(No Model.)

E. A. SPERRY.

CONTROLLER FOR ELECTRIC CARS.

No. 560,658. Patented May 26, 1896.

FIG. 1.

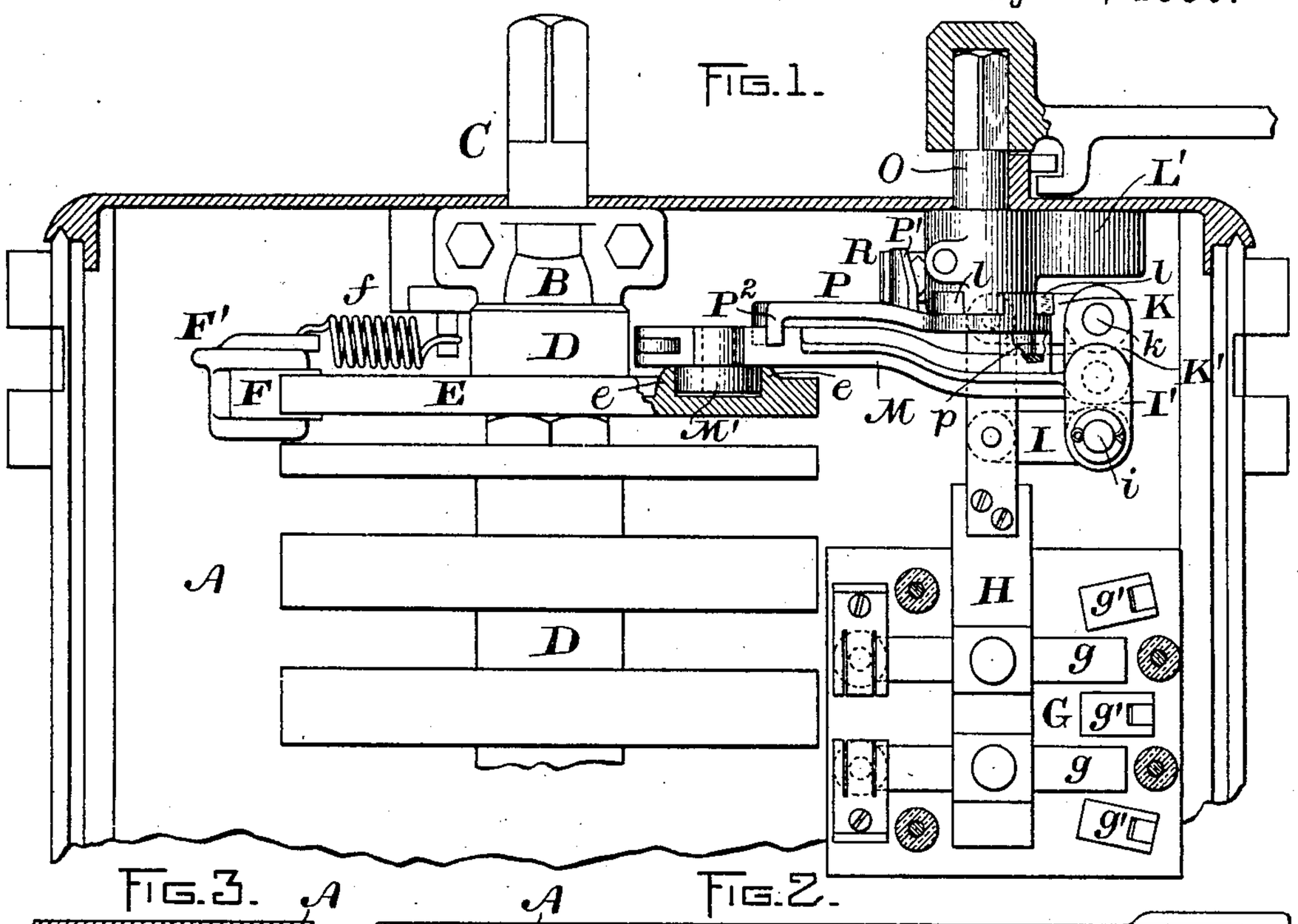


FIG. 3.

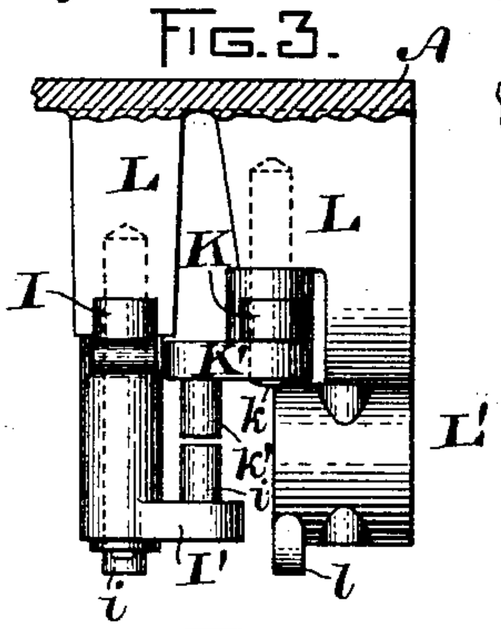


FIG. 2.

