

UNITED STATES PATENT OFFICE.

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SETTS.

CIRCUIT-BREAKER.

SPECIFICATION forming part of Letters Patent No. 756,782, dated April 5, 1904.

Original application filed June 20, 1901, Serial No. 65,241. Divided and this application filed December 10, 1903. Serial
No. 184,648. (No model.)

To all whom it may concern:

Be it known that I, LEONARD L. ELLEN, a
citizen of the United States, residing in Dor-
chester, in the county of Suffolk, in the State
of Massachusetts, have invented an Improve-
ment in Circuit-Breakers, of which the fol-
lowing description, in connection with the ac-
companying drawings, is a specification, like
characters on the drawings representing like
parts.

My present application relates to automatic
circuit-breakers, and is a division of my ap-
plication, Serial No. 65,241, filed June 20,
1901, where I have shown all the details of
the complete invention, the present case be-
ing restricted to one portion or feature thereof.

My invention relates to means for giving
certainty of operation and to means for auto-
matically tripping a plurality of circuit-break-
ers, said means including in one embodiment
of my invention mechanical connections be-
tween the several tripping mechanisms where-
by the automatic tripping of one operates the
others and also electrical connections respond-
ing to the automatic tripping of one of the cir-
cuit-breakers to trip the others and also re-
lates to a compound solenoid arrangement
wherein the solenoids and the armatures of a
plurality of circuit-breakers cooperate with
solenoids and circuit-closing mechanism of an
auxiliary circuit for automatically operating
the several circuit-breakers at the same time
any given circuit-breaker is operated by its
own mechanism, as will appear more at length
from the following description, in which I
have set forth the various constructional de-
tails and further advantages of one embodi-
ment of my invention, the latter being more
particularly defined in the appended claims.

In the drawings, Figure 1 is a perspective
view of the preferred form of my apparatus
viewing the same from the front. Fig. 2 is
a diagrammatic view showing the wiring and
also showing in side elevation details of the
operating mechanism.

It will be understood that I am not limited
to the constructional details of the particular

kind of circuit - breaker herein shown and
that the various novel features herein shown
and not claimed form the subjects-matter of
other copending applications, (serial No.
65,241, filed June 20, 1901, and Serial No.
183,457, filed December 2, 1903,) the appa-
ratus herein shown comprising a plurality of
circuit-breakers, two thereof being shown as
mounted upon a switchboard A, to be operated
either separately or together. These circuit-
breakers are of the automatic kind and are
shown as provided with actuators of the or-
dinary solenoid type, each consisting of a coil
in the main circuit liable to be affected by an
abnormal current, a coil b being shown at one
side of the upper circuit-breaker, carried by
a bracket b' on the switchboard and contain-
ing a suitable core b^2 , carrying at its lower
end a projection or plate-armature b^3 and
guided on rods b^4 . A similar coil b^5 is pro-
vided on the opposite side of said circuit-
breaker, and also a like pair of coils $b^{12} b^{13}$ are
similarly provided for the lower circuit-
breaker.

The wiring, as herein shown, comprises a
main wire 1, leading to a binding-post c and
thence to form the coil b , terminating at c' ,
whence a wire 2 leads to one side of a pair of
contacts a^{13} of the circuit-breaker, (see Fig. 2,) a wire 3 leading out from the other side there-
of. A wire 4 likewise leads to a binding-post,
(indicated at c^2 , Fig. 2,) then forms the coil
 b^5 , terminating at b^6 , whence a wire 5 connects
with a second set of contacts and out by a
wire 6.

As herein shown, the intermediate circuit-
wires 7 8 do not have any actuating coils or
solenoids for the reason that the illustration
which I have used for explaining my inven-
tion is supposed to be that of a three-phase
generator.

The cores b^2 of the coils of the lower circuit-
breaker are shown as each provided with a
pin or extension b^{10} , preferably removable, in
position beneath the armature b^3 of the coil
above it, so that if its coil b^{12} or b^{13} , as the case
may be, be suddenly energized, thereby rais-

ing the core thereof, the projection b^{10} of the latter will instantly raise mechanically the core above it, and thereby operate the upper circuit-breaker. For still greater certainty I
 5 prefer also to employ a separate battery-circuit for connecting the several breakers electrically, although for usual purposes either the electrical or mechanical connection will be sufficient. For this purpose I provide a
 10 battery or any other independent source of energy d and arrange pairs of independent contact-springs d' d'' on the switchboard, as shown at the upper left hand of Fig. 1 in perspective and shown adjacent the remaining
 15 coils diagrammatically, and connect the battery-circuit with these various contacts in multiple, (or it may be in series, if desired.)

