Oct. 18, 1927. 1,646,219

W. W. SCHILLING

RELAY

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Fig. 1.

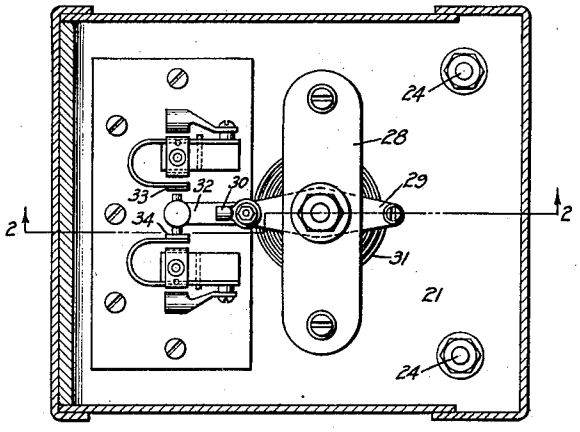


Fig. 2.

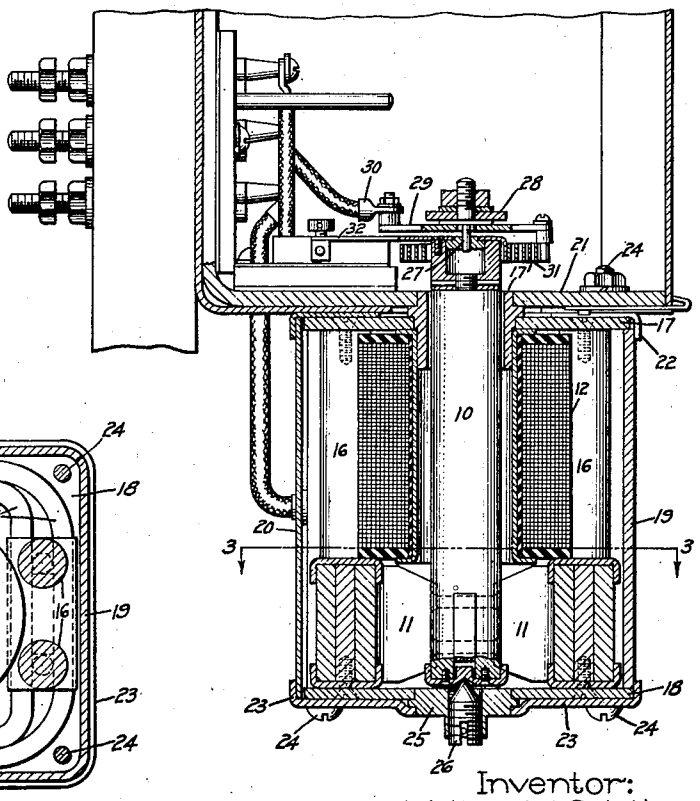
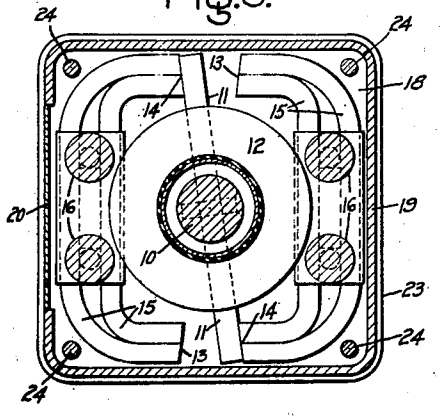


Fig. 3.



Inventor:
Walter W. Schilling,
by [signature]
His Attorney.

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Fig. 4.

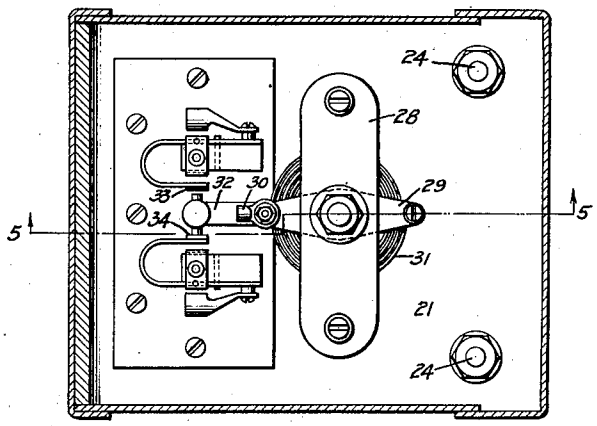


Fig. 5.

