No. 675,865.

Patented June 4, 1901.

C. E. STARR.

AUTOMATIC CIRCUIT BREAKER.

(Application filed Nov. 22, 1899.)

(No Model.)

2 Sheets—Sheet 1.

Fig. 1.

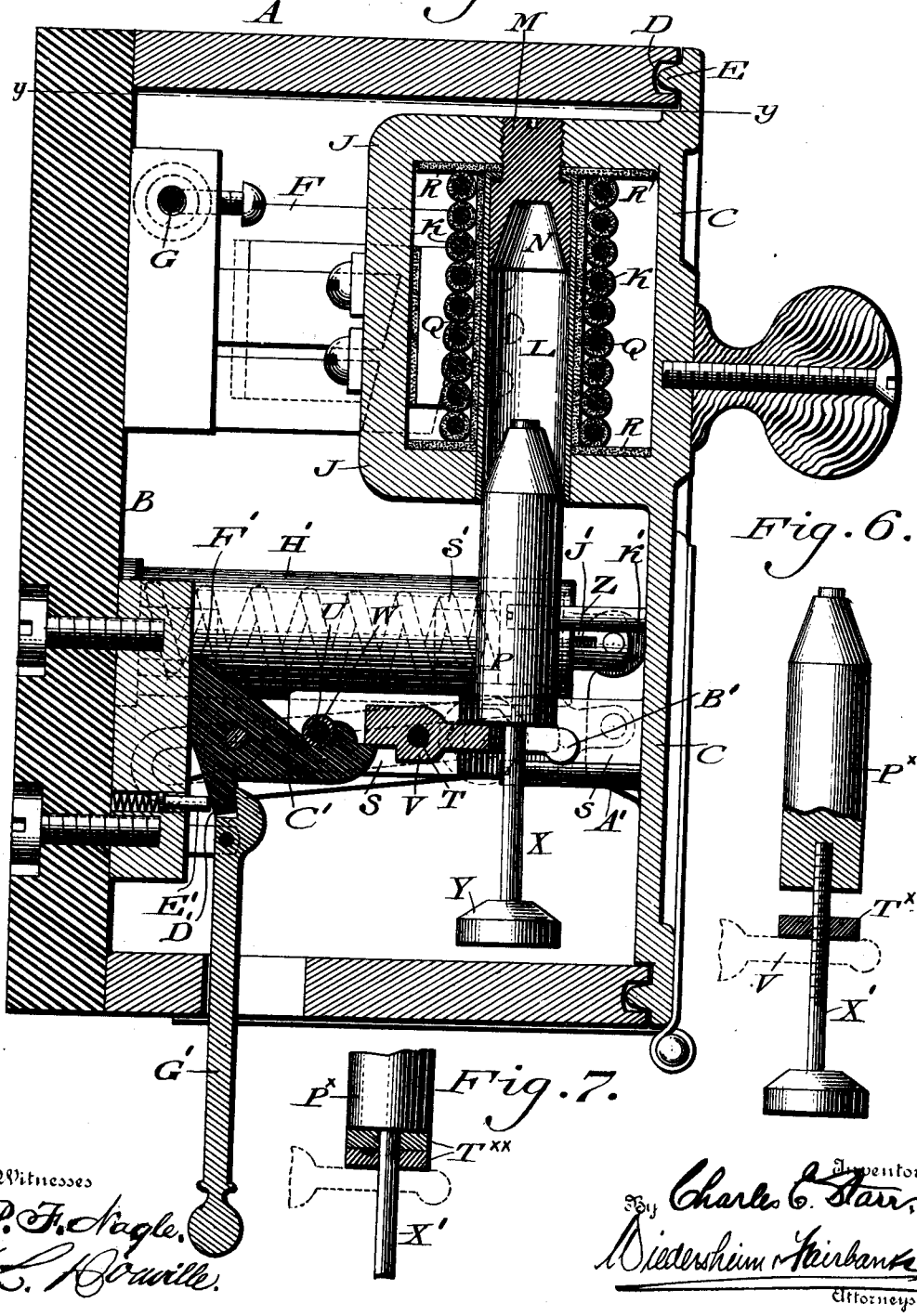

Fig. 6.

