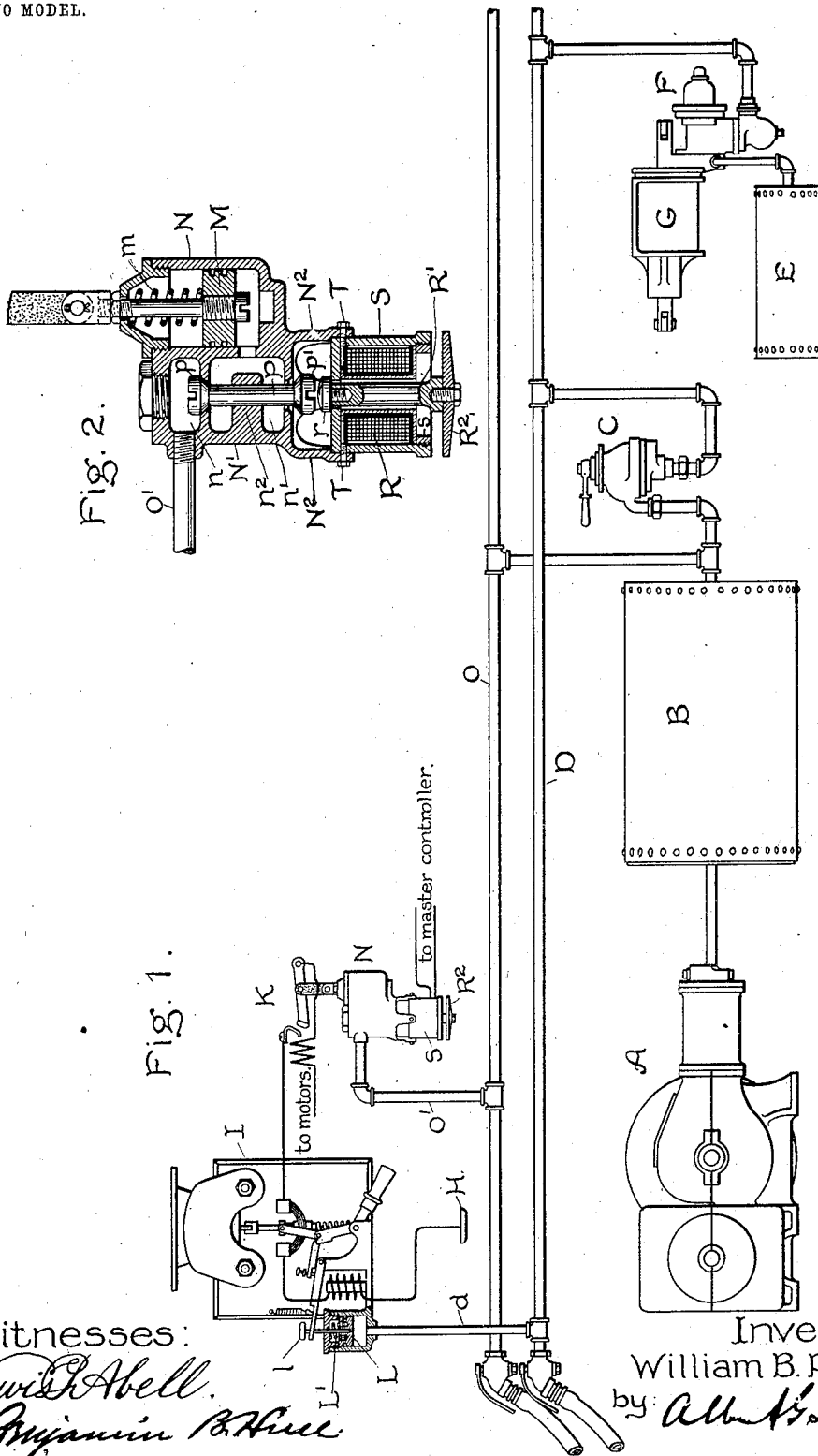


W. B. POTTER.
SYSTEM OF MOTOR CONTROL.
APPLICATION FILED JAN. 24, 1901.

NO MODEL.



Witnesses:
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UNITED STATES PATENT OFFICE.

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SYSTEM OF MOTOR CONTROL.

SPECIFICATION forming part of Letters Patent No. 728,611, dated May 19, 1903.

Application filed January 24, 1901. Serial No. 44,561. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM B. POTTER, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Systems of Motor Control, of which the following is a specification.

