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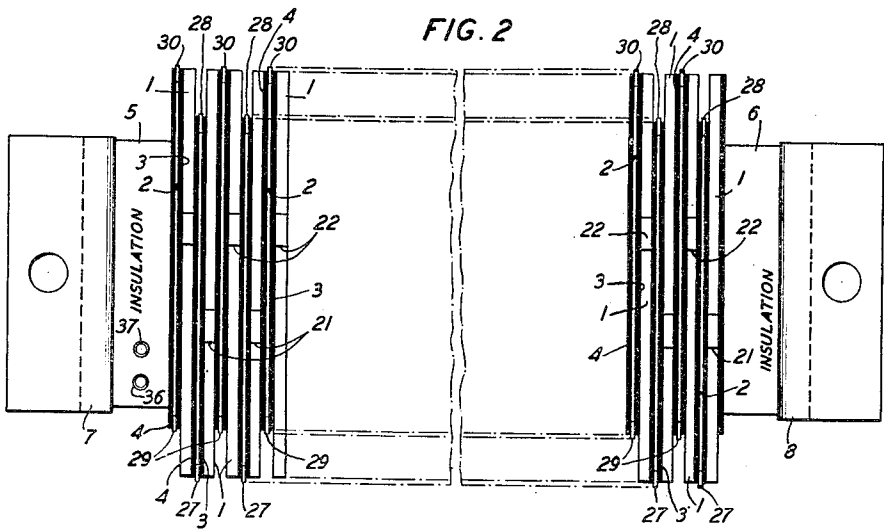
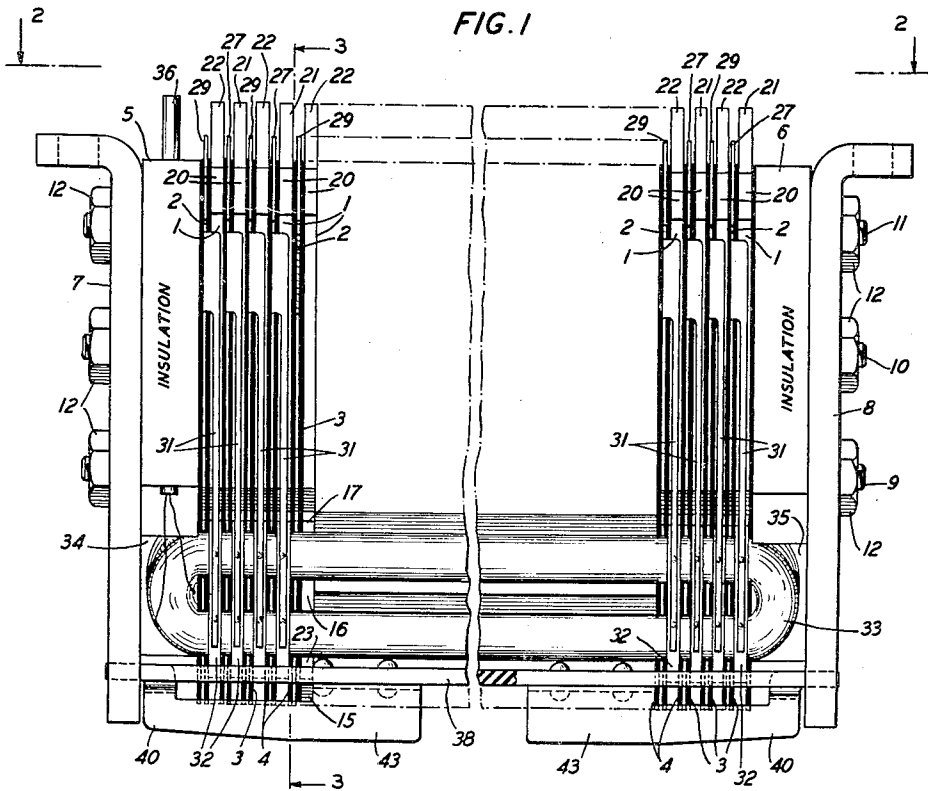
C. N. HICKMAN ET AL

