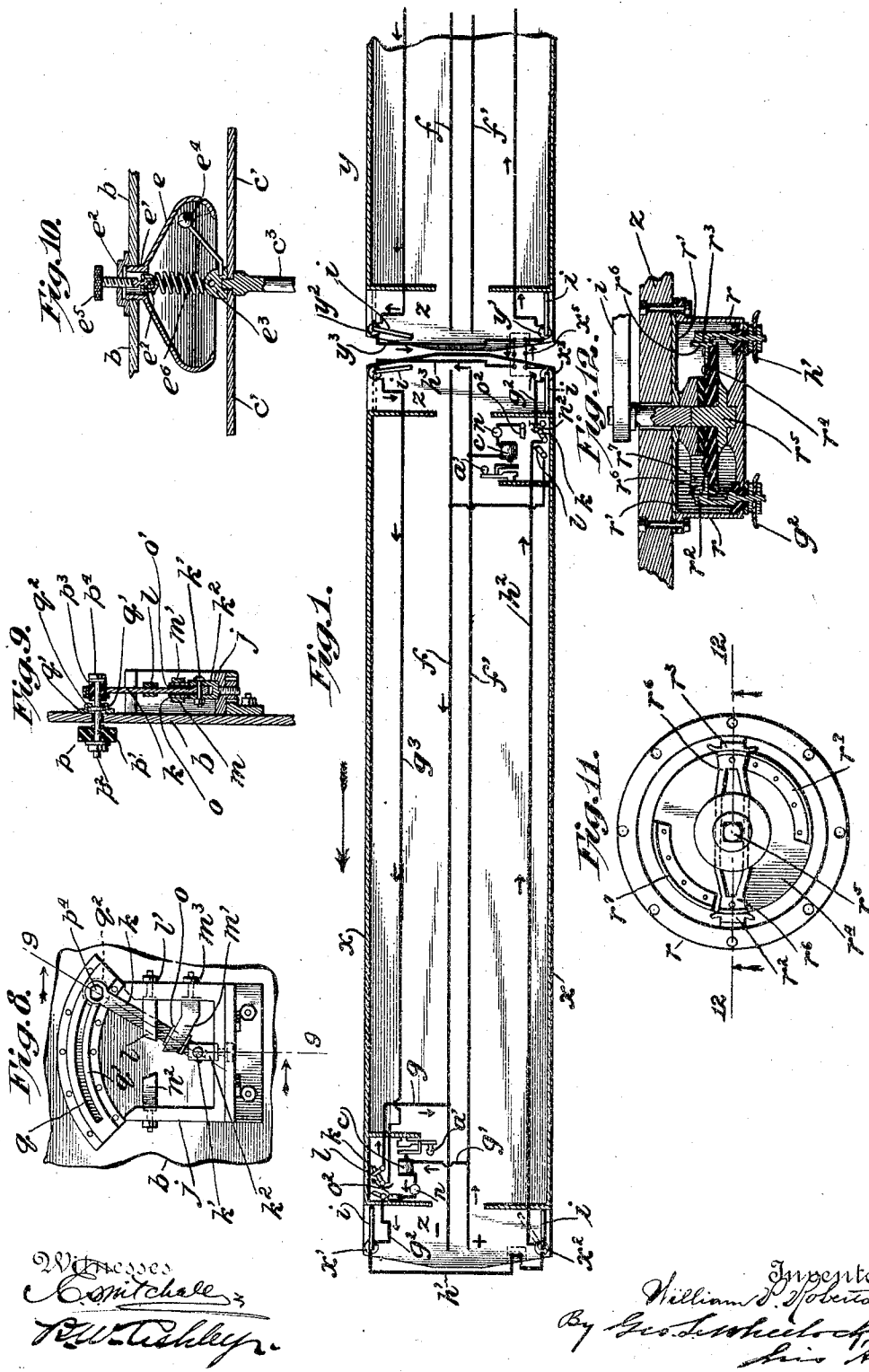


W. P. ROBERTSON.
ELECTRIC SAFETY APPARATUS FOR CARS OR TRAINS.

APPLICATION FILED MAY 12, 1904.

NO MODEL.

