(No Model.)

2 Sheets—Sheet 1.

A. H. JOHNSON.

POWER APPLYING DEVICE FOR ELECTRIC MOTORS.

No. 510,603. Patented Dec. 12, 1893.

Fig. 1.

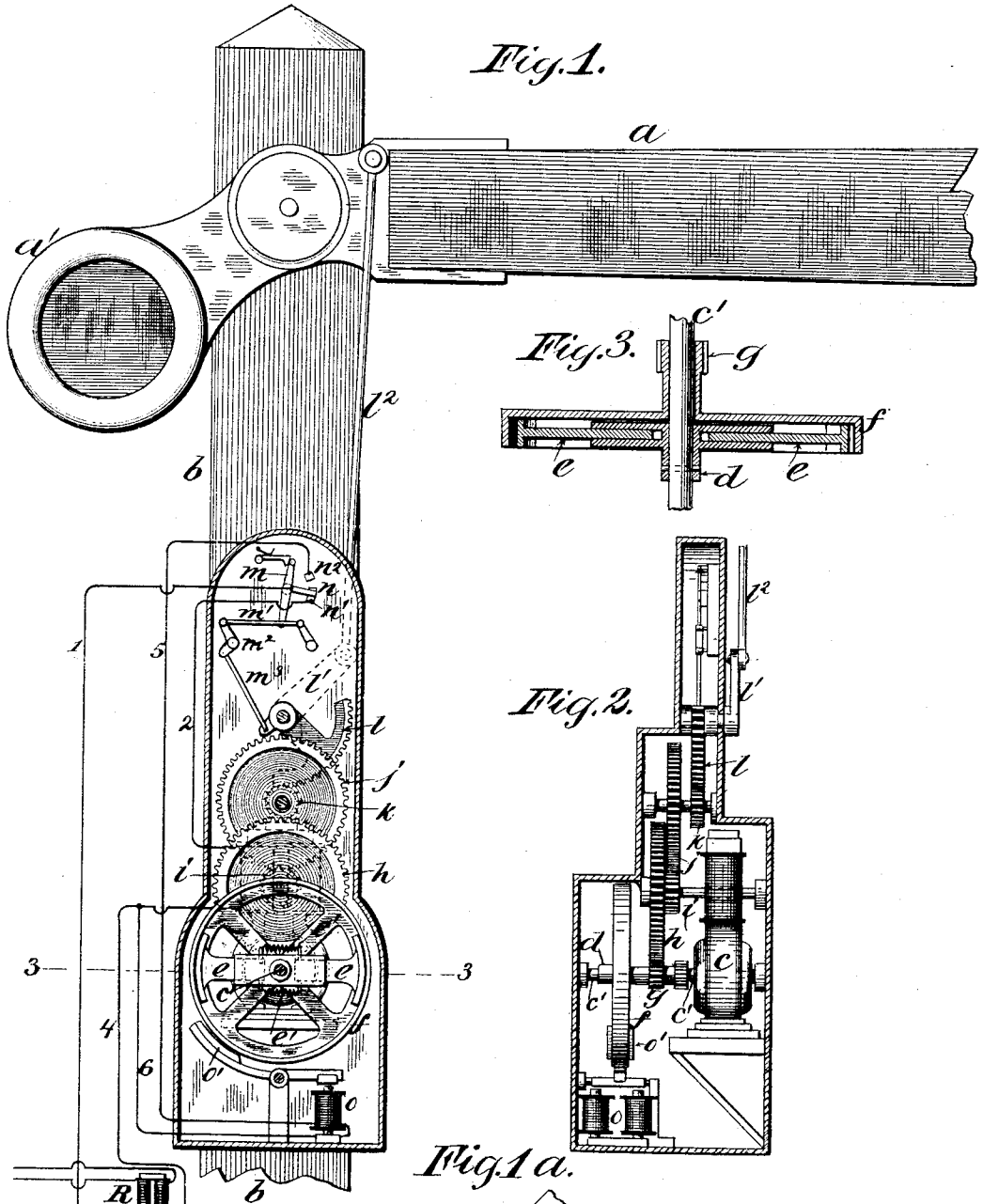
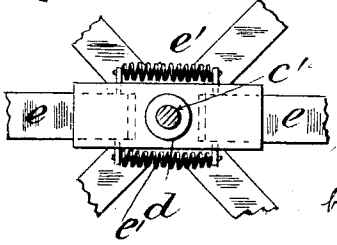


Fig. 3.