2,212,830

RELAY

Filed Dec. 9, 1939

2 Sheets-Sheet 1



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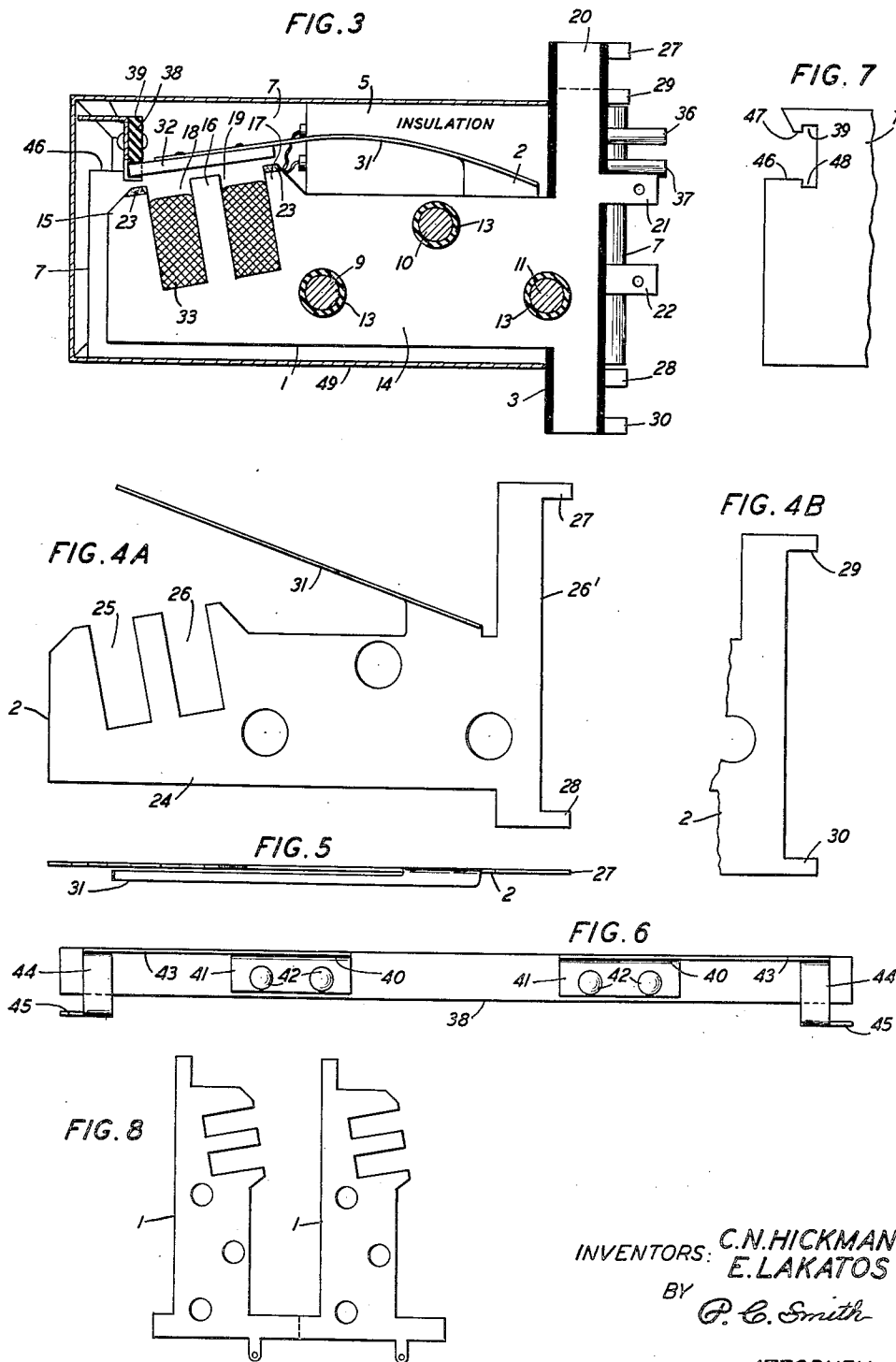
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UNITED STATES PATENT OFFICE

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RELAY

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12 Claims. (Cl. 200—103)

This invention relates to relays and more particularly to a relay which is capable of simultaneously controlling a plurality of work circuits.

Multicontact relays are used extensively in telephone systems and particularly in systems of the all-relay and cross-bar types for controlling and establishing circuits. Heretofore such relays have been provided with a single armature which, when actuated by the energization of the magnet coil, effects the operation of a plurality of contact springs to engage with a plurality of mate contact springs. A relay of this type has a very considerable spring load and thus requires a magnet coil having a large number of ampere turns necessitating a relatively large operating and holding current. Furthermore, if a large number of pairs of contact springs are to be operated the magnet circuit required must comprise considerable magnetic material thus increasing the size of the relay structure and the mounting space required for it.

