C. C. & I. F. BADEAU.

CIRCUIT BREAKER.

APPLICATION FILED DEC. 10, 1906.

996,393. Patented June 27, 1911.

2 SHEETS—SHEET 1.

Fig. 2

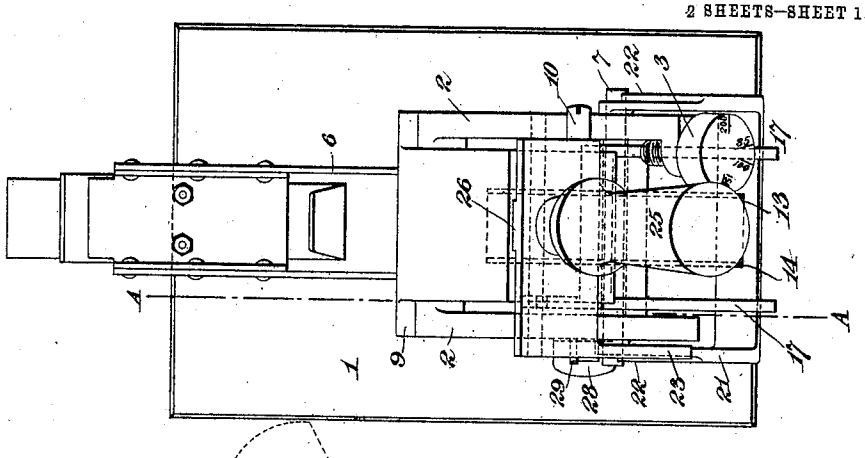
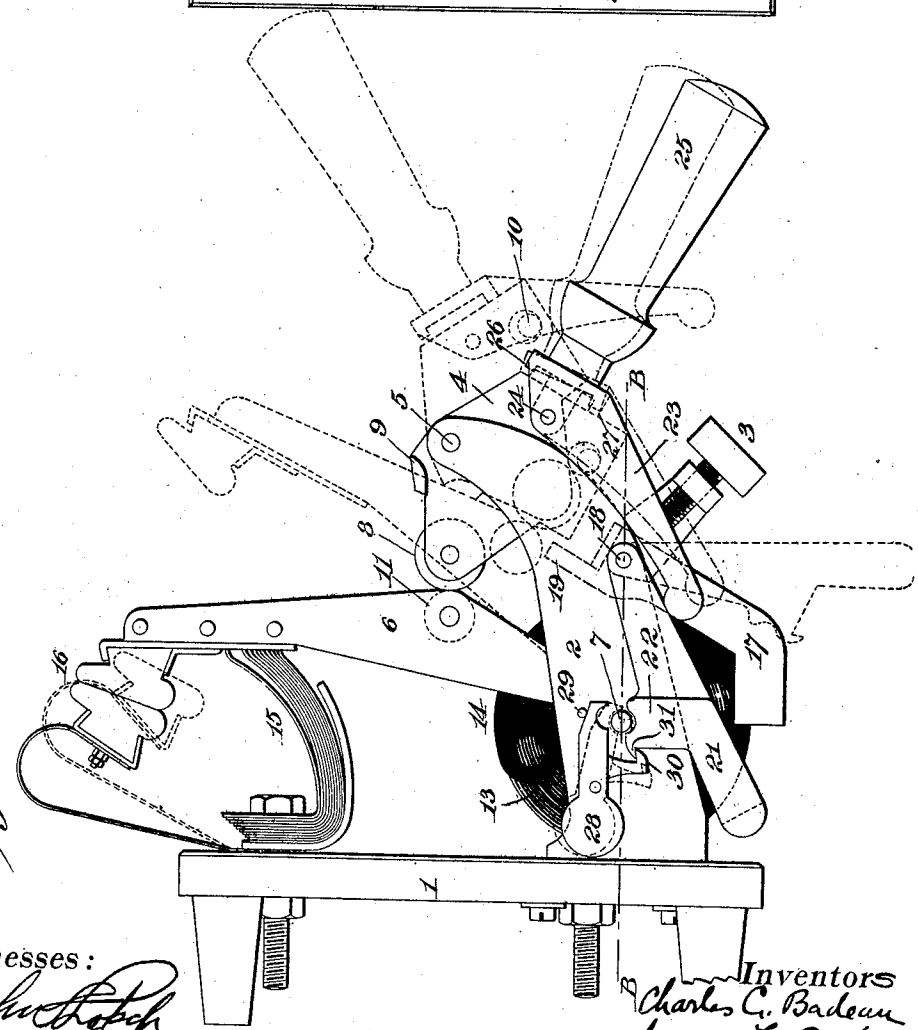