Fig. 2.

Fig. 1a.



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(No Model.) 2 Sheets—Sheet 2.

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Fig. 4.

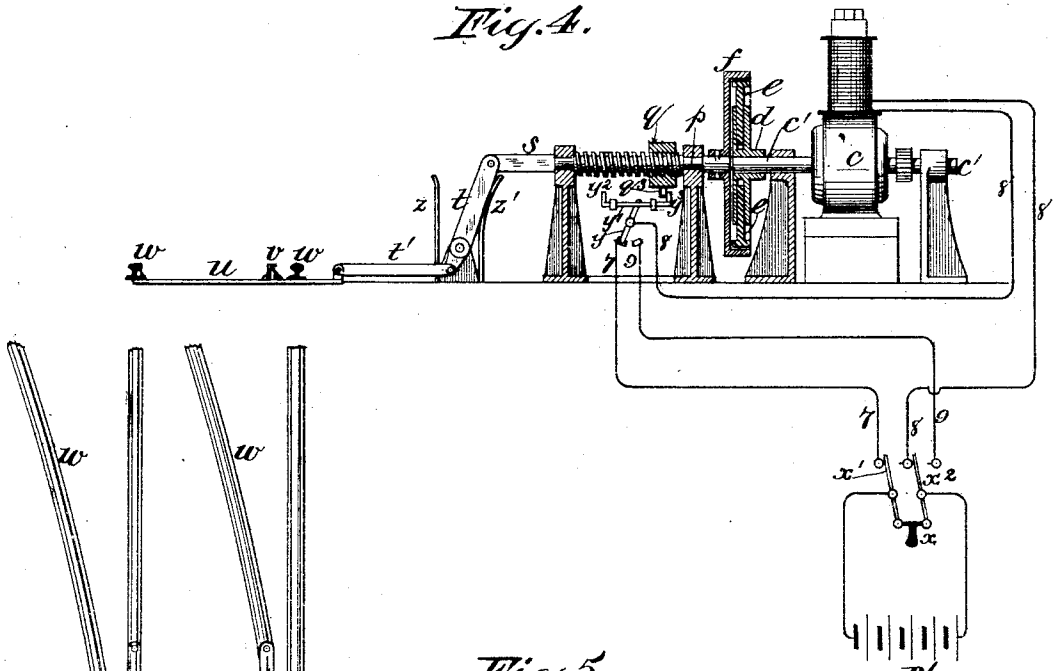
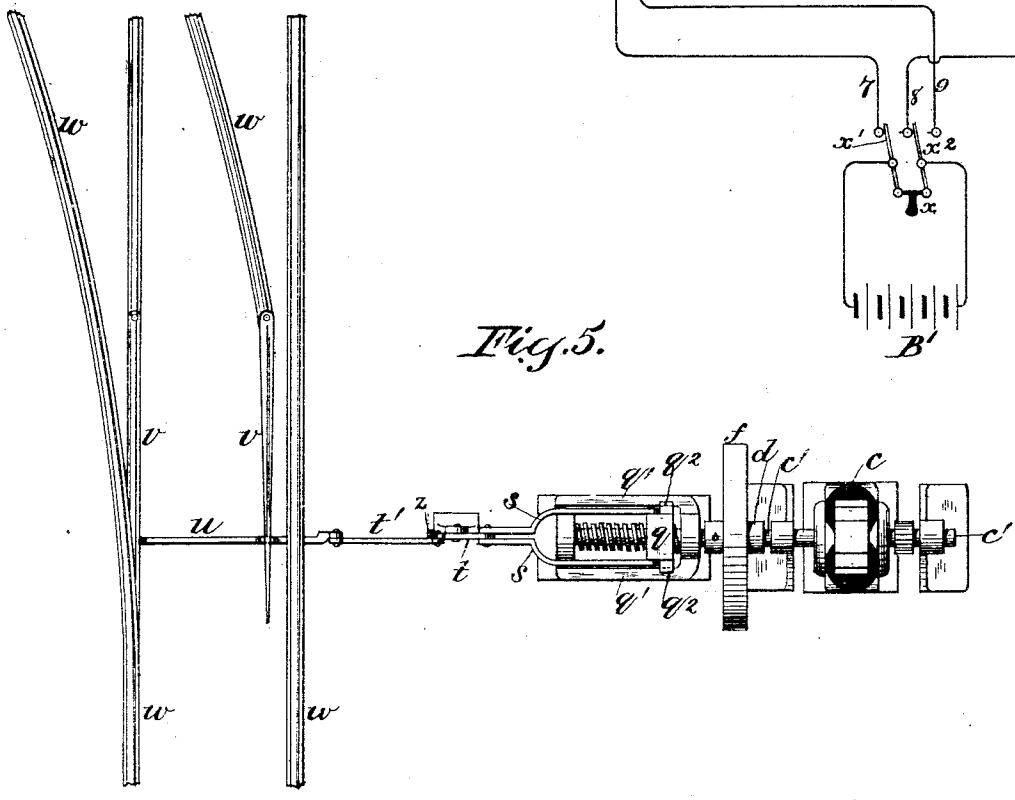


