No. 744,051. PATENTED NOV. 17, 1903.

F. B. COREY.

TIME LIMIT DEVICE FOR MOTOR CONTROLLERS.

APPLICATION FILED MAY 24, 1902.

NO MODEL.

Fig. 1.

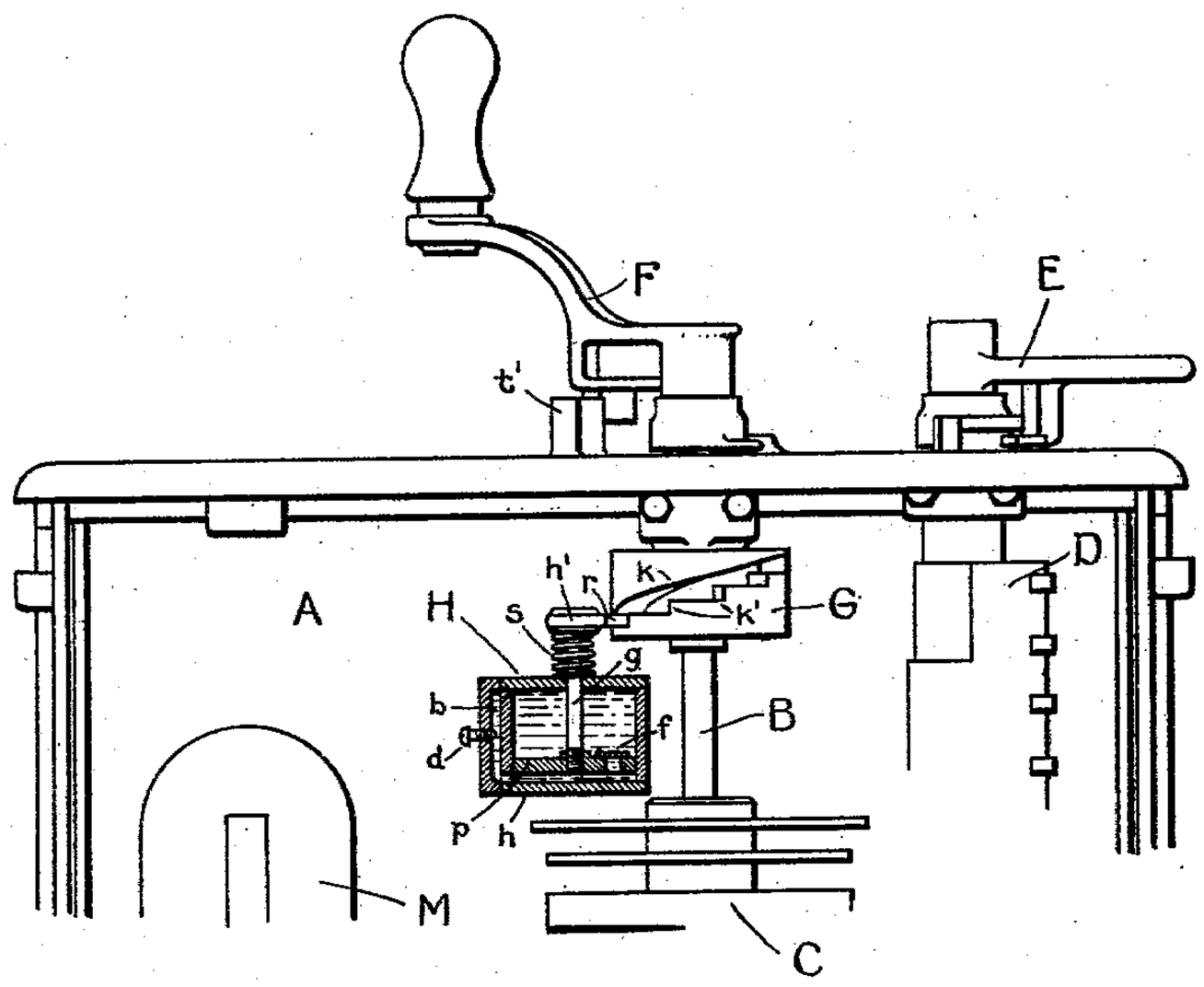


Fig. 2.

