

H. B. VAN DAALEN.
 ACTUATION OF CONTROLLERS AND THE LIKE FOR ELECTRIC MACHINERY.
 APPLICATION FILED MAY 13, 1910.

1,004,314.

Patented Sept. 26, 1911.

3 SHEETS—SHEET 1.

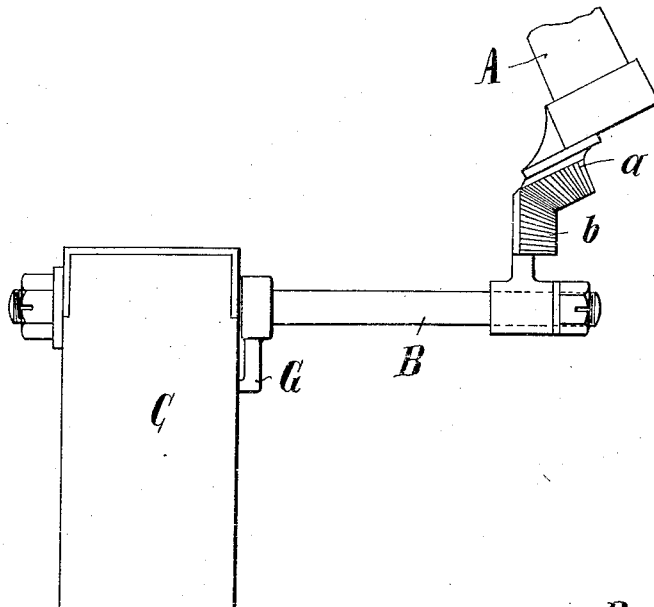


Fig. 1.

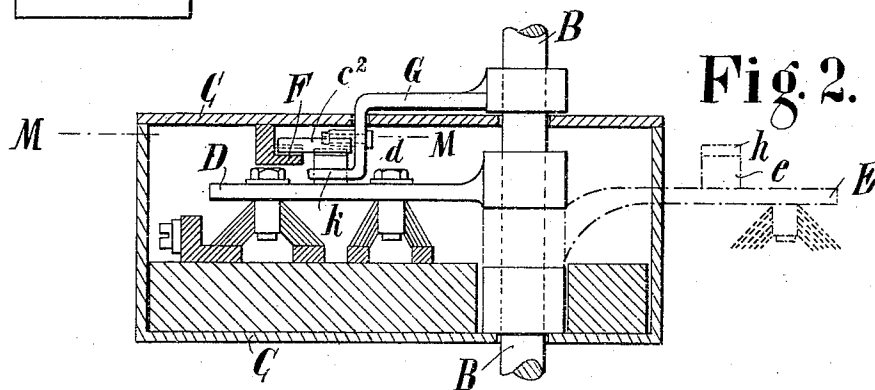


Fig. 2.

