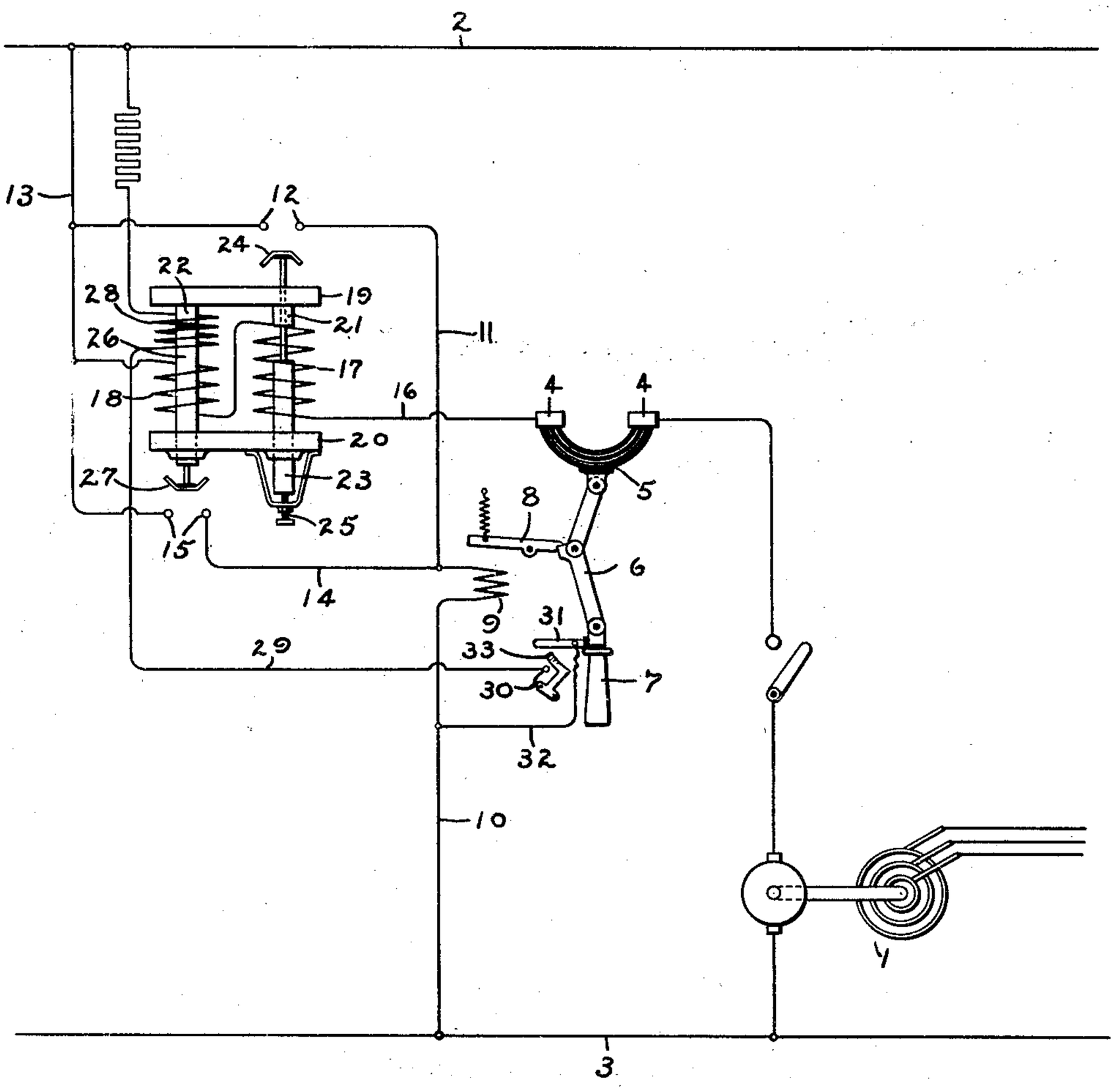
E. M. HEWLETT.

REVERSE CURRENT RELAY.

APPLICATION FILED SEPT. 17, 1907.

953,420. **Patented Mar. 29, 1910.**



WITNESSES:

Lester H. Fulmer.

J. Ellis Glen

INVENTOR

EDWARD M. HEWLETT.

BY Albert G. Davis

ATT'Y.

UNITED STATES PATENT OFFICE.

EDWARD M. HEWLETT, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

REVERSE-CURRENT RELAY.

953,420. Specification of Letters Patent. Patented Mar. 29, 1910.

Application filed September 17, 1907. Serial No. 393,380.