Fig. 1



Witnesses:

John Robb

Samuel O. Pearce.

Inventors

Charles C. Badeau

Isaac F. Badeau

By Dyer & Dyer

Attorneys.

C. C. & I. F. BADEAU.

CIRCUIT BREAKER.

APPLICATION FILED DEC. 10, 1906.

996,393.

Patented June 27, 1911.

2 SHEETS—SHEET 2.

Fig. 4

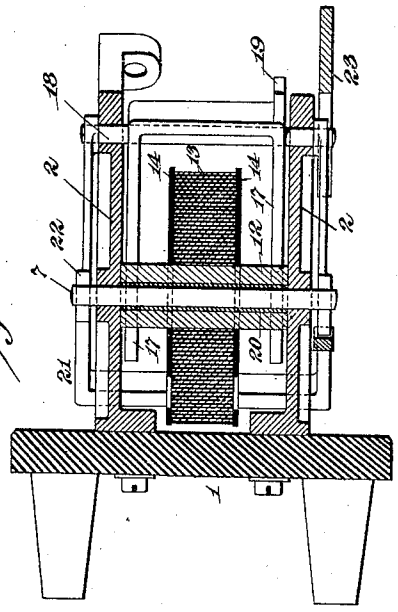
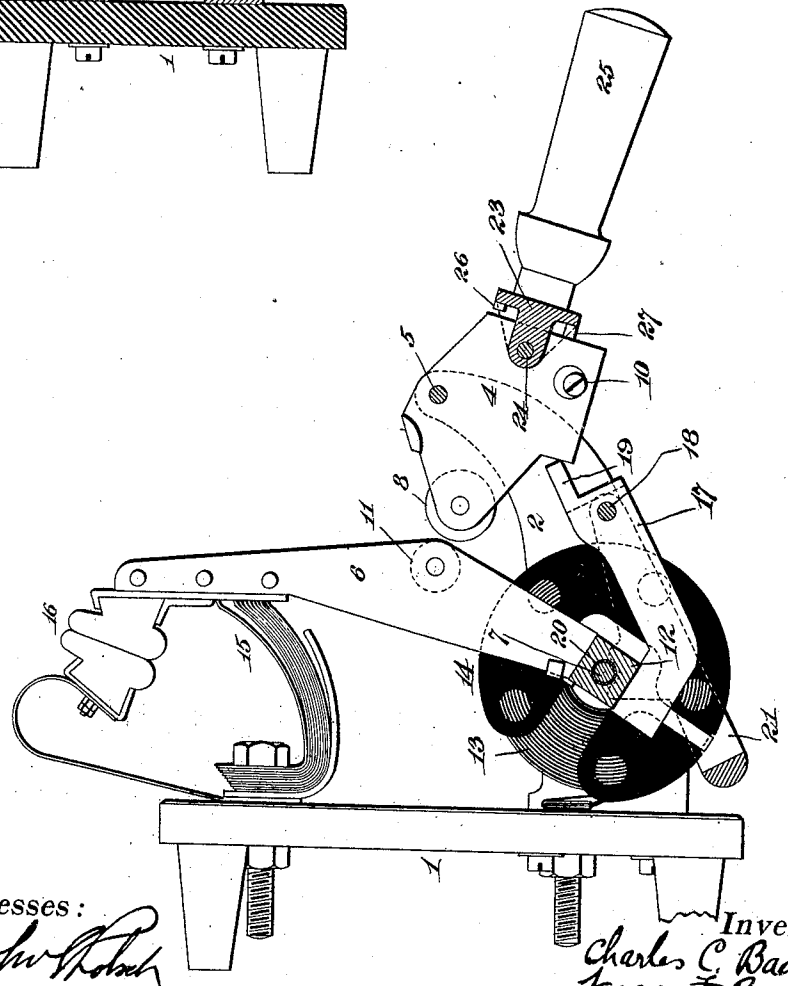


