Aug. 3, 1943. E. R. MORTON ET AL 2,326,054

MULTIUNIT RELAY

Filed Aug. 10, 1940 2 Sheets-Sheet 1

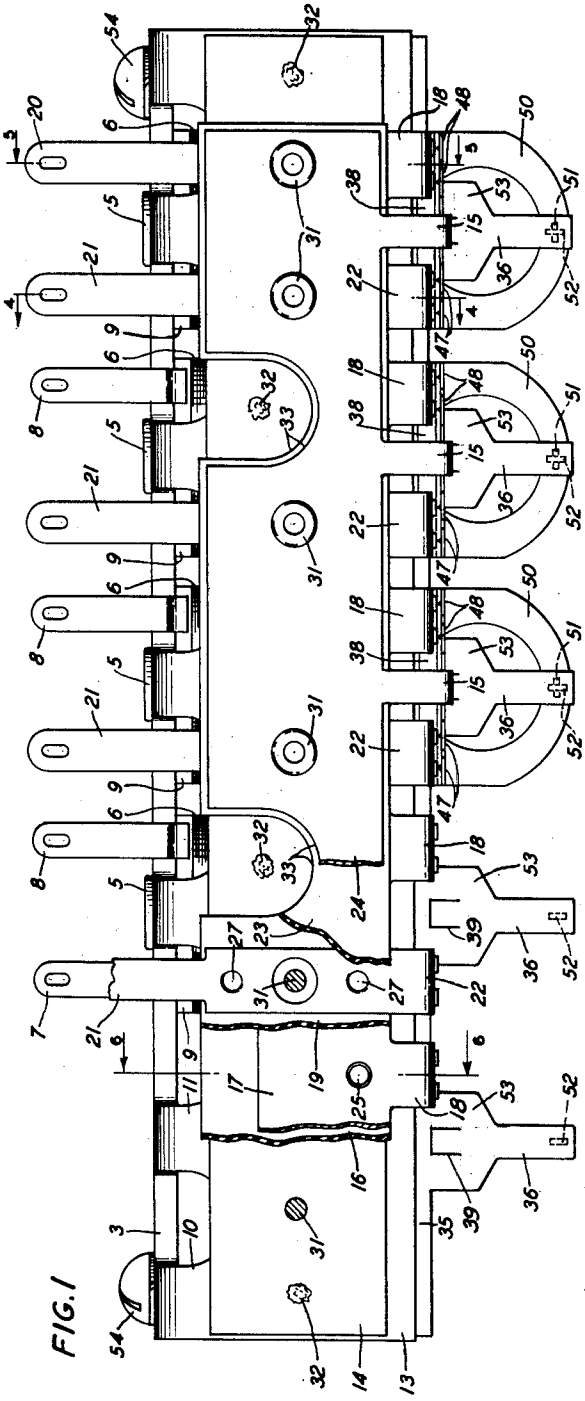


FIG. 1

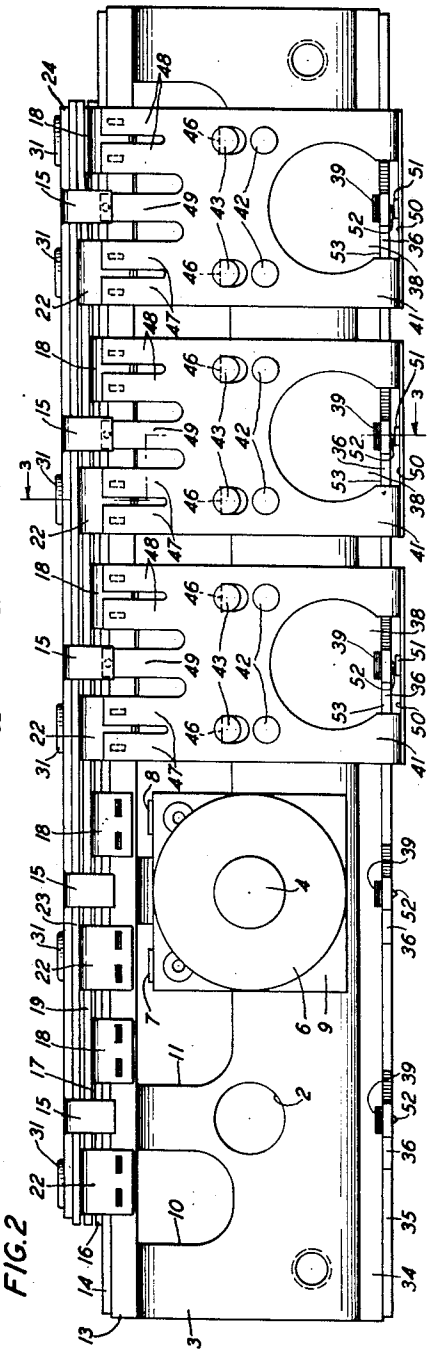


FIG. 2

INVENTORS: E. R. MORTON
H. M. STOLLER
BY
P. C. Smith
ATTORNEY

Aug. 3, 1943. E. R. MORTON ET AL 2,326,054

