No. 647,414. Patented Apr. 10, 1900.

W. F. JONES.

ELECTRIC SWITCH.

(Application filed Feb. 6, 1900.)

(No Model.) 2 Sheets—Sheet 1.

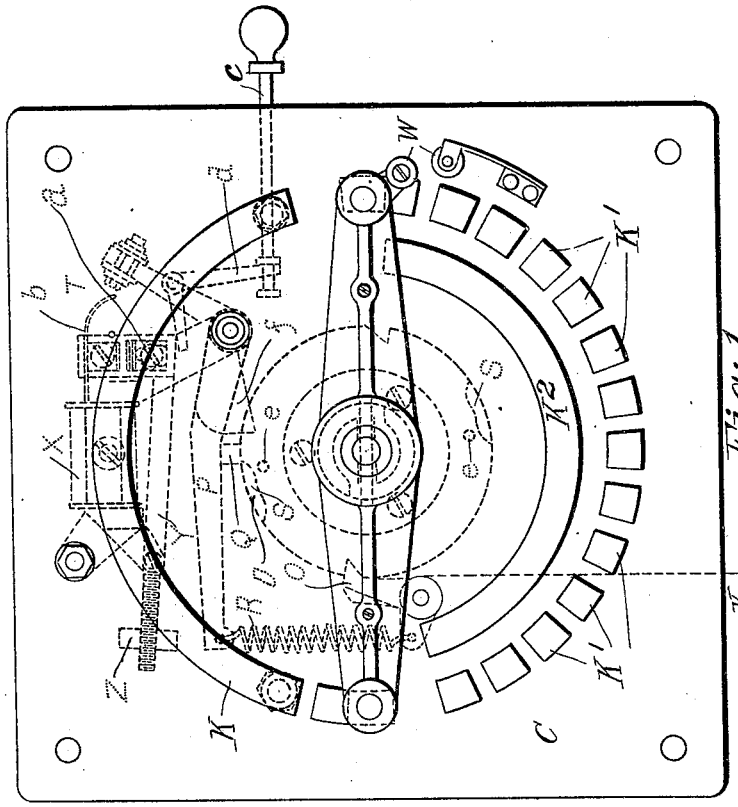

Fig. 1.

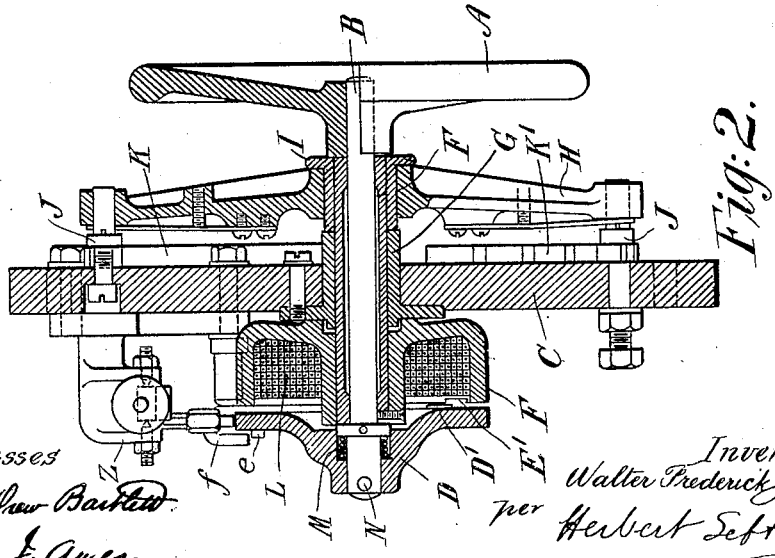

Fig. 2.

Witnesses
Edwin Drew Bartlett
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Walter Frederick Jones
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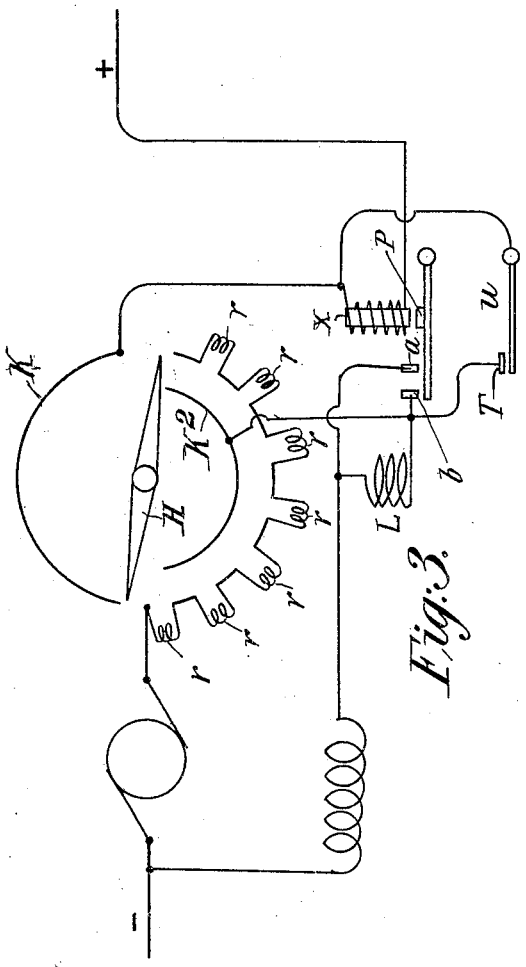