WITNESSES

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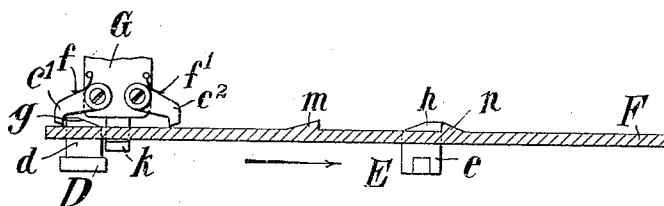
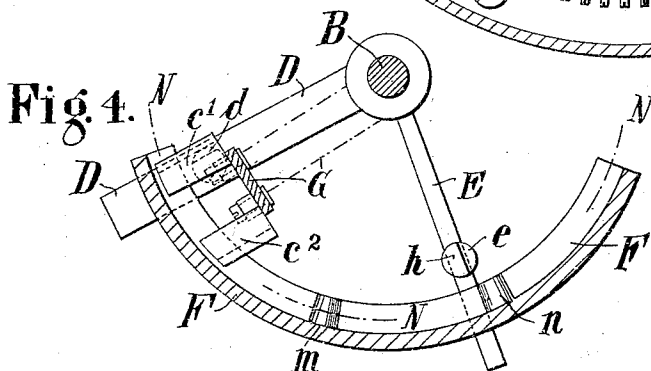
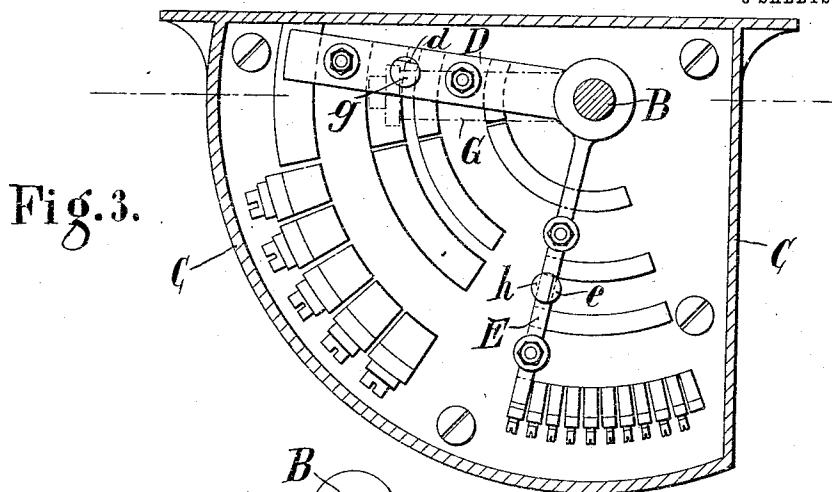


Fig. 5.

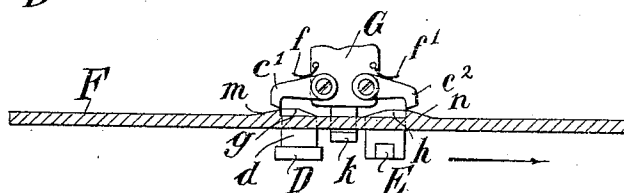


Fig. 6.

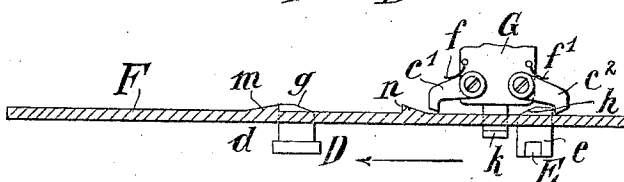


Fig. 7.

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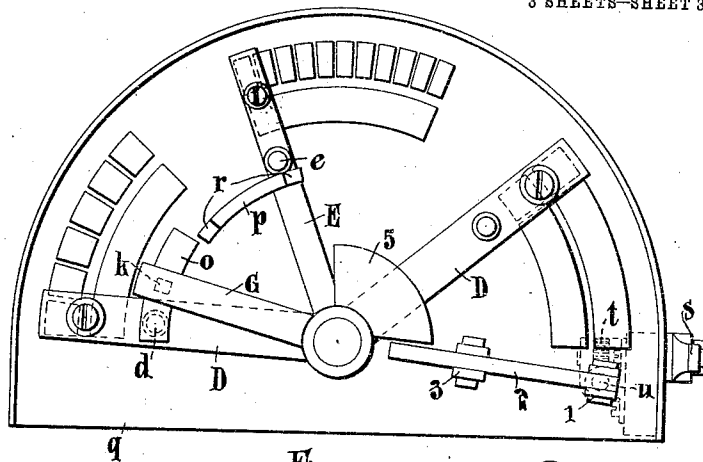


Fig. 8.

