C. C. BADEAU.

CIRCUIT BREAKER.

APPLICATION FILED FEB. 20, 1909.

1,023,102.

Patented Apr. 9, 1912.

2 SHEETS—SHEET 1.

Fig. 1.

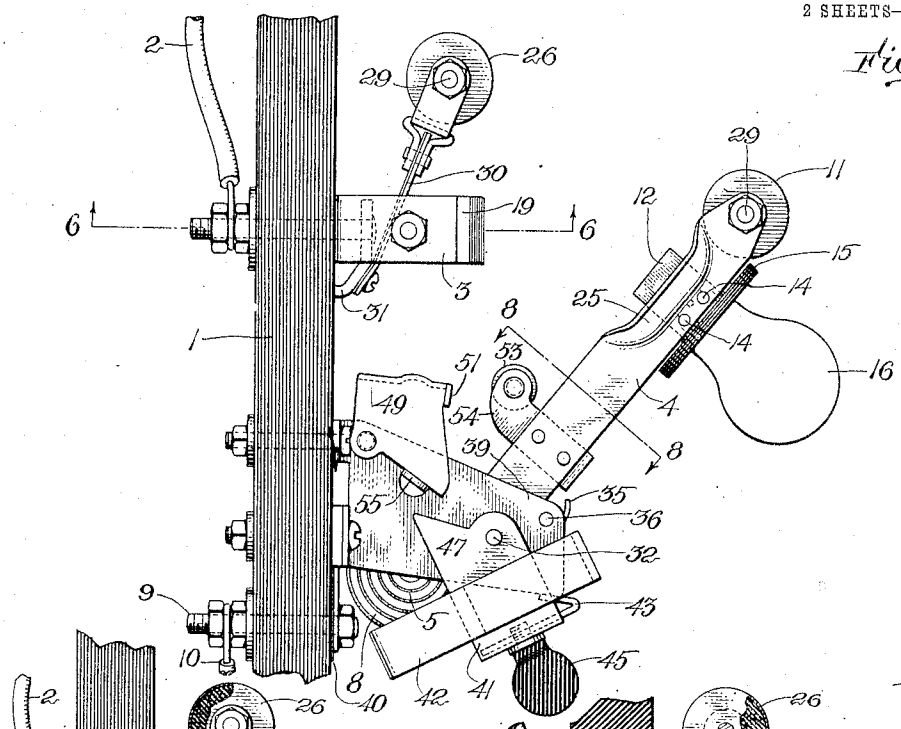


Fig. 3.

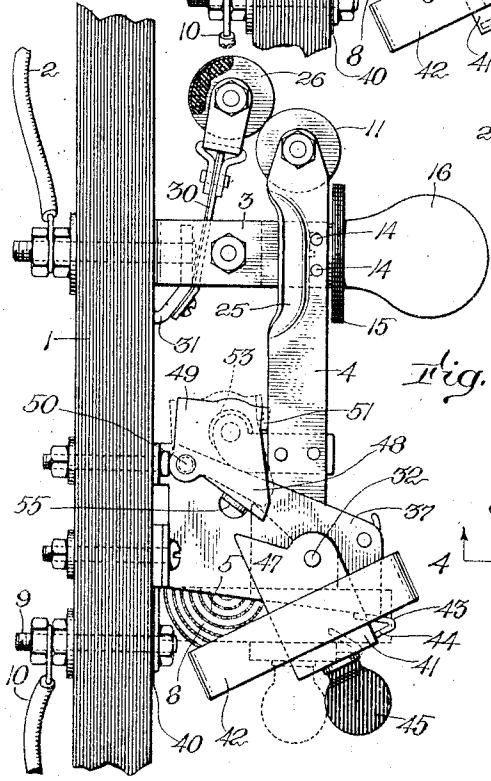
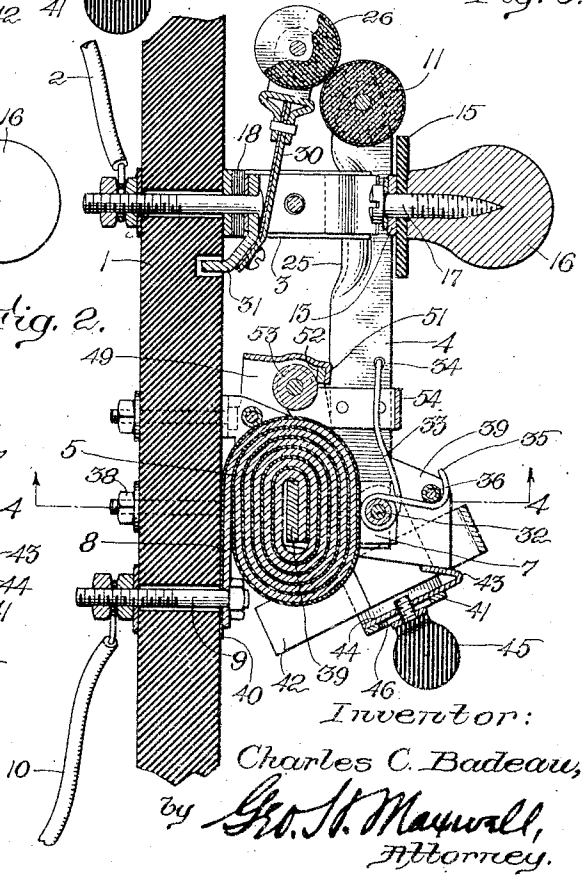


