

Oct. 21, 1969

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3,474,364

CROSS POINT STRIP RELAY ASSEMBLY

Filed June 12, 1967

2 Sheets-Sheet 2

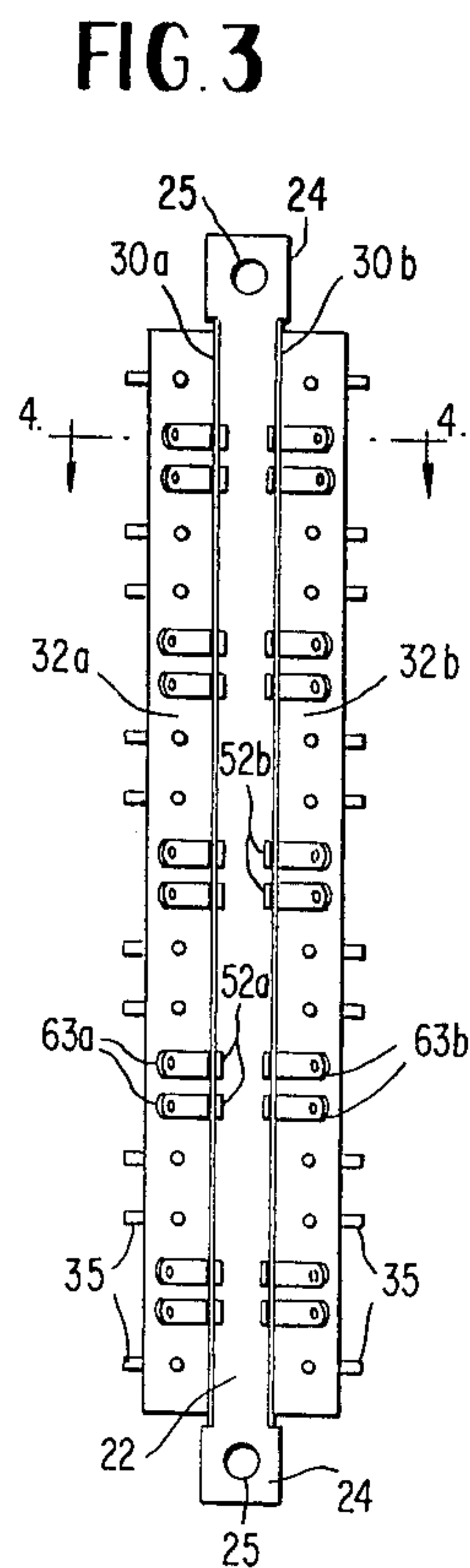
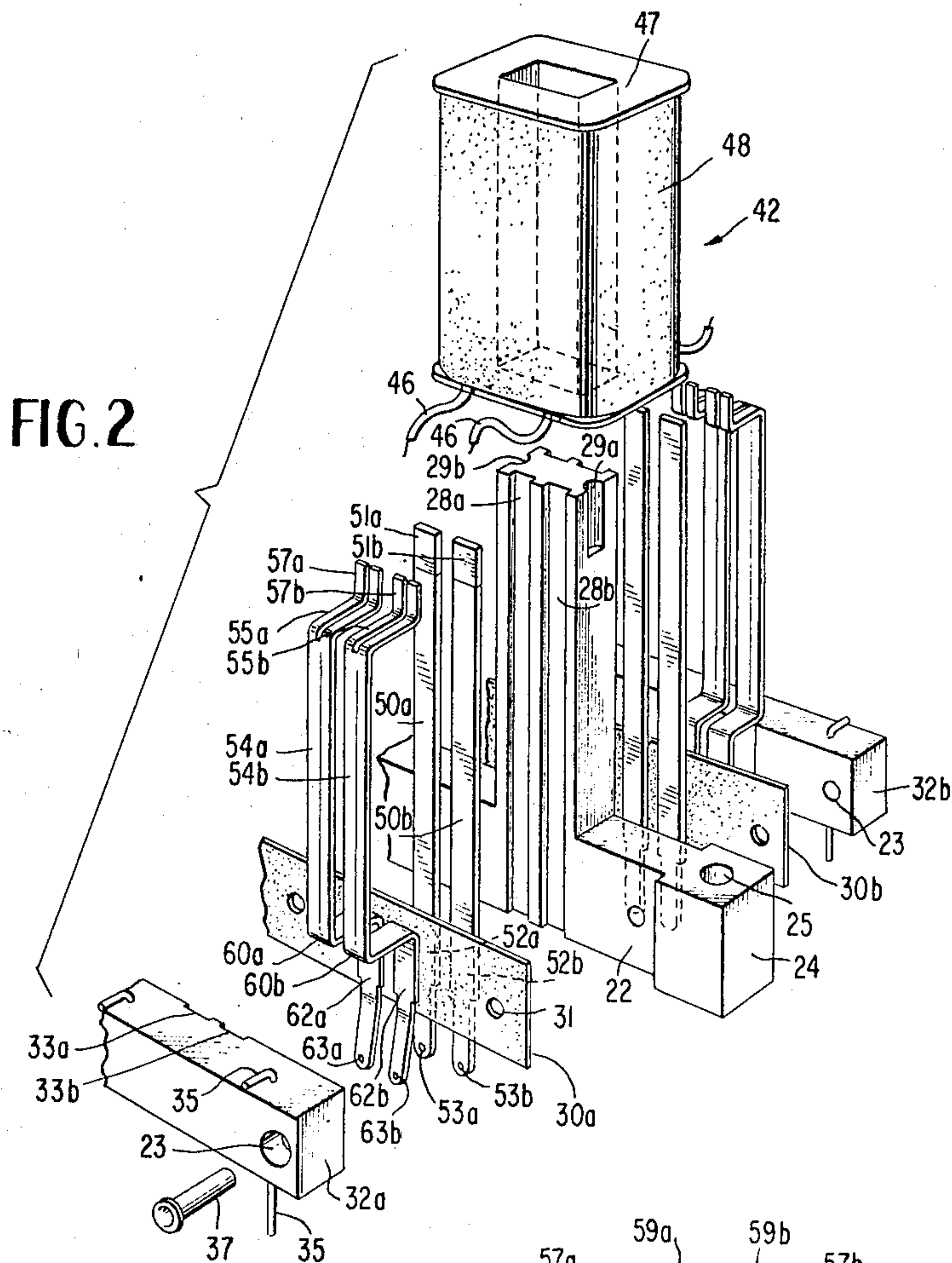
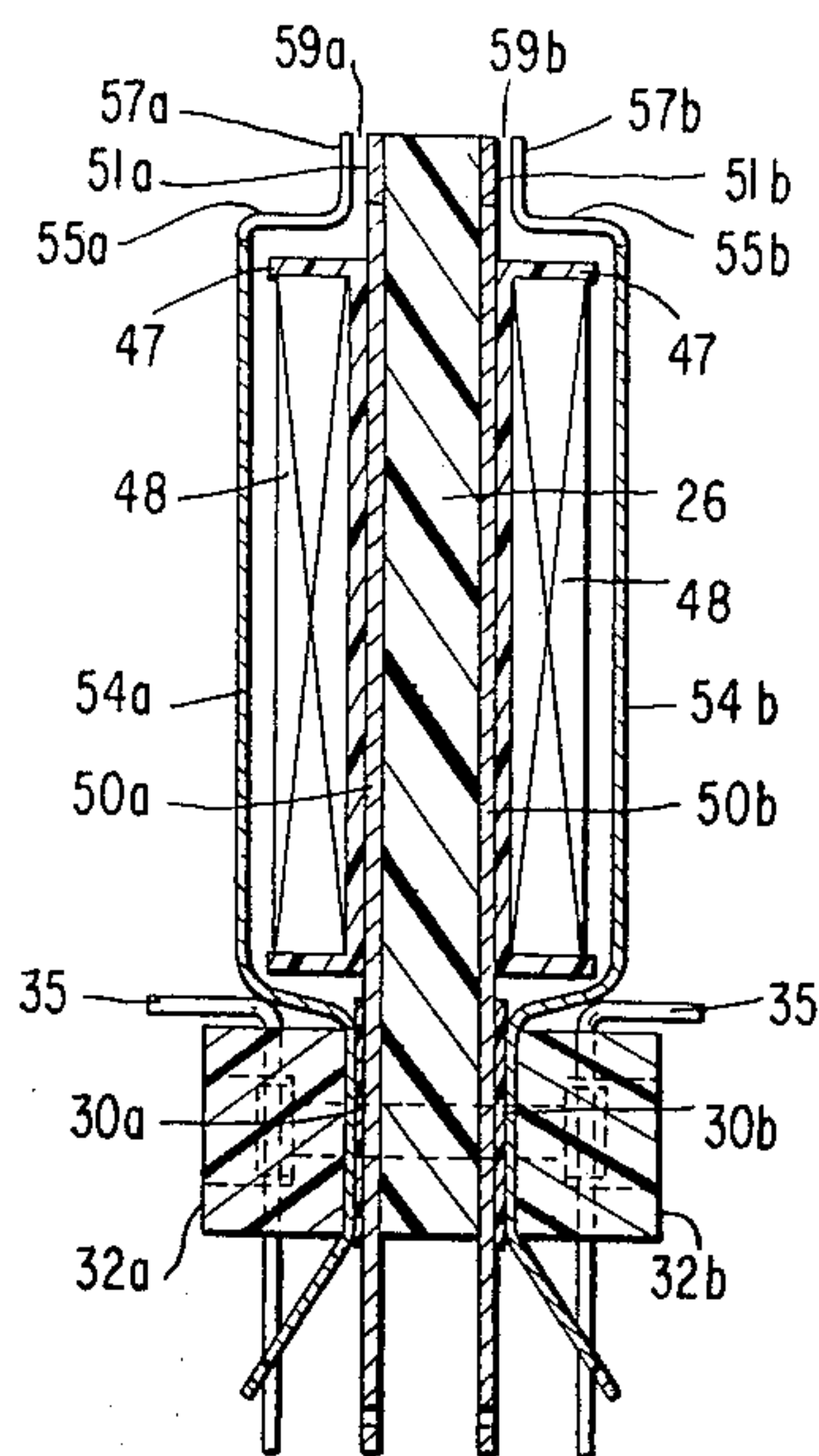


