No. 688,982. Patented Dec. 17, 1901.

A. H. ADAMS.

AUTOMATIC ELECTRIC SWITCH.

(Application filed Apr. 22, 1901.)

(No Model.) 3 Sheets—Sheet 1.

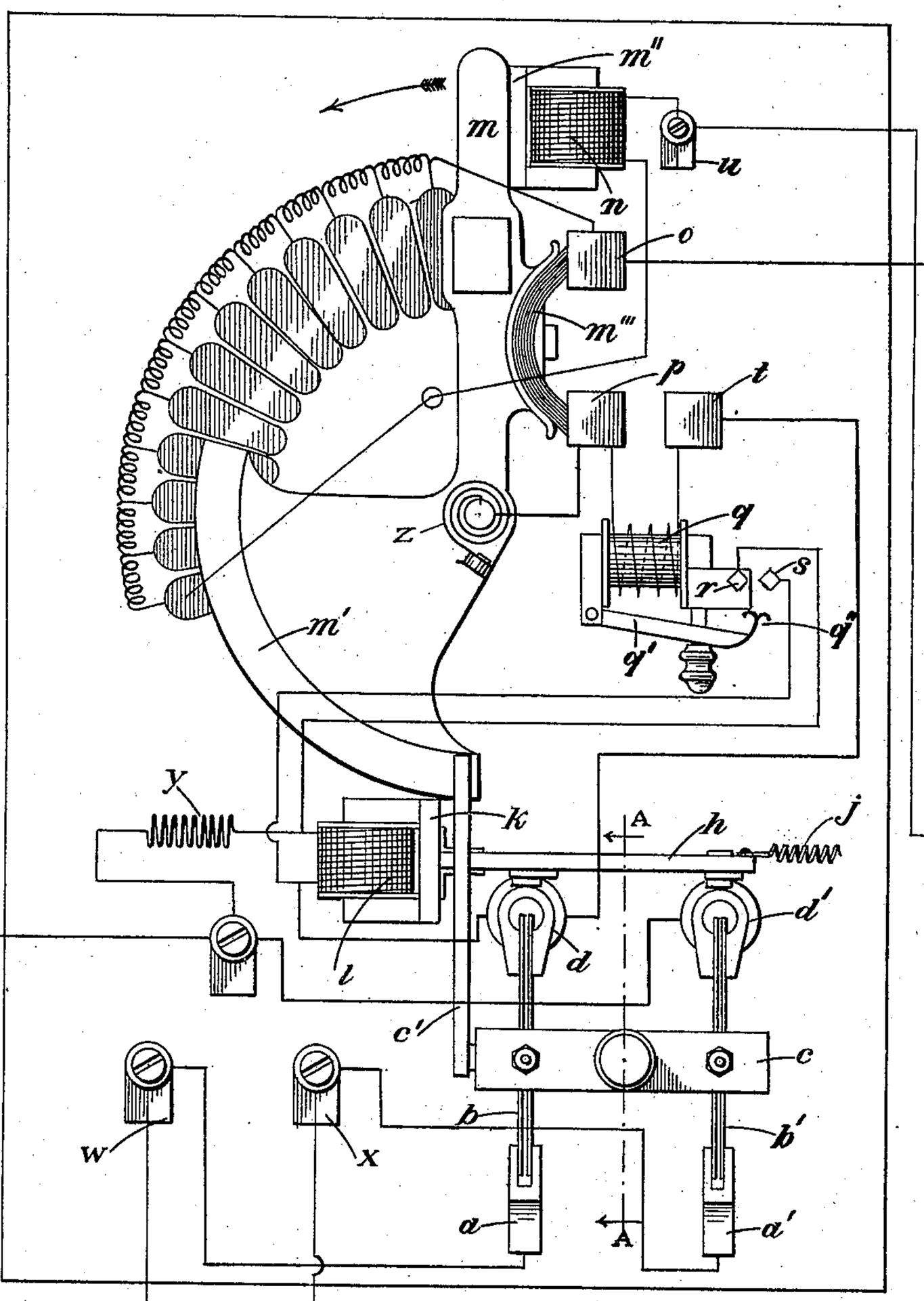

Fig. 1.