Fig. 2.



Witnesses:
Edward Maxwell
M. J. Spalding

Inventor:
Charles C. Badeau,
by Geo. S. Maxwell,
Attorney.

C. C. BADEAU.

CIRCUIT BREAKER.

APPLICATION FILED FEB. 20, 1909.

1,023,102.

Patented Apr. 9, 1912.

2 SHEETS—SHEET 2.

Fig. 8.

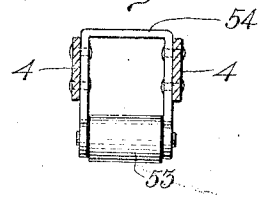


Fig. 4.

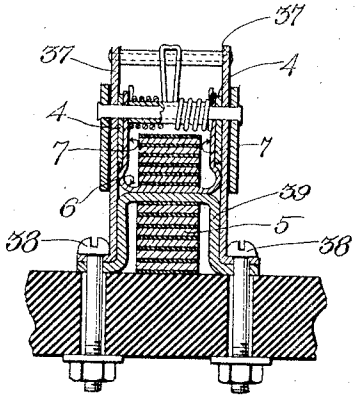


Fig. 5.

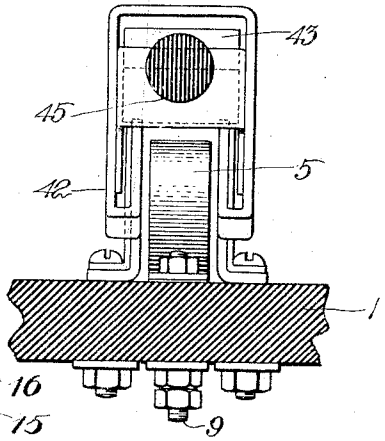


Fig. 6.

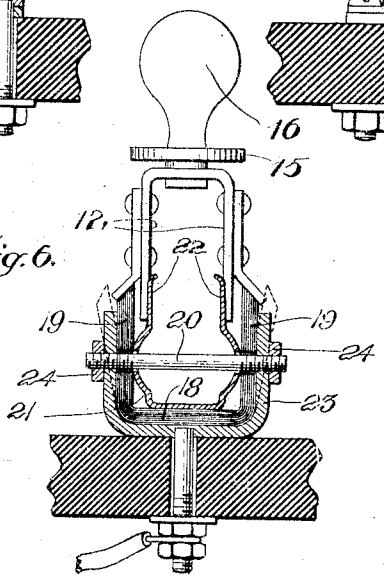
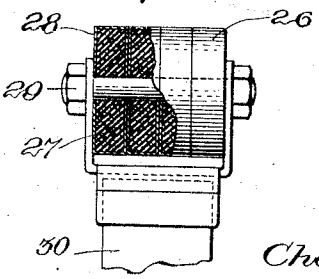


Fig. 7.



Witnesses:
Edward Maxwell
M. J. Spalding.

Inventor:
Charles C. Badeau,
by Geo. S. Maxwell,
Attorney.

UNITED STATES PATENT OFFICE.

CHARLES C. BADEAU, OF BOSTON, MASSACHUSETTS, ASSIGNOR TO SEARS B. CONDIT, JR. OF BOSTON, MASSACHUSETTS.