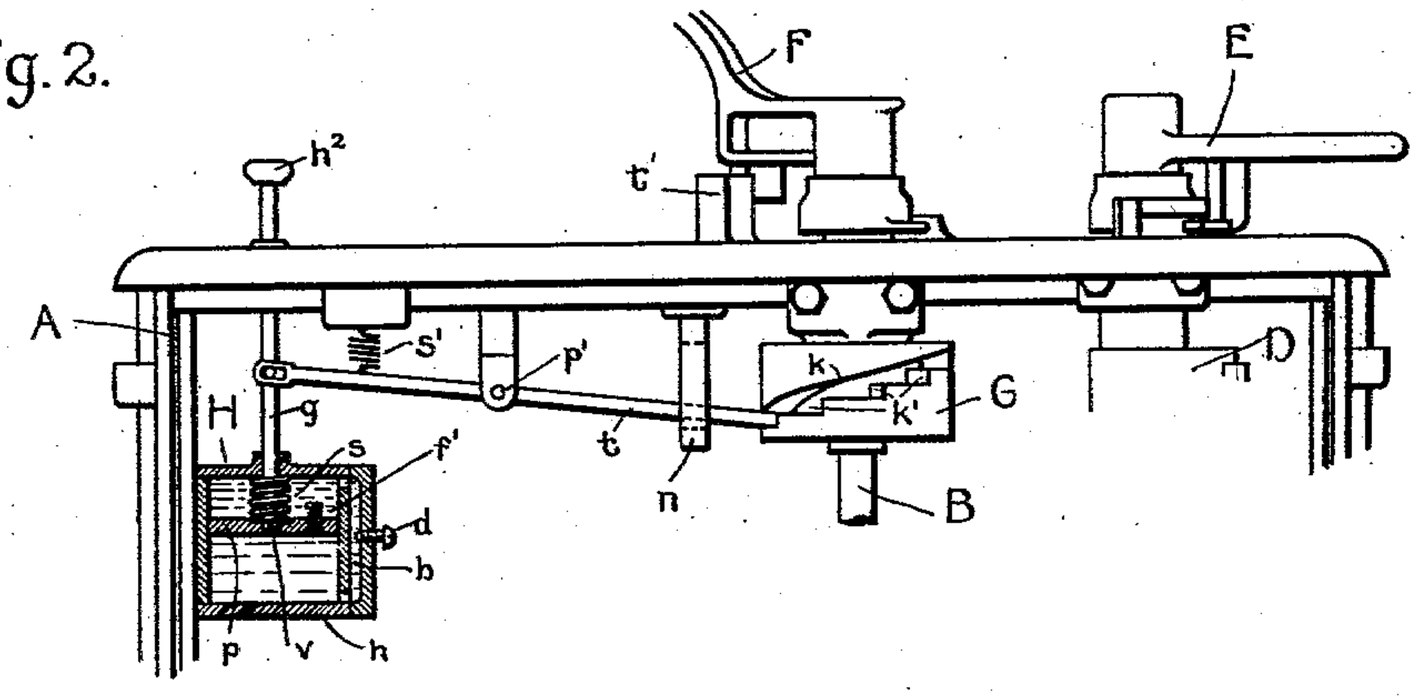


Fig. 3.

