No. 734,046. PATENTED JULY 21, 1903.

C. C. CHESNEY.

RETURN CURRENT CIRCUIT BREAKER.

APPLICATION FILED JULY 18, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

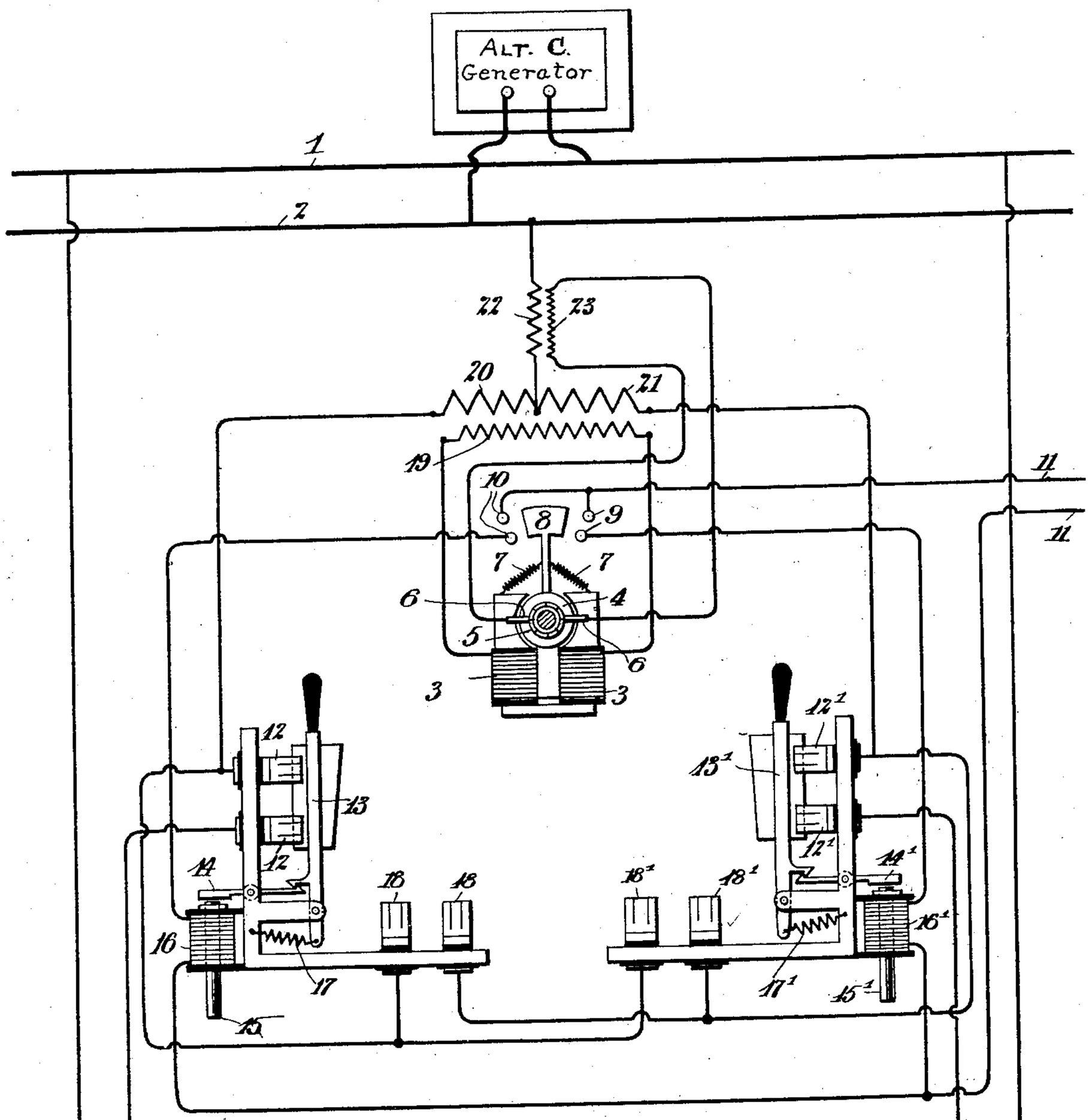

Fig. 1.

