No. 806,751. PATENTED DEC. 5, 1905.

J. S. PEVEAR.

SWITCH CONTROLLING MECHANISM.

APPLICATION FILED FEB. 27, 1905.

2 SHEETS—SHEET 1.

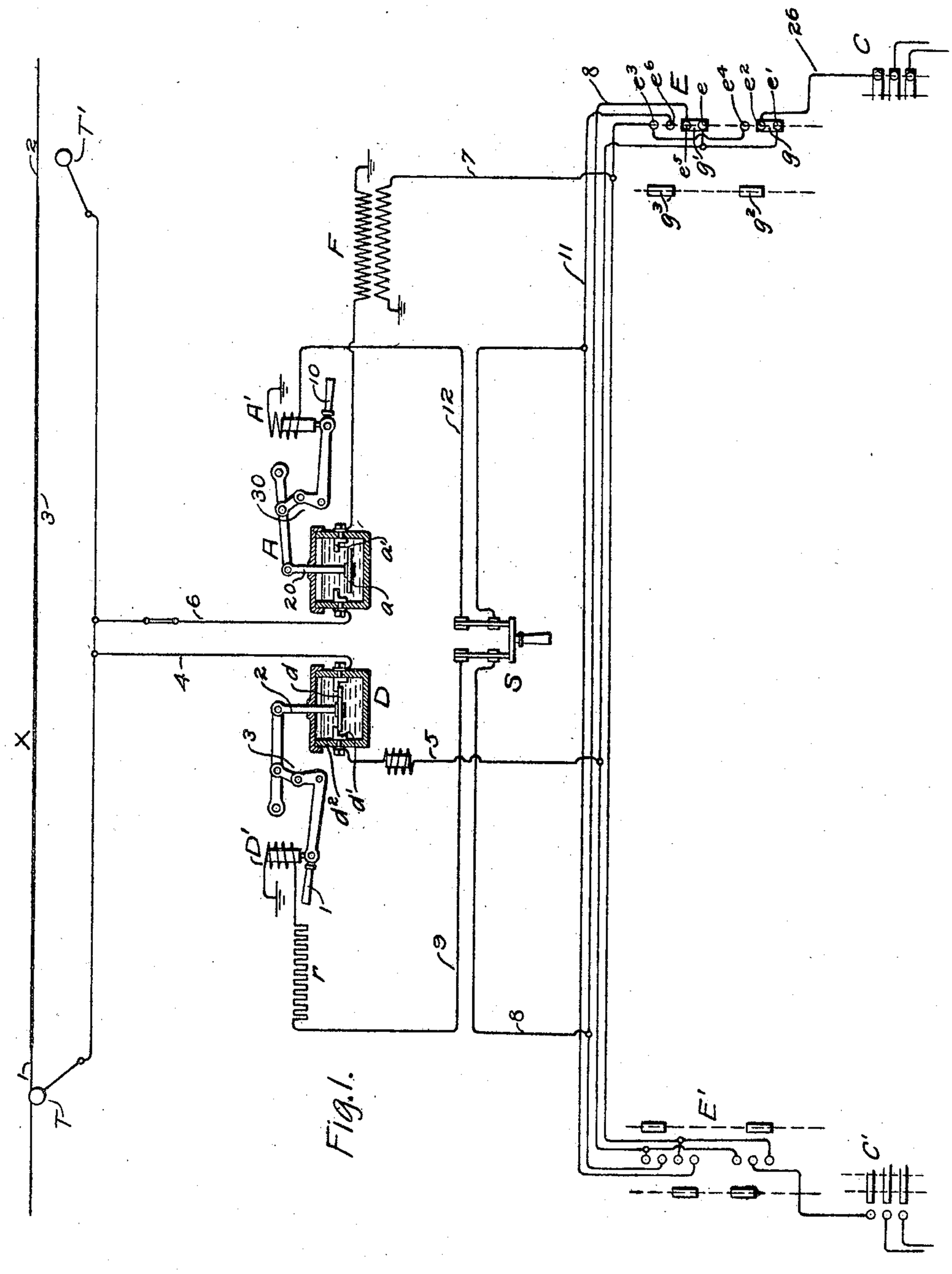

Fig. 1.