3 SHEETS—SHEET 1.



Witnesses
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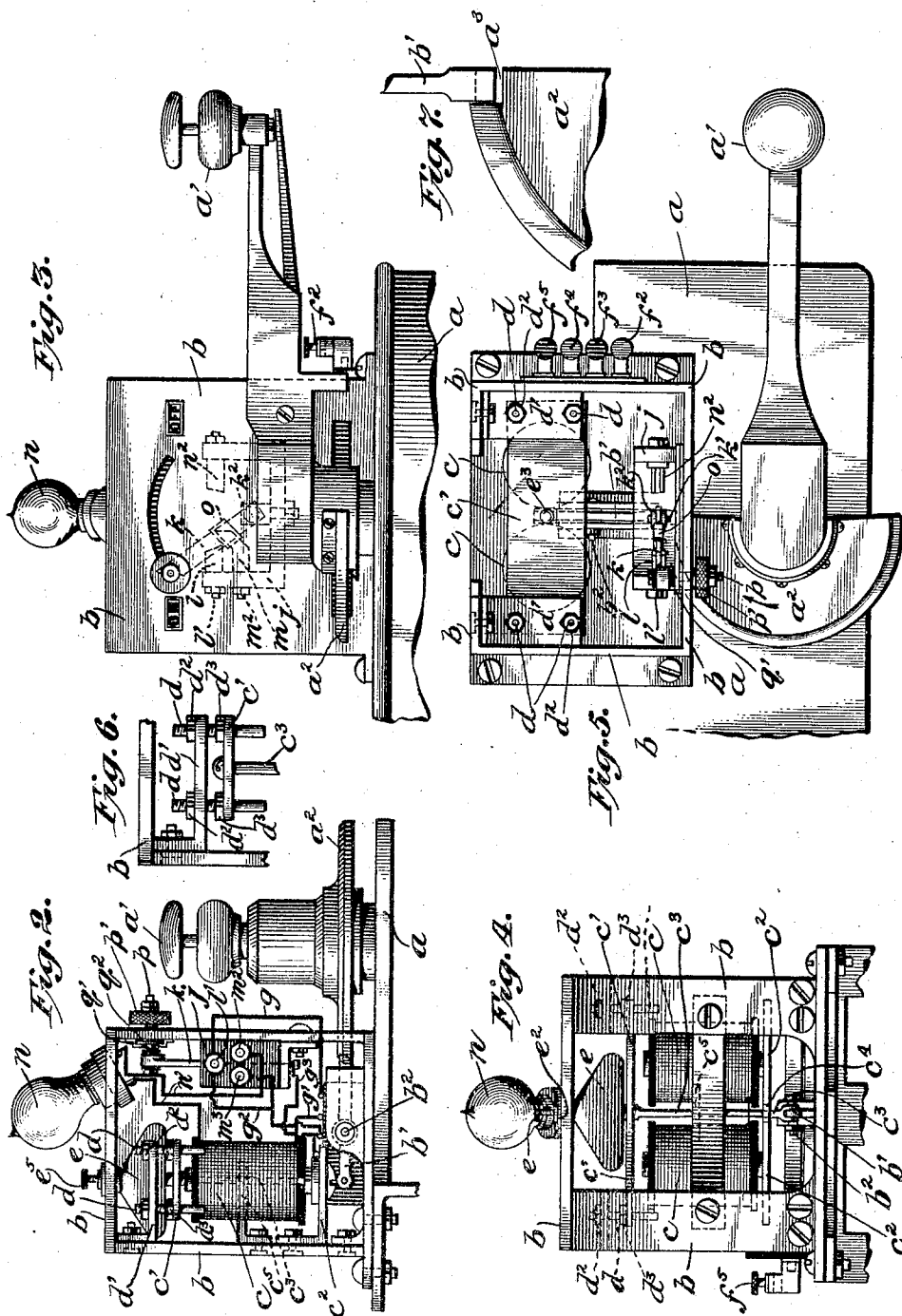
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3 SHEETS—SHEET 2.



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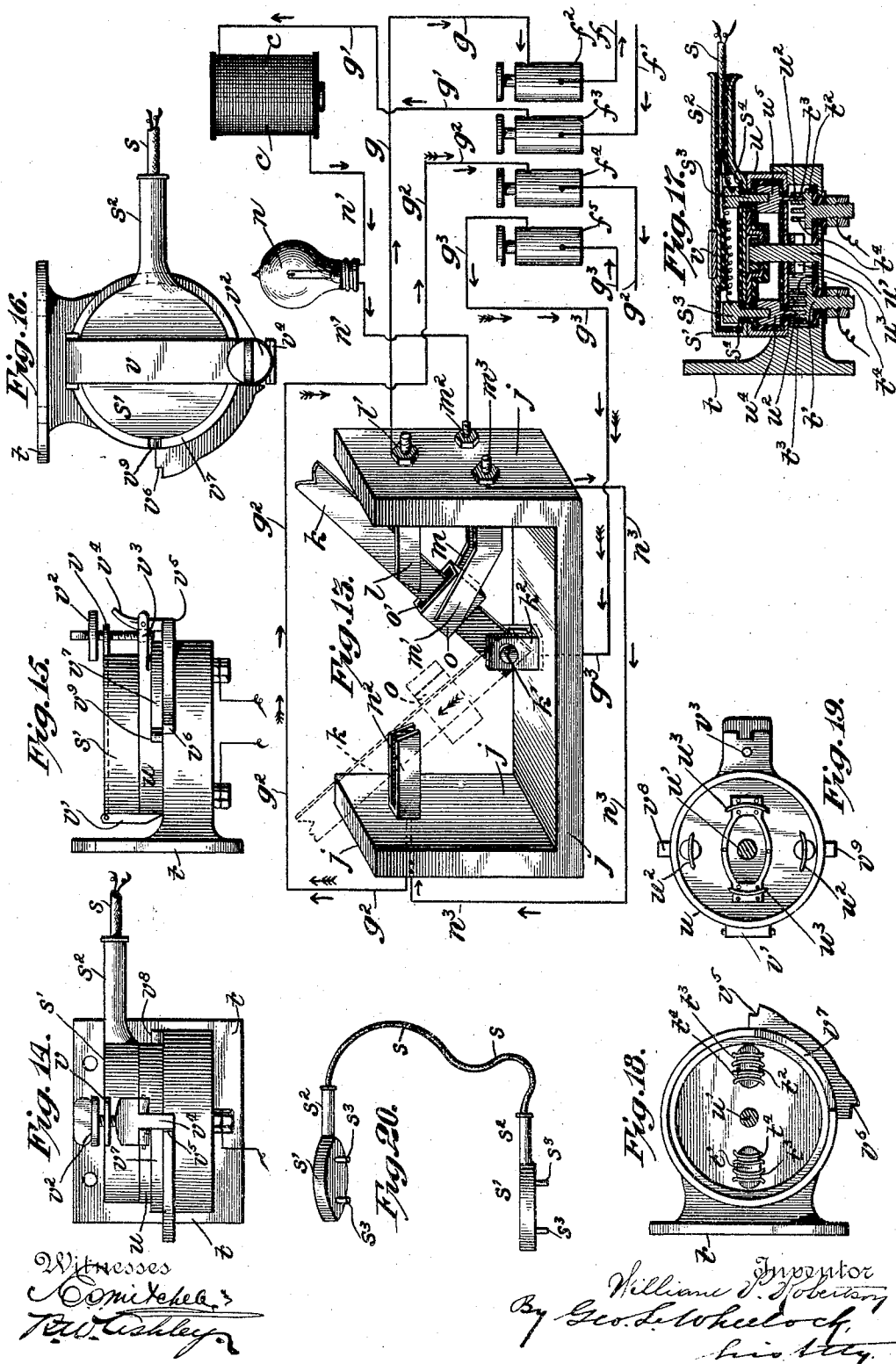
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3 SHEETS—SHEET 3.



