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PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Electrical Relays

We, WESTERN ELECTRIC COMPANY INCORPORATED, of 195 Broadway, New York City, New York State, United States of America, a Corporation of the State of New York, United States of America, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to electrical relays.

According to this invention there is provided a relay comprising a coil, magnetic circuit elements including a core within the coil, a substantially L-shaped yoke secured to the core across one end of the coil and extending along one side of the coil to the other end of the coil and an armature extending across the other end of the coil and hinged to the yoke by means of a substantially L-shaped spring secured to the armature and to the yoke, a substantially L-shaped mounting bracket of magnetic material having one branch secured to the yoke and the other branch extending across said other end of the coil in spaced relation to the armature, and means for operatively connecting the armature to an electrical contact array.

In one embodiment the means for operatively connecting include extended arms secured to or formed integral with the armature, and a card of insulating material mounted to move with the extended arms and to move movable contact bearing members of the electrical contact array thereby to operate the electrical contact array.

In this embodiment the movable contact bearing members spring-bias the card against the yoke, and the card is preferably of yieldable material capable of absorbing shocks. Thus the tendency for the card to bounce on the yoke on return of the movable contact bearing members after deenergization of the coil is reduced.

This invention has been applied with advantage to miniature relays. The term miniature is here intended to include relays that require about 3/4ths of to one square inch mounting area and that occupy a volume of approximately 1 cubic inch. For example, one relay in this category is 1-1/4 inches long and has a 1 inch by 3/4 inch mounting area. Another slightly larger relay is about 1-3/8 inches long with a 5/8 inch by 1-3/8 inches mounting area.

Two embodiments of this invention are described in detail by way of example with reference to the accompanying drawings, in which:

FIG. 1 is a side elevation of one embodiment with its housing in section;

FIG. 2 is a similar, top elevation of the relay;

FIG. 3 is an end view looking from the left of FIGS. 1 and 2; and

FIG. 4 is a part view of another embodiment.

The basic mounting element of these embodiments is an L-shaped bracket 10 having branches 10a and 10b to which all other parts are connected directly or indirectly. A coil 11 is mounted on a core 12, which is secured to the branch 10a of the bracket 10 by a yoke 13. The yoke 13 is L-shaped with its shorter leg 14 secured to one end of the core and its longer leg 15 extending along one side of the coil to the other end of the coil. The leg 15 is secured to the branch 10a.

The armature assembly comprises an armature 16 and contact operating arms 17. These parts may be, and advantageously are, integral. The armature is secured to and held against the end of the yoke by a spring hinge 20, which is L-shaped with a long arm sandwiched between branch 10a of the bracket 10 and the long leg 15 of the yoke 13. The short arm of the spring hinge is secured, such as by rivets, to the armature 16. The arms of the hinge 20 may have an included angle of 90

[Price 4s. 6d.]

degrees, or more or less, it it is desired to leave the armature urged away from the core, or urged toward it. The return bias on the armature is provided by movable contact springs, as will be subsequently described. The yoke leg 15, the spring hinge 20, and the branch 10a of the bracket 10 are secured together by a screw 21.

The contact spring assembly 22, comprising a plurality of contact springs, spring stops, and insulating spacers, is secured to branch 10a of the bracket 10 by screws 23. Various arrangements of springs, stops, and contacts may be made, depending upon the use to which the relays is to be put. The arrangement shown in the drawings will suffice to illustrate the assembly. Four change-over contact sets are shown, two side by side in two tiers.

Each contact set comprises a fixed spring 30 with its stop spring 1, a fixed spring 32 with its stop spring 33, and a movable spring 34 between the fixed springs. The movable spring 34 has contacts 34a and 34b on either side to mate respectively with the contacts 30a and 32a on the fixed springs 30 and 32. These fixed spring are bifurcated and have a contact on each furcation. The movable springs carry a contact of sufficient extent to mate with both contacts of the cooperating fixed spring. The contacts may be of a precious metal or of a suitable alloy. The springs may be of a nickel-silver and the stops of brass.

As shown in FIG. 1, the fixed spring 30 is bent toward the movable spring 34 and rests against the stop 31. The movable spring 34 is biased downwardly and holds the fixed spring 32 away from its stop 33. All of the movable springs 34 have their outer ends in the slots 35 of an operating card 36 of insulating material, such as phenol fibre or polytetrafluoroethylene known as "Teflon" (R.T.M.) This card is secured to a support or bracket member 37 projecting beyond the side edges of the card with its ends secured to the operating arms 17. The arms 17 are slotted at their ends to receive ears 38 projecting from the bracket member 37. These slots are closed slightly after insertion of the ears to ensure that the card is properly secured. The card 36 has a central portion 39 that extends beyond the member 37 and rests on the surface of the leg 15 of the yoke 13 adjacent to its union with the leg 14. When the relay is deenergized to allow the contacts to return to their illustrated positions, the card extension 39 serves as a stop when it strikes against the yoke. The movable contact springs 34 are return springs for the whole assembly including the armature. A card having integral ears of insulation to cooperate with the operating arms 17 may also be used if desired. Because the card is made of yieldable material the impact shock when it comes to rest against the essentially rigid yoke is absorbed, thereby inhibiting false contact reoperation or "bounce".

As has been noted, the bracket 10 is the basic mounting element of the relay.