MULTIUNIT RELAY

Filed Aug. 10, 1940 2 Sheets-Sheet 2

FIG. 3

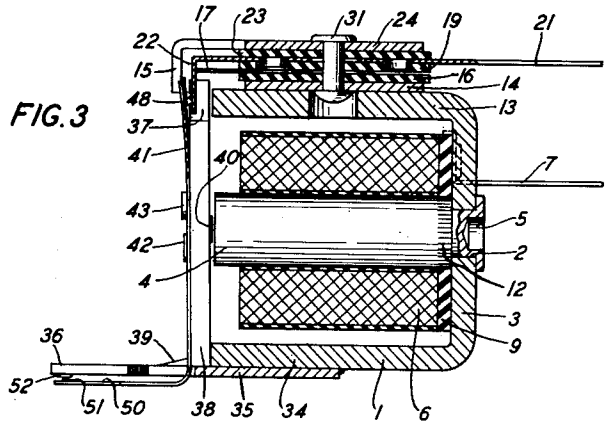


FIG. 4

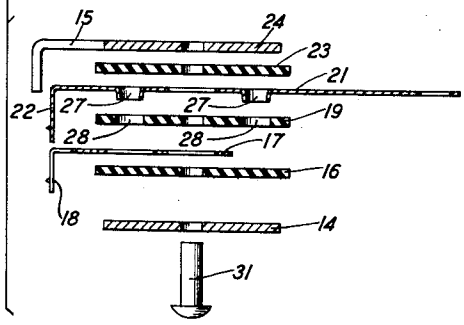


FIG. 5

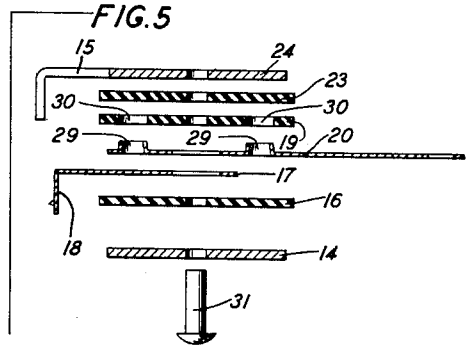


FIG. 6

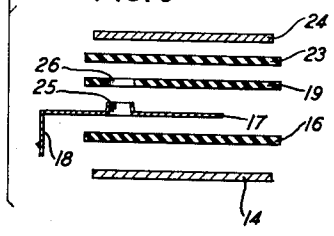
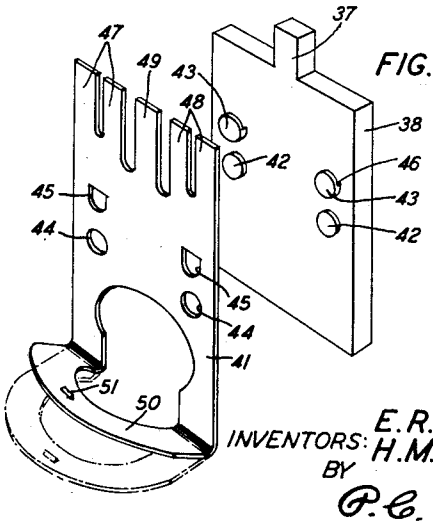