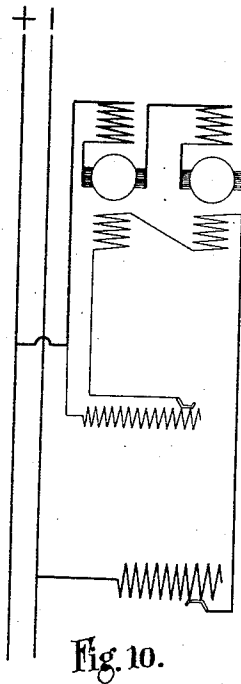


Fig. 10.

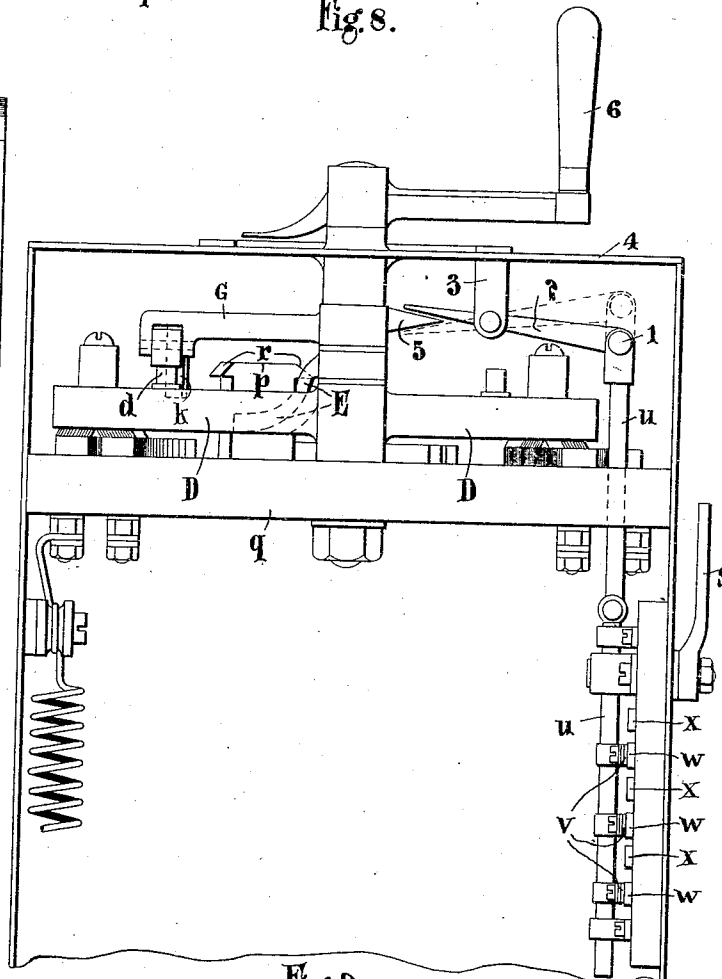


Fig. 9.

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UNITED STATES PATENT OFFICE.

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ACTUATION OF CONTROLLERS AND THE LIKE FOR ELECTRIC MACHINERY.

1,004,314.

Specification of Letters Patent. Patented Sept. 26, 1911.

Application filed May 13, 1910. Serial No. 561,119.

To all whom it may concern:

Be it known that I, HERMAN BERNARD VAN DAALEN, a subject of the Queen of the Netherlands, residing at 142 Portsdown road, Maida Vale, in the county of London, England, have invented certain new and useful Improvements in and Relating to the Actuation of Controllers and the Like for Electric Machinery, of which the following is a specification.

This invention relates to an improved apparatus for actuating controllers, rheostats or similar appliances for electric machinery, of the kind in which two independent controlling elements are actuated from a single spindle.

According to the present invention two or more rheostats or similar appliances to be controlled are successfully actuated by means of a single arm, mounted on a rotary spindle and acting upon two or more other independent arms in such a manner that on its backward movement the other arms return successively and gradually to their former positions, this return being possible at any point of the forward path.

The arrangement and working of this apparatus will be well understood from the following description in connection with the accompanying drawings.