FIG. 4



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CROSS POINT STRIP RELAY ASSEMBLY

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Filed June 12, 1967, Ser. No. 645,190

Int. Cl. H01h 9/02, 13/04

U.S. Cl. 335—202

13 Claims

ABSTRACT OF THE DISCLOSURE

A relay structure embodying fixed contact members mounted to channels on opposite sides of a relay support column extending through a central opening in the relay coil structure. The movable spring contact members are specially shaped to be positioned outside of the coil structure and have bifurcated end contact portions. The individual relay structures are mounted to a support assembly having a center base support extending the length of the relay column and which includes the relay support columns as integral structures. The end portions of the central base support include means for mounting the strip relay assembly to an equipment frame. The relay support columns each have key slots on their end portions in close proximity to the contact portions of the contact members. Side fastening strips mate with the center base support to secure the fixed and movable contact members. A positioner and guard assembly, provided with embedded deflecting bars and keys for engaging the key slots in the respective relay supported columns, is constructed to fit over the contact portions of the contact members. The deflecting bars capture the stray magnetic fields extending beyond the contact portions and the keys automatically align and gap the contact portions of the fixed and movable contact members. A transparent cover snap fits over the entire relay assembly to protect it from the surrounding environment.

Background of the invention

The increasing demand for switching circuitry in communication equipment and related equipment, such as telephone distribution networks, has necessarily resulted in an ever-increasing demand for multiple contact relay structures to perform the required switching and connecting operations. To meet such a demand, equipment manufacturers have resorted to automated production and assembly techniques for manufacturing multiple contact relay components. Industry uses such relay components assembled as strip relays to provide a compact, more efficient, and economical relay assembly.