Witnesses
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by Allen B. Davis
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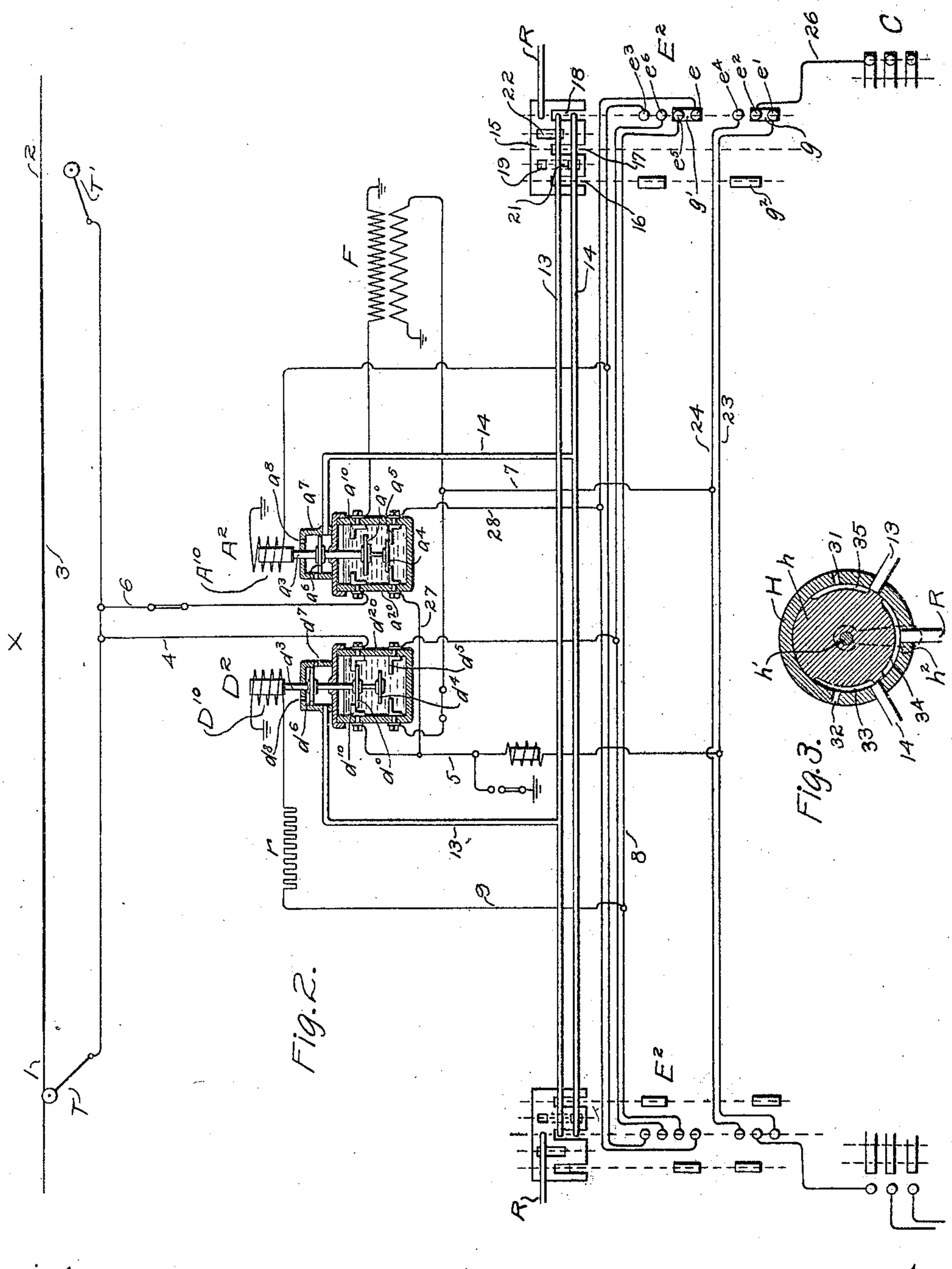

Fig. 2.