The apparatus is shown in Figures 1 to 7 as applied, by way of example, to two rheostats used for varying the speed of a shunt or compound wound traction motor. The two successive operations can therefore be defined as follows: 1. Starting the motor by gradually cutting out the resistance in series with the machine. 2. Acceleration of the speed by introducing increasing resistance into the shunt windings. The return must be performed in the reverse order.

Fig. 1 is a general diagrammatic view in which may be seen a spindle A, which is guided for example, by the ordinary steering rod of a mechanically propelled vehicle and carries a toothed sector, *a*, engaging with another toothed sector, *b*, mounted on a rod B actuating the single arm G which is to successively work the two rheostats.— This operating device is arranged inside the box, C whose exterior can be seen in Fig. 1. Fig. 2 is a section, on a larger scale, of the box inclosing the mechanism the latter being shown partly in elevation and partly in section, the arm of the second rheostat being supposed turned round into the direc-

tion produced of the arm of the first rheostat so that its shape may be properly seen. Fig. 3 is a view of the inside bottom plate of the box showing the rheostats and the contact arms. Fig. 4 is a partial plan at the section MM in Fig. 2, showing the position at rest of the two contact arms which are to be operated successively. Fig. 5 is a sectional elevation at the curved line NNN showing the development of the circular path on which the pawls of the single operating arm move. Fig. 6 is a section similar to that shown in Fig. 5, when the pawl arm has just released the contact arm of the first rheostat. Fig. 7 is also a similar view showing the single operating arm bringing back to rest the arm of the second rheostat. Fig. 8 shows the application of the invention to a tram way or like controller, being a plan of the controller with the cover removed. Fig. 9 is an elevation showing the controlling mechanism inside the casing. Fig. 10 illustrates diagrammatically the electrical connections.

The contact arm B of the first rheostat moves from the position shown in Fig. 3 to beyond the inclined projection *m*, shown in Figs. 4 and 7. The arm E, of the second rheostat can be moved from its position at rest shown in Fig. 3 as far as the end of the curved path F.

The arm E only being operated when the arm D ceases to move, the displacement of these two arms is produced by means of a single arm G, mounted on the spindle B mentioned above, this arm being able to move through an angle corresponding to the entire length of the curved path F by means of the toothed sectors *a b*.

The arm G carries two pawls *c' c²* at its extremity the first of which, *c'* is to engage with a lug, *d*, fixed to the arm D, of the first rheostat. The second pawl, *c²* is to engage with the lug, *e*, carried by the arm E, of the second rheostat. These pivoted pawls *c'*, *c²*, which are acted on by the springs *f f'*, are curved as shown clearly in Figs. 5, 6 and 7, so as to act from the side on the upper ends of the lugs *d e*. These ratchets are wide enough to extend beyond the lugs with which they are to engage and rest on the curved guide F which carries the two inclines *m, n*. Each of the lugs, *d e*, is also provided on its upper end with a beveled surface *g*, or *h*, whose purpose will be hereinafter described. The arm G also carried a projection *k*, which

is always located between the lugs, d and e and is to operate alternately on the lugs d and e .

If the apparatus be considered in its position of rest the arms of the two rheostats being then in the positions shown in Figs. 3, 4 and 5, the operating arm G, will be located above the arm D, and its projection k , in advance of the said arm D, the pawl c' , being down so that its hook is behind the upper end of the stud d . If the single arm G be therefore moved by means of the operating mechanism above described, the pawl c' will drag with it the lug d , and the arm D, of the first rheostat until the pawl c' encounters the incline m of the guide F. The pawl c' is then lifted by this incline, as will be seen from Fig. 6, in such a way that the end of its hook is then above the upper face of the lug d , and the arm D is therefore left behind. The arm G continuing its movement, its projection k will, after a very small displacement, strike the lug e of the arm E of the second rheostat, and this arm will therefore be displaced in its turn, the first arm D remaining at rest. It will be seen from Fig. 6 that the pawl c^2 has reached the upper inclined surface h of the lug e , and has been lifted so that it can pass over this lug, in such a way that its hook will fall behind this stud e , as soon as the pawl has passed, the downward incline n , a little farther on. The projection k thus continues to move the arm E of the second rheostat as far as the end of its path, as shown in Fig. 7. If the arm G, be then moved in the reverse direction according to the arrow shown in Fig. 7 the hook of the pawl c^2 draws with it the lug e on the arm E until it reaches the incline n . The pawl c^2 is then lifted by the said incline, and leaves the lug e of the arm E which is thus left behind. The projection k then engages with the arm of the first rheostat and brings it back approximately to its original position, the pawl c' being then under the same conditions as those described above with reference to the pawl c^2 .