Fig. 3



Witnesses:

John Robb

Samuel C Pearce

Inventors

Charles C. Badeau

Isaac F. Badeau

By Dyer & Dyer

Attorneys.

UNITED STATES PATENT OFFICE.

CHARLES C. BADEAU AND ISAAC F. BADEAU, OF BETHLEHEM, PENNSYLVANIA, ASSIGNORS, BY MESNE ASSIGNMENTS, TO ROLLER-SMITH COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

CIRCUIT-BREAKER.

996,393. Specification of Letters Patent. **Patented June 27, 1911.**

Application filed December 10, 1906. Serial No. 347,102.

To all whom it may concern:

Be it known that we, CHARLES C. BADEAU and ISAAC F. BADEAU, both citizens of the United States of America, residing in Bethlehem, county of Montgomery, State of Pennsylvania, and each having a post-office address in care of the Switchboard Equipment Company, Bethlehem, Pennsylvania, have invented a certain new and useful Improvement in Circuit-Breakers, of which the following is a specification.

The general object of our invention is to produce a new and improved form of overload and underload circuit breaker.

Further objects are to produce a circuit-breaker which may be closed when no current is flowing through it, and which may remain closed, and will automatically set itself when the current flows through the breaker so that when the current falls to minimum or rises above maximum, the breaker will open the circuit.

Other objects lie in the details of construction, as will more fully appear from the following specification and accompanying drawings, in which—

Figure 1 is a side view of a breaker embodying our invention, Fig. 2 is a front view thereof, Fig. 3 is a sectional view of the breaker taken on the line A—A, Fig. 2. Fig. 4 is a section taken on the line B—B, of Fig. 1.

In all of the views, like parts are designated by the same reference characters.

The breaker shown in the drawings is similar in many respects to that forming the subject matter of the application for patent of Charles C. Badeau filed September 18, 1906, under Serial Number 335,057, but with additional features applied thereto. These additional features, it is to be understood, are not limited to use in connection with a circuit-breaker of the type illustrated or disclosed in that application for patent, but they may be used in connection with any other type of circuit-breaker.

In the drawings, the apparatus is shown as comprising a base 1, having housings 2 secured thereto, which support the moving portions of the breaker. These housings may be made of cast metal, if desired, and both are alike except that one of the housings has an attachment for the armature calibrating screw 3. The main handle lever 4 is mounted upon a shaft 5. The main arm 6 is supported upon the main shaft 7. The main handle lever 4 is provided with a roller 8 and has a fixed stop 9 and an adjustable stop 10. The main arm 6 carries a roller 11 adapted to be engaged by the roller 8 for closing the breaker. A square core piece 12 surrounds and is supported upon the main shaft 7 and also supports the main arm 6. A conducting ribbon or strip 13, constituting a coil similar to that shown in Patent 747,673 of Charles C. Badeau, surrounds the core piece 12 and lies between the sides of the main arm 6. This conducting ribbon or strip constitutes the overload and underload coil and at the same time serves as a spring for opening the breaker. Washers 14 of insulating material are arranged upon each side of the coil The main contacts 15 and the shunt contacts 16 are arranged as shown.