To all whom it may concern:

Be it known that I, EDWARD M. HEWLETT, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Reverse-Current Relays, of which the following is a specification.

My invention relates to tripping devices for opening an electric circuit when the direction of energy flow in the circuit is changed, and more particularly to a relay for opening a direct current circuit upon a reversal in the direction of flow of current in the circuit.

My invention is an improvement upon the device disclosed in Patent No. 630,539 granted to me on August 8, 1899, and the object of my invention is to provide a relay having a polarized armature coöperating with a series coil in which the armature is in the most effective position relative to the coil, in which the armature is very strongly polarized and quickly responsive to a reverse current, and which is, in general, an improvement on the devices of this kind heretofore used.

In carrying out my invention, I provide a coil connected in series in the circuit with a polarized movable core and thereby secure the maximum effect of the coil upon the polarized member of the device. A very strongly polarized armature is secured by making a hardened steel, movable armature, a part of a magnetic circuit common to two series coils, one preferably arranged to act as an overload coil when the current is in the normal direction, while upon the reversal of current both coils coöperate to overpower the polarized armature and cause it to move to open the circuit. The armature may be in any part of the magnetic circuit common to the two coils, but is preferably formed as a core for one coil and arranged to close a gap in the iron magnetic circuit of the overload coil, so that when the current is in the normal direction the core forms part of a closed magnetic circuit and is strongly polarized by the flux due to the conjoint action of the two series coils.

My invention will best be understood in connection with the accompanying drawing, which is merely an illustration of one embodiment of the invention, and which shows the invention applied to a rotary converter connected to a direct current circuit.

The drawing shows a rotary converter 1 connected to leads 2 and 3 of a direct current circuit through a circuit breaker having fixed contacts 4 coöperating with a bridging contact 5, which is moved into engagement with the fixed contacts 4 to close the circuit, by means of an actuating toggle 6 operated by means of a handle 7. The circuit breaker is held in the closed position by means of a pivoted latch 8, which engages the toggle 6. The latch may be moved to release the toggle 6 and permit the circuit breaker to open by means of a trip coil 9, energized from the direct current circuit through a lead 10, a lead 11 connected to one of a pair of contacts 12 separated by an air gap, and a lead 13 connected to the other contact, so that current from the direct current circuit flows through the trip coil when the gap between the contacts 12 is closed. A circuit may also be closed through the trip coil by means of a lead 14 and a pair of contacts 15 separated by a gap, which may be bridged by a conducting member. One of the fixed contacts 4 of the circuit breaker is connected through the rotary converter to the lead 3, while the other fixed contact is connected to the other lead 2 of the direct current circuit through the lead 16, a series coil 17 arranged to act as an overload coil, and a second series coil 18. Soft iron yokes 19 and 20 connect the corresponding ends of the series coils, which are so wound that they coöperate to produce a magnetic flux in their common closed magnetic circuit, of which the yokes are a part. Where the coils are arranged parallel to each other, as shown in the drawing, the windings are reversely connected. The yoke 19 is provided with projections 21 and 22, which form fixed cores extending into the coils 17 and 18. The coil 17 acts as an overload coil and has a movable core 23 carrying a bridging contact 24 arranged to bridge the gap between the contacts 12 upon the occurrence of an overload, and thereby close the circuit through the trip coil 9 and open the circuit breaker. The overload to which the trip responds may be varied by means of a calibrating screw 25 which engages the lower end of the core 23.

The common magnetic circuit for the two

coils formed by the yokes 19 and 20, the fixed core 21 and the movable core 23 of the overload coil, has a gap adjacent the series coil 18, which may be closed by a movable polarized armature of any suitable form, but preferably in the form of a core, as shown in the drawing, mounted to move longitudinally in the axis of the coil 18 and normally in engagement with the fixed core or projection 22 of the yoke 19. When the polarized armature or core 26 is in the normal position, as shown in the drawing, there is a closed magnetic circuit formed in the yokes 19 and 20 and the cores of the two coils, while the coils are so connected as to coöperate in producing a flux, which tends to polarize the core 26 and maintain it in the normal position. The armature or core 26 carries a bridging contact 27 arranged to close the gap between contacts 15, and thereby energizes the trip coil 9, when the core drops as a result of reversal of current.

