorman should fail to return the brake-controlling device or devices at what was the forward end of the train to their normal position before going to what was the rear end of that train to start the return trip, he might succeed in applying current to the motors, thus putting the train in motion, but upon attempting to apply the air brakes by the use of the engineer's valve or other controlling device at the new controlling position, the motorman might find that the brakes could not be applied on account of his failure to restore the brake-controller at the extreme opposite end of the train to its proper running position. In such a case the motorman would have no practical or suitable means of stopping the train and disastrous accidents may and, in fact, have often occurred from this cause. So, also, in many brake systems it is necessary to open certain valves leading to the engineer's valve at any point before the engineer's valve at such point can be used to effect the control of the air brake system. It has sometimes happened that the failure of the motorman to open such governor valves before starting a return trip has placed him in the position of being unable to control the application of the brakes by the use of the engineer's valve when the occasion for braking the train arises.

My invention has for its object the provision of interlocking mechanisms and appliances which will prevent the application of any current to the motor or motors of a train until the brake-controlling devices have been placed in the proper position for the exercise of such control of the motors.

My invention is particularly applicable to systems of train operation in which one or more cars of the train are equipped with electric motors for driving such cars and these motors are jointly controlled from a master controller located as desired on the train. In common practice several of the cars of the train may be provided with such master controllers, and whether there is a motor on one car only or there are motors on several of the cars, the control exercised from each of the controllers governs all of the motors.

When an air brake system is employed in conjunction with such a motor-controlling system, my invention specifically consists in means associated with the controlling valves of the air brake system which prohibit and prevent any operation of the train under the control of the motor controllers unless the air brake controlling valves are properly set to permit the operation of the brakes as contemplated. In other words, the motor con-

troller becomes effective only upon the proper setting of the devices for controlling the air brake mechanism.

These and the other features of my invention will be more fully understood from the following description of a preferred embodiment, which, however, contains certain improvements and modifications of my broad invention which I do not claim as my own. This description may be read in conjunction with the accompanying drawings, in which

Figure 1 shows in diagrammatic view the operating mechanism for controlling the motors on a train, and associated therewith air brake operating mechanism adapted to embody my invention; Figs. 2 and 3 are detailed front and top views of devices which I preferably attach to one of the air pipes of the braking system to coöperate with a valve in such pipe for accomplishing the results to be described; Fig. 4 shows in detailed sectional view a modified form of operating mechanism for the main switch of the main motor circuit, and Fig. 5 shows in detailed sectional view a modified form of air controlled switching mechanism for insuring proper working conditions in the air brake system before the car can be operated.

Referring to Fig. 1, it will be noticed that several sets of identical mechanism are indicated, that is, a controller C and brake controlling mechanism V, represented as associated with each end of each of two cars, the dividing line between such cars being indicated by the dotted line x, y. The system of control herein represented is that well known in the art, in which a master controller located at either end of any car in a train may control switching mechanism for regulating the speed of a motor on one of such cars or motors on several of such cars. As shown in the drawings, 10, 11 and 12 are conductors arranged to extend throughout the train, being connected from car to car by jumper connections, as shown, and from these conductors connections are made to the controller C, as indicated. This controller consists of several movable contact sections, as c, c^1, and c^2 electrically connected and arranged in accordance with ordinary construction to move together. Another section c^3 is also adapted to be moved with the sections just mentioned. These several sections are arranged to make contact with a number of contact points when such sections are moved in the operation of control, and in a manner well known in the art the several circuits closed by such operation are adapted to operate switching mechanism for controlling the driving motors of the car, as a result of which controller C controls these motors and therefore the motion of the car. In this connection we are concerned with but one of the circuits controlled by the controller C, this being a circuit adapted to operate the main switch of the motor controlling mechanism by which an operative circuit is closed through the driving motors, after which the controller further operates to establish various speed conditions of such motors, as desired. A storage battery B is usually connected, as indicated, between conductors 11 and 12 to operate the switching mechanism.