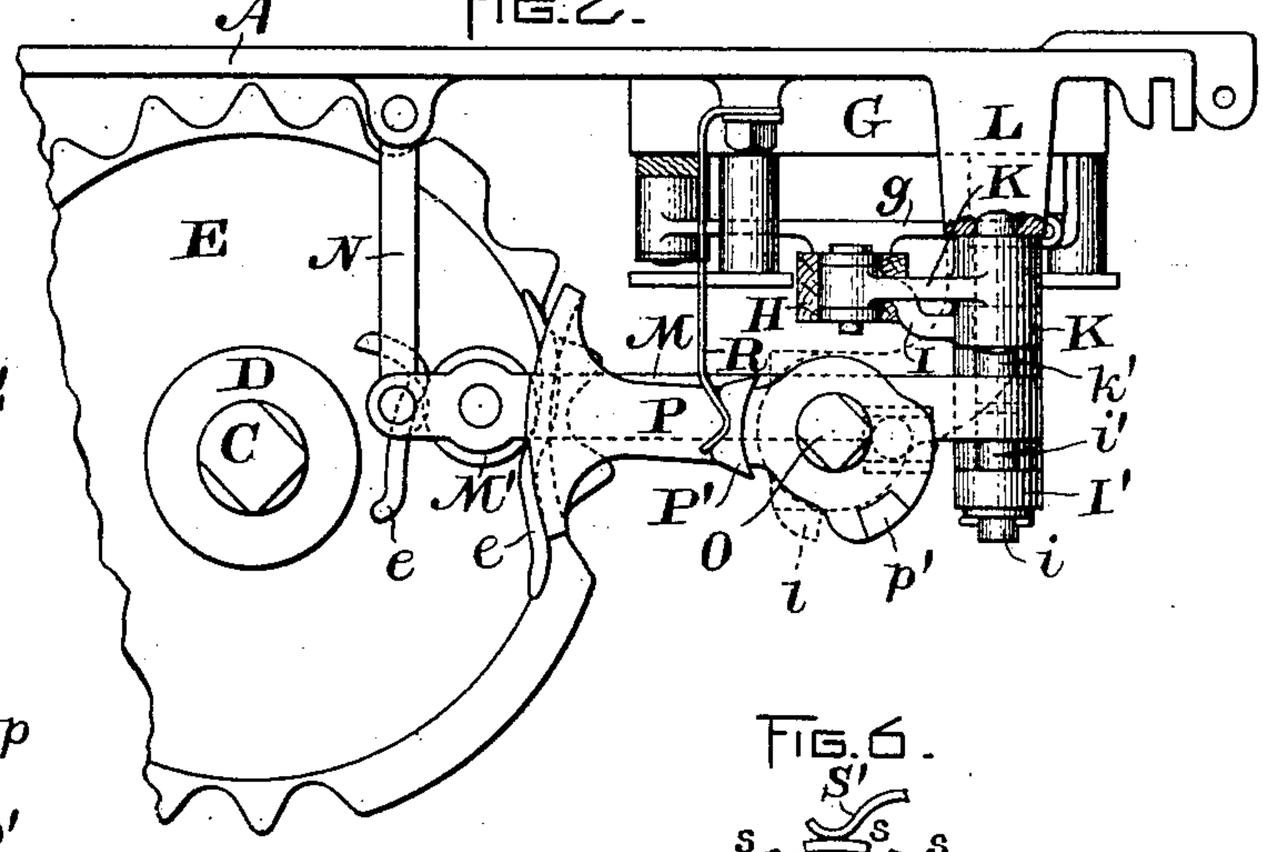


FIG. 4.

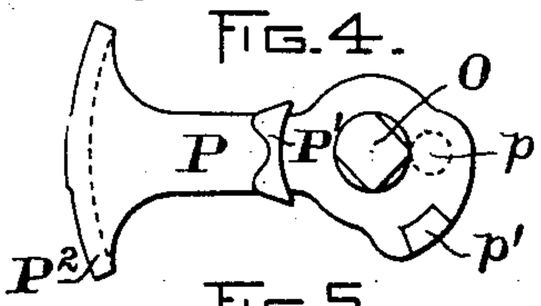


FIG. 5.

