April 14, 1942. E. LAKATOS 2,279,404

RELAY

Filed Nov. 27, 1940

FIG. 4

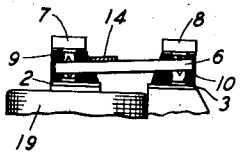


FIG. 2

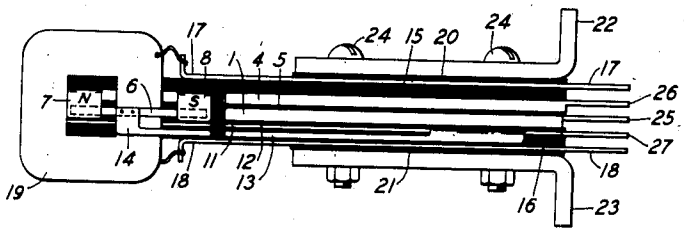


FIG. 3

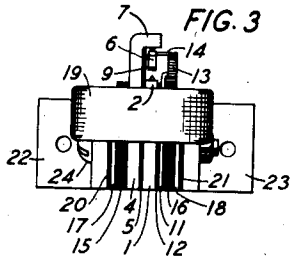


FIG. 1

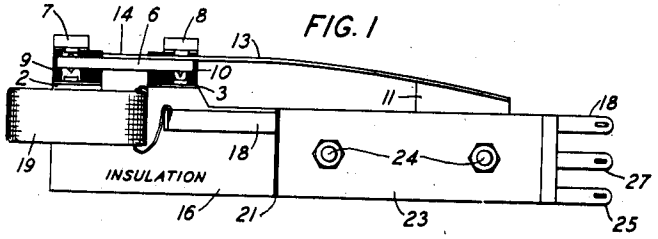


FIG. 6

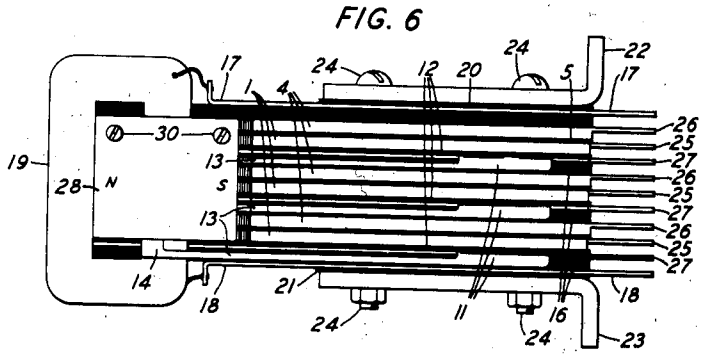


FIG. 7

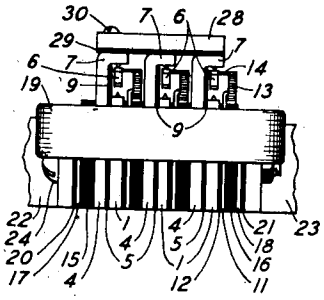
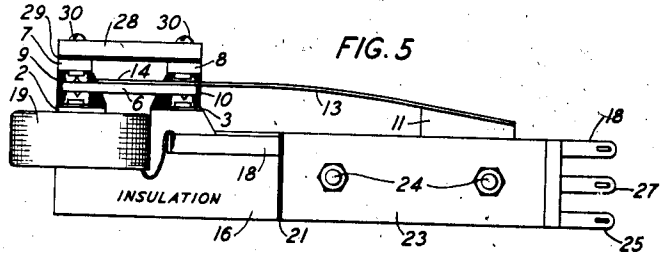


FIG. 5



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Patented Apr. 14, 1942

2,279,404

UNITED STATES PATENT OFFICE

2,279,404

RELAY

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Application November 27, 1940, Serial No. 367,340

11 Claims. (Cl. 200—93)

This invention relates to relays and more particularly to relays of the general type disclosed in Patent No. 2,212,830 granted August 27, 1940, to C. N. Hickman and E. Lakatos in which each work circuit controlled by the relay is established by the conductive engagement of an armature with a relay core member.

With the structure disclosed in the patent above referred to it is possible to secure only contacts which are normally open and which become closed upon the attraction of the armatures into engagement with their associated core laminations. Such relays of course would find extensive use in telephone or other circuits but there is an even greater field of utility for relays which are provided with both normally open and normally closed contacts and for relays which have continuity contact combinations. While it is possible to tension an armature supporting spring to such an extent as to normally hold the armature against a backstop member with sufficient force to secure a suitable back contact pressure, an increase in the ampere turns of the relay coil would be required to overcome this tension which increase might be prohibitive if a relay were provided with a large number of armature springs so tensioned.