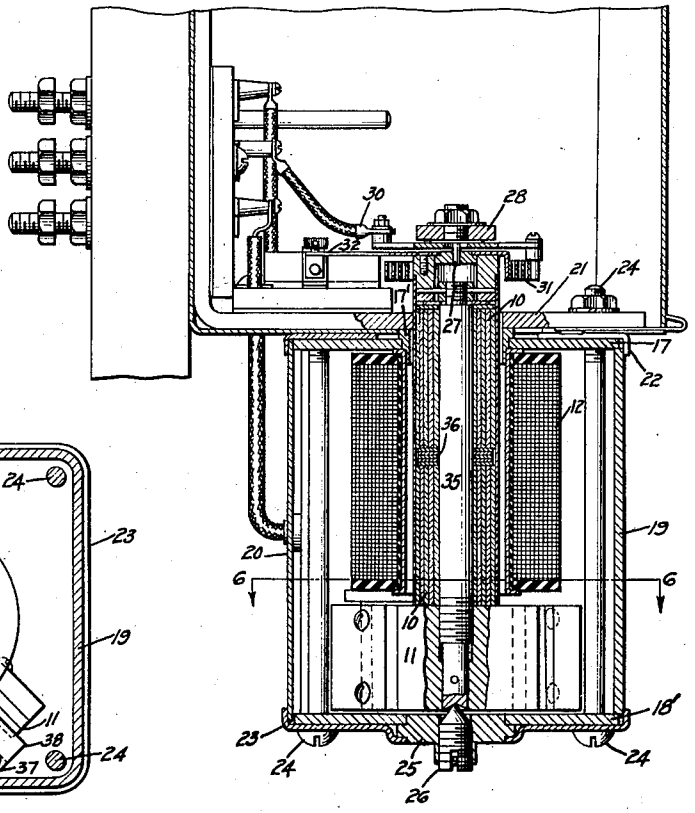
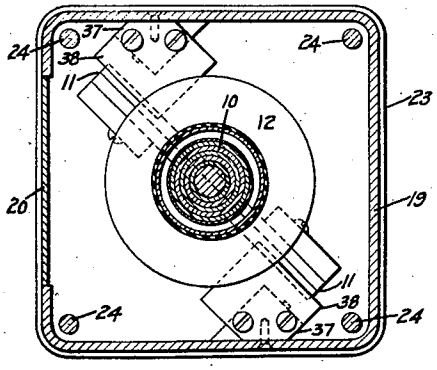


Fig. 6.



Inventor:
Walter W. Schilling,
by Alexander S. Lunt
His Attorney.

Patented Oct. 18, 1927. 1,646,219

UNITED STATES PATENT OFFICE.

WALTER W. SCHILLING, OF SCOTIA, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

RELAY.

Application filed November 4, 1925. Serial No. 66,882.

My invention relates to improvements in relays and more particularly to improvements in protective relays for controlling electric systems and apparatus in response to abnormal circuit conditions and an object of my invention is to provide a relatively economical and yet very sensitively responsive relay, the operation of which is not impaired by external or stray magnetic fields and which is adapted to function in conformance with a predetermined value or direction of current or voltage or both.

My invention will be better understood from the following description taken in connection with the accompanying drawings and its scope will be pointed out in the appended claims.

In the accompanying drawings, Fig. 1 is a plan view of a relay embodying my invention; Fig. 2 is a sectional view on the line 2—2 of Fig. 1; Fig. 3 is a sectional view on the line 3—3 of Fig. 2; Fig. 4 is a plan view of a modification embodying my invention; Fig. 5 is a sectional view on the line 5—5 of Fig. 4; and Fig. 6 is a sectional view on the line 6—6 of Fig. 5.

The relay shown in Figs. 1, 2 and 3 comprises a rotatably mounted armature which has two magnetic portions 10 and 11 and which is arranged to be polarized by an energizing winding 12 around the portion 10. The armature may have the shape of an inverted T with the two portions 10 and 11 relatively fixed and substantially perpendicular and constituting respectively the stem and the cross of the T, that is one portion is substantially perpendicular to the other portion at an intermediate point thereof.