As hereinbefore stated the apparatus is shown applied to the two rheostats used for varying the speed of a shunt or compound wound traction motor. The arm D of the first rheostat effects the starting of the motor by gradually cutting out resistances in series with the motor. When the operating arm G, ceases to drag with it the arm D of the first rheostat, it actuates the arm E of the second rheostat in order to accelerate the speed by introducing an increasing resistance into the shunt windings. The return is of course effected in the reverse order.

As hereinbefore stated, this apparatus has been considered as applied to the gradual and successive control of two independent arms. It will be understood that it is pos-

sible to adapt it so as to be applicable to the control of three or more arms. For instance the projection k may be mounted on the arm G in such a manner that it can easily be withdrawn from the paths of the lugs on the arms to be operated and be returned to its normal position (such as by means of a spring) when the arm G has been moved a little farther, it being thereby rendered possible to control with said arm G any number of arms.

Figs. 8 and 9 illustrate the application of the invention to a tramway or like controller, similar parts to those shown in the preceding figures being indicated by like letters of reference. The controller is arranged in the usual way so that it can be operated by the motor-man when standing on the platform of the car or the like, and special means are provided to prevent the operation of the reversing lever with which the controller is provided unless the controller is in its neutral position.

The operation of the apparatus is somewhat similar to that before described, the contact arm D being arranged to control the series resistance and the contact arm E the shunt resistance. The contact arm D (see left hand side of Fig. 8) is made integral or has attached thereto another contact arm D (see right hand side of said figure) adapted to interrupt the shunt circuit when the contact arm D which controls the series resistance is in the position shown in the drawing and to maintain the said circuit closed when said contact arm is in any other position.

The arm G is of the modified form illustrated, and carries at or near its extremity the ratchet mechanism o which is similar to that above described, a modified arrangement for raising the pawls out of engagement with the pins or projections d and e on the contact arms D and E, being, however, employed. This consists of a raised bridge-piece p carried by the slate or other insulating material q carrying the controller mechanism, and provided with inclined or sloping ends r up which the ratchet mechanism is adapted to slide so as to be raised out of engagement with the arms D and E.

The reversing lever s is conveniently placed at the side of the controller and mounted upon the spindle, carrying the lever s is a spur wheel t adapted to engage with a rack on the bar u which carries any convenient number of brushes v , as for example three. These brushes are adapted to make contact with a number of stationary contacts w , x , of which two are provided for each brush. These contacts are insulated from one another and one set w is used when the car or other vehicle is going in the forward direction, while the other set x is for the reverse direction. The bar u is extended

upward as shown, and is pivoted at its upper end at 1 to one extremity of a lever 2 pivoted to a bracket 3 attached to the cover 4 of the controller. Formed integral with or secured to the operating lever G is a segmental piece 5 of wedge-shape which, when the controller is in the neutral position occupies the position shown in Fig. 8. In this position the reversing lever S can be operated to bring the brushes *v* into engagement with either the contacts *w* or the contacts *x*, according as the vehicle is required to travel in the forward or reverse direction. Supposing the reversing lever to be in the position shown in Fig. 9 for the ahead direction for example, and the controller to be moved out of its neutral position, the wedge-shaped piece 5 will have moved under the end of the lever 2, and it will be seen that it is now impossible to move the reversing lever until the controller is once more in its neutral position. When the reversing lever is in the reverse position, the lever 2 occupies the position shown dotted in Fig. 9, and the wedged-shaped piece 5 moves over the end of said lever and thus prevents the operation of the reversing lever until the controller is in its neutral position.