Fig. 3.

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UNITED STATES PATENT OFFICE.

JESSE S. PEVEAR, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

SWITCH-CONTROLLING MECHANISM.

No. 806,751. Specification of Letters Patent. Patented Dec. 5, 1905.

Application filed February 27, 1905. Serial No. 247,441.

To all whom it may concern:

Be it known that I, JESSE S. PEVEAR, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Switch-Controlling Mechanism, of which the following is a specification.

The present invention relates to switches which are adapted to be closed selectively—as, for instance, in apparatus arranged for operation on both alternating and direct current, wherein different switches are employed for connecting the apparatus to the source of current-supply according as the current which is being supplied is alternating or direct.

In my application, Serial No. 247,440, for switch-operating mechanism I have disclosed switches of the character specified arranged to be closed automatically and selectively by means of the current which is to be supplied to the apparatus, the selection being determined by the character of the current. In some cases this automatic selection is not necessary. In electric railways, for example, in which the cars are arranged to operate on either direct or alternating current, it may not always be deemed desirable to operate such switches automatically as soon as the current-collecting device comes into engagement with the trolley or third rail. It is, however, desirable that all the main switches shall open as soon as the flow of current is interrupted.

One object of the present invention is to so construct and arrange the parts of switch mechanism of the character referred to that the switches will automatically open upon failure of current, although they may not close automatically.

A further object of the present invention is to so construct and arrange the controlling means for switches of the character described that they are automatically and selectively closed and maintained in closed position when the electric apparatus to which current is to be supplied is placed in the proper condition for operation on the current which is to be supplied.

Further objects of the present invention will appear in connection with the following description thereof.

In the accompanying drawings, Figure 1 illustrates diagrammatically one form of the present invention. Fig. 2 is a diagrammatic representation of a second form, and Fig. 3 shows a detail.

Similar reference characters will be used throughout the specification and drawings to indicate like parts.

I have illustrated the present invention in connection with railway apparatus adapted for operation on both alternating and direct current and in which a plurality of switches are arranged to connect the motor and control apparatus to the trolley or other collecting device. Only a portion of the control apparatus is illustrated, since it in itself forms no part of the present invention, and a simple switch for connecting the control apparatus proper to the source of current-supply is shown, although this switch may perform other functions. For instance, it may be similar to the commutating-switch E in my prior application, Serial No. 220,163, filed August 10, 1904, and reference will be made to it as a "commutating-switch."

Reference being had to Fig. 1, X indicates a trolley-wire or third rail at the point of junction of portions 1 and 2, which are energized, respectively, by direct and alternating currents. 3 indicates an insulated or dead section connecting the live sections 1 and 2. T and T′ are trolleys or other current-collecting devices, adapted to make contact with the trolley-wire or third rail X. D and A are two main switches carried by the car and are respectively adapted to connect the motor and control apparatus to the current-collecting device when direct or alternating current is being supplied. E and C represent a commutating-switch and a controller, respectively, and either or both of these may be duplicated, as at E′ and C′. These parts may all be of any usual or desired construction, since they in themselves form no part of the present invention except as will be hereinafter specified. The switch D consists of the movable contact member *d*, adapted to engage with fixed contacts *d′*. These contacts may be placed within an oil-receptacle d^2, whereby the arc formed upon breaking contact is extinguished. The movable contact member *d* may be operated in any suitable manner, as by means of a handle 1, which is connected to stem 2, upon which the contact member *d* is mounted by means of the lever mechanism 3. When the switch D is closed, current may pass from trolley T or T′, through wire 4, contacts *d* and *d′*, wire 5, to contacts *e* and *e′* on the commutating-switch E. The switch A may be similar in every respect to the switch D, having movable