It is therefore an object of the present invention to provide means in a relay of the magnetic contact type for securing back or continuity transfer contacts in a simple and economical manner.

To attain this object the relay in accordance with the present invention is provided, for each contact transfer unit thereof, with a core lamination of magnetic material having a plurality of upwardly extending pole-pieces, an associated armature supporting spring lamination, a second core lamination of magnetic material having pole-pieces extending at right angles from its upper edge and overlying the pole-pieces of the first core lamination, laminations of insulating material interposed between the core laminations and the armature spring lamination and an armature secured to the free end of the spring lamination and normally held in engagement with the under or pole faces of the second core lamination and attractable into conductive engagement with the pole faces of the pole-pieces of the first core lamination. The pole faces of the pole-pieces of both core laminations and the upper and lower surfaces of the armature are provided with cooperating contact bars. The second core lamination is magnetized as a permanent magnet or its pole-pieces are polarized by an associated permanent magnet so that normally the armature is held attracted to its pole-pieces. The energizing coil of the relay surrounds the corresponding pole-pieces of both laminations of each unit and when energized creates magnetic flux in the permanently magnetized core laminations which opposes the permanent magnetic flux and creates magnetic flux in the first core laminations whereby the armatures are released from the pole-pieces of the permanent magnet laminations and are attracted into conductive engagement with the pole-pieces of the first core laminations.

The supporting spring may be attached to the armature in such a manner that the armature breaks contact with both pole-pieces of the permanent magnet lamination before it makes contact with either pole-piece of the first core lamination whereby a simple contact transfer is effected. If, however, the supporting spring is attached to the armature at a point nearer the pole-pieces of the laminations on which the energizing coil is supported than to the rear pole-pieces of the laminations, the forward end of the armature will be released from the forward pole-piece of the permanent magnet lamination and attracted into conductive engagement with the forward pole-piece of the first core lamination before the rear end thereof becomes released from the rear pole-piece of the permanent magnet lamination.

For a better understanding of the invention reference may be had to the following detailed description thereof taken in connection with the accompanying drawing in which:

Fig. 1 is a side elevational view of a relay constructed in accordance with the present invention;

Fig. 2 is a top plan view of the relay disclosed in Fig. 1;

Fig. 3 is a front end view of the relay disclosed in Fig. 1;

Fig. 4 is a partial view of the forward end of the relay of Fig. 1 disclosing the armature in a partially attracted position to illustrate the continuity contact transfer;

Fig. 5 is a side elevational view of a modified form of the relay;

Fig. 6 is a top plan view of the relay disclosed in Fig. 5; and

Fig. 7 is a front end view of the relay disclosed in Fig. 5.

Referring first to Figs. 1 to 4, inclusive, the relay disclosed is provided with but a single pair of back contacts, a single pair of front contacts

and a single armature provided with contacts cooperating with the two pairs of contacts and so supported on its supporting spring as to effect a simple make-before-break transfer upon the energization of the relay coil. The magnetic circuit of the relay comprises a first centrally positioned core lamination 1 of magnetic iron having two pole-pieces 2 and 3 extending upwardly from its upper edge near its forward end, a second core lamination 4 positioned at the rear of the lamination 1 and insulated therefrom by an interposed lamination 5 of insulating material, such as hard rubber or fiber, and an armature 6. The core lamination 4 is provided near its forward end with two upwardly extending pole-pieces 7 and 8, the upper ends of which are bent at right angles to overlie the upper ends of pole-pieces 2 and 3 of the first core lamination 1. The core lamination 4 is made of suitable magnet steel and is permanently magnetized in such a manner that its forward pole-piece 7 constitutes a north pole and its rear pole-piece 8 constitutes a south pole. The interposed lamination 5 of insulating material is of substantially the same shape as the core lamination 1 but portions 9 and 10 thereof extend upwardly into engagement with the under surfaces of the pole-pieces 7 and 8 of the permanent magnet core lamination 4 so that the side face of the armature 6 is insulated from the upwardly extending portions of the pole-pieces 7 and 8 and cannot falsely vibrate into contact therewith during the operation of the relay.

