(No Model.) 2 Sheets—Sheet 1.

G. H. WHITTINGHAM.

ELECTRIC SWITCH.

No. 423,462. Patented Mar. 18, 1890.

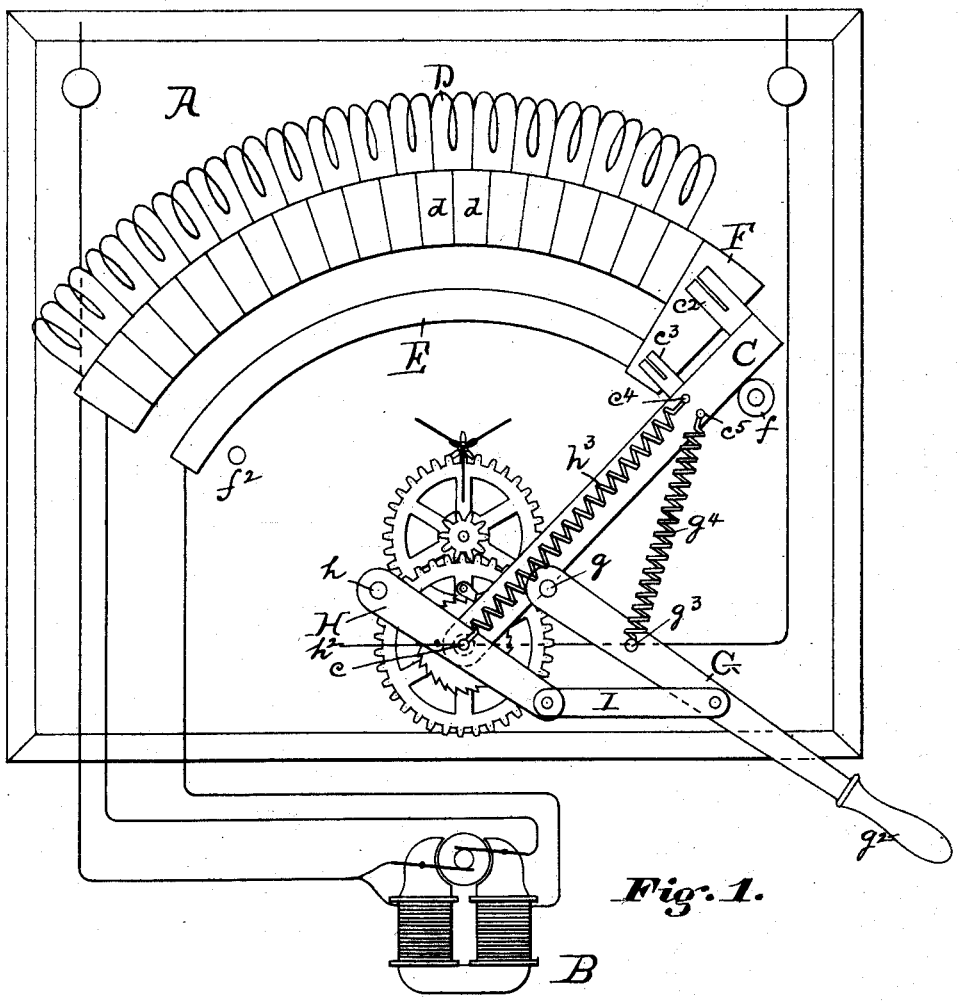

Fig. 1.

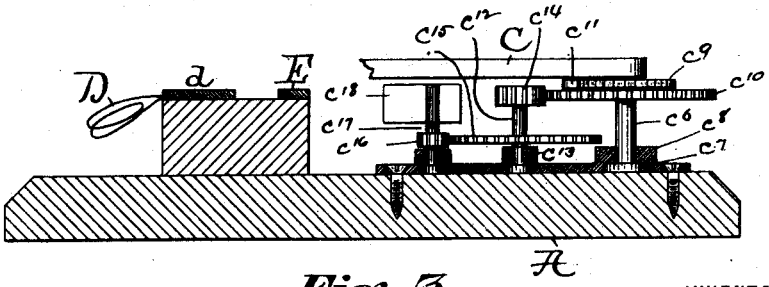

Fig. 3.