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FIG. II

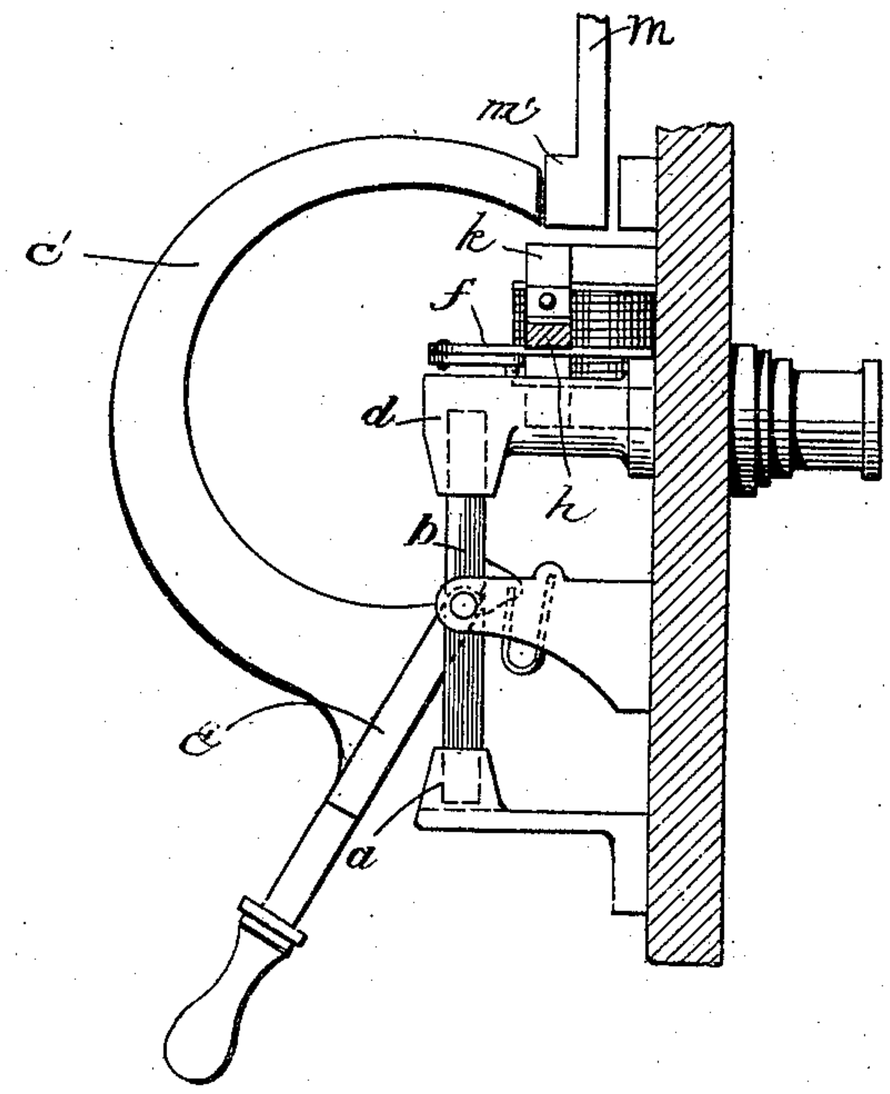

FIG. III

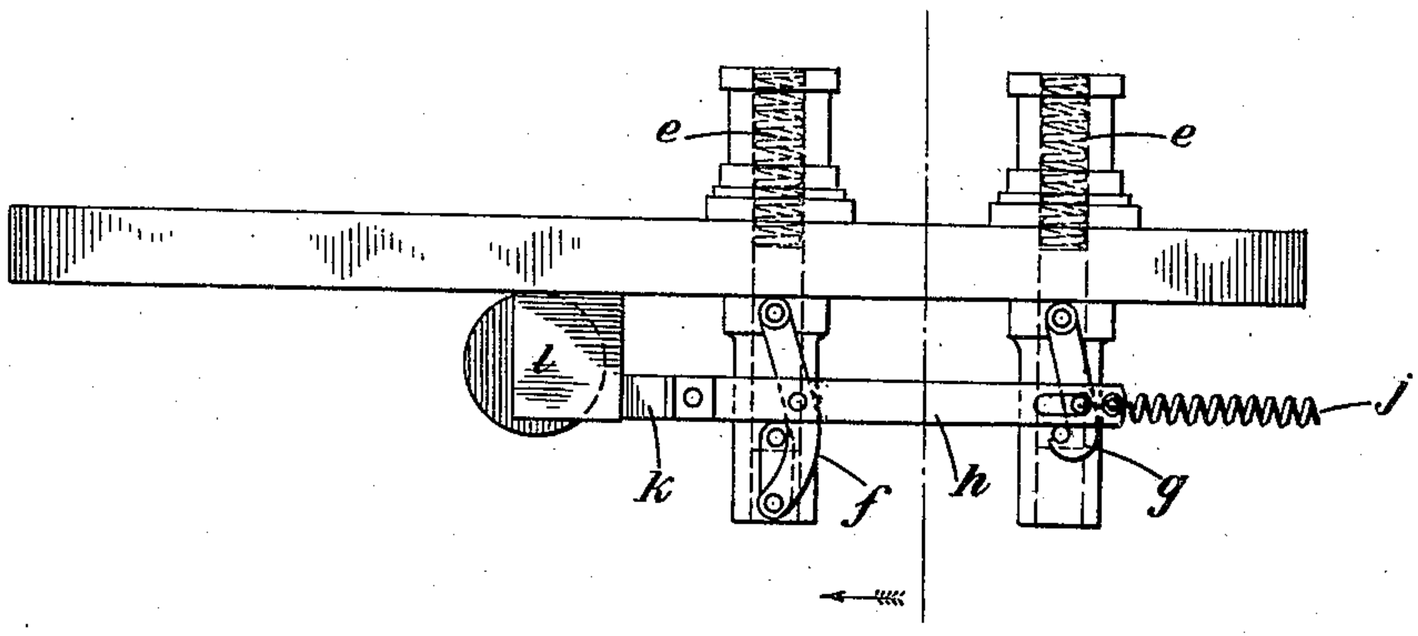