The armature 6 is supported by a spring lamination 11 positioned adjacent to the front face of core lamination 1 and insulated therefrom by a lamination 12 of insulating material such as hard rubber or fiber. The spring is bent at right angles along its upper edge and the bent-over portion is severed from the body of the lamination along the major portion of its length to form a spring finger 13 which extends forwardly at an angle of approximately 20 degrees to the upper edge of the horizontal portion of the lamination. The forward end of the finger 13 is provided with an in-turned portion 14 which is welded or otherwise secured to the upper face of the short bar armature 6. The armature 6 is provided on its upper and lower faces with bars of contact material suitably secured thereto, as by welding, which are positioned for cooperation with bars of contact material secured to the under pole faces of the pole-pieces 7 and 8 and with other bars of contact material secured to the pole faces of the pole-pieces 2 and 3. Normally, the slight biasing tension of spring finger 13 holds the armature 6 in such a position that its ends are held attracted to the pole-pieces 7 and 8 of the lamination 4 by the permanent magnet flux thereof, whereby suitable back contact pressure is effected between the contact bars secured to the upper face of the armature 6 and the contact bars secured to the under faces of the pole-pieces 7 and 8.

Positioned adjacent to the permanent magnet core lamination 4 and at the rear thereof is a lamination 15 of insulating material and positioned adjacent to the spring lamination 11 and in front thereof is the lamination 16 of insulating material, which laminations serve to insulate the core lamination 4 and the spring lamination 11 from the coil terminal lugs 17 and 18. These laminations are of substantially the same shape as the core lamination 1 and the outer upwardly extending portions thereof serve to support the energizing coil 19 which is positioned in the slots between the upwardly extending portions of the core and insulating laminations and which surrounds the forward pole-pieces 2 and 7 of the core laminations 1 and 4. Positioned outside of the terminal lugs 17 and 18 are strips 20 and 21 of insulating material.

The entire assembly of core laminations 1 and 4, armature spring lamination 11, interposed laminations 5, 12, 15 and 16 of insulating material, the terminal lugs 17 and 18 and the insulating strips 20 and 21 are clamped between the bracket members 22 and 23 by the bolts 24 which extend through holes therethrough and which are suitably insulated from the core laminations 1 and 4 and spring lamination 11 by sleeves of rubber or fiber (not shown) surrounding their shanks. The brackets 22 and 23 have their rear ends out-turned for attachment to a relay mounting plate. The rear ends of the core laminations 1 and 4 are stamped or milled thin to form soldering terminals 25 and 26, respectively, and the rear end of the spring lamination 11 is provided with a soldering terminal 27.

As disclosed most clearly in Fig. 2 the in-turned end 14 of the spring finger 13 is secured to the armature 6 forward of its center or nearer the front pole-pieces 2 and 7 than to the rear pole-pieces 3 and 8. It will be recalled that the permanent magnet flux in the pole-pieces 7 and 8 normally holds the ends of armature 6 attracted thereto. When the coil 19 becomes energized, the pole-pieces 2 and 3 of core lamination 1 become magnetized and the pole-pieces 7 and 8 of the core laminations 4 also become magnetized, the magnetization set up in the pole-pieces 7 and 8 by the energization of the coil being in such a sense as to oppose the permanent magnetism. Since the flux in the front pole-pieces 2 and 7 due to the coil 19 surrounding them builds up faster than in the rear pole-pieces 3 and 8, the flux generated by the coil overcomes the permanent magnet flux in pole-piece 7 before the flux generated by the coil overcomes the permanent magnet flux in pole-piece 8, whereupon the forward end of the armature is released from the front pole-piece 7 and is attracted into conductive engagement with the front pole-piece 2 before the rear end of the armature is released from engagement with the rear pole-piece 8, as disclosed in Fig. 4, whereby the armature momentarily joins its back and front contacts. When thereafter the flux is built up in the rear pole-pieces 3 and 8 to such extent that the flux built up in the pole-piece 8 overcomes the permanent magnet flux the rear end of the armature is released from engagement with the rear pole-piece 8 and is attracted into engagement with the rear pole-piece 3 whereby the armature is moved entirely out of engagement with the back contacts of the pole-pieces 7 and 8 and into engagement with the front contacts on the pole-pieces 2 and 3. It is thus apparent that a make-before-break continuity contact condition is attained.

By attaching the in-turned end 14 of the spring finger 13 to the armature at a point nearer the rear end thereof, the relay may be made to operate to effect a simple contact transfer since then both ends of the armature will be released from engagement with the back contacts carried by the pole-pieces 7 and 8 before the armature engages with the front contacts carried by the pole-pieces 2 and 3.

It is to be noted that instead of magnetizing

the lamination 4 to form permanent magnet pole-pieces 7 and 8 of opposite polarity, a bar magnet may be bridged across the pole-pieces with its north pole in engagement with the pole-piece 7 whereby such pole-piece is magnetized to become a north pole and with its south pole in engagement with the pole-piece 8 whereby such pole-piece is magnetized to become a south pole.