Fig. 7.

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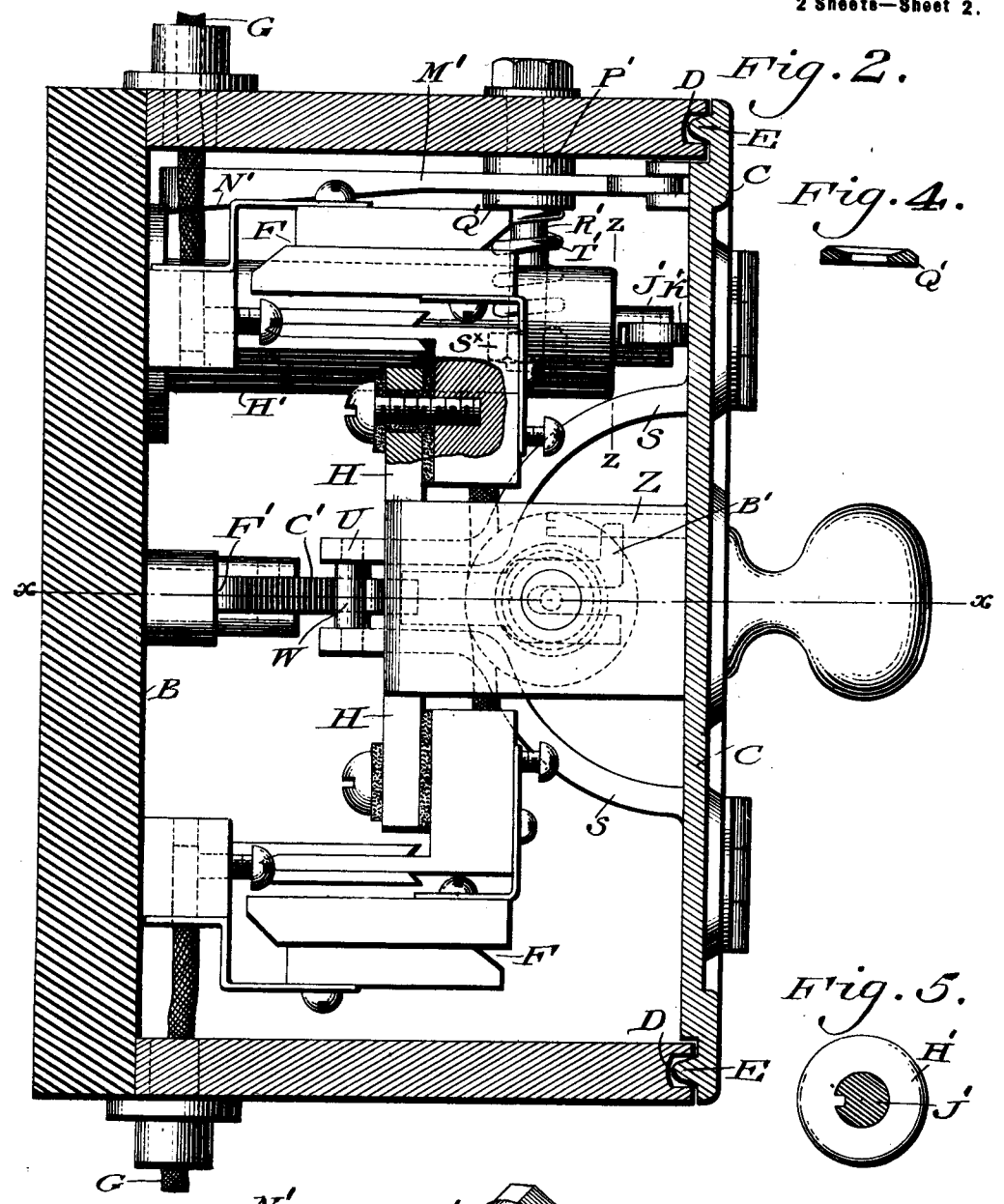

Fig. 2.

