

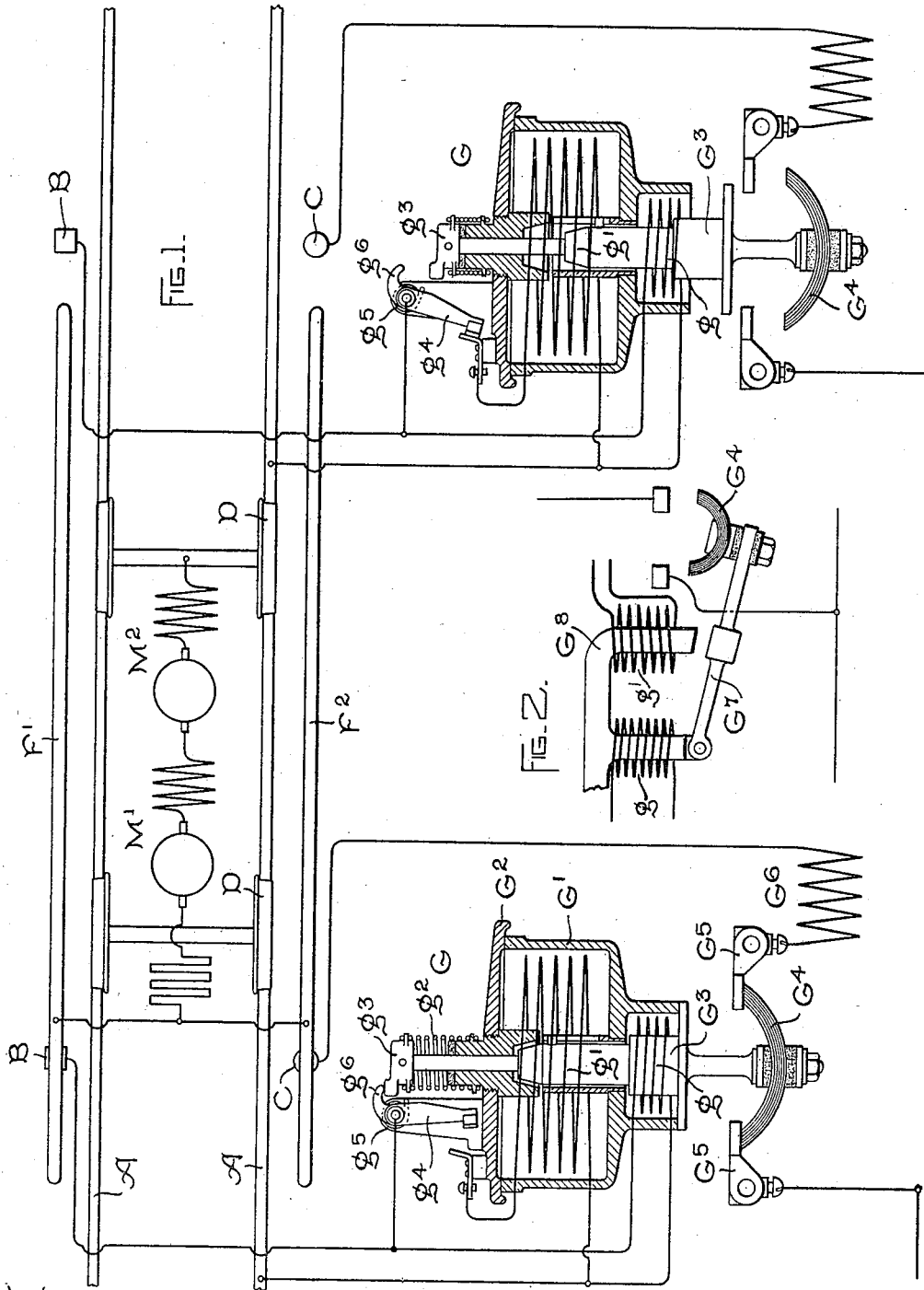
No. 645,684.