WITNESSES:

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C. C. Woolley

INVENTOR

George H. Whittingham

BY

Price & Stuart

ATTORNEYS

(No Model.) 2 Sheets—Sheet 2

G. H. WHITTINGHAM.

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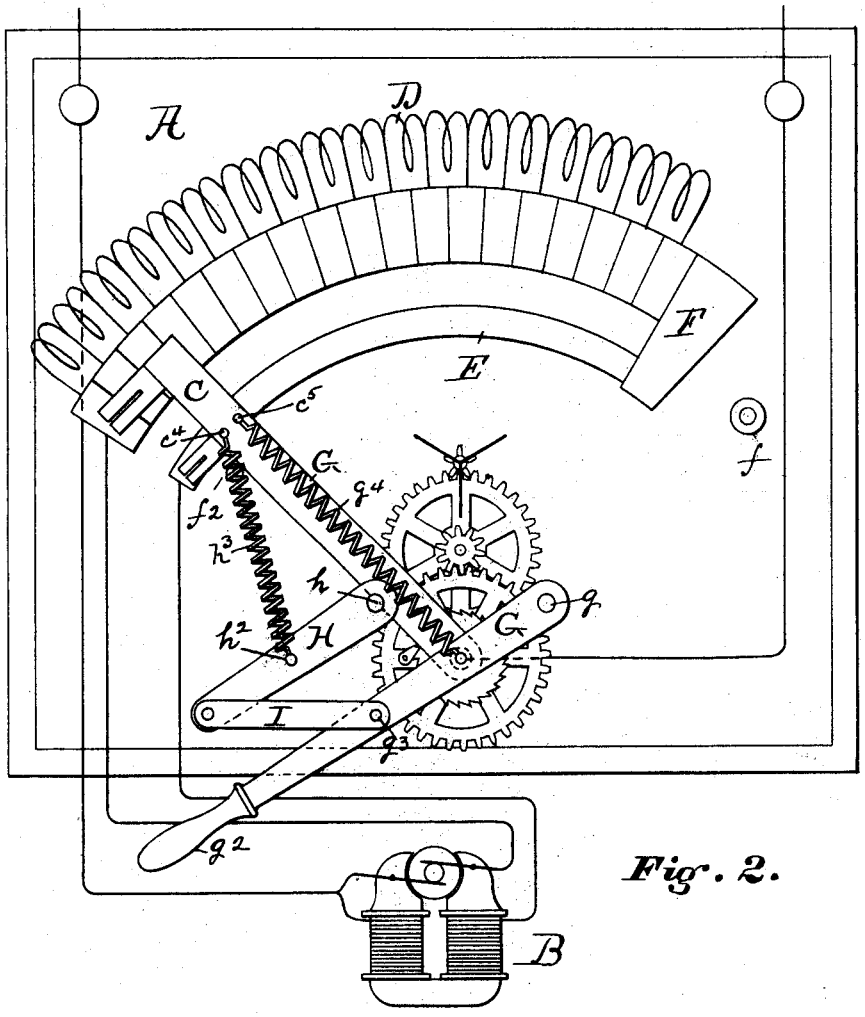

Fig. 2.

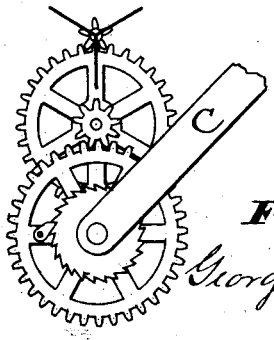

Fig. 4.

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UNITED STATES PATENT OFFICE.

GEORGE HUBERT WHITTINGHAM, OF BALTIMORE, MARYLAND, ASSIGNOR TO THE AUTOMATIC ELECTRIC SWITCH COMPANY, OF SAME PLACE.

ELECTRIC SWITCH.

SPECIFICATION forming part of Letters Patent No. 423,462, dated March 18, 1890.

Application filed July 1, 1889. Serial No. 316,206. (No model.)

To all whom it may concern:

Be it known that I, GEORGE HUBERT WHITTINGHAM, a citizen of the United States, and a resident of the city of Baltimore and State of Maryland, have invented certain new and useful Improvements in Electric Switches, of which the following is a full and complete specification, reference being had to the accompanying drawings, in which similar letters of reference indicate similar parts.

My invention relates to that class of switches which are used upon circuits employed for electric motors, and particularly upon circuits bearing a high tension.

