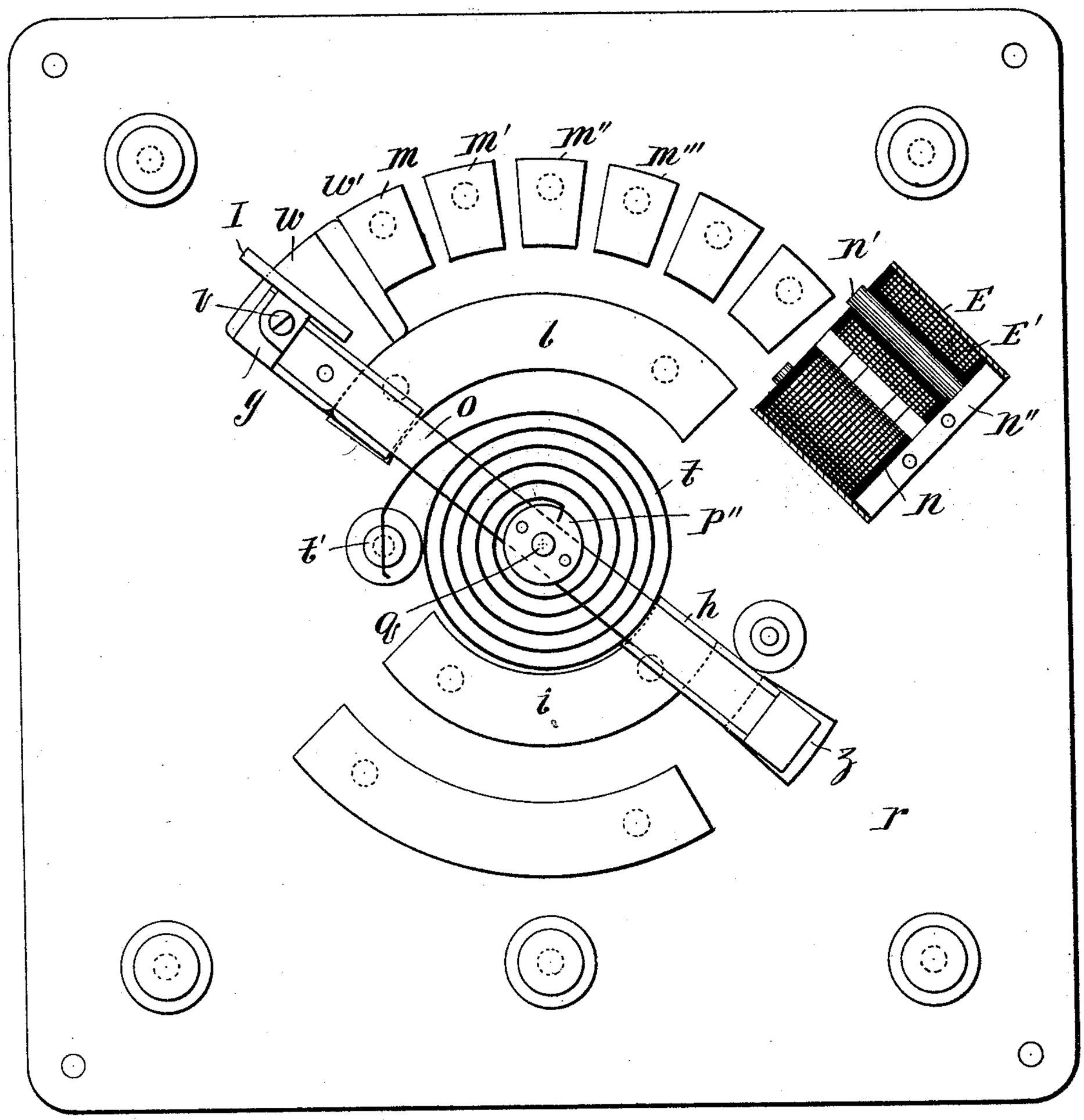
(No Model.) 3 Sheets—Sheet 1.

F. V. HENSHAW.

ELECTRIC STARTING SWITCH.

No. 518,404. Patented Apr. 17, 1894.

Fig. 1.



Witnesses
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Edward P. Thompson

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(No Model.)

3 Sheets—Sheet 2.

F. V. HENSHAW.

ELECTRIC STARTING SWITCH.

No. 518,404. Patented Apr. 17, 1894.

