No. 844,777. PATENTED FEB. 19, 1907.

F. E. CASE.

CONTROL SYSTEM FOR CONNECTING MOTORS AS BRAKING GENERATORS.

APPLICATION FILED JUNE 6, 1906.

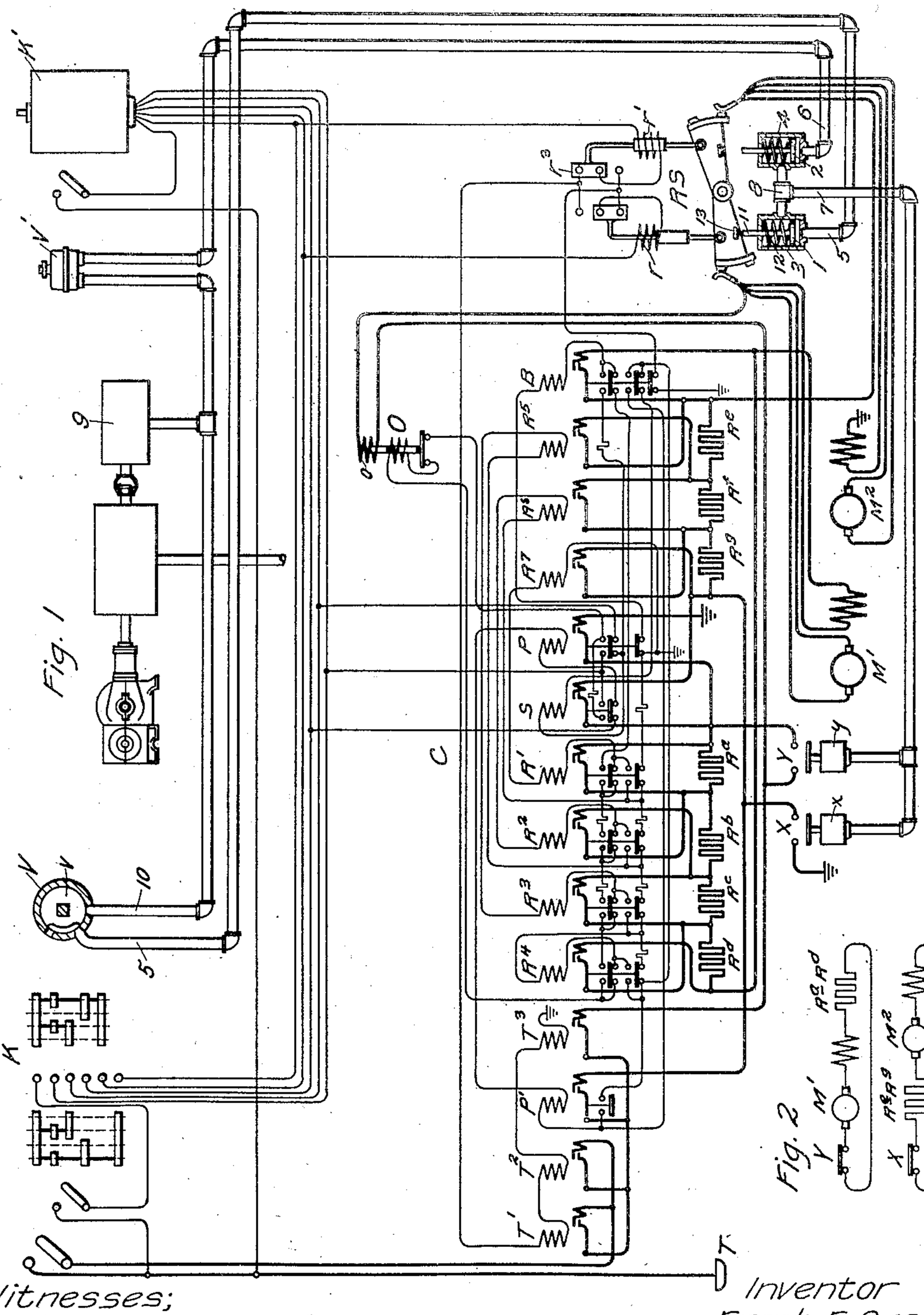

Fig. 1

Fig. 2

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UNITED STATES PATENT OFFICE.

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CONTROL SYSTEM FOR CONNECTING MOTORS AS BRAKING-GENERATORS.