The bracket 10 is advantageously made of steel which provides a strong support and also serves as an important element of the magnetic circuit. The L-shaped spring hinge on which the armature is mounted has a thin section and advantageously is of nonmagnetic material. The hinge holds the armature snugly against the end of the yoke but the resulting "gap" is still of relatively high reluctance. As a consequence, a portion of the flux in the yoke 13 fringes in the region of the hinge and is thereby lost with respect to the gap between the armature 16 and the core 12. The bracket 10, however, captures the fringing flux and directs it back to the core 12 by way of armature 16 so as to reinforce the flux in the gap thereby increasing the force acting on the armature 16. Tests of such relays have shown an increase of about eight per cent in tractive force on the armature when the magnetic bracket was used rather than one of insulation or nonmagnetic material.

The coil 11 is provided with flexible leads of stranded wire, one of which is shown at 40 in FIG. 1 connected to a terminal 41. Alternatively, as shown in FIG. 4 the coil assembly may include terminals secured directly to the coil head. The coil proper, designated as 50, is wound on a spool of insulation having a thick head 51 on one end. The terminals 52 are rectangular in section and are force fitted as by driving, into slightly undersized rectangular orifices in the spool head. The coil wire ends are brought through the head in the openings 53 and secured to the terminals 52, rspectively. These wire ends are bared of insulation, wrapped around the terminals and soldered to them.

The required switching circuit connections are made to the projecting ends 42 of the contact springs or stops. The relay is advantageously enclosed in a cover 60 which may be of a suitable moulded plastic material. The cover is provided with slotted orifices 61 which fit over ears 62 on the mounting bracket 10 to secure the cover in place.

WHAT WE CLAIM IS:—

1. A relay comprising a coil, magnetic circuit elements including a core within the coil, a substantially L-shaped yoke secured to the core across one end of the coil and extending along one side of the coil to the other end of the coil and an armature extending across the other end of the coil and hinged to the yoke by means of a substantially L-shaped spring secured to the armature and to the yoke, a substantially L-shaped mounting bracket of magnetic material having one branch secured to the yoke and the other branch extending across said other end of the coil in spaced relation to the armature, and means for operatively connecting the armature to an electrical contact array.

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degrees, or more or less, it it is desired to leave the armature urged away from the core, or urged toward it. The return bias on the armature is provided by movable contact springs, as will be subsequently described. The yoke leg 15, the spring hinge 20, and the branch 10a of the bracket 10 are secured together by a screw 21.

The contact spring assembly 22, comprising a plurality of contact springs, spring stops, and insulating spacers, is secured to branch 10a of the bracket 10 by screws 23. Various arrangements of springs, stops, and contacts may be made, depending upon the use to which the relays is to be put. The arrangement shown in the drawings will suffice to illustrate the assembly. Four change-over contact sets are shown, two side by side in two tiers.

Each contact set comprises a fixed spring 30 with its stop spring 1, a fixed spring 32 with its stop spring 33, and a movable spring 34 between the fixed springs. The movable spring 34 has contacts 34a and 34b on either side to mate respectively with the contacts 30a and 32a on the fixed springs 30 and 32. These fixed spring are bifurcated and have a contact on each furcation. The movable springs carry a contact of sufficient extent to mate with both contacts of the cooperating fixed spring. The contacts may be of a precious metal or of a suitable alloy. The springs may be of a nickel-silver and the stops of brass.

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As has been noted, the bracket 10 is the basic mounting element of the relay.

The bracket 10 is advantageously made of steel which provides a strong support and also serves as an important element of the magnetic circuit. The L-shaped spring hinge on which the armature is mounted has a thin section and advantageously is of nonmagnetic material. The hinge holds the armature snugly against the end of the yoke but the resulting "gap" is still of relatively high reluctance. As a consequence, a portion of the flux in the yoke 13 fringes in the region of the hinge and is thereby lost with respect to the gap between the armature 16 and the core 12. The bracket 10, however, captures the fringing flux and directs it back to the core 12 by way of armature 16 so as to reinforce the flux in the gap thereby increasing the force acting on the armature 16. Tests of such relays have shown an increase of about eight per cent in tractive force on the armature when the magnetic bracket was used rather than one of insulation or nonmagnetic material.

The coil 11 is provided with flexible leads of stranded wire, one of which is shown at 40 in FIG. 1 connected to a terminal 41. Alternatively, as shown in FIG. 4 the coil assembly may include terminals secured directly to the coil head. The coil proper, designated as 50, is wound on a spool of insulation having a thick head 51 on one end. The terminals 52 are rectangular in section and are force fitted as by driving, into slightly undersized rectangular orifices in the spool head. The coil wire ends are brought through the head in the openings 53 and secured to the terminals 52, rspectively. These wire ends are bared of insulation, wrapped around the terminals and soldered to them.

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WHAT WE CLAIM IS:—

1. A relay comprising a coil, magnetic circuit elements including a core within the coil, a substantially L-shaped yoke secured to the core across one end of the coil and extending along one side of the coil to the other end of the coil and an armature extending across the other end of the coil and hinged to the yoke by means of a substantially L-shaped spring secured to the armature and to the yoke, a substantially L-shaped mounting bracket of magnetic material having one branch secured to the yoke and the other branch extending across said other end of the coil in spaced relation to the armature, and means for operatively connecting the armature to an electrical contact array.

2. A relay according to claim 1, in which the means for operatively connecting the armature to the contact array include extended arms secured to or formed integral with the armature, and a card of insulating material mounted to move with the extended arms and to move movable contact bearing members of the electrical contact array thereby to operate the electrical contact array.

3. A relay according to claim 2, in which the movable contact bearing members spring-bias the card against the yoke and the card is of yieldable material capable of absorbing shocks.

4. A relay according to claim 3, in which the card is of phenol fibre.

5. A relay according to claim 3, in which the card is of polytetra-fluoroethylene.

6. An electrical relay substantially as herein described with reference to and as shown in FIGS. 1, 2 and 3 or FIG. 4 of the accompanying drawings.

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