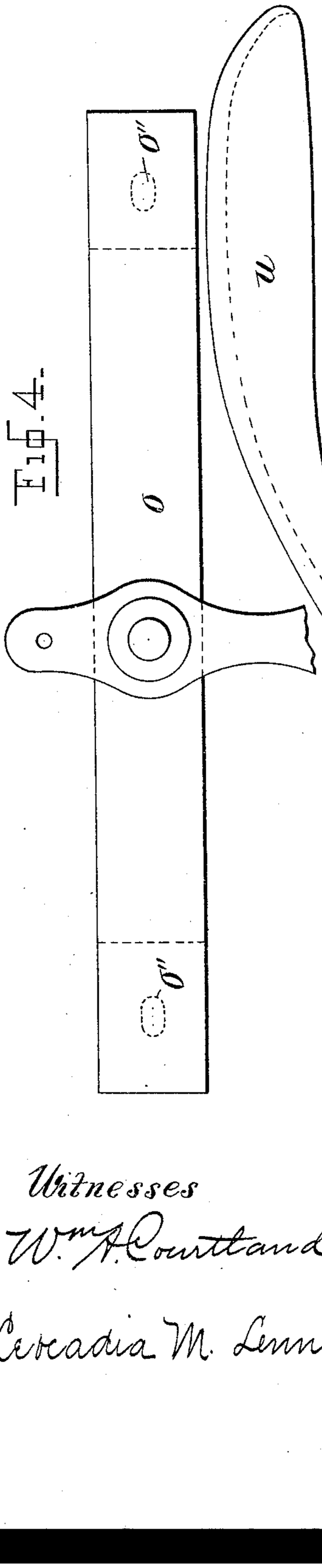

Fig. 4.

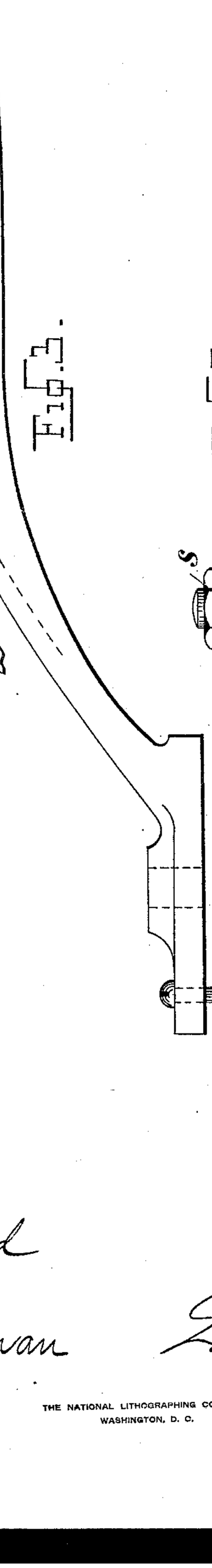

Fig. 3.