When the controller C is moved so as to bring the section c^2 into engagement with the contacts 3 and 4, assuming that the line switch s is thrown in the position shown in dotted lines, a circuit is closed as follows: battery B, conductor 11, wire 6, contact 16, switch 17, contact 15, wire 5, contact 4, section c^2, contact 3, wire 14, resistance r, contact 13, switch s, wire 9, contact 18, switch s^1, contact 19, wire 8, conductor 10, wire 28, solenoid 27, wire 29, conductor 12 back to battery B. For this position of the controller C it will be understood the section c^3 is moved out of engagement with the contacts 1 and 2, so that connection between wires 7 and 9 is opened. As a result of the circuit above described the solenoid 27 is energized by which the core 26 is drawn downwardly against the resistance of the spring 45, closing switch s^2 and an operating circuit through the motors as follows: third rail shoe s^3, wire 24, switch s^2, contact 25, resistance r^1 and thence in series through the motors M, M and field windings f, f to ground back to the source of energy used to drive the cars. The spring 45 serves to return the core 26 to its normal position and to thereby open the switch s^2 when the solenoid 27 is not energized. A trolley T is shown as connected to the wire 24 in order that power may be taken from an overhead trolley instead of a third rail, if desired. The closing of the circuit through the motors results in starting the same, and by successive positions of the controller C the value of the resistance r^1 may be varied as desired, and other changes in the relations of the motors M, M to the operating circuit may be effected in any well-known way familiar to those versed in the art.

The air brake controlling system shown in connection with this invention consists in a motor M^1 adapted to drive an air pump P connected to an air tank R and supply pipe p for furnishing air as required to operate the braking mechanism. This pipe p extends throughout the train, as does a second pipe p^1 known as the train pipe. Connections are made from the pipes p and p^1 at each position of control by pipes p^2 and p^3 respectively, through valves v and v^1 to a controlling valve of a type well known in the art. A third pipe p^4 known as the exhaust pipe, is also connected to this operating valve. A valve v^2 is connected with the train pipe p^1 and there are also connected to this valve v^2 an air tank R^1 and operating cylinder 23 for operating the brakes. The valve v^2 is adapted to be

operated in such a manner that when the pressure in the pipe p^1 reaches a certain amount this valve is operated to open a passageway between the pipe p^1 and tank R^1. This condition is maintained as long as the pressure in the pipe p^1 is maintained, and when the air is permitted to escape from the pipe p^1 and the pressure is thereby diminished below a certain predetermined amount, the valve v^2 operates to form a passage between the tank R^1 and the cylinder 23, as a result of which the air in the tank R^1 serves to set the brakes in a manner well known. When the pressure in the pipe p^1 is again increased to the amount required to operate the valve v^2 connection is again established between the pipe p^1 and the tank R^1 through such valve and an exhaust passage is opened from the cylinder 23 by which the brakes are released.

In order to provide that the conditions in the air brake system shall be proper for operating the train, I make use of a switch s^1 associated with the operating handle of the valve v^1 by which, when the valve v^1 is in a position to open the pipe p^3 to the operating valve, connection will be established between the contacts 18 and 19 and therefore the operating circuit through the solenoid 27 will be established upon actuation of the controller C in the manner already described. From this it will be seen that if the valve v^1 is not in an open position so that air can be supplied from the supply pipe p to the train pipe p^1, the controller C is rendered inoperative by the opening of its circuit between contacts 18 and 19. It is to be noted in this connection that there is also a valve v located in the supply pipe and that the operating handles on valves v and v^1 are so related that the valve v must be opened before the valve v^1 can be opened, and hence the switch s^1 constitutes a means by which both of these valves must be in open or operative position, that is, a position to permit the operation of the brake mechanism, in order to complete the operating circuit of the controller.

As shown diagrammatically in connection with the supply pipe p^2, an air operated mechanism is made use of to control the switch 17 as a result of which, if the air pressure in the supply pipe is not sufficient to operate the brake mechanism, the switch 17 is maintained in open position and is not closed until the air pressure has been increased sufficiently to operate the brake mechanism, for which condition the switch 17 is closed. This mechanism consists of a cylinder 20 in which a piston 21 is adapted to move against the resistance of a spring 22. The switch 17, as indicated, is connected to the piston 21, so that movement of the piston by the air pressure in the cylinder will operate such switch. The spring 22 is adjusted for the air pressure used in the supply pipe to cause the piston and associated switch to operate as indicated above. As shown in Fig. 5, the tension of the spring 22 may be regulated by means of the threaded plug 30 in the end of the cylinder to provide for adjusting this switch mechanism for various air pressures.

