(No Model.)

2 Sheets—Sheet 1

G. H. WHITTINGHAM.

SELF CONTROLLED MOTOR SWITCH.

No. 452,151. Patented May 12, 1891.

Fig. 1.

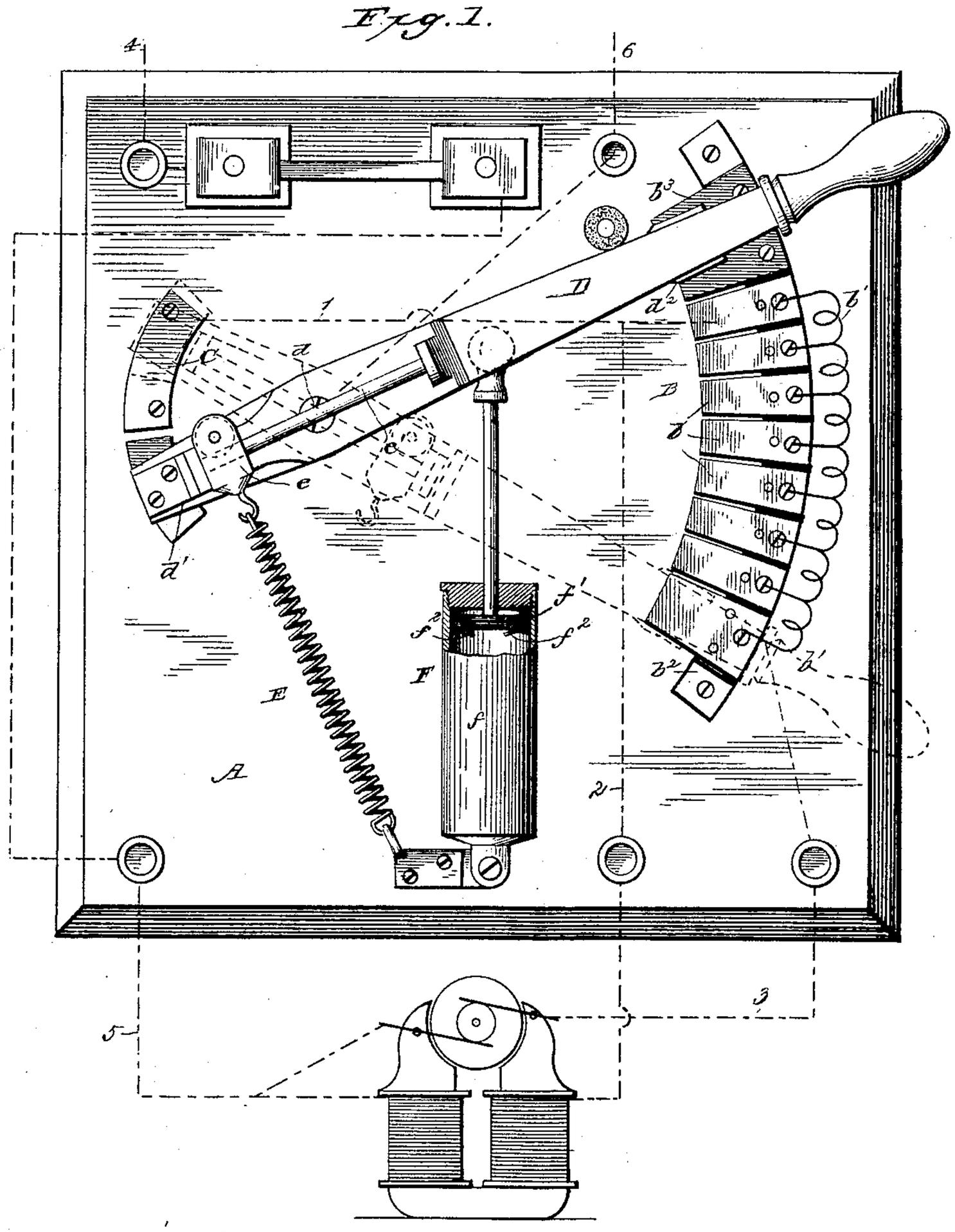
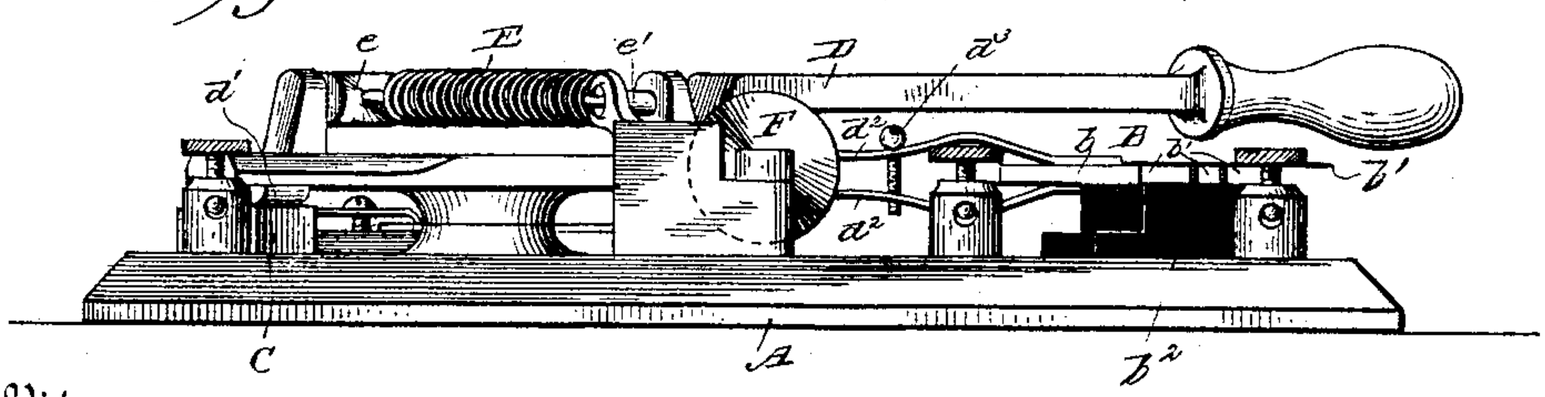