Fig. 4.

Fig. 5.

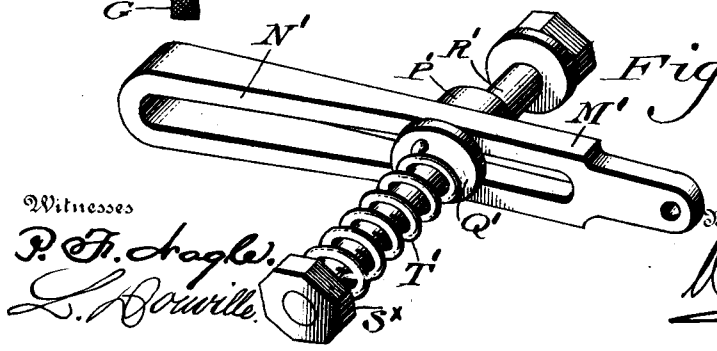

Fig. 3.

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UNITED STATES PATENT OFFICE.

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AUTOMATIC CIRCUIT-BREAKER.

SPECIFICATION forming part of Letters Patent No. 675,865, dated June 4, 1901.

Application filed November 22, 1899. Serial No. 737,937. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. STARR, a citizen of the United States, residing in the city and county of Camden, State of New Jersey, have invented a new and useful Improvement in Automatic Circuit-Breakers, which improvement is fully set forth in the following specification and accompanying drawings.

My invention relates to circuit-breakers of the type that are actuated to separate suitable contact devices by reason of an excessive current; and it consists of improvements in a device of this description tending to increase its efficiency and utility and to simplify its construction and operation.

The invention further consists of certain structural details hereinafter described and claimed.

Figure 1 represents a vertical sectional view taken on the line *x x* of Fig. 2. Fig. 2 represents a horizontal sectional view taken on the line *y y* of Fig. 1. Fig. 3 represents a perspective view of the cushioning devices for the lid or switch-carrying arm. Fig. 4 represents a section of a tension-washer employed. Fig. 5 represents a cross-section on line *z z* of the tension device for throwing the lid or switch-carrying arm. Fig. 6 represents a detail sectional view of the armature, illustrating means whereby it can be regulated to vary the capacity of the circuit-breaker. Fig. 7 represents a similar view illustrating another construction for accomplishing such regulation.

Similar letters of reference indicate corresponding parts in the figures.

Referring to the drawings, A designates the box or casing of the circuit-breaker, having a base B, of stone or other insulating material, and a hinged lid C, serving as a switch-carrying arm. The edge of the box has a channel D, receiving a rib E on said lid to make a close joint to resist the entrance of moisture, dust, &c.

In accordance with my invention I employ an electromagnet, the coil of which forms a part of the circuit to be controlled by the circuit-breaker and the armature of which directly actuates the locking devices that hold the switch-carrying arm, with the members of the contact devices carried thereby, in operative contact with the other members of said contact devices. The switch-carrying arm is held in this position under tension or against the force of suitable tension devices, which throw the arm when the latter is released. As before stated, the armature of the electromagnet actuates the locking means directly as contradistinguished from operating the same through the intermediacy of other devices which actuate the locking means, not by power derived from the movement of the armature, but by latent power—a weight, for instance, which is released or made operative by the movement of said armature. In the drawings I have shown a simple catch, which holds the switch-carrying arm in operative position and which is disengaged by a lever that is moved by the armature, although it will be understood that except in the claims for the specific construction I do not consider that my invention is limited to the structural details shown and hereinafter described, but rather that my invention covers, broadly, means for locking the switch-carrying arm that are actuated to release the arm by the armature of an electromagnet in a circuit controlled by the circuit-breaker.