No. 844,777. Specification of Letters Patent. Patented Feb. 19, 1907.

Application filed June 6, 1906. Serial No. 320,436.

To all whom it may concern:

Be it known that I, FRANK E. CASE, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Control Systems for Connecting Motors as Braking-Generators, of which the following is a specification.

For electric-railway service it is desirable to have the motor-control apparatus so arranged that the propelling-motors may be made to serve as braking-generators to stop or retard the movement of a car or train. The series motors usually employed need only have the connections between the fields and armatures reversed in order to cause them to operate as generators. In the ordinary systems the motor-controllers and the reversing-switch are electrically operated, so that in case the power fails the service operating means cannot be used to effect the proper connections. In my prior patent, No. 809,773, granted January 9, 1906, this difficulty is overcome through the use of auxiliary or emergency operating means for controlling the reversing-switch independently of the source of current-supply. Where, however, the motors are not normally connected in closed circuits—as, for example, in an ordinary two-motor equipment—means must also be provided for forming closed circuits for the motors at the same time that the reversing-switch is thrown, since otherwise no braking action will take place.

The object of the present invention is to provide a simple and novel arrangement for effecting the proper motor connections for braking independently of the supply-current, particularly in cases where the motors are not normally grouped, closed circuits when the controller is in its "off" position.

To the above end the present invention consists in certain features of construction and organization of parts to be hereinafter described, and particularly pointed out in the claims.

In the accompanying drawings, Figure 1 shows diagrammatically a two-motor car equipment arranged in accordance with the present invention, and Fig. 2 indicates the motor-circuits when the motors are acting as braking-generators.

Reference being had to the drawings, M' and M^2 represent two series motors; T, a current-collecting device; C, a motor-controller of the separately-actuated-contact type for connecting the motors in series and in parallel and varying the amount of resistance R^a R^g in the motor-circuit. The motor-controller comprises a series of line-contacts T', T^2, and T^3, a series contact S, parallel contacts P and P', a bridging-contact B, and resistance-controlling contacts R' to R^7. This controller is identical with the controller shown in Patent 809,774, granted on January 9, 1906, on an application filed by me, except that the normally closed contacts T^a T^b are omitted. K and K' are master-controllers located at opposite ends of the car and arranged to energize either of the actuating-coils r or r' of the reversing-switch and to control the operation of the contacts of the controller C, so as to connect the motors for operation either in the forward or reverse direction at varying speeds in the usual way. r^3 is an interlock on the reversing-switch arranged to shift the actuating-circuit of the electromagnet r or r' through the actuating-coils of the line-contacts after the reversing-switch has operated, this interlock being of the type usually employed for this purpose. All these parts may be of any usual or preferred forms, since the particular forms illustrated are indicative only of general types.

The present invention, specifically considered, consists in providing auxiliary actuating means for the reversing-switch, together with two auxiliary switches, which are closed at the same time or shortly after the reversing-switch is actuated, whereby the circuits of the motors are completed, as shown in Fig. 2. This auxiliary apparatus preferably consists of a pair of pneumatically-actuated contacts X and Y and a pair of pneumatically-actuated pistons 1 and 2, the contacts X and Y being arranged to complete the motor-circuits and the pistons being adapted to operate the reversing-switch. The pistons 1 and 2 may conveniently be arranged within cylinders 3 and 4, into the bottom of which pipes 5 and 6 open. A pipe 7, leading to the cylinders x and y of the switches X and Y, is connected, as by means of a T-head 8, to the cylinders 3 and 4 at points intermediate the ends thereof. The

pipe 5 leads to an engineer's valve V at one end of the car, and the pipe 6 leads to a similar valve V′ at the opposite end of the car. The valves V and V′ are also connected to an auxiliary reservoir 9 and receive air therefrom. The valve V is shown in a developed form as comprising an ordinary plug-valve *v*, arranged to connect pipe 5 either to atmosphere or to pipe 10, leading to the reservoir. In the first position—namely, that shown—the cylinders 3, 4, *x*, and *y* are exhausted. In the other position of this valve air flows from the auxiliary reservoir through the valve, through pipe 5 into cylinder 3, and forces the piston 1 and its attached stem 11 upward against the tension of the spring 12. The stem 11 engages a lug 13 on the movable member of the reversing-switch and forces the switch to the position opposite to that shown. As the piston approaches its upper limit the opening to pipe 7 is uncovered and air flows into this pipe and into pistons *x* and *y*, closing the switches X and Y. Similarly if valve V′ is operated the piston 2 is moved outward and the reversing-switch, if not already in the position shown, is brought to that position, and air then flows into pipe 7, as before, and closes the switches X and Y.