Fig. 2.



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(No Model.) 2 Sheets—Sheet 2.

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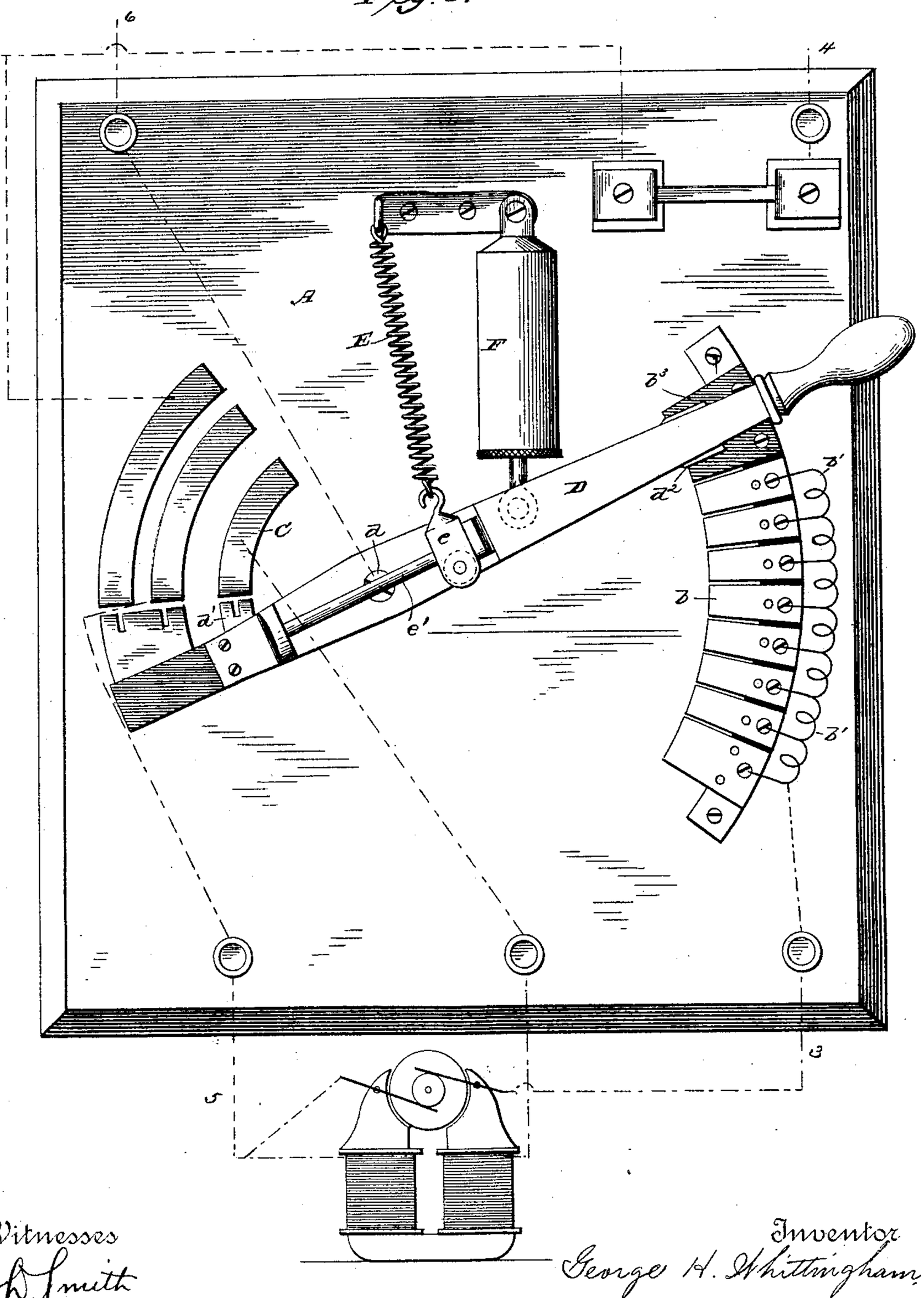
Fig. 3.