UNITED STATES PATENT OFFICE.

WILLIAM P. ROBERTSON, OF BRONXVILLE, NEW YORK.

ELECTRIC SAFETY APPARATUS FOR CARS OR TRAINS.

SPECIFICATION forming part of Letters Patent No. 774,896, dated November 15, 1904.

Application filed May 12, 1904. Serial No. 207,556. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM P. ROBERTSON, a citizen of the United States, residing at Bronxville, Westchester county, and State of New York, have invented certain new and useful Improvements in Electric Safety Apparatus for Cars or Trains, of which the following is a specification.

To-day the so-called "multiple-unit" system is much used on electric roads, but only the ordinary devices whereby the gatemen or the conductors may signal the motormen are employed. There are no suitable precautions against accident where the motorman relies on the ordinary signals of the gateman or the conductor to go ahead, for not only is the application of the power under the immediate control of the motorman, but the conductors or gatemen may give the usual signal to turn on the power before the train is ready to proceed.

The present invention relates to improvements in safety appliances which may be used not only in the multiple-unit system of traction, but on single cars, although it seems to lend its advantages more particularly to trains of cars, whatever be the power by which they are driven.

One of the objects of the invention is to guard against the movement of the car or train before the gates or doors controlling the entrances for the passengers are all closed.

A further object is to provide means independent of the customary signals to indicate to the motorman or engineer that he may actuate the necessary mechanism for applying the motive power, and hence that the car or train is ready to go ahead.

A further object is to lock a "master-controller" or other controller against actuation by the motorman or engineer so that it may be unlocked by one other than the motorman or when the train or car is ready to proceed.

Other objects are to improve upon electric or other cars or trains and to render their operation more safe and reliable.

A suitable form of means or mechanism embodying the invention which may be used is illustrated in the accompanying drawings, in which—

Figure 1 is a diagrammatic view illustrating

two cars and their electric connections. Fig. 2 is an end view of means for signaling and means for locking the master-controller of a car or train. Fig. 3 is a side view of same parts as seen from the right of Fig. 2. Fig. 4 is a view of the same parts as seen from the left of Fig. 2. Fig. 5 is a plan view thereof. Figs. 6 and 7 are details. Fig. 8 is a detail view of the motorman's trip-switch or circuit making and breaking device. Fig. 9 is a section of the same on the line 9 9; Fig. 10, an enlarged detail section of the audible signaling device and armature of the electromagnet; Fig. 11, a plan view of the gate or door switch, the cover being removed. Fig. 12 is a section thereof on line 12 12. Fig. 13 is a perspective view of the motorman's trip-switch or circuit making and breaking device, also showing diagrammatically various parts connected electrically therewith. Fig. 14 is an end elevation of means for electrically connecting two adjacent cars. Fig. 15 is a side elevation thereof. Fig. 16 is a plan view. Fig. 17 is a central section through the same parts in the position in which they stand when the cars are electrically connected. Fig. 18 is a separate plan view of one member of the circuit maker and breaker for the coupling-cable. Fig. 19 is a reverse plan of the other or movable member of the same, and Fig. 20 is a detail view of a coupling-cable and its heads.

Referring to the drawings, there are shown diagrammatically in Fig. 1 two cars x y , or at least a part of a car, (indicated by y .) The car y may be a trailer and is so shown, or it may be a motor-car. Car x is shown as a motor-car.

The improved safety apparatus to be described may clearly be applied either in whole or in part to a single car, be it electrically or otherwise driven, or to a train of electric or other cars, be they arranged so that the alternate cars are motor-cars or not. The apparatus will be described as applied to a train of electric cars such as used in the multiple-unit system of traction.