It is therefore the object of the present invention to provide a multicontact relay which is efficient in operation, is inexpensive to manufacture, which requires a small space for mounting, which requires no contact springs and which is easily maintained in an efficient operating condition.

In accordance with the present invention this object is attained by the provision of a plurality of magnetic circuit units each comprising a core lamination of magnetic material having a plurality of upwardly extending pole-pieces, an associated armature supporting spring lamination and a lamination of insulating material interposed between the core lamination and the spring lamination. The magnetic circuit units are assembled side by side with their corresponding pole-pieces in alignment and insulated from each other by further interposed laminations of insulating material and are clamped in their assembled position by insulated bolts which extend through holes in end plates and holes in the core, spring and insulating laminations whereby each core and each spring lamination is completely insulated. A single energizing coil lies in the slots between the pole-pieces of all the core laminations and embraces one pole-piece of every lamination.

Each armature spring lamination is provided with a forwardly extending spring finger which overlies the top of the core lamination with which it is associated and has secured to the inner face of its free end a short bar armature which overlies the faces of the pole-pieces of the core lamination

and makes a conductive engagement therewith when attracted by the magnetization of the pole-pieces. To serve as a back-stop for all of the armatures a bar of insulating material is supported between the ends of the end plates of the relay above the armatures against which the armatures are normally engaged by their supporting spring fingers.

The rear ends of the core and spring laminations are provided with terminal lugs to which the conductors of work circuits may be soldered. For enabling the soldering operations to be more easily effected the terminal lugs of alternate core laminations are staggered into two horizontal rows and the terminal lugs of alternate spring laminations are similarly staggered into other rows.

When the common coil is energized all of the armatures are attracted into conductive engagement with their associated core laminations and since all of the armatures are insulated from each other and the core laminations are also insulated from each other and from the armatures, a plurality of circuit paths is established, each extending from a core lamination through its associated armature to the supporting spring lamination. For increasing the electrical conductivity between an armature and its core lamination the contacting surface of the armature and the ends of the pole-pieces may be plated or otherwise provided with a coating of conducting metal such as silver.

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

Fig. 1 is a top plan view of the relay with some of the magnetic circuit units omitted;

Fig. 2 is a rear end view of the relay disclosed in Fig. 1;

Fig. 3 is a cross-sectional view of the relay as viewed along section line 3—3 of Fig. 1;

Fig. 4A is a detail view of one of the armature supporting spring laminations;

Fig. 4B is a partial detail view showing the position of the terminal lugs of another spring lamination;

Fig. 5 is a top plan view of the spring lamination shown in Fig. 4A;

Fig. 6 is a detail view of the back stop assembly;

Fig. 7 shows the notched end of one of the end plates for receiving the end of the back-stop; and

Fig. 8 discloses a modification of a lamination illustrating how a core lamination may be made

when it is desired to multiple the work circuits of two or more relays together.

The relay as previously described comprises an assembly of a plurality of magnetic circuit units, for example, thirty, each comprising a core lamination 1, an armature spring lamination 2, and an interposed lamination 3 of insulating material such as hard rubber or fiber. The several units are assembled side by side and insulated from each other by spacing laminations 4 of insulating material such as hard rubber or fiber between the end blocks 5 and 6 of hard rubber and the end plates 7 and 8 on studs 9, 10 and 11 threaded on each end, which extend through aligned holes in the end plates, the end blocks, the spacing laminations and the laminations of the units. The assembled structure is clamped together by nuts 12 which are threaded upon the ends of the studs and then tightened. The studs are surrounded by sleeves 13 of insulating material whereby they are effectively insulated from the core and armature spring laminations through which they pass.

The end plates 7 and 8 are provided on their rear ends with outturned flanges by means of which the relay structure may be bolted to a suitable relay or apparatus rack.

Each core lamination 1 is stamped from a sheet of suitable magnetic material into the T shape disclosed most clearly in Fig. 3 and comprises a horizontal portion 14 having three pole-piece portions 15, 16 and 17 formed by the two parallel slanting slots 18 and 19, and a rear portion 20 provided with a rearwardly extending terminal lug 21. Alternate ones of the core laminations have their terminal lugs in the vertical position disclosed by the lug 21 in Fig. 3 and intermediate laminations have their lugs positioned as illustrated by the lug 22 whereby the lugs are staggered as disclosed in Fig. 2 to give greater clearance between the lugs of adjacent laminations for enabling conductors to be more readily soldered thereto and to eliminate the possibility of cross-connections between the laminations. The pole faces of the pole-pieces are slanted as disclosed in Fig. 3 and are preferably provided with a coating 23 of conducting material such as silver, plated thereon or welded thereto.