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UNITED STATES PATENT OFFICE.

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SELF-CONTROLLED MOTOR-SWITCH.

SPECIFICATION forming part of Letters Patent No. 452,151, dated May 12, 1891.

Application filed April 25, 1890. Serial No. 349,545. (No model.)

To all whom it may concern:

Be it known that I, GEORGE HERBERT WHITTINGHAM, of the city of Baltimore, in the State of Maryland, have invented certain new and useful Improvements in Self-Controlled Motor-Switches; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification, and to the figures and letters of reference marked thereon.

This invention relates to a new and improved switch mechanism for use in connection with electric motors and like translating devices for simultaneously closing or opening communication between the main or working circuit and two branch circuits, the one including the field; and the other the armature of the motor and it consists in the novel construction and arrangements of parts constituting said switch mechanism, as hereinafter fully described and pointed out.

The design of the present invention is to provide a simple and efficient means whereby the starting and stopping of the motor can be readily effected by an unskilled operator, ample provision being made to prevent the too sudden closing of the armature-circuit by the application of a governor controlling the movement of the contact on the resistance or rheostat through which communication is established with said armature-circuit, to insure the complete closing or opening of the circuits after the movement of the switch has once been inaugurated by providing a motor device acting upon the switch-lever or other movable contact controlling device for carrying and sustaining said movable contact at one or the other extreme of its movement in closing or opening the circuit, and to facilitate the operation of cutting out or stopping the motor by providing means whereby the governing device which controls the movement in closing the circuit shall be thrown out of action, thereby permitting the contact to be quickly shifted to break the circuit.

In the accompanying drawings, Figure 1 is a top plan view of an improved self-controlled motor-switch embodying the present invention, and Fig. 2 is a side elevation of the same. Fig. 3 is a top plan view of double-pole switch. Similar letters and numerals of reference in the several figures indicate the same parts.

The several operating devices or parts of the apparatus are preferably mounted upon a base A of non-conducting material, such as slate, and they comprise a rheostat or resistance B, provided with a series of contacts or plates *b*, a contact C, a movable switch, such as the lever D, provided with contacts co-operating with *b* and C, a governor F for controlling the movement of the movable switch D in one direction, and a motor or actuating device, represented by spring E and its connections, arranged to operate upon the movable section or switch D in a manner to impel or hold it pressed toward one extreme of its movement in either direction.