Fig. 5.



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UNITED STATES PATENT OFFICE.

ARTHUR H. JOHNSON, OF RAHWAY, NEW JERSEY, ASSIGNOR TO THE HALL SIGNAL COMPANY, OF NEW YORK AND MAINE.

POWER-APPLYING DEVICE FOR ELECTRIC MOTORS.

SPECIFICATION forming part of Letters Patent No. 510,603, dated December 12, 1893.

Application filed December 15, 1892. Serial No. 455,313. (No model.)

To all whom it may concern:

Be it known that I, ARTHUR H. JOHNSON, a subject of the Queen of Great Britain, and a resident of Rahway, in the county of Union and State of New Jersey, have invented certain new and useful Improvements in Power-Applying Devices for Electro-Magnetic Motors, of which the following is a specification, reference being had to the accompanying drawings, forming part hereof.

My invention is generally applicable to all devices to be moved, but is especially designed for railway signal arms or semaphores, railway gates, railway switches, &c., in which the arms, semaphores, gates, switches, &c., are to receive a definite movement upon the breaking or closing of a circuit or upon the happening of some event such as the approach or recedence of a train.

It consists of means for utilizing an ordinary rotary electro-motor to cause these movements.

The means embodying my broad invention consist of a centrifugally operated clutch interposed between the electro-motor and the device to be moved so that at low speeds the motor is not connected to the device to be moved, but as the speed of the motor increases the centrifugal clutch acts to hold the revolving parts together and the power is applied to move the device. The employment of this centrifugal clutch permits the electro-motor to acquire a high speed and to store up considerable momentum before any work is put upon it. It also permits the work to be applied gradualiy to the electro-motor, as the centrifugal clutch may be so constructed that as the electro-motor approaches the speed at which the clutch will positively grip and hold the parts of the clutch together, the parts will slip to some extent, but nevertheless the movement of one will cause a slight movement of the other, and this slip will gradually decrease until the gripping speed is reached.

My entire invention includes gearing connected at its fast end by the centrifugal clutch to the electro-motor, and connected at its slow end to the device to be moved, and a switch connected to the moving mechanism for cutting off the current from the electro-motor and applying an electrically-operated brake at the completion of a definite movement of the device to be moved, and for continuing the application of the brake until the cessation of the electrical current; also a relay for controlling the movement of the device by making and breaking the actuating circuit.

For the purpose of fully explaining my invention I have shown in Figures 1, 2 and 3 of the drawings an application of the same to operate the semaphore arm of a railway signal, and in Figs. 4 and 5 another application of the same for operating a railway switch.