Leading from each set of contacts is a shunt-circuit of fine wire which is wound underneath
 20 the coarse winding of the coil proper and is clearly shown at d^3 , Fig. 1, and then I connect these several shunt-windings in multiple by wires d^4 .

On each core b^2 I mount contact-makers d^5 ,
 25 separated by insulation, in position to engage the pairs of stationary contacts d' d'' . When, therefore, an accident occurs in any circuit of any one of the set of circuit-breakers which are connected together on the switchboard,
 30 (or it may be in any other situation or even at long distances apart,) the coil of that branch or wire of the circuit in which the accident occurs will instantly respond to the increasing current, thereby moving its core and auto-
 35 matically tripping its circuit-breaker, while at the same time the local or auxiliary battery-circuit or other circuit is made by the engagement of the contact-makers d^5 with the pairs of contacts d' d'' , thereby compelling the
 40 simultaneous breaking of all the circuits governed by all the circuit-breakers which may be coupled together or controlled by the mechanical or electrical connection (either near or remote) and also serving to compel cer-
 45 tainty of the operation in its own circuit-breaker. For example, suppose the disturbance is not sufficient to raise the lever a^{51} (of the circuit-breaker presently to be described in detail) quite enough or that said lever is
 50 broken or the armature b^3 is broken the independent battery-circuit will be closed, and thereby through its coil on the opposite side of the circuit-breaker will cause the breaker to operate from that side.

55 A brief description of the remaining features herein shown will be sufficient for the purposes of the present application.

Two circuit-breakers are herein shown, and as both are similar in construction therefore
 60 a description of one will suffice for both. The construction in general comprises a reciprocating rod or plunger a^{31} , normally held inwardly by a spring a^{34} and having at its rear end a slot a^{28} , in which is slidably mounted
 65 the free end a^{27} of a bell-crank a^{24} , pivoted at

a^{25} to a stationary part and pivoted at a^{23} to a link a^{21} , connected at its lower end at a^{22} to an insulating-bar a^{20} , provided with three sets of contact-makers a^{19} , corresponding to the con-
 70 tacts a^{13} below the same, from which lead the wires 2 3 5 6 7 8, as herein shown, from a three-phase generator or the wires of any other three circuits which may be interre-
 75 lated in such a manner that it is desirable to make and break the same simultaneously. At its outer end the rod or plunger a^{31} is connected at a^{41} to a swinging lever adapted to swing above and below a dead-center, said lever be-
 80 ing herein shown as a toggle consisting of opposite pairs of links a^{35} a^{36} , pivoted to each other at a^{37} , the pairs being connected together by a bridge a^{38} , said toggles being pivotally connected at a^{39} to brackets a^{40} and normally maintained with a downward tendency by
 85 springs a^{29} . The pivot-pin a^{41} extends across a slot a^{42} in the plunger a^{31} and is engaged by the upper end a^{43} of an actuating handle or lever a^{44} , pivoted at a^{45} to said brackets. The toggle is provided with laterally-extending
 90 pins a^{52} in position when the toggle is extended, as shown in Fig. 1, to engage, respectively, the upper eccentric side a^{53} of a device herein shown, for convenience, as a lever a^{54} , pivoted
 95 at a^{55} to the adjacent bracket a^{40} and preferably provided with an adjusting-screw a^{56} for regulating the normal height of the surface a^{53} , which engages the pin a^{52} and having a projecting end or arm a^{57} in position to be engaged and raised by any suitable automatic actuator.

In operation when a rise of current takes
 100 place in any wire it tends instantly to operate its coil—as, for instance, the coil b^{12} —thereby raising its core and armature into contact with the break-lever or tripping device a^{51} , and when the latter has been raised sufficiently to
 105 throw the toggle device over the dead-center the plunger a^{31} is instantly retracted by its spring a^{34} , thereby opening the circuit.

If the circuit-breaker operates a gang of
 110 circuits, they are all simultaneously broken, and so likewise the raising of the armature of the coil b^{12} serves simultaneously to lift the mechanical actuator b^{10} into lifting engage-
 115 ment with the superposed armature and brings also instantaneously to the aid thereof the auxiliary circuit by the closing thereof, due to the contact of the contact-makers d^5 with the pairs of contacts d' d'' , so that the shunt-coil of the upper coil b is operated, and this serves instantly to operate the upper cir-
 120 cuit-breaker. Of course when the separate circuit-breakers of the series which are connected together are located at considerable distances apart it is impracticable to employ the mechanical connection, and they must there-
 125 fore be coupled together electrically; but when possible I prefer to employ both to make more certain the operation of the whole device.