Automated production and assembly of such relay switching and connection equipment devices requires that the component elements be suitable for bulk handling and economical manufacture. Prior art relay components have not completely met such requirements for the most expeditious application of automated production techniques in the assembly of strip relay devices. The individual components have been large and bulky, complex and unreliable, especially when assembled in a strip relay structure. Moreover, the strip relay assemblies have been noisy and uneconomical due to the high power required for contact actuation.

The features of the present invention result in an improved strip relay assembly which is especially suited for automated production techniques. The component elements are easily constructed, economical to produce in large quantities and easy to assemble as a strip relay device that is more compact, less noisy and more efficient than prior art relay strip assemblies.

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Brief description of the invention

In accordance with the invention, the movable contact members of the individual relay units are located outside of their associated coil winding structure in contradistinction to prior art movable contact members which are located within the coil winding structure. In comparison to such conventional relay structure, the arrangement of the invention provides a tighter magnetic circuit which allows a lower value of ampere turns to operate the relay resulting in improved efficiency.

The relay structure of the individual relay assemblies forming the strip relay of the invention is provided with a positioner and guard assembly having embedded deflecting bars which are in close proximity to the contact tips of the contact members to capture stray magnetic fields extending from the contact tips during the relay operating cycle. The deflecting bars improve the magnetomotive force distribution in the air gap between the contact tips and thereby improve the power consumption of the relay assembly.

Key slots are also provided in the relay support columns to mate with keys in the positioner and guard assembly such that when the latter assembly is mounted over the individual relay components, the air gaps between the contact tip pairs are automatically aligned and set to closely held tolerances without the need for additional costly and time consuming adjustment.

A primary object of the invention is to provide an improved relay assembly which is adapted specifically for automated production and assembly.

Another object is to provide an improved strip relay assembly for automated production which is more compact, more efficient, and less costly than prior conventional strip relay assemblies.

A further object is to provide a relay assembly wherein the assembled individual relay component elements produce a tighter magnetic circuit enabling the relay assembly to operate with lower ampere turns.

Still another object is to enable the automatic alignment and gapping of each of the operating contact pairs to closely held tolerances.

And yet a further object is to provide a relay assembly having an improved magnetomotive force distribution in the air gaps between associated contact pairs and thereby improve the power consumption of the assembled relay structure.

In accordance with a specific embodiment of the invention, a support assembly is provided for mounting a plurality of individual relay components in a column or strip array. The support assembly comprises an elongated center base support which has a plurality of rectangular shaped relay support columns extending vertically from its upper surface as integral structures. Two opposite faces of each of the relay support columns have a number of parallel spaced channels running the full length of the support column. Fixed contact members are mounted within each channel and are provided with a reduced lug terminal at one end extending beyond the bottom of the central base support and a contact tip at the other end extending to the top of the channel. The relay support column and fixed contact members extend through an opening in the central portion of each relay coil structure so that the contact tips are exposed above the upper surface of each respective relay coil. Specially shaped movable spring contact members are provided with bifurcated contact tips and positioned outside the coil structure such that the bifurcated contact tips are directly opposite the contact tips of an associated fixed contact member. The lower portion of each movable spring contact member is bent to form an elbow to provide additional springiness and to allow the contact member to pass

around the outer surface of the relay coil structure. The end of the elbow portion is bent approximately 90° and extended downward beyond the bottom of the central base support and aligned with the associated fixed contact members. An insulating strip is placed between the fixed contact members and the movable spring contact members on each side of the central base support. A fastening strip, having vertical parallel spaced channels to accommodate an opposing portion of the movable spring contact members, is positioned on each side of the central base support and securely fastened thereto by suitable rivets or bolts which are inserted into, and through, aligned holes provided in the fastening strips, insulating strips and central base support. The coil terminals for the coil assemblies are embedded in each of the side fastening strips to extend directly below the bottom surfaces of the strips to engage with connecting equipment forming no part of the invention.