Fig. 1 is a front elevation of the signal post, semaphore arm and operating mechanism. Fig. 1ª is an enlarged detail of a portion of the centrifugal clutch. Fig. 2 is a side elevation showing the operating mechanism, with the inclosing case in section. Fig. 3 is an enlarged horizontal section of the centrifugal clutch taken on the line 3—3, Fig. 1. Fig. 4 is a sectional elevation of the electro-motor, railway switch and connecting mechanism, and Fig. 5 is a plan view of the same.

The electro-motor *c* is shown in Figs. 1, 2, 4 and 5. Its shaft *c'* has secured to it a collar *d* provided with radial bearings in which are fitted to slide the gripping pieces *e*. The outer peripheries of these gripping pieces fit against the inner periphery of a wheel or flanged disk *f* fitted so as to rotate independently of the shaft *c'* and connected with the device to be moved. This disk *f* will not by its rotation cause any movement of the motor shaft *c'*, while, on the other hand, the rotation of the motor shaft, when at a sufficiently high speed to cause the gripping pieces or grippers *e* to tightly grip the inner periphery of the disk *f*, will cause the rotation of the disk *f* and devices connected therewith. To regulate the gripping action of the grippers *e*, springs *e'* are provided which tend to pull the grippers toward the center, thus resisting the centrifugal action. These springs and the weight of the grippers can be so adjusted that this clutch will hold the motor shaft *c'* and disk *f* so as to rotate together at any desired speed. It will be noted also that the clutch may be constructed so that the engagement of the two rotating parts

will occur very gradually as the motor shaft approaches its gripping speed, by making the engaging faces of the clutch smooth and non-adherent so that there will be considerable slip before the positive engagement of the faces take place. This arrangement will permit the motor to acquire a high rotative velocity and to store up considerable momentum before its work is put upon it.

I have shown in the drawings two arrangements of mechanism for connecting the disk of the centrifugal clutch with the devices to be moved. I will first describe that shown in Figs. 1, 2 and 3 which embodies my entire invention. In this construction the motor and clutch are connected with a semaphore arm *a* supported by the post *b*. Only a portion of the arm *a* and the post *b* are shown in the drawings. The electro-motor is mounted within a protected casing at the side of the post, and is connected through a train of gearing and connecting rod to the semaphore arm. The disk *f* is secured to or formed upon a sleeve fitted loosely upon the electro-motor shaft *c'*, and a pinion *g* is formed upon or secured to this sleeve. The pinion *g* meshes with the gear wheel *h* mounted upon the same shaft with the pinion *i*; the pinion *i* meshes into the gear wheel *j* mounted on the same shaft as the pinion *k*; the pinion *k* meshes into the toothed sector *l* mounted on the same shaft as the arm *l'*, and the arm *l'* is joined by the connecting rod l^2 to the semaphore arm *a*. The semaphore arm is shown in its horizontal or danger position. It is advisable to make this danger position the normal position of the semaphore arm, and to that end the semaphore is shown counter-weighted at *a'* on the opposite side of the center from the arm, the weight *a'* being sufficient to hold the semaphore arm at the danger position under all ordinary circumstances. The power of the electro-motor is applied for the purpose of pulling down the arm from the horizontal danger position to the nearly vertical or safety position. When the semaphore has reached the safety position, no further movement of the mechanism in that direction is required. I therefore provide a switch for cutting off the supply of electric current to the motor, and an electrically-operated brake to be applied to the moving mechanism at about the end of the downward movement of the semaphore. The switch *m* is shown mounted in the upper part of the casing and connected by the actuating rod *m'*, bell-crank m^2 and connecting rod m^3 with an arm mounted on the same shaft as the sector *l*. The switch could, of course, be connected with any suitable moving part of the mechanism. The switch *m* is shown as a snap switch, the object of this construction being to make the switch arm *n* move quickly from the contact plate *n'* to the contact plate n^2. The switch arm *n* is connected by the wire 1 to the battery B. The contact plate *n'* is connected by the wire 2 and through the coils of the electro-motor *c* and wire 4 to the other end of the battery B. The contact plate n^2 is connected by the wire 5 and through the coils of the electro-magnet *o* and wire 6 to the wire 4, thence of course to the same end of the battery B as the contact plate *n'*. When therefore the switch arm *n* is in contact with the plate *n'*, the current from battery B flows through the electro-motor coils, and is cut off from the electro-magnet *o*, and when the switch arm *n* is in contact with the plate n^2 the current is cut off from the electro-motor coils and flows through the electro-magnet *o*. This electro-magnet *o* has an armature connected with the brake-shoe *o'* arranged to bear upon the outer periphery of the disk *f*. The current flowing through this electro-magnet causes the brake *o'* to be applied to the disk *f* and speedily checks the movement of the mechanism.