My system includes a further protective feature, as a result of which, if the air controlling valves are not left in a position to permit the operation of the air brake mechanism from another location on the train, the solenoid 27 will be rendered inoperative, thus indicating that at some point the relation of the valves is not right and requiring the proper adjustment of such valves before the train can be started. This condition may be illustrated with regard to the controller C as follows: The controller is shown in normal or neutral position, that is, the position in which it is left when it is desired to operate the train from one of the other controllers. For this condition the valves v and v^1 should occupy a vertical position in order to shut off the pipes p^2 and p^3 and thus positively prevent improper opening of the train pipe p^1 or the supply pipe p by means of the operating valve associated with the controller C. In the event, however, of the valves being carelessly or maliciously moved to a position to open the pipes p^2 and p^3, whether the operating valve is moved to a position to improperly operate the system or not, the switch s^1 is moved to a closed position, as a result of which a circuit is closed as follows: conductor 12, wire 7, contact 1, section c^3, contact 2, wire 9, contact 18, switch s^1, contact 19, wire 8, conductor 10, that is, a circuit of very low resistance is closed across the conductors 10 and 12, and hence this path of low resistance will take any current delivered to the conductors 10 and 12 by another of the controlling mechanisms, instead of such current going through solenoids 27 to operate the same, and hence for this condition the solenoids 27 are rendered inoperative. I have above described in detail the controlling mechanism for but one end of one car, and this description applies equally to the other controlling mechanisms used, as well as to the brake and motor mechanism indicated on the second car and hence no detailed description of these other controlling and operating mechanisms is necessary. As shown in Fig. 1, the controllers C^1, C^2 and C^3 are in neutral position and the valves in the supply and train pipe connections are in closed position, while the line switches at the controller are open, all of which should be to properly control the train from the controller C.

In Figs. 2 and 3 I have shown in detail one form of construction of the switch s^1 and means for securing such switch to the pipe p^3. A supporting member 38 is arranged to carry the base 39 of insulating material to which contacts 18 and 19 are secured. This supporting member 38 is adapted to be

clamped to the pipe p^3 by a clip 37, as indicated. A lever 36 pivoted at 40 to the base 39 has secured thereto by insulating means, the switch member s^1 adapted to engage the contacts 18 and 19 or to be disengaged therefrom as such lever is moved upon its pivot. This lever has formed in its outer end a slot, as indicated, to engage a screw 35 secured in the operating handle 34 of the valve v^1, as a result of which when the handle 34 is moved from the position indicated to a vertical position the lever 36 is moved upon its pivot 40 so as to disengage the switch s^1 from the contacts 18 and 19.

In Fig. 4 I have shown a modified form of mechanism for operating the main switch s^2 in which the solenoid 27 is adapted to operate a needle valve 44 by means of a core 42 and to thereby open connection from pipe p^5 adapted to be connected with the supply pipe p, the air pressure thus admitted by the valve serving to move the piston 32 in the cylinder 31 against the tension of the spring 33. A spring 43 is provided to insure the closing of the valve 44 when the solenoid 27 is not energized. After the switch s^2 is actuated by this means when the solenoid 27 is deënergized, the valve 44 is returned to its seat and an exhaust passage 41, which is closed by the valve 44 in its operative position, is opened to permit the air in the cylinder 31 to escape and to permit the spring 33 to move the switch s^2 to its open position.

While I have shown my invention in the particular embodiment herein described, I do not, however, limit myself to this construction but claim all equivalent constructions and modifications that will readily suggest themselves to those skilled in the art.

I claim:

1. In an electric railway train, the combination of a brake system, a plurality of brake controlling mechanisms therefor, an electric motor controller, and means associated with said brake controlling mechanisms for rendering the motor controller inoperative when any of the brake controlling mechanisms is in a condition to prevent setting the brakes.

2. In an electric railway train, the combination of a brake system, a plurality of similar brake controlling mechanisms located at different points on said train and each available for the control of the brake system, an electric motor controller, means associated with said brake controlling mechanisms for rendering the motor controller ineffective to start the motor or motors when any of the brake controlling mechanisms is in a condition to prevent setting the brakes.

