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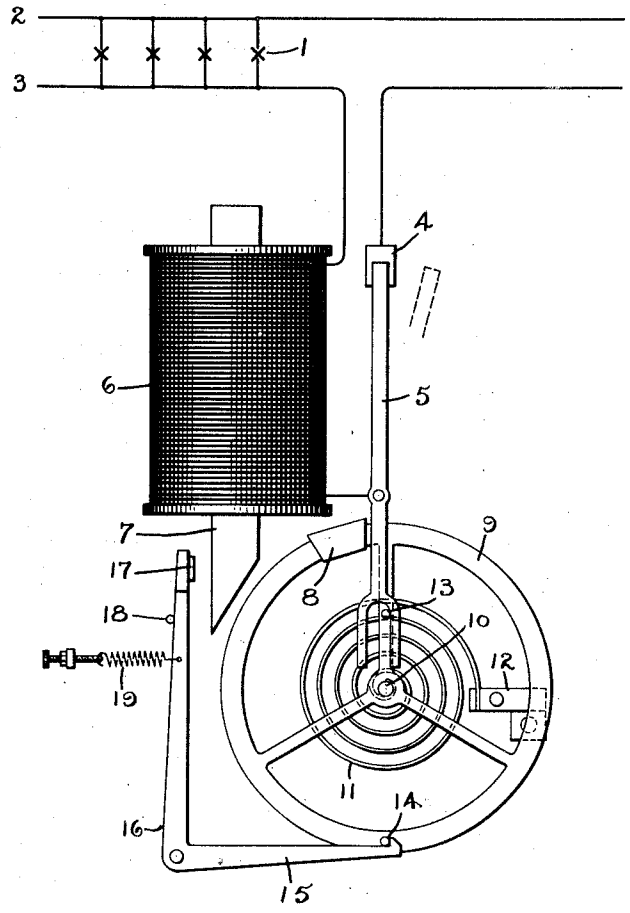
CURRENT LIMITING DEVICE.

APPLICATION FILED MAY 25, 1908.

1,011,732. Patented Dec. 12, 1911



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UNITED STATES PATENT OFFICE.

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CURRENT-LIMITING DEVICE.

1,011,732. Specification of Letters Patent. Patented Dec. 12, 1911.

Application filed May 25, 1908. Serial No. 434,724.

To all whom it may concern:

Be it known that I, DAVID BROIDO, a subject of the Czar of Russia, residing at Berlin, Germany, have invented certain new and useful Improvements in Current-Limiting Devices, of which the following is a specification.

My invention relates to devices for automatically making and breaking electric circuits, and more particularly to current-limiting devices which automatically interrupt an electric circuit when the amount of energy flowing in the circuit exceeds a predetermined limit.

When current is sold on a flat-rate basis the charges are based on the assumption that the consumer's load will be kept below a fixed maximum, and it is desirable to have some automatic device to interrupt the supply when the load exceeds the predetermined limit. Current-limiting devices have been used which are arranged to make and break the circuit automatically with great rapidity upon the occurrence of an overload and thereby cause the lamps to flicker and give notice to the customer that he is using more current than his contract permits; but since less energy is required to keep such devices in operation than is required to start them the load must be reduced considerably below the normal in order to stop them, although after they have been stopped the load may be raised to normal without causing an interruption of the supply.

The object of my invention is to provide a current-limiting device of the make-and-break type which will respond instantly to very slight overloads and will immediately cease operation when the load is reduced to normal without any tendency to continue in operation with a normal load.

In carrying out my invention I connect in the consumer's circuit an automatic interrupter or make-and-break device for making and breaking the circuit to cause the lamps to flicker, and provide some suitable electro-responsive regulator or restraining means which positively prevents the operation of the interrupter except during the existence of an overload on the consumer's circuit. Both the automatic interrupter and the regulating or restraining means may assume many different forms; but preferably the circuit interrupter comprises an electro-magnet provided with a vibrating armature to make and break both the consumer's circuit and the circuit of the electro-magnet, while the regulating or restraining means is preferably some form of latch or detent which during normal load positively restrains the armature in circuit-closing position, and during even slight overload moves out of latching position and leaves the armature free to vibrate and interrupt the circuit. By this arrangement the regulating or restraining means for the automatic interrupter may be made very sensitive to permit operation of the interrupter on a very slight overload and to stop the vibration of the armature instantly when the load becomes normal.