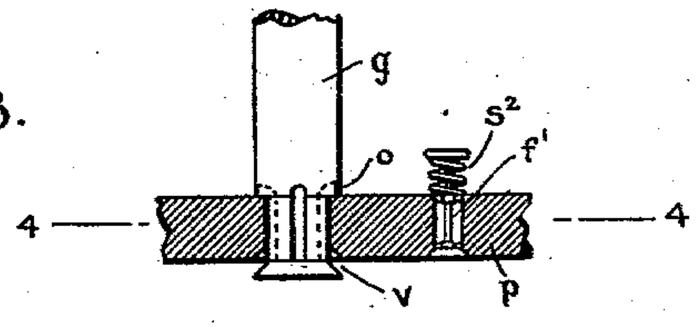
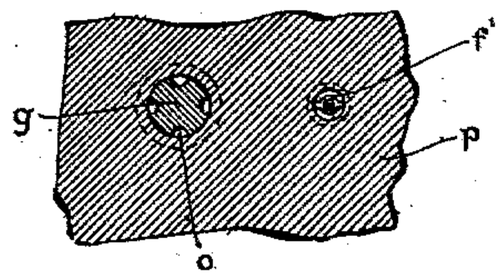


Fig. 4.



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No. 744,051. Patented November 17, 1903.

UNITED STATES PATENT OFFICE.

FRED B. COREY, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

TIME-LIMIT DEVICE FOR MOTOR-CONTROLLERS.

SPECIFICATION forming part of Letters Patent No. 744,051, dated November 17, 1903.

Application filed May 24, 1902. Serial No. 108,869. (No model.)

To all whom it may concern:

Be it known that I, FRED B. COREY, a citizen of the United States, residing at Schenectady, in the county of Schenectady, State of New York, have invented certain new and useful Improvements in Time-Limit Devices for Motor-Controllers, of which the following is a specification.

My invention relates to devices for protecting electric motors from currents of sufficiently large volume to endanger their insulation, and relates more particularly to time-limit devices for preventing a too-rapid forward movement of the controllers commonly used in the control of electric railway-motors.

The object of my invention is to provide simple and efficient means for preventing the operator of a rheostat or controller from moving said rheostat or controller, so as to cause a current in excess of any predetermined amount to pass to the motor or motors governed by the said rheostat or controller.

It is customary in the control of electric motors to insert a variable resistance in the circuit when the motor is started and to cut out said resistance as the counter electromotive force of the motor rises. If this resistance be cut out too rapidly, a large current will flow through the motor, and even though the motor is uninjured this current will be needlessly wasted. In the operation of street-railways, especially where a large number of cars are used, the too-rapid forward movement of the motor-controllers carried by the cars causes a great waste of current in the operation of the system and also endangers the motors.

My invention consists of a time-limit device so constructed and arranged as to prevent the controller-handle from being moved more than one step or point forward at a time, but to allow a free and unretarded movement of the handle between one point and the next point in advance, whereby the danger from arcing, due to a retarded movement of the controller-contacts, is obviated, the operator being obliged to wait a certain predetermined length of time at each point of the controller before moving forward to the next point in advance.

More particularly my invention consists of a spring-actuated dash-pot comprising a cylinder filled with a heavy liquid, such as oil, said cylinder containing a spring-pressed piston, which is operatively connected to a member formed with a series of steps or stops and operated by the controller-shaft, said stepped member and dash-pot coacting to allow a step-by-step forward movement of the controller-shaft.

My invention also consists of means comprising a cam-surface formed on said stepped member with which the piston of said dash-pot coacts, which serves, together with a one-way valve in the piston of the dash-pot, to allow said controller to be turned rapidly backward toward its initial position.

My invention further comprises means whereby in case of an emergency an auxiliary valve in the piston of the dash-pot may be opened and the controller moved forward as rapidly as desired.

In the accompanying drawings, Figure 1 is an elevation, partly in section, of my invention as applied to a drum type of controller. Fig. 2 is a similar view of a modification. Fig. 3 is a detailed section of the piston shown in Fig. 2 on a larger scale, and Fig. 4 is a section of line 4 4 of Fig. 3.