Each spring lamination 2 is stamped from a sheet of nickel silver and is also T-shaped as disclosed in Fig. 4A and comprises a horizontal portion 24 provided with parallel slanting slots 25 and 26 positioned in the end thereof for alignment with the slots 18 and 19 of the associated core lamination and a rear portion 26' which is provided with two rearwardly extending terminal lugs 27 and 28. Alternate ones of the spring laminations have their terminal lugs in the positions illustrated by the lugs 27 and 28 of Fig. 4A whereas intermediate laminations have their lugs positioned as illustrated by the lugs 29 and 30 as illustrated in Fig. 4B whereby the lugs are staggered to give greater clearance between the lugs of adjacent spring laminations for enabling conductors to be more readily soldered thereto and to eliminate the possibility of cross-connections. It will be noted from Fig. 3 that the several horizontal rows of terminal lugs of core and spring laminations are vertically separated from each other thereby further permitting accessibility thereto. Each spring lamination 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 31 which extends forwardly at an angle of approx-

imately 20 degrees to the upper edge of the horizontal portion 24.

Welded or otherwise secured to the lower face of the finger 31 at its outer or free end is a short bar armature 32 of magnetic material. The lower surface of this armature may, if desired, be coated with conducting material in the same manner as the pole faces of the core laminations.

As previously stated, each magnetic circuit element comprises a core lamination 1 and a spring lamination 2 insulated from each other by an interposed lamination 3 of insulating material. Each lamination 3 is of the same general shape as the core and spring laminations but the rear or vertical portion thereof is slightly wider than the rear portions of the other laminations to afford better insulating protection. When each unit is assembled the forwardly extending spring finger 31 will overlie the upper edge of the associated core lamination as best shown in Fig. 1 and the armature 32 secured to the end of finger 31 will overlie the pole faces of the pole-pieces 15, 16 and 17 of the core lamination. The spacing laminations 4 which separate adjacent magnetic circuit units are also of the same general shape as the laminations 3.

When all of the units are assembled with their spacing laminations 4, the end blocks 5 and 6, and the end plates 7 and 8, and have been clamped together by the studs 9, 10, 11 and their associated nuts 12, a coil 33 is inserted in the aligned slots 18 and 19 of the core laminations, slots 25 and 26 of the spring laminations and in similar slots in insulating laminations 3 and 4 thereby surrounding all of the middle pole-pieces 16 of the core laminations. To provide clearance for the ends of the coil, the end blocks 5 and 6 are cut away as indicated by the reference numerals 34 and 35. The end block 5 is provided with two brass tubes 36 and 37 extending longitudinally therethrough to the forward ends of which the terminals of coil 33 are connected and the rear ends of which serve as terminal lugs to which the conductors of the energizing circuit of the relay winding may be connected.

To afford a back-stop for the armatures 32 of all the relay units a bar 38 of insulating material extends transversely across the front of the relay and is engaged in notches 39 in the forward ends of the end plates 7 and 8. The bar 38, as disclosed more clearly in Figs. 1 and 6, has a spring member 40 riveted thereto near each end thereof. Each of these members comprises a base portion 41 by which it is secured to the bar as by rivets 42, a portion 43 bent into a plane at right angles to the base portion 41, a portion 44 extending downwardly from the end of the portion 43 and adjacent to the front face of the bar 38 and an outwardly extending finger 45 underlying the lower edge of the bar 38 with its end extending to the end of the bar. These spring members serve to hold the bar in position in the notches in the ends of the end plates 7 and 8. To assemble the back-stop bar on the relay, the armatures 32 are all held depressed, the bar 38 is positioned with the fingers 45 of its spring members 40 resting on the shoulders 46 of the end plates and the ends of the bar are then pressed downwardly against the tension of the spring fingers 45 until the top edge of the bar is below the projections 47 on the end plates and then the ends of the bar are pressed inwardly. The ends of the spring fingers 45 will now snap into the notches 48 in the end plates and their tension will force the upper edge of the ends of the bar into the

notches 39 in the end plates. The bar is thus positioned above the armatures and held in position by the engagement of its upper edge in the notches 39 and by the engagement of the spring fingers in the notches 48. The armatures may then be released to engage against the lower edge of the bar. The bar will then serve to similarly adjust the air-gaps between all the armatures and the pole faces of their associated core laminations.