This invention relates to train-control systems for electric-railway trains, and especially to those in which the individual car-controllers are actuated by fluid-pressure controlled electrically by a master-controller. Such a system is set forth in detail in my pending application filed April 8, 1899, Serial No. 712,220. In said system the valves which control the flow of fluid-pressure to and from the devices by means of which the switches of the motor-controller are opened and closed are rigidly secured to the armatures of the electromagnets by which said valves are actuated and are spring-held in their closed positions. This is liable to cause a sluggish movement of the valve owing to the inertia of the armature and valve.

The object of the present invention is to insure a prompt and quick movement of the valve both in opening and closing.

To this end my invention consists in an electropneumatic valve structure, in which the valve proper consists of a freely-movable stem having an admission-valve head at one end and an exhaust-valve head at the other. The admission-valve head is on the admission side of the admission-port and is held normally closed by the fluid-pressure supply, the exhaust-valve head being on the exhaust side of the exhaust-port and normally open. The stem and its heads are not connected with the armature of the electromagnet. Upon energizing the electromagnet its armature is caused to strike the valve a sudden blow, thereby driving the admission-valve open instantly and holding it open against the fluid-pressure, the exhaust-valve being simultaneously closed. When the electromagnet is deenergized, its armature drops and the admission-valve is instantly closed not only by the pressure of the supply, but also by the rush of fluid-pressure through the exhaust. The valve is thus rendered very quick and positive in its movements, insuring a livelier

action of the switches and reducing the chances of arcing.

In the accompanying drawings, Figure 1 is a general diagram of a fluid-pressure braking system combined with electropneumatic electric-motor-controlling devices embodying my invention. Fig. 2 is a longitudinal section of my improved electropneumatic valve structure.

The motor-driven air-pump A supplies compressed air to the main reservoir B. The pump may be regulated by any of the usual governors, which I have not deemed it necessary to illustrate, as they are well known in practice. From the main reservoir the air passes through the engineer's valve C to the train-pipe D, by means of which it is conducted to the auxiliary reservoirs E through the triple valve F, and thence allowed to enter the brake-cylinders G. These parts are common to air-brake systems and need no detailed description. It is understood that each car has its auxiliary reservoir, triple valve, and brake-cylinder.

The electric current for driving the car-motors is taken from a third rail or other working conductor by a sliding contact H on each car, from which it is led through an automatic circuit-breaker I to a main switch K and thence through suitable controlling devices to the motors. A branch pipe d conducts air from the train-pipe D to a movable abutment L, having a stem provided with a head l, adapted to actuate the tripping device of the circuit-breaker. When the train-pipe pressure is reduced to apply the air-brakes, the abutment L is moved by a spring L' or otherwise and trips the circuit-breaker to open-circuit the motors. These parts are all shown and described in my pending application aforesaid.

The motor-controller, as illustrated in my application above referred to, is of the separately-actuated contact type and comprises a plurality of switches each actuated by a pneumatically-operated device which is electromagnetically controlled. Each switch, together with its actuating device, constitutes what I have termed one of the "elements" of the controller. One of these elements I have shown at the left in Fig. 1, with its

switch K connected to the motor-circuit and its electromagnet provided with leads, which may be connected to a source of supply through the contacts of a master-controller or any suitable circuit-closing device. Although a complete controller comprises a plurality of such elements, I have deemed it unnecessary to illustrate more than one in this application, since my present invention relates only to the valve and its operating mechanism.

In the element which I have illustrated the switch K is actuated by a movable abutment M, preferably a piston in a cylinder N. A spring *m* holds the switch normally open. Adjacent to the cylinder is a valve-casing N', containing a chamber *n*, into which fluid-pressure is brought by a branch pipe O' from a second train-pipe O, connected directly with the main reservoir. Another chamber *n'* in the valve-casing connects with the cylinder N below the piston M. An admission-port connects the chambers *n* and *n'*, and an exhaust-port opens from the latter chamber to the atmosphere. Simultaneously controlling these ports is an electrically-actuated valve consisting of a stem P, preferably guided in a septum *n*² in the casing and carrying two heads *p* *p'*, constituting, respectively, admission and exhaust valves. The head *p* seats downwardly in the admission-port, and the head *p'* seats upwardly in the exhaust-port, one being open when the other is closed. The fluid-pressure in the chamber *n* keeps the admission-valve normally closed.

To open the valve and permit the fluid-pressure to pass through the chamber *n'* to the cylinder and actuate the abutment to close the switch K, I provide a solenoid R, attached to the valve-casing N', with its movable core R' in line with the valve-stem P. A convenient way to support the solenoid is to incase it in an iron box S, in which it is secured by a screw-threaded ring *s*. The box is fastened by screws T to arms N², depending from the valve-casing. The spaces between the arms give access to the exhaust-port and valve *p'* and permit the escape of the exhaust-air. The lower end of the core R' carries a disk armature R², adapted to fit the end of the box S. The core R' passes up through the closed top of the box S and has a head *r*, by means of which it hangs on said box, the head lying normally a little below the bottom of the valve *p'*.