Referring now to Fig. 1, A designates the frame of the controller, B the controller-shaft, and C the drum carrying the contacts which are secured to said shaft. D represents a reversing-switch, E the handle for operating said switch, and F the handle for operating shaft B. M designates the blow-out magnet-coil ordinarily used with such a controller. Rigidly attached to the shaft B is a drum or member G, on which the cam-surface *k* and the steps or stops *k'* have been formed. Rigidly attached to the casing of the controller is the cylinder *h* of a dash-pot H, the ends of which are connected together by means of the by-pass *b*, in which is inserted an adjustable valve *d*. The piston *p*, to which is attached the piston-rod *g*, operates in said cylinder *h*. Attached to the upper end of said piston-rod *g* is an enlarged head *h'*, which carries the stud *r*, normally engaging with the cam-face *k* of the member G through the ac-

tion of the spring *s*. The piston *p* carries a one-way or flap valve *f*, which governs an opening through said piston.

In operation when the controller-handle is in its initial position the stud or arm *r* bears against the cam-face *k*, as shown in Fig. 1. As the handle F is rapidly moved forward away from the stop *t'* the drum G is moved forward, thereby causing the stud *r* to leave the cam-surface *k* and strike the first of the steps *k'*. The handle must be held in this position until the spring *s* acts to lift the piston *p*, so that the stud *r* will again strike the cam-face *k*. The rapidity with which the piston *p* rises is regulated by the small valve *d*, which controls the flow of the liquid contained in the cylinder *h* from its position above said piston through the by-pass *b* to the lower end of said cylinder below said piston. The handle F can now be moved unretarded into the next operative position of the controller—that is, until the stud *r* strikes the second of the series of steps *k'*—and so on, step by step, until the controller has been moved into the desired working position. If the handle is moved forward slowly, the stud or arm *r* will follow the cam-face *k* and will not strike any of the stops *k'*, thereby allowing an uninterrupted forward movement. It will be seen that throughout the forward movement of the controller-cylinder the piston *p* has a movement in but one direction, the said movement being either continuous or intermittent, dependent upon the rapidity with which the controller-cylinder is moved forward. It will also be seen that on account of the movement of the piston *p* in but one direction no energy is expended by the motorman in returning said piston to its initial position against the action of the spring *s* when the controller is moved from one operative position to the next, thereby allowing an unretarded movement of the controller-cylinder between the operative positions. On returning the handle F to its initial or first operative position the stud *r* follows the cam-face *k* as the drum G rotates, thereby compressing the spring *s* and forcing the piston *p* downward, the valve *f* operating to allow a rapid flow of the liquid contained in the lower part of the cylinder *h* into the upper part of the same above the piston.

In the modification shown in Fig. 2 of the drawings means are provided whereby the operator is enabled to move the controller-handle forward rapidly in case of an emergency. To this end the piston-rod *g* is extended through the top of the controller-case A and is terminated in a head h^2, the lower end of said piston-rod *g* passing loosely through the piston *p* and constructed so as to form a valve *v*. The valve *v* is opened by a downward pressure on the piston-rod *g*, and the end of the rod *g* adjacent to the valve *v* is cut away to form the passage-ways *o*, which allow a rapid flow of the liquid contained in the cylinder *h* through the piston *p* as said piston is forced downward by pressure on the head *h'*, assisted by the spring *s*, which in this case is contained within the cylinder *h*. The piston-rod *g* is operatively connected to the stepped member or drum G by means of the lever *t*, pivoted at *p'*. A spring *s'*, one end of which is attached to the casing A, is connected to the lever *t* and serves to maintain the valve *v* normally closed by supporting the weight of the rod *g*. The end of the lever nearest to the drum G is constrained to move in the vertical guide *n*.