Patented Mar. 20, 1900.

E. M. HEWLETT.
ELECTRICALLY OPERATED SWITCH.

(Application filed Dec. 30, 1898.)

(No Model.)



WITNESSES.

A. H. Abell,

C. F. Macdonald.

INVENTOR.

Edward M. Hewlett,

by *Albert G. Davis*
Atty.

UNITED STATES PATENT OFFICE.

EDWARD M. HEWLETT, OF SCHENECTADY, NEW YORK, ASSIGNOR TO THE
GENERAL ELECTRIC COMPANY, OF NEW YORK.

ELECTRICALLY-OPERATED SWITCH.

SPECIFICATION forming part of Letters Patent No. 645,684, dated March 20, 1900.

Application filed December 30, 1898. Serial No. 700,711. (No model.)

To all whom it may concern:

Be it known that I, EDWARD M. HEWLETT, a citizen of the United States, residing at Schenectady, in the county of Schenectady, State of New York, have invented certain new and useful Improvements in Electrically-Operated Switches, (Case No. 793,) of which the following is a specification.

My present invention relates to switches which are to be opened or closed by the action of an electric current upon the usual magnetized circuit of one form or another.

It has for its object to provide a switch which shall be closed with promptness and held closed with a minimum of expenditure of energy. The means which I have shown in this case for effecting this object consists, in general, of a magnetic circuit, one or more windings which close the circuit, and a winding which then maintains the circuit closed independently of the first winding.

It is manifest that the broad invention here indicated may take many different forms and be applied to many uses, all of which I do not describe, but which I aim to cover. For example, one winding might be used to close the circuit, that winding might then be cut out, and a second winding cut in to keep the circuit closed. The particular type of switch in which I have embodied the invention and in which it is of special utility is that used to close the circuits between a feeder and the sectional conductors of a surface-contact railway system. In this particular class of switch it is of course important that the contacts should be closed with the least possible delay. Where the switch acts promptly, the overlap of shoe required is diminished and the possible speed at which trains on the road can be operated is increased.

In general the embodiment of the invention herein described consists of a solenoid with two coils in multiple. Both of these are shunt-coils in the sense of being connected directly across the mains with no exterior resistance—that is to say, they are herein shown in a shunt to ground between the feeder and car-motors, although, if desired to diminish the copper cost and current loss, I may include a resistance in series with either coil. This will not in general be necessary or desir-

able. The shunt-coils are in multiple, as has already been explained. One of them is the usual high-resistance winding designed to remain in circuit for so long a time as may be necessary. The other, however, is of greater ampere-turns or current-carrying capacity and is wound with a wire which while permitting large current-flow is of such low resistance that this could not be maintained for any length of time without destroying the coil. By this construction I obtain a coil of very small lag and which has such powerful magnetizing effect that it quickly overcomes or assists in overcoming the reluctance of the magnetic circuit, enabling the switch to be closed at once. It is manifest, however, that as the larger coil cannot be left in circuit the next step of the invention is to provide a device by which as the switch is closed the circuit of this coil is opened. When this is done, the diminished reluctance of the magnetic circuit, owing to the closing of the air-gap between the armature and core or between the core of the solenoid and the surrounding case, will be such as to permit the smaller or permanent shunt-coil to hold the switch closed. Furthermore, inasmuch as the circuit is already powerfully magnetized, the magnetization is readily maintained by a coil of comparatively-slight effect. A solenoid is not the only form of magnetic circuit which may be employed. An electromagnet of usual construction may be utilized with a winding of this class, and it will embody the advantage of the solenoid to a great extent, the common advantage of the two forms being that a wide gap may be left between the two parts to be brought together—for instance, the contacts of a switch—and yet the movement of the armature required to close the gap will be only moderate. In the solenoid this may be attained by so proportioning the core that when it is drawn up the closure of the magnetic circuit is almost complete, and owing to the circuit connections, as already described, the core will operate efficiently over a great range of movement, so that the contacts may be left well opened, and yet be closed with positiveness over an air-gap greater than could be economically overcome with other arrangements of winding.