The combined effects of the series coils 17 and 18 will ordinarily be amply sufficient to keep the core 26 polarized, but in order to make sure that this core will always be polarized in the proper direction, some suitable polarizing device may be used, preferably so arranged that it will polarize the core while the circuit breaker is either open or is being closed. The arrangement for this purpose shown in the drawing comprises a shunt coil 28 mounted upon the projection 22 of the yoke 19 co-axial with the series coil 18 and connected in shunt across the direct-current circuit by means of a lead 29 and a fixed contact 30 in the path of a wiping contact 31, mounted on and insulated from the handle 7, the wiping contact being connected to the lead 3 of the direct current circuit by means of a lead 32. A yielding guide 33 in the form of a spring blade may be provided, if necessary, to insure that the wiping contact 31 will pass over the fixed contact 30 and make proper engagement therewith.

The operation of the device is as follows:—When the current is flowing in the normal direction, the two series coils 17 and 18 coöperate to produce a flux in their common closed magnetic circuit formed by the yokes 19 and 20 and the cores of the series coils. This flux very strongly polarizes the armature or core 26, which remains in the normal position shown in the drawing. If the current in the circuit should reverse, the two coils cooperate to produce a flux in the opposite direction, which very quickly neutralizes the attraction of the fixed core 22 for the polarized armature or core 26, which thereupon drops, bridging the gap between the contacts 15 and energizing the trip coil 9, whereupon the circuit breaker is tripped and the circuit through the rotary converter is opened. When the handle 7 is moved to close the circuit breaker, the wiping contact 31 passes over the fixed contact 30, momentarily energizing the shunt coil 28, which polarizes the armature or core 26 in the proper direction and causes it to move to normal position. As soon as the circuit breaker is closed, current begins to flow through the two series coils, and if the direction of flow is normal, the two coils cooperate and very strongly polarize the armature or core 26; while if the current begins to flow in a reverse direction, the core 26 instantly drops and again opens the circuit breaker.

My invention may be embodied in many other forms than that shown and described, and I therefore do not wish to be limited to the precise form shown, 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 relay, the combination with a coil, of two armatures included in the magnetic circuit of said coil, one of said armatures being polarized and thereby rendered responsive to change in direction of current through said coil and the other armature being responsive only to excess current through said coil.

2. In a relay, the combination with a coil, of two armatures included in the magnetic circuit of said coil, one being responsive only to excess current through said coil and the other being polarized to cause said coil to attract it when current flows in one direction and to repel it when current flows in the other direction.

3. A relay comprising a coil, two armatures included in the magnetic circuit of said coil, one of said armatures being responsive only to excess current through said coil, and means for polarizing the other of said armatures and thereby causing said coil to attract it when current flows in one direction and to repel it when current flows in the other direction.

4. In a tripping mechanism for circuit breakers, the combination with two coils connected in series and having a common magnetic circuit, of an armature forming part of said magnetic circuit and responsive only to excess current through said coils, a polarized armature forming part of said magnetic circuit and responsive to change in direction of current through said coils and means actuated by either armature for tripping the circuit breaker.

5. In a tripping mechanism for circuit breakers, the combination with two coils connected in series and iron yokes separated by two air gaps and related to both of said coils to form a common open magnetic circuit, of an armature movable into position to close one gap in said magnetic circuit only in re-

sponse to excess current through said coil, a hardened steel armature for closing the other gap in said magnetic circuit in response to current in one direction through said coils, and means actuated by either of said armatures for tripping the circuit breaker.

6. In a tripping device for circuit breakers, the combination with two coils connected in series with the circuit breaker, of a polarized core for one of the coils forming part of a magnetic circuit common to both coils, and means for tripping the circuit breaker controlled by said core.

7. In a tripping device for circuit breakers, the combination with an overload coil connected in series with the circuit breaker and a second coil connected in series with the overload coil, of a polarized armature for the second coil forming part of the magnetic circuit of the overload coil, and means for tripping the circuit breaker by the movement of said armature.

8. In a tripping device for circuit breakers, the combination with two coils connected in series with the circuit breaker and having iron yokes in juxtaposition to corresponding ends of said coils, of a hardened steel armature for one of said coils arranged to form part of the magnetic circuit between said yokes, and means controlled by said armature to trip the breaker.

9. In a tripping device for circuit breakers, the combination with an overload coil and a second coil connected in series with the overload coil and the circuit breaker, of iron yokes in juxtaposition to corresponding ends of said coils, a core for said overload coil, and a polarized core for said second coil both slidably mounted in one of said yokes, and means for tripping the circuit breaker controlled by each of said cores.

In witness whereof, I have hereunto set my hand this 16th day of September, 1907.

EDWARD M. HEWLETT.

Witnesses:

BENJAMIN B. HULL,

H. L. ROCKWELL.