and fixed contact members a and a', respectively, the operating-handle 10 and the lever mechanism 30 connecting the handle 10 to the stem 20, which carries the movable contact member a. When the switch A is closed, current may pass from the trolley through wire 6, contacts a and a', primary of transformer F, to ground. The secondary of transformer F is connected by means of wire 7 to fixed contacts e^3 e^4 in the commutating-switch. A fixed contact e^5 in the commutating-switch is connected to one terminal of the coil of electromagnet D', whose core is connected to the handle 1, the circuit being through wire 8, one blade of S, wire 9, resistance r, and the opposite terminal of the coil of the electromagnet D' is connected to ground. Similarly, one terminal of the coil of electromagnet A', whose core is secured to handle 10, is connected to a fixed contact e^6 in the commutating-switch E by means of the wire 11, one blade of switch S, to wire 12, and the other terminal of this coil is grounded. In addition to the fixed contacts enumerated the commutating-switch is provided with an additional fixed contact e^2, which may be connected to the motor and control apparatus by means of a wire 26. The commutating-switch is further provided with a number of movable contact-segments g g', g^2 g^3, arranged in pairs, as shown, so that when the switch is moved to its direct-current position, as illustrated, segment g serves to connect together contacts e' and e^2 and segment g' engages with contacts e and e^5. If, on the other hand, the commutating-switch is moved to its alternating-current position, segment g^2 connects together contacts e^2 and e^4, and segment g^3 connects together contacts e^3 and e^6. In either position of the commutating-switch, therefore, the wire 26, which supplies current to the motor and control apparatus, is connected to the source of supply, while the coil of electromagnet D' or of electromagnet A' is connected to the source of supply, according as the commutating-switch is in its direct or its alternating current position.

It is evident that if the main switch A is closed when the commutating-switch is in its direct-current position electromagnet A' is not energized, since no current is supplied thereto. Consequently as soon as the handle 10 is released the switch resumes its normal open position. In the same way switch D will be maintained closed only when the commutating-switch is in the direct-current position. Likewise it is impossible to supply current to both of the maintaining-magnets at the same time, since one set of contacts on the commutating-switch must remain open when the other set is closed. In other words, in order that either main switch may be held in its closed position after it is closed manually, it is necessary that the commutating-switch be first moved to a corresponding running position.

In Fig. 2 a somewhat different modification is illustrated, the switches instead of being manually operated being closed by means of compressed air. The main switch D^2 consists of a stem d^3, carrying the movable contact member d^0 and the auxiliary contact member d^4, these contacts being adapted for engagement with fixed contacts d^{10} and d^5, respectively. A piston d^6 is connected or mounted upon the stem d^3 and is adapted to move within a cylinder d^7, secured to or arranged adjacent the casing d^{20}. The arrangement of contacts is such that when the auxiliary contacts are closed the main contacts are open, and vice versa. The main switch A^2 is similar to the switch D^2, the members a^0 a^3 to a^7 a^{10} a^{20} corresponding to the members d^0, d^3 to d^7, d^{10}, and d^{20} of the switch D^2. Air-pipes 13 and 14 are connected to the cylinders d^7 and a^7, respectively, at points beneath the pistons d^6 and a^6, whereby when pressure is admitted to the pipes the pistons are forced upwardly, opening the auxiliary contacts and closing the main contacts. The cylinders are preferably provided with openings to atmosphere d^8 and a^8, respectively, in order that the movement of the pistons will not be retarded. The contacts on the commutating-switch E^2 are similar to those on the switch E; but in addition to the electrical contacts the commutating-switch E^2 is provided with valve mechanism so arranged that when the commutating-switch is moved toward its alternating-current position air is admitted from a suitable reservoir to the piston a^6, while if the commutating-switch is moved toward its other running position air will be admitted to the piston d^6. The operation of the main switches is therefore made dependent upon the commutating-switch, and the main switches are operated selectively, according as the commutating-switch is in its alternating-current or in its direct-current running position. Furthermore, it is impossible to operate both simultaneously, for the reason that air cannot be admitted to both operating-pistons at the same time. The commutating-switch E^2 is shown in duplicate, and therefore the valve mechanism associated therewith is likewise duplicated, although but one commutating-switch and one valve mechanism is necessary. The commutating-switch and valve mechanism at the left are shown in their "off" positions, while on the right these parts have been moved to the direct-current position. The valve mechanism is shown in developed form as a plate 15, having three ports 16, 17, and 18, which lead to the atmosphere, connected ports 19 and 21, and the port 22. The arrangement of these ports is such that when the commutating-switch is in its off position or in either working position the pipes 13 and 14 are connected to atmosphere through one of the ports 16, 17, or 18, thereby insuring that neither main switch may be maintained closed