For protection against the infiltration of dust to the contacting surfaces of the relay a metal can cover 49, as disclosed in Fig. 3, may be provided which is slipped over the top and bottom edges of the end plates 7 and 8 from the front end of the relay.

In the operation of the relay, when the coil 33 is energized all of the core laminations become magnetized and attract their associated armatures into conductive engagement therewith thereby establishing a plurality of work circuits, each work circuit extending from a core lamination through the attracted armature to the spring lamination to which the armature is secured. Upon the deenergization of the coil the armatures are all retracted out of engagement with their associated core laminations thus opening the work circuits.

In some circuits in which relays of this type could be used advantageously, it is often necessary to multiple the work circuits of several multicontact relays. This could be readily done by stamping out the core laminations in tandem as disclosed in Fig. 8 to serve, for example, five or ten relays whereby the core laminations would in themselves serve as multiples for interconnecting one side of the work circuit terminals of the several relays, or upon installation the several relays could be positioned one above the other with the upper ends of the end portions 20 of the core laminations of one relay, abutted against the lower ends of the end portions 20 of the core laminations of the adjacent relay and the abutting ends then soldered or otherwise secured together as indicated by the dotted line in Fig. 8.

What is claimed is:

1. In a relay, a core assembly comprising a plurality of laminations of magnetic material each having a pole-piece and interposed laminations of insulating material, an energizing coil for said core assembly, a plurality of armature members associated respectively with said core laminations and attractable into conductive engagement with the pole-pieces thereof upon the energization of said coil, and an insulated support for each of said armature members whereby upon the energization of said coil a plurality of circuit paths is established, each extending from an armature member support through the armature member supported thereby to the associated core lamination.

2. In a relay, a core assembly comprising a plurality of laminations of magnetic material each having a plurality of pole-pieces and interposed laminations of insulating material, an energizing coil for said core assembly, a plurality of armatures associated respectively with said core laminations and attractable into conductive engagement with the pole-pieces thereof upon the energization of said coil, and an insulated supporting spring for each of said armatures whereby upon the energization of said coil, a plurality of circuit paths is established, each extending from an armature supporting spring

through the armature supported thereby to the associated core lamination.

3. In a relay, a core assembly comprising a plurality of laminations of magnetic material each having a pole-piece and interposed laminations of insulating material, an energizing coil for said core assembly, a plurality of armature members associated respectively with said core laminations and attractable into conductive engagement with the pole-pieces thereof upon the energization of said coil, the contacting surfaces of said pole-pieces being provided with coatings of contact metal, and an insulated support for each of said armature members whereby upon the energization of said coil a plurality of circuit paths is established, each extending from an armature member support through the armature member supported thereby to the associated core lamination.

4. In a relay, a core assembly comprising a plurality of laminations of magnetic material each having a pole-piece and interposed laminations of insulating material, an energizing coil for said core assembly, a plurality of armature members associated respectively with said core laminations and attractable into conductive engagement with the pole-pieces thereof upon the energization of said coil, the contacting surfaces of said pole-pieces and armatures being provided with coatings of contact metal, and an insulated support for each of said armature members whereby upon the energization of said coil a plurality of circuit paths is established, each extending from an armature member support through the armature supported thereby to the associated core lamination.

5. In a relay, a core assembly comprising a plurality of laminations of magnetic material each having a plurality of pole-pieces and interposed laminations of insulating material, an energizing coil surrounding one set of similar pole-pieces of all of said laminations, a plurality of armatures associated respectively with said core laminations and attractable into conductive engagement with the pole-pieces thereof upon the energization of said coil, an insulated supporting spring for each of said armatures and a back-stop common to all of said armatures against which said armatures are normally held by their supporting springs, whereby upon the energization of said coil a plurality of circuit paths is established, each extending from a supporting spring through the armature supported thereby to the associated core lamination.

6. In a relay, a plurality of core laminations of magnetic material each having a plurality of pole-pieces, a plurality of spring laminations associated respectively with said core laminations and interposed laminations of insulating material, each of said spring laminations having its upper edge bent at right angles and severed therefrom throughout the major portion of its length and overlying the associated core lamination to provide an armature supporting spring, armatures secured to the free ends of said springs and attractable into conductive engagement with the pole-pieces of the associated core laminations, and an energizing coil associated with the pole-pieces of all of said core laminations whereby upon the energization of said coil a plurality of circuit paths is established, each extending from a spring lamination through the armature secured thereto to the associated core lamination.