The box a of the master-controller, which may be of any suitable type, has above it the handle a' for the controller, Figs. 2, 3, 4, 5, and 7. On the hub of the handle is a segment a'' , at one end of which a recess or notch

a^3 is preferably formed. To one side of the controller-shaft there is located on the top of box a a separate or extension box b . In the lower part of the box a latch b' is pivoted at b^2 , its outer end, as shown more clearly in Fig. 7, engaging in said notch or recess. This engagement is preferably effectuated as described later. An electromagnet c (or, if desired, a solenoid) is provided with an armature c' and is preferably mounted on a supporting-bracket c^2 , suitably secured to the inner side of box b , and its said armature is connected, by means of a rod c^3 , with the inner end of the latch b' , as shown in Figs. 2 and 4. Suitable guides for the rod c^3 may be formed by means of cross-pieces c^4 c^5 , and guides for armature c' may be formed by the pins d , which are threaded at their upper ends into top brackets d' and the lower ends of which are smooth and protrude through openings in the ends of the armature. Bolt-heads or turning-nuts d^2 serve for turning and adjusting the pins d in the said brackets d' , and lock-nuts d^3 , screwed onto the threaded ends of the pins, hold the same rigid in their adjusted position. The movement of the armature away from the magnet may thus be restricted as desired.

An audible signal is preferably employed in the present invention in connection with or to supplement a visual signal n and comprises a bell e , Figs. 2, 4, and 10, which is provided with an open screw-neck e' , that screws into the top of the box b and receives a screw-cap e^2 , which is screwed down against the said top. A head or nut e^3 is screwed onto the upper end of rod c^3 and confines the armature c' thereon, and projecting therefrom is the clapper e^4 . A thumb-screw e^5 is screwed through cap e^2 and serves for regulating the tension of a spring e^6 , which has a swivel-joint connection at e^7 with a screw and is attached to the head e^3 on the rod c^3 . The spring e^6 serves to pull the armature c' away from its electromagnet when released therefrom and causes a sounding of the bell in addition to that caused by the action of the electromagnet. To accomplish this resounding of the bell, the shank of the clapper e^4 is preferably of a springy nature.

Feed-wires f f' , which supply the incandescent lamps of the car or train, may serve as the source of electricity for the herein-described electrical apparatus or the like, or the current may be derived from separate batteries should the voltage impressed on such feed-wires be found too high for the apparatus or parts thereof. Binding-posts f^2 f^3 f^4 f^5 (shown in Figs 5 and 13) are located on one side of the box b , the posts f^2 f^3 serving to secure the supply-wires f f' . Wires g g' g^2 g^3 lead from the said binding-posts to the interior of the box b , and sections of wires g^2 g^3 lead from the posts f^4 f^5 to the circuit making and breaking devices or switches, which

are actuated by the gates or doors i of the train and will be described hereinafter. This description applies to the corresponding devices at each end of a car, although in Fig. 1 the letters of reference apply more particularly to the head device. Contact-support j , which may be the shape shown and of any suitable insulating material, is suitably secured in the box b , and a lever k , forming part of a knife-switch or a circuit maker and breaker, is centralized thereon by means of a pivot-pin k' , mounted in lugs k^2 . A bifurcated contact l is secured to one end of support j , its end l' forming a binding-post to which the wire g is secured. Two separate or paired contacts m m' in the form of a bifurcated contact are secured to the support j below the contact l , and the ends thereof form binding-posts m^2 m^3 .

The visual signal n , preferably an incandescent lamp mounted on the box b or otherwise supported, is connected by one end of wire n' with one of the coils of electromagnet c , the other end of the said wire being secured to binding-post m^2 . At the opposite end of support j is secured a bifurcated contact n^2 , with which wire g^2 is connected and also with which is connected a wire n^3 , which leads from the binding-post m^3 . The wire g^2 leads from binding-post f^5 to the lug on which switch-lever k is mounted. A contact-sleeve or shoe o is located on the lever k and is insulated therefrom by an insulating-bushing o' , which shoe serves to form an electrical connection between the contacts m m' when the knife or lever is moved between the said contacts and between the bifurcations of contact l . The just-described circuit maker and breaker forms a motorman's trip-switch and is further illustrated in Figs. 8 and 9, where convenient means of manipulation are shown. The handle p of the lever comprises a suitably mounted knob p' , a shank p^2 , and an insulating-bushing p^3 , secured on the shank, as by nut p^4 . The handle of the lever is oscillated and is guided in an arcuate slot q in the box b . Arc-shaped guides q' receive a fixed flange q^2 , that makes the application of the lever to the contacts certain, due to the fact that the incasement of the flange in the guides prevents lateral movement of the lever.

Gates or doors of the swinging type are shown, and the form of circuit-closer which is shown is of the rotary-switch type, although it is evident that if the invention is to be applied to sliding gates or doors, as is intended, a suitable circuit closer or switch may be used.

Figs. 11 and 12 show a suitable form of switch for swinging gates or doors. It comprises a casing r , having a removable top r' and which is secured to the car-platform z , Fig. 12, of any car, be it, for instance, x or y , Fig. 1. The said casing r contains a pair, at least, of contact-shoes r^2 r^3 , which are insulated from the casing and are located dia-

metrically opposite and with which are connected, with reference to the forward motorman's trip-switch and concomitant parts, the wires $g^2 h'$. At this point it may be noted that the wires g^3 and $h' h^2 h^3$ may connect electrically, either directly or indirectly, with the switches of the gates or doors at the four corners of the car, Fig. 1. Reverting to the gate or door switch, the rotary member thereof comprises in the main a disk r^4 , of insulating material, mounted on a spindle r^5 , and electrically-connected contacts r^6 , fixed diametrically opposite on the said disk to simultaneously establish electrical connection with contact-shoes $r^2 r^3$. Fixed to the disk r^4 are curved insulated segments r^7 , which are frictionally engaged by the contact-shoes $r^2 r^3$ and serve as guides to the shoes after leaving the contacts. A gate or door i is suitably keyed or fixed against rotation on the spindle or shaft r^5 . Such gate or door i when closed establishes electrical connection between the wires leading to the said switch-casing and breaks it when opened.