Witnesses
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By his Attorney R. C. Mitchell

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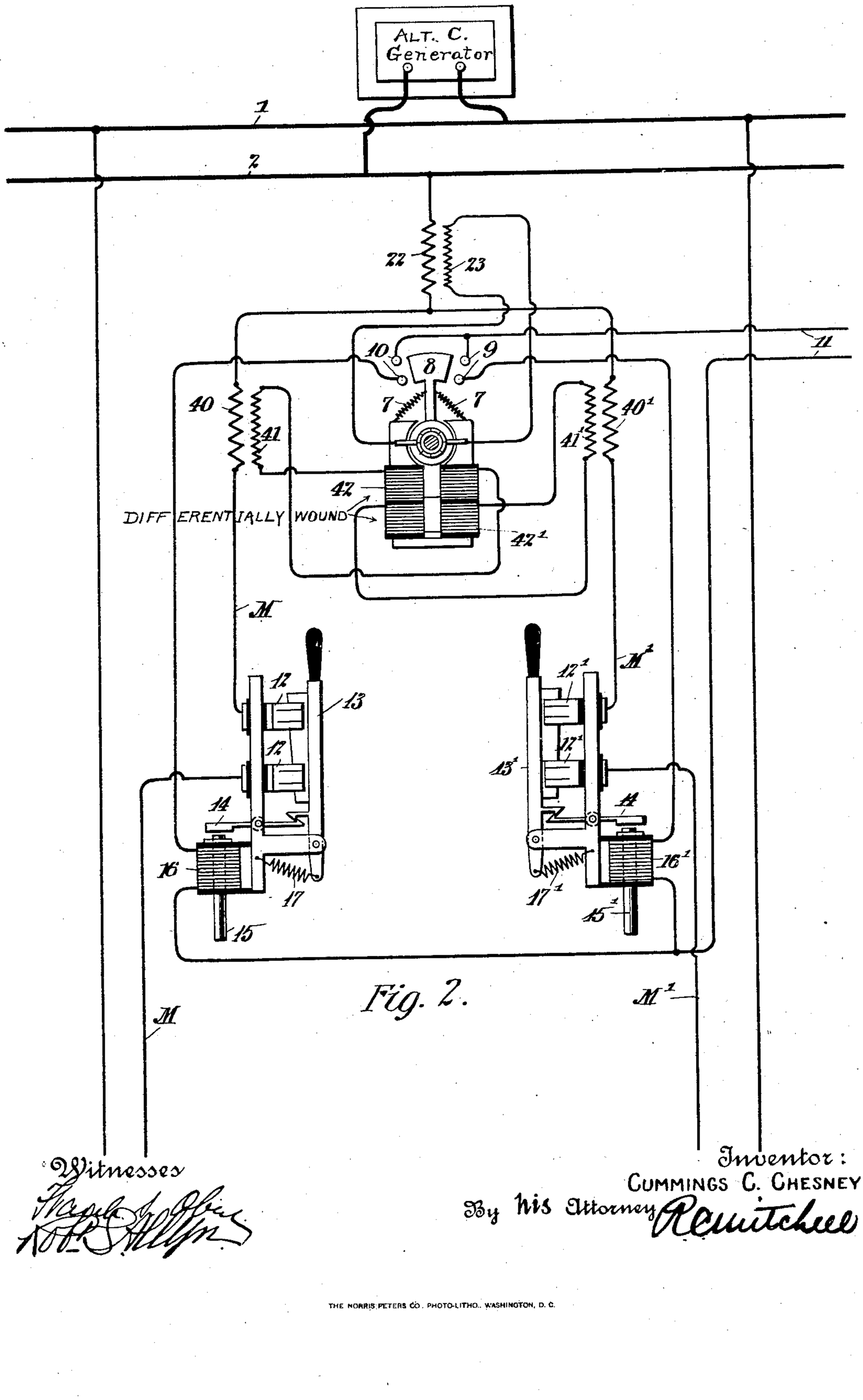

Fig. 2.

Witnesses

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UNITED STATES PATENT OFFICE.

CUMMINGS C. CHESNEY, OF PITTSFIELD, MASSACHUSETTS.

RETURN-CURRENT CIRCUIT-BREAKER.

SPECIFICATION forming part of Letters Patent No. 734,046, dated July 21, 1903.

Application filed July 18, 1902. Serial No. 116,012. (No model.)

To all whom it may concern:

Be it known that I, CUMMINGS C. CHESNEY, a citizen of the United States, residing at Pittsfield, Berkshire county, and State of Massachusetts, have invented certain new and useful Improvements in Return-Current Circuit-Breakers, of which the following is a full, clear, and exact description.

My invention relates to return-current circuit-breakers, and has for its object to produce a simple and effective apparatus particularly adapted for use on high-potential circuits. Return-current circuit-breakers heretofore have usually, if not always, required a potential transformer or a shunt-circuit and have therefore not been well adapted for high-potential systems. In my form, however, a mechanism is used which is entirely controlled by currents flowing in the main distribution-circuits and is entirely independent of the electromotive force upon the line.