When the switches X and Y are closed, a circuit may be traced from one terminal of motor M^2 to ground and thence through switch X, through resistance-sections R^g, R^f, and R^e, to the reversing-switch, to the opposite terminal of this motor. A circuit may also be traced from the right-hand terminal of motor M′, through resistance R^d to R^a, through switch Y, through the coil *o* of throttle-relay O, through reversing-switch, and thence back to the left-hand terminal of this motor—namely, the two motors are connected as shown in Fig. 2.

It will be seen that by arranging the parts as described it is impossible for the operator to throw the reversing-switch in the wrong direction, for when the motorman is at one end of a car and he desires to apply the brakes the valve at that end is operative only to produce the proper operation of the reversing-switch to permit the motors to build up their fields. It will also be seen that the switches X and Y are not closed until the reversing-switch has first been brought to the proper position, and thereby the motors are prevented from generating current in a direction to neutralize the residual magnetism in the field.

My invention is not limited to the particular devices illustrated or to a combination of all such devices, since it contemplates all devices or combinations of devices within the scope of the appended claims.

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

1. In a system of control, a source of current-supply, a motor, a motor-controller, a reversing-switch, means controlled by current from said source of supply for normally actuating said reversing-switch, an auxiliary controller for completing a circuit for said motor, and means independent of the said source of current-supply for operating said reversing-switch and said auxiliary controller to connect the motor for operation as a braking-generator.

2. In a system of control, a motor, a motor-controller, a reversing-switch, electromagnetic actuating means for said reversing-switch, a contact independent of the said controller for completing a circuit for said motor, and means for actuating said reversing-switch and said contact to connect the motor for operation as a braking-generator.

3. In a system of control, a motor, a motor-controller, a reversing-switch, service operating means for said switch, a contact for completing a circuit for said motor, and emergency operating means for said reversing-switch, said emergency operating means being arranged to also close said contact.

4. In a system of control, a motor, a reversing-switch, service operating means for said reversing-switch, a contact for completing a circuit for said motor, and emergency actuating means arranged to first operate said reversing-switch and then said contact in order to connect the motor for operation as a braking-generator.

5. In a system of control, a motor, a reversing-switch, service actuating means for said reversing-switch, a contact for completing a circuit for said motor, a pair of pneumatic actuating devices adjacent said reversing-switch, pneumatic actuating means for said contact, separate supply-pipes leading to the pneumatic actuating devices for the reversing-switch, and means for connecting each supply-pipe to the said contact actuating means when the corresponding actuating device has moved to the switch-operating position.

6. In a system of control, a plurality of motors, a motor-controller, a reversing-switch, service operating means for said reversing-switch, contacts for completing separate circuits for each of said motors, and emergency operating means for said reversing-switch and said contacts.

7. In an electrically-propelled vehicle, a motor, a reversing-switch, service operating means for said reversing-switch arranged to be controlled from either end of the vehicle to connect the motor for propelling the vehicle in either direction, a pair of pistons adjacent said reversing-switch for operating the said switch respectively to the forward and reverse running positions, a valve at one end of the vehicle for admitting compressed fluid to one of said pistons only, and a valve at the other end of the vehicle for admitting compressed fluid to the other piston only.

8. In an electrically-propelled vehicle, a motor, a motor-controller, a reversing-switch, service operating means for said reversing-switch arranged to be controlled from either end of the vehicle to connect the motor for propelling the vehicle in either direction, a pair of pistons adjacent said reversing-switch for operating the said switch respectively to the forward and reverse running positions, a valve at one end of the vehicle for admitting compressed fluid to one of said pistons only, a valve at the other end of the vehicle for admitting compressed fluid to the other piston only, a contact for completing a circuit for said motor, and means controlled by each of said pistons for operating said contact.

In witness whereof I have hereunto set my hand this 5th day of June, 1906.

FRANK E. CASE.

Witnesses:
BENJAMIN B. HULL,
HELEN ORFORD.