A relay is shown for controlling the semaphore, although of course it is obvious that any suitable circuit breaker may be used. This relay R has an armature *r* which when attracted by the relay magnet closes a break in wire 4. The relay R may be operated by track circuits or track instruments or other automatic or hand-operated devices, at any desired distance from the semaphore.

In the positions of parts shown in the drawings the relay circuit R has just been closed and the electro-motor is about to commence its movement. The electro-motor will revolve freely until it has attained the speed at which it is to be connected with the semaphore, and then it will gradually or quickly, as may be desired, through its centrifugal clutch, impart motion to the semaphore operating mechanism and pull the semaphore downward toward the safety position. If the weight of this mechanism proves at any time too much for the electro-motor so as to cause a diminution of its speed, the electro-motor would be temporarily disconnected and would store up more momentum. When the semaphore has about reached its safety position the arm of the switch *m* is snapped over and contact is broken between the switch arm *n* and plate *n'*, and made between the switch arm *n* and plate n^2. Thereby the current is cut off from the electro-motor and sent through the brake-actuating magnet *o*, and the brake *o'* is applied to the mechanism. It will be noted here that as soon as the speed of the mechanism becomes lower than the gripping speed of the centrifugal clutch, the electro-motor will be disconnected and will slowly and freely come to rest, so that all sudden shocks to the electro-motor are prevented. The brake *o'* will be held in contact with the disk *f* until the circuit of the electro-magnet *o* is broken, and this circuit will not ordinarily be broken until the relay R releases its armature *r*. If, however, the semaphore were moved by hand, or otherwise, from its safety position while the circuit of battery B remains closed at the point *r*, the current will be switched through

the electro-motor and the semaphore will be immediately returned to safety position. Thus it will be seen that the mechanism acts to move the semaphore to the safety position and to hold it in that position so long as the current of its actuating battery is closed. As soon, however, as the current of the battery B is broken at the point r, the mechanism is released and the semaphore returns to the danger position. It will be noted that this return movement of the semaphore mechanism and of the disk f does not cause rotation of the armature, and thus the electro-magnet is guarded against any unnecessary movements. The disk f and connected gearing act to regulate the return movement of the semaphore by reason of the resistance of the air to their rapid rotation, and thus prevent a too rapid return movement and prevent a sudden jar or shock of the semaphore at the completion of such return movement when the semaphore reaches the danger position and comes against its stop.

In Figs. 4 and 5 the connecting gearing between the centrifugal clutch and the device to be moved (in this case a switch) consists of a revolving screw and its nut and suitable arms and links. The sleeve d is rigidly fixed to the shaft c'. The disk f is rigidly mounted upon a separate shaft p in alignment with shaft c which rotates in suitable bearings and is screw-threaded between its bearings. A nut q meshes into the threaded portion of the shaft p and is guided by the straight guide arms q' q' which engage with projections q^2 q^2 from the nut so that it slides in a straight line when the screw shaft p is rotated. Links s, s are also connected to the nut q and to the switch lever t. The switch lever t is pivotally mounted and has secured to it the link t' connecting it with the switch. bar u. v v are the moving tongues of the switch and w w the rails. With this construction it is necessary to actuate the electro-motor for each movement of the switch. It will therefore be necessary to send the current in one direction through the motor to move the switch in one direction, and to reverse the current for a reverse movement of the switch. This is provided for by the arrangement of switches shown diagrammatically in Fig. 4. The switch lever y is controlled by a sliding bar y', and this sliding bar y' has two projections y^3 and y^3 which engage with the projection q^3 of the sliding nut q. There are two contacts to this switch, one connected to the wire 7 and the other to the wire 9. When the nut is in the extreme right hand position, as shown in Fig. 4, the switch lever y is in contact with the wire 7. When the nut q is in the extreme left hand position, the switch lever y is in contact with the wire 9. While the nut is moving in the intermediate positions the switch lever is unaffected. For instance, the nut q as shown in Fig. 4, is about to move to the left and will not operate the switch until just before it reaches the extreme left hand position.