Figs. 5 to 7, inclusive, illustrate a relay having three contact units of the type disclosed in Figs. 1 to 4, inclusive, each of such units comprising a first core lamination 1, a second core lamination 4, an armature spring lamination 11 and an armature 6 supported thereby, and interposed insulating laminations 5 and 12. The several units are insulated from each other by interposed laminations 16 of insulating material. For polarizing the pole-pieces 7 and 8 of all of the units a single permanent magnet 28 is supported on the upper ends of such pole-pieces, insulated therefrom by the interposed strip 29 of insulating material and secured to the pole-pieces 7 and 8 of one of the units by screws 30. The magnet 28 is so poled as to render the front pole-pieces 7 of all units north poles and to render the rear pole-pieces 8 of all units south poles.

While in Figs. 5 to 7, inclusive, a multiple unit relay has been illustrated having all of its units of the continuity contact type, it will be obvious that a multiple unit relay for any desired purpose might be assembled having as many of such continuity contact type units as required, having other units of the simple transfer contact type previously described or having still other units from which the core laminations 4 would be omitted and backstop pins depending over the armatures of such units from the magnet 28 would be supplied whereby such units would be of the simple make contact type disclosed, for example, in the patent to Hickman and Lakatos hereinbefore referred to.

What is claimed is:

1. In a relay, a first core of magnetic material having a plurality of pole-pieces, a second core of magnetic material insulated therefrom and having its magnetically polarized pole-pieces overlying the pole-pieces of said first core, a spring supported armature normally attracted into conductive engagement with the pole-pieces of said second core, and a coil surrounding corresponding pole-pieces of said cores and energizable to oppositely polarize the pole-pieces of each core to disengage said armature from the pole-pieces of said second core and to conductively engage said armature with the pole-pieces of said first core.

2. In a relay, a core of magnetic material having a plurality of pole-pieces, a permanent magnet insulated therefrom and having its oppositely polarized pole-pieces overlying the pole-pieces of said core, a spring supported armature normally attracted into conductive engagement with the pole-pieces of said magnet, and a coil surrounding corresponding pole-pieces of said core and of said magnet and energizable to oppositely polarize the pole-pieces of said core and of said magnet to disengage said armature from the pole-pieces of said magnet and to conductively engage said armature with the pole-pieces of said core.

3. In a relay, a first core of magnetic material having a plurality of pole-pieces, a second core of magnetic material insulated therefrom and having its pole-pieces overlying the pole-pieces of said first core, a permanent magnet bridged across the pole-pieces of said second core for oppositely polarizing said pole-pieces, a spring supported armature normally attracted into conductive engagement with the pole-pieces of said second core, and a coil surrounding corresponding pole-pieces of said cores and energizable to oppositely polarize the pole-pieces of each core to disengage said armature from the pole-pieces of said second core and to conductively engage said armature with the pole-pieces of said first core.

4. In a relay, a first core lamination of magnetic material having a plurality of pole-pieces, a second core lamination of magnetic material having its pole-pieces magnetically polarized and overlying the pole-pieces of said first lamination, a spring lamination having its upper edge bent at right angles and severed therefrom throughout the major portion of its length to provide an armature supporting spring, laminations of insulating material interposed between said other laminations, an armature secured to the free end of said spring and normally attracted into conductive engagement with the pole-pieces of said second core lamination and a coil surrounding corresponding pole-pieces of said core laminations and energizable to disengage said armature from the pole-pieces of said second core lamination and to conductively engage said armature with the pole-pieces of said first core lamination.

5. In a relay, a plurality of magnetic circuit units each comprising a first core lamination of magnetic material having a plurality of pole-pieces, a second core lamination of magnetic material having its pole-pieces magnetically polarized and overlying the pole-pieces of said first lamination, an armature supporting spring lamination having an armature secured thereto and normally attracted into conductive engagement with the pole-pieces of said second core lamination, and laminations of insulating material interposed between said other laminations, laminations of insulating material interposed between adjacent units and an energizing coil for said units surrounding corresponding pole-pieces of the core laminations of all of said units whereby upon the energization of said coil said armatures are disengaged from the pole-pieces of their associated second core laminations and are conductively engaged with the pole-pieces of their associated first core laminations.