The opposite faces, not having the channels, of the upper portion of the relay column supports extending above the surface of the relay coil are provided with key slots. A positioner and guard assembly having a plurality of rectangular openings is constructed to receive the end portions of the relay column supports, and keys are provided on the opposing sides of each opening to mate with the key slots in the relay column supports. The sides of the rectangular openings facing the movable spring contact members are constructed to abut directly against the outer surface portions of the contact tips on the movable spring contact members and force the contact tips into an aligned and preset gapped relationship with the respective associated contact tips of the fixed contact members. This automatic alignment and setting of the contact gaps is achieved when the positioner and guard assembly is mounted on the relay support columns. The mounted relay assemblies are covered by a removable, snap fit, transparent cover provided with protrusions mating with fastening holes on each outer side of the fastening strips. The cover is constructed to receive the positioner and guard assembly within its upper portion in a press fit to hold the latter component securely within the cover. The cover protects the relay structure and, in particular, the contact tips, from dust and other harmful objects in the surrounding environment.

These and further features, objects and advantages of the present invention will become more obvious from the following description when taken in connection with the accompanying drawings which show, for purposes of illustration only, one embodiment in accordance with the present invention, and wherein:

FIGURE 1 illustrates the relay assemblies mounted on the supporting assembly as a strip relay assembly with positioner and guard cover assembly partially cut away;

FIGURE 2 is an exploded detail view of the relay components and supporting assembly structure in accordance with a specific embodiment of the invention;

FIGURE 3 is a bottom view of the mounting support assembly showing the inter-relationship of the assembled mounting support components;

FIGURE 4 shows a sectional view of the strip relay assembly taken through section 4—4 of FIGURE 3.

A specific embodiment of the invention is described hereinafter with particular reference to the accompanying figures wherein corresponding components have been given the same numerical designation.

Detailed description of the invention

With reference to FIGURE 1, relay strip assembly 10 is shown with mounting support assembly 20, relay assembly 40, and positioner and guard cover assembly 60 in their respective assembled relationship. Mounting support assembly 20 essentially comprises elongated center base support 22 provided with integral rectangular shaped end pieces 24 and mounting holes 25. Mounting holes 25 enable relay strip assembly 10 to be mounted to the frame portions of an equipment rack which is not illus-

trated since it forms no part of the invention. Side fastening strips 32a, 32b, are provided to mate with center base support 22, and for this purpose alignment fastening holes 23 extend through side fastening strips 32a, 32b and center base support 22 to receive a fastening rivet (reference FIGURE 2) for securing mounting support strips 32a, 32b to center base support 22. Center base support 22 and side fastening strips 32a, 32b are preferably formed from a polystyrene insulating material, such as Teflon, but other materials may also be used, as can be appreciated. Coil terminals 35 are embedded within side fastening strips 32a, 32b and extend perpendicularly beyond the bottom side fastening strips to engage a conventional associated connector, forming no part of the invention, to provide excitation to coil assemblies 42. Coil leads 46 are connected in a known manner to the upper bent-over portions of coil terminals 35.

Relay column supports 26 are provided preferably as an integrated structure with center base support 22 and extend vertically through openings in the center portion of coil assemblies 42 to support the latter on mounting support assembly 20. Key positioner slots 29a, 29b are provided on one or both opposite side surfaces of relay column supports 26 for purposes which will be more clearly explained, infra.

Relay assembly 40 comprises a plurality of coil assemblies 42 which are mounted in strip fashion to mounting assembly 20 and are guided by relay column supports 26. Each coil assembly 42 includes a coil 48 (FIGURE 4), end supports 43a, 43b and coil leads 46 connected to coil terminals 35. An important feature of the invention is provided in the form of movable spring contact members 54a, 54b which are provided with bifurcated end portions 55. Movable strip contact members 54a, 54b are shaped and mounted to mounting support assembly 20 to be positioned outside of each coil assembly 42. The operation and advantages of such a structural relationship will be described more fully hereinafter. Although each coil assembly 42 is illustrated in FIGURE 1 as having two movable strip contact members 54a, 54b, three or more such movable contact members may be provided in accordance with the design requirements of the associated switching or connecting equipment.