The rheostat B may be of any well-known or approved form, comprising a series of resistances or coil *b'*, each interposed between and connected to adjacent contacts *b*, the latter being composed of metallic strips secured upon a support b^2 and insulated from each other. The contact C is mounted upon the base A, and is connected by conductor 1 with the contact *b* at one end of the series of resistance-contacts, and both of said contacts C and *b* are placed in communication with the field of the motor through a conductor 2. The contact *b* at the opposite end of the rheostat or resistance device B is placed in communication with the armature of the motor through a conductor 3, and the opposite ends of the field and armature circuits communicate with the line-wire 4 through a conductor 5. The movable member D of the switch is interposed between and is given motion toward and away from the contact C and the contacts *b* of the rheostat B for the purpose of establishing communication between the other line-wire 6, to which D is connected, and the conductors leading to the field and armature of the motor. In the present instance the movable member of the switch is in the form of a hand-lever D, pivotally supported at *d* upon the base A and carrying a spring-contact *d'* for engagement with contact C, and two spring-contact plates d^2, provided with an adjusting-screw d^3 or equivalent device, said plates d^2 being arranged to engage opposite faces of the contacts or strips *b* of

the rheostat. The lever D is so arranged that when at one extreme of its movement the contacts d^2 will rest upon an insulated strip b^3, with the contact d' removed from contact C, the main-line circuit being thus interrupted or broken and the motor cut out. The direction of motion of lever D is such as to cause the contact d' to approach and engage contact C, and simultaneously therewith cause the contacts d^2 to engage the first contact d of the series, thereby closing the field-circuit through conductors 1 and 2, and the armature-circuit through the rheostat and conductor 3. During the further movement of lever D in the same direction the circuit through the field of the motor is preserved unchanged, contact d' riding or being held upon contact C, while the resistance interposed by the rheostat B in the armature-circuit is gradually diminished as the contacts d^2 are moved successively over the series of contacts b, until finally the lever reaches the extreme of its movement in that direction and establishes direct commnnication with the armature-circuit through conductor 3, thus cutting out the resistance. The motor is now in circuit and will remain so until the lever D is moved in the opposite direction, causing its contacts to engage the contacts b of the rheostat, but in the reversed order, thereby increasing the resistance in the armature-circuit and finally interrupting both the armature and field circuits.

With the usual switch mechanism of this character heretofore used all of the operations necessary for starting and stopping the motor can be performed; but some skill and care on the part of the operator are necessary to prevent damage to the switch or to the motor. Thus if in starting the motor the lever is quickly moved onto the contact b, connected to conductor 3, the full force of the line-current will be brought to bear upon the armature of the motor with the possible result of burning out the coils, whereas the rheostat is especially introduced to prevent such accidents by providing a means for gradually increasing the strength of the current in the armature-circuit by the withdrawal of resistance, and in order that this may be successfully accomplished it is requisite that the motion of the lever or movable member of the switch should be controlled or restrained, so that it cannot possibly be shifted so rapidly as to cause damage to the armature, but will be caused to move gradually, and thus prevent extreme and sudden changes. Moreover, if means are not provided for preventing it, the operator in starting the motor may willfully or carelessly allow the movable member of the switch to remain upon one of the intermediate contacts b, in which case the line-current, instead of being conducted directly to line 3, will be carried through a portion of the rheostat and may burn out the latter. To overcome these and other defects and provide means whereby the movable member D will when free be held or carried at all times to one extreme of its movement in either direction—that is to say, will be held fully off or fully on and prevented from standing at any intermediate point—and to further provide against the too rapid shifting of the movable member when starting the motor, but permit of a free movement in cutting off or stopping the motor. For these purposes in this new mechanism automatic actuating and automatic controlling or governing devices are connected to the lever or movable member of the switch. The automatic-actuating mechanism shown comprises a spring E, attached at one end to a support on the base A and at the opposite end to a yoke or slide e, preferably provided with an anti-friction roller and guided to reciprocate longitudinally of a rod or guide e' upon the lever D. The guide or rod e', upon which the slide e reciprocates, extends upon opposite sides of the pivot or fulcrum about which lever D vibrates, so that when the lever is at one extreme of its movement the slide e will stand on one side of the pivot, and when the lever is moved to the opposite extreme the slide will be shifted upon its guide-rod to the opposite side of the pivot, and the pressure of the spring will thus be transferred from one side of the pivot to the other.