My invention will best be understood in connection with the accompanying drawing, which shows, merely for purposes of illustration, one of the many forms in which the invention may be embodied.

In this drawing the lamps, or other translating devices 1 of the consumer's circuit are supplied from the mains 2 and 3 of the supply circuit. An automatic interrupter, or make-and-break device of any suitable design is connected in series between the supply mains and the consumer's circuit and is preferably adjusted to operate at normal load if unrestrained and to make and break the consumer's circuit through coöperating contacts 4 and 5 which form part of the interrupter.

In the specific form of circuit interrupter illustrated in the drawings the contact 4 is fixed and the movable contact 5 is pivoted and actuated by an electro-magnet 6 connected in series with the consumer's circuit, so that opening the consumer's circuit also opens the circuit of the electro-magnet. The power for opening and closing the circuit is furnished by the flow of current through the electro-magnet, which has an armature 8 arranged to actuate the pivoted contact 5 to make and break the circuit through the electro-magnet as the armature recedes from or approaches the core 7. The armature 8 may be movably mounted in any suitable manner which will permit it to vibrate and thereby make the device an automatic interrupter or make-and-break device. In the specific form shown in the drawing the armature 8 is secured to a movable member or wheel 9 mounted on a shaft 10, which is

influenced by a spiral or hair spring 11 which has one end secured to the shaft and the other end to a fixed support 12. The armature can vibrate and describe an arc about the shaft 10 as a center and is biased to a neutral point near the middle of the arc described by it by means of the spring 11, which is so adjusted that when the armature is free and the spring in its neutral position the armature is resiliently held at a neutral point from which it can be moved in either direction only by straining the spring 11. The wheel 9, which carries a pin 13 working with great freedom in a fork on the lower end of the pivoted contact 5, coöperates with the pivoted contact to form a device substantially like the lever escapement used in time pieces. The oscillation of the wheel 9, due to the action of the electro-magnet and the spiral spring, will cause the contact 5 to oscillate about its pivot, and make and break the circuit through the electro-magnet 6 and the translating devices 1.

The mechanism above described constitutes an automatic interrupter usually so proportioned that it tends to operate to make and break the circuit at the normal load on the consumer's circuit and prevented from operating except during abnormal or excessive load by any suitable regulating or restraining means which will during the continuance of the normal load positively prevent the operation of the interrupter. Various forms of regulating or restraining mechanisms may be used, but the preferred form is a latching or detent mechanism which locks the movable member of the automatic interrupter in position to close the circuit, and releases it only during the time the overload persists. In the specific form shown in the drawing the movable member or wheel 9 carries on its rim a pin 14 positively locking the movable member or wheel 9 against movement by engaging a projection 15 on one arm of a regulator or detent 16, shown in the form of a bell-crank lever, and having on the other arm an armature 17 responsive to the electro-magnet 6. Under normal conditions the detent is held in the position shown in the drawing against a stop 18 by means of an adjustable spring 19, the tension of which may be varied in order to vary the amount of current which must flow through the electro-magnet 6 in order to move the restraining means or detent 16 and release the movable member of the circuit interrupter.