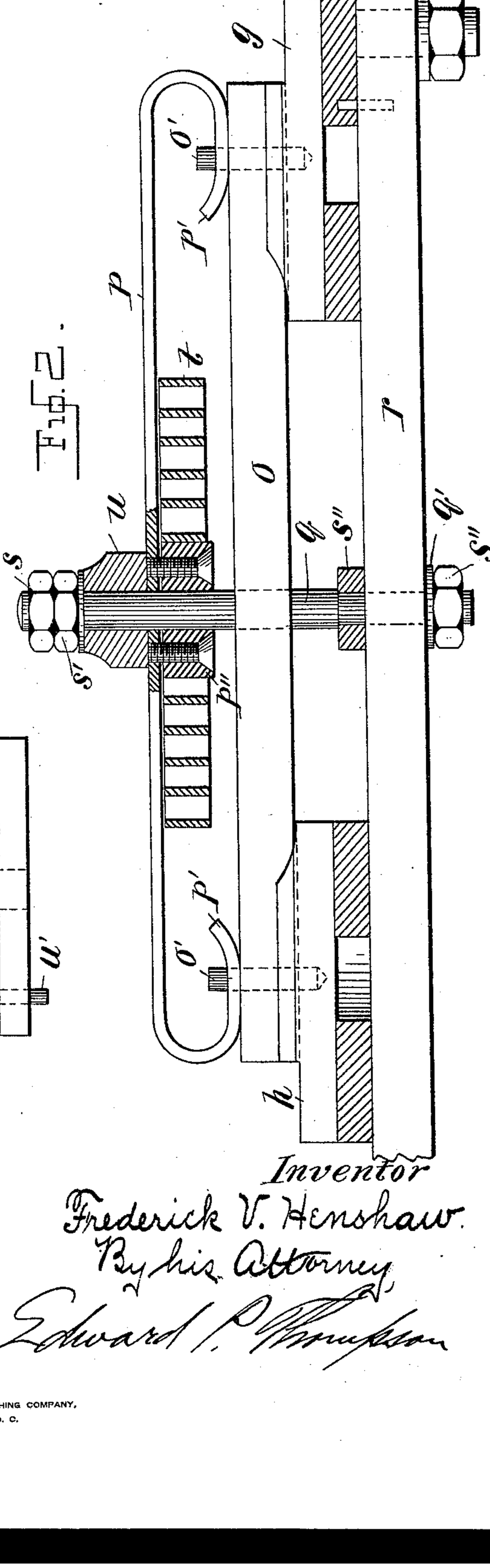

Fig. 2.

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Fig. 5.

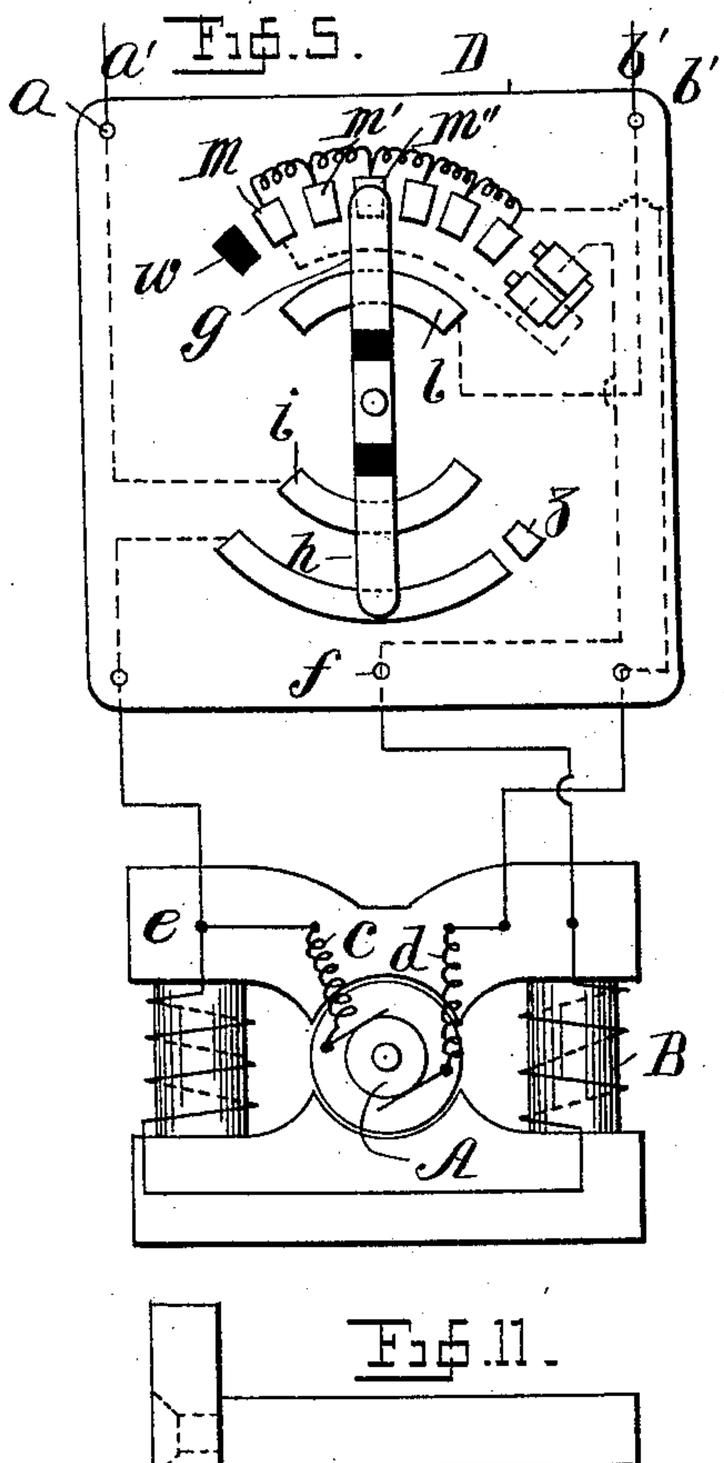


Fig. 6.