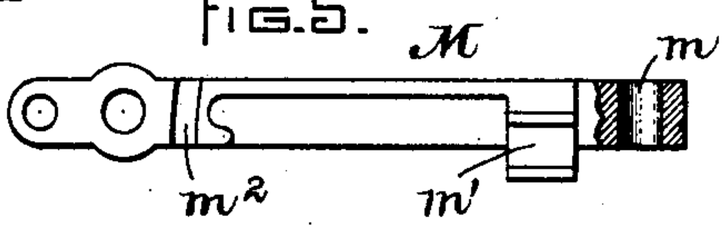


FIG. 6.

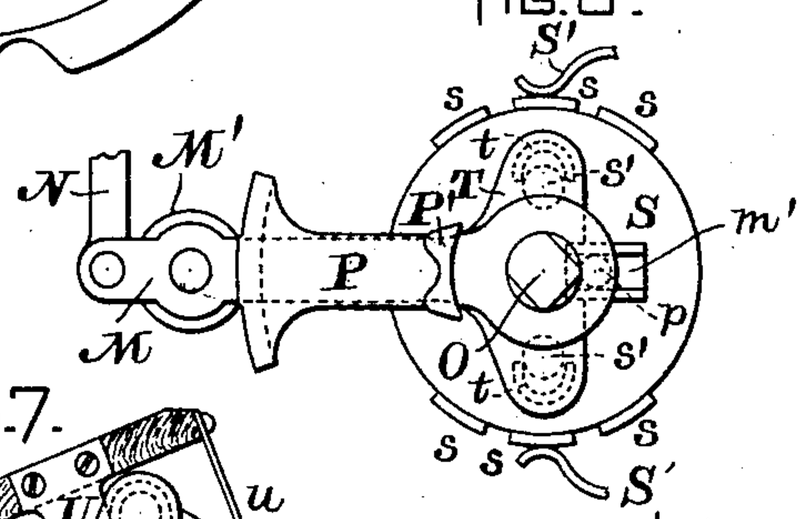
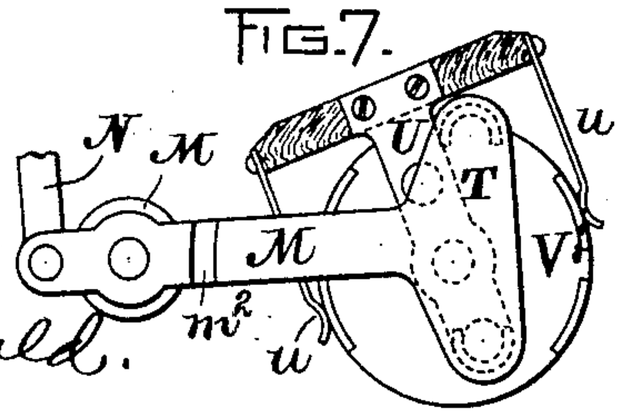


FIG. 7.



WITNESSES.

A. H. Abell.

A. D. Macdonald.

INVENTOR.

Elmer A. Sperry, by

Geo. R. Blodgett,

Atty.

UNITED STATES PATENT OFFICE.

ELMER A. SPERRY, OF CLEVELAND, OHIO, ASSIGNOR TO THE GENERAL ELECTRIC COMPANY, OF NEW YORK.

CONTROLLER FOR ELECTRIC CARS.

SPECIFICATION forming part of Letters Patent No. 560,658, dated May 26, 1896.

Application filed March 20, 1896. Serial No. 584,061. (No model.)

To all whom it may concern:

Be it known that I, ELMER A. SPERRY, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga, State of Ohio, have invented certain new and useful Improvements in Controllers for Electric Cars, (Case No. 326,) of which the following is a specification.

My invention relates to that class of controllers which are used not only to vary the current supplied to the motors in electric-railway cars, but also to regulate the operation of these motors when used as generators of current for energizing the magnets of electric brakes. These controllers are customarily provided with two reversing-switches, one to determine the direction in which the car shall travel and the other to reverse the connections of the armature and field coil of the motor or motors at the time the power-circuit is broken and the braking-circuits are established. This second reversal is necessary because the current generated by the motor-armature is in the opposite direction to the power-current, and if it were allowed to flow through the field-coils in the opposite direction to the power-current it would destroy the residual magnetism of the field-cores and reverse the poles. This would entail not only a waste of energy, but also a loss of field strength just at the moment when it is most needed to generate the braking-current.