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FIG. V

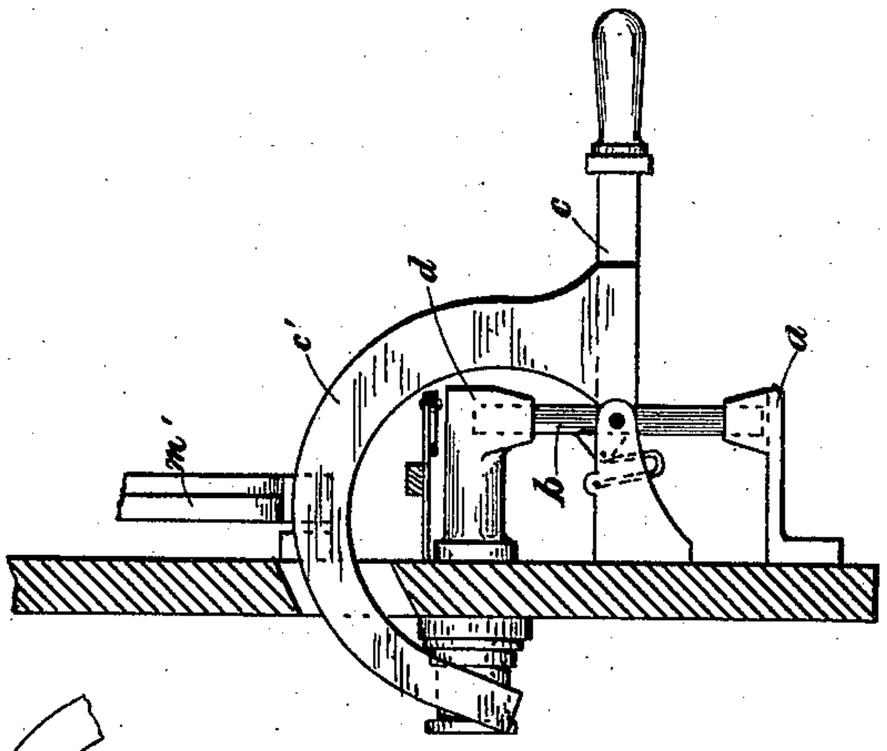


Fig. VI.