The operation of the device is as follows: when the current flowing through the consumer's circuit is normal the parts are in the position shown in the figure and the spring, which in this position is under strain because uncoiled beyond neutral position, tends to move the armature toward the magnet, but is restrained by the latch. If the current becomes abnormal and rises beyond the predetermined limit the core 7 attracts the armature 17 strongly enough to move the restraining means or latch 16 against the resistance of the spring 19, and thereby moves the projection 15 away from the pin 14 and unlocks the movable member or wheel 9. As soon as the movable member is released the spring 11 rotates the wheel 9 and moves the armature toward the magnet. By the time the spring is free from strain it has moved the armature 8 into such a position that the pull of the core 7 moves the armature toward the core of the magnet, rotating the wheel 9 on its shaft and bringing the pin 13 into engagement with one side of the fork on the contact 5, thereby moving the contact about its pivot to the position shown in dotted lines and opening the circuit through the electro-magnet 6 and through the consumer's translating devices and at the same time coiling up the spring 11. As soon as the circuit is opened the magnet releases the armature, the spring 11 uncoils and swings the armature 8 and wheel 9 back to the position shown in the drawing, since the momentum of the parts carries the spring beyond its neutral position and puts it under strain due to uncoiling. During this backward swing the pivoted contact 5 is moved to the position shown in full lines to close the circuit through the consumer's translating devices, whereupon the operation is repeated if the armature 8 is still free to move. Each time the circuit of the magnet is opened the armature 17 is released and the latch or detent 16 springs back to the latching position shown in full lines, ready to engage the pin 14 and to lock the armature 8 against further movement unless the presence of an overload when the consumer's circuit is closed causes the electro-magnet 6 to attract the armature 17 and move the detent out of latching position before the pin 14 is caught by the projection 15. The armature 8 is, therefore, free to vibrate as long as the overload continues, but as soon as the load becomes normal the detent remains in locking position, and as the armature 8 swings back under the influence of the spring 11 and closes the consumer's circuit the pin 14 is caught by the projection 15 and the action of the automatic interrupter is stopped. The momentum of the moving parts of the interrupter can have no effect in prolonging the action of the interrupter or in causing it to operate at normal load, since the latch or detent positively stops the movement instantly.

My invention may be embodied in many other forms than that shown and described, and I do not wish to be restricted to the precise arrangement disclosed, but intend to cover by the appended claims all changes

and modifications within the spirit and scope of my invention.

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

1. In a current limiter, the combination with an automatic interrupter comprising an electromagnet and a movable circuit-controlling member actuated by said electromagnet to break the circuit through said magnet, of restraining means responsive to current through said interrupter and arranged to normally hold said member immovable in circuit-closing position and to release said member during abnormal current.

2. In a current limiter, the combination with an automatic interrupter comprising an electromagnet and a movable circuit-controlling member actuated by said electromagnet to break the circuit through said magnet, of latching means responsive to current through said interrupter and arranged to hold said member immovable in circuit-closing position during normal current, said means being held out of latching position by said electromagnet during abnormal current.

3. In a current limiter, the combination with an automatic interrupter comprising an electromagnet and a movable circuit-controlling member actuated by said electromagnet to break the circuit through said magnet, of a regulator responsive to current through said interrupter and arranged to normally restrain movement of said member, and adjusting means for varying the amount of current required to operate said regulator.

4. In a current limiter, the combination with an automatic interrupter comprising an electro-magnet and a movable circuit-controlling armature for opening the circuit of said electromagnet when attracted thereby, of latching means responsive to said magnet and arranged to hold said armature in circuit-closing position during normal current and to release said armature during abnormal current through said magnet.

5. In a current limiter, the combination with an automatic interrupter comprising an electro-magnet and a movable circuit-controlling armature for opening the circuit of said electromagnet when attracted thereby, of a latch for said armature movable by said magnet out of latching position to release said armature, and resilient means for maintaining said latch in latching position to hold said armature in circuit-closing position.

6. In a current limiter, the combination with an automatic interrupter comprising an electro-magnet and a movable circuit-controlling armature for opening the circuit of said electromagnet when attracted thereby, of a latch normally in latching position to hold said armature in circuit-closing position and actuated by said magnet to release said armature, and an adjustable spring for holding said latch in latching position against the pull of said magnet.

7. In a current limiter, the combination with an automatic interrupter comprising an electro-magnet, a spring-restrained armature for said magnet, and a switch in series with said magnet actuated to open the circuit as the armature approaches and to close the circuit as the armature recedes from the magnet, of a spring-restrained latch normally in engagement with said armature to hold said switch closed and actuated by said magnet during abnormal current to release said armature.

8. An automatic circuit interrupter comprising an electromagnet having a vibratory circuit-controlling armature arranged to break the circuit by movement toward said magnet, a spring tending to move said armature to break the circuit, and a latch responsive to said electro magnet for restraining said armature in circuit-closing position against the tension of said spring.

9. An automatic circuit interrupter comprising an electro-magnet having a vibratory circuit-controlling armature movable between two extreme positions, of a spring for resiliently holding said armature between said positions, and restraining means responsive to current in the circuit for normally holding said armature in one of said positions.

In witness whereof, I have hereunto set my hand this first day of May, 1908.

DAVID BROIDO.

Witnesses:

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