FIG. 7



INVENTORS: E. R. MORTON
H. M. STOLLER
BY
P. C. Smith
ATTORNEY

Patented Aug. 3, 1943

2,326,054

UNITED STATES PATENT OFFICE

2,326,054

MULTIUNIT RELAY

Edmund R. Morton, New York, N. Y., and Hugh M. Stoller, Mountain Lakes, N. J., assignors to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York

Application August 10, 1940, Serial No. 352,162

6 Claims. (Cl. 200—98)

This invention relates to electromagnetic devices and more particularly to relays of the multiunit type.

It has heretofore been customary to manufacture relays such, for example, as relays used as line relays in telephone systems, as individual units, each with its own pole-pieces, core, armature, coil and contact springs, to assemble such individual units on mounting plates of a relay rack and to multiple contact springs of a group of such relays together if so required. For example, relays used as the line relays in telephone systems of the cross-bar type are customarily mounted in groups of ten, each relay having two pairs of contact springs. One spring of each pair is connected to the grounded terminal of the central office battery, the other spring of one pair is connected to a circuit individual to the line with which the relay is associated and the other spring of the other pair is connected to a circuit which is common to ten lines. It is thus apparent that upon the installation of such a group of ten line relays it is necessary to connect three springs of each relay in multiple with the corresponding springs of the other relays of the group of ten thus requiring thirty soldering operations. A consideration of these requirements has led to the conclusion that a considerable simplification of the structure of relays of this type might be achieved.

It is, therefore, the object of the present invention to simplify the manufacturing and assembling of relays of the type above discussed by constructing such relays as multiunit assemblies.

In accordance with the present invention this object is attained by providing a channel-shaped return pole-piece of sufficient length to be used in common for five relay units and having five cores secured to its base portion and extending forwardly between the flanges thereof. The front edges of the channel and the ends of the cores are ground flat after assembling. The magnetic circuit comprises the core, the armature and the lower flange of the return pole-piece, the upper flange of the return pole-piece not forming a part of the magnetic circuit. Each core supports a layer wound coil. The contact spring pile-up is a separate subassembly mounted on the outer face of the upper channel flange and comprises a supporting plate having forwardly and downwardly extending members serving as back stops for the five armatures of the multiunit relay, a common contact member having five downwardly extending contact portions, five individual contact members each having a downwardly extending contact portion, an outer clamping plate and interposed strips of insulating material for insulating the contact members from each other and from the supporting and clamping plates. After its assembly the elements of the pile-up are held together in their assembled positions by rivets and the pile-up supporting plate is spot welded to the upper flange of the return pole-piece.

Welded to the outer face of the lower flange of the return pole-piece is an armature supporting member having five arms extending forwardly in vertical alignment with the five cores. Positioned with their lower edges resting upon the arms of the supporting member are five armatures which cooperate respectively with the five cores. Each armature carries a spring member, the upper end of which is provided with bifurcated contact portions which cooperate with one of the individual contact members and with one of the contact portions of the common contact member and the lower portion of which is bent outwardly and hooked beneath the corresponding arm of the armature supporting member. The armature springs serve as grounded springs for the units of the relay and, therefore, to insure good conductivity between each supporting arm and the armature spring, the supporting arms and the hook portions of the armature springs are provided with cooperating contacts or connector bars. The armature springs simultaneously provide retractile force for the armatures and also hold the heels of the armatures firmly against the supporting arms and against the forward edge of the lower channel flange.

The relay structure above outlined provides a five-unit relay having about one-quarter of the parts which would enter into the assembly of five individual relays whereby a great saving is realized in the cost of assembly and in the cost of installation.