Two embodiments of my apparatus are shown in the accompanying drawings, in which—

Figure 1 is a preferred form, and Fig. 2 a modification thereof.

Referring particularly to the drawings, M and M′ are the branches of two distribution-circuits connected to the bus-bars 1 2 of an alternating-current generator G. The present embodiment has a relay in the form of a motor having field-coils 3 3, an armature 4, and commutator 5, on which bear brushes 6 6. The armature is restrained from complete revolution by springs 7, connected to the arm 8, which terminates in a contact-piece adapted to engage with contacts 9 and 10, connected to the circuit 11, supplied with electric energy from any convenient source. In each of the mains M and M′ is a circuit-interrupting mechanism or switch, consisting, respectively, of the terminals 12 12 12′ 12′ and the arms 13 13′ for electrically connecting the same, thereby completing the connection between the bus-bar and the mains M M′, respectively. The arm 13 is held in contact with the terminals 12 by a detent 14, one end of which comes over the core 15 of the solenoid 16. The spring 17 acts to throw the arm 13 into a horizontal position when the detent 14 releases it. When in a horizontal position, it engages the contacts 18 18, one of which is electrically connected with the upper terminal 12 of one switch and the upper terminal 12′ of the other switch, with the result that when either arm 13 13′ is in engagement with the corresponding terminals 18 18′ the upper terminals of the two switches are electrically connected and any devices in the two mains between those terminals and their common point are thereby placed in parallel. The relay has its field energized by a secondary current due to electromotive force generated in the secondary coil 19, which is acted upon by the coils 20 and 21, said coils being so wound that when the currents in the two mains M and M′ are equal the effect of one counteracts the effect of the other. If, however, the current in the main M, for instance, reverses, the two coils 20 and 21 coact, so as to assist one another in producing an electromotive force in the coil 19, and thereby energizes the coils 3 3 of the field-magnet of the relay. Between the coils 20 and 21 a connection is made with the bus-bar 2. This connection has within it a transformer 22, whose secondary 23 is in series with the armature 4, thereby supplying it with the necessary amount of energy.

The action of the apparatus as a whole is thus: Under normal conditions the current flowing through the transformer 22 divides between the two mains M and M′, producing in the coils 20 and 20′ a differential effect such that they either neutralize each other completely or to such an extent as not to energize the relay so as to cause it to act. Suppose, however, that the current in the wire M is for any cause reversed. The coils 20 and 21 act together and a current is induced in the secondary 19. This current energizes the field of the relay, so that the armature being energized from the secondary 23 of the series transformer 22 the armature 4 immediately moves to the left, carrying with it the arm 8, which short-circuits the terminals 10. The solenoid 16 is thereupon energized by the current in the circuit 11 causing its core 15 to rise and unlatch the trigger 14. The switch-blade 13 is at once withdrawn from the contacts 12 12 by the spring 17, attached to its heel. Thus the circuit through the main M is opened. The switch-blade 13 in opening the circuit for contacts 12 12 closes

on contacts 18 18, connecting the coil 20 in parallel with the coil 21. Since these two coils neutralize each the effect of the other, the choking action due to the presence of either acting alone is thus eliminated. If the current is reversed in the conductor M′ instead of M, the relay short-circuits the contacts 9 9 and the switch-arm 13′ is released and acts in a corresponding manner.

In the other form of apparatus, Fig. 2, two separate transformers 40 and 40′ are placed in the mains M M′, their secondaries 41 41′ supplying circuit energizing coils 42 42′ upon the relay, said energizing-coils being wound so that under normal conditions the action of one opposes the action of the other. When the currents in the mains M and M′ are normal, the differential effect of the transformers 40 and 40′ upon the relay counteract each other and do not produce sufficient magnetization to cause the relay to operate. If, however, the current in one of the mains becomes reversed, the two transformers 40 and 40′ coact, so as to assist each other in energizing the relay, with the result that it operates to close the proper contacts for energizing the solenoid restraining the switch in the circuit, whose condition is abnormal, thereby releasing the latch and permitting the spring attached to the heel of the blade to withdraw the blade from its contacts and open the circuit.

My invention can be embodied in various other forms, and, as before stated, it is particularly adapted to high-potential systems.

What I claim is—

1. In a return-current circuit-breaker, two distribution-circuits, devices in series in the two circuits, a relay actuated by the cumulative effect of said devices and circuit-controlling mechanism operated by said relay when actuated by said cumulative effect and interrupting one of said circuits when its current becomes reversed.

