

E. B. WEDMORE & W. P. HAMLYN.
 REVERSE CURRENT RELAY.
 APPLICATION FILED JUNE 6, 1908.

1,060,724.

Patented May 6, 1913.
 2 SHEETS—SHEET 1.

Fig. 1.

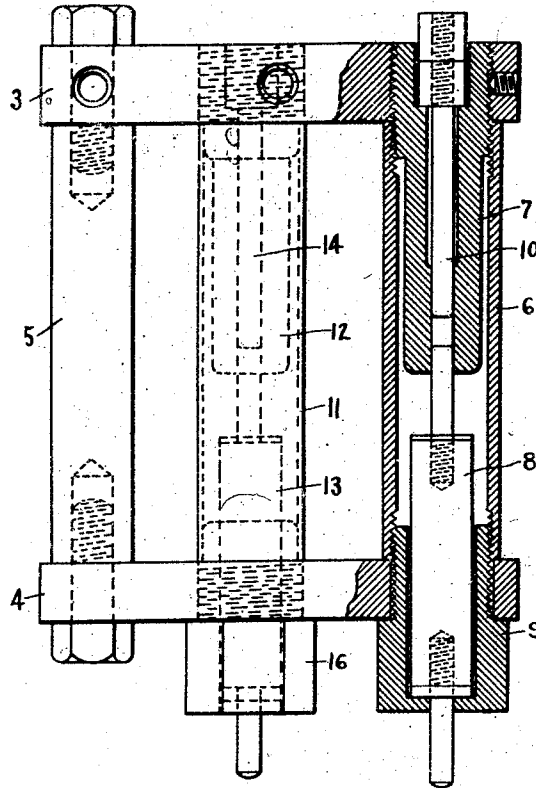
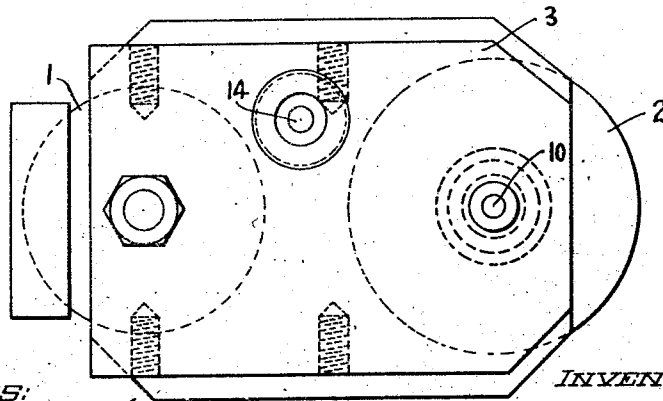


Fig. 2.



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2 SHEETS—SHEET 2.

Fig. 3.

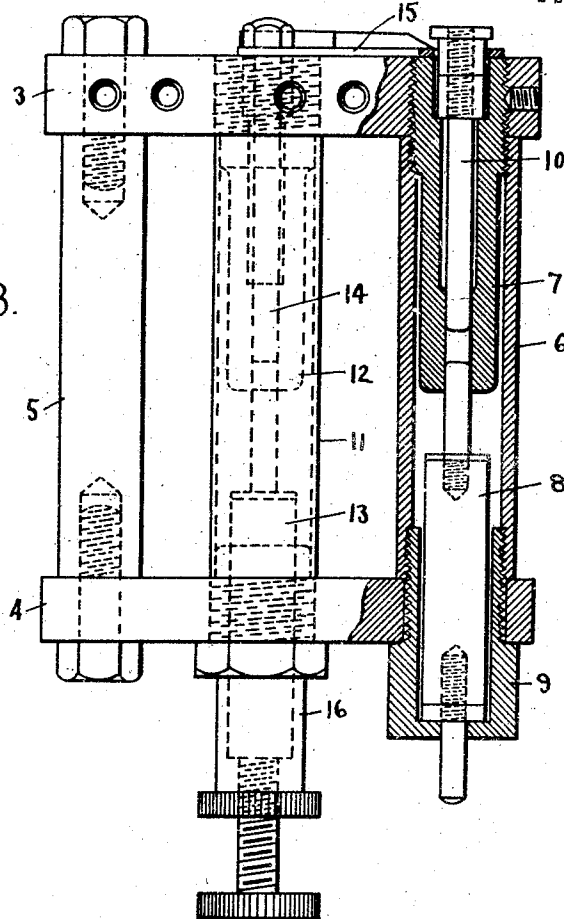
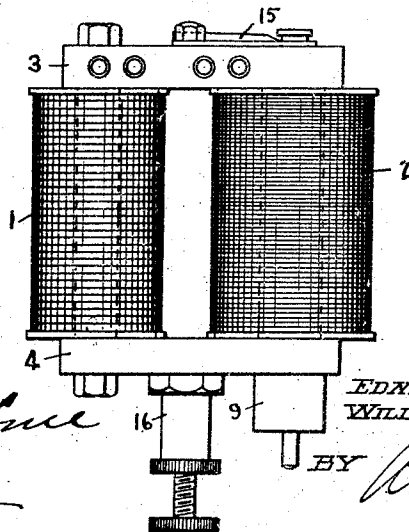


Fig. 4.