CIRCUIT-BREAKER.

1,023,102. Specification of Letters Patent. Patented Apr. 9, 1912.

Application filed February 20, 1909. Serial No. 478,208.

To all whom it may concern:

Be it known that I, CHARLES C. BADEAU, a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented an Improvement in Circuit-Breakers, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

My invention is an improved circuit breaker of the direct acting type, having for its object a construction which permits the passage of an extra large amount of current per pound of copper.

A further object is to provide a construction in which all the moving parts may be fastened together in final adjustment at the shop, requiring thereafter merely to be mounted as a whole on the switchboard.

Various further advantages of my invention and the constructional details of the preferred embodiment thereof will appear more at length from the following description taken with reference to the accompanying drawings.

In the drawings, Figure 1 is a view in side elevation showing the switch open; Fig. 2 is a similar view showing the switch closed; Fig. 3 is a central vertical sectional view thereof; Fig. 4 is a transverse sectional view on the line 4—4 Fig. 2; Fig. 5 is an end view looking upward at Fig. 2; Fig. 6 is a cross sectional view on the line 6—6, Fig. 1; Fig. 7 is a fragmentary view partly in elevation and partly in section, of the secondary contact; and Fig. 8 is a cross-sectional view to show the wide extent of the holding catch.

My invention is shown in the drawings as applied to the type of circuit breaker in which the brush is stationary. The circuit breaker is shown as mounted on a switchboard 1, with the current entering at 2 and passing from the brush contact 3 to the blade contacts 4, back through the blades to the rear ends thereof to a spiral coil 5 whose inner end is secured to a U-shaped clip 6 whose ends 7 contact with said blade ends, and the outer end 8 of the coil is secured to a stud 9 whence the current is transmitted to the outgoing terminal 10.

One of my main objects is to make the circuit breaker exceedingly easy to operate by hand and very small in proportion to its capacity, and to accomplish the latter result all the current carrying portions of the circuit breaker are formed in thin wide sheets so that thereby the surface is large in proportion to its bulk or contents.

My aim is to provide a construction having minimum resistance and maximum radiating surface, thereby providing for minimum copper losses due to heating. The heating of electrical apparatus, whose main losses are copper losses (as distinguished from iron losses thereof) bears a direct relation to the resistance and radiating surface. Accordingly I make the blades 4 relatively wide and very thin, see Figs. 1 and 4, set edgewise parallel to each other. Their outer ends are braced apart by a movable secondary contact 11 shown in cylindrical form and by a U-shaped contact maker 12 whose bridge portion 13 spans between the opposite blades 4, the upper ends of the down-hanging parallel parts of said contact maker 12 being riveted as indicated at 14, directly to the blades 4. A transverse insulating plate 15 rests across the top edges of the blades and on the part 13 of the U-shaped contact piece 12, for bracing the part and supporting the handle 16 secured thereto by any suitable means as by a screw 17. The coöperating brush contact is specially formed to coöperate with the contact 12, being shown best in Fig. 6, where it will be seen that the laminæ of the brush are bent into U-shape, the bottom or bridging portion thereof being indicated at 18 and the upright parts at 19 being held by a rod 20 which also retains an inner U-shaped spring member 21 whose ends 22 project upwardly and are deflected toward each other, and a U-shaped holding member 23. The latter is made of spring metal, as steel, normally tending to spring outwardly the same as the ends 19 of the brush, being held inwardly by the bolt 20 and its retaining nuts 24. Thus, when it is desired to adjust the brush ends 19 toward or from each other all that is necessary is to tighten or loosen the nuts 24, thereby crowding the holder 23 and brush ends toward each other or permitting them to spring apart. The unrestrained position of the brush is indicated in dotted lines.