When the solenoid is energized by a current from the master-controller or other source, the core is lifted quickly and strikes the end of the valve a sudden and powerful blow, instantly raising it off its seat and admitting fluid-pressure to the cylinder. The exhaust-port is simultaneously closed and is held closed so long as the solenoid remains energized.

On open-circuiting the solenoid the core drops, letting the valve drop also. This action is expedited by the air-pressure in the

chamber *n* and also by the rush of the exhaust-air out through the lower port.

While I have shown the admission-valve as the upper one and the exhaust-valve as the lower one on a common stem P, yet it should be understood that I do not limit myself to this construction, since any arrangement by which the two valves can be operated simultaneously by the solenoid to accomplish the result set forth would be within the scope of my invention so long as they are disconnected from the solenoid-core.

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

1. In an electropneumatic valve structure, the combination with a valve-casing, of a freely-movable valve therein adapted to be held in its closed position by fluid-pressure, a solenoid, and a movable core for the said solenoid having no connection with the valve but arranged to impart a quick movement thereto to cause it to open.

2. In an electropneumatic valve structure, the combination with a valve-casing having admission and exhaust ports, of a freely-movable valve in said casing controlling said ports, said valve being adapted to be held by fluid-pressure in such a position as to close the admission-port and open the exhaust-port, and a solenoid provided with a movable core having no connection with said valve but arranged to actuate it suddenly.

3. In an electropneumatic valve structure, the combination with a valve-casing, of a freely-movable valve therein adapted to be held closed by fluid-pressure, a solenoid, and a movable core for said solenoid having no connection with the valve but mounted in alignment therewith so as to be capable of striking it a sudden powerful blow to open it against the pressure of said fluid.

4. The combination with a valve-casing having two chambers with an admission-port between them and an exhaust-port leading out of one of them, of a freely-movable valve having two heads, one on the admission side of the admission-port and the other on the exhaust side of the exhaust-port, and electromagnetic means for actuating said valve to close the exhaust-port and open the admission-port.

5. The combination with a valve-casing having two chambers, with an admission-port between them and an exhaust-port leading out of one of them, of a freely-movable valve having two heads, one on the admission side of the admission-port and the other on the exhaust side of the exhaust-port, a solenoid, and a movable core therefor arranged to move the said valve to close the exhaust-port and open the admission-port when the said solenoid is energized.

6. The combination with a valve-casing having two chambers, one connected with a source of fluid-pressure and the other with a device to be actuated, with an admission-port between said chambers and an exhaust-port

leading from the latter chamber, of a freely-movable valve comprising a connecting-stem and two heads adapted to close said ports alternately, and electromagnetic means for imparting a blow to said valve to actuate the same.

7. The combination with a valve-casing, of a reciprocating valve-stem carrying a valve-head located below the bottom of the casing, depending arms on the casing, and a solenoid suspended by said arms and having a movable core to actuate said valve.

8. The combination with a valve-casing having a port in its lower end, arms depending from the casing, a box secured to said arms, a solenoid in the box, a movable core passing up through the top of the box and having a head, and a freely-movable valve controlling said port and in line with the core.

9. In a controller of the separately-actuated contact type, a pneumatically-actuated switch member, a piston for actuating said switch member, a freely-movable valve for controlling the admission of compressed fluid from any suitable source to actuate said piston, said valve being adapted to be held in its closed position by the pressure of said fluid, and electromagnetic means for actuating said valve.

10. In a controller of the separately-actuated contact type, a pneumatically-actuated

switch member, a piston for actuating said switch member, a freely-movable valve for controlling the admission of compressed fluid from any suitable source to actuate said piston, said valve being adapted to be maintained in its closed position by pressure of said fluid, a solenoid, a movable core for said solenoid separate therefrom but in alinement therewith and capable of striking said valve a sudden blow to open the same against the pressure of said fluid.

11. In a controller of the separately-actuated contact type, a pneumatically-actuated switch member, a cylinder having a piston for actuating said switch member, a valve-casing provided with admission and exhaust ports communicating with said cylinder, a freely-movable valve structure constructed and arranged normally to close the admission-port and open the exhaust-port and adapted to be held in said position by fluid-pressure, and electromagnetic means for actuating said valve structure to open said admission-port and close the exhaust-port against said fluid-pressure.

In witness whereof I have hereunto set my hand this 21st day of January, 1901.

WILLIAM B. POTTER.

Witnesses:

JAMES J. MAHONY,
ANNE HARWARD.