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UNITED STATES PATENT OFFICE.

EDMUND B. WEDMORE AND WILLIAM P. HAMLYN, OF RUGBY, ENGLAND, ASSIGNORS
TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

REVERSE-CURRENT RELAY.

1,060,724.

Specification of Letters Patent.

Patented May 6, 1913.

Application filed June 6, 1908. Serial No. 437,172.

To all whom it may concern:

Be it known that we, EDMUND B. WEDMORE and WILLIAM P. HAMLYN, subjects of the King of Great Britain, residing at Rugby, England, have invented certain new and useful Improvements in Reverse-Current Relays, of which the following is a specification.

Our invention relates to protective devices for automatically opening electric circuits on the occurrence of reverse energy flow, and particularly to devices of this type comprising a series and a potential coil differentially wound and cooperating to trip the circuit-breaker or automatic switch upon the occurrence of reverse energy flow, and also arranged to operate on overload.

In many cases it is desirable to have a protective device which will open the circuit automatically upon the occurrence of a very slight reverse energy flow, but which is not affected by an overload. In the differential coil protective devices heretofore used difficulty is encountered because on severe overloads without any reverse energy flow the series coil overpowers the potential coil and causes the device to operate, while during a short circuit the voltage drops and the sensitiveness of the device to reverse energy flow is very greatly reduced, on account of the series coil overpowering the weakened potential coil. It is also desirable in some cases to provide a device which will open on overload as well as on reverse energy flow, and in such cases the device should permit calibration of the overload independently of calibration for the reverse current and thereby prevent a change in calibration for overload causing an alteration in the sensitiveness of the device to reverse current.

The object of our invention is to provide a protective device which will respond instantly to a very slight reverse energy flow, which is not altered in sensitiveness by a heavy current through the series coil, and which when constructed to open on overload as well as on reverse energy flow can be calibrated to change the responsiveness to overload without affecting the sensitiveness to reverse energy flow.

In carrying out our invention we provide a series and a potential coil differentially wound and connected in the usual way and

having a tripping armature arranged to open the circuit-breaker or automatic switch when the relation of the currents through the two coils changes on account of reverse energy flow. The tripping armature is shielded from the influence of an abnormal current through the series coil by some protective means which is actuated by the abnormal current to complete a magnetic circuit of low reluctance around the tripping armature, thereby shunting the magnetic flux due to the abnormal current in the series coil past the tripping armature and shielding it from said flux. The means for shunting a portion of the magnetic flux from the tripping armature may assume various forms, but is preferably made in the form of a movable armature, such as the core commonly used with tripping coils, arranged to respond to abnormal current through the overload coil and establish a closed path of iron for the flux of the series coil. The device is preferably rendered responsive to overload by connecting the means for shunting the tripping armature to the latch of the circuit-breaker, whereby an overload through the series coil which causes the magnetic shunt to become operative likewise trips the circuit-breaker and opens the circuit. Since the tripping armature responds only to reverse current flow and the means for shunting the tripping armature responds only to overload, and each may be calibrated independently of the other, the sensitiveness of the device to overload and to reverse energy flow may be varied in any desired manner.

Our invention will best be understood in connection with the accompanying drawings, which are merely illustrative of one of the many forms in which the invention may be embodied, and in which—

Figure 1 is an elevation of the magnetic circuit with the core of the potential coil in section; Fig. 2 is a plan view of the device shown in Fig. 1; Fig. 3 is a view similar to Fig. 1 but showing the device arranged to respond to overload as well as to reverse current; and Fig. 4 is a view in elevation of the device shown in Fig. 3 with the series and potential coil in position.