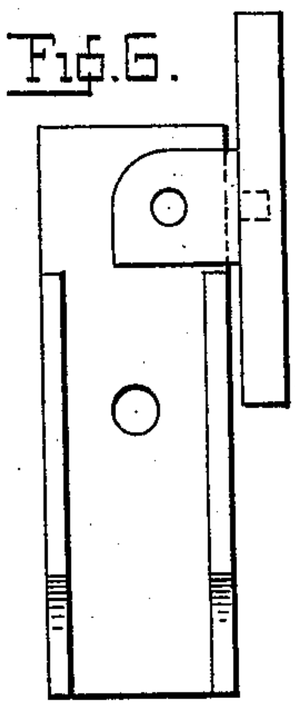


Fig. 7.

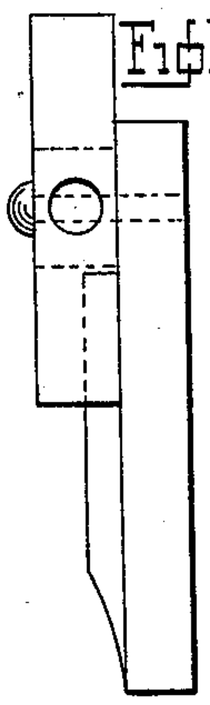


Fig. 8.

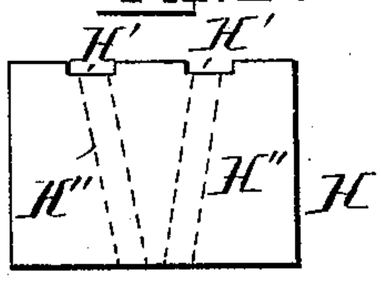


Fig. 9.

Fig. 10.

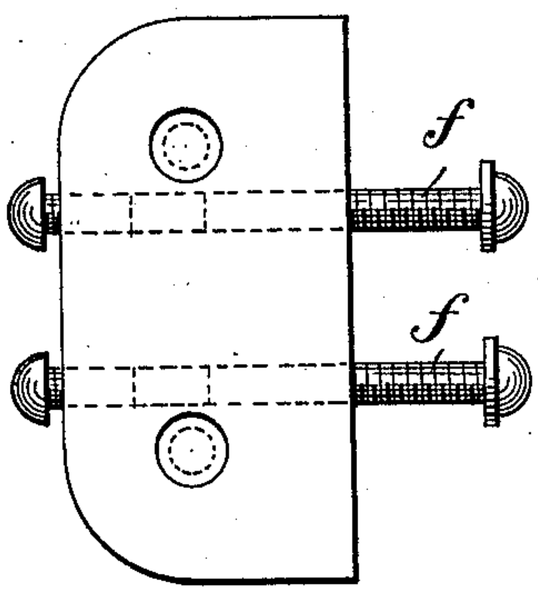


Fig. 12.

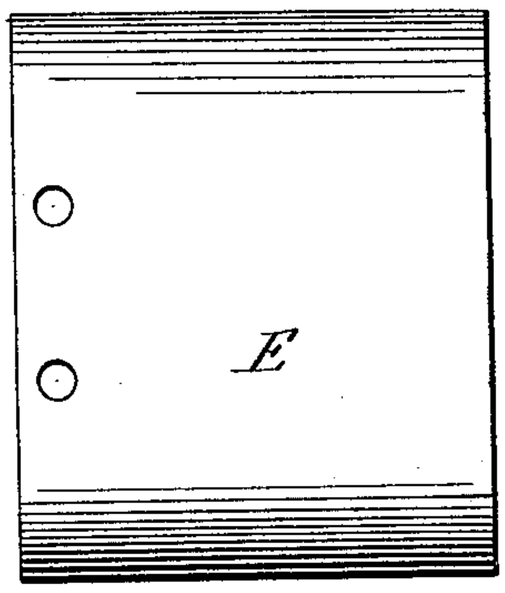


Fig. 11.

Fig. 14.