Fig. 3.

Witnesses,
Edwin Drew Bartlett.
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UNITED STATES PATENT OFFICE.

WALTER FREDERICK JONES, OF LONDON, ENGLAND.

ELECTRIC SWITCH.

SPECIFICATION forming part of Letters Patent No. 647,414, dated April 10, 1900.

Application filed February 6, 1900. Serial No. 4,233. (No model.)

To all whom it may concern:

Be it known that I, WALTER FREDERICK JONES, engineer, a subject of the Queen of Great Britain, residing at Albert Works, Hammersmith, London, England, have invented a new and useful Improvement in Electric Switches, of which the following is a specification.

My invention relates to electric switches, and in particular to switches for starting, stopping, regulating, and reversing electric motors.

The main object of my invention is to construct a switch for use with electric motors in such a manner that if the current-supply stops or if the current in the supply-circuit to the motor becomes greater than a predetermined maximum the switch will be automatically operated to break the motor-circuit. According to my invention I so arrange the switch that the movement of the hand-wheel or lever is transmitted to the switch arm or arms through an electromagnetic clutch which is magnetized by a coil in series with the field-coils of the motor or by a separate circuit from the source supplying current to the motor. The portion of the clutch which is secured to the hand-wheel or lever is held in the position to which it is turned by a pawl or other suitable stop or by friction; but since the other part of the clutch is held in this position by electromagnetic means alone, as soon as the current ceases this portion of the clutch will be released and operate the switch to break the circuit.

In order that my invention may be the better understood, I will now proceed to describe the same with reference to the accompanying drawings, in which the same letters refer to the same parts in the different figures.

Figure 1 is a front elevation of my improved switch. Fig. 2 is a side elevation, partly sectional, looking from the left hand of Fig. 1, the switch being in a position at right angles to that shown in said figure. Fig. 3 shows a convenient method of connecting up the various circuits when the switch is used with a shunt-motor.

The switch is actuated by a lever or by a hand-wheel A, fixed on the spindle B, which passes through the switchboard or base C, of slate or other suitable insulating material, and carries at its farther end the armature D of the clutch-electromagnet E. The clutch-magnet E, as shown in section in Fig. 2, is of the iron-clad type, but may be of other suitable design, and is secured to one end of the sleeve F, loosely carried on the spindle B. This sleeve finds a bearing in the sleeve G, fixed to the switchboard C, and carries at its other end the switch-arm H, which is insulated from the sleeve F by the insulating-piece I. The switch-arm H is provided at its two ends with contact-pieces J J, adapted to engage with the contact-blocks K K′ K′ on the switchboard. Resistances *r r*, Fig. 3, are inserted between the blocks K′ K′. It will thus be seen that the switch-arm H is driven by the hand-wheel A through the electromagnetic clutch, consisting of the armature D and the magnet E, containing the coil L, which is connected in series with the field-coil of the motor or any other way to the source of electric supply. When the motor has been switched on by turning the hand-wheel, the armature D is held by the pawl O, while the electromagnet E, and consequently the switch-arm H, is held in position by the electromagnetic clutch alone against the reaction of a spring or weight attached to the cord V, which is wound on the outside of the magnet E as it is turned, or a spring may be attached direct to its hub. When the electromagnet E is not magnetized by a current, the spring M, Fig. 2, surrounding the spindle B, maintains the armature D out of engagement with the electromagnet, the pin N, connecting the armature to the spindle B, permitting a slight movement parallel to the axis of the spindle. Projections and depressions on the armature-face and magnet may also be shaped, as in some tapping apparatus, so as to cause the magnet to shear the armature back, when the clutch is demagnetized and weight or spring on cord V is acting. In this case the spring M can be very weak. This disengagement of the two parts of the clutch when the clutch is not magnetized permits the switch-arm under the influence of the spring or weight attached to the cord V to return to its original position.