3. In an electric car, the combination of one or more electric motors for driving the car, a plurality of motor controllers, a brake system, a brake controlling device associated with each motor controller, and means operated by said brake controlling devices to render any one of said electric motor controllers ineffective to apply current to the motor or motors when the brake controlling devices are in a condition to release the brakes.

4. In an electric motor driven railway train, the combination of a brake system, a plurality of brake controlling devices located at different points on said train, a plurality of electric motor controllers located at different points on said train, and means associated with each brake controlling device to render any one of the motor controllers ineffective to control the supply of current to the motor or motors when the brake controlling device is in a condition to release the brakes.

5. In an electric railway car, the combination of a motor controller, a brake system, a brake controller, a switch for controlling a circuit through the motor controller and thereby governing the effective operation of such motor controller, and means for mechanically operating such switch by the brake controller.

6. In combination with a car adapted to be electrically driven, a motor therefor, means for supplying electric energy from feeders to the operating circuit of such motor, a controller for controlling such circuit, brake mechanism carried by such car, operating means for such brake mechanism and means associated with such operating means for rendering such controller inoperative when such operating means is in a condition to prevent the operation of such brake mechanism.

7. In combination with a car adapted to be electrically driven, a motor therefor, means for supplying electric energy from feeders to the operating circuit of such motor, switching mechanism for controlling such circuit, a controller adapted to operate such switching mechanism, brake mechanism carried by such car, operating means for such brake mechanism, and means associated with such operating means for rendering such controller inoperative when such operating means is in a condition to prevent the operation of such brake mechanism.

8. In combination with a car adapted to be electrically driven, a motor therefor, means for supplying electric energy from feeders to the operating circuit of such motor, switching mechanism for controlling such circuit, two controllers on such car each adapted to operate such switching mechanism, brake mechanism carried by such car, operating means for such brake mechanism, means associated with such operating means for rendering one of such controllers inoperative when such operating means is i. condition to prevent the operation of such brake mechanism and means for rendering the other controller inoperative when such operating means is in a condition to permit the operation of such brake mechanism.

9. In combination with a car adapted to be electrically driven, a motor therefor, means for supplying electric energy from feeders to the operating circuit of such motor, a controller for controlling such circuit, brakes carried by such car, mechanism for pneumatically operating such brakes, a valve for controlling the operation of such pneumatic mechanism, and means associated with such valve for rendering such controller inoperative when such valve is in a position to prevent the operation of such brakes.

10. In combination with a car adapted to be electrically driven, a motor therefor, means for supplying electric energy from feeders to the operating circuit of such motor, switching mechanism for controlling such circuit, two controllers on such car each adapted to operate such switching mechanism, brakes carried by such car, mechanism for pneumatically operating such brakes, a valve for controlling the operation of such pneumatic mechanism, means associated with such valve for rendering one of such controllers inoperative when such valve is in a position to prevent the operation of such brakes, and means for rendering the other controller inoperative when such valve is in a position to permit the operation of such brakes.

11. In combination with a car adapted to be electrically driven, a motor therefor, means for supplying electric energy from feeders to the operating circuit of such motor, switching mechanism for controlling such circuit, two controllers on such car each adapted to operate such switching mechanism, brakes carried by such car, mechanism for pneumatically operating such brakes, a valve associated with each controller, each of such valves adapted to control the operation of such pneumatic mechanism, means associated with each of such valves for rendering the corresponding controller inoperative when such valve is in a position to prevent the operation of such brakes, and means for rendering the other controller inoperative when such valve is in a position to permit the operation of such brakes.

12. In a system of train control, a plurality of cars, an electric motor carried by one of such cars, means for supplying electric energy to the operating circuit of such motor, a controller on each of such cars adapted to control such circuit, brake mechanism carried by each of such cars, operating mechanism on each of such cars for controlling such brake mechanisms, means associated with one of such operating mechanisms for rendering the corresponding controller inoperative when such operating mechanism is in a condition to prevent the operation of such brake mechanism, and means associated with such operating mechanism for rendering a controller on another car inoperative when such operating mechanism is in a condition to permit the operation of such brake mechanism.

13. In a system of train control, a plurality of cars, an electric motor carried by one of such cars, means for supplying electric energy to the operating circuit of such motor, a controller on each of such cars adapted to control such circuit, brake mechanism carried by each of such cars, operating mechanism on each of such cars for controlling such brake mechanisms, and means associated with each of such operating mechanisms for rendering a controller on another car inoperative when such operating mechanism is in a condition to permit the operation of such brake mechanism.