The object of the present invention is to simplify the construction of such a controller and lessen the cost by so arranging a single reversing-switch that it will serve both for reversing the direction in which the car shall travel and also for reversing the relation between the armature and field coils when the brake is to be used. In connection with this single reversing-switch I use a regulating device separate from the controller for determining the direction in which the car shall run. After this device is set it remains stationary, while the reversing-switch is free to move from one set of contacts to the other under the control of the main controller-handle, with which it is connected in such a manner that it is actuated in the interval between the "off" position of the power-circuit and the first position on the brake side of the controller.

The present invention is an improvement on the one described and shown in my application, Serial No. 584,062, filed March 20, 1896. In said application I have claimed, broadly, certain mechanism for effecting the same results as are accomplished by the mechanism hereinafter set forth and specifically claimed.

In the accompanying drawings, Figure 1 is an elevation, partly in section, of the upper portion of a controller embodying my invention. Fig. 2 is a partial plan view of the same. Fig. 3 is an end elevation of the rock-shafts. Fig. 4 is a plan of the tumbler. Fig. 5 is a plan of the movable connecting-rod. Figs. 6 and 7 are modifications.

Upon the back plate A are several suitable bearings B, in which is journaled the main shaft C, on which is mounted the controller-cylinder D, provided with suitable contacts for making any desired change in the circuit relations of the motors. The contacts on one side of the cylinder govern the power-circuit and the speed of the motors, while those on the other side control the braking-circuits. The cylinder has in each case a step-by-step movement regulated by a click-wheel E, with whose notches engages a roller F, pivoted in the end of a detent-pawl F′ and held against the wheel by a spring *f*.

On the back plate A is secured a reversing-switch G of the customary double-pole type, having two movable contacts or blades *g g* insulated from each other and coupled by a bar H, so as to move simultaneously. Three stationary contacts *g′* are arranged to be engaged by the blades *g* and are connected electrically with the terminals of the armature-coils, the middle contact with one terminal and the upper and lower contacts with the other terminal. The upper blade *g* is connected through the field-coil with the controller-contacts, and the lower blade is grounded. These parts and arrangements of circuits are more fully shown in my other application aforesaid. The present invention relates to the means whereby the reversing-switch is actuated by the controller-cylinder and is so

set as to move in accordance with the direction in which the car is to travel. The bar H of the reversing-switch is pivotally connected with two rock-arms I K on rock-shafts *i k*, suitably journaled in brackets L, secured to the back plate A. The shafts are arranged one above the other, as shown in Fig. 1, and are provided with rock-arms I′ K′, which extend past each other and carry wrist-pins *i′ k′*, whose axes are in line when the reversing-switch is open, as shown in Fig. 1.

In order to actuate the rock-arms and move the blades of the switch to close it, I provide a connecting-rod M, which has at one end an eye M, fitting the wrist-pins *i′ k′*. The thickness of the rod at the eye is not greater than the length of one of the pins, so that the rod can be slid from one pin to the other and will be received wholly, thereupon leaving the other disengaged. The other end of the rod is connected with the back plate A by a link N and carries a friction-roller M′, which is arranged to be engaged by ribs *e*, formed on or attached to the upper side of the click-wheel E, and constituting together a cam-slot which operates to reciprocate the rod M lengthwise, and thus rock the shaft with which the rod is in engagement. If this is the lower shaft, the blades will be lifted when the cylinder D is turned to put on the power and the motor will run in one direction, say forward. If the upper rock-shaft is actuated, the blades will be lowered and the car will travel in the other direction or backward. Similarly, if the lower rock-shaft being engaged and the car running forward, the cylinder D is turned in the opposite direction to close the braking-circuits the blades *g* will be lowered and the circuit through the armature-coils will be reversed. The same result is produced if the car is running backward, with the upper rock-shaft engaged, and the cylinder D is rotated backward to put on the brake, the blades being thereupon lifted to reverse the armature connections.

For the purpose of shifting the rod M from one pin to the other I provide an upright stem O, journaled in a bracket L′, and carrying at its lower end a horizontal tumbler P, provided on its lower side with a crank-pin *p*, engaging with a groove *m′* in the upper side of the rod M. When the stem O is given a partial turn, the pin *p* carries the rod M to one side or the other. The groove *m′* being lengthwise of the rod permits the rod to be moved lengthwise irrespective of the pin. A lug *p′* on the tumbler limits the movements thereof by striking the fixed stops *l* on the bracket L′. The end of the tumbler P has a downward-curved flange p^2, which engages a transverse groove m^2 near the roller M′ while the stem O is being turned, so that during this time the rod M is positively locked and cannot move to close the switch. The middle portion of the flange is made slightly thicker than the end portions, so as to fit the groove m^2 very accurately and thus insure the exact alinement of the two wrist-pins *i′* and *k′* to facilitate the transfer of the rod from one to the other. In order that the controller may be left with the switch locked open, a spring-detent R is arranged to engage with a V-shaped notch in a lug P′ on the upper side of the tumbler when the parts are in a midway position, as shown in Fig. 1. The contacts on the cylinder D are so arranged that the movement of the rod and the reversing of the switch take place between the off position of the power and the first braking position. It will be seen that no circuit changes can be made by the controller-cylinder until the reversing-switch has completed its movement.