Cooperating with the armature to control the position thereof in accordance with the direction of the current in the winding 12 is a magnetic circuit having a plurality of pairs of opposed polar projections 13, 14 which are arranged in the path of movement of the armature portion 11. The polarities of each pair of projections, between which the ends of the armature portion 11 are positioned, are definite and unlike and the projections may be the poles of permanent magnets 15 or of definitely polarized electromagnets. The magnetic circuit of the armature 10—11 comprises the armature portion 10 from which the circuit divides into two parallel paths through the halves of the armature portion 11, the permanent magnets 15, magnetic tie members 16 secured to the permanent magnets, a magnetic top plate 17 secured to the members 16 and a magnetic pole piece or bushing 17′.

In order that the sensitivity of the operation of the relay may not be impaired by external or stray magnetic fields, the armature 10—11, the winding 12, the permanent magnets 15 and the magnetic tie members 16 are surrounded by or housed within a magnetic shell comprising the top magnetic plate 17, a bottom magnetic plate 18 and side magnetic plates 19 and 20. These are secured together and to a contact housing base 21 by top and bottom clamping plates 22 and 23 respectively, which may be brass, and bolts 24.

In order that the position of the armature can be adjusted vertically, there is provided an adjustable bearing comprising a bearing support 25 which is held between the bottom magnetic plate 18 and bottom clamping plate 23 and which carries an adjustable bearing member or pivot such as a pointed screw 26. The upper end of the armature portion 10 is pivoted on a pin 27 which is carried by a supporting plate 28 mounted above and secured to the contact housing base 21. The plate 28 also serves to support a terminal plate 29 to one end of which is secured a terminal 30 and to the other end of which is secured one end of an armature biasing means such as a torsion spring 31 which has its other end secured to a movable contact 32 mounted on the upper end of the armature portion 10. Adjustment of the spring torque may be effected by varying the angularity between the terminal plate 29 and the supporting plate 28. The contact 32 is movable between two relatively stationary contacts 33 and 34, so as to control two circuits in accordance with the position of the armature.

Referring now particularly to Fig. 3 and assuming that the polar projections 13 and 14 of the permanent magnets are respectively south and north poles and that the winding 12 is energized by a direct current whose direction is such as to make the ends of the armature portion 11 of north polarity, then the armature 10—11 will be moved from the position shown to a position in which the ends of the armature portion 11 engage the

polar projections 13 and the contact 32 engages the contact 33. The spring 31 is stressed and tends to turn the armature 10—11 to the position shown in Fig. 3, that is in such a direction as to cause contact 32 to engage contact 34. If now, the direction of the current in the winding 12 changes, the polarity of the ends of the armature portion 11 will change from north to south, since the fluxes in the parallel branches of the armature magnetic circuit change in direction. Therefore, the ends of the armature portion 11 will be attracted by the north polar projections of the permanent magnets 15 and the armature is moved to the position shown in Figs. 1, 2 and 3. The ends of the armature portion 11 engage the polar projections 14 and contact 32 is moved from engagement with contact 33 to engagement with contact 34. The spring 31, of course, assists in this movement and may even be initially stressed enough so that the armature 10—11 will be actuated to move contact 32 from the contact 33 to the contact 34 on a decrease in current, without reversal, in the coil 12 and vice versa when the current increases sufficiently to overcome the spring 31. Therefore, if the coil 12 is connected in series relation with a circuit, the relay will respond to an increase, decrease or reversal of current, and if connected in shunt relation with a circuit to an increase, decrease, or reversal in voltage.

The embodiment of my invention shown in Figs. 4, 5 and 6 is in general similar to the relay shown in Figs. 1, 2 and 3 but represents a modification intended for use in connection with alternating current circuits to respond to an increase or decrease in current or voltage. Consequently the permanent magnets are omitted and the armature 10—11 is somewhat modified although the T-shape and the pivot arrangement heretofore described are retained. The upright portion 10 of the armature as shown comprises two sections of magnetic material, which in order to avoid eddy currents, are rolled in the form of a cylinder and mounted on a center 35. This provides in effect a laminated magnetic structure. Although two sections separated by a short section 36 of non-magnetic material to increase the reluctance are shown, one long section may be used.