2. In a return-current circuit-breaker, two distribution-circuits, induction-coils in series in the two circuits, a relay actuated by the cumulative effect of said induction-coils and circuit-controlling mechanism operated by said relay when actuated by said cumulative effect and interrupting one of said circuits when its current becomes reversed.

3. In a return-current circuit-breaker, two distributing-circuits, induction-coils having a common induced element and located in series in the two circuits respectively, a relay controlled by the differential and cumulative effects of said induction-coils and separate breaking mechanism interrupting one of said circuits when its current becomes abnormal.

4. The combination of two distribution-circuits, a relay having its exciting-coils energized by means which are in inductive relation to said distribution-circuits, means for substantially neutralizing the normal inductive effects of the two distribution-circuits upon said exciting-coils and a circuit-breaker operated by the movement of said relay.

5. The combination of two distribution-circuits, a circuit-breaker device in each circuit, and a relay movable to close a circuit to the actuating-coil of either circuit-breaker, said relay being normally deënergized by the differential effects of the currents in the two distribution-circuits and energized by the cumulative effects of the currents in the distribution-circuits when either is reversed to close the circuit to the coil of the circuit-breaker in the circuit carrying the reversed current.

6. The combination of two distribution-circuits, a circuit-breaker in one of said circuits, a relay for actuating the same, normally ineffective magnet-windings thereon, and means dependent upon the relative direction of current-flow in the two circuits for actuating said relay so as to interrupt the circuit in which the circuit-breaker is located in case its current becomes abnormally reversed.

7. The combination of two distribution-circuits, inducing-coils in each circuit, a relay, magnet-windings thereon for actuating the same, coils in such inductive relation to said inducing-coils and so connected to said magnet-windings as to energize the same and actuate the relay when the currents in the two circuits are in opposite directions, and a circuit-breaker in one of said distribution-circuits operated by the movement of the relay to interrupt that circuit when its current becomes abnormally reversed.

8. The combination of two distribution-circuits, inducing-coils in each circuit, a relay, magnet-windings thereon for actuating the same, coils in such inductive relation to said inducing-coils and so connected to said magnet-windings as to energize the same and actuate the relay when the currents in the two circuits are in opposite directions, a circuit-breaker in each circuit and a coil for opening each circuit-breaker, said relay closing a circuit to one or other of the circuit-breaker coils, according to the direction of movement of the relay so as to open the circuit carrying the reversed current.

9. The combination of a main circuit and two distribution-circuits, a conductor in series with both of said circuits, an induction device therein, a relay whose armature receives the current generated by said induction device, inducing-coils in each distribution-circuit, coils in such inductive relation to said inducing-coils and so connected to the magnet-windings of said relay as to energize the same and actuate the relay when the currents in the two circuits are in opposite directions, and a circuit-breaker operated by the movement of the relay.

10. In a return-current circuit-breaker, two distribution-circuits, devices in series in the two circuits, a relay actuated by the cumulative effect of said devices and circuit-control-

ling-mechanism operated by said relay and interrupting one of said circuits when its current becomes abnormal and connecting said devices in parallel in the other distribution-circuit.

11. In a return-current circuit-breaker, two distribution-circuits, induction-coils in series in the two circuits, a relay actuated by the cumulative effect of said induction-coils and circuit-controlling mechanism operated by said relay and interrupting one of said circuits when its current becomes abnormal, and means for connecting said induction-coils in parallel in the other distribution-circuit.

12. In a return-current circuit-breaker, two distributing-circuits, induction-coils having a common induced element and located in the two circuits respectively, a relay controlled by the differential and cumulative effects of said induction-coils and separate breaking mechanism interrupting one of said circuits when its current becomes abnormal, and means for automatically connecting the primaries of said induction-coils in parallel in the other distribution-circuit.

13. The combination of a main circuit and two distribution-circuits, two switches, permanent circuits between the two switches and connected to the distribution-circuits, each switch having one position closing one of the said distribution-circuits and a second position connecting it to the other switch and in series with the load of the distribution-circuit of said other switch, and a relay for controlling the position of either switch, said relay being controlled by the currents in said distribution-circuits.

14. The combination of a main circuit and two distribution-circuits, two switches, permanent circuits between the two switches and connected to the distribution-circuits, each switch having one position closing one of the said distribution-circuits and a second position connecting it to the other switch and in series with the load of the distribution-circuit of said other switch, a relay for controlling the position of either switch, magnet-windings on said relay for actuating the same, the current in said magnet-windings being controlled by the direction of currents in said distribution-circuits.