The overload armature 17 is pivoted to a shaft 18. This overload armature is adapted to be attracted by the square core piece 12 and has a lug 19 which is adapted to engage with the main handle lever 4, and trip the latter when attracted to the core-piece by an excess of current passing through the coil 13. So much of the apparatus described is similar to that illustrated in the co-pending application of C. C. Badeau already referred to. The additional mechanism is as follows: The square core piece 12 is mounted upon the main shaft 7 so as to turn thereon. Between the two is a brass bushing 20. The main shaft 7 is made of iron so that it also will serve as a core-piece or core-shaft. The brass bushing is useful in order to prevent the core-piece 12 rusting to the main shaft 7 which might be the case if the bushing were not present. The main shaft 7 extends out beyond the sides of the housings 2 a sufficient distance to engage with an auxiliary armature 21. This auxiliary armature we denominate the underload armature. The underload armature 21 is mounted upon the shaft 18 in such a manner that it may freely move to engage with the main shaft 7 or swing to a vertical position, as shown in dotted lines in Fig. 1, when the breaker is open.

The underload armature is shown as formed of U-shape with projecting cheek pieces 22 which are formed with concave extremities where they come in contact with

the core-shaft 7 so as to increase the magnetic attraction.

An auxiliary handle lever 23 is pivoted by means of a shaft 24 to the main handle lever 4. This auxiliary handle lever carries the operating handle 25. This operating handle 25, together with the auxiliary handle lever 23, turns within a limited extent upon the shaft 24. The extent of movement is limited by the stops 26, 27, which are carried by the auxiliary handle lever and engage with the main handle lever 4. This connection between the handle and the handle lever permitting, as it does, a certain amount of lost motion between the auxiliary handle lever and the main handle lever, constitutes a lost-motion connection. The extent of lost motion need be slight, and is shown in Fig. 1 as extending between the limits shown by the solid lines and the dash and dot lines. The auxiliary handle lever 23 is adapted to engage at its free end with one of the sides of the underload armature 21 in such a manner that the latter can be forced up to engagement with the shaft 7. The operation of so much of the invention is as follows: The breaker is shown as closed in the position indicated by the solid lines in Fig. 1, and entirely open in dotted lines in that figure. The breaker is closed by lowering the handle to the full-line position. This causes the roller 8 to engage with the roller 11 and swing the main arm 6 upon its axis so as to engage the main and shunt contacts. The roller 8 swings beyond the center, that is, beyond the line drawn between the axes of the roller 11 and the shaft 5, so that the breaker remains closed. During the downward movement of the handle, the auxiliary handle lever 23 will engage with the underload armature 21 and move the latter upon its shaft 18 so as to engage it with the core-shaft 7. Upon the current passing through the breaker, the core-shaft 7 will be magnetized and will attract the underload armature 21, holding it in position. Should an overload of current occur, the overload armature 17 will be attracted to the square core-piece 12, causing the lug 19 to engage with the main handle lever 4, moving the latter upon its pivot and raising the handle, permitting the main arm 6 to swing upon its shaft and thereby separate the contacts. Should a sufficient diminution in current occur to permit the underload armature 21 to drop through failure of magnetism in the core-shaft 7, it will swing upon its shaft 18 and depress the auxiliary handle lever 23. Owing to the lost-motion connection between the auxiliary handle lever and the handle lever 4, the former can move some distance before it causes the handle lever to move; consequently the underload armature can drop a considerable distance before resistance to opening the handle lever is met with. This underload armature will therefore acquire sufficient momentum to overcome the inertia of the handle lever and the resistance of the rollers 8 and 11 and will invariably insure the opening of the breaker. Another advantage of the lost-motion connection between the auxiliary handle lever 4 is that it permits a comparatively light armature 21 to be used without any spring.