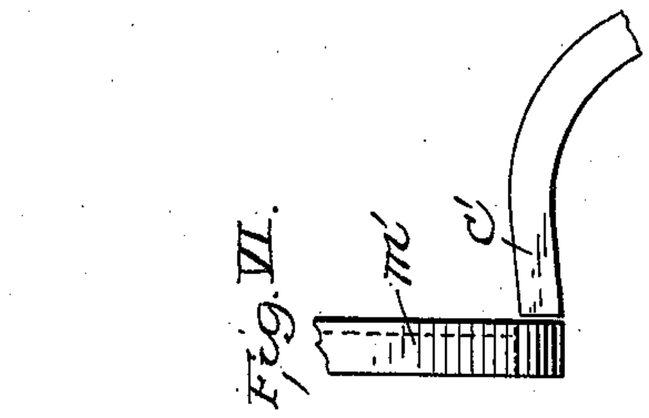
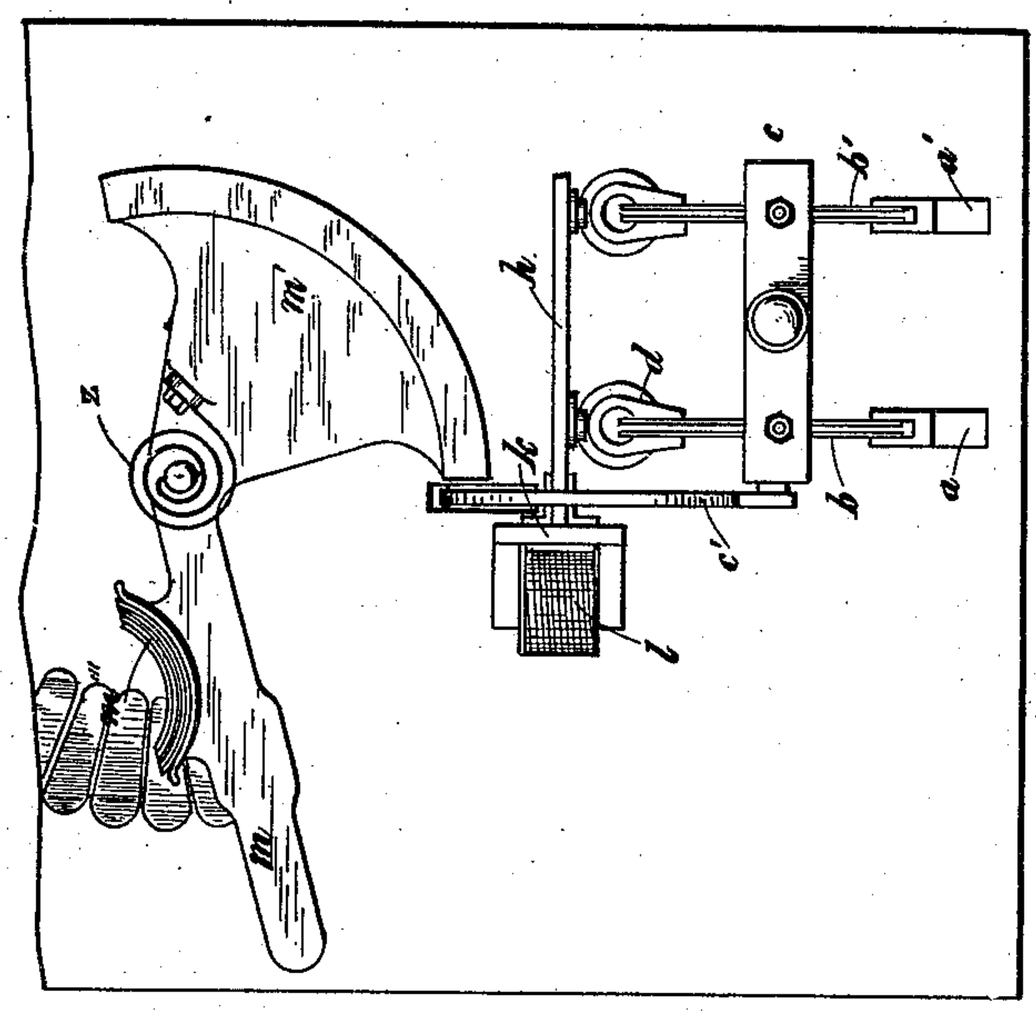


FIG. IV



Witnesses
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UNITED STATES PATENT OFFICE.

ARTHUR HENRY ADAMS, OF LONDON, ENGLAND.

AUTOMATIC ELECTRIC SWITCH.

SPECIFICATION forming part of Letters Patent No. 688,982, dated December 17, 1901.

Application filed April 22, 1901. Serial No. 56,928. (No model.)

To all whom it may concern:

Be it known that I, ARTHUR HENRY ADAMS, a citizen of the United States of America, residing in London, in the county of Middlesex, England, have invented certain new and useful Improvements Relating to Automatic Electric Switches, of which the following is a specification.