7. In a relay, a plurality of core laminations of

magnetic material each having a plurality of pole-pieces and a rearwardly extending terminal lug, a plurality of spring laminations associated respectively with said core laminations each having a rearwardly extending terminal lug, and a plurality of interposed laminations of insulating material, the terminal lugs of adjacent core laminations and the terminal lugs of adjacent spring laminations being positioned in staggered relationship, each of said spring laminations having its upper edge bent at right angles and severed therefrom throughout the major portion of its length and overlying the core lamination with which it is associated to provide an armature supporting spring, armatures secured to the free ends of said springs and attractable into conductive engagement with the pole-pieces of the associated core laminations, and an energizing coil associated with the pole-pieces of all of said core laminations whereby upon the energization of said coil a plurality of circuit paths is established, each extending from a spring lamination through the armature secured thereto to the associated core lamination.

8. In a relay, a plurality of magnetic circuit units each comprising a core lamination of magnetic material having a plurality of pole-pieces, an armature supporting spring lamination having an armature secured thereto and attractable into conductive engagement with the pole-pieces of the associated core lamination and a lamination of insulating material interposed between said spring lamination and said core lamination, laminations of insulating material interposed between adjacent units and an energizing coil for said units surrounding corresponding pole-pieces of all of said units whereby upon the energization of said coil a separate circuit path is established from the spring lamination through the armature to the core lamination of each of said units.

9. In a relay, a plurality of magnetic circuit units each comprising a core lamination of magnetic material having a plurality of pole-pieces, a spring lamination having its upper edge bent at right angles and severed therefrom throughout the major portion of its length and overlying the associated core lamination to provide an armature supporting spring, an armature secured to the free end of said spring and attractable into conductive engagement with the pole-pieces of the associated core lamination, and a lamination of insulating material interposed between said core lamination and said spring lamination, laminations of insulating material interposed between adjacent units and an energizing coil for said units surrounding corresponding pole-pieces of all of said units whereby upon the energization of said coil a separate circuit path is established from the spring lamination through the armature to the core lamination of each of said units.

10. In a relay, a plurality of magnetic circuit units each comprising a core lamination of magnetic material having a plurality of pole-pieces, an armature supporting spring lamination hav-

ing an armature secured thereto and attractable into conductive engagement with the pole-pieces of the associated core lamination, and a lamination of insulating material interposed between said spring lamination and said core lamination, end plates serving as mounting brackets, laminations of insulating material interposed between adjacent units and between the outer ones of said units and said end plates, clamping means for clamping said units together and to said end plates, and an energizing coil for said units surrounding corresponding pole-pieces of all of said units whereby upon the energization of said coil a separate circuit path is established from the spring lamination through the armature to the core lamination of each of said units.

11. In a relay, a plurality of magnetic circuit units each comprising a core lamination of magnetic material having a plurality of pole-pieces, an armature supporting spring lamination having an armature secured thereto and attractable into conductive engagement with the pole-pieces of the associated core lamination, and a lamination of insulating material interposed between said spring lamination and said core lamination, end plates serving as mounting brackets and having notched openings in their outer ends, laminations of insulating material interposed between adjacent units and between the outer ones of said units and said end plates, clamping means for clamping said units together and to said end plates, a back-stop bar supported in the notched ends of said end plates and overlying the armatures of said units, spring means secured to said bar for retaining it in position in said notches, and an energizing coil for said units surrounding corresponding pole-pieces of all of said units whereby upon the energization of said coil a separate circuit path is established from the spring lamination through the armature to the core lamination of each of said units.

12. In a multiple relay structure, a core assembly comprising a plurality of laminations of magnetic material each having a plurality of sets of pole-pieces, said laminations being assembled side by side with their corresponding sets of pole-pieces in transverse alignment, and laminations of insulating material interposed between said core laminations, a plurality of energizing coils associated respectively with said aligned sets of pole-pieces, an armature associated with each of said sets of pole-pieces, and an insulated supporting spring for each of said armatures whereby upon the energization of any one of said coils the armatures associated with the aligned sets of pole-pieces with which said coil is associated are attracted into conductive engagement with their associated pole-pieces to establish a plurality of circuit paths, each extending through a core lamination, the armature engaged with the pole-pieces thereof and the supporting spring of said armature.

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