In case it is desired to use a cylindrical reversing-switch the modification shown in Fig. 6 can be employed. The disk or drum S carries the contacts *s*, coacting with fixed contacts or brushes S′ S′. On the disk are two diametrically opposite wrist-pins *s′*, adapted to engage with semicircular flanges *t* on the under side of a cross-head T, formed on the connecting-rod M. The crank-pin *p* on the tumbler P throws the cross-head to one side or the other and causes one or the other of the flanges *t* to engage with a pin *s′*, so that when the rod is actuated the disk S will be partly rotated to change the contacts on which the brushes rest.

In Fig. 7 the wrist-pins are placed on a rock-arm U, which carries brushes *u*, adapted to coact with a set of contacts on a stationary disk or drum V.

In these modifications the arm and the rock-arm U serve as the oscillating or rocking element or device, which is actuated by the reciprocating rod M, so that these parts correspond with the two rock-shafts shown in Fig. 1.

Having thus described my invention, what I claim is—

1. The combination with a controller-cylinder, of a switch for reversing the armature connections, a rocking device arranged to actuate said reversing-switch, a connecting-rod arranged to be actuated by the cylinder, and means for engaging said rod with and disengaging it from the rocking device, substantially as described.

2. The combination with a controller-cylinder, of a switch for reversing the armature connections, a rocking device controlling the changes of said switch, and carrying two wrist-pins, a connecting-rod arranged to be actuated by the cylinder, and means for causing said rod to engage with one or the other of said pins, substantially as described.

3. The combination with a controller-cylinder, of a switch for reversing the armature connections, a rocking device controlling the changes of said switch, and carrying two wrist-pins, a connecting-rod arranged to be reciprocated by the cylinder, and means for mov-

ing said rod laterally to cause it to engage with one or the other of said wrist-pins, substantially as described.

4. The combination with a controller-cylinder of a switch for reversing the armature connections, a rocking device controlling the changes of said switch, and carrying two wrist-pins, a connecting-rod arranged to be reciprocated by said cylinder and having a groove, and a stem carrying a crank-pin engaging with said groove to move the rod laterally, substantially as described.

5. The combination with a controller-cylinder, of a switch for reversing the armature connections, a rocking device controlling the changes of said switch, and carrying two wrist-pins, a connecting-rod arranged to be reciprocated by said cylinders, and provided with a lengthwise groove near one end and a transverse groove near the other end, a stem journaled near the rod, and a tumbler on the stem having a crank-pin engaging with the lengthwise groove and a flange engaging with the transverse groove, substantially as described.

6. The combination, with a controller-cylinder, of a switch for reversing the armature connections, a rocking device controlling the changes of said switch, a connecting-rod carrying a roller at one end, means for connecting the rod with the rocking device, and cam-ribs on the cylinder engaging with said roller to reciprocate the rod, substantially as described.

7. The combination with a controller-cylinder, of a switch for reversing the armature connections, a pair of rock-shafts each having an arm pivotally connected with said switch and an arm carrying a wrist-pin, a connecting-rod having an eye fitting said pins, means for reciprocating the rod, when the cylinder is rotated, and means for shifting said rod from one to the other of said pins, substantially as described.

8. The combination with a controller-cylinder, of a switch for reversing the armature connections, a pair of rock-shafts each having one arm pivotally connected with the switch, and one arm provided with a wrist-pin, said pins having their axes in line when the switch is open, a connecting-rod having an eye fitting said pins, means for reciprocating the rod when the cylinder is turned, means for shifting the rod from one pin to the other, and a locking device having means for accurately alining said pins when the rod is to be shifted, substantially as described.

9. The combination with a controller-cylinder, of a switch for reversing the armature connections, a pair of rock-shafts pivotally connected with the switch, wrist-pins carried by said shafts, a connecting-rod having an eye fitting said pins, a stem carrying a tumbler to shift said rod from one pin to the other, and an arm having a locking-flange to engage a transverse groove in the rod, said flange having a thicker middle portion substantially as described.

ELMER A. SPERRY.

Witnesses:
M. NIELSON,
C. NIELSON.