by the pneumatic closing mechanism. When the commutating-switch is moved from its off position toward its direct-current-running position, the port 22 connects the pipe 13 to a pipe R, leading from a suitable reservoir, allowing air to flow from the pipe R to the piston d^6. Port 22 is of such dimensions that the supply of air to the pipe 13 is cut off just before the commutating-switch reaches its running position in order to permit this pipe to be again connected to atmosphere through the port 18 when the commutating-switch is in its extreme position. If, on the other hand, the commutating-switch is moved to its alternating-current-running position, air is first supplied to pipe 14, then the supply is cut off and the pipe 14 is connected to atmosphere. The purpose of this arrangement is to enable the main switches to be automatically and selectively closed when the commutating-switch is thrown to one running position or the other without, however, causing the switches to be maintained closed merely by reason of the position of the commutating-switch. The switches D^2 and A^2 are maintained in their closed positions when current is being supplied to the trolley by means of the electromagnets D^{10} and A^{10}, the cores of which in this case are connected directly to the stems d^3 and d^4. The electrical connections are the same as those shown in Fig. 1, except that the circuit of each electromagnet passes also through the auxiliary switch controlled by the other electromagnet, in this way forming a double interlock—namely, between the main switches themselves and in the commutating-switch. The use of the contacts on the main switches necessitates the use of additional wires 23 and 24 for connecting the direct-current switch and transformer F, respectively, to the contacts e^4 and e' of the commutating-switch instead of connecting these contacts in parallel with contacts e^3 and e. Assuming direct current to be flowing into trolley T and the commutating-switch E^2 to have been moved to its direct-current-running position, air will have been admitted to piston d^6, closing the main contacts of switch D^2 and opening the auxiliary contacts. Thereupon current began to flow through wire 4, contact d^9 and d^{10}, wire 5, wire 23, contact e', and thence to contact g and e^2, to wire 26, as before, supplying current to the motor and control apparatus. At wire 5 the current divides and a portion passes through wire 27, through auxiliary contacts a^4 and a^5, through wire 28 to contact e, contacts g' and e^5, wire 8, wire 9, resistance r, coil of electromagnet D^{10}, to ground, thereby energizing the core of the electromagnet D^{10} and maintaining the direct-current switch closed independently of the pneumatic closing means. As soon, however, as the flow of current is interrupted electromagnet D^{10} is deënergized and the main switch is free to open. Similarly, when the commutating-switch is in its alternating-current position and alternating current is being supplied to the trolley the wire 26 is furnished with current through the main switch A^2, transformer F, wire 7, wire 24, contacts e^4, g^2, and e^2, to wire 26, and a branch circuit for electromagnet A^{10} passes through auxiliary contacts on the main switch D^2 and through the proper contacts on the commutating-switch.

In Fig. 3 I have shown in cross-section a simple form of valve mechanism which may be placed in the commutating-switch and which consists of a casing H, into which are led the pipes 13, 14, and R. Ports 31 and 32 extend through the wall of the casing, so as to connect the interior of the casing to atmosphere. A plug-valve h is secured to the shaft h' of the commutating-switch and is provided with three peripheral ports 33, 34, and 35, so arranged that when the valve is in the position shown—the off position—pipes 13 and 14 are connected to atmosphere and shut off from communication with pipe R. When the handle h^2 (shown in dotted lines) is moved to the right, pipe 13 will be connected to pipe R, and then this connection will be interrupted and pipe 13 will be connected to atmosphere through port 31. In the same way upon turning the handle h^2 to the left pipe 14 will first be connected to pipe R and then to atmosphere through port 32.

In each of the modifications illustrated it is impossible for both main switches to be maintained in their closed positions at the same time, and, furthermore, either switch which may be closed will be automatically opened upon cessation of current, so that the operator must perform some act in order to cause it to be again closed. If the switches are located near the trolley-base, the current will be cut off from the car, so that there is no danger of giving a shock to passengers in case the current return is interrupted.

