(No Model.)

G. S. DUNN.

ELECTROMAGNETIC CIRCUIT BREAKER.

No. 601,871. Patented Apr. 5, 1898.

Fig. 1.

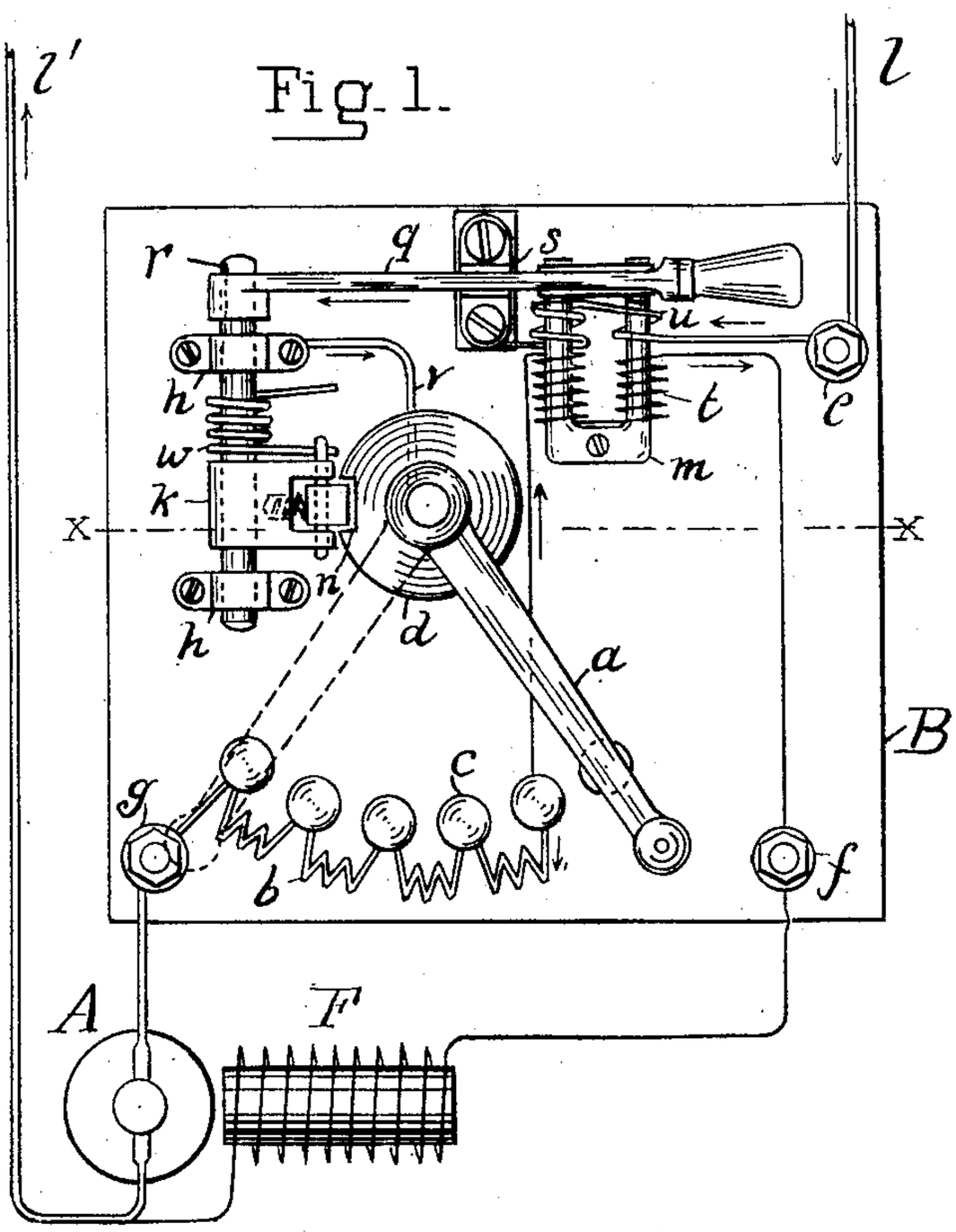
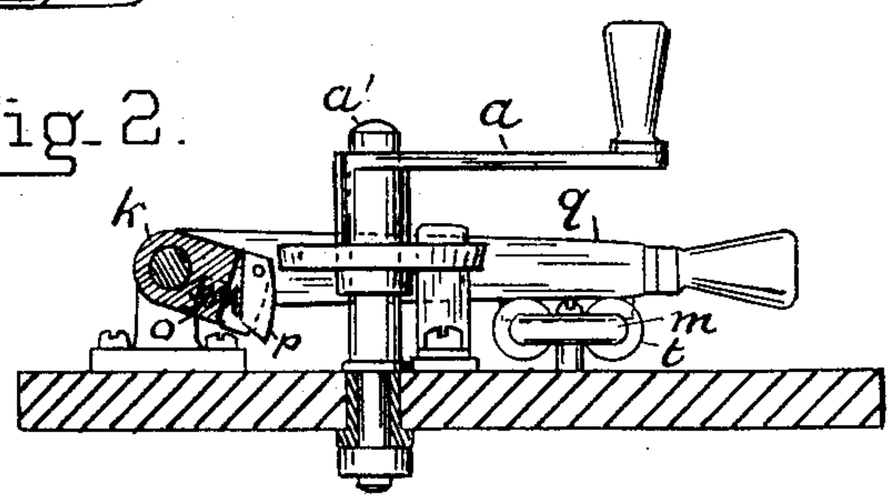