The apparatus may be operated and controlled by a relay or by a hand-operated switch. The drawings show a hand-operated switch containing a handle x, and two mechanically connected but electrically insulated switch bars x' and x^2. The switch bar x' is connected with one pole of the battery B', and the switch bar x^2 is connected with the other pole of said battery. There are three contacts. One of these contacts is connected directly by the wire 7 to a corresponding contact in the switch on the machine. The second of these contacts is connected by the wire 8, through the the coils of the electro-motor, to the switch lever y on the machine. The third contact is connected by the wire 9 directly to the second contact of the switch on the machine. As shown, the switch bars x' and x^2 have just been operated to connect the wires 7 and 8 to the battery B', and the current flows through the switch bar x^2 by the wire 8, including the coils of the electro-magnet, and from the wire 8 through the switch lever y to the wire 7, and through switch bar x' back to the battery. The electric current will now flow through the electro-motor and cause the mechanism to close the railway switch. At the completion of the closing of the railway switch, the lever y breaks contact with the wire 7, thus breaking the electro-motor circuit. To cushion the stroke of the switch lever and prevent jarring, I provide a spring z against which the lever t will come in contact at about this part of its movement. The railway switch will remain closed until the switch bars x' and x^2 are operated to bring x' into contact with the wire 8 and x^2 into contact with the wire 9; then the current will flow from the battery through bar x^2 and the wire 9, switch bar y, (which is now in contact with wire 9) wire 8 and electro-motor coils, and back to battery by the switch-bar x', thus flowing in the reverse direction from that in which it flowed to close the switch. This will cause the electro-motor and connected parts to move in the opposite direction from that employed in closing the railway switch, and will therefore result in opening the switch. Just before the nut q returns to its extreme right hand position, it will move the switch lever y so as to break contact with the wire 9 and thus cut off the supply of current from the electro-motor.

The spring z', working against the lever t, will cushion the shock of the mechanism as it comes to a standstill. This construction makes it possible to control the switch at any desired distance therefrom, either manually or automatically. The current is permitted to flow until the work has been accomplished and the circuit is broken, but at the same time the parts are put in position to be operated in the reverse direction upon a change in the operating switch or relay.

It is obvious that other applications may

be made of my broad invention, and various modifications may be made in the applications shown without departing from the spirit of my broad invention.

What I claim, and desire to secure by Letters Patent, is—

1. The combination of an electric motor and a circuit therefor, a device to be moved by the motor, a brake and circuit therefor, said circuits so operatively connected with the moving parts that when they have completed a definite movement the circuit for the motor is automatically de-energized and the circuit for the brake is automatically energized, substantially as set forth.

2. The combination of an electric motor and a circuit therefor, a device to be moved by the motor, a brake and a circuit therefor, a switch for said circuits automatically operated by the moving parts to de-energize the circuit for the motor and energize the circuit for the brake substantially as set forth.

3. The combination of an electric motor and a circuit therefor, a device to be moved by the motor, a brake and a circuit therefor so operatively connected with the moving parts that when they have completed a definite movement the circuit for the brake is energized, substantially as set forth.

4. The combination of an electric motor and a circuit therefor, a device to be moved by the motor, a brake and a circuit therefor, a switch for said circuits automatically operated by the moving parts to energize the circuit for the brake, substantially as set forth.

5. The combination with an electro-motor and a device to be moved thereby, and a circuit for conveying current to the electro-motor, of an electrically-actuated brake controlling, when operated, the movement of said device, and a circuit for said brake, and a switch operated by the moving parts to cut off the current from the electro-motor circuit and send it through the brake actuating circuit on the completion of a definite movement of the device, substantially as set forth.