Although I have explained in detail two embodiments of the present invention, I do not desire to limit the present invention to the particular embodiments shown, since in its broader aspects the present invention may be embodied in various other forms which I intend to cover in the appended claims.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. In combination, a supply-conductor, electric apparatus operating upon current supplied by said conductor, a controlling device arranged to connect said apparatus to said conductor and having two working positions, a pair of switches intermediate said controlling device and said conductor, and maintaining means for said switches energized selectively according as the controlling device is in one position or the other.

2. In combination, a supply-conductor, electric apparatus operable on both alternat-

ing and direct currents, a controlling device arranged to connect said apparatus to said conductors and having alternating-current and direct-current running positions, a pair of switches intermediate said controlling device and said conductor, and maintaining means for said switches energized selectively according as the controlling device is in its alternating-current or direct-current position.

3. In an electric system adapted for operation on both direct and alternating current, a supply-conductor, electric apparatus including a controlling device having alternating and direct current working positions, a pair of switches for connecting said apparatus to said supply-conductor, electromagnetic maintaining means for said switches, and contacts associated with said controlling device for completing the maintaining-circuit of one switch when the controlling device is in its alternating-current position and of the other switch when the controlling device is in the direct-current position.

4. In an electric railway, a car having a current-collector, a controlling device arranged to connect the motor and control apparatus to said collector and having alternating and direct current running positions, a pair of switches located between said controlling device and said collector, and maintaining means for said switches energized selectively according as the controlling device is in its alternating or direct current running position.

5. In combination, a supply-conductor, electric apparatus operating on current supplied by said conductor, a connection including a switch and a second connection including a switch and a transformer between said apparatus and said conductor, maintaining means for said switches, and a controlling device so arranged that in one position the maintaining means for the first switch is rendered inoperative while in another position the maintaining means for the second switch is rendered inoperative and the transformer is cut out.

6. In combination, a supply-conductor, electric apparatus operating on current supplied by said conductor, a controlling device arranged to connect said apparatus to said conductor and having alternating and direct current positions, a pair of switches intermediate said controlling device and said conductor, means whereby said switches may be closed, an electromagnet associated with each switch for holding it closed, actuating-circuits for said electromagnets, and means associated with said controlling device for closing said actuating-circuits selectively according as the controlling device is in its alternating or its direct current position.

7. In an electric system arranged to operate on both alternating and direct current, a supply-conductor, electric apparatus including a controlling device having alternating-current and direct-current working positions, a pair of switches adapted to connect said apparatus to said supply-conductor, an electromagnet operatively connected to each of said latter switches for holding it closed, and contacts associated with the controlling device for interrupting the circuit of one of said electromagnets when the controlling device is in its alternating-current working position and for interrupting the circuit of the other electromagnet when the controlling device is in its direct-current working position.

8. In an electric system adapted for operation on both alternating current and direct current, a supply-conductor, electric apparatus including a controlling device having an alternating-current and a direct-current position, a pair of switches for connecting said apparatus to said supply-conductor, means whereby said latter switches may be closed, means for maintaining one of said switches closed when the current supplied is alternating and the controlling device is in its alternating-current position, and means for holding the other switch closed when the current supplied is direct and the controlling device is in its direct-current position.

9. In an electric railway, a collector-shoe, a controlling device for connecting said collector-shoe to the motor and control apparatus of a car and having alternating-current and direct-current running positions, a pair of switches intermediate the collector-shoe and the controlling device, independent actuating and maintaining means for each of said switches, and means controlled by said controlling device for selectively energizing said alternating and maintaining means according as the controlling device is moved to its alternating or its direct current position.

10. In an electric railway, a collector-shoe, a controlling device for connecting said shoe to the motor and control apparatus of a car and having direct and alternating current running positions, a pair of switches intermediate the controlling device and the collector-shoe, independent actuating and maintaining means for each switch, and means associated with said controlling means for selectively causing the actuating means for the switches and the maintaining means to be energized and the actuating means again deënergized according as the controlling device is moved to its alternating or its direct current position.