Each blade 4 is bent diagonally outward at 25 at the same angle as the beveled ends of the parts 19 of the brush, so that when the handle 16 is pressed forward these beveled or inclined portions 25 engage the beveled ends 19 and thereby get good contact therewith while the contacts 12 enter between the ends 19 and 22 at the respective sides of the stationary contact member in knife-contact position, the inclines 25 serving to press the brush ends 19 hard against said contacts 12. Thus it will be understood that again one of my objects is secured, namely, affording wide superficial conducting area or surface of contact. The U-shaped construction 18, 19, enables me to make this laminated member of identical plates or strips, which is not only an inexpensive construction but facilitates perfect uniformity, and also the U-shape gives an extra amount of contact and conducting surface to the wedge shape, coöperating with the diagonal or inclined portion 25 secures great pressure against the contact under comparatively small pressure of the handle 16. Also the U-shape provides two contact surfaces integral with each other, *i. e.*, the opposite contact-making ends are thereby electrically and mechanically united in the most perfect manner. The carbon or secondary contact 11 and its coöperating contact 26 are likewise specially constructed for giving large superficial, superior conducting, surface contact of comparatively low resistance and infusible character, being composed of a plurality of carbon sections 27, preferably in the form of disks, each section being copper plated as indicated at 28, see Fig. 7, whereby there is a copper skin or surface covering not only at the periphery, but on each side of each disk, said disks being clamped together on a transverse bolt 29. The thickness of this copper skin or surface is somewhat exaggerated as shown in the drawings so as to make it more readily noticeable. In practice this is only a thin skin coating which will disappear from the periphery of the disks in the heat of arcing after a few contacts: its prime function is to promote conductivity between the lateral surfaces of the several disks and its application to the periphery of these disks is incidental. This copper coating on the sides of the disks greatly promotes conductivity between the several disk elements, making them substantially a single cylinder when clamped together, so far as electric connection is concerned. The disks are molded, thereby being stronger and constituting better conductors than the average cut carbon, and by having them plated with copper and clamped side by side I obtain superior contact through to the lever and between the respective contacts 11 and 26 of the secondary element. The contact 26 is supported on a secondary spring 30 mounted between the two ends 19 of the U-shaped bridge contact on the rear end 31 of the conductor plate, which serves to clamp the horizontal portion 18 of the brush contact immovably in place as best shown in Fig. 3. By this provision I am enabled to obtain a relatively long and wide spring 30, which gives free action under like pressure of the handle, together with sure contact and large conducting surface.

The blade levers 4 which constitute the swinging lever, are pivoted on a transverse bolt 32, which also carries a coiled spring 33 the opposite ends of which are secured at 34 to said levers and the middle portion 35 thereof passes beneath a transverse stationary rod 36 whereby the normal tension of the spring maintains the lever always under tension to move from the closed position Fig. 3 to the open position Fig. 1. This operating spring has three functions, it opens the breaker, stops or checks the opening movement of the breaker, and pushes laterally, see Fig. 4, against the wide ends 7 of the clip 6, thereby compelling good contact between the latter and the correspondingly wide ends of the lever blades 4. The U-shape of the clip 6 also aids in getting large superficial area of contact for the coil 5 of the electromagnet, which, in keeping with all the rest of the switch, is thin and wide, see Fig. 4.

All the moving parts of the switch are carried on opposite brackets 37 of non-magnetic material such as brass, bolted at 38 to the switchboard or other support, said bolts also clamping the U-shaped iron member or electromagnet 39, to which is secured the inner end of the coil 5. The latter consists of a copper ribbon, preferably wound with a ribbon of insulating material so as to prevent short-circuiting between its successive turns. Pivoted at 32, preferably externally the bracket 37, is a yoke 41 which supports an armature 42 in position to be attracted by the magnet 39. The calibration of the air gap or distance between the armature and electromagnet is regulated by a stop 43 of a plate 44 adjustably supported by a handle or button 45 of insulation material, movable in a slot 46 of the yoke 41, said stop being arranged to strike against the lower ends of the bracket 37. By this provision the circuit breaker can be tripped without danger when alive. At its upper end the yoke 41 is provided with projections 47 constituting tripping dogs, movable under the influence of the electromagnet and armature, into tripping engagement against depending ends or dogs 48 of a locking detent or latch 49 pivoted at 50 to the brackets 37 and provided at its front edge with a lip 51 backed by a metal block 52 normally hanging down in the position

shown in full lines in the drawings, to interlock or overlap sufficiently a roll or latch 53 of brass or other non-rusting metal projecting from the rear side of the operating lever 4 and supported by a U-shaped bracket 54 carried thereby. The parts 51 and 53 are wide, the extent of the roll or latch 53 being best shown in Fig. 8, so that the pressure per square inch is reduced, thus making feasible the use of non-rusting metal. These parts are usually very small and narrow and made of iron, so that they sometimes rust together with resulting large damage. An ear 55 limits the downward or locking position of the catch 49.