The main line is divided at the motor, one branch passing around the field-magnets and the other through the armature. Most motors employed upon high-tension circuits are so constructed that when in operation a quantity of current passes through the armature, which is to some extent proportioned to the load, and when the armature is in motion the counter-electro-motive force generated by the revolution of the armature adds to the resistance of the armature-circuit and causes the larger part of the current to be diverted to the field-circuit, thus protecting the armature from being burned by an escape of the current. When the motor is being started, however, if a full current be turned on before the speed of the armature has become sufficient to generate the requisite counter-electro-motive force, there is great danger that the insulation will be broken and the armature temporarily destroyed. To provide against this possible evil, it was formerly customary to place a series of resistance-coils in the armature-circuit, and after the current had been turned on to cut this resistance out of the circuit gradually as the speed of the armature increased. This device was open to the objection that the speed with which the resistance was cut out of the circuit could not be controlled and was liable in the hands of ignorant people to be too rapid. I have invented and patented several forms of switch for this purpose, which include automatic devices for reducing the resistance of the armature-circuit, thus insuring the safety of the armature, and the subject of this application is another form of structure designed to accomplish the same end.

In the drawings, Figure 1 is an elevation of the switch, showing arrangement of circuits and connection to motor. The switch is shown as open and the circuit broken. Fig. 2 is a similar plan of the switch, showing arrangement of circuits and connections to motor, the switch and circuit being closed. Fig. 3 is a plan of the governor-train. Fig. 4 is a side elevation of the governor-train.

A represents the switch-box, in which the switch is located, the door being open, and B a motor. The switch and motor are arranged in circuit with one another, as indicated by lines representing the connecting-wires.

C is a switch-lever, pivoted at *c* and made of conducting material, and connected at the pivot to one of the terminals of the main line, generally the incoming terminal. The switch-lever C is provided on its free end with two contact fingers or brushes c^2 and c^3, made of conducting material, and in the path of one of these brushes in the form of a quadrant is placed a series of insulated conducting-plates *d d d*, which are connected to one another by coils of wire, generally of German silver and calculated to offer a desired resistance to the passage of a current, and so arranged that as said finger passes over the plates the current flowing through the switch-lever and this brush will have to pass through such sections of said resistance-coils as may be between it and the point to which the current is flowing. In the path of the other contact finger or brush c^3 is placed an arc of conducting material, generally copper and without resistance-coils, so that as the current flows down the switch-lever C it will divide and a part of it pass through finger c^2 and resistance-coils D and another part through the finger c^3 and the conducting-plate E. The quantity of current passing through each of these conductors will be proportional to the resistance of the circuit. The resistance-coils D are connected at the end opposite to that at which the finger c^2 begins to move over the insulated plates with the armature of the motor, and the plate E is connected directly to the coils of the field-magnets.

F is a piece of insulating material, upon which the contact-fingers rest when the switch is open, and f is a stop provided to limit the throw of the switch-lever in one direction.

f^2 is a stop shown on Figs. 1 and 2 and provided to limit the throw of the lever in the opposite direction.

G is a lever, pivoted at g and provided with a handle g^2, which extends through a slot in the casing of the switch, and is the means by which the switch is operated.

H is another lever, pivoted at h to the casing and connected at its free end by a rigid link I, which is pivoted to it and to the lever G, said link I being also pivoted to the lever G.

The levers G and H act as parallel levers; but they may not be exactly parallel, as it may happen that some advantages of construction may be gained by making the link I somewhat longer than the distance between the pivots of the levers.

h^2 is a stud set in lever H at a point which, as the lever H moves, will describe a circle to which the center line of the switch-lever will be approximately tangent when the lever is in the position shown in Fig. 1. To said stud h^2 is connected a helical spring h^3 at one of its extremities, the other end of said spring being connected to a stud c^4, set in the switch-lever near its free extremity.

It will be observed from Fig. 1 that when the levers H and C are in the position shown in that figure the spring h^3 will exert upon the lever C no influence to move it from its position, because its action is directly in the axial line of the said lever.

g^3 is a stud set in the lever g at a point which, as the lever G moves, will describe a circle to which the axial line of the lever C will be approximately tangent when said lever is in the position shown in Fig. 2. To said stud is connected one end of the helical spring g^4, the other end of which is secured to a stud c^5, set in the lever C near its free end.