11. In an electric railway, a collector-shoe, a controlling device for connecting said shoe to the motor and control apparatus of a car, a switch intermediate the controlling device and the shoe, independent actuating and maintaining means for said switch, and means associated with said controlling device for causing said actuating and maintaining means to be energized and the actuating means again deënergized as the controlling device is moved into its working position.

12. In an electric railway, a collector-shoe,

a controlling device for connecting said collector-shoe to the motor and control apparatus, and having alternating and direct current running positions, a pair of switches intermediate the controlling device and the collector-shoe, pneumatic actuating means for said switches, means controlled by said controlling device for selectively energizing said actuating means according as the collecting device is moved toward its alternating or its direct current running position.

13. In an electric system adapted for operation on both alternating and direct current, a supply-conductor, electric apparatus including a controlling device, a pair of switches for connecting the said apparatus with the supply-conductor, pneumatic actuating means and electromagnetic maintaining means for said pair of switches, and means associated with said controlling device for controlling said actuating and said maintaining means.

14. In combination, a source of current-supply, electric apparatus including a controlling device, a switch for connecting said apparatus to said source of current-supply, pneumatically-actuated means for operating said switch, a valve associated with said controlling device for controlling said pneumatically-actuated means, and electromagnetic means for maintaining said switch closed.

15. In combination, a source of current-supply, electric apparatus including a controlling device, a switch for connecting said apparatus to said source of current-supply, means associated with said controlling device and operative during a portion only of the movement thereof to its working position for closing the said switch, and electromagnetic means operative when the controlling device is in its working position to maintain the said switch closed.

16. In combination, a source of current-supply, electric apparatus including a controlling device, a switch for connecting said apparatus to said source of current-supply, pneumatically-actuating means operative during a portion of the movement of the controlling device for closing said switch, and electromagnetic maintaining means including said switch in its circuit.

17. In combination, a source of current-supply, electric apparatus including a controlling device, a switch for connecting said apparatus to said source of current-supply, pneumatic actuating means for said switch, valve mechanism associated with said controlling device and arranged to supply compressed air to said actuating means during a portion of the movement of said controlling device and to again exhaust the air therefrom when the controlling device is in a working position, and electromagnetic maintaining means controlled by said switch.

18. In combination, a source of current-supply, electric apparatus arranged to operate on alternating current and on direct current and including a controlling device having alternating-current and direct-current working positions, a pair of switches for connecting said apparatus to said source of current-supply, means for holding said switches closed, and means associated with said controlling device and arranged to render said holding means effective as to one of the switches when the controlling device is in its alternating-current position and as to the other switch when the controlling device is in its direct-current position.

19. In combination, a source of current-supply, electric apparatus arranged to operate on both alternating and direct current and including a controlling device having alternating and direct current working positions, a pair of switches for connecting said apparatus to said source of current-supply, actuating means for said switches, and means associated with said controlling device for rendering said actuating means effective as to one of said switches when the controlling device is moved toward one of its working positions and as to the other of said switches when the controlling device is moved toward its other position.

20. In combination, a source of current-supply, electric apparatus arranged to operate on both alternating and direct current and including a controlling device having alternating and direct current positions, a pair of switches for connecting said apparatus to said source of supply, a piston associated with each of said switches, and means associated with said controlling device for admitting air to one of said pistons when the controlling device is moved toward one of its working positions and to the other piston when the controlling device is moved toward its other working position.

21. In combination, a source of current-supply, electric apparatus arranged to operate on both alternating and direct current and including a controlling device having alternating and direct current working positions, a pair of switches for connecting said apparatus to said source of supply, a piston operatively related to each of said switches, means associated with said controlling device for admitting compressed air to one or the other of said pistons according as the controlling device is moved toward its alternating-current or its direct-current position and for exhausting the air when a full working position is reached, and means for maintaining the switches closed after they have been closed.

In witness whereof I have hereunto set my hand this 24th day of February, 1905.

JESSE S. PEVEAR.

Witnesses:

BENJAMIN B. HULL,

HELEN ORFORD.