Positioner and guard cover assembly 60 comprises cover 61 and positioner and guard element 66 in which are embedded deflection bars 68 running the length of relay assembly 40 and are constructed to be in close proximity to the contact tips 51a, 51b and 57a, 57b. Positioning openings 70 are formed through positioner and guard element 66 to receive the end portions of relay column supports 26. Side faces 71a, 71b abut against the outer surface portions of contact tips 57a, 57b exerting an inward force to provide the desired air gap with contact tips 51a, 51b. Keys 72a, 72b mate with the respective key slots 29a, 29b to align positioner and guard assembly 60 with relay assemblies 40. Positioner and guard element 66 is preferably formed from an insulating material such as polystyrene, of which Teflon is a suitable material, although it is recognized that other insulating materials may also be used. Positioner and guard element 66 is shaped to fit securely within the upper portion of cover 61 such that it remains in position as cover 61 is removed from, and mounted over, relay assemblies 40.

Continuing with FIGURE 1, cover 61 is preferably formed from a clear plastic material and is provided with rib depressions 62 to produce increased structural rigidity. Snap fit fasteners 64, comprising cone-shaped protrusions are provided along the lower portion to cover 61 and aligned with fastener holes 23 in mounting support assembly 20 for engagement therewith to secure the cover to the assembly 20 in a releasable manner. Cover 61 primarily provides a means for isolating relay assemblies 40 from hazardous and harmful elements such as dust and moisture in the surrounding environment but also provides additional advantages as will be indicated, infra.

A more detailed description of coil assembly 42 and the means by which it is mounted to mounting support assembly 20 follows with the aid of the exploded view of FIGURE 2.

Relay column support 26 extends vertically from center base support 22 and is provided with parallel spaced channels 27a, 27b and 28a, 28b in its opposite faces. However, it is recognized that the number of channels is not critical, and depending on the number of contact tip pairs desired, there may be only one channel in each face, more than two channels in each face, or channels only in one face. Fixed contact members 50a, 50b are constructed to force fit into channels 27a, 27b and 28a, 28b. Contact tips 51a, 51b are formed at the upper end portions of fixed contact members 50a, 50b and mounted within channels 27a, 27b and 28a, 28b so that their end surfaces are flush with the upper surface of relay column support 26. The lower portion of fixed contact members 50a, 50b are reduced in size to form reduced lug terminals 52a, 52b which may be provided with wire holes 53a, 53b. Reduced lug terminals 52a, 52b are of sufficient length to extend below the bottom of mounting support assembly 20 to enable wire wrap connections or soldered connections to be made to the lug terminals. Fixed contact members 50a, 50b are preferably made from a copper or copper alloy material to provide good electrical conductivity although any suitable electrically conductive material may be used.

Movable spring contact members 54a, 54b are constructed from the same material as fixed contact members 50a, 50b, and are specially shaped to be positioned outside of coil assembly 42. Upper portions 55a, 55b are bifurcated to form a more resilient structure and are L-shaped with contact tips 57a, 57b formed at the short arms of the L. The longer arm of the L-shaped portion extends contact tips 57a, 57b over the top of coil assembly 42 to form the required air gap with opposing contact tips 51a, 51b. The lower portion of movable spring contact members 54a, 54b are formed into L-shaped segments 62a, 62b and are provided with reduced lug terminals 63a, 63b. Reduced lug terminals 63a, 63b are of sufficient length to extend beyond the bottom of center base support 22 to enable either a wire wrap connection or soldered connection to be made thereto. A bend is introduced into reduced lug terminals 63a, 63b to move them away from reduced lug terminals 52a, 52b and provide adequate space for making the necessary electrical connections thereto without contacting the connections made to opposing lug terminals 52a, 52b.