The operation of the modification shown in Fig. 2 when acting to prevent a too-rapid forward movement of the controller is substantially the same as that shown in Fig. 1 except that the piston *p* is forced downward instead of upward by means of the spring *s* as the controller-handle is moved forward. When it is desired to move the controller-handle forward rapidly, the operator presses on the head or handle h^2, thereby forcing the piston-rod *g* downward and opening the valve *v*. As the controller-handle is moved forward the lever *t* follows the cam-surface *k*, which governs the rapidity with which the piston *p* is moved downward. In order to accomplish this rapid forward movement, a pressure sufficient to maintain the valve *v* away from its seat in the piston *p*—that is, to keep the valve *v* ahead of the piston *p* in the downward movement—must be applied to the piston-rod *g* at the head h^2. The valve *f'* accomplishes the same purpose for which the valve *f* was used in the modification shown in Fig. 1, the spring s^2 being used to maintain the said valve *f'* normally closed, and as the handle F is moved backward the end of the lever *t*, which engages with the stepped member or drum G, is constrained to follow the cam-surface *k* of the said drum G, thereby raising the piston *p*, compressing the spring *s*, and forcing the valve *f'* open to allow the fluid contained in the cylinder *h* to flow from the upper part of said cylinder through the opening controlled by said valve *f'* into the lower part of said cylinder. The construction of the valves *v* and *f'* is clearly shown in Figs. 3 and 4.

Although I have shown and described my invention as applied to a controller of the ordinary drum type used in electric-railway work, I do not care to limit myself to such an application, since my invention is perfectly applicable to any type of rheostat or controller.

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

1. The combination with a controller, of a time-limit device comprising a dash-pot and a stepped member so constructed and arranged as to prevent a too-rapid movement of said controller though allowing a free and unretarded movement of said controller from one contact-point to the next.

2. The combination with a controller, of a time-limit device comprising a stepped member operatively connected with the movable

member of said controller, and a dash-pot cooperating therewith to allow a step-by-step movement of said movable member, the piston of said dash-pot having a movement in one direction throughout the forward movement of the controller.

3. In combination with the movable member of a controller, a time-limit device comprising a dash-pot and a stepped member operatively connected with said movable member, the piston of said dash-pot having a movement in one direction throughout the forward movement of the controller and coacting with said stepped member to prevent a too-rapid movement of said movable member.

4. In combination, with the movable member of a controller, a time-limit device comprising a dash-pot and stepped member operatively connected with said movable member, the piston of said dash-pot having a movement in one direction throughout the forward movement of the controller and a movement in the opposite direction throughout the backward movement of the controller, the said piston coacting with said stepped member to prevent a too-rapid forward movement of said movable member, and means for allowing the uninterrupted return of said parts to their initial position.

5. The combination with the movable member of a controller, of a stepped member operatively connected with said movable member, and a dash-pot which includes a spring-pressed piston and an adjustable by-pass, said piston being adapted to coact with said stepped member to stop said movable member at each point of the controller a predetermined length of time and to allow a free movement of said movable member between the points of said controller.

6. In a controller, a movable part, a member operatively connected with said movable part, having formed thereon a cam-surface and a series of steps corresponding with the points of the controller, and a retarding device set to operate at a predetermined rate of speed and normally resting against said cam-surface, the retarding device being so adjusted that it will leave the said cam-surface and strike one of the said steps if the movable part is moved forward faster than said predetermined rate of speed.

7. The combination with the movable member of a controller, of a time-limit device comprising a stepped member operatively connected with said movable member, and a dash-pot coöperating therewith to allow a step-by-step movement of said movable member, and means for rendering said time-limit device inoperative.

8. The combination with the movable member of a controller, of a time-limit device comprising a stepped member operatively connected with said movable member, a dash-pot coöperating therewith to allow a step-by-step movement of said movable member, and an auxiliary valve in the piston of said dash-pot adapted to be opened to render said time-limit device inoperative.

In witness whereof I have hereunto set my hand this 23d day of May, 1902.

FRED B. COREY.

Witnesses:
BENJAMIN B. HULL,
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