My construction of circuit-breaker makes
 130 it readily feasible to operate any number of

separate circuits by one circuit-breaker simply by extending the bar a^{20} and number of parts carried thereby, and while, as already explained, it would be unnecessary to have as many coils on the face of the switchboard as there were circuits, in case said circuits all led from a polyphase generator this would not be the case if said circuits were each from separate sources of supply, and in the latter case there would be an actuating-coil for each wire of each circuit, said coils being preferably arranged, as shown in Fig. 1, below each other in pairs, the top pair $b \ b^5$ serving to operate the breaker directly and being themselves operated by any one of the other coils below them in case an accident should occur in the circuit of any one of said lower coils.

When a gang of breakers are operated together or when a gang of distinct circuits are operated together, either by different breakers or by the same breaker, it is often desirable that part of them should then be thrown out of automatic operation together, and hence I provide in the circuits d^4 switches d^6 , which serve to cut out the separate shunt-coils of fine wire d^3 .

For further explanation of details and capabilities and advantages of my invention reference is had to the original specification, of which this is a division, as before stated, and while I intend that the features herein claimed shall not be limited to any particular form of circuit-breaker I have shown them in connection with a particular circuit-breaker which is not herein claimed, as it forms the subject-matter of claims in other copending applications.

In general it will be understood that I do not restrict myself to the precise mechanism herein described, as various modifications and rearrangements may be resorted to within the spirit of my invention.

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

1. A plurality of electric circuits, a circuit-breaker governing certain of said circuits, an actuator for said circuit-breaker, a solenoid in and operated by each circuit, said solenoids cooperating with said actuator to actuate the circuit-breaker, and connections responsive to the operation of one of said solenoids for automatically operating all of said solenoids.

2. A plurality of separate circuit-breakers, means for automatically tripping said respective breakers, mechanical connections between said several tripping mechanisms, whereby the automatic tripping of one operates the others, and auxiliary electrical connections responding to the automatic tripping of one of the breakers to trip the remaining circuit-breakers.

3. A circuit-breaker, comprising a plurality or circuit-wires, make-and-break contacts therefor, an operating member, a solenoid in

each of the circuits which are liable to be affected by an abnormal current, each solenoid controlling means cooperating with the operating member to actuate the circuit-breaker, and an independent circuit having windings on said solenoids, said independent circuit being operated by the energizing of any solenoid to cooperate with said solenoids to insure the actuating of said operating member.

4. A circuit-breaker, comprising a plurality of circuit-wires, make-and-break contacts therefor, an operating member, a solenoid in each of the wires which are liable to be affected by an abnormal current, an independent circuit, rendered operative by the energizing of any one of said solenoids, a second circuit-breaker, the circuits of said two circuit-breakers being interrelated, and means operated by said independent circuit for operating said second circuit-breaker at the same time the other circuit-breaker is operated.

5. A circuit-breaker, comprising a plurality of circuit-wires, make-and-break contacts therefor, an operating member, a solenoid in each of the wires which are liable to be affected by an abnormal current, an independent circuit, rendered operative by the energizing of any one of said solenoids, a solenoid in said circuit, means operated thereby for actuating said operating member, a second circuit-breaker, the circuits of said two circuit-breakers being interrelated, and means operated by said independent circuit for operating said second circuit-breaker at the same time the other circuit-breaker is operated.

6. A plurality of separate circuit-breakers, an actuator for each circuit-breaker, a plurality of electric circuits governed by said circuit-breakers, a solenoid in and operated by each circuit, said solenoids cooperating with said actuators to actuate the circuit-breakers, and an independent circuit having windings on said solenoids, said independent circuit being operated by the energizing of any solenoid to cooperate with the other solenoids in tripping all the circuit-breakers.

7. A plurality of separate circuit-breakers, a plurality of electric circuits governed thereby, a solenoid in each of the circuits which are liable to be affected by an abnormal current, automatic tripping mechanism actuated by said solenoids for tripping said respective circuit-breakers, an independent circuit rendered operative by the tripping of any one of the circuit-breakers, and means operated by said independent circuit for operating the remaining circuit-breakers at the same time the last-mentioned circuit-breaker is operated.

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

LEONARD L. ELDEN.

Witnesses:

GEO. H. MAXWELL,
J. ETHEL TARR.