As far as described the safety system applies to means for establishing a circuit between the gates or doors of a single car; but it is important in many cases that means also be provided for forming a closed circuit between all the gates or doors of a train or a multiple unit. To this end a break is formed in each end wire h^3 and h' of each car. The breach in either wire $h' h^3$ will be closed electrically by a suitable coupling-cable and coupler-switches, preferably in such way that when the cars are disconnected electrically a separate safety-circuit for each car will be established, while when they are electrically connected a single safety-circuit will be formed for any two or more cars. A suitable construction of coupling-cable and coupler-switches is shown in Figs. 14 to 20, inclusive. A coupling-cable or jumper s preferably contains at least two conducting-wires, and there is a coupling-head, as s' , at each end of the cable, each having a hollow handle s^2 serving for imparting a partial rotation to the head. Plug-connectors s^3 are arranged in pairs on each head s' , being connected with the cable-wires and being insulated from the head by means of suitable insulation s^4 . On the end of each car-platform there is mounted a bracket t , which supports stationary contacts $t^1 t^2$, insulated therefrom and each provided with paired blades $t^3 t^4$, whereby a fixed switch member is formed. A rotary switch member u is pivoted to turn on the fixed member by means of an axial pin u' , and it is provided with a pair of movable contacts or knives $u^2 u^3$, at the inner ends of which contacts u^2 are sockets $u^4 u^5$ to receive the plugs s^3 . Pivoted to the rotary switch member u is a keeper or hasp v , the pivot connection being made with a lug v' , projecting alongside the coupling-head, and the outer end of the

keeper bearing a set-screw v^2 , which may screw into an eye v^3 on the rotary switch member to lock the latter and the coupling-head together. A catch v^4 is located on the rotary switch member to lock the same in either of two positions by engaging with lock-shoulders v^5 and v^6 . To provide a positive stop in either direction of the quarter-turn of the rotary switch member, stops are formed by opposite ends of a raised portion v^7 on the bracket t , against which strike projections $v^8 v^9$ on the said rotary member, so that by the combination of the said stops and the catch v^4 the absolute stability of the movable parts in the desired position is obtained. It will be apparent from this description of suitable coupling-cable and coupler-switches that when the parts at the adjacent car ends are in the position shown in Fig. 17 a closed circuit may be formed in the two cars, the knives u^2 being in contact with blades t^3 , and when the parts are in the position shown in Figs. 14, 15, and 16 the knives u^3 will be in contact with the blades t^4 . In the last-named position a local car-circuit may be formed and the head at the opposite end of the cable will be detached from the car cut-off. The detached cable may be hung from a suitable hook on the car-platform.

Having described a suitable construction for the entire system, as well as each part which may form one of its components, the manner in which the system or apparatus works on a train of cars will now be briefly described with reference to the diagrams, Figs. 1 and 13.

Assuming that the invention is applied to a train of six cars and that the improved circuit through the train, be it an additional signal-circuit only or be it a controller-locking circuit, or both combined, operated from gates or doors which admit passengers or which bar their entrance, the current when only the head motorman's trip-switch or circuit maker and breaker is set by him to place the local devices in condition to enable a signal to be produced or the controller to be locked or unlocked and all the gates or doors are closed will flow, as indicated by darts, as follows: from the source of electricity along wire g' and the coils of the electromagnet c , thence along the wire n' and through the incandescent lamp or other visual signal n (said lamp glowing and indicating to the motorman that it is safe to proceed) and to the contact m , from whence it passes around the contact-shoe o to contact m' . The closed circuit through the contact m , shoe o , and contact m' is illustrated diagrammatically only in Fig. 1 by a bridge c^2 , corresponding with the closed circuit through the switch-lever k , as will be described. From contact m' the current passes along wire n^3 to contact n^2 , from whence it passes along wire g^2 to the adjacent gate or door switch x' , and this being in closed-circuit position, as in Fig.

12, the current flows therethrough and along the car end wire h' . Thence the current passes through the closed gate or door switch x^2 at the same end of the car across to wire h^2 , which extends to the motorman's circuit maker and breaker at the other end of the car, but the signaling and controller-locking devices being at this end out of commission the current flows along wire g^2 and through the closed gate or door switch x^3 and the coupling-cable x^5 , together with its closed switches. (Not shown in the diagrams.) Thence the current passes through the closed gate or door switch y' of the connected car y and through all the electrically-connected wires and circuit making and breaking or switching devices of this and the remaining cars, finding its way to the closed gate or door switch y^2 , from whence it passes by a wire y^3 back through the said coupling-cable and its closed switches and to the car end wire h^3 . Thence the current flows along wire g^3 back to the devices in the motorman's box or inclosure at the head of the train, the same passing along the switch-lever k to the contact l , from whence it passes by wire g back to the source of electricity. The opening of any gate or door of the train will break the circuit and a signal given the motorman by the extinguishing of the light or in any other suitable manner indicating to the motorman that it is unsafe for the train to proceed. This might happen between stations as well as at a station. If the train has stopped to take on passengers, the glowing of the signal-lamp indicates that all the gates or doors have been closed. Instead of closing the circuit by gate or door switches, whether the cars have gates or not, it is evident that suitable push-buttons may be arranged in the circuit to be operated by the gatemen or conductors. It will be understood that when the current excites the electromagnet c or solenoid, as the case may be, an audible signal is given by the striking of the clapper e^1 on bell e and that when any gate or door is opened the breaking of the circuit demagnetizes the electromagnet and the spring e^2 throws the clapper against and sounds the bell. When the motive power-current is turned off, the controller will be locked by the latch b' and the motorman cannot turn the current on until all the gates or doors are closed and the electromagnet excited.