In addition to the mechanism for opening the breaker, we provide mechanism for permitting the breaker to be closed when no current passes through it and permit it to remain set until current does pass through it, when it will be ready to be automatically opened when a maximum or minimum amount of current passes. The mechanism for permitting this to be done is as follows:—An auxiliary armature 28 is pivoted to one of the housings 2 in such a manner that it can be attracted by one extremity of the core shaft 7. This auxiliary armature is counterbalanced and its extent of movement upward is limited by means of a stop 29. The auxiliary armature carries a catch 30, which is adapted to engage the finger 31 formed upon the underload armature 21. The upper face of the finger 31 and the lower face of the catch 30 are beveled so that the catch will automatically engage with the finger when the auxiliary armature is raised. The position that the auxiliary armature assumes when no current passes is shown in solid lines in Fig. 1, and it is moved to the position shown in dotted lines when it is attracted to engage with the core-shaft 7. When in this position, the catch 30 will be disengaged from the finger 31 so that the underload armature 21 will be free to drop unless otherwise supported. The position of the finger 31 of the underload armature 21 is such that it will be engaged by the catch 30 and will be held in position at some slight distance away from the core-piece 7. This is for the purpose of disengaging the catch 30 from the finger 31 when the underload armature is attracted to the core-pin and thereby relieve the catch 30 of the weight of the underload armature and make it possible for the counterbalanced armature 28 to be attracted to the core-pin. The operation of this portion of our invention is as follows: Upon closing the breaker by moving the operating handle 25 downward, the underload armature will be elevated, causing the finger 31 to engage with the catch 30. If no current passes through the breaker, the underload armature will be held in the elevated position by the mechanical engagement of the finger with the catch and the breaker will be kept closed. As soon as current passes through it, the armatures 21 and 28 will be attracted toward the core-shaft 7 releasing the finger from engagement with the catch. If, now, there be a

diminution of current passing through the breaker producing an underload, the breaker will be opened in the manner already described. The underload armature 21 is very much larger and heavier than the auxiliary armature 28. Furthermore, its point of pivoting is toward one of its sides while the auxiliary armature 28 has its pivoting point near its center and its counterbalancing moment is very much smaller than that of the underload armature 21. As there is always a momentary tendency of an armature to stick to a magnet owing to the residual magnetism, the armature 21 will drop before the auxiliary armature 28 is counterbalanced. Consequently the latter will not have an opportunity to cause engagement of the catch 30 with the finger 31, when the breaker is opened by the underload.

It will be seen that there are two magnetic circuits both induced by the same coil 13. One is a normally open circuit through the overload armature 17, and the other is a normally closed magnetic circuit through the underload armature 21. It will therefore be seen from the foregoing description that the armatures are magnetically in multiple and that they are operated by a single tripping coil. It is possible to use both of these magnetic circuits and obtain practically the same power from each as though the other circuit were absent as will be understood by those skilled in the art.

Before claiming our invention we wish to define our meaning of the terms "overload armature" and "underload armature". By the term "overload armature" is meant an armature which operates when the magnetism of the armature exceeds a certain amount, and by the term "underload armature" is meant an armature that operates when the magnetism drops below a predetermined amount; the magnetism in either case being generated in any manner, as by a heavy series coil, by a fine wire shunt coil or by the combination of the two.

In accordance with the provisions of the patent statutes, we have described the principle of our invention, together with the apparatus which we now consider to represent the best embodiment thereof; but we desire to have it understood that the apparatus shown is merely illustrative and that the invention can be carried out in other ways.

Having now particularly described and ascertained the nature of our invention, and in what manner the same is to be performed, what we claim and desire to secure by Letters Patent is:—

1. A circuit breaker having a main closing device, an auxiliary handle lever, pivoted thereto with lost-motion, said handle lever having a projection, and an underload armature which engages with the projection to open the breaker.

2. A circuit breaker having a main closing device, an overload armature which engages with such main closing device to open the breaker, an auxiliary handle lever pivoted to the main closing device with lost-motion, an underload armature, and a mechanical connection between the underload armature and the auxiliary handle lever to open the breaker.

3. A circuit breaker having a main closing device, and a single coil, an overload armature influenced by the coil, an underload armature influenced by the coil, and an auxiliary armature also influenced by the coil, and adapted to mechanically engage with the underload armature to set the same on no load.

4. A circuit breaker having an underload armature and an auxiliary armature adapted to mechanically engage therewith under no load.

5. A circuit breaker having an underload armature and an auxiliary armature adapted to mechanically engage therewith to set the same under no load, the armatures being influenced by a single coil.

This specification signed and witnessed this 6th day of December, 1906.

C. C. BADEAU.
I. F. BADEAU.

Witnesses:
F. J. HAUS,
IVAN RICE.