To illustrate the action of the devices, let it be presumed that the parts are in the position shown in Fig. 1, the hand-lever elevated, the motor disconnected from the line, and the slide e on the side of the pivot most remote from the handle. When in this position the spring E operates to hold the handle of the lever elevated. If now the lever is depressed to close the circuits through the field and the armature through rheostat, the tension of the spring will be increased as the slide e is carried upward to a point slightly above the pivot, thereby inclining the guide-rod so that the tension of the spring will cause the slide to move quickly down the rod and occupy a position on the opposite side of the pivot, so that the tension of the spring will be applied in a direction to assist instead of retarding the downward motion of the lever. The same action takes place as the lever is elevated to cut out the motor. The movement of the slide e across the center or pivot on which the lever turns is very rapidly performed, and is effected by the action of the spring under increased tension, and the inclination of the guide or rod on which the slide travels. Hence there is little or no opportunity for the slide to come to a stand between the extremes of its movements in opposite directions, and the spring is thus caused to operate at all times to force the lever either up or down and cause it to move to one extreme or the other of the rheostat. If, therefore, in attempting to start or stop the motor the lever is moved only part way, it will either be carried back to the starting-point or compelled to perform the full stroke, accordingly as the slide e stands or is

carried to one side or the other of the pivot during the movement of the lever as effected by hand. Whether the movement of the lever be controlled wholly by hand or started by hand and the movement continued by the actuating devices, it is very desirable that the motion in the direction to start the motor should be controlled, and for this purpose a governor F is connected to the lever D and arranged to operate so as to regulate the movement of the lever in one direction, and, preferably, to release or permit of its free movement in the opposite direction, inasmuch as the governing is unnecessary in cutting out the motor.

Any competent governing or controlling device may be employed for the purpose; but the preferred form is shown, the same comprising a cylinder *f*, pivotally supported upon the base A, provided with a piston *f'*, connected to lever D on one side of its pivot. The cylinder *f* is closed at both ends and contains oil or other suitable fluid, and the piston *f'* is furnished with one or more valves f^2. The valve opens to permit circulation of the fluid as the hand-lever is elevated or moved in a direction to stop the motor, but is closed when the lever is moved in the opposite direction.

Provision is made for a regulated and gradual passage of the fluid from one end of the cylinder to the other as the piston is moved in a direction to close the valve, as by providing for a regulated or restricted escape through or around the piston. The movement of the lever D in a direction to close the circuit and start the motor will thus be resisted and regulated so that it will be impossible through carelessness or accident to shift the lever so rapidly as to endanger the coils of the armature.

The switch mechanism thus far described is arranged for controlling one branch only of the line-connection with the motor—that connected to contact C; but when it is desired to simultaneously or successively open or close communication with both line-wires an arrangement substantially such as indicated in Fig. 3 may be adopted. In this example the line 4, instead of being connected to one pole of the field-circuit, terminates at a contact-plate 10 and the field-circuit is connected to a contact-plate 11.

The switch-lever is provided with an insulated section 12, carrying a contact or contacts 13, which engage contacts 10 and 11 as the lever is shifted to start the motor, thereby closing this branch of the field-circuit, while the other branch is closed through contacts *d'* C.

Having thus described my invention, what I claim as new is—

1. In a switch mechanism for electric motors, the combination of a single rigid pivoted hand-lever to which is connected one of the wires of an electric circuit and which is provided with two contacts, with a rheostat and a contact device, the rheostat connected to the armature of an electric motor and the contact device with the field, the contacts of the hand-lever engaging the rheostat and contact device, and a holding device for said lever, consisting of a reciprocating slide mounted upon said lever and reciprocating across its pivot and to which is connected one extremity of a spring, the other end of which is fixed to any suitable point, substantially as described.

2. In a switch mechanism for electric motors, the combination of a single rigid pivoted hand-lever to which is connected one of the wires of an electric circuit and which is provided with two contacts, with a rheostat and a contact device, the rheostat connected to the armature of an electric motor and the contact device with the field, the contacts of the hand-lever engaging the rheostat and contact device, and a holding device for said lever, consisting of a reciprocating slide mounted upon said lever and reciprocating across its pivot and to which is connected one extremity of a spring, the other end of which is fixed to any suitable point, and a governor also connected to the hand-lever and by which the motion of the lever is automatically governed while moving in one direction, but not in the reverse direction.

3. In a switch mechanism for electric motors, the combination of a pivoted hand-lever to which is connected one of the wires of an electric circuit and which is provided with two contacts, one on each side of its pivot, one of which—that which engages the rheostat—consisting of two springs between which the plates of the rheostat pass, with a rheostat and a contact device, the rheostat connected to the armature of an electric motor and the contact device with the field, the contacts of the hand-lever engaging the rheostat and contact device, and a holding device for said lever, consisting of a reciprocating slide mounted upon said lever and reciprocating across its pivot and to which is connected one extremity of a spring, the other end of which is fixed to any suitable point, substantially as described.

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