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

Fig. 1 is a top plan view, drawn to approximately double scale, of a multicontact relay constructed in accordance with the present invention with portions of two of the units omitted and a portion of the spring pile-up broken away to better disclose features of the construction;

Fig. 2 is a front elevational view of the relay disclosed in Fig. 1;

Fig. 3 is a view partly in cross-section taken along section line 3—3 of Fig. 2;

Fig. 4 is an exploded cross-sectional view of the spring pile-up subassembly of the relay taken along section line 4—4 of Fig. 1;

Fig. 5 is an exploded cross-sectional view of the spring pile-up subassembly of the relay taken along section line 5—5 of Fig. 1;

Fig. 6 is an exploded cross-sectional view of the spring pile-up subassembly taken along section line 6—6 of Fig. 1; and

Fig. 7 is a disassembled perspective view of an armature and its associated spring.

Referring now to the drawings and particularly to Figs. 1, 2 and 3, the multiunit relay structure is provided with a channel-shaped common return pole-piece 1 of magnetic material having five holes 2 provided in its base portion 3 through which the shouldered ends of five cores 4 are extended and firmly secured by staking as indicated at 5. A layer wound coil 6 having two terminal lugs 7 and 8 secured by eyelets to its rear spoolhead 9 is supported on each core. The left-hand core and coil have been omitted to better disclose the manner in which the base portion 3 of the pole-piece 1 is cut away as indicated at 10 and 11 to permit the coil terminal lugs to extend rearwardly beyond the base portion 3. For assisting in retaining the coils 6 on the cores 4, the cores 4 are knurled at 12 for engagement in the holes in the rear spoolheads 9.

The contact spring pile-up of the relay is a separate subassembly mountable upon the outer face of the upper flange 13 of the pole-piece 1. It comprises a lower supporting plate 14 extending the full length of the flange 13, a strip 16 of insulating material, such as black phenol fibre, superimposed thereon, a common contact strip 17 of suitable spring material, such as nickel silver, superimposed on the insulating strip 16 and having five forwardly and downwardly extending contact portions 18, a soldering terminal lug 20 in engagement with the contact strip 17 near one end thereof, a second strip 19 of insulating material superimposed on the contact strip 17 and the lug 20, five equally spaced individual contact members 21 of suitable spring material, such as nickel silver, superimposed on the insulating strip 19 and each having a forwardly and downwardly extending contact portion 22, a third strip 23 of insulating material superimposed on the contact members 21 and an outer clamping plate 24 superimposed on the strip 23, and having five forwardly and downwardly extending back stop members 15 having a spacing equal to the spacing between the axes of the cores 4.

For holding the common contact strip 17 in its proper assembled position in the spring pile-up, strip 17 is provided with a plurality of upwardly extending embossments 25 distributed along its length, one of which is disclosed most clearly in Fig. 6, which are engaged in holes 26 in the middle insulating strip 19. Each individual contact member 21 is also provided with two downwardly extending embossments 27 which engage in holes 28 in the middle insulating strip 19 and the soldering terminal lug 20 is also provided with two upwardly extending embossments 29 which engage in holes 30 in the middle insulating strip 19.

The entire spring pile-up assembly is clamped together by rivets 31 which extend through holes in the insulating strips 16, 19 and 23, through holes in the contact strip 17 and contact members 21 and through holes in the supporting plate 14 and in the outer clamping plate 24 and are headed over on the clamping plate 24. The holes in the contact strip 17 and in the contact members 21 are of sufficient diameter to permit the rivets 31 to extend therethrough without conductive engagement with such strip and members. The subassembly is secured to the upper flange 13 of the return pole-piece 1 by spot welding the supporting plate 14 thereof to the flange at the points 32, the terminal strip 17, insulating strips 16, 19 and 23 and the outer clamping plate 24 being provided with notches as indicated at 33 to enable the spot welds to be made at certain intervals along the plate 14. When thus assembled, the backstop members 15 of the plate 24 are in vertical alignment with the cores 4, with the contact portion 22 of an individual contact member 21, and a contact portion 18 of the common contact strip 17 positioned on either side thereof.