In the particular construction illustrated the coacting members of the contact devices F are mounted upon the base B and the switch-carrying arm C, the conductor G being connected with the former, while the electromagnet or solenoid is connected with the members upon the arm. The said electromagnet and the members of the contact devices are mounted upon a bracket J upon said arm C, said bracket having upper, lower, and outer sides, as shown, while upon the outer side thereof are lateral extensions H, upon which the members of the insulated contact devices are mounted.

The electromagnet consists of an inner metallic core L, having an open lower end and secured at its upper end to the upper side of the bracket. I prefer to connect the upper end of this core by means of a plug N, having a screw-threaded stem M, that passes through an opening in the closed upper end of the core and screws into an opening in the

upper side of the bracket. Insulating-plates R are situated against the inner faces of the upper and lower sides of the bracket, and an insulating-core Q, upon which the coil of the electromagnet K is wound, surrounds the core L.

One form of locking means which I have found operative consists of a catch C', mounted upon the base B and engaging the switch-carrying arm when the latter is in operative position. This catch C' is adapted to be actuated or moved or to be disengaged from said switch-carrying arm by a lever V, mounted upon the latter, and which is actuated or swung on its pivot by the armature P when the latter is drawn into the solenoid. The lever V is mounted upon a pivot T, extending between the limbs of a bifurcated bracket S, one end being bifurcated to receive the stem X on the armature P. The other end of this stem has a head Y, so that the lever is situated between the shoulders formed by the end of the armature and said head Y. The armature normally rests upon the upper side of the lever V, the latter being sustained by a lower stop A', for instance, upon a lug B', while an upper stop Z contacts with said lever when the latter is raised by the head Y. A pin U, that is engaged by the catch C', is mounted upon the end of the bracket S and is preferably provided with an antifriction-roller W. When the parts are locked in operative position, the lever V on the switch-carrying arm engages the catch C', but when the lever is moved by the armature it moves the catch and releases the arm. This catch is mounted upon the base B, being held in position to engage the switch-carrying arm by a spring-actuated pin E', while the toe F' of the catch forms a stop that contacts with the block upon which it is mounted.

As a further improvement I provide means for actuating the locking means independently of the armature and exterior to the box, and as one construction for accomplishing this I have shown a lever G', one end of which engages the lug D' of the catch and the other end projects through an opening in the box.

To regulate the capacity of the circuit-breaker or the amount of current in excess of normal that is necessary to actuate the armature and the locking means, said armature may be adjustable, so that its normal relation to the electromagnet can be varied. In Figs. 6 and 7 I have shown constructions embodying this part of my invention, the same being designed to vary the length of the stem or the distance between the shoulders thereof, between which the end of the lever V is situated. In Fig. 6 the stem X' is screw-threaded and is provided with a nut $T^{\times}$, that normally rests upon the lever V. By changing the position of this nut it is obvious that the normal position of the armature $P^{\times}$ relative to the electromagnet is regulated. In Fig. 7 one or more washers or disks $T^{\times\times}$ are fastened upon the stem X' of the armature $P^{\times}$, thus varying the normal relation between said armature and the electromagnet.

The tension devices for moving the switch-carrying arm may consist of any suitable actuating device or spring, and I have shown a barrel H', having the stem J', provided at its outer end with an antifriction-roller K', engaging the switch-carrying arm, and a spring S' within the barrel to actuate the stem, a groove and key, as shown in Fig. 5, serving to prevent the stem from turning.

Another part of my invention consists of means for controlling and gradually arresting the throw of the switch-carrying arm, and although any approved construction of cushion could be employed, yet I have illustrated a cushion consisting of a yoke or members M', pivoted at one end to the switch-carrying arm and having a wedge or cam N'. A bolt R', mounted upon the box, extends through said yoke M', the latter being situated between a washer P' and a spring-actuated member or washer Q'. The contact-face of this washer Q' is chamfered, as shown in Fig. 4, and a spring T' holds it under tension against the yoke, such tension being regulated by a nut $S^{\times}$ upon the bolt.