6. In a relay, a plurality of magnetic circuit units each comprising a first core lamination of magnetic material having a plurality of pole-pieces, a second core lamination of magnetic material having its pole-pieces overlying the pole-pieces of said first lamination, an armature supporting spring lamination having an armature secured thereto and laminations of insulating material interposed between said other laminations, laminations of insulating material interposed between adjacent units, a permanent magnet insulatedly associated with the pole-pieces of the second core laminations of all of said units for oppositely polarizing said pole-pieces whereby the armatures of said units are normally attracted into conductive engagement with said pole-pieces, and an energizing coil for said units surrounding corresponding pole-pieces of the core laminations of all of said units whereby upon the energization of said coil said armatures are disengaged from the pole-pieces of their associated second core laminations and are conductively engaged with the pole-pieces of their associated first core laminations.

7. In a relay, a first core of magnetic material

having a pair of pole-pieces, a second core of magnetic material insulated therefrom and having its magnetically polarized pole-pieces overlying the pole-pieces of said first core, a spring supported armature normally attracted into conductive engagement with the pole-pieces of said second core and a coil surrounding the front pole-pieces of said cores and energizable to disengage said armature from the pole-pieces of said second core and to conductively engage said armature with the pole-pieces of said first core, said armature being so biased by said spring that upon the energization of said coil said armature engages the forward pole-piece of said first core before disengaging from the rear pole-piece of said second core whereby a make-before-break contact transfer is effected.

8. In a relay, a core of magnetic material having a pair of pole-pieces, a permanent magnet insulated therefrom and having its pole-pieces overlying the pole-pieces of said core, a spring supported armature normally attracted into conductive engagement with the pole-pieces of said magnet, and a coil surrounding the front pole-pieces of said core and of said magnet and energizable to disengage said armature from the pole-pieces of said magnet and to conductively engage said armature with the pole-pieces of said core, said armature being so biased by said spring that upon the energization of said coil said armature engages the forward pole-piece of said core before disengaging from the rear pole-piece of said magnet whereby a make-before-break contact transfer is effected.

9. In a relay, a first core of magnetic material having a pair of pole-pieces, a second core of magnetic material insulated therefrom and having its pole-pieces overlying the pole-pieces of said first core, a permanent magnet bridged across the pole-pieces of said second core for oppositely polarizing the pole-pieces thereof, a spring supported armature normally attracted into conductive engagement with the pole-pieces of said second core and a coil surrounding the front pole-pieces of said cores and energizable to disengage said armature from the pole-pieces of said second core and to conductively engage said armature with the pole-pieces of said first core, said armature being so biased by said spring that upon the energization of said coil said armature engages the forward pole-piece of said first core before disengaging from the rear pole-piece of said second core whereby a make-before-break contact transfer is effected.

10. In a relay, a first core lamination of magnetic material having a pair of pole-pieces, a second core lamination of magnetic material having its pole-pieces magnetically polarized and overlying the pole-pieces of said first lamination, a spring lamination having its upper edge bent at right angles and severed therefrom throughout the major portion of its length to provide an armature supporting spring, laminations of insulating material interposed between said other laminations, an armature secured to the free end of said spring and normally attracted into conductive engagement with the pole-pieces of said second core lamination, and a coil surrounding the front pole-pieces of said core laminations and energizable to disengage said armature from the pole-pieces of said second core lamination and to conductively engage said armature with the pole-pieces of said first core lamination, said spring being attached to said armature adjacent to the front end thereof to so bias it that upon the energization of said coil said armature engages the front pole-piece of said first core lamination before disengaging from the rear pole-piece of said second core lamination whereby a make-before-break contact transfer is effected.

11. In a relay, a plurality of magnetic circuit units each comprising a first core lamination of magnetic material having a pair of pole-pieces, a second core lamination of magnetic material having its pole-pieces overlying the pole-pieces of said first lamination, an armature supporting spring lamination having an armature secured thereto, and laminations of insulating material interposed between said other laminations, laminations of insulating material interposed between adjacent units, a permanent magnet insulatedly associated with the pole-pieces of the second core laminations of all of said units for oppositely polarizing said pole-pieces whereby the armatures of said units are normally attracted into conductive engagement with said pole-pieces and an energizing coil for said units surrounding the front pole-pieces of the core laminations of all of said units and energizable to disengage said armatures from the pole-pieces of their associated second core laminations and to conductively engage said armatures with the pole-pieces of their associated first core laminations, the armatures of certain of said units being so biased by their supporting springs that upon the energization of said coil the armatures of such units engage the front pole-pieces of their associated first core laminations before disengaging from the rear pole-pieces of their associated second core laminations whereby make-before-break contact transfers are effected.

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