The operation of the contact arms is as follows:—On moving the controller handle 6 the arm G is also moved, and one of the pawls of the ratchet mechanism engaging the pin *d* on the contact arm D moves the latter over its contacts until it reaches the last of said contacts. By this time the ratchet mechanism has been raised through the medium of the bridge-piece *p*. On further rotation of the controller handle, the depending stud or projection *k* (Fig. 9) engages the lever E and moves it over its contacts. In the meantime the ratchet mechanism has been disengaged from the bridge piece *p* and on the return movement of the handle 6 the second pawl engages the arm E and returns it to its initial position. The pawl mechanism is once more raised by the bridge-piece *p* and the projection *k* operates to return the arm D to its initial position.

Fig. 10 illustrates diagrammatically the electrical connections of the motors. The motor or motors employed are preferably compound, although the invention is equally applicable to shunt motors.

It will be noticed that at the highest speed of the motors the shunt current is zero and the motors are operating as series motors, and when the shunt current is wholly or in part reestablished there will be electric braking of the motors, and consequently braking of the car or other vehicle. The system is, therefore, recuperative, and it possesses the further advantage that the whole scale of speeds is obtained without the coupling of motors and that the controller contains one brush only which is traversed by the main

current. In this way the multiplicity of contacts found in the usual series parallel controllers is avoided.

Having now described my invention what I claim as new and desire to secure by Letters Patent is:—

1. Apparatus comprising in combination a rotary spindle, a single operating arm carried by said spindle, a plurality of independently working arms separate from said single operating arm, a plurality of groups of variable resistances to be controlled by said plurality of arms, and means for permitting the latter to be gradually and successively operated by the single arm during both the forward and backward movement of the same and in a reversed succession during the backward movement, as set forth.

2. Apparatus comprising in combination a rotary spindle, a single operating arm carried by said spindle, a plurality of independently working arms separate from said single operating arm, a plurality of groups of variable resistances to be controlled by said plurality of arms, a lug on each independently working arm and pawls on the single operating arm adapted to coöperate with the lugs on the independently working arms, whereby the latter are gradually and successively operated by the single arm during both the forward and backward movement of the same and in a reversed succession during the backward movement, as set forth.

3. Apparatus comprising in combination a rotary spindle, a single operating arm carried by said spindle, a plurality of independently working arms separate from said single operating arm, a plurality of groups of variable resistances to be controlled by said plurality of arms, a lug on each independently working arm and pawls and a lower projection on the single operating arm adapted to coöperate with the lugs on the independently working arms, whereby the latter are gradually and successively operated by the single arm during both the forward and backward movement of the same and in a reversed succession during the backward movement, as set forth.

4. Apparatus comprising in combination a rotary spindle, a single operating arm carried by said spindle, a plurality of arms which work independently of one another and are actuated gradually and successively by said single arm, a lug on each independently working arm, and pawls on the single operating arm, the upper end of the lug being provided with an inclined face to allow one of the pawls to be raised so that the hook of the pawl may fall behind the said lug for the purpose of dragging the latter along, as set forth.

5. Apparatus comprising in combination

a rotary spindle, a single operating arm carried by said spindle, a plurality of arms which work independently of one another and are actuated gradually and successively by said single arm, a lug on each independently working arm, and two pawls arranged in opposite directions on the single operating arm and intended to coöperate with the lugs on two adjacent independently working arms, as set forth.

6. Apparatus comprising in combination a rotary spindle, a single operating arm carried by said spindle, a plurality of arms which work independently of one another and are actuated gradually and successively by said single arm, a lug on each independently working arm, two pawls arranged in opposite directions on the single operating arm, and a lower projection on the said single operating arm, as set forth.