In use, the handle 19 is pressed forward from the position Fig. 1 to the position Figs. 2 and 3, and with very little pressure thereon the coöperating contacts 12, 19 and 11, 26, are brought together and the switch is locked by the engagement of the latch 54 beneath the catch 51. Upon the occurrence of an overload, the armature 42 is attracted by the magnet 39, thereby raising the dog 47 against the detent member 49 and thereby disengaging the members 51, 54, whereupon the spring 33 instantly swings the switch open.

It will be observed that all the movable parts of the switch, *i. e.*, the lever, armature, tripping mechanism, etc., are fastened together and carried by the brackets 37 so that all the adjustments may be finished at the factory, thereby permitting the circuit breaker to be sent out right, without requiring further attention. Also the circuit breaker is very small in proportion to its capacity. This is the main object of my invention, viz., to enable the circuit breaker to carry an extra large amount of current per pound of copper, and to this end all the conducting parts are thin and wide, thereby giving as large a surface area as possible for the contents. Yet the construction is sufficiently strong for ordinary rough usage. Another reason for making the circuit breaker in this particular form is that, as all the parts are simply plane, smooth parts, requiring merely to be cut, no expensive stamping dies are required. I have already mentioned other constructional and functional advantages of the circuit breaker in the course of the description thereof.

It will be understood that some of the features of the invention, as hereinafter claimed, are broadly new, others being structural improvements only, and accordingly I wish it understood that my invention is not limited to the details herein shown, except as otherwise required by the claims.

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

1. In an electric switch, a movable contact member, its lever, a coöperating latch and catch having a mutual engaging width substantially coextensive with the width of the switch, and means for tripping said latch mechanism.

2. In an electric switch, a movable contact member, its lever, means for normally holding the switch closed, a flat spiral tripping coil, a U-shaped core secured at its middle to the center of said coil at one end of the latter and embracing the coil at each side thereof, and a tripping armature actuated by said core when energized by the coil.

3. In an electric switch, a movable contact member, its lever, means for normally holding the switch closed, a flat spiral tripping coil, a U-shaped core secured at its middle to the center of said coil at one end of the latter and embracing the coil at each side thereof, and a pivoted armature having side portions movable respectively in the respective fields of the said opposite embracing portions of said core to trip said holding means.

4. In an electric switch, a movable contact member, its lever, means for normally holding the switch closed, an electromagnetic tripping mechanism for tripping said holding means, including a U-shaped armature embracing the coöperative part of said mechanism, and pivoted to swing below the rest of the switch, said armature having a part adapted to be engaged for operating the same.

5. In an electric switch, a movable contact member, its lever, means for normally holding the switch closed, and electromagnetic tripping mechanism for tripping said holding means, including a U-shaped armature embracing the coöperating part of said mechanism and pivoted to swing below the rest of the switch, and an insulated handle projecting below the switch for moving said armature.

6. In an electric switch, a movable contact member, its lever, electromagnetic tripping mechanism, and latching mechanism, including a catch of relatively thin plate-like material having an angular end-part downhanging at one side of said electromagnetic tripping mechanism, said electromagnetic tripping mechanism including a pivoted armature actuated by abnormal current and having tripping means extending into the path of movement of said downhanging end of the catch for tripping the latter.

7. In an electric switch, a movable contact member, its lever, electromagnetic tripping mechanism, and latching mechanism including a catch of relatively thin plate like material, U-shaped in cross section, having its ends downhanging at the sides of the electromagnetic tripping mechanism, said

electromagnetic tripping mechanism including a pivoted armature actuated by abnormal current and having tripping means extending into the path of movement of a downhanging end of the catch for tripping the latter.

8. In an electric switch, a movable contact member, its lever, electromagnetic tripping mechanism, including a pivoted armature actuated by abnormal current, and latching mechanism, including a catch of thin plate-like material having a portion downhanging in the path of said armature, and a roll normally restrained by said catch.

9. In an electric switch, a movable contact member, its lever, a flat spiral tripping coil standing in the plane of movement of said lever, latching mechanism including a catch pivoted to swing in said plane and downhanging at the side of said coil, and a pivoted armature actuated by abnormal current in said coil and having tripping means extending into the path of movement of said catch for tripping the latter.