This invention relates to automatic switches, and is specially applicable to switches for electromotors, and I will describe it with reference to the accompanying drawings, which illustrate the application of my invention to the latter type of switch, and in which—

Fig. I is an elevation; Fig. II, a side elevation of the main switch in section on the line A A of Fig. I; Fig. III, a plan view of the main switch. Figs. IV, V, and VI are detail views illustrating the action of the interlocking pieces.

For the sake of clearness certain parts of the main switch, the greater part of the rheostat, and the connections are omitted in Figs. II, III, IV, V, and VI.

The main switch and the mode by which it is interlocked with the rheostat-arm are substantially the same as illustrated and fully described in the specification accompanying an application for Letters Patent made by Robert Alexander Sloan and John Edward Lloyd Barnes and filed on June 19, 1900.

a a' are the one pair of contacts of the main switch connected to the mains. *b b'* are the switch-bars operated by a loose handle *c*. The other pair of contacts *d d'* each contain a spiral spring *e*, which springs are compressed when the switch-bars are closed, the springs are held closed in the case of one of the springs by the pivoted detent *f* and in the case of the other spring by the ordinary detent *g*. A bar *h* is articulated directly to the detent *f* and by a slot-hole or other device for permitting backlash to the detent *g*. The bar *h* is urged by a spring *j* in a direction to release the detents, and it carries an armature *k*, which is attracted by an electromagnet *l*, the winding of which is connected, in series with a high resistance *y*, across the terminals *d d'*. The rheostat-arm *m* carries an interlocking piece *m'*, which interlocks with a second interlocking piece *c'*, carried from the switch-arm, and it will be seen that these interlocking pieces prevent, first, the main switch being closed, except when the rheostat-arm is in the position in which all the resistance is included in the circuit, and, second, the rheostat-arm being moved from this position unless the main switch-handle is drawn back clear of the switch-bars.

Fig. IV shows the rheostat-arm in the position in which all the resistance is included in the circuit, and it will be seen from Figs. IV and V that when in this position the locking-piece *m'* does not prevent the switch being closed, as the locking-piece *c'* can pass clear of it. It will also be seen that in this position the piece *c'* prevents movement of the rheostat-arm and that to allow the arm *m* to move the handle *c*, and with it the piece *c'*, must be pulled back, as shown in Figs. I, II, and VI. When, however, the rheostat-arm is moved so as to cut out resistance, as in Fig. 1, then *m'* locks *c'* and prevents the handle *c* being moved far enough to close the switch.

The rheostat-arm tends under the influence of a spring X to move in the direction of the arrow, and it is held against this action when in the position shown in the drawings by an armature *m''*, attracted by the electromagnet *n*. When in this position, the switch-bar *m'''* short-circuits the whole of the resistance by contact with the blocks *o* and *p*, as shown. A third magnet *q* is provided, the armature *q'* of which carries a switch *q''*, adapted to connect the blocks *r* and *s*, and so short-circuit the windings of the magnet *l*, and, if desired, it may also short-circuit the magnet *n*.

The electrical connections are as follows: *a* and *a'* are connected to the positive and negative mains through the terminals *w* and *x*. *d* is connected to the block *t* and the latter to the block *p* through the winding of the magnet *q*. *p* is also connected to the rheostat-arm *m*. The block *o* is connected to one of the motor-brushes, and the other brush is connected to *d'* through the terminal *v*. One end of the shunt-winding of the motor is connected to the last-mentioned brush, and the other end of the shunt is connected through a terminal *u* to the winding of the magnet *n*, and the other end of the said winding is connected to the other brush of the motor

through the rheostat-resistance and the block *o*. The winding of the magnet *l* is connected in series with a high resistance *y* across the contacts *d* and *d'*, or alternatively it may be connected across these terminals in series with the magnet *n* and the shunt-winding of the motor, in which case the shunt-winding is excited immediately the main switch is closed.

