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ELECTRICAL RELAY

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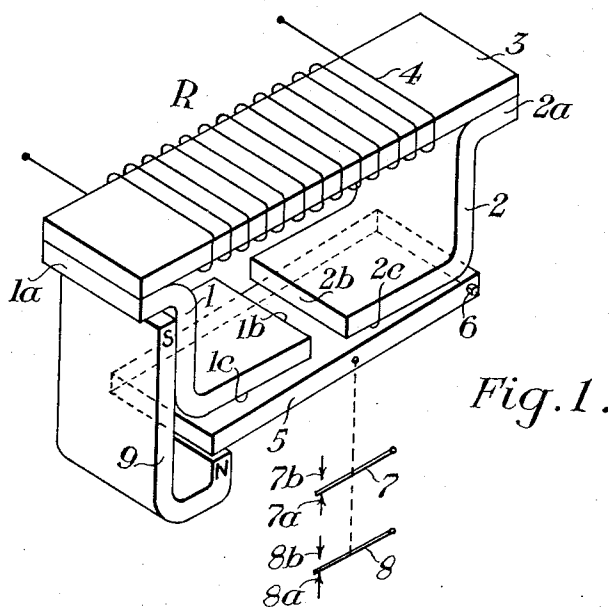


Fig.1.

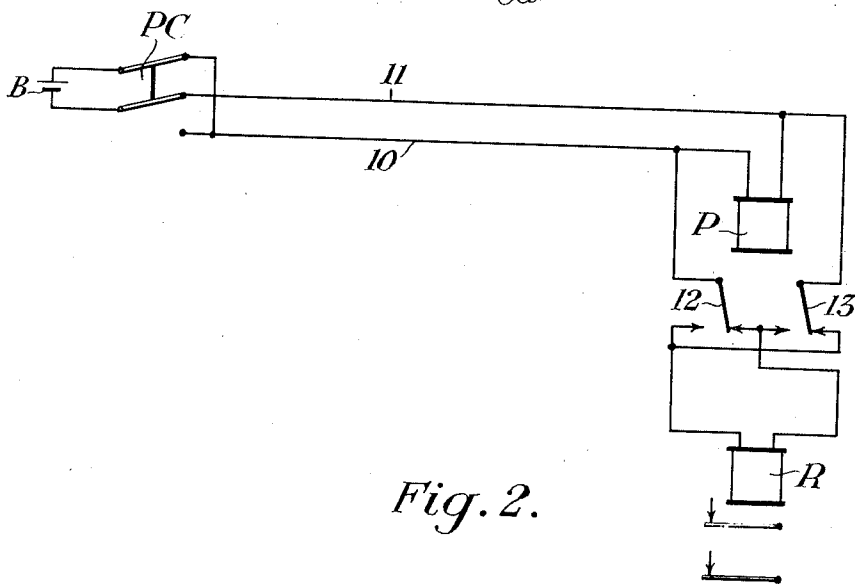


Fig. 2.

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ELECTRICAL RELAY

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Application March 5, 1938, Serial No. 194,160

1 Claim. (Cl. 175—339)

My invention relates to electrical relays, and particularly to electrical relays which are intended to be operated on direct current.

One object of my invention is to provide a relay of the type described which will pick up its armature when the relay is supplied with current of one relative polarity, but not when it is supplied with current of the opposite relative polarity.

Another object of my invention is to provide a relay of the type described in which the back contacts of the relay are prevented from bouncing open due to vibration or shock when the relay is deenergized.

A further object of my invention is to accomplish the two aforementioned objects by the addition, to a relay of the usual and well-known type, of a single permanent magnet.

Relays embodying my invention are an improvement on the relay described and claimed in an application for Letters Patent of the United States, Serial No. 146,997, filed by Branko Lazich on June 8, 1937, for Electrical relays.

I shall describe one form of electrical relays embodying my invention, and one circuit in which relays of this type are adapted to be used, and shall then point out the novel features thereof in claims.

In the accompanying drawing, Fig. 1 is a view, partly in isometric projection, and partly diagrammatic, showing one form of relay embodying my invention. Fig. 2 is a diagrammatic view showing one form of circuit in which the relay shown in Fig. 1 is adapted to be used.

Similar reference characters refer to similar parts in both views.

Referring first to Fig. 1, the relay, which is designated as a whole by the reference character R, comprises an electromagnet consisting of two magnetizable pole pieces 1 and 2 provided at their upper ends with outwardly extending portions 1a and 2a, respectively, and at their lower ends with inwardly extending portions 1b and 2b, respectively. The outwardly extending portions 1a and 2a are connected by a backstrap 3, and mounted on this backstrap is an energizing winding 4. The portions 1b and 2b of the pole pieces have their lower or pole faces 1c and 2c ground to lie in the same plane.

The relay also comprises a magnetizable armature 5 which is pivotally mounted adjacent one end at point 6 for swinging movement toward and away from the pole faces 1c and 2c of the pole pieces 1 and 2. The armature 5 is operatively connected with a plurality of contact fingers 7 and 8, shown diagrammatically in the

drawing, in such manner that, when the armature is swung away from the pole pieces 1 and 2, the fingers 7 and 8 will engage fixed back contact members 7a and 8a, respectively, to close back contacts 7—7a and 8—8a, but that, when the armature is swung toward the pole pieces, the contact fingers will then move out of engagement with the back contact members and into engagement with fixed front contact members 7b and 8b, to open the back contacts and close front contacts 7—7b and 8—8b, respectively. The physical structure of the contact fingers and associated fixed contact members, and the means for connecting the fingers with the armature 5, form no part of my present invention and may be similar to that shown in the Lazich application referred to hereinbefore.