Fig. 2.



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UNITED STATES PATENT OFFICE.

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ELECTROMAGNETIC CIRCUIT-BREAKER.

SPECIFICATION forming part of Letters Patent No. 601,871, dated April 5, 1898.

Application filed June 12, 1897. Serial No. 640,411. (No model.)

To all whom it may concern:

Be it known that I, GANO S. DUNN, a citizen of the United States of America, residing at East Orange, county of Essex, State of New Jersey, have invented certain new and useful Improvements in Electromagnetic Circuit-Breakers, of which the following is a specification.

The object of my invention is to provide means whereby upon the occurrence of abnormal conditions within an electric circuit the circuit will be automatically broken, the construction of my invention being such that the circuit can be completed again only through a rheostat, the resistance of which may be subsequently successively cut out. The utility and necessity for such a construction may be explained in connection with an electric motor, although it will be understood that it is capable of use for the protection of other electrical apparatus. Let it be understood, for instance, that a shunt-wound motor be connected to the mains in the usual manner and is running at its normal speed. It is then developing an electromotive force which opposes the passage through its armature of the current supplied from the mains, and which cuts down the quantity of the current passing therethrough. If now the current supplied to the armature fails and the armature comes to rest and the current again begins to flow, it will pass through the armature without opposition from the counter electromotive force thereof, and unless means be applied to prevent the passage of the full current until the armature is again in motion will seriously injure the motor, as is well known, and the same is true to a less extent of every partial failure of the current and its subsequent increase. To remedy this defect, electromagnetic circuit-breakers have been heretofore employed, which upon the dropping of the line voltage below or its rise above predetermined limits or upon a reversal of polarity will break the circuit until the circuit-breaker is restored by an attendant when the voltage has again resumed its normal conditions. In such cases the attendant should move the rheostat-arm to a position to open the circuit before restoring the cut-out and then move the said arm over the successive contact-plates of the rheostat, so that the current is gradually fed to the armature of the motor. It is possible, however, for the attendant to restore the circuit-breaker without effecting the above-stated movements of the rheostat-arm, thus throwing the full strength of the line-current on the armature of the motor and causing the damage which the electromagnetic circuit-breaker is designed to prevent.

My invention therefore consists in so combining an electromagnetic circuit-breaker with a resistance-controlling switch or rheostat-arm that the circuit-breaker will be locked by the rheostat-arm or a part governed thereby from being moved into a position to complete the circuit until the rheostat-arm is moved into a position to break the circuit or to introduce resistance therein, while the circuit-breaker will be capable of moving to break the circuit irrespective of the position of the rheostat-arm; and my invention further consists in the construction, arrangement, and combination of the several parts of which it is composed, as will be hereinafter more fully described and claimed, one form of my invention being particularly described, from which it will be seen that various modifications can be made without departing from the general scope and idea.

In the accompanying sheet of drawings, which form a part of the specification, Figure 1 is a plan view of a resistance-box provided with my invention and connected with a shunt-wound motor. Fig. 2 is a vertical section of the box on line X X of Fig. 1.