7. Apparatus comprising in combination a rotary spindle, a single operating arm carried by said spindle, a plurality of arms which work independently of one another and are actuated gradually and successively by said single arm, a lug on each independently working arm, two pawls arranged in opposite directions on the single operating arm, and a lower projection on the said single operating arm, whereby the said lower projection draws along either of the adjacent independently working arms in order to bring them to the extreme ends of their paths, while the pawls serve to draw the said arms toward the inner ends of their paths, as set forth.

8. Apparatus comprising in combination a rotary spindle, a single operating arm carried by said spindle, a plurality of arms which work independently of one another and are actuated gradually and successively by said single arm, a lug on each independently working arm, pawls on the single operating arm and a circular guide for the pawls, as set forth.

9. Apparatus comprising in combination a rotary spindle, a single operating arm carried by said spindle, a plurality of arms which work independently of one another and are actuated gradually and successively by said single arm, a lug on each independently working arm, pawls on the single operating arm, a circular guide for the pawls, and inclined projections on the guide, as set forth.

10. Apparatus comprising in combination a rotary spindle, a single operating arm carried by said spindle, a plurality of arms which work independently of one another and are actuated gradually and successively by said single arm, a lug on each independently working arm, a circular guide for the pawls, and inclined projections disposed in opposite directions on the guide, as set forth.

11. Apparatus comprising in combination

a rotary spindle, a single operating arm carried by said spindle, a plurality of arms which work independently of one another and are actuated gradually and successively by said single arm, a lug on each independently working arm, pawls on the single operating arm, a circular guide for the pawls and inclined projections on the guide, whereby the lugs on the independently working arms pass along a path other than that of the said guide, as set forth.

12. Apparatus comprising in combination a rotary spindle, a single operating arm carried by said spindle, a plurality of arms which work independently of one another and are actuated gradually and successively by said single arm, a lug on each independently working arm, a lower projection and pawls on the single operating arm for dragging along either of the said independently working arms, a circular guide for the pawls, and inclined projections disposed in opposite directions on the guide, whereby the lugs on the independently working arms pass along a path other than that of the said guide, and the projections on the guide lift the dragging pawl when the latter reaches the end of the path where it is to be disengaged from behind the lug on the arm which is dragged along so that the latter arm is left behind and the adjacent arm is engaged and dragged along by the lower projection on the single operating arm, as set forth.

13. Apparatus comprising in combination a spindle, means for rotating the spindle, a single operating arm carried by said spindle, two rheostats, two contact arms which work independently of one another and are actuated gradually and successively by said operating arm, a lug on each contact arm, having an inclined upper face, a lower projection on the operating arm, two pawls arranged in opposite directions on the operating arm for dragging along either of the contact arms, a circular guide for the pawls, inclined projections disposed in opposite directions on the guide, whereby the lugs on the contact arms pass along a path other than that of the said guide, and the projections on the guide lift the dragging pawl when the latter reaches the end of the path where it is to be disengaged from behind the lug on the contact arm which is dragged along so that the latter arm is left behind and the second contact arm is engaged and dragged along by the lower projection on the operating arm, as set forth.

14. In a tramway or like electric controller, interlocking means between a controller switch and a reversing switch comprising in combination a segmental piece rigidly attached to an operating arm of a controller switch and a lever operated by a reciprocating bar of a reversing switch, said lever be-

ing pivotally mounted on a controller casing and having one of its ends pivotally connected to the reciprocating bar and the other end arranged to lie in front but not directly in the path of the segmental piece, whereby on the operating arm of the controller switch being moved out of its neutral position, the segmental piece is brought underneath the end of the lever, when the reciprocating bar is in its normal position, and

above the same, when the reciprocating bar is in its reversed position, as and for the purpose set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

HERMAN BERNARD VAN DAALEN.

Witnesses:

GEORGE TAPPING, Jr.,

R. F. WILLIAMS.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."