Since when the circuit is broken the clutch is demagnetized and the switch therefore cannot be operated, I arrange that the first move-

ment of the handle shall cause a circuit to be made temporarily or otherwise which magnetizes the clutch. I effect this by means of an elbow-lever P, pivoted at the back of the switchboard, provided with a projection Q, which rests on the edge of the circular armature D. One end of said lever is connected by the spring R to the detent O, which is adapted to engage with recesses on the edge of the armature to hold said armature after the switch has been actuated. On the edge of the clutch-armature D there are also formed depressions S, which when the armature is turned allow the projection Q to fall and the elbow-lever P to turn on its pivot under the influence of the spring R, temporarily causing contact to be made between the contact on the shorter arm U of the elbow-lever and a spring T. A current thus flows through the coils L, magnetizing the clutch. (See Figs. 1 and 3.) Consequently on further turning the hand-wheel the switch-arm is caused to complete the motor-circuit, so that the clutch remains magnetized by the current of the field-coils of the motor after the contact at T has been broken by the lever P returning to its original position after the depression S has moved away from the projection Q. The switch-arm can thus be turned until all the resistances between the blocks K′ K′ have been cut out, in which position the detent O will hold the clutch-armature D, and the clutch-magnet being magnetized by the field-current of the motor will hold the switch-arm H against the reaction of the spring or weight at the end of the cord V.

In order to prevent current being supplied to the motor-armature when the temporary contact is made, the connection between the end of the clutch-coil and the motor-armature is made through a switch formed by a bar K^2, with which the switch-arm H engages as soon as it is rotated from its zero position.

It is essential in switches where the switch-arm must only be left in the "full-on" position, as in a starting-switch where the resistances are only sufficiently large to carry the current for a short period or where the switch is used with one contact only for simply making a circuit when joining dynamos in parallel, for example, or for other purposes, that the clutch-armature and magnet should engage when they are in a certain relative position in order to insure the arm being at the position of full on when the detent engages. In view of this the surface of the armature D has one or more projections D′ formed upon it to engage with one or more depressions E′ on the electromagnet E to prevent slipping. To insure that the electromagnet shall engage only at the right place, I provide a stop *f* on the lever P, adapted to engage with stop-pins *e* on the clutch-armature D when the projection Q falls into a depression S. The stop *f* thus prevents any further movement of the switch hand-wheel A until the clutch has become magnetized, when the armature D is attracted to the electromagnet E against the action of the spring M. This inward motion of the armature D allows the stop-pin *e* to escape from engagement with the stop *f*, and thus the hand-wheel can be turned farther around, moving the switch-arm with it.

If the current-supply to the motor ceases from any reason, the clutch will become demagnetized and the motor will be automatically switched out of circuit by the switch-arm returning to its original position under the action of the spring or weight at the end of the cord V.

Carbon sparking-contacts W are provided, as shown in Fig. 1.

For automatically opening the circuit when the current-supply becomes excessive I provide an electromagnet X, Figs. 1 and 3, operated by a coil in series with the motor. The armature Y of this electromagnet forms one arm of a pivoted lever, the other arm carrying an adjustable weight Z. When the current rises above the predetermined amount for which the position of the weight Z has been adjusted, the armature is attracted upward and a contact-piece *a* on the armature makes contact with another fixed piece *b*, short-circuiting the clutch-coil L and causing the automatic switching off of the motor through the switch-arm returning to its original position, as hereinbefore described. Any suitable form of electromagnetic short-circuiting device may be employed for the purpose of rendering the clutch-coil L inoperative when an excessive current passes. With this switch it is therefore impossible to switch on the motor if there is any defect in the circuit which would permit an excessive current to pass when the circuit is made, because the clutch cannot in such case be magnetized, whereas with switches of some of the ordinary type circuit-breaking or overload magnet cannot act while the handle or handle-wheel of the switch is being operated.

In order to switch off at any time when desired, I make contact at *a* and *b* by means of a press-button or push-bar *c*, which actuates the elbow-lever *d* and raises the armature carrying the contact *a* against the contact *b*, whereby the clutch becomes demagnetized.

I have described the switch as applied to the circuit of a shunt-motor; but the switch may be used for many other purposes, the connections of the switch being altered, as required, to suit each particular case.

What I claim is—

1. In an electric switch the combination with circuit-closing means of an electromagnet rigidly connected therewith, an actuating-handle, an armature connected therewith and adapted to be held by said electromagnet when magnetized, substantially as described.

2. In an electric switch the combination with circuit-closing means of an electromagnet rigidly connected therewith, an actuating-handle, a spindle driven thereby, an ar-

mature mounted on said spindle and a spring adapted to disengage the armature from the electromagnet when the same is not magnetized, substantially as described.

3. In an electric switch the combination of circuit-closing means, an electromagnet rigidly connected therewith, means for winding up a weight when the circuit is closed, an actuating-handle and an armature connected therewith forming with the electromagnet an electromagnetic clutch and a detent adapted to prevent backward motion of the armature, substantially as described.