The resistance-controlling switch or rheostat arm *a* is pivoted on the stud *a'* to move over a suitable base, having thereon the contact-plates *c*, connected by resistances *b*, as is well known. A disk *d* is concentrically secured to the rheostat-arm *a*, and as it moves therewith it may form a part thereof, the disk having a notch *n* in its periphery, for the purpose hereinafter set forth. A binding-post *g* is mounted upon the base B and is directly connected to the last contact-plate and to the other plates *c* through the resistances *b*.

The circuit-breaker arm *q* is keyed to one end of a shaft *r*, mounted in bearings *h* on the base-plate and extending parallel therewith

adjacent to the disk, a suitable handle being provided upon the end of the arm q to operate it. A pair of spring-plates s form contacts for the circuit-breaker arm.

Upon the shaft r is a short arm k, which carries a latch p at its outer end. This latch is held out by a spring o and is so pivoted that it will offer no obstruction to the opening of the circuit-breaker in any positions of the disk, but prevents closure except in proper position of the disk. Thus when the circuit-breaker is closed, as shown in the drawings, the side of the latch will contact with the edge of the disk when the circuit-breaker arm is lifted and the latch will be depressed. However, when the circuit-breaker arm is up the latch will be above the disk d and will prevent the closure of the circuit-breaker unless the notch n in the disk is under the latch. Only where the rheostat-arm is in a position to open the circuit or throw in all the resistance will this notch be opposite the latch, so as to permit the closure of the circuit-breaker arm. The circuit-breaker arm is electrically connected to the rheostat-arm a through the bearing h by the connecting-wire v. A suitable electromagnet m is mounted upon the base and in the line of motion of the circuit-breaker arm and is energized by a current taken from the main line, and while so energized holds the arm in contact with the contacts s against the tension of a spring w, which is shown as coiled upon the shaft r and which tends to throw the circuit-breaker arm upwardly and from between the contacts. It is obvious that any equivalent for the spring, such as gravity, may be used.

In the drawings the resistance-box is shown as a motor-starting box in connection with a shunt-wound motor, the connections to which will now be described.

One main l is connected to the binding-post e, and the opposite main l' is connected through the armature A of a motor with the binding-post g and through the field F of the motor to the binding-post f, the latter being connected through the coil of the magnet m with the first of the contact-plates c, so that the magnet is in the field-circuit of the motor, both the field and armature coils of the motor being in the circuit which is broken by the rheostat and circuit-breaker arm. It is obvious that the described arrangement of wiring may be varied, the essential features being that in the same circuit there are two contact-makers in series, one being a magnetic circuit-breaker and the other a rheostat-arm, which are interlocked in the manner stated. When the rheostat-arm is moved over to the position shown in dotted lines, the circuit will be completed, and the resistances are not included therein. Upon a failure of the current from the mains the magnet m will release the circuit-breaker arm, which will be thrown by the spring w, breaking contact with the contacts s, the latch p turning upon its pivot and escaping past the edge of the disk d. No current can now pass, since all circuits are broken at s. To close the circuit again at this point, the circuit-breaker must be depressed; but before this can be done it is necessary that the rheostat-arm be moved to the position shown in full lines, so that the notch in the disk will be in a position to admit the passage therethrough of the latch p. When the rheostat-arm has been thus moved to break the circuit, the circuit-breaker arm can be moved to make contact with the contacts s, and while held in that position the rheostat-arm can be moved over the contact-plates c. Upon contacting with the first of these plates a circuit will be established from main l through binding-post e, contacts s, circuit-breaker arm q, wire v, rheostat-arm a, then dividing, a part passing through coils t of magnet m, binding-post f, and field F of motor to the main l', while the other part will pass from the rheostat-arm to the binding-post g and armature A of motor to the main l'. The circuit-breaker arm will now be held in place by the magnet m.

The essential feature of this invention consists in combining two contact-makers in series in the same circuit, one being electrically held in position to close the circuit and the other controlling the inclusion or exclusion in the circuit of resistance, the first-named contact-maker being free to open the circuit irrespective of the position of the second one, but when opened being locked against closing the circuit except when the second contact-maker is in certain predetermined positions, such that the circuit is entirely broken or has resistance included therein.