14. In a system of train control, a plurality of cars, an electric motor carried by one of such cars, means for supplying electric energy to the operating circuit of such motor, switching mechanism for controlling such circuit, a controller on each of such cars adapted to operate such switching mechanism, brake mechanism carried by each of such cars, operating mechanism on each of such cars for controlling such brake mechanisms, means associated with one of such operating mechanisms for rendering the corresponding controller inoperative when such operating mechanism is in a condition to prevent the operation of such brake mechanism, and means associated with such operating mechanism for rendering a controller on another car inoperative when such operating mechanism is in a condition to permit the operation of such brake mechanism.

15. In a system of train control, a plurality of cars, an electric motor carried by one of such cars, means for supplying electric energy to the operating circuit of such motor, switching mechanism for controlling such circuit, a controller on each of such cars adapted to operate such switching mechanism, brakes carried by such car, mechanism for pneumatically operating such brakes, a valve for controlling the operation of such pneumatic mechanism, and means associated with such valve for rendering a controller on another car inoperative when such valve is in a position to release such brake mechanism.

16. In a system of train control, a plurality of cars, an electric motor carried by one of such cars, means for supplying electric energy to the operating circuit of such motor, switching mechanism for controlling such circuit, a controller on each of such cars adapted to operate such switching mechanism, brakes carried by such car, mechanism for pneumatically operating such brakes, a valve associated with each controller, each of such valves adapted to control the operation of such pneumatic mechanism, means associated with one of such valves for rendering the corresponding controller inoperative when such valve is in a position to prevent

the operation of such brake mechanism, and means associated with such valve for rendering a controller on another car inoperative when such valve is in a position to permit the operation of such brake mechanism.

17. In a system of train control, a plurality of cars, an electric motor carried by each of such cars, means for supplying electric energy to the operating circuits of such motors, a controller on each of such cars adapted to control such circuits, brake mechanism carried by each of such cars, operating mechanism on each of such cars for controlling such brake mechanism, means associated with one of such operating mechanisms for rendering the corresponding controller inoperative when such operating mechanism is in a condition to prevent the operation of such brake mechanism, and means associated with such operating mechanism for rendering a controller on another car inoperative when such operating mechanism is in a condition to permit the operation of such brake mechanism.

18. In a system of train control, a plurality of cars, an electric motor carried by each of such cars, means for supplying electric energy to the operating circuits of such motors, switching mechanism for controlling such circuits, a controller on each of such cars adapted to operate such switching mechanism, brakes carried by such cars, mechanism for pneumatically operating such brakes, a valve associated with each controller, each of such valves adapted to control the operation of such pneumatic mechanism, means associated with one of such valves for rendering the corresponding controller inoperative when such valve is in a position to prevent the operation of such brake mechanism, and means associated with such valve for rendering a controller on another car inoperative when such valve is in a position to permit the operation of such brake mechanism.

19. In a system of train control, a plurality of cars, one or more electric motors carried by one of such cars, means for supplying electric energy to the operating circuit of such motor, switching mechanism for controlling such circuit, a controller on each of such cars adapted to operate such switching mechanism, brakes carried by such cars, mechanism for pneumatically operating such brakes, a valve for controlling the operation of such pneumatic mechanism, and means for opening the operative circuit of one of such controllers when such valve is in a position to prevent the operation of such brakes.

20. In a system of train control, a plurality of cars, an electric motor carried by each of such cars, feeders adapted to supply electric energy to the operating circuits of such motors, switching mechanism for controlling such circuits, conductors extending through the train, an electromagnetic mechanism bridged between two of such conductors and adapted to control such switching mechanism, a controller on each of such cars adapted to operate such electromagnetic mechanism, brakes carried by such cars, mechanism for pneumatically operating such brakes, a valve associated with each controller and adapted to control such pneumatic mechanism, and a switch operated by each valve, each of such switches adapted to open the operative circuit of the corresponding controller when the associated valve is in a position to prevent the operation of such brakes.