Spot welded or otherwise secured to the lower flange 34 of the return pole-piece 1 is an armature supporting member 35 having five arms 36 extending forwardly therefrom and positioned in vertical alignment with the cores 4. Positioned on the arms 36 with their lower ends or heels in engagement with the forward edge of the lower flange 34 of the return pole-piece and with their upper ends 37 positioned between the forward edge of the upper flange 13 of the return pole-piece and the inner face of the backstop members 15 are five armatures 38. The heel pieces of the armatures are held adjacent to the forward edge of the flange 34 of the return pole-piece by ledges 39 struck up from the armature supporting arms 36. Secured to the inner surface of each armature is a disc 40 of nickel silver which engages with the end of the core 4 with which the armature is associated to prevent the armature from sticking to the core upon its attraction toward the core.

Secured to the outer surface of each armature is a spring 41, preferably made of hard nickel silver, which is detachably secured to the armature by means of two lower studs 42 and two upper studs 43 which may be formed as embossments on the armature and which fit into holes 44 and 45 in the spring 41. The upper studs 43 are milled or sawed to form slots, as shown at 46 in Fig. 7, and the holes 45 in the spring 41 are formed with horizontal upper edges. In assembling the spring 41 on the armature 38 the studs 43 are slipped through the holes 45 in the spring and the spring is then pushed downwardly until the upper straight edges of the holes 45 are seated in the bottoms of the slots of the studs 43 and the spring is thus embraced between the heads of such studs and the outer face of the armature at which time the holes 44 in the spring will be aligned with the studs 42 and such studs will then enter such holes. The spring 41 is now held against the outer face of the armature by the heads of studs 43 and is held from moving lengthwise or laterally with respect to the armature by the studs 42.

The upper end of the spring is slotted to form two bifurcated contact portions 47 and 48 and a central tongue 49 which engages with the inner face of a backstop member 15 and which serves with the backstop member 15 to determine the normal air-gap between the armature 38 and the end of the core 4 with which it is associated. The contact portions 47 and 48 are provided with suitable contacts which cooperate with contacts

carried by the associated contact portions 18 and 22. The lower end of the armature spring 41 is cut away to form a loop portion 50 which is normally bent as indicated in Fig. 7 and is provided on its inner surface with a connector bar 51 of contact material.

With the spring 41 assembled on the armature 38 as previously described and the heel of the armature seated on the arm 36 of the support 35 between the ledge 39 and the forward edge of the flange 34 of the return pole-piece, the loop portion 50 of the spring is engaged beneath the end of arm 36 with its connector bar 51 in engagement with a connector bar 52 of contact material secured to the underside of the arm 36. The loop portion 50 of the spring being pretensioned by bending as disclosed in Fig. 7, the spring in its assembled position as disclosed in Fig. 3, biases the armature toward the backstop member 15 and exerts sufficient downward force to hold the heel of the armature firmly against the supporting arm 36 and against the forward edge of the flange 34 of the return pole-piece thereby reducing the reluctance of the air-gap between the heel of the armature and the return pole-piece. To prevent the armature from slipping laterally with respect to the supporting arm 36, the width of the opening in the lower end of the armature spring 41 which forms the loop portion 50 is only slightly greater than the width of the enlarged portion 53 of the supporting arm 36 as best disclosed in Fig. 2.

To insure that when any one coil is energized only the armature associated with the core on which such coil is supported will be attracted, the cross-sectional area of the core and of the armature are made less than the cross-sectional area of the return pole-piece so that magnetic saturation occurs in the core and in the armature rather than in the return pole-piece. Consequently there is no saturation in the common parts of the magnetic circuit and, therefore, negligible coupling between the units of the relay occurs. Such coupling is known as magnetic crossfire and in the case of marginal relays must be held at times to less than one per cent of the magnetomotive force of the operating coil. When any armature becomes attracted its armature spring 41, which is connected to ground over connector bars 51 and 52, through the return pole-piece 1 and the relay rack to which it may be secured by the screws 54, engages its contact portions 47 and 48 with the contact portion 22 of an individual contact member 21 and with the contact portion 18 of the common contact strip 17 whereby ground becomes connected to the individual contact member 21 and to the common contact strip 17 and the soldering lug 20 connected therewith.