On those cars which follow the first car the lever of each motorman's trip-switch or circuit maker and breaker is moved into the position shown in dotted lines in Fig. 13 and the current flows as indicated by the arrows—that is to say, from wire g^3 to lug k^2 , thence along the lever k to contact n^2 , from n^2 to g^2 , the circuit from g^2 to g^3 being completed in evident manner.

It is evident from the above description and the claims to follow that the invention is not restricted to the system of wiring nor to the details of the various components, as many

changes in means and mechanism are within the spirit and scope of the invention and will readily suggest themselves to those skilled.

Having thus described my new electric safety apparatus for cars or trains, what I claim, and desire to secure by Letters Patent, is—

1. The combination of an electric car and its gate or door, the controller, a lock therefor, and electrical means under control of the gate or door for acting on said lock.

2. The combination of an electric car and its gate or door, the controller, an electromagnetic lock therefor, and means under control of the gate or door for acting on said lock.

3. The combination of an electric car and its gate or door, the controller, a lock therefor, a signal, electric circuit connections leading from the signal, and means in conjunction with said connections and under control of the gate or door to cause the operation of the lock and signal.

4. A train, having in combination, its cars provided with gates or doors, a signal, connections from said signal, for an electric circuit controlled from the gates or doors, a motorman's trip-switch in said connections, and means in conjunction with said connections and operated by the opening or closing of a door to cause a signal.

5. A train, having in combination, its cars provided with swinging gates or doors, a signal, connections from said signal for an electric circuit controlled from the gates or doors, a motorman's trip-switch in said connections, and means in conjunction with said connections and operated by the opening or closing of a door to cause a signal.

6. A train, having in combination, its cars provided with gates or doors, a visual signal, connections from said signal, for an electric circuit controlled from the gates or doors, a motorman's trip-switch in said connections, and means in conjunction with said connections and operated by the opening or closing of a door to cause a visual signal.

7. A train, having in combination, its cars provided with gates or doors, an audible signal, connections from said signal for an electric circuit controlled from the gates or doors, a motorman's trip-switch in said connections, and means in conjunction with said connections and operated by the opening or closing of a door to cause an audible signal.

8. A train, having in combination, its cars provided with gates or doors, a signal, connections from said signal, for an electric circuit controlled from the gates or doors, a motorman's trip-switch in said connections, and switches for the connections, operated by the opening or closing of the gates or doors to cause a signal.

9. A train, having in combination with its cars provided with gates or doors, the controller at the forward end of the train, a lock

therefor, and electrical means under the control of the gates or doors for acting on said lock either to lock or unlock the controller.

10. A train, having in combination with its cars provided with gates or doors, the controller at the forward end of the train, an electromagnetic lock therefor, and electrical means under the control of the gates or doors for acting on said lock either to lock or unlock the controller.

11. A train, having in combination with its cars provided with gates or doors, the controller, a lock therefor, a signal, connections from the signal, for an electric circuit for the signal and for commanding the said lock, and means under control of either of the gates or doors to cause the operation of the lock and signal.

12. The combination of a number of cars composing an electric train and their gates or doors, the controller at the forward end of the train, a lock therefor, a signal at the forward end, and electrical means for effectuating the action of the signal and the operation of the lock from the gate or door of any car.

13. The combination of an electric car, the master or motorman's controller thereof, a lock therefor, and means at the rear of the car for operating the lock to release the controller, or to secure it.

14. The combination of an electric car, the master or motorman's controller thereof, a lock therefor, a lock-actuating part, an electric circuit embracing the latter, and means for effecting the circuit to actuate the lock from the rear of the car.

15. An electric train, having in combination, with its cars, the gates or doors and the forward controller, a lock for the controller, and means for operating the lock to release the controller, from between adjacent cars.

16. An electric train, having, in combination with its cars, the master or motorman's controller at the front end of the first car, a lock therefor, an electric circuit embracing the actuating part of the lock, and means for effecting the circuit to actuate the lock from the rear of any car.

17. The combination of a car and its gate or door, an electric circuit, a motorman's trip-switch in the circuit, a signal, and means operated by the gate or door to effect the circuit and cause a signal.

18. The combination of a car and its gate or door, an electric circuit, a motorman's trip-switch in the circuit, a visual signal, and means operated by the gate or door to effect the circuit and cause a signal.

19. The combination of a car and its gate or door, an electric circuit, a motorman's trip-switch in the circuit, an audible signal, and means operated by the gate or door to effect the circuit and cause a signal.

20. The combination of an electric car, a master or motorman's controller at one end, a

lock therefor, and connections leading to the other end of the car for actuating the lock and releasing the controller.