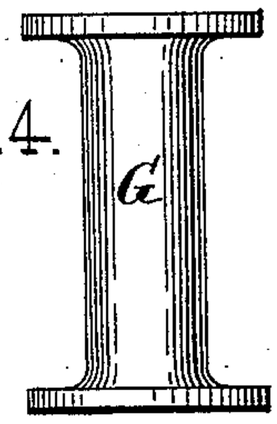


Fig. 13.

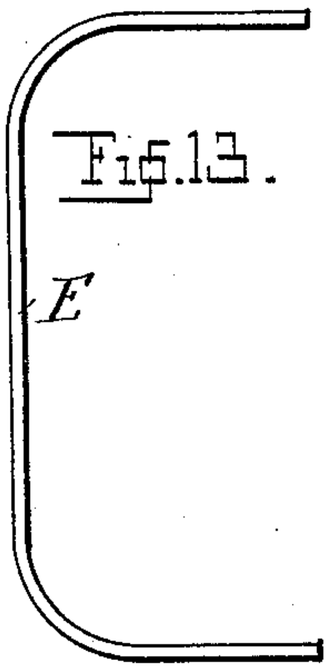


Fig. 17.

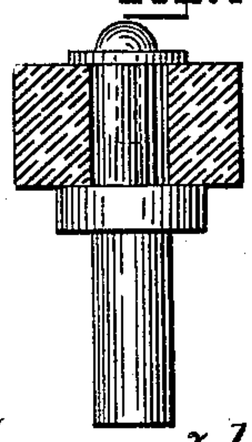


Fig. 15

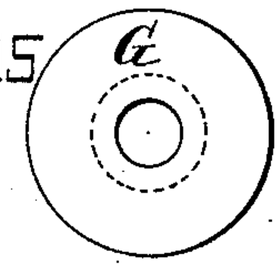


Fig. 16.

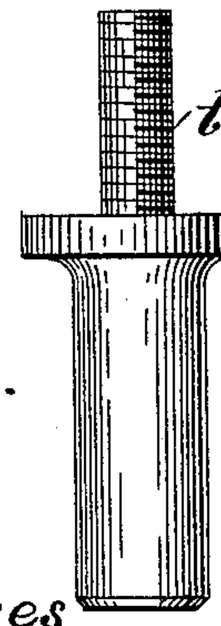
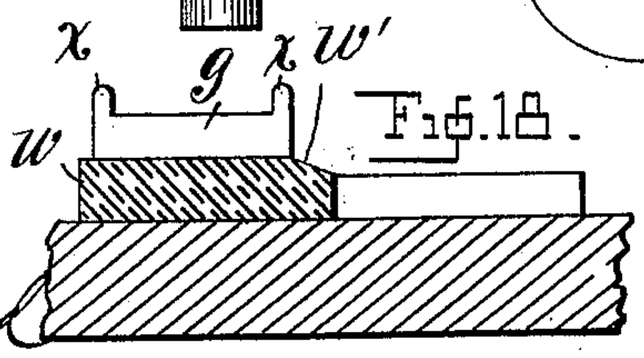


Fig. 18.



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UNITED STATES PATENT OFFICE.

FREDERICK V. HENSHAW, OF BROOKLYN, NEW YORK.

ELECTRIC STARTING-SWITCH.

SPECIFICATION forming part of Letters Patent No. 518,404, dated April 17, 1894.

Application filed June 2, 1893. Serial No. 476,332. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK V. HENSHAW, a citizen of the United States of America, and a resident of Brooklyn, in the county of Kings, State of New York, have invented certain new and useful Improvements in Electric Starting-Switches, (Case I,) of which the following is a specification.

My invention relates to switches so organized that during operation the one opens or closes one main line through a gradually variable resistance, while the other opens or closes the other main line.

The object of the invention is the starting of an electric motor with electric connections so arranged that the current from the mains is distributed by means of three or more branches to the armature and magnet coil of a motor, in the manner hereinafter set forth, in detail.

A further object is the production of a simple and effective mechanical device for starting a motor and for automatically cutting off both main lines, by means of a magnet operated by current from the main line, acting when energized, to hold the switch closed.

The invention is illustrated by the accompanying drawings.