6. The combination with an electro-motor and a device to be moved thereby, and a circuit for conveying current to the electro-motor, of a clutch containing two revolving parts, said parts being independently revoluble at low speeds but held by centrifugal force so as to rotate together at high speeds, one of such parts being connected to the electro-motor and the other to the device to be moved, and of an electrically-actuated brake adapted to retard the movement of the device, and a circuit for said brake, and a switch operated by the moving parts to cut off the current from the electro-motor circuit and send it through the brake actuating circuit on the completion of a definite movement of the device, substantially as set forth.

7. The combination with an electro-motor and a device to be moved thereby, and a circuit for conveying current to the electro-motor, of an electrically-actuated brake controlling, when operated, the movement of said device and a circuit for said brake, a switch operated by the moving parts to cut off the current from the electro-motor circuit and send it through the brake actuating circuit on the completion of a definite movement of the device, and a circuit breaker for closing and holding closed the path for said current, and also for cutting off said current, whereby said circuit breaker will control the movement of said device, substantially as set forth.

8. The combination of an electro-motor, a device to be moved thereby, a train of gearing connecting said device and the electro-motor, a centrifugal clutch interposed in said gearing, an electrically actuated brake adapted to retard the movement of the device, and a switch operated by the moving parts to cut off the current from the electro-motor and send it to the brake on the completion of a definite movement of the device, substantially as set forth.

9. The combination with a pivoted arm of a train of gearing connected at its slow end to said arm, an electro-motor, a centrifugal clutch connecting the fast end of the gearing to the electro-motor and a switch operated by the moving parts to cut off the current from the electro-motor at about the completion of the movement of the pivoted arm in one direction, substantially as set forth.

10. The combination with a pivoted arm of a train of gearing connected at its slow end to said arm, an electro-motor, a centrifugal clutch connecting the fast end of the gearing to the electro-motor, an electrically-actuated brake arranged to be put in frictional contact with some revolving part at the fast end of the gearing, and a switch operated by the moving parts to cut off the current from the electro-motor and send it to the brake on the completion of the movement of the pivoted arm in one direction, substantially as set forth.

11. The combination with an electro-motor, its shaft and the radially sliding grippers *e*, *e*, thereon, the flanged disk *f* and pinion *g* connected together and mounted loosely upon said electro-motor shaft, the wheel *h* and pinion *i*, the wheel *j* and pinion *k*, the toothed sector *l* and arm *l'*, a switch connected to said sector *l*, and an arm to be moved connected to said arm *l'*, substantially as set forth.

12. The combination with an electro-motor and a device to be moved thereby, and a circuit for conveying current to the electro-motor, of a revolving wheel having an inner cylindrical surface and connected to said device, and revolving grippers adapted to fit against the inner cylindrical surface of the wheel, and radial bearings in which said grippers are fitted to slide, said bearings being connected to the electro-motor, an electrically actuated brake controlling, when operated, the movement of said device and a circuit for said brake, a switch operated by the moving parts to cut off the current from the electro-

motor circuit and send it through the brake actuating circuit on the completion of a definite movement of the device, and a circuit breaker for closing and holding closed the path of said current, and also for cutting off said current, whereby said circuit breaker will control the movement of said device, substantially as set forth.

13. The combination with an electro-motor and a device to be moved thereby, and a circuit for conveying current to the electro-motor, of a revolving wheel having an inner cylindrical surface and connected to said device, and revolving grippers adapted to fit against the inner cylindrical surface of the wheel and radial bearings in which said grippers are fitted to slide, said bearings being connected to the electro-motor, an electrically actuated brake controlling, when operated, the movement of said device and a circuit for said brake, a train of gearing connecting said wheel and the device to be moved, said device to be moved being at the slow end of said train of gearing, a switch operated by the moving parts to cut off the current from the electro-motor circuit and send it through the brake actuating circuit on the completion of a definite movement of the device, and a circuit breaker for closing and holding closed the path of said current, and also for cutting off said current whereby said circuit breaker will control the movement of said device, substantially as set forth.

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