21. In combination with a car adapted to be electrically driven, means for supplying electric energy from feeders to the operating circuit of the motor thereof, a controller for controlling such circuit, air brakes on the car, a main operating valve for such brakes associated with such controller, supply and train pipe connections from the brake system of the car to such main valve, auxiliary control valves in such supply and train pipe connections, and means associated with such auxiliary control valves for rendering such controller inoperative when such auxiliary control valves are in a position to prevent the operation of such brakes.

22. In a system of train control, an electric motor carried by one of the cars of the train, means for supplying electric energy to the operating circuit of such motor, a controller on each of such cars adapted to control such circuit, air brakes on such train, a main operating valve on one of such cars for controlling such brakes, supply and train pipe connections from the brake system of the train to each of such main valves, auxiliary control valves in such supply and train pipe connections, means associated with the auxiliary control valves associated with one of such main valves for rendering the controller associated therewith inoperative when such auxiliary control valves are in a position to prevent the operation of such brakes, and means associated with such auxiliary control valves for rendering a controller on another car inoperative when such auxiliary control valves are in a position to permit the operation of such brakes.

23. In a system of train control, an electric motor carried by one of the cars of the train, means for supplying electric energy to the operating circuit of such motor, a controller on each of the cars of the train adapted to control such circuit, air brakes carried by the train, a main operating valve for such brakes on each of the cars, supply and train pipe connections from the brake system of the train to each of such main valves, auxiliary control valves in such supply and train pipe connections, and means associated with each of such main valves and controlled by

the corresponding auxiliary control valves for rendering a controller on another car inoperative when such auxiliary control valves are in a position to permit the operation of such brake mechanism.

24. In a system of train control, one or more electric motors carried by one of the cars of the train, means for supplying electric energy to the operating circuit of such motor, switching mechanism for controlling such circuit, a controller on each of the cars adapted to operate such switching mechanism, air brakes on the train, a main operating valve for such brakes associated with one of such controllers, supply and train pipe connections from the brake system of the train to such main valve, auxiliary control valves in such supply and train pipe connections, and means for opening the operative circuit of one of such controllers when one of such auxiliary control valves is in a position to prevent the operation of the brakes.

25. In a system of train control, an electric motor carried by each of the cars of the train, feeders adapted to supply electric energy to the operating circuits of such motors, switching mechanism for controlling such circuits, conductors extending through the train, electromagnetic mechanism bridged between two of such conductors and adapted to control such switching mechanism, a controller on each of such cars adapted to operate such electromagnetic mechanism, air brakes on the train, a main operating valve for such brakes associated with each controller, supply and train pipe connections from the brake system of the train to each of such main valves, auxiliary control valves in such supply and train pipe connections, and a switch associated with each of such main valves and adapted to be operated by one of such auxiliary control valves, each of such switches adapted to open the operative circuit of the corresponding controller when the associated auxiliary control valve is in a position to prevent the operation of the brakes.

26. In an electric railway train, the combination of a brake system, a plurality of brake controlling mechanisms therefor, an electric motor controller, and means positively operated by said brake controlling mechanisms for rendering the motor controller inoperative when any of the brake controlling mechanisms is out of its proper running position.

27. In an electric railway train, the combination of a plurality of similar brake controlling mechanisms located at different points on said train and each available for the control of the brake system, an electric motor controller, and means positively operated by said brake controlling mechanisms for rendering the motor controller inoperative to start the motor or motors when any of the brake controlling mechanisms is out of its proper running position.

28. In an electric car, the combination of one or more electric motors for driving the car, a plurality of motor controllers, a brake system, a brake controlling device associated with each motor controller, and means directly operated by said brake controlling devices to render any one of said electric motor controllers ineffective to apply current to the motor or motors when the brake controlling devices are not in proper position for the control of the car by that controller.

29. In an electric motor driven railway train, the combination of a brake system, a plurality of brake controlling devices located at different points on said train, a plurality of electric motor controllers located at different points on said train, and means directly operated by each brake controlling device to render any one of the motor controllers ineffective to control the supply of current to the motor or motors when the brake controlling device is not in proper position for the control of the train from the point at which the electric motor controller is located.

In witness whereof, I hereunto subscribe my name this 27th day of November, A. D. 1907.

EDWIN T. MUNGER.

Witnesses:
ADOLPH H. DAWS,
HARLEY A. JOHNSON.