In the electromagnet I have preferred the form which I will more specifically describe in connection with the drawings; but other forms could be used. I thus obtain by my invention a long-range magnet actuated over this long range by a current of great strength and a short-range magnet which is held closed by a small current. The economy and utility of this construction will be manifest.

Nothing in my invention limits me to its use in a surface-contact railway nor to an electric switch; but, as already explained, it so happens that the form of switch in connection with which it was first developed is one adapted to that system, in which it is of great utility. My invention not only saves waste of current in the large coil, but also insures the prompt opening of the switch, inasmuch as the power of the smaller shunt-coil is comparatively slight, and upon any substantial decrease of current the switch readily opens. Of course more than two windings might be used, or the smaller winding may be cut in after the other; but all such variations of my invention it is unnecessary to illustrate or describe, as they are within the scope of the claims founded on the embodiment of the invention illustrated in the accompanying drawings, in which—

Figure 1 shows an adaptation of the invention to a now well-known surface-contact system in which shunt-coils are employed. Fig. 2 shows the modified form of switch referred to in the statement of invention in which an electromagnet is used.

A A are the track-rails.

B is the stud in circuit with the switch by which it is energized.

C is the positive contact from which the motors M' M² derive current.

D D are the car-wheels.

F' F² are the shoes, F² supplying current to the motors, and F' electrically connected with F² and actuating the switches G G. These are composed of boxes of iron G', with covers G².

G³ is the core of the solenoid by which the contact G⁴ is actuated to bridge the fixed contacts G⁵ G⁵, with the latter of which the blow-out coil G⁶ is in circuit. The coils g g' are those referred to in the statement of invention. The circuit of the coil g' is closed through the switch-blade g⁴, actuated in one direction by a spring g⁵, having a toe g⁶, with which registers a lug on the head g³ of the solenoid-core.

The action of the parts thus outlined is as follows: The shoes F' F² being connected, when the shoe F' touches the stud B a shunt-current flows through both of the coils g g', lifting the core G³ and closing the bridging contact G⁴. As the head g³ of the solenoid-core rises, however, it strikes the toe g⁶ of the switch g⁴, opening the circuit of the coil g'. When the main switch is opened by gravity, assisted by the spring g², the spring g⁵ also closes the circuit of the coil g'. The opening

of switch g⁴ is so sudden as to amount in practice to a snap action.

In Fig. 2 I have shown one way of arranging an electromagnet which would be within my invention. In this figure G⁸ is the core of the magnet, made in horseshoe form, and G⁷ is the armature, by the play of which a variation in the reluctance of the magnetic circuit is caused, it being evident that upon this variation in either the solenoid or magnet the effective operation of the invention depends. The other parts are lettered as before; but the stronger coil g' is opposite the air-gap between the armature G⁷ and the core G⁸, while the high-resistance coil g is wound upon the other leg of the magnet. The circuit connections are not illustrated, they being like those shown in Fig. 1. In operation both coils will, as in Fig. 1, be energized when the shoe F' touches the contact B, after which the circuit of the coil g' will be opened. As the armature G⁷ will have been attracted and the air-gap closed or practically closed the diminished reluctance of the magnetic circuit now permits the coil g to hold up the armature.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. The combination with an electric switch which it is desired to move and to maintain for a time to the position to which it has been moved, of an electromotive device for controlling the movement of said switch, a circuit of large current capacity which energizes said device to move said switch and break its own continuity, and a circuit of less current capacity which energizes said device to maintain said switch in the position to which it has been moved.