21. The combination of a car, a signal at one end, a controller at the same end, a lock therefor, and the car gate or door at the other end for operating the signal and lock.

22. The combination of a car and its gate or door, an audible signal for signaling twice, the controller, a lock for the controller, means for actuating the signal and locking the controller when the gate or door is opened, and means for again actuating the signal and unlocking the controller when the gate or door is closed.

23. A train of electric cars, the master or motorman's controller at the forward end of the train, a lock therefor, and connections leading to the end of each car for releasing the controller.

24. A train of electric cars, a controller at the forward end of the train, a lock therefor, a signal, and connections leading to the rear ends of the cars for releasing the controller or securing it, and for operating the signal.

25. In combination with the cars of a train and its gates or doors, an audible signal for signaling twice, connections from said signal, for an electric circuit controlled from the gates or doors, a motorman's trip-switch in said connections, means for actuating the signal when a gate or door is opened, and means for again actuating the signal when all the gates or doors are closed.

26. In combination with the cars of a train and its swinging gates or doors, connections from said signal, for an electric circuit controlled from the gates or doors, a motorman's trip-switch in said connections, an audible signal for signaling twice, means for actuating the signal when a gate or door is opened, and means for actuating the signal when all the gates or doors are closed.

27. The combination of an electric car and its controller, an electromagnetic lock therefor, and means under the control of the conductor for actuating said lock.

28. The combination of an electric car, the controller therefor, an electromagnetic lock for the controller, and the gate or door of the car under the control of the conductor for actuating said lock.

29. The combination of an electric car, the controller therefor, a latch, an electromagnetic circuit controlling the latch, and means under the control of the conductor for making and breaking the circuit.

30. The combination of an electric car, the controller therefor, a latch, an electromagnetic circuit controlling the latch, and the gate or door of the car under the control of the conductor for making or breaking the circuit.

31. An electric train of cars, having, in combination with the forward controller, an electromagnetic lock for the controller, and means

under the control of the conductors of the train for actuating said lock.

32. An electric train of cars, having, in combination with the forward controller, a latch, an electromagnetic circuit controlling the latch, and means under the control of the conductors of the train for making and breaking the circuit.

33. An electric train of cars, having, in combination with the forward controller, a latch, an electromagnetic circuit controlling the latch, and the gate or door of the car under the control of the conductors of the train for making and breaking the circuit.

34. A car having a gate or door, in combination with a signal on the front end of the car, and means for operating the signal through the closing or opening of the gate or door.

35. A car having a gate or door, in combination with an audible signal on the front end of the car, and means for operating the signal through the closing or opening of the gate or door.

36. A car having a gate or door, in combination with a visual signal on the front end of the car, and means for operating the signal through the closing or opening of the gate or door.

37. An electric car having, in combination with its gate or door, a controller, locking means therefor, and means for locking or unlocking the controller through the closing or opening of the gate or door.

38. A train of cars having, in combination with the forward controller, locking means therefor, and means for locking or unlocking the controller through the closing of all the gates or doors or the opening of a single gate or door.

39. In combination, a plurality of cars, gate or door switches throughout the train of cars, doors or gates insulated from the switches, electric circuit connections from the said switches, and a motorman's trip-switch and a signal in said connections, said circuit being closed when the gates or doors are all closed, and being broken by the opening of a gate or door.

40. In combination, a plurality of cars, gate or door switches throughout the train of cars, doors or gates insulated from the switches, electric circuit connections from the said switches, and a motorman's trip-switch and an audible signal in said circuit connections, said circuit being closed when the gates or doors are all closed, and being broken by the opening of a gate or door.

41. In combination, a plurality of cars, gate or door switches throughout the train of cars, doors or gates insulated from the switches, electric circuit connections from the said switches, and a motorman's trip-switch and a visual signal in said circuit connections, said circuit being closed when the gates or doors

are all closed, and being broken by the opening of a gate or door.

42. In combination, a plurality of cars, gate or door switches therefor, electric circuit connections from the said switches, a controller, a lock therefor, and a signal in the circuit connections, the lock and signal being controlled from the circuit, and said circuit being closed when the gates are all closed for releasing the controller, and being broken for locking the controller when a gate is opened.

43. In combination, a plurality of cars, gate or door switches therefor, electric circuit connections from the said switches, a controller, a lock therefor, and a visual signal in the circuit connections, the lock and signal being controlled from the circuit, and said circuit being closed when the gates are all closed for releasing the controller, and being broken for locking the controller when a gate is opened.

44. In combination, a plurality of cars, gate or door switches therefor, electric circuit connections from the said switches, a controller, a lock therefor, and an audible signal in the circuit connections, the lock and signal being controlled from the circuit, and said circuit being closed when the gates are all closed for releasing the controller, and being broken for locking the controller when a gate is opened.

45. In combination, a plurality of cars, gate or door switches therefor, electric circuit connections for the said switches, a controller, a lock therefor, and audible and visual signals in the circuit connections, the lock and signals being controlled from the circuit, and said circuit being closed when the gates are all closed for releasing the controller, and being broken for locking the controller when a gate is opened.

46. In combination, a plurality of cars, gate or door switches, electric circuit connections for the said switches, a controller, a lock therefor, an electromagnet, and a signal in the circuit connections, the lock and signal being controlled from the circuit, and said circuit being closed when the gates are all closed, and being broken by the opening of a gate.