The switch-lever C is keyed to a stud c^6, which constitutes its pivot and which is suitably mounted in a socket, in which it can turn as the lever moves. This stud may be provided with a flanged head c^7, fitting beneath a cap-socket c^8, which cap is secured to the back of the casing A, so that the stud will be held in place as well as permitted to turn. On the stud c^6 is keyed a ratchet-wheel c^9, and next to it is placed the gear c^{10}, which fits loosely over the stud and turns freely upon it. To the side of the gear c^{10} next the ratchet-wheel is pivoted the spring-pawl c^{11}, which engages the ratchet-wheel c^9 and causes the lever when moved in one direction to operate the train, but not in the other.

c^{12} is a stud provided with a flanged head like c^7 and secured to the casing A by a cap c^{13}, similar to the cap c^8. To this stud is keyed the pinion c^{14} and the gear-wheel c^{15}, with which engages the pinion c^{16} upon the stud c^{17}, which also carries the fan c^{18}, arranged to control the motion of the lever C through the train geared to it. The fan may be substituted by an escapement-wheel and verge, if desired. It acts as a governor which controls the movement of the switch-lever in one direction, and it will be readily seen that any other structure that will accomplish the same result may be substituted for it without affecting my invention.

The operation of my device is as follows: When the parts are in the position shown in Fig. 1, the circuit is broken and the motor stationary. If now the lever G be moved from right to left by means of the handle g^2, the rigid link I will move the lever H at the same time and to a corresponding extent. As the studs g^3 and h^2 are caused to move through the arcs of their motion from right to left, the stud h^2 will constantly depart from the axis of the switch-lever and the stud g^3 will constantly approach toward said axial line. If the springs h^3 and g^4 are of equal strength, g^4 will continue to hold the switch-lever in the position of Fig. 1 until the angle formed by the spring h^3 and the lever is greater than the angle formed by the spring g^4 and said lever. As this angle increases the force of the spring h^3 as applied to the lever will increase, and the switch-lever will be moved forward across the resistance-plates as fast as the governor will permit until it reaches the stop f^2. As soon as the contact-fingers c^2 and c^3 make contact with the conductors D and E the current will begin to flow through the field-coils and armature of the motor, and will divide itself in proportion to the resistance of the circuits. The resistance-coils being in the armature-circuit, a small part only of the current will pass therethrough; but this quantity will increase as the resistance of the armature-circuit is reduced by the switch-lever cutting out resistance-coils. The governor is so arranged that the switch-bar C will be controlled in its forward motion and only permitted to move slowly. When now the lever G is moved in the reverse direction from left to right, or from the position of Fig. 2 to that of Fig. 1, the spring g^4 will be brought into action, and the switch-lever, being uncontrolled by the governor while moving in this direction, will be pulled quickly over to its first position. One of the features of this invention resides in the fact that I employ two springs for moving the switch-lever, which act independently of one another and on opposite sides of the lever, one acting exclusively to move it in one direction and the other in the opposite direction. They are never permitted to cross the center of the lever, but one is brought up to it and the other removed from it, and vice versa.

What I claim is—

1. In a switch for electric circuits, the combination of a pivoted switch-lever and two helical springs, each secured to the lever at one end at a distance from its pivot, and

means for moving the free end of one of said springs toward the axial line of said lever and the other away from said axial line, substantially as described.

2. In a switch for electric circuits, the combination of a pivoted switch-lever, two helical springs secured to said lever at one end at a distance from its pivot, and a pair of levers pivoted at a suitable distance from the switch-lever and connected together by a rigid link, and having the free ends of the helical springs secured to them at points equally distant from their pivots as those pivots are distant from the pivot of the switch-lever.

3. In a switch for electric circuits, the combination of a pivoted switch-lever having a throw of approximately ninety degrees, two helical springs secured to said lever at one end at a distance from its pivot, two levers pivoted in the same or a parallel plane with the switch-lever and at points outside of the angle formed by the two extreme positions of the switch-lever connected together by a rigid link and having free ends of the springs secured to them at such a distance from the pivots of said levers that the axis of the switch-lever, when in its extreme position most remote from the pivots of said levers, will be approximately tangent to the circle described by said points, respectively.

4. In a switch for electric circuits, the combination of a main line which divides into two branches, which reunites an electric motor, the field of which is included in one branch and the armature in the other, resistance-coils and a pivoted switch-lever co-operating therewith to cut portions of said resistance into and out of the circuit, said resistance-coils being included in the armature branch of the main line, and two helical springs, each secured to said switch-lever at a distance from its pivot, and means for moving the free end of one of said springs toward the pivot of said lever and the other away from it, substantially as described.

GEORGE HUBERT WHITTINGHAM.

Attest:
ARTHUR STEUART,
JNO. T. MADDOX.