The magnet for holding the circuit-breaker arm in position to complete the circuit may be variously constructed, so that, for example, the circuit-breaker arm will be released not only upon a decrease of the current fed from the mains, owing to decrease of voltage, but also when the motor is overloaded or underloaded, or both, or upon a too high voltage, too low voltage, or a reversal of polarity. As a means of releasing the circuit-breaker when the current from the mains exceeds a predetermined limit the magnet m, in addition to the fine-wire winding t in series with the field of the motor, is provided with a few turns of comparatively large wire u, through which the entire current to the motor passes in an opposite direction to the current in the other winding. The magnetizing force of this opposing coil u is ordinarily insufficient to neutralize the magnetizing force of the coil t, but will upon increase of the current m to a certain value so weaken the magnet or even completely neutralize it as to permit the spring w to withdraw the circuit-breaker arm from the contact s. As an alternative device for accomplishing the same effect I may use the electromagnetic circuit-breaker described and shown in the application of William G. Lowrie, filed April 24, 1897, Serial No. 633,641, which has issued as Letters Patent No.

593,481, dated November 9, 1897, and is owned by the Crocker-Wheeler Electric Company.

Instead of connecting the coil *t* of the magnet *m* in series with the field F, as shown, this coil may be connected in multiple. For example, the field F may be connected directly with the first of the contact-plates *c* of the rheostat instead of being connected with binding-post *f* and the coil *t* may be connected across the leads *l l'* in series with the arm *q* of the circuit-breaker. The coil should be of high resistance. With this arrangement when the arm *q* is depressed, so as to close the circuit, the magnet *m* will hold it down even before the rheostat-arm *a* is brought into contact with a plate *c*. With the arrangement of wiring shown in the drawings it may be desirable to provide a catch to hold the circuit-breaker arm down until the circuit is closed at the rheostat, when the catch should be released by the operation of the arm *a*.

Having thus described my invention, what I claim, and desire to secure by Letters Patent of the United States, is—

1. The combination of an electromagnetic circuit-breaker, a resistance-controlling switch, means controlled by the resistance-controlling switch for locking the circuit-breaker against closure in certain positions of the switch, and means for permitting the opening of the circuit-breaker in all positions of the switch, substantially as described.

2. The combination of an electromagnetic circuit-breaker, a resistance-controlling switch, a part moved by the switch into position to lock the circuit-breaker against movement in one direction, and means for permitting the circuit-breaker to open the circuit in any position of the switch, substantially as described.

3. The combination of an electromagnetic circuit-breaker, a latch thereon which permits it to move freely in one direction only, a resistance-controlling switch, and a part on the resistance-controlling switch movable into the path of the latch, substantially as described.

4. The combination with a resistance-controlling switch, of an electromagnetic circuit-breaker governing the admission of current to the resistance, the circuit-breaker being interlocked with the resistance-controlling switch and free to move at all times to break the circuit, but being locked from closing the circuit by the resistance-controlling switch in certain positions, substantially as described.

5. In a switch, the combination of a shaft, a circuit-breaker arm keyed thereto and pressed to open the switch, an electromagnet for holding the arm in position to close the circuit, the electromagnet being energized from the circuit to be controlled, a latch pivoted on the shaft, a resistance-controlling switch and a part operated by the switch and movable by it into position to obstruct the latch, and prevent the closure of the switch, substantially as described.

6. In a motor-starting box, the combination of a resistance-controlling switch and resistances, a circuit-breaker arm for breaking and completing the circuit in which the resistances are included, a finger upon said arm free to move in one direction only, an electromagnet for holding the arm in position to complete the circuit, a shunt-wound motor having its field-coils and armature in series with the contacts made by the circuit-breaker arm and switch-arm, the coils of the electromagnet being also in series with the circuit-breaker arm and switch-arm and in shunt with the armature of the motor, substantially as described.

7. In a motor-starting box, the combination of resistances, a switch governing the flow of current therethrough, a circuit-breaker arm for breaking and completing the circuit in which the resistances are included, a latch upon the circuit-breaking arm free to move in one direction only, an electromagnet provided with oppositely-wound coils, and holding the circuit-breaker in position to complete the circuit, a shunt-wound motor whose armature and field-coils are in series with the contacts of the switch and circuit-breaker arm, one of the windings upon the magnet being in shunt with the armature of the motor, and the other winding upon the magnet being in series with the armature of the motor, substantially as described.

Signed by me at Ampere, Newark, New Jersey, this 10th day of June, 1897.

GANO S. DUNN.

Witnesses:
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FREDK. K. VREELAND.