10. In an electric switch, a movable contact member, a pivoted carrying lever therefor having opposite thin wide flat end-conductor portions at its sides standing in its plane of swinging movement at the pivot, a tripping coil having end conductor clips in flat engagement with said lever ends, and a spring at said pivot pressing sidewise to hold said clips and ends hard-pressed together.

11. In an electric switch, a movable contact member, a pivoted carrying lever therefor having opposite thin wide flat end-conductor portions at its sides standing in its plane of swinging movement at the pivot, a tripping coil having end conductor clips in flat engagement with said lever ends, and a spring at said pivot pressing sidewise to hold said clips and ends hard-pressed together, said spring having also connection with said lever for giving said lever an initial opening movement and checking the opening movement when the switch is fully opened.

12. In an electric switch, a movable contact member, a pivoted carrying lever therefor having flat end conductor portions at its opposite sides at said pivot, and tripping mechanism including a tripping coil having at one end a U-shaped clip with thin flat ends holding flat against the end portions of said lever.

13. In an electric switch, a movable contact member, a pivoted carrying lever therefor having flat end conductor portions at its opposite sides at said pivot, and tripping mechanism including a flat spiral coil of thin flat ribbon, and a U-shaped clip secured to the inner end of said coil having thin wide ends held flat against the ends of said lever at said pivot.

14. In an electric switch, a movable contact member, a pivoted carrying lever therefor having flat conductor portions at its opposite sides, tripping mechanism, including a tripping coil terminating at one end in thin wide portions held flat against said flat conductor portions of the lever, and a U-shaped core having its metal portion secured to the inner end of said coil.

15. In an electric switch, a movable contact member, a pivoted carrying lever therefor having flat end conductor portions at its opposite sides at said pivot, tripping mechanism including a flat spiral coil of thin flat ribbon, and a U-shaped clip secured to the inner end of said coil having thin wide ends held flat against the ends of said lever at said pivot, and a U-shaped core having its middle portion secured also to the inner end of said coil.

16. In an electric switch, a movable contact member having a U-shape form whose opposite ends constitute knife contacts, a pivoted lever having opposite plate-like sides stood edgewise in the plane of its swinging movement, said U-shaped contact member being secured at the free end of said lever and braced at its side by said opposite side members of the lever, and coöperating stationary contacts for engaging the opposite ends of said U-shaped movable contact member.

17. In an electric switch, a movable contact member having a U-shape form whose opposite ends constitute knife contacts, a pivoted lever having opposite plate-like sides stood edgewise in the plane of its swinging movement, said U-shaped contact member being secured at the free end of said lever and braced at its side by said opposite side members of the lever, and coöperating stationary contacts for engaging the opposite ends of said U-shaped movable contact member, the sides of said lever adjacent the end portions of said U-shaped movable contact member having obliquely flaring portions for wedging against said stationary contacts when the switch is closed.

18. In an electric switch, a brush contact composed of a plurality of superposed laminæ all of substantially the same length bent to U-shape, coöperating contact means for making and breaking contact therewith, the opposite ends of said U-shaped member being normally under tendency to move apart, and clamping means for holding them toward each other in opposition to said tendency.

19. In an electric switch, a brush contact composed of a plurality of superposed laminæ all of substantially the same length bent to U-shape, coöperating contact means for making and breaking contact therewith, the opposite ends of said U-shaped member being normally under tendency to move apart,

and adjustable clamping means for holding them toward each other in opposition to said tendency.

20. In an electric switch, a stationary U-shaped contact having its ends projecting outwardly, a coöperating movable U-shaped contact having its ends projecting toward the stationary contact to engage therewith, a carrying lever for said movable contact, a wide flat secondary contact spring mounted between the projecting ends of the stationary contact and extending diagonally forward beyond the latter, a secondary contact carried at the end of said spring, and a coöperating secondary contact carried by the free end of said lever.

21. In an electric switch, a stationary contact, a movable contact, a pivoted lever therefor, and an operating handle, said lever having separated plate-like sides, said movable contact having U shape for joining the free ends of said separated plate-like sides, said handle being fastened to said connecting movable contact for strengthening the latter and bracing said sides of the lever.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

CHARLES C. BADEAU.

Witnesses:

GEO. H. MAXWELL,

M. J. SPALDING.