The relay further comprises an L-shaped permanent magnet 9 which is secured at one end to the pole piece 1, and the other end of which extends underneath the armature 5 opposite the pole face 1c of the pole piece 1 in such manner that, when the armature 5 is swung away from the pole pieces 1 and 2, it will be swung toward the permanent magnet, and vice versa. In actual practice, the armature 5 will be prevented from actually touching the pole pieces 1 and 2, or the permanent magnet, by suitable non-magnetic stops or core pins not shown in the drawing.

Assuming that the lower end of the permanent magnet 9 is a north magnetic pole and the upper end a south magnetic pole, as indicated by the letters N and S in the drawing, the operation of the relay is as follows: When the winding 4 is deenergized, the neutral armature will drop, under the influence of gravity, to the position shown so that the back contacts 7—7a and 8—8a will be closed, and under these conditions, a part of the flux from the permanent magnet will pass lengthwise through the armature and will exert on the armature a torque which assists the pull of gravity in holding the back contacts closed. The parts are so proportioned that this torque, together with the force of gravity, will be sufficient to prevent the back contacts from bouncing open even though the relay is subjected to considerable shock or vibration.

I shall now assume that the winding 4 is energized in such manner that the pole piece 1 becomes a south pole and the pole piece 2 becomes a north pole. Under these conditions, the permanent magnet and electromagnet fluxes will buck each other in the armature 5, and as the electromagnet flux builds up in the armature, a point will be reached at which the upward pull

exerted on the armature by this flux will exceed the downward pull due to the permanent magnet flux and the force of gravity, and when this happens, the armature 5 will swing toward the pole pieces 1 and 2 to thereby open the back contacts 7—7a and 8—8a and to close the front contacts 7—7b and 8—8b.

If, when the armature occupies its released position, the winding 4 is energized in such manner that the pole piece 1 becomes a north pole and the pole piece 2 becomes a south pole, the flux due to both the electromagnet and the permanent magnet will then thread the armature in the same direction and under these conditions the armature 5 will remain in the position shown even though the energization of the winding 4 is increased to many times its normal value. For example, tests made on a relay which was constructed in accordance with my invention, and which was designed to operate at 10 volts when current of the proper polarity was supplied to the winding 4, indicated that the relay would not pick up its armature when current of the opposite polarity was supplied to the winding 4 even though the voltage was increased to 120 volts.

It should be particularly pointed out that, if the polarity of the permanent magnet 9 is reversed from that shown in the drawing, the relay will operate in a manner similar to that just described, except for the fact that the polarity of the current which must be supplied to the winding 4 to cause the armature to pick up will then be reversed.

One advantage of a relay embodying my invention is that, by properly proportioning the parts, the back contact pressures may be made substantially equal to the front contact pressures without materially increasing the energy which must be supplied to the relay to cause the armature to pick up over that which would be necessary if the permanent magnet were not provided.

Referring now to Fig. 2, I have here shown a relay embodying my invention connected with a pair of wires 10 and 11 over pole changing contacts 12 and 13 of a polar relay P, which latter relay is also connected with the line wires 10 and 11. The line wires 10 and 11, in turn, are connected with a battery B over a pole changer PC, which pole changer may either be operated manually or may comprise contacts of another relay. With this arrangement, whenever the pole changer PC is reversed, the polar relay will nor-

mally reverse its polar contacts, with the result that the relay R will normally always be supplied with current of the same polarity. This polarity is so chosen that relay R will close its front contacts and open its back contacts when it is supplied with current of this polarity, and as a result, if the polar contacts of relay P should fail to reverse for any reason, relay R will then be supplied with current of the polarity to which it will not respond, and it will then fail to close its front contacts. Such an arrangement is useful in certain forms of signalling systems wherein the signal indication depends upon the position of the polar armature of a polar relay, and it is desired to insure that an indication will not be given unless the polar armature reverses in the proper manner, the necessary check on the operation of the polar relay being provided by including in the signal circuits a front contact of the relay R, so that the signal circuits will become closed when and only when relay R is picked up.

Although I have herein shown and described only one form of relay embodying my invention, and one form of circuit in which it is designed to operate, it is understood that various changes and modifications may be made therein within the scope of the appended claim without departing from the spirit and scope of my invention.

Having thus described my invention, what I claim is:

A relay comprising a winding, a backstrap on which said winding is mounted provided at each end with a pole piece, an armature pivotally supported adjacent one pole piece for swinging movement either toward or away from both said pole pieces simultaneously and biased by gravity to swing away from said pole pieces, and a permanent magnet secured at one end directly to the pole piece at the free end of said armature and having its other end disposed opposite the pole face of said last mentioned pole piece in such manner that when said armature swings away from said pole pieces it will swing toward said other end of said permanent magnet, whereby said permanent magnet exerts a hold-down torque on said armature when said electromagnet is deenergized and prevents said armature from swinging toward said pole pieces when said winding is supplied with current of one polarity but not when said winding is supplied with current of the other polarity.

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