2. In an electric-railway system, the combination with a feeder, of a sectional conductor, a switch in the circuit between the feeder and the sectional conductor, an electromotive device for controlling the movement of said switch, a circuit of large current capacity which energizes said device to move the switch, and a circuit of less current capacity which energizes said device to maintain the switch in the position to which it has been moved.

3. In a switch for a surface-contact railway, the combination of a plurality of coils of different powers, with means actuated by the coils for closing the switch, and an auxiliary switch operated by the closing of the main switch for opening the circuit of a coil of greater power.

4. The combination with a circuit to be magnetized, of a plurality of separate solenoids coacting to initially magnetize the circuit, with means for thereafter throwing a desired part of the solenoids out of action.

5. In a switch, the combination of a magnetic circuit with a plurality of coils in parallel and simultaneously magnetizing the circuit, and means for cutting out one of the coils after the initial energization.

6. The combination with a circuit to be

magnetized, of means for overcoming the initial reluctance of the circuit, consisting of a plurality of windings, one of which may be kept permanently in circuit and the other of which is of capacity to carry a momentary rush of current greater than may be maintained with safety, and a device for opening the circuit of the larger winding.

7. The combination with a magnetic circuit of variable reluctance, of means for overcoming the initial reluctance of the circuit, means for maintaining the magnetization, and means for throwing out of operation the first-named means.

8. The combination with a switch having a magnetic circuit of variable reluctance, of a plurality of windings, one of low resistance, and the other of high resistance, means for passing current through both windings to close the switch, and means for holding the switch closed with the winding of high resistance only.

9. In a switch for a surface-contact railway, the combination of a magnetic circuit including the actuating part of the switch, with two shunt-coils one of which is of high resistance and the other of which is of size adapted to carry momentarily a large current, with a device for cutting out the coil of larger size by the closing of the switch, leaving the high-resistance coil in circuit to hold the switch closed.

10. In a switch for a surface-contact electric railway, the combination of a solenoid having two coils, one of comparatively-large current capacity, and the other of smaller capacity, both acting upon a common core, switch-contacts operated by the core, an auxiliary switch in the circuit of the larger coil, and means for opening the auxiliary switch when the core is drawn up to close the contacts of the main switch.

11. In an electromagnetic switch for a surface-contact railway, the combination of contacts, a solenoid-core operating them, two coils one of which is larger than the other, connected in multiple to act upon the same core, a switch in the circuit of the larger coil, and a projection upon the core of the solenoid for opening the switch when the main contacts are closed.

12. In an electric-railway system, the combination with a feeder, of a sectional conductor, car-motors, a switch which is adapted to connect the feeder with the sectional conductor, an electromotive device in shunt between the feeder and motors, for controlling said switch, a circuit of large current capacity which energizes said device to move said switch, and a circuit of less current capacity which energizes said device to maintain said switch in the position to which it has been moved.

13. In an electric-railway system, the combination with a feeder, of a sectional conductor, car-motors, a switch which is adapted to connect the feeder with the sectional conductor, an electromotive device in shunt between the feeder and motors for controlling said switch, a circuit of large current capacity which energizes said device to move said switch and break its own continuity, and a circuit of less current capacity which energizes said device to maintain said switch in the position to which it has been moved.

14. In an electric-railway system, the combination with a feeder, of a sectional conductor, car-motors, a switch which connects the feeder to a conductor-section, an electromotive device in shunt between the feeder and motors, a circuit of large current capacity which energizes said device to close the switch and a circuit of less current capacity which energizes said device to keep the switch closed.

15. The combination with a body which it is desired to move and to maintain for a time in the position to which it has been moved, of an electromotive device for controlling said body, a circuit of large current capacity which energizes said device to move said body and break its own continuity, and a circuit of less current capacity which energizes said device to maintain said body in the position to which it has been moved.

In witness whereof I have hereunto set my hand this 28th day of December, 1898.

EDWARD M. HEWLETT.

Witnesses:

B. B. HULL,

A. F. MACDONALD.