4. The combination of main-circuit-closing means an electromagnet rigidly connected therewith, a rotary actuating-handle, an armature for said electromagnet connected and rotating with said actuating-handle, a second circuit for energizing the electromagnet, a fixed contact-terminal in said second circuit, a coöperating movable contact-terminal and means operated by the first movement of the actuating-handle to bring said terminals into connection thereby closing the second circuit, substantially as described.

5. The combination of main-circuit-closing means an electromagnet rigidly connected therewith, a rotary actuating-handle, an armature for said electromagnet connected and rotating with said actuating-handle, a second circuit for energizing the electromagnet, a fixed contact-terminal in said second circuit, a coöperating movable contact-terminal carried by a pivoted elbow-lever and a cam on the armature of the electromagnet adapted to engage with the elbow-lever and close the second circuit-terminals when the actuating-handle is rotated substantially as and for the purpose set forth.

6. The combination of main-circuit-closing means an electromagnet rigidly connected therewith, a rotary actuating-handle, an armature for said electromagnet connected and rotating with said actuating-handle, a second circuit for energizing the electromagnet, a fixed contact-terminal in said second circuit, a coöperating movable contact-terminal carried by a pivoted elbow-lever, a cam on the armature of the electromagnet adapted to engage with the elbow-lever and close the second circuit-terminals when the actuating-handle is rotated and means for stopping the further movement of the armature unless the armature is attracted to the electromagnet, substantially as described.

7. The combination of main-circuit-closing means an electromagnet rigidly connected therewith, a rotary actuating-handle, an armature for said electromagnet connected and rotating with said actuating-handle, a second circuit for energizing the electromagnet, a fixed contact-terminal in said second circuit, a coöperating movable contact-terminal carried by a pivoted elbow-lever, a cam on the armature of the electromagnet adapted to engage with the elbow-lever and close the second circuit-terminals when the actuating-handle is rotated, stop-pins on the armature and a coöperating stop on the elbow-lever adapted to prevent further movement of the armature unless the armature is attracted to the electromagnet, substantially as described.

8. In an electric switch the combination with circuit-closing means, of an electromagnet rigidly connected therewith, an actuating-handle, an armature connected therewith, and adapted to be held by said electromagnet when magnetized and means for short-circuiting the electromagnet when the current-supply rises above a predetermined amount, substantially as described.

9. In an electric switch the combination with circuit-closing-means, of an electromagnet rigidly connected therewith, an actuating-handle, an armature connected therewith and adapted to be held by said electromagnet when magnetized, a second electromagnet in series with the current-supply, an armature for said second electromagnet, two contacts respectively joined to the terminals of the first electromagnet and means whereby said terminals are connected when the armature of the second electromagnet is attracted to short-circuit the first electromagnet, substantially as described.

10. In an electric switch the combination with circuit-closing means, of an electromagnet rigidly connected therewith, an actuating-handle, an armature connected therewith and adapted to be held by said electromagnet when magnetized, a second electromagnet in series with the current-supply, a pivoted armature for said second electromagnet, a weight adjustable on said armature, two contacts respectively joined to the terminals of the first electromagnet and means whereby said terminals are connected when the armature of the second electromagnet is attracted to short-circuit the first electromagnet substantially as described.

11. In an electric switch the combination with circuit-closing means, of an electromagnet rigidly connected therewith, an actuating-handle, an armature connected therewith and adapted to be held by said electromagnet when magnetized, a second electromagnet in series with the current-supply, a pivoted armature for said second electromagnet, a weight adjustable on said armature, a contact on said armature connected with one terminal of the first electromagnet, a fixed contact connected with the other terminal of the first electromagnet and adapted to make contact with the contact on the armature when said armature is attracted, substantially as and for the purpose set forth.

12. In an electric switch the combination with circuit-closing means, of an electromagnet rigidly connected therewith, an actuating-handle, an armature connected therewith and adapted to be held by said electromagnet when magnetized and means for short-circuiting the electromagnet at will to cause switching off substantially as described.

13. In an electric switch the combination with circuit-closing means, of an electromagnet rigidly connected therewith, an actuating-handle, an armature connected therewith and adapted to be held by said electromagnet when magnetized, a pivoted elbow-lever, a movable contact carried thereon and connected with one terminal of the electromagnet, a fixed contact connected with the other terminal of the electromagnet and a push-bar operatively connected with the elbow-lever substantially as and for the purpose specified.

In witness whereof I have hereunto set my hand in presence of two witnesses.

WALTER FREDERICK JONES.

Witnesses:

JOSEPH BOOKER,

FREDERICK WILLIAM LE TALL.