Contact tips 51a, 51b and 57a, 57b are preferably formed of a diffused precious metals, such as gold or rhodium and nickel or a similar alloy, instead of discrete contacts, over a nickel iron or a soft iron base material. A nickel plating prior to the gold flashing prevents migration of the base material during the annealing process thereby providing a contact surface relatively free from pits and nodes.

When relay column support 26 has been fitted with the necessary fixed contact members 50a, 50b in its channels 27a, 27b, coil assembly 42 is fitted over relay column support 26 which extends through coil frame 47. Strip insulators 30a, 30b are then positioned between the adjacent lower portions of fixed contact members 50a, 50b, and movable spring contact members 54a, 54b; and side fastening strips 32a, 32b positioned with respect to center base support 22 to enable rivet 37 to pass through hole 23 to securely fasten strip elements 32a, 32b strip insulators 30a, 30b, contact members 50a, 50b and 54a, 54b to form rigid mounting support assembly 20.

With continuing reference to FIGURE 2, channels 33a, 33b are provided in the inner side surfaces of side fastening strips 32a, 32b to accommodate the lower portions of movable spring contact members 54a, 54b. This insures that side fastening strips 32a, 32b will abut firmly against strip insulators 30a, 30b to securely mount the lower portions of movable spring contact members 54a, 54b

and to form a more rigid structure. Fastening holes 23 are widened to a sufficient depth such that the head of rivet 37 will not interfere with the snap fit fasteners 64 of cover 61 (see FIGURE 1).

FIGURE 3 shows the bottom of mounting support assembly 20 as it appears when its constituent elements have been securely fastened together. Side strip fasteners 32a, 32b are shown firmly gripping insulators 30a, 30b which are sandwiched between fixed contact members 50a, 50b and movable spring contact members 54a, 54b; the above mentioned elements being tightly pressed against the sides of center base support 22. The reduced lug terminals 52a, 52b extend directly out from the surface of FIGURE 3 toward the reader, while reduced lug terminals 63a, 63b extend out from the bottom of center base support 22 at an oblique angle. The upper portion of coil terminals 35 extend beyond the outer sides of side fastening strips 32a, 32b, while the lower portions extend directly out from the bottom surfaces of said fastening strips 32a, 32b. The bottom portions of coil terminals 35 engage corresponding connector receptacle in a connector assembly not forming a part of the invention when the strip relay assembly 10 is used with its associated equipment.

FIGURE 4 shows the internal structure of one of the relay assemblies 40 mounted to mounting support assembly 20 taken through section 4—4 as indicated in FIGURE 3. Relay column support 26 extends upwardly through the opening provided in coil frame 47 and is tightly engaged by the side surfaces of coil frame 47. Double coil 47 is wound on coil frame 47 in a manner known to those skilled in the art.

Movable spring contact members 54a, 54b are forced inwardly toward fixed contact members 50a, 50b by the magnetomotive force produced when coil 48 is excited. The normal spring deflection of movable spring contact member 54a, 54b moves them outwardly away from fixed contact members 50a, 50b when coil 48 is not excited.

With coil 48 unexcited, and movable spring contact members 54a, 54b in their normal deflected position, the outer portions of contact tips 57a, 57b abut against the respective side surfaces 71a, 71b of position openings 70 (see FIGURE 1). In this manner, air gaps 59a, 59b are automatically set to their desired design tolerances when positioner and guard cover assembly is mounted in its position on top of relay assembly 40. Positioner and guard cover assembly 60 (reference FIG. 1) is aligned with respect to relay assemblies 40 by the mating of keys 72 with key slots 29. Snap fit fasteners 64 provide additional holding and aligning of this assembly with mounting support assembly 20.