Figure 1 is a plan of the complete device, some parts being shown in section and partly broken away. Fig. 2 is a cross-section at the line X in Fig. 1, the switch having a different phase from that exhibited in Fig. 1. The direction of view is that of the arrow Y. Fig. 3 is an elevation of the handle of the switch. Fig. 4 is a plan of a portion of the handle and of the insulator connecting the circuit closers of the switch. Fig. 5 is a diagram of the circuits from the main line through the device and an electric motor. Figs. 6 and 7 are plan and side elevations of one of the circuit closers and armature attached, thereon. Figs. 8 and 9 are different views of the insulator between the limbs of the cut-out magnet. Figs. 10 and 11 are different views of the yoke and core of said magnet. Figs. 12 and 13 are different views of the cover for placing over said magnet, a portion thereof being shown in section in Fig. 1. Figs. 14 and 15 are different views of the spool of the said magnet. Fig. 16 is an elevation of the spiral spring holding post. Fig. 17 is a view of the rubber stop, (the rubber portion being in section) for receiving the blow of the switch when released. Fig. 18 is a view partly in section, of the projecting insulator for receiving one of the circuit closers, and provided with an inclined surface as described hereinafter.

The circuit closer is shown in part on the top.

a and *b* are respectively the terminals of the lines *a'*, *b'*, and *c* and *d* of the armature A of the motor, and *e*, *f* of the field magnet B.

g, *h*, are the respective main line circuit closers of a double pole switch C.

i, is the terminal of main line *a'* and *l*, is a terminal of main line *b'*. The other terminal is divided into multiple contacts *m*, *m'*, *m''*, &c., connected by resistances D as in a rheostat. A magnet *n* is included in the shunt field magnet B circuit.

The switch circuit closers *g*, *h*, are held together by an insulator *o*, from the end of which project pins *o'*. A stout spring *p* having slotted curved ends *p'* is so located that the pins pass through the slots. A stationary central pin *q*, projects upward from the base plate *r*. The insulator *o* and spring *p* are loose on this pin and can turn thereon, being held by means of the spiral spring *t*. Interposed between the spring and nuts is a handle *u* which is pivoted upon said pin *q*, and freely, so as to fall into a downward position by gravity. One end of this spring *t* is attached to the stationary post *t'*, and one end to the spring *p*. When the last spring is turned, the circuit closers *g*, *h*, turn with it, and fly back when released. The spring *p* is not attached directly to the spring *t*, but to the hub *p''* which is carried by the spring *p*.

The handle *u* has a peculiar construction as to its means of attachment. Although it is loose upon the pin *q*, yet it has friction by reason of the nuts *s*, *s'* and a projection *u'* projecting into the plane of the spring *p* so that when the handle is turned to the right the projection forces the switch to turn on the current, and the switch is held closed by the magnet *n*. When the magnet releases the switch (having the armature I) the latter moves to its former position rapidly, and the momentum of the handle is taken up by the

friction at its bearing leaving the handle standing in an upright position ready to be turned again to the right. The nuts s, s' are on the pin q and can be tightened or loosened to obtain proper friction at the bearing of the handle u. Another object of having this handle loose is this—in turning the switch off the operator moves the loose handle until the spring p meets the stud u'. A little further pressure then pulls the magnet armature away from the magnet n and this allows the whole system to snap back to the off position independently of the operator's movements.

A spring p serves to press the circuit closers g, h, upon their terminals according to the tension produced by the nuts s, s'. The insulator block w is slightly higher than the terminals m, m', m'', &c., so that when leaving it, the circuit closer g will arrive above the contact m, and fall upon it suddenly and equally as suddenly leave it. The block w is curved upward at or near its edge as shown at w', so that the circuit closer g may slide upward and rest on the said insulator block when the circuit is opened. By this construction the sparking on closing or rupture is less because the circuit closer g does not slide on to or off of the terminal m, but is dropped or lifted. Two surfaces make contact or separate rather than two lines or edges.

The insulator bar o, is attached to the circuit closers thus. The latter are provided with lugs x between which the bar fits and is prevented from turning laterally. The insulator pins o' pass wholly through both said bar o and partly through said circuit closers g, h, thereby preventing longitudinal movement. The slots o'' in the spring p are longitudinal in the direction of the bar o, and the pins o' project therein. The oval shape of the slots permits the spring p to be applied easily and yet to be attached to the bar o rigidly as far as lateral movement is concerned, because the slots o'' are only as wide as the pins o'.