15. The combination of a main circuit and two distribution-circuits, two switches, permanent circuits between the two switches and connected to the distribution-circuits, each switch having one position closing one of the said distribution-circuits and a second position connecting it to the other switch and in series with the load of the distribution-circuit of said other switch, a relay for controlling the position of either switch, magnet-windings on said relay for actuating the same, coils in said distribution-circuits and coils in inductive relation thereto and connected to said magnet-windings.

16. The combination of a main circuit and two distribution-circuits, two switches, a permanent circuit between the two switches and connected to the distribution-circuits, each switch having one position closing one of the said distribution-circuits and a second position connecting it to the other switch and in series with the load of the distribution-circuit of said other switch, a relay for controlling the position of either switch, magnet-windings on said relay for actuating the same, coils in said distribution-circuits and coils in such inductive relation thereto and so connected to said magnet-windings as to operate one or other of said switches according to the direction of the currents in said permanent circuit.

17. The combination of a main circuit, a transformer, a connection between the center of the primary of said transformer and one of the main-circuit conductors, two distribution-circuits, corresponding leads of the two circuits being connected to the opposite terminals of said primary, a switch in each of said leads, a relay for controlling said switches and magnet-windings for actuating the relay connected to the secondary of said transformer.

18. The combination of a main circuit, a transformer, a connection between the center of the primary of said transformer and one of the main-circuit conductors, two distribution-circuits, corresponding leads of the two circuits being connected to the opposite terminals of said primary, a circuit-opening switch, a relay for actuating the same, and magnet-windings for actuating said relay connected to the secondary of said transformer.

19. The combination of a main circuit, a transformer, a connection between the center of the primary of said transformer and one of the main-circuit conductors, two distribution-circuits, corresponding leads of the two circuits being connected to the opposite terminals of said primary, two switches, permanent circuits between the two switches and connected to the distribution-circuits, each switch having one position closing the circuit of one of said leads and a second position opening one lead and connecting both switches in series with the load of one of the said circuits, a relay for controlling both of said switches, and magnet-windings for actuating the relay connected to the secondary of said transformer.

20. The combination of a main circuit, a transformer, a connection between the center of the primary of said transformer and one of the main-circuit conductors, two distribution-circuits, corresponding leads of the two circuits being connected to the opposite terminals of said primary, two switches, permanent circuits between the two switches and connected to the distribution-circuits, each switch having one position closing the circuit of one of said leads and a second position opening one lead and connecting both switches in series with the load of one of the said circuits, electromagnetic devices for changing the switches

from their normal position to their said second position, a circuit for said electromagnetic devices, a relay adapted to close said circuit to either electromagnetic device, and magnet-windings on said relay for actuating the same connected to the secondary of said transformer.

21. The combination of a main circuit, a transformer, a connection between the center of the primary of said transformer and one of the main-circuit conductors, two distribution-circuits, corresponding leads of the two circuits being connected to the opposite terminals of said primary, two switches, permanent circuits between the two switches and connected to the distribution-circuits, each switch having one position closing the circuit of one of said leads and a second position opening one lead and connecting both switches in series with the load of one of the said circuits, electromagnetic devices for changing the switches from their normal position to their said second position, a circuit for said electromagnetic devices, a relay adapted to close said circuit to either electromagnetic device, an armature-winding on said relay, whose current is controlled by the current in the connection between said transformer and the main circuit, and magnet-windings on said relay connected to the secondary of said transformer.

22. In a system of distribution, a return-current circuit-breaker consisting of two induction devices, each in series, respectively, with a distribution-circuit, a common return for said distribution-circuits connected at a point intermediate of said devices, an induction device in said common return, a relay actuated by the common-return induction device and the cumulative effect of the other induction devices and means actuated thereby for interrupting one of the circuits when its condition becomes abnormal.

23. In a system of distribution, a return-current circuit-breaker consisting of two induction devices, each in series, respectively, with one of two distribution-circuits, a common return for said distribution-circuits connected at a point intermediate of said devices, an induction device in said common return, a relay actuated by the common-return induction device and the cumulative effect of the other induction devices and means actuated thereby for interrupting one of the circuits when its condition becomes abnormal, and means for putting said two induction devices in parallel in the other distribution-circuit in case of such interruption.

Signed at Pittsfield, Massachusetts, this 15th day of July, 1902.

CUMMINGS C. CHESNEY.

Witnesses:

CHARLES E. DORR,

ARTHUR E. JENNEY.