47. The combination of a gate or door, a source of electricity, a signal, gate or door switches, a short-circuit contact connected with the said switches, additional contacts connected with the said switches and signal, said contacts being all connected with the source of electricity, and means for making and breaking circuit at said contacts.

48. The combination with a gate or door, a source of electricity, a signal, gate or door switches, paired short-circuit contacts connected with the said switches, additional paired contacts connected with the said switches and signal, said contacts being all connected with the source of electricity, and a suitable knife-switch lever for making and breaking circuit at said contacts.

49. The combination of a gate or door, a

source of electricity, a signal, gate or door switches, two pairs of contacts connected with the said switches and signal, said contacts being connected with the source of electricity, and a suitable knife-switch lever for making and breaking circuit at said contacts.

50. The combination of a gate or door, a source of electricity, a signal, gate or door switches, paired short-circuit contacts connected with the said switches, two pairs of additional contacts connected with the said switches and signal, said contacts being all connected with the source of electricity, and a suitable knife-switch lever for making and breaking circuit at said contacts.

51. The combination of a gate or door, a source of electricity, a signal, gate or door switches, paired short-circuit contacts connected with the gate-switches, additional paired contacts connected with the gate-switches and signal, said contacts being all connected with the source of electricity, a suitable switch-lever, and an insulated contact on said lever for making and breaking circuit with a pair of said additional contacts.

52. The combination of a gate or door, a source of electricity, a signal, gate or door switches, two pairs of contacts connected with the said switches and signal, said contacts being connected with the source of electricity, a suitable switch-lever, and an insulated contact on said lever for making and breaking circuit with a pair of said contacts.

53. The combination of a gate or door, a source of electricity, a signal, gate or door switches, paired short-circuit contacts connected with the said switches, two pairs of additional contacts connected with the said switches and signal, said contacts being all connected with the source of electricity, a suitable switch-lever, and an insulated contact on said lever for making or breaking circuit with a pair of said additional contacts.

54. A train of cars and their respective gates or doors, in combination with a source of electricity, a signal, gate or door switches, a short-circuit contact connected with the said switches, additional contacts connected with the said switches and signal, said contacts being all connected with the source of electricity, and means for making and breaking circuit at said contacts.

55. A train of cars and their respective gates or doors, in combination with a source of electricity, a signal, gate or door switches, paired short-circuit contacts connected with the said switches, additional paired contacts connected with the said switches and signal, said contacts being all connected with the source of electricity, and a suitable knife-switch lever for making and breaking circuit at said contacts.

56. A train of cars and their respective gates or doors, in combination with a source of elec-

tricity, a signal, gate or door switches, two pairs of contacts connected with the said switches and signal, said contacts being connected with the source of electricity, and a knife-switch lever for making and breaking circuit at said contacts.

57. A train of cars and their respective gates or doors, in combination with a source of electricity, a signal, gate or door switches, paired short-circuit contacts connected with the said switches, two pairs of additional contacts connected with the said switches and signal, said contacts being all connected with the source of electricity, and a suitable knife-switch lever for making and breaking circuit at said contacts.

58. A train of cars and their respective gates or doors, in combination with a source of electricity, a signal, gate or door switches, paired short-circuit contacts connected with the said switches, additional paired contacts connected with the said switches and signal, said contacts being all connected with the source of electricity, a suitable switch-lever, and an insulated contact on said lever for making and breaking circuit with a pair of said additional contacts.

59. A train of cars and their respective gates or doors, in combination with a source of electricity, a signal, gate or door switches, two pairs of contacts connected with the said switches and signal, said contacts being connected with the source of electricity, a suitable switch-lever, and an insulated contact on said lever for making and breaking circuit with a pair of said additional contacts.

60. A train of cars and their respective gates or doors, in combination with a source of electricity, a signal, gate or door switches, paired short-circuit contacts connected with the said switches, two pairs of additional contacts connected with the said switches and signal, said contacts being all connected with the source of electricity, a suitable switch-lever, and an insulated contact on said lever for making or breaking circuit with a pair of said additional contacts.

61. A train having in combination with the gates or doors of the individual cars, switches actuated by each gate or door, a signaling device on at least two of the cars, electric circuit connections between the switches and signaling devices, and circuit making and breaking means for cutting either signaling device out of circuit and for establishing suitable electric connections with another, as a head-signaling device, remaining in circuit, whereby, when the last gate or door of the train is closed, said head-signal will be operated.

62. An electric train having in combination with the gates or doors of the individual cars and the controllers, switches actuated by each gate or door, locking means for the controllers, electric circuit connections between the

locking means and switches, and circuit making and breaking means for cutting either controller-locking means out of circuit and for establishing suitable electric connection with
5 the controller-locking means at the head of the forward car, whereby, when the last gate or door is closed, said head controller will be released.

63. A train of electric cars equipped with
10 means for closing a controller-locking circuit upon breaking such circuit between the cars.

64. A train of electric cars equipped with means for automatically closing a controller-

locking circuit upon breaking such circuit between the cars.

65. A train of electric cars equipped with switches for automatically closing a controller-locking circuit upon breaking such circuit between the cars.

Signed at New York, N. Y., this 4th day of
May, 1904.

WILLIAM P. ROBERTSON.

Witnesses:

GEO. L. WHEELLOCK,
E. VAN ZANDT.