The armature I belonging to the magnet n is carried by the circuit closer g being parallel thereto and secured thereto by a screw v. When the switch is in the open circuit phase, the circuit closer g rests upon insulator w, and the closer h rests upon the insulated block z. When the switch is turned to the first terminal m, the main line a' is immediately fully closed, through the terminals i, j, and the main line b' is closed through the resistance D. As the switch moves more and more to the right, more and more resistances are cut out of the circuit. As soon as the main line b' is closed the magnet n is included in circuit with the shunt field magnet B of the motor. This magnet n holds the circuit closer with the main lines fully closed. One of the main objects of the spring t is to prevent the operator from using any of the resistances D for regulation. These resistances are of short time capacity and would burn out if left in circuit. The main object of the magnet n however is to allow both of the main lines to be automatically cut off when the circuit breaks at any point.

The object in a starting switch is to start motor by cutting the resistances out of armature circuit gradually and to stop same by cutting whole circuit off quickly.

Remaining details and operations are enumerated thus:—In practice it is usual to provide the magnet n with a cover E of metal, between which and the magnet is any suitable insulator such as micanite E'. This cover is fastened on by screws F. The cores n' of the magnet n are held together by the yoke piece n'', and the yoke is attached to the base plate r by screws F'. The cover E consists of a sheet of metal bent at two places at right angles to the sheet and parallel to each other. The spools of the magnet are lettered G. Between the two limbs of the magnet n is an insulating block H having grooves H' and holes H'' at the grooves for the passage of the conductors or terminals of said magnet. The pin q is held rigidly to the base plate r by means of the collar q' thereon and nuts s'' respectively on opposite sides of the plate. It is evident that the circuit closers g, h, may be called also circuit breakers, and also armature circuit breakers, because an armature I is rigidly and permanently attached to the circuit closer g. The cutout magnet's core n' as shown is in circuit, so that as soon as the circuit closer g touches it, the resistances are short circuited.

I claim as my invention—

1. The combination with main line conductors and with a motor having its armature in circuit with the main line conductors and its field in shunt, of a magnet in the shunt circuit, a circuit closer for one main line conductor retained closed by said magnet, a spring for the circuit closer opposing the action of said magnet, resistances whose terminals lie in the path of said circuit closer for the purpose set forth, and a second circuit closer rigidly attached to the first and in circuit with the other main line conductor, the contact surfaces of said terminals being in one plane, and an insulating block in said path but raised above said plane, and provided with an inclined surface.

2. The combination of an electric motor, main line conductors, circuit closers in circuit with the main line conductors, an insulator bar connecting said circuit closers pins projecting from said bar, a linear spring having slotted and curved ends, the pins passing through said slots, a spiral retractile spring for said linear spring, a central pin forming a bearing for said bar and linear spring, a handle rotary upon said pin, nuts pressing the handle against the linear spring, and a projection upon the handle and extending into the plane of the rotation of the said linear spring.

3. The combination of an electric motor,

main line conductors, circuit closers in circuit with the main line conductors, an insulator bar connecting said circuit closers pins projecting from said bar, a linear spring having slotted and curved ends, the pins passing through said slots, a spiral retractile spring for said linear spring, a central pin forming a bearing for said bar and linear spring, a handle rotary upon said pin, nuts pressing the handle against the linear spring, a projection upon the handle and extending into the plane of the rotation of the said linear spring, and resistances interposed in circuit between one main line conductor, and one circuit closer.

4. The combination of an electric motor, main line conductors, circuit closers in circuit with the main line conductors, an insulator bar connecting said circuit closers pins projecting from said bar, a linear spring having slotted and curved ends, the pins passing through said slots, a spiral retractile spring for said linear spring, a central pin forming a bearing for said bar and linear spring, a handle rotary upon said pin, nuts pressing the handle against the linear spring, a projection upon the handle and extending into the plane of the rotation of the said linear spring, and resistances interposed in circuit between one main line conductor, and one circuit closer, an armature attached to said last named circuit closer, and a magnet in circuit with said motor and in the path of said armature.

5. The combination with an electric motor and with main line conductors, of circuit closers closed between both conductors, and the motor, and variable resistance between one conductor and the motor, and in series with the field magnet, and having terminals in the path of the last named circuit closer, and means for short circuiting the said resistances with respect to the field magnet.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 1st day of June, 1893.

FREDERICK V. HENSHAW.

Witnesses:
EDWARD P. THOMPSON,
WM. A. COURSEN, Jr.