We claim:

1. A strip relay assembly having at least one relay coil element consisting of electrical coil means and electrical connection means for exciting said coil means, said coil element having an opening through said electrical coil means, in combination, comprising:

mounting support means for mounting said relay coil elements;

said mounting support means including fixed contact members extending through the opening in said electrical coil means,

movable spring contact means mounted at an end portion thereof to said mounting support means and the free end thereof being in opposed relationship to said fixed contact members to form an air gap therebetween, and the portion of said movable spring contact means between said mounted end and said free end being positioned in close proximity to the outer surface of said coil elements with said movable contact means and said air gap being located outside of said relay coil element.

2. The strip relay assembly according to claim 1 wherein, said mounting support means have a top and a bottom surface and said mounting support means further comprises a central base support element having a top and

a bottom surface and including relay support means positioned along said top surface in spaced relation,

said relay support means including recessed channel means for mounting said fixed contact members substantially normal with respect to said center base support element,

said relay support means being shaped to conform to the opening in said coil element and said relay support means extending through said opening for mounting said relay coil element on said mounting support means.

3. The strip relay assembly according to claim 2 wherein a portion of said relay support means and said fixed contact members extend above the upper surface of said relay coil element,

said free end of said movable spring contact means is bifurcated and each branch of said bifurcation includes first electrical contact means,

said extended portion of said fixed contact members above said relay coil element includes second electrical contact means,

said air gap being formed between said first and said second electrical contact means,

and said movable spring contact means and said fixed contact members further includes electrical terminal means extending beyond the bottom surface of said center base support element.

4. The strip relay assembly according to claim 3 wherein said mounting support means further comprises, strip fastening means extending parallel to said center base support element,

said movable spring contact means being positioned parallel to said relay support means and extending between said center base support element,

said strip fastening means being securely mounted to said center base support element to hold said movable spring contact means.

5. The strip relay assembly according to claim 4 wherein said strip fastening means has a bottom surface and a top surface and includes embedded coil terminals extending through and beyond said bottom and top surfaces to enable electrical connections to be made to the extended portions of said coil terminals.

6. The strip relay according to claim 5 wherein said mounting support means further includes insulator means positioned between said center base support element and said movable spring contact means.

7. The strip relay assembly according to claim 5 wherein said strip fastening means further includes additional recessed channel means in a side facing said center base support element for receiving and holding said movable spring contact means, said recessed channel means extending from the top surface to the bottom surface of said strip fastening means.

8. The strip relay assembly according to claim 1, further comprising:

cover means mounted on said mounting support means and enclosing said relay coil element, said fixed con-

tact members, and said movable spring contact means.

9. The strip relay according to claim 8 wherein said mounting support means includes recessed means for holding said cover means and said cover means further includes protruding elements for engaging and covering said recessed means to securely mount said cover means on said mounting support means.

10. The strip relay assembly according to claim 8 wherein said cover means includes positioner and guard means for aligning said cover means on said mounting support means and positioning said free end of said movable spring contact means to automatically set the gap length of said air gap.

11. The strip relay assembly according to claim 10 wherein said positioner and guard means further includes embedded deflecting means located in close proximity to said air gap for capturing stray magnetic fields extending from said air gap.

12. The strip relay assembly according to claim 2 wherein a portion of said relay support means and said fixed contact members extend above the upper surface of said relay coil element, said relay support means further includes key slot means formed in said portion of said relay support means extending above the upper surface of said relay coil element, and further comprising cover means mounted on said mounting support means and enclosing said relay coil element, said fixed contact members, and said movable spring contact means, said cover means including positioner and guard means for aligning said cover means on said mounting support means and positioning said free end of said movable spring contact means to automatically set the gap length of said air gap, said positioner and guard means including key means for engaging with said key slot means for aligning said cover means.

13. The strip relay assembly according to claim 3, further comprising, cover means mounted on said mounting support means and enclosing said relay coil element, said fixed contact members, and said movable spring contact means, said cover means including positioner and guard means for aligning said cover means on said mounting support means, and said positioner and guard means including position opening means aligned with respect to said relay support means and constructed to engage with said first electrical contact means to automatically set the gap length of said air gap.

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