The action is as follows: Assuming the rheostat-arm to be in the opposite extreme position to that shown in the drawings, the main switch can now be closed, and the springs will be compressed and held compressed by the detents, and if there is the desired voltage across the mains the magnet *l* will be energized and will hold the bar *h* by the armature *k* against the spring *j*. The handle of the switch must now be drawn back to clear the switch-bars, after which the rheostat-arm can be moved to the position shown. It is held in this position by the magnet *n*, and under normal circumstances the motor will be running. Should the current fail, the magnet *l* releases *k* and the spring *j* positively pulls the pivoted detent past the dead-point. This releases the spring in *d*, which now acts to still further displace the pivoted detent, and the full pressure of this spring is available to disengage the ordinary detent as soon as the bar *h* comes into contact with the latter. Thus the main switch will at once open, and it will be noticed that the bars of the main switch are, in consequence of the interlocking action described, quite free from the handle. The rheostat-arm will also have returned to the proper position for starting, as it will be no longer held by the magnet *n*. Should the current exceed the maximum, the magnet *q* attracts its armature, and by connecting *r* and *s* short-circuits the magnet *l*, (and if desired the magnet *n*,) with the result that the main switch is opened and the rheostat-arm released, the former action usually preceding the latter, owing to the self-induction in the shunt-circuit.

Having now fully described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In combination: a switch-bar; a handle by which the bar is operated; contacts adapted to be connected by the bar; a spring which is compressed when the contacts are so connected, and which tends to force the bar out of the contacts; a detent for holding the said spring compressed but which leaves the switch-bar free to be opened by the handle; means for releasing the said detent, comprising a bar carrying an armature and under the influence of a spring which normally tends to move the bar so as to release the detent, an electromagnet energized when the switch is closed, and which when there is the desired voltage holds the armature and prevents the spring moving the bar, and a second electromagnet energized by the current and the armature of which, when the desired maximum current is exceeded, is attracted and closes a subsidiary switch which short-circuits the magnet first referred to; substantially as described and illustrated.

2. In combination, a switch which normally tends to open under the influence of a spring, a detent adapted to hold the said spring inoperative, a bar, articulated to the detent and connected to a spring which tends to move it so as to release the detent, an electromagnet energized when the switch is closed, and which when there is the desired voltage, overcomes the force of the last-mentioned spring by attracting an armature attached to the bar and prevents the release of the detent, and a second electromagnet adapted, when the maximum current is exceeded, to close a subsidiary switch which short-circuits the magnet first referred to, substantially as described and illustrated.

3. In combination; a main switch, a spring tending to open the main switch, a detent adapted to hold the said spring, a bar articulated to the detent and urged by a spring to release the said detent, an electromagnet adapted to hold the bar against movement by the said spring, a rheostat, the arm of which is interlocked with the said main switch and which has to be moved against a spring to cut out the resistance, an electromagnet adapted to hold the said arm in its extreme position, and a third electromagnet adapted, when the desired maximum current is exceeded, to operate a switch which short-circuits the first-mentioned magnet and so opens the main switch; substantially as described and illustrated.

4. In combination; a double-pole switch each bar of which, when closed, compresses a spiral spring, a pivoted detent adapted to hold one of the said springs closed, an ordinary detent adapted to hold the other spring closed, a bar articulated directly to the former detent, and also, by means permitting a certain amount of backlash, to the latter detent, a spring tending to move the bar to release the pivoted detent, an electromagnet holding the bar against such movement and a second electromagnet adapted to short-circuit the first-mentioned one; substantially as described and illustrated.

5. In combination; a main switch, an electromagnet which, when there is the desired voltage, is instrumental in maintaining the main switch closed, a rheostat held in its one extreme position by an electromagnet; interlocking means for preventing the closing of the main switch except when the rheostat-arm is in its other extreme position, and for preventing the movement of the rheostat-arm from its latter position till the handle of the switch is drawn back clear of the bars thereof; and an electromagnet energized by the current and adapted, when the current reaches a value in excess of the desired maximum, to short-circuit the two electromagnets first men-

tioned; substantially as described and illustrated.

6. In combination; a main switch; means for opening the main switch; an electromagnet energized by the current when the main switch is closed and which controls the opening means; a rheostat interlocked with the main switch and held in its extreme position by an electromagnet energized by the shunt-current of an electromotor, and an electromagnet energized by the current to be controlled and adapted, when the latter exceeds the predetermined maximum, to short-circuit the two electromagnets first mentioned; substantially as described and illustrated.

7. In combination, a main switch adapted to be held closed under spring tension, an electromagnet for maintaining said switch closed during the continuance of a determined amount of current but releasing said switch on the reduction of the current below a predetermined degree, and a switch having connections for short-circuiting said magnet, and an electromagnet for operating said second switch on the presence of an excess of current, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

ARTHUR HENRY ADAMS.

Witnesses:
JOHN THOMAS MOULD,
ARTHUR HERBERT CURTIS.