The relay requires very little adjustment in service but an adjustment of the contact portions 47 and 48 of the armature spring 41 may be made by removing the spring from the armature, bending such portions and reassembling the spring on the armature as previously described. It is to be noted that the method employed for securing the armature spring to the armature in no manner flexes the armature spring to upset the adjustment of its contact portions 47 and 48 as would be the case were the spring 41 secured to the armature by rivets or screws.

What is claimed is:

1. In a relay, a return pole-piece, a core supported thereby, a coil on said core, an armature supporting arm secured to said return pole-piece, an armature supported on said arm with its heel resting on said arm and against the pole face of said return pole-piece, and a leaf spring prebent into a V-shape having one leg thereof secured to said armature and having the portion thereof near its bend cut away to form a loop in the other leg thereof through which said arm extends and conductively engaged with the outer surface of said arm whereby said spring normally biases said armature into its retracted position and engages the heel thereof with said arm and with the pole face of said return pole-piece.

2. In a relay, a return pole-piece, a core supported thereby, a coil on said core, an armature supporting arm secured to said return pole-piece, an armature supported on said arm with its heel resting on said arm and against the pole face of said return pole-piece, and a leaf spring prebent into a V-shape having one leg thereof secured to said armature and having the portion thereof near its bend cut away to form a loop in the other leg thereof through which said arm extends and conductively engaged with the outer surface of said arm and with the inner side edges of said loop engaged against the edges of said arm, whereby said spring normally biases said armature into its retracted position, engages the heel thereof with said arm and the pole face of said return pole-piece and centers said armature with respect to said core.

3. In a relay, a return pole-piece, a core supported thereby, a coil on said core, an armature supporting arm secured to said return pole-piece, an armature supported on said arm with its heel resting on said arm and against the pole face of said return pole-piece, a leaf contact spring prebent into a V-shape having one leg thereof secured to said armature and having the portion thereof near its bend cut away to form a loop in the other leg thereof through which said arm extends and engaged with the outer surface of said arm, whereby said spring normally biases said armature into its retracted position and engages the heel thereof with said arm and the pole face of said return pole-piece, and a pair of cooperating connector bars one secured to the underside of said arm and the other secured to the loop portion of said spring for insuring good conductivity between said spring and said return pole-piece.

4. In a relay, a return pole-piece, a core supported thereby, a coil on said core, an armature cooperative with said core and said return pole-piece having two pairs of studs embossed from its outer face, one pair of said studs being transversely slotted adjacent the outer face of said armature and the other pair of said studs serving as locking studs, and a spring detachably secured to said armature for holding said armature in a pivoted relationship with said return pole-piece having a first pair of holes through which said slotted studs extend and having a second pair of holes through which said locking studs extend when said spring is moved to a position to engage the upper edges of its first pair of holes in the bottoms of the slots of said first pair of studs.

5. A multiunit relay comprising a channel-shaped return pole-piece, a plurality of cores supported thereby, a coil on each of said cores, a member secured to one flange of said pole-piece having a plurality of armature supporting arms, an armature supported on each of said arms opposite each of said cores, a spring pile-up secured to the other flange of said pole-piece comprising as many pairs of contacts as there are armatures,

one contact of each pair being an individual contact and the other contact being a multiple from a common contact strip, and a spring secured to each of said armatures for bridging engagement with an associated pair of contacts of said pile-up and having an outturned portion engaged beneath the associated armature supporting arm whereby said armature is held in its retracted position with its heel held against the pole face of said one flange.

6. A multiunit relay comprising a return pole-piece, a plurality of cores supported thereby, a coil on each of said cores, an armature cooperative with each of said cores, a spring pile-up secured to said return pole-piece comprising a lower supporting plate, a contact strip having a contact portion associated with each of said armatures, a layer of individual contact members associated respectively with said armatures, an outer clamping plate provided with a backstop extension for each of said armatures, strips of insulating material interposed between said lower supporting plate, said contact strip, said layer of contact members and said outer clamping plate, and means for clamping said elements of said pile-up together, and a spring secured to each of said armatures for bridging engagement with the contact portion of said contact strip and the individual contact member associated with each of said cores.

EDMUND R. MORTON.
HUGH M. STOLLER.