In the form of device shown in the drawings, the series coil 1 and the potential coil 2 have a common magnetic circuit comprising iron plates or yokes 3 and 4 held in

proper relation to each other by a distance piece 5 forming the core of the series coil and a tube 6 of non-magnetic material on which the potential coil is wound. The tube 6 is secured to the yoke 3 by means of a stationary pole piece or core 7 threaded into the tube and into the yoke and cooperating with a movable core or tripping armature 8 supported in the tube 6 on a support 9, which is threaded into the tube and into the yoke 4. Since the tripping armature 8 is included in the common magnetic circuit of the two coils a definite amount of magnetic flux, due either to the series coil alone or to the combined effect of both coils, will cause the armature to rise into engagement with the fixed pole piece or core 7 and actuate a tripping pin 10 slidably mounted in the stationary pole piece 7 in a position to be engaged by the tripping armature. The tripping pin may open the circuit in any desired manner, either by engaging the latch of a circuit-breaker or by closing the circuit of the trip coil of an automatic switch.

The device so far described constitutes a reverse current relay of the ordinary type, and the effect of abnormal current through the series coil of the tripping armature 8 is avoided by providing means for establishing a magnetic path of low reluctance between the yokes 3 and 4 when the current through the series coil exceeds a predetermined limit, thereby causing the magnetic flux of the series coil to pass through the path of low reluctance instead of through the tripping armature. Various forms of magnetic shunt may be used but the preferred form is that shown in the drawings, in which a tube 11 connects the two yokes and carries at the upper end a stationary pole piece, or core 12 with which cooperates a movable core or shunting armature 13 slidably mounted in the tube and extending through the yoke 4. When the pole piece 12 and the shunting armature 13 are in engagement the greater portion of the flux due to the series coil passes through them, and is thereby shunted from the tripping armature 8. The parts are so proportioned that under normal conditions the shunting armature 13 is in the position shown in Fig. 1 while upon the occurrence of an abnormal current in the series coil, the shunting armature moves into engagement with the pole piece 12, thereby shielding the tripping armature and preventing the opening of the circuit due to overload.

If it is desired to provide a device which will open on overload as well as on reverse energy flow, the shunting armature is made an overload armature by providing the pole piece 12 with a tripping pin 14 which opens the circuit in any suitable way, preferably through the tripping pin 10, to which it is

connected by any suitable interlock, such as the bar 15. The shunting armature 13 is provided with a calibrating stop 16 to vary the amount of overload required to actuate it. The operation of this form of the device is substantially the same as that shown in Fig. 1 except that the movement of the shunting armature 13, due to overload on the series coil, causes the circuit to be opened. Since the position of the shunting armature 13 with relation to the core 12 may be varied independently of armature 8 and core 7, the device can be calibrated for any desired overload without in any way affecting its sensitiveness in responding to reverse energy flow.

Our invention may be embodied in many other forms than that shown and described, and we therefore do not wish to be restricted to the exact form shown but intend to cover by the appended claims all changes and modifications within the spirit and scope of our invention.

What we claim as new and desire to secure by Letters Patent of the United States, is:—

1. In a protective device for electric circuits, the combination with two coils and a tripping armature movable into tripping position in response to the magnetic flux of said coils, of means responsive to abnormal magnetic flux from one of said coils for shunting part of the flux from said tripping armature to prevent the tripping of said armature thereby.

2. In a protective device for electric circuits, the combination with a potential coil and a series coil differentially wound with respect to each other in the normal operation of the system, a tripping armature movable into tripping position in response to a combined magnetic flux of both of said coils, and means responsive to abnormal current in said series coil for shunting part of the magnetic flux from said tripping armature.

3. In a protective device for electric circuits, the combination with differentially wound potential and series coils having a common magnetic circuit and a tripping armature forming part of said magnetic circuit, of a shunting armature actuated by said series coil to divert part of the magnetic flux of said series coil from said tripping armature.

4. In a protective device for electric circuits, the combination with differentially wound series and potential coils having a common magnetic circuit, of a movable core for said potential coil forming part of said magnetic circuit, and an armature actuated by abnormal current in said series coil to complete a magnetic circuit of low reluctance independent of said core, thereby shunting part of the magnetic flux from said core.

5. In a protective device for electric cir-

5 cuits, the combination with differentially wound coils having a common magnetic circuit, of two armatures forming part of said magnetic circuit, one arranged to shunt part of the magnetic flux of said circuit from the other, and means actuated by either of said armatures to open the circuit to be protected.

10 - 6. In a protective device for electric circuits, the combination with differentially wound series and potential coils having a common magnetic flux, of two independent armatures responsive to the magnetic flux

in said magnetic circuit and one arranged to shunt said flux from the other, means for adjusting each armature independently of the other, and means actuated by either of said armatures to open the circuit to be protected.

In witness whereof, we have hereunto set our hands this 25th day of May, 1908.

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WILLIAM P. HAMLYN.

Witnesses:

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