In this relay, pole pieces 37 are mounted on the magnetic side plate 19 in the path of movement of the ends of the armature portion 11. The magnetic circuit of the armature 10—11 comprises the armature portion 10 from which the circuit divides into two parallel paths through the halves of the armature portion 11, the poles 37, the magnetic side plates 19 and 20, the magnetic top plate 17 and the pole piece or bushing 17'. In order to have a definite minimum range between the pick up and drop out values of current in the winding 12, the poles 37 are provided with overhanging or projecting portions 38 for shading the flux into the ends of the armature portion 11. The bottom plate 18' is non-magnetic in this relay so as to cause the fluxes to go through the pole pieces 37 to the armature 10—11 instead of directly.

Assuming that there is no current in the winding 12, the armature 10—11 under the bias of the spring 31 will take the position shown in Fig. 6. As the current in the winding increases up to some predetermined value sufficient to overcome the bias of the spring, the armature will be attracted by the poles 37 and move clockwise, thereby causing contact 32 to leave contact 34 and engage contact 33. Upon a decrease in the current to such a value that the spring 31 again predominates, the armature 10—11 will be returned to the position shown with contact 32 engaging contact 34. Therefore if the coil 12 is connected in series relation with a circuit, the relay will respond to an increase or decrease in current and if connected in shunt relation, to an increase or decrease in voltage.

While I have shown and described my invention in considerable detail, I do not desire to be limited to the exact arrangements shown, but seek to cover in the appended claims all those modifications that fall within the true spirit and scope of my invention.

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

1. A relay comprising a magnetic circuit having a plurality of pairs of opposed polar projections, the polarities of the projections of each pair being definite and unlike, an armature comprising two magnetic portions substantially perpendicular to each other, the ends of one portion being positioned between the polar projections of respective pairs thereof and the armature being mounted for rotation about the other portion, and an energizing winding around said other portion for polarizing the armature, the construction and arrangement of parts being such that when said winding is energized the armature assumes a position relative to like polar projections of said magnetic circuit in accordance with the direction of the current in the winding.

2. A relay comprising a magnetic circuit having a plurality of pairs of opposed polar projections, and armature comprising two magnetic portions, one of said portions being positioned between the polar projections of respective pairs thereof, and the armature being mounted for rotation about the other portion, and an energizing winding around said other portion for polarizing the

armature, the construction and arrangement of parts being such that when the winding is energized the armature assumes a position relative to like polar projections of said magnetic circuit in accordance with the direction of the current in the winding.

3. A relay comprising a magnetic circuit having a plurality of pairs of opposed polar projections, an armature comprising two magnetic portions substantially perpendicular to each other, one of said portions being positioned between the polar projections of respective pairs thereof and the armature being mounted for rotation about the other portion, an energizing winding for the armature around said other portion thereof, and a shell of magnetic material surrounding the magnetic circuit, the armature and the winding.

4. A relay comprising an armature having two magnetic portions, one portion being substantially perpendicular to the other portion at an intermediate point thereof and said armature being mounted for rotation about said one portion, an energizing winding for said armature around said one portion thereof, and a magnetic circuit having a plurality of polar projections arranged in the path of movement of the other armature portion.

5. A relay comprising a magnetic circuit having a plurality of polar projections, an armature having two magnetic portions, one portion being substantially perpendicular to the other portion at an intermediate point thereof and said other portion being positioned between said polar projections, said armature being mounted for movement about said one portion, and an energizing winding for the armature around said one portion thereof.

6. A relay comprising a T-shaped armature rotatable about the axis of the stem of the T, a magnetic circuit comprising a plurality of polar projections arranged in the path of movement of the cross of the T, and an energizing winding for the magnetic circuit and the armature around the stem of the T.

7. A relay comprising an inverted T-shaped armature rotatable about the axis of the stem of the T, a magnetic circuit comprising a plurality of spaced polar projections arranged in the path of movement of the cross of the T, and an energizing winding for the magnetic circuit and the armature around the stem of the T.

8. A relay comprising an armature having two relatively fixed magnetic portions substantially perpendicular to each other, said armature being mounted for rotation about one of said portions, an energizing winding for the armature around said one portion thereof, a magnetic circuit having a plurality of polar projections arranged in the path of movement of the other armature portion, and a magnetic shell surrounding the magnetic circuit, the armature and the winding.

In witness whereof, I have hereunto set my hand this 3d day of November, 1925.

WALTER W. SCHILLING