The operation is as follows: The parts are shown in their normal position with the catch engaging the switch-carrying arm, the armature P at the lower limit of its movement and resting upon the lever V, and the members of the contact devices F in contact. When the armature P is drawn into the solenoid, the outer end of the lever V is elevated by the head Y. The inner end of the lever depresses and disengages the catch C' and releases the switch-carrying arm C, which is quickly thrown by the tension devices to disconnect the members of the contact devices F. The throw of said arm C is cushioned and gradually arrested by the cushion formed by the yoke M' and the spring-actuated washer Q'. The circuit-breaker is reset by merely closing the lid which causes the catch to engage the switch-carrying arm, while the armature P falls to its normal position, as shown in Fig. 1.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A circuit-breaker, consisting of a box having an open side, contact devices mounted therein, a lid adapted to close the open side of said box and hinged at one edge to one side thereof, said lid forming the switch-carrying arm of the circuit-breaker, tension devices situated within said box and bearing against the inner face of said lid, and locking devices for said arm adapted to be actuated by an abnormal current in the line to release said lid.

2. In a circuit-breaker, a switch-carrying arm, an electromagnet mounted thereon, an armature therefor, a lever mounted on said arm and adapted to be actuated by said arma-

ture, and a catch engaging said arm and adapted to be actuated directly by contact with said lever and moved out of engagement with said arm thereby.

3. In a circuit-breaker, a switch-carrying arm, an electromagnet mounted thereon, an armature therefor having a stem provided with shoulders, a lever mounted upon said arm and having one end situated in the path of said shoulders, rigid stops for said lever, one of said stops being situated to support said lever and said armature, and a catch engaging said arm and adapted to be actuated directly by engagement with said lever and moved out of engagement with said arm thereby, the other stop limiting the movement of said lever when thus actuated.

4. In a circuit-breaker, a switch-carrying arm, an electromagnet mounted thereon, an armature therefor, a lever mounted on said arm and adapted to be actuated by said armature, a catch engaging said arm and adapted to be actuated directly by contact with said lever and moved out of engagement with said arm thereby, and means for actuating said catch independent of said armature and said lever actuated thereby.

5. In a circuit-breaker, a stationary base or support, a movable switch-carrying arm, a wedge or cam shaped member upon one of said parts, a movable member upon the other of said parts held under tension against said wedge or cam shaped member, and tension devices for throwing said arm.

6. In a circuit-breaker, a switch-carrying arm, tension devices for throwing the same, a wedge or cam shaped member upon said arm, and a movable member held under tension against said wedge or cam shaped member.

7. In a circuit-breaker, a switch-carrying arm, tension devices for throwing the same, a yoke upon said arm having a wedge or cam, a pin extending through said yoke, and a spring-actuated washer engaging said yoke.

8. In a circuit-breaker, a switch-carrying arm, tension devices for throwing the same, a cushion for controlling and gradually arresting the throw of said arm, an electromagnet on said arm, an armature therefor, and means for locking said arm, adapted to be actuated by said armature to release said arm.

9. A circuit-breaker comprising stationary line-terminals and a latching device, all inclosed in a casing open at one side only, in combination with a hinged door for closing said casing having secured to and moving with it a switch arranged to engage the terminals when the door is closed, and a latching device adapted to engage the latching device in the casing and hold the door closed, mechanism for actuating the latch to release it when the current is excessive, and means for opening the door and actuating the switch to break the circuit when the latch is disengaged.

10. A circuit-breaker comprising stationary line-terminals and a latching device, all inclosed in a casing open at one side only, in combination with a hinged cast-metal door for closing said casing having formed integral with it a solenoid-box and secured to and moving with it, a switch arranged to engage the terminals when the door is closed, and a latching device adapted to engage the latching device in the casing and hold the door closed, mechanism, including a solenoid-coil, supported in the solenoid-box for actuating the latch to release it when the current is excessive, and means for opening the door and actuating the switch to break the circuit when the latch is disengaged.

11. In a circuit-breaker, the door having a solenoid-box and a latch-supporting device projecting from its inner face, in combination with a casing or box adapted to contain the circuit-breaking mechanism and closed by the door.

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